



Qualitative Scenarios

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1. Introduction

PASHMINA WP1 Global meta-analysis aimed to deliver comprehensive **qualitative** scenarios for Europe by scanning the range of development options up to 2030 and 2050, harmonising and integrating **quantitative** results from many previous future-studies and developing a new generation of long term metamodels.

The analysis has been done developing two parallel streams of investigation:

- **Qualitative analysis:** identification of “shifts” in future trends in relation to a plurality of socio-economic, technological, territorial, environmental and institutional factors (Task 1.1). This task aimed to develop visions of alternative futures (exploratory scenarios) based on a qualitative analysis of different pathways of development dependent on key drivers and paradigm shifts. A community of experts of different disciplines has been involved in a DELPHI survey. Special attention has been given to possible paradigm shifts in the energy-transport-environment nexus and the land-use and territorial functions within the next decades in Europe, developing separate analyses for: 1) energy transition the climate change challenge; 2) changes in urban form and dominant transport patterns; 3) changes in rural land use and biodiversity.
- **Quantitative analysis:** developing of meta-models and long-term forecasts (Tasks 1.2 to 1.5). The metamodels address the main long-term evolutions of key economic, social, technological and environmental indicators, showing up possible future states of the system at 2050, including the impact of different paradigm shifts that may result by a number of unfolding demographic economic, social and cultural trends, global environmental changes and breakthrough discontinuities, as for instance the emergence of new technologies and applications (e.g. nanotechnologies, competitive solar energy, zero-emission technological process etc.).

These two streams of analysis have been coordinated and coherent qualitative and quantitative appraisal results are presented now in two deliverables:

- **D 1.1 – Qualitative Scenarios:** this deliverable includes the background paper presenting the “Paradigm Shift Analyser”, i.e. the conceptual tool used to frame the DELPHI survey, a review of the most prominent global scenarios available from recent studies and foresight exercises, the description of the DELPHI process and the summary of experts’ opinions about a first sketch of the four qualitative scenarios – the so called “pear”, “apple”, “orange” and “potato” world scenarios - and finally the description of the PASHMINA explorative scenarios emerging as a result of the whole qualitative analysis. Qualitative scenarios’ features have been harmonised with the forecast of key variables undertaken in the quantitative stream of analysis. For this purpose, an intense sensitivity analysis has been carried out to explore the potential impacts of relatively minor changes on key variables overtime. Since the time required to run metamodels is just few seconds, metamodels can be used in a flexible way to further improve our understanding and the qualitative description of reference and alternative scenarios.
- **D1.2 – Forecast and quantitative scenarios, as evolution of the qualitative:** this deliverable includes a description of: 1) the meta-modelling approach and of its application for the PASHMINA purposes; 2) the virtual library available on the PASHMINA web-site (www.pashmina-project.eu), which includes around 130 relevant entries; 3) global and European baseline 1950-

2000 trends and available long-term projections for a number of relevant indicators sourced from the most prominent international databases (socio-demographic trends, economic trends, transport trends, energy trends, environmental trends, technological trends, polity and governance trends; 4) megatrends, seeds, wildcards and global patterns and limits of growth in the socio-demography, economy, transport and mobility, energy, environment, governance fields; 5) advanced algorithms for complex modelling; 6) detailed design and development of the PASHMINA meta-model and its application in the process of building four qualitative scenarios and the forecast of key variables in the four alternative scenarios.

The last section of Deliverable 1.1 (Chapter 5) presents the narratives of four **PASHMINA explorative scenarios**, namely:

- **Growth without Limits**, based on the “pear world” DELPHI scenario (Business As Usual – BAU)
- **Growth within Limits**, based on the “apple world” DELPHI scenario (shift to low carbon economy)
- **Stagnation in a resource constrained world**, based on the “potato world” DELPHI scenario (shift to a resource constrained world)
- **Beyond Growth**, based on the “orange world” DELPHI scenario (shift to a paradigm of prosperity beyond growth)

The four scenarios take into account the first sketch of qualitative scenarios assessed with a number of PASHMINA consortium and external experts, engaged in the DELPHI survey, and discussed at the PASHMINA Barcelona Workshop of 29-20 September 2010.

A quick overview of the four explorative scenarios is provided at the outset of Chapter 5, pages 132-136.

2. Developing visions of paradigm shifts: the “Paradigm Shift Analyzer”

The “Paradigm Shift Analyzer” is a conceptual tool conceived to help a group of experts to explore, discuss and develop coherent pictures of a possible (desired) shift away from the predominant global growth paradigm.

The currently still dominant - but increasingly challenged - paradigm is unlimited growth, “growing without limits”, i.e. growth centered upon the concept and measurement of Gross Domestic Product (GDP) of countries and regions and the increase of total material wealth, without taking care too much in practice of the depletion of natural resources, global climate change, degradation of the ecosystems and increasing disparities in the distribution of wealth and social well being.¹ More precisely, “not taking too much care” means that the dominant attitude of GDP centered growth is to put the economy as first priority, whereas the environmental damages and social problems can be dealt with/adjusted later, mitigating the impacts or recovering the damages. The assumption being that most environmental problems will have a techno-scientific solution, helping to cope with some planetary boundaries² which otherwise would clearly set limits to global growth.

There are several reasons for claiming such a paradigm shift:

- Looking forward to the distant future (namely the 2050 horizon), and considering the story of humanity’s impact on the natural earth³, the “business as usual” projection of the currently unlimited growth trends⁴ can be considered the less realistic one because – unless breakthrough technologies and discoveries will help to widen substantially the planetary boundaries (e.g. new sources of clean, abundant and cheap energy and/or new nanotechnologies drastically reducing the consumption and waste of materials in production processes) – it will eventually lead to an unmanageable situation of resource scarcity, ecological degradation and economic and social crisis, i.e. it will forcibly lead to a shift from a growth scenario to one of decline, depression and of collapse of the world economy.⁵
- Besides the reasonable – but still debatable – fears of global collapse, perhaps an even more substantial issue on which international consensus is growing relates to the increasingly evident limits of GDP in measuring progress. For most people alive today, Gross Domestic Product is one of those unconsidered parts of our common consciousness that seems immutable. GDP is how countries size themselves up against their peers, how they measure progress. And yet the U.S. Department of Commerce created GDP as statistic only in 1942. However, if a country’s ultimate responsibility to its citizens is to ensure and increase happiness and well-being, GDP is indeed an incomplete measure of the state’s performance.

¹ OECD 2008) Growing Unequal? Income Distribution and Poverty in OECD Countries, Paris.

² Cfr. Johan Rockstrom and others, Planetary Boundaries: Exploring the Safe Operating Space for Humanity, Ecology and Society 142), 2009. Online at: <http://www.ecologyandsociety.org/vol14/iss2/art32/>

³ Remarkable graphs showing the “great collision” of the global economy against the earth – with the exponential growth from 1750 to 2000 of a number of population, economic and natural resource exploitation and environmental impact variables – are presented in W. Steffen et al., *Global Change and Earth System: A Planet under Pressure* Berlin: Springer, 2005), 132-133.

⁴ See for example the ‘reference’ scenario for growth of energy demand, developed by the International Energy Agency: IEA 2008) Energy Technology Perspectives, Scenarios & Strategies to 2050, Executive Summary, IEA/OECD, Paris, <http://www.iea.org/Textbase/techno/etp/index.asp> accessed: 4/3/09).

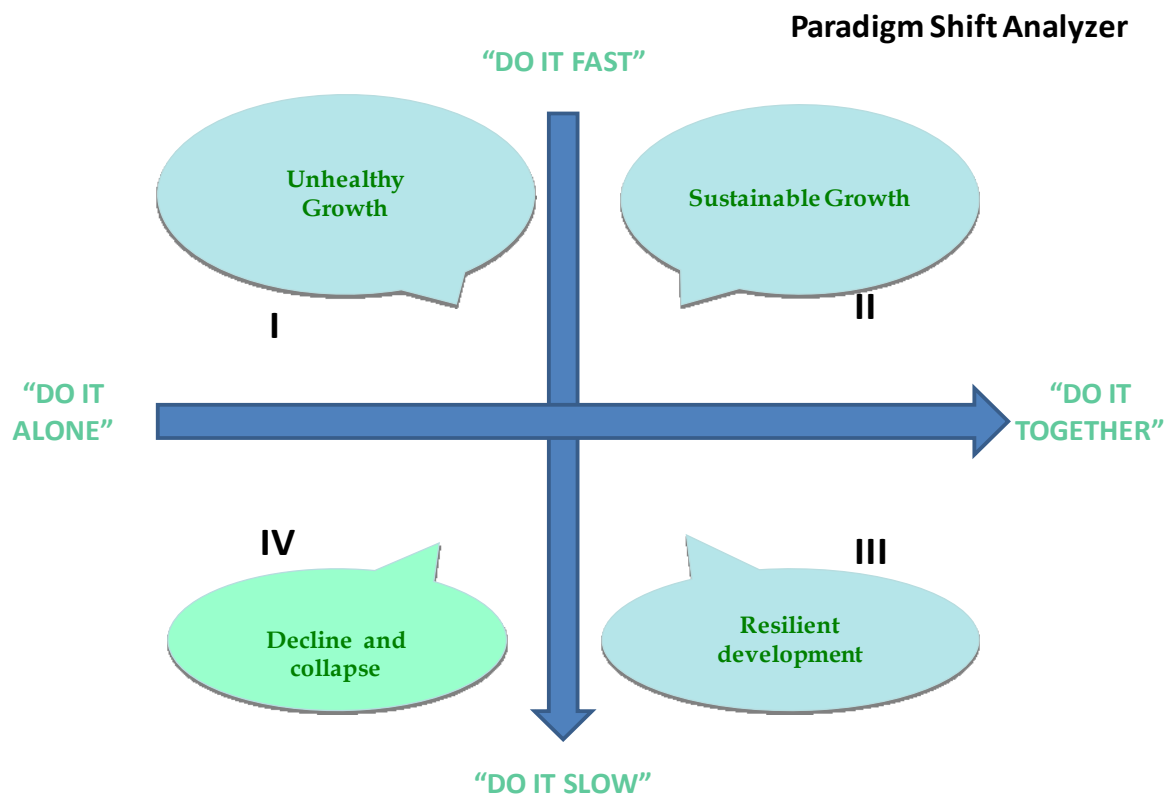
⁵ See. For example: WBCSD 2010) Vision 2050 - The New Agenda for Business, World Business Council for Sustainable Development WBCSD), Geneva, <http://www.wbcsd.org/includes/getTarget.asp?type=d&id=MzczOTg>, page 32.

Variables such as engagement in fulfilling personal activities, social connectedness, political voice, and environmental conditions have been shown to greatly influence well-being but are not accounted for in GDP. A campaign to shift away from GDP as exclusive mainstream indicator of well-being is gaining traction. This is based on the increasing evidence that growth of material wealth is good but not enough, and above a certain threshold could become even counterproductive for people health and happiness.

The Paradigm Shift Analyzer represents the paradigm shift with the support of two basic – very intuitive - **dimensions or drivers of shift**, both related to human activities and their impact on the natural environment and social progress:

1. From doing things “fast” to doing them “slow”.
2. From doing things “alone” to doing them “together”.

These two dimensions are combined forming a 2x2 grid with four quadrants:



First we need to explain the two dimensions of shift, and then what is included in the four different quadrants.

The first “vertical” dimension shows the shift in the way humanity produces and consume a number of goods and services – including material and immaterial activities – to achieve a desired level of satisfaction and affluence. Underpinning this dimension there is, therefore, the way the economy is shaped, and production and consumption technologies are applied, to provide for individual well-being. “Fast” production or consumption activities require that the number of products which can be crafted and of consumption opportunities which can be exploited in the unit of time are large, by:

- concentrating production, distribution or service activities in large units which exploit economies of scale, and
- connecting these units to local and global markets with fast transport and information infrastructure - to transfer people (workers, customers), goods and information in and out - as well as with efficient energy infrastructure, water infrastructure, waste collection services and so on, to satisfy their highly concentrated needs.

This is the paradigm of modern globalised economies and lifestyle, which requires high amounts of extra-somatic energy per capita (“katabolic” processes), high productivity per worker, high capital intensity and global markets to be sustained. In other terms, doing things fast implies doing them big, high energy and natural resources’ consuming, high capital/low labour intensive, and dependent on global markets. The high productivity per worker and speed of the production or consumption processes is the result of an increasing processes’ mechanisation/automation, e.g. by means of automatic tellers in the banking sector or other *do-it-yourself* devices in the service sector. Mechanisation of agriculture, coupled with the use of fossil-intensive fertilisers, is perhaps the most important example of “speed” factor behind increasing urbanisation, as it pushes out of rural areas people previously employed in agriculture, to find new urban jobs. To be sustained, “fast” production requires ever-increasing levels of material consumption, which ultimately evolve into over-consumption – i.e. consuming more than it is actually needed to achieve a sound level of satisfaction of reasonable needs.

“Slow” production and consumption activities do not require the concentration in large production, distribution or service units, as for them it is usually sufficient and more effective to have smaller organisational units, using lesser amounts of extra-somatic energy per capita (“metabolic” processes), lower capital intensity and productivity per worker – i.e. more labour intensive processes – and greater reliance upon local resources and markets, as well as sharing and exchange of knowledge resources in the global Net. Also the need of fast transport infrastructure is reduced - as it is the need of energy, water, waste disposal etc. – due to the smaller scale of production and consumption processes and the greater reliance upon local resources of labour, energy etc. In other terms, doing things slow implies doing them small, low energy and natural resources’ consuming, low capital and high labour intensive (including an intense exploitation of people’s knowledge capital), and dependent on local markets or virtual purposeful communities in the global Net. This was partly the paradigm of the pre-industrial world, still dominant in the less developed and traditional economies, but it is also a paradigm that – in a new form which exploits knowledge intense networking - is being recovered now in post-industrial economies, where preference start to be given again to more environmental friendly and social cohesive production schemes.⁶

“Slow” production requires a different vision of prosperity, no more relying on ever-increasing material consumption. It requires something more like the “steady economy state” first proposed by the economist Herman Daly.⁷ In this new prosperity paradigm, innovation and change would be concentrated on using finite resources more effectively for the benefit of humankind. Think of material living standards as given by the stock of goods in use, rather than the rate of flow from consumption to waste. The faster things wear out and need replacing, the more they contribute to the flow and to the waste. If material living standards depend on the goods we have in use, than each thing that wears out is a subtraction from that. Rather than serving as consumers, helping business to keep sales up, we need incentives to build and maintain longer-lasting goods of every

⁶ For instance organic farming and the production of local food within or in the immediate proximity of cities is now again an increasing practice in Europe.

⁷ H. Daly, *Steady-state Economics*. Washington, DC: Island Press, 1991

kind.⁸ But underpinning a different functioning of the economy, the key change to sustain “slow” production patterns is a cultural one, well summarised by the Gandhi’s comment about the Earth’s providing enough to satisfy every man’s need, but not every man’s greed. And in what indeed represents a bit of a strange casting, some economists say the answer to carve out a vastly different vision of prosperity may lie in drawing on Asia’s religious traditions – Shinto, Taoism, Buddhism and Hinduism – with their emphasis on harmony with nature and self-denial.⁹

Summing up, the first dimension (vertical axis) represents the **paradigm shift in providing individual well-being**, from a civilization featured by higher consumption of an ever-increasing variety and quantity of mass-produced goods and supply of standardized services on the top (“more quantity”) to less massive consumption on the bottom, substituted by the use of longer-lasting goods of every kind and increasingly tailored services - in a sufficient variety and quantity to satisfy the needs for a decent quality of life - and increasing time available for leisure and self-development spiritual activities (“more quality”).

The second “horizontal” dimension shows the **paradigm shift in the way human beings consider their interaction with the natural environment and the social context** (the “others”), from using the resources and playing in the social arena “alone” – i.e. pursuing their individual interest mostly in competition with others – to increasingly play their life “together” – i.e. considering natural resources, knowledge and social well being as common assets to be exploited in cooperation with others, pursuing collective environmental sustainability and social justice goals. Solving common dilemmas will be increasingly needed as the number and affluence of human beings on the earth increases, approaching several boundaries in the exploitation of planet’s resources. Social justice is also increasingly needed, being increasingly evident that the average growth of the economy is associated with a growing inequality of income and, associated to the latter, growing health and social problems: anxiety, self-esteem and social insecurity, poor community life and social relations, mental health and drug use, physical health, obesity and life expectancy, poor educational performance, increasing violence and imprisonment, to name a few. The latter problems ultimately affect the well-being of all the population, not only that of the low income classes¹⁰.

Whereas the first (vertical) axis represents therefore the “individual well being” dimension – i.e. our rights to a worthwhile life - the second (horizontal) axis represents intuitively the “relation with other than our own individual well being” – i.e. our duties towards the nature and society - and includes therefore two components: environmental and social.

The environmental component envisages the shift from human beings seeing themselves as living in a limitless plain, on which a frontier exists that can be pushed back indefinitely – i.e. the “cowboy” perception of the economy – to seeing themselves part of a thermodynamically closed economic and ecological system, with a fixed supply of energy inputs from the outside in the form of solar radiation

⁸ It would be a mistake to think that a steady state economy would mean stagnation and lack of change. Paradoxically, the transition to a sustainable steady state economy would create huge demands for innovation and change. Trying to get more from the limited resources available has always been one of the fundamental drivers of innovation and technical change. Fixing limits on resource consumption and emissions would require innovation as never before. Continued rapid technological advances, such as digitization, electronic communication and virtual systems, creating “weightless” sectors of the economy, make it very much easier to combine high living standards with low resource consumption and emissions.

⁹ Again, the reality today seems far from this possible transition: think for instance of the news of increasing traffic congestion problems in China, with the recent August 2010) “nightmare jam” on the highway to Tibet: vehicles have been stuck in a 100 km line, proceeding at a speed of 1 km per day, and with the prospect of remaining in the jam for one month!

¹⁰ Richard Wilkinson, Kate Pickett, *The Spirit Level: Why Equality is Better for Everyone*, Penguin Books 2010

and without unlimited reserves of anything – i.e. the “spaceman” perception of the earth seen from the space as a “blue” planet¹¹.

As it concerns the social component, we consider a shift from the currently dominant paradigm of individualistic and hyper-consumerist behaviour and ethics, where people wishes to maximise their own utility or the firms their own profits by exploiting as far as possible market opportunities – even extending the privatization of common goods, such as water delivery, land resources etc. – towards a new paradigm of social justice. One prominent thinker that has anticipated the social justice paradigm in his work is John Rawls, whose most important ideas are presented in his 1971 book *A Theory of Justice*.¹² It is clearly beyond the scope of this paper to discuss the merits and limits of the Rawls theory, and in particular of his first and second principles of justice. However, what is important here is to catch the basic ideas underpinning the theory, and how this could become key social and policy features in the context of a new “do it together” paradigm. A shift to a more just society (a “rawlsian” society) would mean indeed shifting away from utility and profit maximisation principles, which currently govern the global market-oriented society and corporations, to principles of social justice which guarantee the equal access for all to primary goods, including: certain basic rights and liberties; freedom of movement and free choice of occupation; powers and prerogatives of offices; income and wealth; residual social bases of self-respect. Perhaps more important would be the shift from uniform principles of maximisation of total welfare for a society and/or profit maximisation for individual firms in a market context – which are assumed to be applied in a market context by all participants acting alone, independently from each other – to principles and criteria of social justice that are assumed to be the result of building an overlapping consensus among citizens and actors of the civil society – who see therefore themselves empowered and engaged in reaching a consensus with other participants on own to rule their societal institutions (a kind of “do it together” polity).

Summing up, the second dimension (horizontal axis) in the Paradigm Shift Analyzer represents a **paradigm shift from less to more awareness, participation, empowerment and care for nature and social well-being**. As opposed to individual well-being (considered in the first shift dimension above), “social well being” includes only those well-being attributes which are shared with other people - i.e. those living within the same neighbourhood, town or country – or reflect the relations between them (e.g. the extent and quality of relationships with others), or how a society is peaceful, resilient, cohesive. “Care” here means that the solutions of environmental and social problems are put in the first place, as targets embodied in the models of development, and shared by a range of societal actors engaged in the building and maintenance of the collective institutions needed to ensure a sustainable use of natural resources and the equitable progress of society.

The two dimensions of shift described above have been used to frame the DELPHI survey (see section 4 below), sketching four explorative scenarios:

- **Quadrant I – Growing beyond limits: the Pear World paradigm**, featuring the strengthening of corporate capitalism and market mechanisms, rapid globalization of goods and financial markets, a new technological wave in the form of ICT, nano-technologies and biotechnologies.
- **Quadrant II – Growing within limits: the Apple World paradigm**, assuming that a low-carbon economy and adequate biodiversity protection can be achieved with currently identifiable

¹¹ See the classical paper written in 1966, *The economics of the coming Spaceship Earth*, of Kenneth Boulding, one of the early ecological economists.

¹² Rawls’s Theory of Justice has had a profound impact across philosophy, politics, law and economics. However, Rawlsian theory is not easy to understand particularly for beginners and lay people, and this has limited its impact and diffusion outside the academic circles. A good and accessible synthesis of the Rawls biography and theory of justice is provided in Thomas Pogge, *John Rawls: his life and Theory of Justice*, Oxford University Press, 2007.

technologies and at moderate economic costs without damaging opportunities for human development, provided that a number of barriers to achieving the right policy conditions and institutional settings are overcome.

- **Quadrant III – New welfare: the Orange World paradigm**, assuming that the present measurement of growth is abandoned, and a new frame is set up to account features of well-being “beyond GDP”, including self-production and services rendered by nature, taking into account the realities that do not pass through the market or get irrelevant evaluation by a market. A new techno-economic and social paradigm emerges.
- **Quadrant IV – Turbulent decline: the Potato World paradigm**, assuming that the growth in material flows will not be able to cope with the limits for climate change, natural resources’ availability, global ecosystems’ health and biodiversity loss, as well as help to alleviate global poverty, setting the world to collapse.

3. Global Scenarios Review

3.1 Growing within Limits Scenarios, by Netherlands Environmental Assessment Agency

*From Growing within Limits. A Report to the Global Assembly 2009 of the Club of Rome
Netherlands Environmental Assessment Agency (<http://www.pbl.nl/en/publications/2009/Growing-within-limits.-A-report-to-the-Global-Assembly-2009-of-the-Club-of-Rome.html>)*

This report looks into the possible developments in the climate and energy system on the one hand, and biodiversity and land use on the other hand. Two scenarios are presented:

- Trend Scenario (depicting trends without major policy changes)
- Challenge Scenario (depicting the options for change)

Trend Scenario (explores the risks of climate change and biodiversity loss)

In the Trend scenario, it is assumed that the world continues to develop in a business-as-usual (BAU) pattern, which serves as a reference scenario by extrapolating trends for the main parameters of the last decades. In this scenario, there are no explicit policies to address main environmental challenges. The *Trend* scenario is in line with the so-called A-worlds in earlier scenario work (IPCC, 2000). These A-worlds feature a strengthening of corporate capitalism and market mechanism, after the proclaimed 'End of History', rapid globalisation of goods and financial markets, a new technological wave in the form of ICT, and the rapid economic growth in some major world regions, notably China. The *Trend* scenario projects a continuing increase in material goods and services, driven by the same entrepreneurial and market dynamics which the world has experienced over the last decades. At individual levels, this has provided an increase in material welfare for billions of people in OECD countries, as well as outside the OECD – and provided hope to the poor of catching up with the rich. A plethora of high-tech products entered the global market place, satisfying demand from the rich and the poor. Meanwhile, there a huge and partly unsatisfied demand for low-tech elementary goods and services remains.

Population size dynamics in the *Trend* scenario follows the UN medium scenario, increasing to 9 billion around 2050, and slowly declining to around 8 billion by 2100. This projection lies within the uncertainty range of published projections over the last few years. In terms of economic growth, current expectations are followed: economic growth, in general, will be higher in low-income countries than in high-income countries, but this will not result in income convergence. Based on population dynamics (ageing of the population) and declining total factor productivity (TFP) improvement, economic growth in high-income countries is expected to slow down – but, on a global scale, this is compensated by an increasing share of faster growing low-income countries. The key question with respect to the *Trend* scenario is whether the growth in material flows could remain within the limits for climate change and biodiversity loss. In other words: is the collective outcome of such a world indeed a continuing smooth increase in quality of life for the average person, or will it meet its limits?

The *Trend* scenario is likely to lead to an increase in average global temperature of 4 °C above pre-industrial levels, by the end of the century. This implies that the climate policy target of 2 °C (chosen as an interpretation of preventing non dangerous climate change) would not be met. Such a degree of global warming is likely to lead to serious climate change. The scenario shows that greenhouse gas emissions will have more or less doubled, by 2050. Assuming that policymakers would like to limit the probability of overshooting the 2 °C target to less than 50%, or even 25%, emissions need would need to peak in about one to two decades, and be reduced by around 50% by the middle of the century. For achieving this, the energy production system should be very different from that under the *Trend* scenario. Moreover, all major developing countries, including China and Brazil, would have to participate in international climate policy, from 2020 onwards.

Challenge Scenario (explores the pathway and required actions to bring about a more environmentally sustainable future)

The *Challenge* scenario explores the result of policies developed to meet the climate and biodiversity objectives. This scenario is based on two normative choices:

- Greenhouse gases will be reduced in order to limit average global temperature increase to a maximum of 2°C.
- Expansion of agricultural land will be limited in order to avoid further loss of biodiversity, from 2020 onwards.

The main objective of the *Challenge* scenario is to find out what kind of changes in the world's energy and land-use systems would be required to meet the objectives for climate change and biodiversity loss. Given the enormous momentum behind the drivers in the *Trend* scenario, the force to deflect such trends to meet environmental targets is not a trivial task. As no feedback on population and economic growth was taken into account for the *Trend* scenario, population and economic growth in the *Challenge* scenario is assumed to equal that of the *Trend* scenario.

In the *Challenge* scenario, a low-carbon economy could be achieved with currently identifiable technologies. The first steps would be to improve energy savings, increase use of renewable energy and carbon capture and storage, reduce deforestation, and reduce non-CO₂ emissions. An attractive route is based on a further electrification of energy use. In that sense, considerable investments in the power grid would be needed. In the transport sector, energy efficiency could reduce emissions, in the short term. In the long term, however, a dramatic shift towards electric (or hydrogen) vehicles is required.

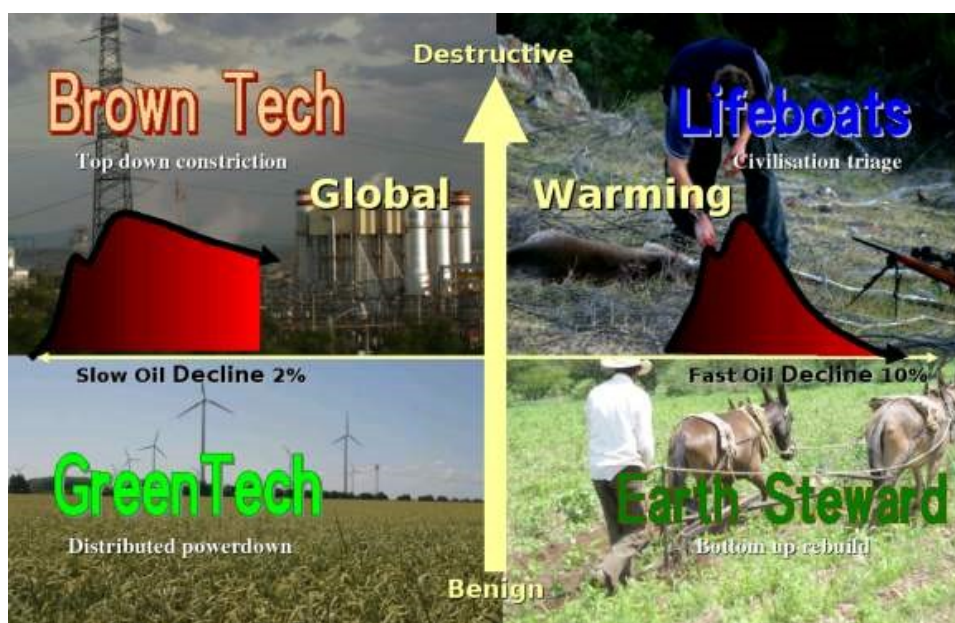
Investments in the energy system (supply-side only) are estimated to be around 60,000 billion USD between 2000 and 2050 (i.e. around 1400 billion per year or 1.5% of GDP). Achieving the *Challenge* scenario could lead to a doubling of these costs. The macro-economic impacts of these costs are significantly smaller. However, economic and technical barriers are not the main obstacles to achieving the *Challenge* scenario. A shared sense of urgency and an international response is critically important. Given the need for reducing global emissions within one to two decades, emissions must be reduced substantially in both high- and low-income countries. The current proposals stated by OECD countries and low-income countries as part of the international climate policy negotiations clearly would not be enough to implement a 2 °C scenario. Significant delays in the negotiations would bring the 2 °C target out of reach.

3.2 The Four Energy Descent and Climate Scenarios, by David Holmgren

From Future Scenarios, Mapping the cultural implications of peak-oil and climate change
By David Holmgren¹³ for Holmgren Design Services, the Source of Permaculture Vision and Innovation, Australia. (<http://www.futurescenarios.org/>)

Four Energy Descent scenarios are considered, each emerging from a combination of either fast or slow oil decline and either mild or severe climate change over the next 10-30 years.

- Brown Tech: (slow oil decline, fast climate change)
- Green Tech: (slow oil decline, slow climate change)
- Earth Steward: (fast oil decline, slow climate change)
- Lifeboats: (fast oil decline, fast climate change)



Brown Tech Scenario (Slow energy decline rates, severe climate change symptoms)

The *Brown Tech* world is one in which the production of oil declines after a peak 2005-2010 at about 2% per annum and the subsequent peak and decline of natural gas is also relatively gentle, but the severity of global warming symptoms is at the extreme end of current mainstream scientific predictions. The tendency in existing systems for massive centralised investment by corporations and governments, give priority to getting more energy out of lower grade non-renewable resources (eg. tar sands, coal and uranium) and biofuels from industrial agriculture and forestry. At the same time the cost of defending or replacing urban infrastructure threatened by storms and future sea level rise consumes more resources. Rapid onset of climate change tends to support centralised nationalist systems

¹³ David Holmgren is a futurist and the co-originator of the permaculture concept with Bill Mollison. Of his best known book, *Permaculture: Principles and Pathways Beyond Sustainability*, Transition Towns concept originator Rob Hopkins has said, "it is no exaggeration to call this the most important book published in the last 15 years"

Green Tech Scenario: Distributed Powerdown (*Slow energy decline rates, mild climate change symptoms*)

The Green Tech scenario is the most benign, in that adverse climate changes are at the low end of projections. Oil and gas production declines slowly as in the Brown Tech future, so the sense of chaos and crisis is more muted without major economic collapse or conflict. However higher commodity prices allows some poorer producer economies to escape their debt cycle. As in the Brown Tech scenario, electrification is a key element in the energy transition but the renewable energy sources of wind, biomass, solar, hydro, tidal, wave etc. grow rapidly developing a more diverse and distributed mix.

Earth Steward Scenario: Bottom Up Rebuild (*Rapid energy decline rates, mild climate change symptoms*)

In this scenario the decline in oil production after a peak in total liquids production before 2010 is at the extreme end of authoritative predictions (about 10%) and is followed by an even faster decline in gas production plus a simultaneous peak in coal production. The shock to the world's fragile financial systems is overwhelming, resulting in severe economic depression and perhaps some further short, sharp resource wars. This economic collapse and these political stresses, more than the actual shortage of resources, prevents the development of more expensive and large scale non-renewable resources that characterise the Brown Tech scenario or the renewable resources and infrastructure of the Green Tech. International and national communications networks break down.

Lifeboats Scenario: Civilization Triage (*Rapid energy decline rates, severe climate change symptoms.*)

In this scenario, supplies of high quality fossil fuels decline rapidly, the economy fails and human contributions to global warming collapse but lag effects and positive feedbacks in the climate system continue to drive an acceleration of global warming. As of 2007, an increasing number of scientists believe it may already be too late to avoid catastrophic climate change. In the Lifeboat scenario the adverse symptoms of the Brown Tech and Earth Steward scenarios combine to force a progressive collapse in most forms of economy and social organisation. Local wars, including use of nuclear weapons accelerate collapse in some areas but the failure of national systems of power prevent global warfare. Successive waves of famine and disease breakdown social and economic capacity on a larger scale than the Black Death in medieval Europe leading to a halving of global population in a few decades.

3.3 Green Tomorrows: the Scenarios, by Jamais Cascio

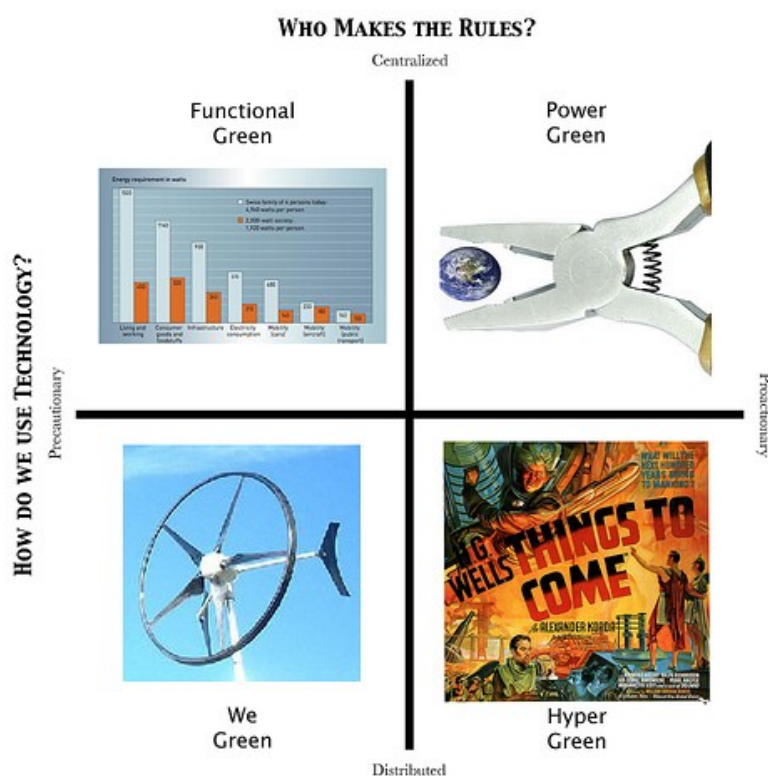
From *Green Tomorrows: the Scenarios*

By Jamais Cascio¹⁴. Open the future

(http://openthefuture.com/2007/11/green_tomorrows_the_scenarios.html)

The combination of two drivers: *Who Makes the Rules?*, *How Do We Use Technology?* provides four distinct scenarios.

- Power Green—Centralized and Proactionary
- Functional Green—Centralized and Precautionary
- We Green—Distributed and Precautionary
- Hyper Green—Distributed and Proactionary



Power Green

A world where government and corporate entities tend to exert most authority, and where new technologies, systems and response models tend to be tried first and evaluated afterwards. This world is most conducive to geoengineering, but is also one in which we might see environmental militarization (i.e., the use of military power to enforce global environmental regulations) and

¹⁴ Selected by *Foreign Policy* magazine as one of the Top 100 Global Thinkers of 2009, Jamais Cascio writes about the intersection of emerging technologies, environmental dilemmas, and cultural transformation, specializing in the design and creation of plausible scenarios of the future. Cascio's work appears in publications as diverse as *Metropolis*, the *Atlantic Monthly*, *The Wall Street Journal*, and *Foreign Policy*. Cascio has worked in the field of scenario development for over a decade, and in 2010 was named a Research Fellow at the Institute for the Future. After several years as technology specialist at scenario planning pioneer Global Business Network

aggressive government environmental controls. “Green Fascism” is one form of this scenario; “Geoengineering 101” from my Earth Day Essay is another.

Functional Green.

A world in which top-down efforts emphasize regulation and mandates, while the deployment of new technologies emphasizes improving our capacities to limit disastrous results. Energy efficiency dominates here, along with economic and social innovations like tradable emissions quotas and re-imagined urban designs. The future as envisioned by Shellenberger and Nordhaus could be one form of this scenario; the future as envisioned by folks like Bill McDonough or Amory Lovins could be another. Arguably, this is the default scenario for Europe and Japan.

We Green.

A world in which collaboration and bottom-up efforts prove decisive, and technological deployments emphasize strengthening local communities, enhancing communication, and improving transparency. This is a world of micro-models and open source platforms, “Earth Witness” environmental sousveillance and locavorous diets. Rainwater capture, energy networks, and carbon labeling all show up here. This world (along with a few elements from the “Functional Green” scenario) is the baseline “bright green” future.

Hyper Green

A world in which things get weird. Distributed decisions and ad-hoc collaboration dominate, largely in the development and deployment of potentially transformative technologies and models. This world embraces experimentation and iterated design, albeit not universally; this scenario is likely to include communities and nations that see themselves as disenfranchised and angry. Micro-models and open source platforms thrive here, too, but are as likely to be micro-ecosystem engineering and open source nanotechnology as micro-finance and open source architecture. States and large corporations aren’t gone, but find it increasingly hard to keep up. One form of this scenario would end with an open source guerilla movement getting its hands on a knowledge-enabled weapon of mass destruction; another form of this scenario is the “Teaching the World to Sing” story from my Earth Day Essay.

3.4 Shell global scenarios to 2025

From Global Scenarios to 2025.

Shell International Limited (SIL), 2005.

(http://www.shell.com/home/content/aboutshell/our_strategy/shell_global_scenarios/dir_global_scenarios_07112006.html)

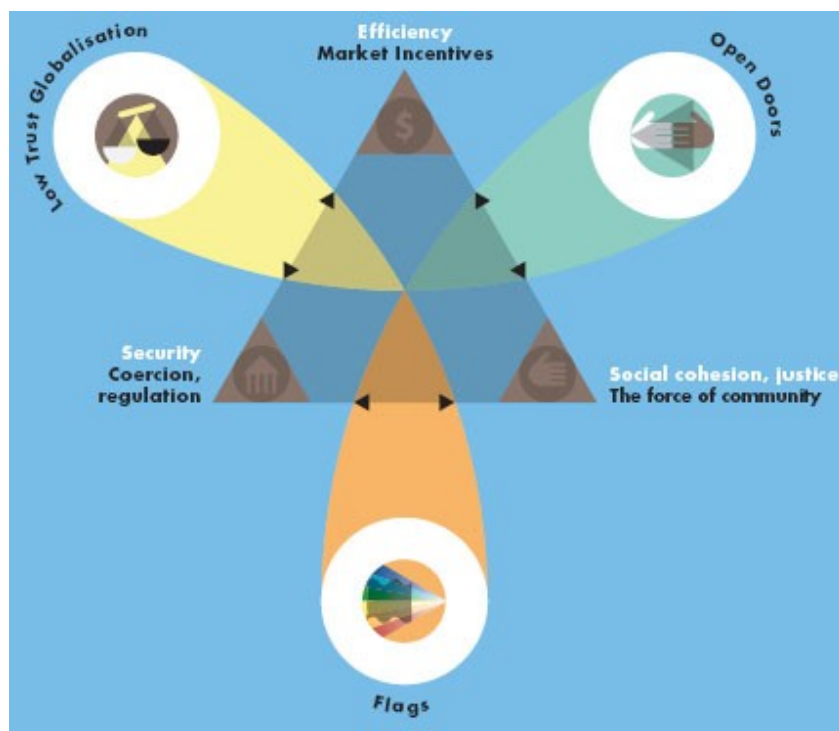
Disruption of both international security and trust in the marketplace highlight the importance of the role of the state.

Two crises—in short, 9.11 and Enron—have unfolded since 2001, affecting national security and trust in the marketplace. Both have highlighted the vulnerability of our globalised world. Western societies now expect the state to lead the restoration of physical security and market integrity. Middle Eastern, Asian, African and Latin American societies have heightened expectations of peaceful solutions to wars and to persisting poverty.

The three forces drive towards different objectives: efficiency, social cohesion and justice, and security. While societies often aspire to all three objectives, the forces display elements of mutual exclusiveness—one cannot be at the same time freer, more conformant to one's group or faith, and more coerced.

Three distinct scenarios are shown:

- Low Trust Globalisation
- Open Doors
- Flags



Low Trust Globalisation

Globalisation carries on, but the world does not evolve towards a *laissezfaire* economy as Shell canvassed in *2001 Business Class*, or previously in *People Power, Just Do It!* And *New Frontiers*. Market incentives are at work in all aspects of the economy and society, but so are efforts to deal with insecurity and distrust. In *Low Trust Globalisation*, the state plays a major role in providing security to the nation and in overseeing the process whereby trust in the market is preserved through satisfactory opportunities to seek redress for market abuses or dysfunctions. This involves a stronger coercive and discretionary power for the state and the independent regulatory agencies. The dual crisis of security and trust in the marketplace leads to a new form of global order in which security concerns become globalised, structured within global networks where strongstates such as the US assert their dominant power. At the same time, globalising markets constrain policy choices for government, who seek to intervene to support their respective national competitive advantages in global markets. In this scenario, the EU sees its political integration process stall and possibly reverse. Russia pursues economic and administrative modernisation while political reform stalls. Meanwhile, China sees the legalistic world of *Low Trust Globalisation* as an opportunity to achieve integration with the global market in ways that minimise foreign pressures and let her achieve some extraterritorial influence. Realpolitik – combined with strong market incentives – provides a good foundation for global governance in this scenario. Nevertheless, international politics is far from harmonious, and alliances tend to be formed on an opportunistic basis.

Open Doors

This is a world, like *Low Trust Globalisation*, in which globalisation progresses further. It is also a world in which civil societies in different countries are reassured that their fundamental values can be affirmed and strengthened, not only domestically but across borders, and in conjunction with market forces. However, for all its emphasis on web-like technologies, cooperative links, seamless transnational operations and citizens' empowerment, this is not a *laissez faire* world. Many governance institutions behind *Open Doors* are of a private and voluntary nature. States and regulators, however, develop a special knack for fostering and channelling these private initiatives.

Participation and the opportunity to be heard become widely accepted elements of good governance, in the corporate as well as governmental setting. In this world, companies' reputations depend not on decisions in court, but on opinions in society. Customers, stakeholders and companies are inclined to rely on networks within which bad reputation is quickly spread on a peer-to-peer basis. While endeavouring to smooth the business cycle, governments generally pursue a prudent policy stance. Over the entire cycle, however, fiscal policy is generally aimed at achieving balanced budgets in order to avoid crowding-out effects in capital markets. Government welfare provision in *Open Doors* is based on redistributing opportunities rather than assets. It is focused, for instance, on retraining people who have fallen into unemployment, rather than on granting unemployment benefits indiscriminately. Multilateralism is seen as an important tool in overcoming the differences in regulations between jurisdictions that hamper free flows of people, information, capital, goods and services. In the world of *Open Doors*, "free trade" encompasses regulatory rules, regional development policies and aid plans as in the EU. People become remarkably mobile, with no-frills airlines helping to define new global standards of openness and accessibility. A pragmatic network of global institutions emerges to support this combination of global market and global civil society. This is nothing like a "world government", although a number of UN institutions reform and play important roles, and some common institutions do develop.

Flags

This is a world in which the dual crisis of security and trust is not solved, fostering the development of "gated communities" – in society and internationally. Distinct social groups, while tight-knit and highly trusting internally, are distrustful of outsiders. Efficiency takes a back seat to security and solidarity. Governments often promote nationalism – under the name of patriotism – in the pursuit of social cohesion. Religious affiliations have a direct impact on political debate. The process of globalisation continues, but at a more measured pace, with a number of countries opting for some form of protection against what they see as the inherent dangers of international integration. Problems are often dealt with through national rules, which differ from country to country, and which form a global patchwork of regulations. This scenario is a heterogeneous world of many different flags. Investors are naturally sceptical about global markets. States are proactive in regulating the market and in providing public goods and services. *Flags* reinforces conventional state-to-state relations. The world is emphatically inter-national, rather than truly global. In Europe, the benefits of harmonised rules that came with the often decried 'Brussels directives' are often diminished by populist policies in favour of national champions and local business practices. Sovereignty is opaque, in that events within a state's borders are held by governments to be entirely internal matters. States pragmatically pursue a mix of multilateral deals, bilateral agreements and regional pacts. Differing national rules and standards, as well as protectionist demands, restrict the global mobility of investment and capital, and diminish trade and migrant flows.

3.5 Shell Energy Scenarios to 2050

From Shell Energy Scenarios to 2050. A challenge for energy and the planet.: more energy, less carbon dioxide.

Shell International Limited (SIL), 2008

(http://www.shell.com/home/content/aboutshell/our_strategy/shell_global_scenarios/dir_global_scenarios_07112006.html)

Two scenarios are described:

- Scramble (Energy security))
- Blueprints(New coalitions of interests)

Scramble Scenario (*national energy security*)

Immediate pressures drive decision-makers, especially the need to secure energy supply in the near future for themselves and their allies. Growth in coal and biofuels becomes particularly significant. Despite increasing rhetoric, action to address climate change and encourage energy efficiency is pushed into the future, leading to largely sequential attention to supply, demand and climate stresses. Demand-side policy is not pursued meaningfully until supply limitations are acute. Likewise, environmental policy is not seriously addressed until major climate events stimulate political responses. Events drive late, but severe, responses to emerging pressures that result in energy price spikes and volatility. This leads to a temporary slowdown within an overall story of strong economic growth.

Blueprints Scenario (*Supply concerns, environmental interests, and associated entrepreneurial opportunities*)

It is a world where broader fears about life style and economic prospects forge new alliances that promote action in both developed and developing nations. This leads to the emergence of a critical mass of parallel responses to supply, demand, and climate stresses, and hence the relative promptness of some of those responses. Initiatives first take root locally as individual cities or regions take the lead. As a result, effective market-driven demand-side efficiency measures emerge more quickly, and market-driven CO₂ management practices spread. Carbon trading markets become more efficient, and CO₂ prices strengthen early. Energy efficiency improvements and the emergence of mass-market electric vehicles are accelerated. The rate of growth of atmospheric CO₂ is constrained leading to a more sustainable environmental pathway.

3.6 EPO Scenarios for the future, by European Patent Office

From EPO Scenarios for the future How might IP regimes evolve by 2025? What global legitimacy might such regimes have?

By European Patent Office, Europe Union (<http://www.epo.org/topics/patent-system/scenarios-for-the-future.html>)

Four scenarios were developed to seek how intellectual property and patenting might evolve over the next fifteen to twenty years.

- Market Rules: (business)
- Whose Game? (geopolitics)
- Trees of Knowledge(Society)
- Blue Skies(technology)



Market Rules Scenarios *(A world where business is the dominant driver)*

This scenario is the story of the consolidation of a system so successful that it is collapsing under its own weight. New forms of subject matter - inevitably including further types of services - become patentable and more players enter the system. The balance of power is held by multinational

corporations with the resources to build powerful patent portfolios, enforce their rights in an increasingly litigious world and drive the patent agenda. A key goal is the growth of shareholder value. Patents are widely used as a financial tool to achieve that end. In the face of ever-increasing volumes of patent applications, various forms of rationalisation of the system occur and it moves to mutual recognition of harmonised patent rights. The market decides the fate of the system, with minor regulation of visible excesses. Patent trolling, anti-competitive behaviour and standards issues all come under scrutiny.

Whose Game? *(A world where geopolitics is the dominant driver)*

This scenario is the story of a boomerang effect which strikes today's dominant players in the patent world as a result of changing geopolitical balances and competing ambitions. The developed world increasingly fails to use IP to maintain technological superiority; new entrants try to catch up so they can improve their citizens' living standards. But many developing world countries are excluded from the process, and work instead within a 'communal knowledge' paradigm. Nationals and cultures compete and IP has become a powerful weapon in this battle. The new entrants become increasingly successful at shaping the evolution of the system, using it to establish economic advantage, adapting the existing rules as their geopolitical influence grows. Enforcement becomes increasingly difficult and the IP world becomes more fragmented. Attempts are made to address the issues of development and technology transfer.

Trees of knowledge *(A world where society is the dominant driver)*

In the story told in this scenario, diminishing societal trust and growing criticism of the IP system result in its gradual erosion. The key players are popular movements - often coalitions of civil society, businesses, concerned governments and individuals - seeking to challenge existing norms. This kaleidoscope Society is fragmented yet united - issue by issue, crisis by crisis - against real and perceived threats to human needs: access to health, knowledge, food and entertainment. Multiple voices and multiple world views feed popular attention and interest, with the media playing an active role in encouraging debate. This loose 'knowledge movement' echoes the environmental movement of the 1980s, initially sparked by small, established special interest groups but slowly gaining momentum and raising wider awareness through alliances such as the A2K (Access to Knowledge) movement. The main issue is how to ensure that knowledge remains a common good, while acknowledging the legitimacy of reward for innovation.

Blue Skies *(A world where technology is the dominant driver)*

The final scenario is the story of a split in the patent system. Societal reliance on technology and growing systemic risks force this change; the key players are technocrats and politicians responding to global crises. Complex new technologies based on a highly cumulative innovation process are seen as the key to solving systemic problems such as climate change, and diffusion of technology in these fields is of paramount importance. The IP needs of these new technologies come increasingly into conflict with the needs of

classic, discrete technologies. In the end, the patent system responds to the speed, interdisciplinary and complex nature of the new technologies by abandoning the one-size-fits-all model: the former patent regime still applies to classic technologies while the new ones use other forms of IP protection, such as the license of rights. The patent system relies on technology, and new forms of knowledge search and classification emerge.

3.7 Global Explanatory Scenarios – 2025, by the Millenium Project

From Global Explanatory Scenarios

Millenium Project, World Federation of UN Associations.

(<http://www.millennium-project.org/millennium/scenarios/explor-s.html>)

The following scenarios are shown:

- Cybertopia
- The Rich Get Richer
- A Passive Mean World
- Trading Places

Cybertopia (*Globalization: trade, govmt involvement: low, communications: vibrant, security high*)

The explosive growth of Internet accelerated globalization in all forms. Cyberspace became the medium of human activity, as the city had for the industrial transition. The majority of human waking hours were spent in cyberspace. In fact most transactions are conducted without any reference to gender. The "Year 2000 problem" was a temporary roadblock for all countries that had older mainframes and software - primarily the OECD countries; solving the problem proved to be an opportunity for modernization and growth. Falling prices and increasing capacity and ease of use of microminiaturized computers connected almost everyone to anyone, anywhere, for nearly anything that could be digitalized. If your company was in the net you were part of the industry, if not your company was a renegade. Decision-making speed was key to success in this world; organizations burdened by bureaucratic overhead were left behind. This explosive growth in international activity translated into increased support for and responsibilities of the UN family of organizations and others that provide global standards and cooperation for international business. With easy access to world education and markets, individuals acted like holding companies investing their time in diverse activities, inventing their careers, granting access to others as nations used to grant visas. UN systems and multi-national corporations formed many partnerships. Developing countries made remarkable progress via tele-education, telemedicine, telebusiness partners, and telecitizens in richer areas who assisted their poorer homelands. It was the Internet that brought advanced medical information, promoted family planning, and enhanced literacy through international lectures of top educators around the world. Technology, including biotechnology, spread globally; this promoted "leap-frog" development in poor countries that could now develop and follow new paths to wealth. In Africa, life expectancy rose, not an unmixed blessing since this helped increase the level of population, but with falling birth rates, literacy improved, and economic conditions were much less dismal than they might have been.

The Rich Get Richer (*Globalization: trade, govmt involvement: low, communications: vibrant and security low*)

Throughout the twentieth century, the rising inequality of incomes within and between nations had been a matter of increasing concern. In 1997, the most prosperous group of workers in the world - the skilled workers of the industrial countries, earned on average sixty times more than the poorest group--the farmers of Sub-Saharan Africa. Even on a national basis, taking account of all income and workers, the gap was huge; in terms of GDP per capita, by 2050 the difference between the richest

country (the US) and the poorest region (Africa) was almost 50 to 1. As one looks back from the vantage point of the mid century, it's clear that there were two separate and distinct periods. At the beginning of the century, economic and social conditions in many of the poorer countries deteriorated and the gap between rich and poor countries increased, to the dismay of the world community. In the last two decades, however, conditions in even the poorest countries have been improving and now exceed those of 50 years ago. In other words, through the last 50 years, the rich got richer, and recently- in the last two decades- conditions in even the poorest countries have improved. So at the midpoint of the 21st century the world finds itself with populations that generally have improved their living conditions. Life span has increased, health has improved; women are more effectively integrated into the labor force; communications and information systems have brought high quality education to every village. Poverty remains, to be sure, but vigorous capitalism and global trade have led to a world that eluded the policy makers of the last century.

A Passive Mean World (*Globalization: isolation, govt involvement: high, communications: stagnant and security high*)

Jobs are the problem. In the simplest of terms, population growth outpaced the rate of job creation almost everywhere. In some places the difference was small, especially within parts of the newly developing countries that traded within the three trading blocks - the EU, Latin America, and the Pacific Rim. In other places, such as Africa, jobs - real jobs - were a precious commodity. For example, in Africa by 2010, there was a surplus of a million people in the manufacturing sector, and almost two million in agriculture. While population growth rate diminished from the highs of the mid 20th century as a result of somewhat improved literacy, and empowerment of women, the levels achieved disappointed many demographers who had been expecting a steeper decline. Population almost doubled in parts of sub-Saharan Africa by 2025, and in Asia, the world's most populous countries experienced rapid growth. By 2025, India's population passed China's.

Trading Places (*Globalization: trade, govt involvement: low, communications: vibrant and security: low*)

From this 2050 vantage point, it is clear that the past five decades have witnessed extraordinary shifts in global economic and political power. The booming economies of East and Southeast Asia have recovered from their meltdowns of the late 1990's and grown and challenge the economic dominance of the US, Western Europe and Japan. U.S. GDP growth averaged a paltry 1.5 percent between 2000 and 2005 and then dropped further. The GDP growth rate of China remained at double digit levels through the first part of the new century and then began a slow decline to a rate about equal to the US. The North/South gap that so preoccupied economists in the late 20th century has narrowed and the concept of balanced equity among nations seems archaic.

3.8 2020 Global Energy Scenarios, by the Millenium Project

From Global Energy Scenarios

Millenium Project, World Federation of UN Associations, , 2006.

(<http://www.millennium-project.org/millennium/scenarios/energy-scenarios.html>)

The following scenarios are depicted:

- “Business as usual – The skeptic”
- “Environmental Backlash”
- “High-tech economy – Technology pushes off the limits”:
- “Political Turmoil”

“Business as usual – The skeptic” *(Moderate growth in technological breakthroughs, in environmental movement impacts, in economic growth and moderate changes in geopolitics and war/peace/ terrorism)*

This scenario assumes that the global dynamics of change continue without great surprises or much change in energy sources and consumption patterns other than those that might be expected as a result of the change dynamics and trends already in place.

So, yes, it’s easy to be a skeptic. We’ve heard it all before. What people miss most about the old days is vacations in distant places, freedom to drive what they wanted and where they wanted, having a government they could believe in, that tells the truth—if indeed anyone knows what truth is any more—and stability. Today there is too much pessimistic thinking about energy. Reserves have grown in the past when depletion was forecast, and now many people in the industry say it will happen again. As for developing new energy systems, with effort and fortitude the world powers can solve the problem; they can do anything they want to do. But the World Soccer Games are on TV now, so let’s worry about all this tomorrow.

“Environmental Backlash” *(Moderate growth in technological breakthroughs, High environmental movement impacts, in economic growth and moderate changes in geopolitics and war/peace/terrorism)*

This scenario assumes that the international environmental movement becomes much more organized; some groups lobby for legal actions and new regulations and sue for action in the courts, while others become violent and attack fossil energy industries.

Technological breakthroughs, regulatory changes, and increased public awareness of the energy-environment linkages have changed the mix of energy usage. For example, hybrid cars now outsell gasoline-only cars, and biofuel and electric cars are catching up fast. The big promise of nanotechnology to decrease manufacturing unit costs, requiring a smaller volume of materials and energy usage and hence lowering the environmental impact and increasing productivity, is just now on the horizon. In the meantime, over one-third of our transportation needs are still met by petroleum. The oil producers also continue to supply the needs of aviation, plastic, and pharmaceutical industries for the foreseeable future.

Unfortunately, the dynamics set in motion over the past will continue climate change for some years to come. Although great gains have been made in both energy efficiency and the production of energy via non-greenhouse-producing systems, humans still emit about 9 billion tons of carbon per year. Granted, this is less than the forecast back in 2005, but it is still too much, since the absorption capacity of carbon by oceans and forests is only about 3 billion tons per year. If we are to avoid the point of inflection for a serious runaway greenhouse effect, we still have to continue improving. We must hope that the new policies, technologies, and cultural patterns will make the impacts less traumatic than they might have been.

“High-tech economy – Technology pushes off the limits” (*High growth in technological breakthroughs, low environmental movement impacts, high economic growth and few changes in geopolitics and war/peace/terrorism*)

This scenario assumes that technological innovations accelerate beyond current expectations and have impacts in the energy supply mix and consumption patterns of a magnitude similar to the Internet’s impact in the 1990s.

“Political Turmoil” (*Moderate growth in technological breakthroughs, low environmental movement impacts, moderate/low economic growth and major changes in geopolitics and war/peace/terrorism*)

This scenario assumes increasing conflicts and wars, with several countries collapsing into failed states, leading to increasing migrations and political instabilities around the world.

3.9 Three Middle East Peace Scenarios, by the Millennium Project

*From Three Middle East Peace Scenarios
Millennium Project, World Federation of UN Associations
(<http://www.millennium-project.org/millennium/ME-Peace-Scenarios.html>)*

The following scenarios are presented:

- Water Works
- The Open City
- Dove

Water Works

Water crises led to water negotiations that built trust that peace was possible and boosted political negotiations. Momentum increased with new youth political movements, the "Salaam-Shalom" TV series complemented by Internet peace phone swarms, tele-education in refugee camps, the Geneva Accords complemented by parallel hardliner negotiations, joint development with Arab oil money and Israeli technology, participatory development processes, new oil pipelines from the Gulf to the Mediterranean, and a unique "calendar-location matrix" for time-sharing of the holy sites. UN troops enforced agreements with non-lethal weapons, and new forms of international collaboration cemented the peace.

The Open City

The new Pope challenged Jewish and Muslim religious leaders to solve the question of governance in Jerusalem. Politics, power, and media all played a role in reaching a proposed solution that was ultimately codified in a resolution adopted by the UN General Assembly. The threat of a fatwa ended the suicide bombings; when the bombings stopped, so did the Israeli retaliatory missions. Education of young Muslims gradually changed; schools that once taught hatred moderated. On the question of refugees, the Israelis were concerned about being overwhelmed and outvoted by Palestinian immigrants in their democratic society. The issue promised to be inimical but a compromise restricted the right to vote to people who had lived in Israel for more than seven years. Finally, a historic proposal came to the UN from Israel-it traded guarantees of Israeli security for establishment of a permanent Palestinian state.

Dove

"Dove" was a secret, contested Israeli plan to de-escalate and unilaterally renounce retaliation in order to demonstrate that Palestinians were aggressors. At the same time, a secret debate was taking place among extremist Palestinians on whether to escalate to more lethal weapons. Those against escalation said "If we desist, Israel will be seen as the aggressor." So each side had reasons for wanting to stop but seemed frozen by circumstances. The tide changed when 27 Israeli pilots said they would not participate in future air raids, initiating the "Refusnik" movement. What happened next was like a chess game. The Israelis got a guarantee that the bombing would stop; the Palestinians got an agreement that the Israelis would withdraw to the pre-1967 borders. A series of non-aggression treaties and agreements stated that Israel had a right to exist. Jerusalem became an open city, with its own democratic government. Immigration quotas were established. Foreign capital flowed into the area. New businesses were established, and unemployment among the

Palestinians dropped sharply. It was a self-fulfilling cycle: the move toward peace sparked the environment for peace.

3.10 Future S&T Management Policy Issues 2025 Global Scenarios, by the Millenium Project

From Future S&T Management Policy Issues 2025 Global Scenarios

Millenium Project, World Federation of UN Associations.

(<http://www.millennium-project.org/millennium/scenarios/st-scenarios.html>)

The following scenarios are presented:

- S&T Develops a Mind of Its Own
- The World Wakes Up
- Please Turn off the Spigot
- Backlash

S&T Develops a Mind of its Own

The rate of scientific discoveries and advanced technological applications exploded. A global science/social feedback system was at work: science made people smarter, and smarter people made better and faster science. Better and faster science opened new doors to discovery, and new doors led to synergies and solving of old roadblocks. Removing the roadblocks created new science that made people smarter. S&T moved so fast that government and international regulations were left in the dust. Science and technology appeared to be taking on a mind of its own.

The World Wakes Up

The murder of 25 million people in 2021 by a self-proclaimed Agent of God who created the genetically modified Congo virus finally woke the world up to the realization that an individual acting alone could create and use a weapon of mass destruction. This phenomenon became known as SIMAD—Single Individual Massively Destructive. Regulatory agencies and mechanisms were put into place to control the science- and technology-related dangers that became apparent. Education was a big part of the answer, but connecting the educational systems with the security systems was disturbing to some people. Nevertheless, further individual acts of mass destruction were prevented. International and government regulations did manage the S&T enterprise for the public good.

Please Turn off the Spigot

Science was attacked as pompous and self-aggrandizing, as encouraging excesses in consumption, raising false hopes and—worse—unexpected consequences that could destroy us all. Particularly worrisome was accidentally or intentionally released genetically modified organisms and the potential for weapons of mass destruction. The poor were ignored. A science guru arose to galvanize the public. A global commission was established but failed because of corruption. But a new commission with built-in safeguards seemed to be working.

Backlash

Control was low and science moved fast, but negative consequences caused public alarm. The golden age of science was hyped by the media, but it all proved to be a chimera. Some of the most valued discoveries and new capabilities had a downside and surprises abounded. Rogue nations took advantage of some of these shortcomings. The level of concern rose. Mobs protested. Regulation failed. Progress stalled. And corporate (or government) scientists frequently felt pressure from within their organizations. Both corporate and government organizations could not be counted on to self-regulate. What's next?

3.11 Anti-Terrorism Scenarios, by the Millenium Project

From Anti-Terrorism Scenarios

Millenium Project, World Federation of UN Associations.

(<http://www.millennium-project.org/millennium/antiterrorism.html>)

The following scenarios are shown:

- Escalation
- Counter Mindset: the intellectual arms race to 2005
- Root Causes
- Socratic Justice
- The Wild West
- The Peaceful Cowboy
- The Next Year
- Fortress USA/OECD
- Establishing a Global Civic Ethic
- Colonialism Reborn
- Call on the UN
- Other Scenarios
- New York University Scenarios

Escalation:

A long war involving attack and counter attack through biological and nuclear saber rattling. The poppy fields of Afghanistan are attacked with Agent Orange to dry up a principal source of terrorist income. But it is a long war. (Gordon)

Counter Mindset

Political Islamists saw secular Western capitalism as reducing everything to a commodity, reinforcing individualism and greed, and arrogantly running financial and political rules of the world to American's benefit. They believed that Islam's mission was now to set the world right. The strategies followed by the international community addressed this mindset. Television, radio, software, magazine, music materials were designed to reinforce the idea that this was a war against terrorism and promoted the restoration of the right and proper image of Islam. A "Global Partnership for Development" gave reason for people not to be sympathetic with terrorists. In short, this was an "intellectual arms race" (Glenn)

Root Causes

The US led military war against terrorism failed to end terrorism. The US proposed a different global strategy involving the provision of minimal standards of health, education, services and housing, worldwide. After a short period of expansion and association with other social radical movements, terrorism started to lose ground. A strong emphasis was placed on education by nations of the world to reduce inequality in access to work opportunities and to attain an acceptable standard of living on a global basis. (Gutierrez)

Socratic Justice

The US used all of the powers that the UN could offer. The US ratified the International Criminal Court and encouraged other nations to do so. The US brought captured terrorists and criminals to the Court and then focused on new modes of international cooperation. (Gordon)

The Wild West

US and Allied military strikes led to endless escalation in a war that apparently was won, but over time sped up the process of decline, with terror meeting terror. The CIA got back into business on a big scale. Nations already poor became poorer. (Inayatullah)

The Peaceful Cowboy

The US sought means to cooperate with other nations to deal with terrorism in a more contained, targeted way, although a great deal of wild west posturing continued. There were three parts to its strategy: improved internal security; enhanced intelligence; and economic action.. Eventually, protection against terrorism has become almost a habit. (Barton)

The Next Year:

An invasion of the Taliban areas results in the execution of the Taliban- held UN aid workers. This provides additional moral support for more military strikes. The US considered withdrawing support for Israel unless they reduced their military severity. Casualties mounted. Bin Laden was apparently assassinated by one of his men but more likely by Alliance special forces. (Rogers)

Fortress USA/OECD

Borders were closed, locked down. This led to general impoverishment and the loss of innovation that accompanies immigration. in the short run. It provided the appearance of security, but in the longer run, poverty resulted. (Inayatullah)

Establishing a Global Civic Ethic

Key international NGO's formed a global council that believed that the major impediment to lasting peace and global security was the lack of a global civic ethic. A World Public Service was formed in which volunteers took on global ethical management tasks in international conflict resolution. Their strategy: potential combatants have to agree to mediation and to implement the outcomes thereof.

Failing this, sustained ongoing sanctions would follow. Comprehensive military action overseen by a global peace force would be a last resort. (Wildman)

Colonialism Reborn

After the US destroys the Taliban regime, internal conflicts in Afghanistan cause local rioting and escalating conflicts. bin Laden's death (or capture) creates enthusiasm in the US and unrest in the Muslim countries. Massive deliveries of assistance for Afghanistan are provided to the country in the form of food, quick rebuilding of hospitals, others services, and infrastructure. In the Middle East, the US is forced either to put pressure on both parties to find a compromise, or to accept complete failure of the peace process and thus the West becomes further involved in the unstable region from Pakistan to the Middle East. An unexpected terrorist event dramatically changes the situation which then becomes similar to the colonial wars of the 19th and 20th centuries. A long period of reshuffling of the political and security system follow.

Call on the UN

The investigation that "followed the money" to map the criminal network and catch the criminals proved to be extremely complex and the speed of international financial markets made this task more difficult than anticipated. It became clear that the US experience in Afghanistan would become similar to the USSR's, but complicated by continued terrorism at home. This situation lasted for more than one year and induced some serious political changes both in different Islamic countries where extremists obtained greater influence and in the US too, where the war (and Bush) became unpopular. The "anti-global" movement gained influence, and new leaders with new policies appeared. The UN was seen as potentially more useful in settling international disputes than direct interventionism had proven to be. The Bin Laden case, still unsolved, was taken over by the International Criminal Court.

Other Scenarios

Other scenarios envisioned the successful rising up of local forces in those countries where the terrorism is based and achieving a situation in which terrorism gradually disappears or is reduced to its minimum.

New York University Scenarios

Outside of this effort, the New York University's Interactive Telecommunications Program identified about 25 possible scenarios, but focused on five that they thought most critical.

3.12 Global Normative Scenarios, by the Millenium Project

From Global Normative Scenarios

Millenium Project, World Federation of UN Associations.1999

(<http://www.millennium-project.org/millennium/normscen.html>)

By 2050 the world had finally achieved a global economy that appears to be environmentally sustainable while providing nearly all people with the basic necessities of life and the majority with a comfortable living. The resulting social stability has created a world in relative peace, exploring possible futures for the second half of the 21st century.

Different explanations have been given for the series of astounding successes achieved by 2050. Some believe that breakthroughs in science and technology were the keys, others that development of the human potential was more fundamental, and still others that political and economic policies made the difference. All three themes were important and mutually reinforcing.

The following scenarios are depicted:

- Technological Theme
- Human Development Theme
- Political Economic Policy Theme

Technological Theme

Internet has become a right of citizenship. Businesses give free accounts to all customers; employers give them as an employee benefit. The connection of virtually all people to the global information and communications systems accelerated the pace of scientific research and the introduction and diffusion of new technology. Biotechnology, nanotechnology, and closed-environment agriculture fed the world. New and improved sources of energy made cleaner economic growth. Brain-like intelligent systems used neural networks to augment human intelligence and improve decision making. Molecular manufacturing (nanotechnology) lowered manufacturing unit cost, requiring less volume of materials and energy usage, and hence, lowered the environmental impact of a population that had almost reached 10 billion. Vaccinology and genetic engineering eliminated most acquired and inherited diseases further reducing the need for more frequent pregnancies to have a similar sized family. This was a factor in further lowering fertility rates, even though generational mini-booms have continued from the great population explosion in the mid-20th century. Cyberspace had become a major medium of civilization creating a constantly growing, non zero-sum economy and had changed day-to-day life as significantly as the industrial revolution had changed life 200 years earlier. The success of the International Space Station had led to other orbital habitats, the lunar base, and the pioneer communities on Mars. Nearly 250,000 people now work in space communities in orbit, on the moon, and on Mars, giving a new frontier for human imagination and advances in civilization.

Human Development Theme

The acknowledgment that education was the solution to many problems and that the knowledge economy was spreading rapidly, stimulated governments and corporations worldwide to increase their investments in education, training, and applications of cognitive science. The race to educate the world began after the World Summit on Cognitive Development in 2010. Most institutions that had even a peripheral association with education began debating the most equitable and cost/effective ways to make everyone knowledgeable, virtuous, and intelligent. Internet access became a right of citizenship. Educational software was imbedded into nearly everything that could hold a computer chip. The World Cyber Games permeating daily life blending entertainment and education.

Political Economic Policy Theme

The number of wars decreased as democracies and respect for cultural diversity increased in the early 21st century. Although old cultural conflict wounds of the past still flare occasionally, we can successfully avert and prevent them from growing into larger conflicts. The resulting social stability nurtured economic growth and created 2 billion people in the global middle class by 2010. This increased conditions for further stability and sustainable growth that moved over 5 billion people in the middle class by 2050.

3.13 Land Use Change Scenarios, by Rudolf de Groot, Kasper Kok, Mita Patel

*From MEDAction: Policies for land use to combat desertification
By Rudolf de Groot, Kasper Kok, Mita Patel*

Three scenarios are presented:

- Convulsive Change
- Big is Beautiful
- Knowledge is King

Convulsive Change (*What if climate change is as disruptive as some are now predicting, triggering a series of severe droughts and desert formation, and outpacing society's ability to adapt?*)

"In the spotlight" 2000-2010 - The Mediterranean region profits from the healthy economic situation and the gradually changing consumption patterns. The First Great Drought takes Europe by surprise and puts the south in the spotlight. It heavily impacts the agricultural sector and damages the tourist industry. Support from the EU to alleviate the effects of climate change is slow, as focus is on floods in the north.

"Dry, dierd, driest" 2010-2025 - A new series of severe droughts demonstrate the lasting impact of climate change beyond any doubt. Mini-deserts are expanding at an alarming rate and irreversibly change the landscape in the south, thus boosting the efforts to combat desertification. Large-scale water transport ameliorates the situation of irrigated agriculture and tourism, but the quickly increasing flux of environmental refugees poses new problems.

"Instable resilience" 2025-2030 - Climate change continues unabated, but the effects of a new drought are not as disruptive as before. Society is very gradually showing signs of resilience and slowly learns how to deal with droughts, water scarcity for cities, tourists and agriculture, and land degradation.

Big is Beautiful Scenario (*What if the 'merger principle' oversteps all limits, creating an oversized EU and powerful multinationals, thus initiating societal degeneration?*)

"Crushed agriculture, anyone?" 2000-2010 - At the European level, the dominant driving forces in all sectors push toward evergreater integration. The EU quickly consists of more than 30 countries, and after a series of mergers the few remaining super multinationals ("BB") gain substantial power. The increased European competition and a series of reforms of the Common Agricultural Policy are the beginning of the end of all direct aid to farmers, and the deathblow for many smallholders.

"The downward spiral" 2010-2025 - The membership of the EU further swells and the BB continues to grow in size and influence. The events are slowly causing a general degradation in the quality of life and a loss of cultural identity. Striking signs of increasing divides within society are developing. Crime and terrorism escalate and gated communities expand into gated cities. The less successful

regions (including unproductive agricultural lands) hold little natural or touristic value due to pollution and neglect. To make matters worse, climate change induced droughts strike the Mediterranean, adding to the substantial problems for what remains of the agricultural sector.

“Twilight at the end of the tunnel” 2025-2030 - The merger era rapidly closes with the EU acting more and more as a Superstate. The social tensions have abated somewhat, but remain, and the ever increasing impacts of climate change have barely been addressed. In the darkest hours of Europe, the first hesitant signs of recovery for the Mediterranean region are apparent. Although the overall situation can at its very best be described as unclear and the future as uncertain, the formation of the Southern Alliance and the Mediterranean BB have triggered developments that seem promising.

Knowledge is King Scenario (*What if technological development is such that a mass migration to the Mediterranean is initiated and a European Sunbelt is formed?*)

“Over our head” 2000-2010 - At European level, the translation to a knowledge economy accelerates. At the same time, the EU expands rapidly. Developments impact large parts of Europe but seem to pass by the Mediterranean, although innovations in the transport sector stimulate tourism and the agricultural sector is harmed by increased competition from the east. Abandoned farmland is quickly bought by real estate developers.

“Incoming” 2010-2025 - A division in society between the “Connected” and the “Unconnected” becomes apparent, which will have profound repercussions on many aspects of life in the Mediterranean. The expanded EU, cheap and fast transport, and the preference and ability of the Connected to move to a milder climate triggers the formation of a European Sunbelt. The huge influx of affluent people boosts local and national economies, but is accompanied by a range of integration problems.

“Quiet after the storm” 2025-2030 - A new healthier society is emerging where two groups exist intertwined in a dynamic harmony. The European Sunbelt is now fully developed and stretches from the south of Portugal to the eastern-most islands of Greece. Still, all Mediterranean countries struggle with the aftermath of the new situation, the Unconnected and Connected being highly polarised. Advantages, however, seem to clearly outweigh *the associated new problems*.

3.14 Future Europe Scenarios by Adjiedj Bakas,

*By Adjiedj Bakas, Trendwatcher author speaker
(<http://www.bakas.nl>)*

Three scenarios are depicted:

- A century of power struggle
- Defeating terrorism
- Turkey becomes the leader of the Islamic world
- Eurabia and New Europe

A century of power struggle

The power struggle between these two blocs (West and Islam) will continue throughout the XXIst Century. The struggle in the coming century will take four possible forms:

Islam wins and becomes the ruler of large parts of the world

Christianity wins and prolongs its position of power

Christianity and Islam unite and prepare for a fight against atheist China

Christianity and China unite in the fight against Islam

This last scenario seems the most probable: China and the Christian bloc have similar interests, including ensuring a free flow of oil from Muslim countries. Both blocs share progressive thinking and a preference for a liberal market economy, which is now manifesting itself in China. What's more, there are many similarities in the way China and the Christian bloc approach religion and spirituality. The Islamic Middle-East is actually surrounded by China, India and Israel: three nuclear powers which share a common distaste of Muslim fundamentalism and will also (aggressively) combat it.

Defeating terrorism

There is the suspicion that religion is not the main motive for many Muslim terrorists. On the contrary, the attraction is the financial rewards that are on offer. In the world of terrorism, a huge amount of money passes hands, and people want to take their share. As long as the money continues to flow, international Muslim terrorism will continue to flourish. It is simply too rewarding to be stopped.

Turkey becomes the leader of the Islamic world

The next possibility is that Turkey will become leader of the Islamic world. If Turkey chooses to reinstate the caliphate and finds a way of immunizing itself against rich fundamentalists of Saudi Arabia, it could become the political and spiritual leader of the Islamic countries. Turkey has everything to become leader of the Islamic world: an economy that is becoming stronger, a good and relatively democratic government, and a strong army. It has a long experience, stretching back over many centuries, in ruling a multicultural Islamic empire, and maintains close links with Turkish-speaking states that were previously part of the Soviet Union, and Turkish-speaking communities in China.

Eurabia and New Europe

The fourth scenario is along the first, the most probable. Western Europe merges with the Maghreb to create Eurabia, and the former Eastern Europe emerges as the non-Islamic New Europe. Western Europe is forced to give up its struggle against Islam and during the 21st century converts to Islam. Christians in the Western European countries are growing old. The young are predominantly Muslim, particularly in larger cities, have a high level of aspiration, are hard workers, assiduous students, ascetic, and a readiness to sacrifice. The Western countries that fall under the rule of Islam will, to all intents and purpose, be annexed by the North African countries, and the actual union of Eurabia will be a fact. In Middle and Eastern Europe, there will arise a New Europe, where non-Islamic migrants will find their salvation. With Berlin / Vienna as its capital, it will be a religious, political, cultural and economic union, perhaps but not necessarily united under one government.

3.15 Northern Mediterranean Scenarios, by Intelcity

From Northern Mediterranean Scenarios

By Intelcity, Mediterranean Regional Platform

<http://www2.polito.it/ricerca/ict-sud/public/index.html>

The following scenarios are presented:

- Democracy City
- Virtual City
- Cultural City
- Environment City
- Post-Catastrophe City

Scenario 1: e-Democracy City

In this scenario ICT is seen as an enabling mechanism, changing peoples' opinions and behaviour patterns through information provision and empowerment. It provides new ways of decision-making and negotiation through inclusiveness and accessible participation in the decision-making processes that affect the community. This would involve the deployment of a variety of tools such as web based group decision support for visioning, scenario planning and automatic translation as well as democratic participation tools such as e-voting and highly devolved decision-making. A peer-to-peer information system architecture is necessary, rather than client/server, that would seek to provide educational support to enable understanding of the socio-economic and environmental impacts of various options under consideration in a way that dissolves boundaries, e.g. between interest groups and between physical and virtual worlds.

The e-governance characteristics include:

- rethinking the role of community education and ways of opinion-forming
- creation of new platforms for articulation of interests
- decentralized, transparent and open decision making at all levels;
- enhanced organisational capacity (structures, knowledge, resources, motivation) to enable an iterative two-way flow of information between the community and decision makers (public and private organisations);

that together will lead not only to better ways of making decisions, but also to better, more sustainable, community decisions through a more self-determined, informed consensus and more accountable leadership.

Thus the scenario is one in which self-determinism occurs within a socially cohesive community, respecting the wider community and the environment.

Scenario 2: Virtual City

This scenario represents a knowledge society of networks and flows, where citizens are able to work and live anywhere in the city, supported by intelligent environments that are 'lean, green and SMART' (economically efficient and ecologically sound). Ubiquitous computing and telework lie at

the centre of work and living, supported by SMART transportation and logistics networks. It also depends on the development of intelligent agents to provide of personalised, self-tailored information to support a culturally rich, mobile lifestyle.

It is recognised this will require major infra-structural development in the supply of utilities and that both the economic and environmental transformation which this predicates would also require “strong” governance. This requirement however, provides the opportunity to use the ICT’s and SMART technologies both to empower citizens and make the corporate sector socially responsible (i.e. by taking on economic and environmental issues). New social support groupings are established such as local virtual village halls as well as more dispersed partnerships (e.g. pressure groups) across the whole city and beyond. Together this offers the potential for a more socially inclusive and therefore, progressive form of governance.

If dispersed, virtual cities are to emerge, they need a stronger cultural basis and their socio-economic and environmental implications need to be more clearly articulated.

Scenario 3: Cultural City

This scenario is underpinned by a strong social and environmental ethic. The principles of the cultural city define its social and political organisation, emphasising liberal democracy, equity, multicultural diversity, and cultural and spiritual integrity. It provides the ideal community environment where individual needs and well-being can be balanced with that of society in general.

Advanced technology is present although entirely invisible - it is embedded. This applies to all forms of technology, including mobility and communication technologies. In the cultural city the additional means and channels of communication that ICTs provide assists, imperceptibly and unobtrusively, in all aspects of life, work, education, art, leisure and the democratic processes. It is particularly useful in the negotiation and mediation necessary for agreeing collectively, e.g. for urban re/development action.

The cultural city has a distinct physical form, which is human in scale. This is a high quality environment in which the buildings and landscape a predominant, rather than the mobility systems. The built heritage provides cultural symbols, a strong, sustainable, binding factor between the present and the past. At the heart is a civic entity, space(s) for cultural and artistic exchange and democratic engagement. Thus it is framed and is facilitated by a fundamentally democratic decision-making process. This commences with commitment to stakeholder definition of goals and objectives for a new sustainable future and its delivery according to a democratic expression of rights and responsibilities, individual, corporate and governmental.

Scenario 4: Environment City

This scenario is based on the realistic concept of incremental change in which all the current environmental and social problems are gradually addressed, solved or ameliorated over the period up to 2030. ICTs would play an important part in this enviro-lution through integration into society in ways that are both enabling and contribute to the quality of life.

In physical and ecological terms the environment city would be very resource efficient achieving factor 4 reductions (at least). An important legal aspect supporting this is the requirement on all manufacturers to recycle/reuse at end of life, thus closing liability loops, which in turn would reduce pollution to very low levels. Resource reduction targets would constrain the outward expansion of

cities, with polycentric (internal) growth patterns to reduce mobility requirements and provide greater flexibility and with a better balance in the investment in public and private spaces. Regeneration of the existing fabric would provide greater density of habitation, more effective and efficient public transport and local food production.

In economic terms full employment (in its wider sense meaning some form of rewarding activity) would be stimulated through the adoption of a service economy where innovative means of extending product life would be sought. The value of “public goods” would be rediscovered.

In social and cultural terms a multi-cultural, secure and safe society will be achieved through a combination of governance measures and the application of ICTs. This would seek to increase ‘self-organising’ capacities through better public information and participation in urban re/generation so that cities could become lively cultural places, which should tend to decrease current problems with crime and insecurity.

The environment city can be summed up as being of long life, low energy and adaptable. This could be applied equally to the buildings and infrastructure as much as to the citizenry.

Scenario 5: Post-Catastrophe City

The scenario is driven by the albeit small possibility of high impact events, such as a natural catastrophe, (e.g. very large volcanic eruption or a meteor strike), environmental catastrophe (e.g. serious global warming causing loss of ice cover at the poles with significant sea level rise of meters) or global war, which may be sufficiently serious to also cause breakdown in the economic system and/or global trade. This would considerably alter the relationship between citizens and the state and impact significantly on the freedom of choice of citizens. This might be exemplified by a crisis in the use of fossil fuel and its adverse impacts on climate and environment and the possible imposition of a carbon tax or very large resource reduction quotas.

It is likely that wealth and quality of life would suffer initially with effective action being seen to be imperative in order to improve matters. Free market conditions would be unlikely to respond quickly enough to events or to respond sufficiently to alleviate the threat(s). Government(s) would have to impose regulations to control behaviour of markets, citizens and industry, assuming, for example that the cost of carbon misuse is sufficient to make it worth saving. Complexities and uncertainties in this situation are large. Means of encouraging rather than enforcing more sustainable behaviour would be relevant, e.g. trading carbon credits, giving interest on carbon accounts, etc.

Amongst these uncertainties information and communication technologies would be highly relevant to such new forms of rationing, i.e., in the equality in allocation of resources. Clearly it can enable real-time monitoring of resource use, carbon in the example, by individual citizens, companies and other organisations.

3.16 Great Transition Scenarios, by Global Scenario Group

From Great Transition: The Promise and Lure of the Times Ahead, 2002.

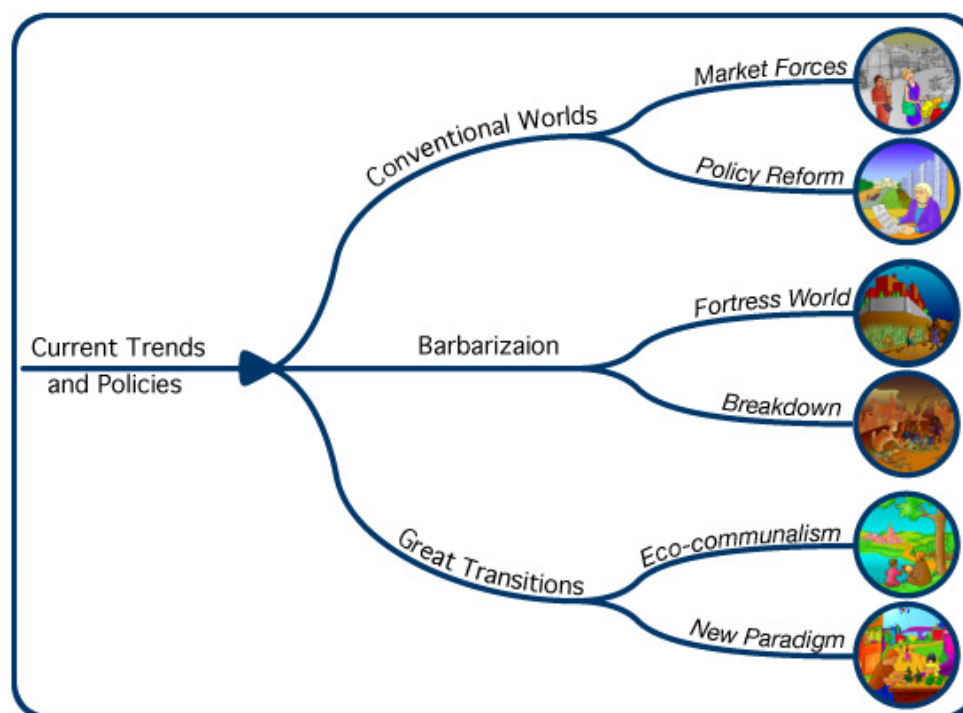
By Paul Raskin, Tariq Banuri, Gilberto Gallopín, Pablo Gutman, Allen Hammond, Robert Kates, Rob Swart for Global Scenario Group¹⁵

(http://gsg.org/scenario_descriptions.html) <http://www.gtinitiative.org/>

Three scenarios with two variants every one are in depicted

- Conventional Worlds
 - Market Forces
 - Policy Reform
- Barbarization
 - Fortress World
 - Breakdown
- Great Transitions
 - Eco-Communalism
 - The New Sustainability Paradigm

¹⁵ The Global Scenario Group was convened in 1995 by the Tellus Institute and Stockholm Environment Institute to engage a distinguished and diverse international group in an examination of the prospects for world development in the twenty-first century. In the years since, numerous global, regional, and national studies have relied on the GSG's scenario framework and quantitative analysis.



Conventional Worlds

In this scenario are futures that evolve gradually from today's dominant forces of globalization as economic interdependence deepens, dominant values spread and developing regions gradually converge toward rich-country patterns of production and consumption. In the Market Forces variant of Conventional Worlds, powerful global actors advance the priority of free markets and economic expansion, relying heavily on technological innovation to reconcile growth with ecological limits. In the Policy Reform variant, governments eventually respond to nagging global problems with comprehensive initiatives to align the economy with environmental and social goals. Fundamental change is absent.

Market Forces

This variant incorporates mid-range population and development projections, and typical technological change assumptions. The problem of resolving the social and environmental stress arising from global population and economic growth is left to the self-correcting logic of competitive markets.

Policy Reform

This variant adds strong, comprehensive and coordinated government action, as called for in many policy-oriented discussions of sustainability, to achieve greater social equity and environmental protection. The political will evolves for strengthening management systems and rapidly diffusing environmentally-friendly technology, in the context of proactive pursuit of sustainability as a strategic priority.

Barbarization

This explores the risk of rejecting the need for deeper change. In these scenarios, Conventional Worlds strategies are inadequate to address mounting environmental and social stress and problems spiral out of control, leading to a general crisis and the erosion of civilized norms. In the Fortress Worlds variants, powerful international forces are able to impose order in the form of an authoritarian system of global apartheid with elites in protected enclaves and an impoverished majority outside. In Breakdown variants, by contrast, these forces are unable to counter or even inhibit spreading chaos, waves of disorder ensue, and institutions collapse.

Fortress World

This variant features an authoritarian response to the threat of breakdown. Ensclosed in protected enclaves, elites safeguard their privilege by controlling an impoverished majority and managing critical natural resources, while outside the fortress there is repression, environmental destruction and misery

Breakdown

In this variant, crises combine and spin out of control, leading to unbridled conflict, institutional disintegration and economic collapse.

Great Transitions

This scenario examine worlds that transcend reform, going on to embrace new values that change the precepts of global development. One variant, Eco-communalism, encompasses the small-is-beautiful visions favored by some environmental and anarchist subcultures. However, it is difficult to envision how a patchwork of self-sustaining communities could emerge from our increasingly connected world, except perhaps in recovery from collapse. The New Sustainability Paradigm, the variant embraced by GTI, sees globalization not only as a threat but also an opportunity to construct new categories of consciousness – global citizenship, humanity-as-whole, the wider web of life, and the well-being of future generations – alongside a governance architecture that balances the twin goals of global unity and regional pluralism.

Eco-Communalism

This variant incorporates the green vision of bio-regionalism, localism, face-to-face democracy, small technology and economic autarky.

The New Sustainability Paradigm

This variant shares some of the goals of the Eco-Communalism scenarios, but would seek to change the character of the urban, industrial situation rather than to replace it, to build a more humane and equitable global civilization rather than retreat into localism.

3.17 IPCC Special Report Emissions Scenarios (SRES), by Intergovernmental Panel on Climate Change

From IPCC Special Report Emissions Scenarios

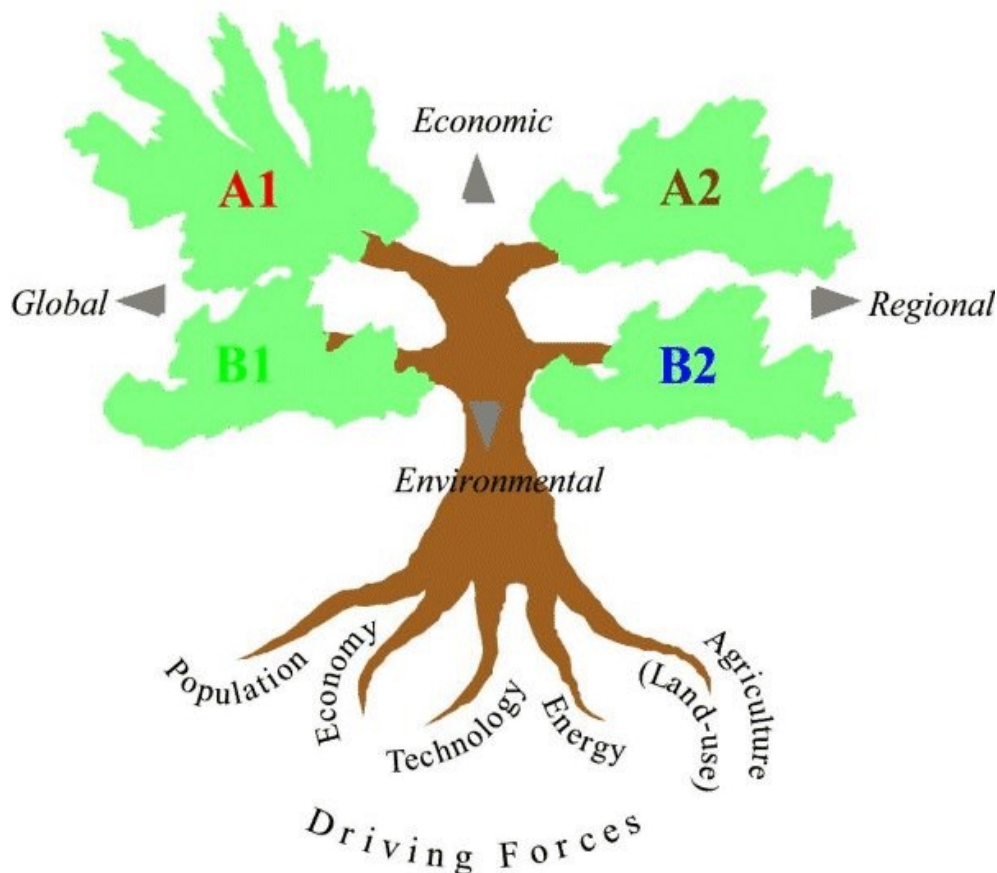
By Intergovernmental Panel on Climate Change, 2000

(http://www.grida.no/publications/other/ipcc_sr/?src=/climate/ipcc/emission/093.htm)

The scenarios developed for the Special Report on Emissions Scenarios (SRES scenarios) are presented below:

- A1
- A2
- B1
- B2.

SRES Scenarios



A1 Scenario

The A1 storyline is a case of rapid and successful economic development, in which regional average income per capita converge - current distinctions between "poor" and "rich" countries eventually

dissolve. The primary dynamics are the strong commitment to market-based solutions, high savings and commitment to education at the household level, high rates of investment and innovation in education, technology, and institutions at the national and international levels and international mobility of people, ideas, and technology. The transition to economic convergence results from advances in transport and communication technology shifts in national policies on immigration and education, and international cooperation in the development of national and international institutions that enhance productivity growth and technology diffusion.

A2 Scenario

The A2 scenario family represents a differentiated world. Compared to the A1 storyline it is characterized by lower trade flows, relatively slow capital stock turnover, and slower technological change. The A2 world "consolidates" into a series of economic regions. Self-reliance in terms of resources and less emphasis on economic, social, and cultural interactions between regions are characteristic for this future. Economic growth is uneven and the income gap between now-industrialized and developing parts of the world does not narrow, unlike in the A1 and B1 scenario families.

B1 Scenario

In the B1 scenario are high levels of environmental and social consciousness combined with a globally coherent approach to a more sustainable development. Heightened environmental consciousness might be brought about by clear evidence that impacts of natural resource use, such as deforestation, soil depletion, over-fishing, and global and regional pollution, pose a serious threat to the continuation of human life on Earth. In the B1 storyline, governments, businesses, the media, and the public pay increased attention to the environmental and social aspects of development. Technological change plays an important role. At the same time, however, the storyline does not include any climate policies, to reflect the SRES terms of reference. Nevertheless, such a possible future cannot be ruled out.

B2 Scenario

The B2 world is one of increased concern for environmental and social sustainability compared to the A2 storyline. Increasingly, government policies and business strategies at the national and local levels are influenced by environmentally aware citizens, with a trend toward local self-reliance and stronger communities. International institutions decline in importance, with a shift toward local and regional decision-making structures and institutions. Human welfare, equality, and environmental protection all have high priority, and they are addressed through community-based social solutions in addition to technical solutions, although implementation rates vary across regions.

3.18 Scenarios for Europe 2010. Five Possible Futures for Europe, by Forward Studies Unit, European Commission.

From Scenarios Europe 2010 Five Possible Futures for Europe

By Gilles Bertrand (coord.), Anna Michalski and Lucio R.. Pench for the Forward Studies Unit, European Commission.

The following scenarios are described:

- Triumphant Markets
- The Hundred Flowers
- Shared Responsibilities
- Creative Societies
- Turbulent Neighbourhoods

Triumphant Markets

This scenario echoes the almost uniform movement of the world towards free trade and the market economy. From the early years of the 21st century the United States continues to record excellent economic results. The economic and social systems of the rest of the world are forced to align with the main features of the American model. European political debate swings to more individualistic values - growing respect for private property, social meritocracy, etc. - and the Member States drastically reduce retirement and social protection systems. Europe becomes a dynamic economic entity characterised by strongly growing trade flows, increasing productivity in all sectors, inflation which has been curbed once and for all, and a return to full employment. On the other hand, lurk three main dangers, without the international community being able to control them. These are: the increasing inequality between rich and poor countries (globalisation continues to benefit only a minority of the world's population), the accelerating deterioration in the planet's ecosystem (the consequence of a growing number of human beings attaining western standards of consumption) and the spread of organised crime, which takes full advantage of the opportunities offered by new technologies and trade liberalisation.

The Hundred Flowers

In this scenario a maximum use of the new information and communication technologies leads to an explosion of micro-activity, but bureaucracies (both public and private) and traditional political systems are falling apart against a background of crisis among the leading nation states and increased fragmentation of the European area. The years 2000-2005 are marked by a massive crisis of confidence in which attacks on the courts, absenteeism, tax evasion and civil disobedience completely wear down the "big bureaucracies". In this period of confusion, Europeans react by falling back on local life and making increasing use of the underground economy. Local identities are strengthened, and this is accompanied by an explosion of neighbourhood structures and the associative sector. New shared values emerge which are a nostalgic mix of local action, neighbourliness and a return to nature, and the consumer society is gradually replaced by a new form of local economy, more oriented towards the neighbourhood and quality and partly

demonetised. The macroeconomic balances are more or less maintained and the economy as a whole manages to regulate itself, but the lack of effective regulatory bodies makes itself felt in more ways than one. Differences in revenue between regions increase, social differences also get wider: systems of social protection start going downhill, even if they continue to irrigate society erratically. In addition, geographical, social and political fragmentation, coupled with the erosion of established structures, gives rise to local outbreaks of violence, ethnic tensions and soaring organised crime.

Shared Responsibilities

In Shared Responsibilities the public actor plays a dominant role. Europe carries out a wide-ranging reform of its systems of government at all geographic levels (regional, national and European) and introduces a new method of conducting public action. In a prosperous international situation it manages to carve a middle way which, while not ideal, combines the ideals of solidarity and social cohesion with technological innovation and economic efficiency. The principle of mutual commitment between the citizen and the State also becomes widespread, particularly in fields such as education and social assistance. As a result of these political advances and the favourable international climate, the overall performance of the European economy is sound and the continent's societies adjust rather well to the situation (the values of trust, solidarity and responsibility are fairly widely shared by Europeans). Poverty and geographical inequality have stopped growing but have stabilised at a high level. Social protection remains solid, even if the generosity of previous decades is clearly no longer fashionable, especially where pensions are concerned.

Creative Societies

In Creative Societies, economic and political systems are thoroughly transformed too. The accounting and tax systems are thoroughly overhauled by introducing new taxes on pollution and international financial movements and better use of human capital and the environment. The other major innovation is the recognition and financing of new types of activity outside the market rationale (services of general interest, cultural stimulation, associative activities), each citizen having a time credit of five years to devote to them. To stimulate demand for these new goods, the Member States have introduced a system of *vouchers* (a proportion of wages may henceforth be paid in the form of leisure and culture cheques). The reforms have had a positive impact on social and regional inequalities and on employment. The economy takes off again gradually, borne up by services, especially the knowledge and creativity sectors (information technology, research, education, etc.), tourism and environmental protection. On the other hand, Creative Societies shows a tendency towards introversion. The scale and difficulty of internal reforms prevented the Union from developing an active external policy. Enlargement is slowed down by the new social and environmental requirements of the Member States

Turbulent Neighbourhoods

This scenario is determined to a large extent by the accelerated deterioration in the economic and political situation in Europe's neighbours. Europe tries in vain to become a fortress, and security (both internal and external) becomes the number one public concern. This psychology of the besieged citadel prevents any large-scale economic and social reform and leads to the return in strength of the nation states. The difficult external situation has strong repercussions on Europe's internal life. National governments use security threats to reassert their governmental authority, and the pervading authoritarianism receives massive support from public opinion, which is closed to change and increasingly intolerant. The priority given to security policies pushes into the background

the structural reforms required by the economy. The preoccupation with security influences all reforms in all sectors. The accession of new members is severely limited, and the creation of the European Security Council and common security agencies are the only significant advances as far as European integration is concerned.

3.19 Global Scenarios to 2025, by US National Intelligence Council

From Global Scenarios to 2025

By US National Intelligence Council, 2008.

(http://www.dni.gov/nic/NIC_2025_global_scenarios.html)

Three scenarios are presented

- Borrowed Time
- Fragmented World
- Constant Renewal

Borrowed Time

This is a world in which planning for global challenges is largely glossed over until they hit. Leaders have faith that solutions can be found and they put a lot of trust in technology as a silver bullet for environmental and climate change solutions. In response to governments limited successes though, other non-state actors (NGOs, MNCs, etc) attempt to create the solutions but find success elusive without the support of clear global state-based leadership. The more powerful nations tend to be suspicious of one another and avoid any long-term commitment to joint projects (except for limited economic projects). They believe that working alone, bilaterally or through informal groupings tends to bring better payoffs for national interests. For most, particularly the newer powers, continued economic growth is the top priority and they want to avoid distractions to that goal. While leaders know that the gap between the rich and poor (both between and within nations) has been widening and even causing disturbances in some countries, they believe that the solution lies in more growth. International policymaking can be characterized as cooperative where it suits short-term interests and requires little sacrifice, yet the bigger powers are not concerned about working at cross purposes if that enables the realization of their strategic goals.

Fragmented World

This is a world in which parochial interests take priority over sustainable economic growth. The lens through which state and non-state actors view and try to address global challenges (such as climate change and proliferation) is primarily one with a local focus, that is, the supply side of the equation is the first priority. 'International cooperation' becomes a misnomer as nations focus on what is best for them to the exclusion of international or multilateral interests. The security landscape is characterized by growing risks because of greater national focus and waning multilateral cooperation. Hence there is an increased chance that terrorism (including the possibility of biological attacks), greater numbers of displaced persons, challenges to energy security, and the threat of nuclear proliferation in the Middle East turn into full-scale crises. R&D increasingly has a strong home bias and technological diffusion dramatically slows as a climate of protectionism takes over. Climate change policies erode, reflecting a reversal from Kyoto. Overall, this is a story of progressively deteriorating environments, a world in which events outpace actions.

Constant Renewal

This is a world in which crises create the shocks needed to force fundamental changes in mindsets among people in key countries – both developed and developing – which carry sufficient weight in

the global system to shape developments. It is grassroots pressure which forces change, with various political groups, NGOs, professional organizations and “people-in-the-street” coalescing to act as an orchestrated lobbying group on government leaders in order to force inter-governmental cooperation at a global level. On the part of the leaders, a stronger international commitment “to make the system work” develops. Environmental sustainability becomes recognized as a global priority alongside maintaining global economic growth. Globalization accelerates and fewer countries are left behind. Technological innovation and R&D, supported by government, and a mix of cooperative and competitive policies becomes the norm. Leaders and pressure groups must, however, work to ensure common interests continue to take precedence. This is a world in which global cooperation is achieved through a mix of existing organizations backed up by the emergence of new global mechanisms where the current ones are found wanting. In essence, the world “learns by doing,” seeking pragmatic solutions (without dogma) and constantly recalibrating what it should do, without leaving any hostages to fortune. Progress is often a case of two steps forward, one step back..

3.20 Which World Scenarios, by Allen Hammond

From Which World? Scenarios for the 21st Century, Global Destinies, Regional Choices. World Resources Institute, 1998.

By Allen Hammond¹⁶

Three scenarios are depicted:

- Market World
- Fortress World
- Transformed World

Market World

This scenario presents a future based on the belief that market forces and new technology will lead to rising prosperity and will offer humanity a bright future, a future in which markets rule and global corporations dominate. In this scenario, economic reform and technological innovation fuel rapid economic growth. Developing regions are integrated into the global economy, creating a powerful global market, and bringing modern techniques and products to virtually all countries. The result is widespread prosperity, peace, and stability. This vision of the future is explicitly or implicitly endorsed by the vast majority of corporate leaders and economic theorists whose voices appear to be bolstered by the failure of centrally-planned economies.

Fortress World

This scenario describes a grimmer future in which islands of prosperity are surrounded by oceans of poverty and despair, a future of conflict, violence, instability, social chaos, and growing environmental degradation. This scenario is a pessimistic vision based on the failure of market-led growth to redress social wrongs and prevent environmental disasters, at least in many parts of the world, so that on the belief that unconstrained markets will exacerbate these problems, large portions of humanity will be left out of the prosperity that markets bring to others. In this scenario these failures eventually destroy the natural resources and social framework on which markets and economic growth depend. Economic stagnation spreads as more resources are diverted to maintain security and stability. Economic fragmentation occurs where conflict dominates or the social order breaks down. In this scenario enclaves of wealth and prosperity coexist, in tension, with widening misery and growing desperation.

Transformed World

This scenario shows a future in which fundamental social and political changes offer hope of fulfilling human aspirations. This is a visionary scenario in which fundamental social and political change, possibly even changed values and cultural norms, give rise to enlightened policies and voluntary

¹⁶ Allen Hammond was Vice President for Innovation and Special Projects at the World Resources Institute, a non-profit, non-partisan policy research institute located in Washington, D.C. He was also director of WRI's Sustainable Enterprise Program and Director of the Development Through Enterprise project. His responsibilities included institute-wide leadership in Base of the Pyramid initiatives. He also works on ICT-for-development with foundations, development agencies, and a number of major corporations

actions that direct or supplement market forces. This scenario envisions a society in which power is more widely shared and in which new social coalitions work from the grass roots up to shape what institutions and governments do. Although markets become effective tools for economic progress, they do not substitute for deliberate social choices. In this scenario economic competition exists but does not outweigh the larger needs for cooperation and solidarity among the world's peoples and for the fulfillment of basic human needs. This vision asserts the possibility of fundamental change for the better - in politics, social institutions, and the environment

3.21 Global Scenarios, by Graeme Taylor

From Evolution's Edge: the Coming Collapse and Transformation of Our World. New Society Publishers, Gabriola Island, BC, September 2008.

By Graeme Taylor¹⁷

Three scenarios are described:

- Rapid Collapse
- Delayed Collapse
- Transformation

Rapid Collapse

The majority of the world's political and business leaders resist making major changes and continue with business as usual. As a consequence the pace of environmental destruction will increase and resource shortages will rapidly worsen. The response to shortages will be to increase the rate of exploitation of the planet's remaining natural capital, a process that will accelerate the destruction of major ecosystems. At some point in the near future cascading environmental, economic and political crises will become uncontrollable. This will cause irreversible damage to social and biophysical systems and bring about the catastrophic collapse of industrial civilization.

Delayed Collapse

The majority of political and business leaders proactively introduce environmentally friendly technologies and provide emergency economic support to prevent unrest and conflict. These efforts will temporarily stabilize the industrial system and slow the pace of global warming and environmental destruction. However, attempts to improve the system without making fundamental changes to its unsustainable culture and economy will fail. The environment will continue to degrade, and efforts to manage crises will consume more and more scarce resources. Although system failure will be delayed, the eventual result will be the same as in the first scenario: the inevitable collapse of major ecosystems and human societies.

Transformation

As regional and global crises grow and the world economy begins to fail, it becomes increasingly clear to people all over the world that the current global system is unsustainable and heading for catastrophic collapse. More and more people will then question the destructive values and institutions of the industrial system and begin to look for constructive alternatives — pathways to survival. Large numbers of people will be attracted to the developing systems-based vision of a sustainable future. The emergence of this new paradigm will enable the rapid constructive transformation of global views, values, technologies and social structures.

¹⁷ Graeme Taylor coordinates BEST Futures (www.bestfutures.org), a family project applying evolutionary systems theory to research and model societal change. He won the Independent Publisher's 2009 Gold Medal for the *Evolution's Edge: The Coming Collapse and Transformation of Our World*

3.22 World Business Council for Sustainable Development (WBSCD) Global Scenarios 2000-2050

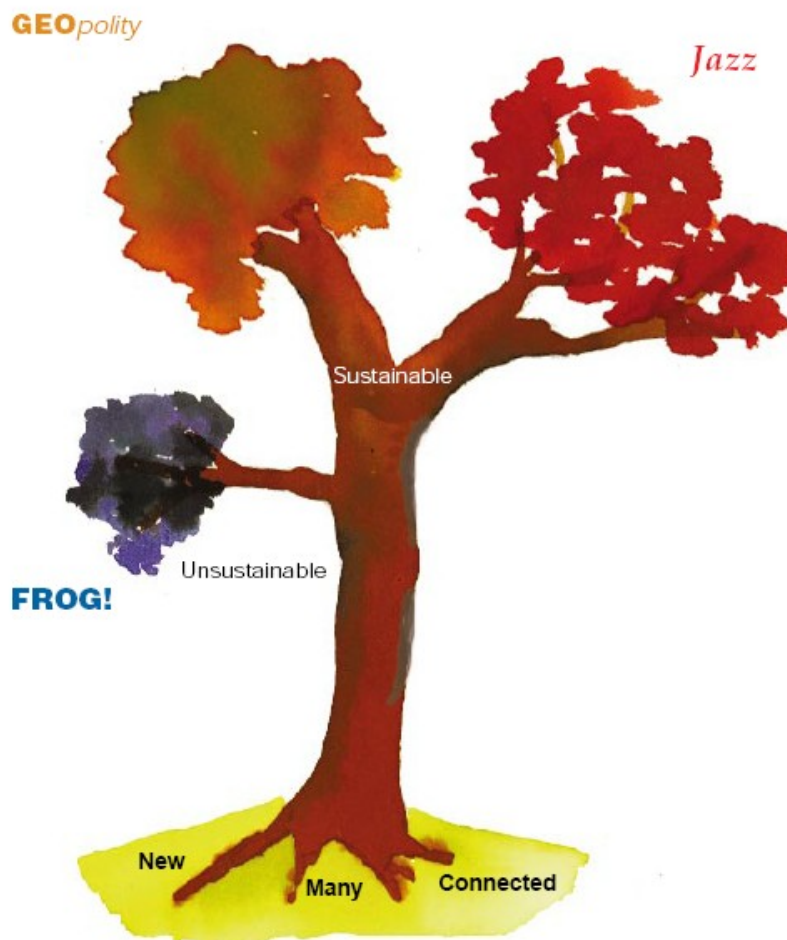
From WBSCD Global Scenarios 2000-2050. Exploring Sustainable Development, 1997

By World Business Council for Sustainable Development (WBSCD)

(<http://www.wbcsd.org/plugins/DocSearch/details.asp?type=DocDet&ObjectId=Mjkkx>)

Three scenarios are described:

- FROG!
- GEPolity
- Jazz



FROG!

Many nations experience a fair degree of economic success, and, for almost all, economic growth is the major concern, with sustainable development acknowledged to be important, but not pressing.

As environmental NGOs continue to demand enforcement of standards that have been set in global summits, those nations who are striving to develop argue that if the developed nations insist on raising environmental standards, they should “First Raise Our Growth!” In this scenario the habitual reliance on technology has not been sufficient to solve longer-term problems of either environmental or social health. Globalisation and liberalisation of markets along with the pressures of rapid urbanisation have raised the degree of social inequity and unrest to a level that threatens basic survival of both human and environmental ecosystems.

GEOpolity

Because neither governments nor businesses are effective in providing leadership, people begin to look for new leaders and to demand new social institutions. Some of these involve the strengthening of government—for example, “sustainable cities,” “sustainable national accounting,” and comprehensive implementation of industrial ecology. Others are politically innovative. The perceived need for strong and certain responses leads to a new global consensus that welcomes technocratic solutions, sanctions, and more direct control of the market to ensure that environmental values and social cohesion are preserved. The impetus behind all these movements is the growing consensus that the market has no inherent incentives to protect the commons, social welfare, or any other non-economic values. In the absence of leadership from business and government to solve problems, people form new global institutions—such as the Global Ecosystem Organisation (GEO), which has broad powers to design and enforce global standards and measures to protect the environment and preserve society—even if doing so requires economic sacrifice.

Jazz

In this world diverse players join in ad hoc alliances to solve social and environmental problems in the most pragmatic possible way. The key note of this scenario is dynamic reciprocity. This is a world of social and technological innovations, experimentation, rapid adaptation, much voluntary interconnectedness, and a powerful and ever-changing global market. In this scenario NGOs, governments, concerned consumers, and businesses act as partners—or fail. Together, along with other players, they learn effective ways of incorporating environmental and social values into market mechanisms.

3.23 Energy Policy Scenarios to 2050, by World Energy Council

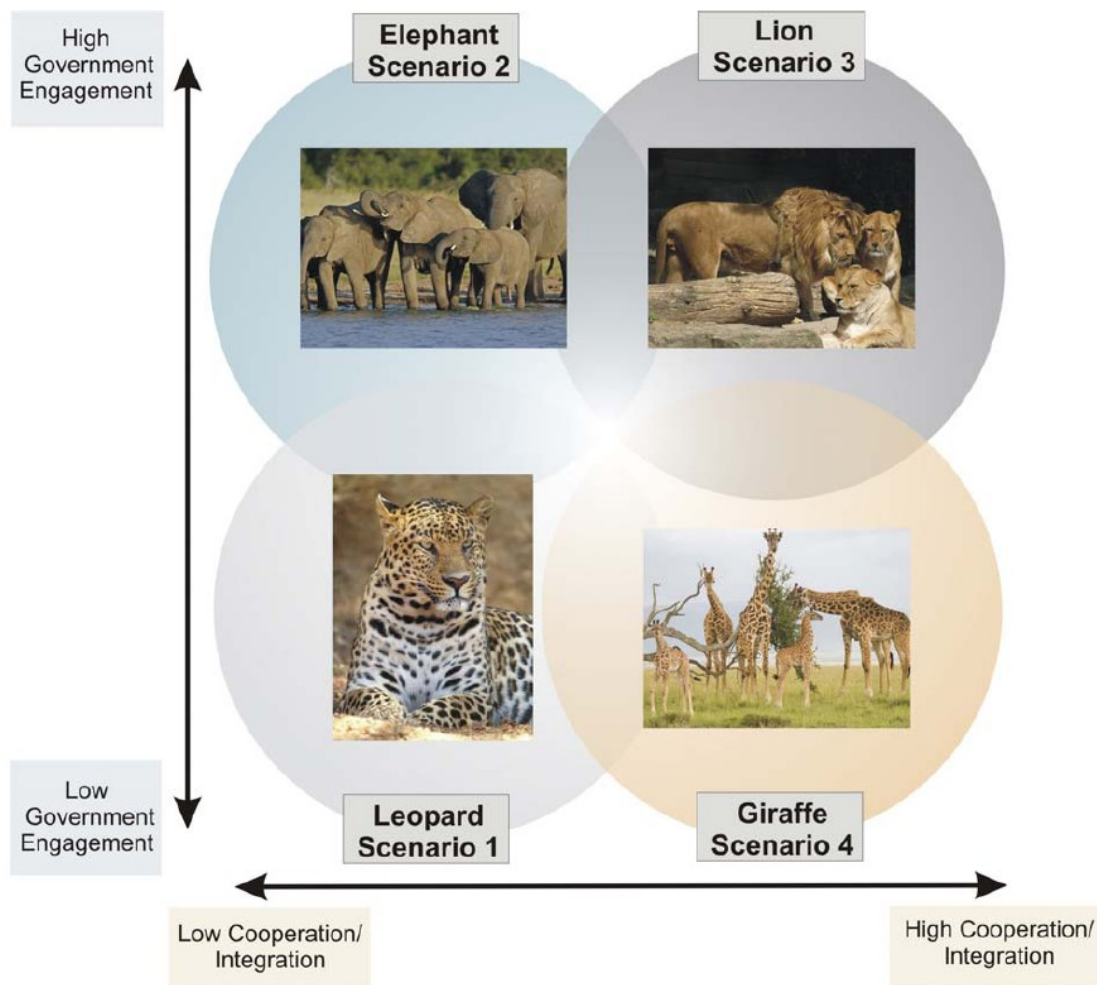
From Deciding the Future: Energy Policy Scenarios to 2050.

By World Energy Council, 2007.

(http://www.worldenergy.org/documents/scenarios_study_online.pdf)

Four distinct scenarios are presented below:

- Leopard
- Elephant
- Lion
- Giraffe



Leopard (*Low Government Engagement – Low Cooperation and Integration*)

This scenario has the least government engagement and global or regional cooperation and integration. Domestic economic development is the primary driver, underpinned by domestic energy security. World market forces and free trade tend to be hindered by national barriers that protect local production, which may lead to higher prices and lower efficiencies. Government engagement is constrained and there are few levies or subsidies. Many industrialised countries are reluctant to pursue structural reforms and continue to rely on welfare policies, increasing the level of unemployment and limiting economic dynamism. Most developing countries see their economic growth limited by the lack of equitable policies in terms of gender equality, education, telecommunication, electricity, water, health, and infrastructures (road, pipeline, and electricity transmission).

Elephant (*High Government Engagement – Low Cooperation and Integration*)

This scenario has significant government engagement but minimal international or regional cooperation and integration. The first priority is energy security to support economic activity and growth. Governments intervene and nations take responsibility for their energy security (short-, medium-, and long-term) through such actions as diversification of primary energy sources, development of indigenous resources, controlling exports, and/or securing imports by bilateral negotiations. In response to potential oil and gas shortages, governments may take specific steps to ensure national and/or regional security of supply through actions such as: conservation programmes, coal- or gas-to-liquid projects for countries with appropriate resources, enhanced and more expensive oil recovery projects such as oil sands and oil shale, biofuel projects, bilateral development of offshore energy resources, nuclear power programmes, large-scale hydropower, infrastructure investment and subsidies for renewable technologies.

Lion (*High Government Engagement – High Cooperation and Integration*)

This scenario has significant government engagement and significant international or regional cooperation/integration. Governments actively share their experience and expertise, primarily in achieving basic human rights and alleviating poverty. In some cases, this strengthens regional integration initiatives. Countries cooperate on key energy issues of sustainable development. The global concerns of greenhouse gas emissions and energy poverty are the subjects of intense negotiations and strong international agreements and programmes. Yet measures to mitigate concerns may often conflict with each other (e.g., greenhouse gas emission mitigation may raise prices and thus affect access for the poor).

Giraffe (*Low Government Engagement – High Cooperation and Integration*)

This scenario has minimal government engagement but significant international and regional cooperation and integration. In this scenario, the primary driver is economic development. The main preoccupation is freeing up global markets to promote GDP growth through affordable energy and international trade. There is increased reliance on market mechanisms, including in the developing world. Government involvement is constrained (predominantly directed to market regulation, when necessary) and there are few levies or subsidies. There are few restrictions on global movement of goods and services.

3.24 Intelligent Infrastructure Futures The Scenarios – Towards 2055, by Office of Science and Technology.

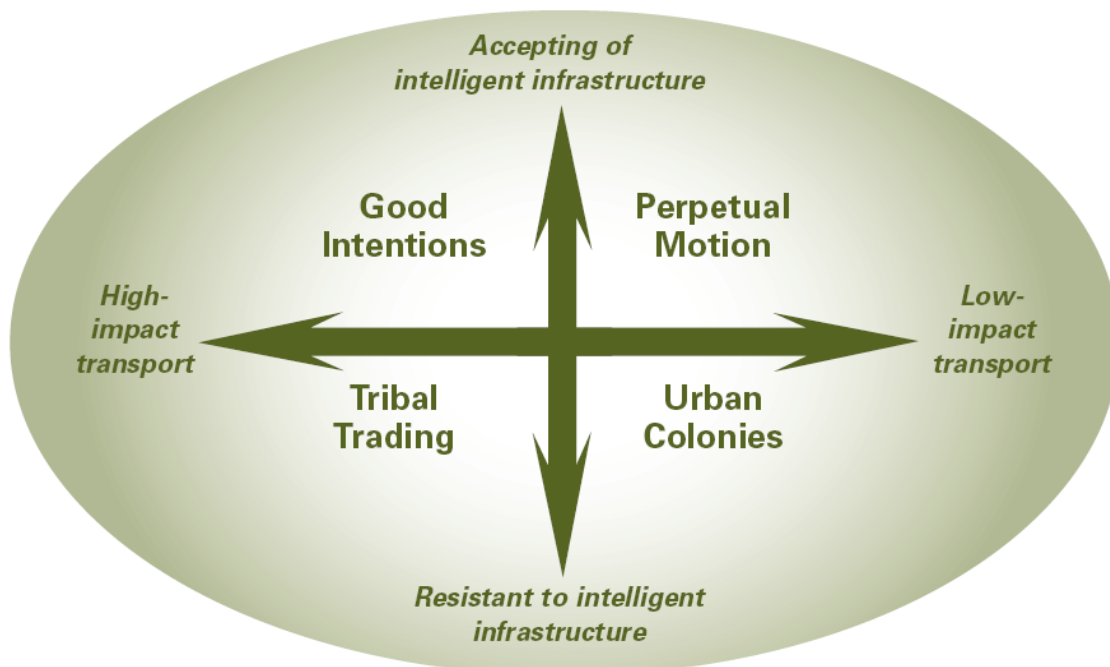
From Intelligent Infrastructure Futures The Scenarios – Towards 2055

By Andrew Curry, Tony Hodgson, Rachel Kelnar and Alister Wilson for the Foresight Programme of the Office of Science and Technology of the Department of Business Innovation and Skills of United Kingdom.

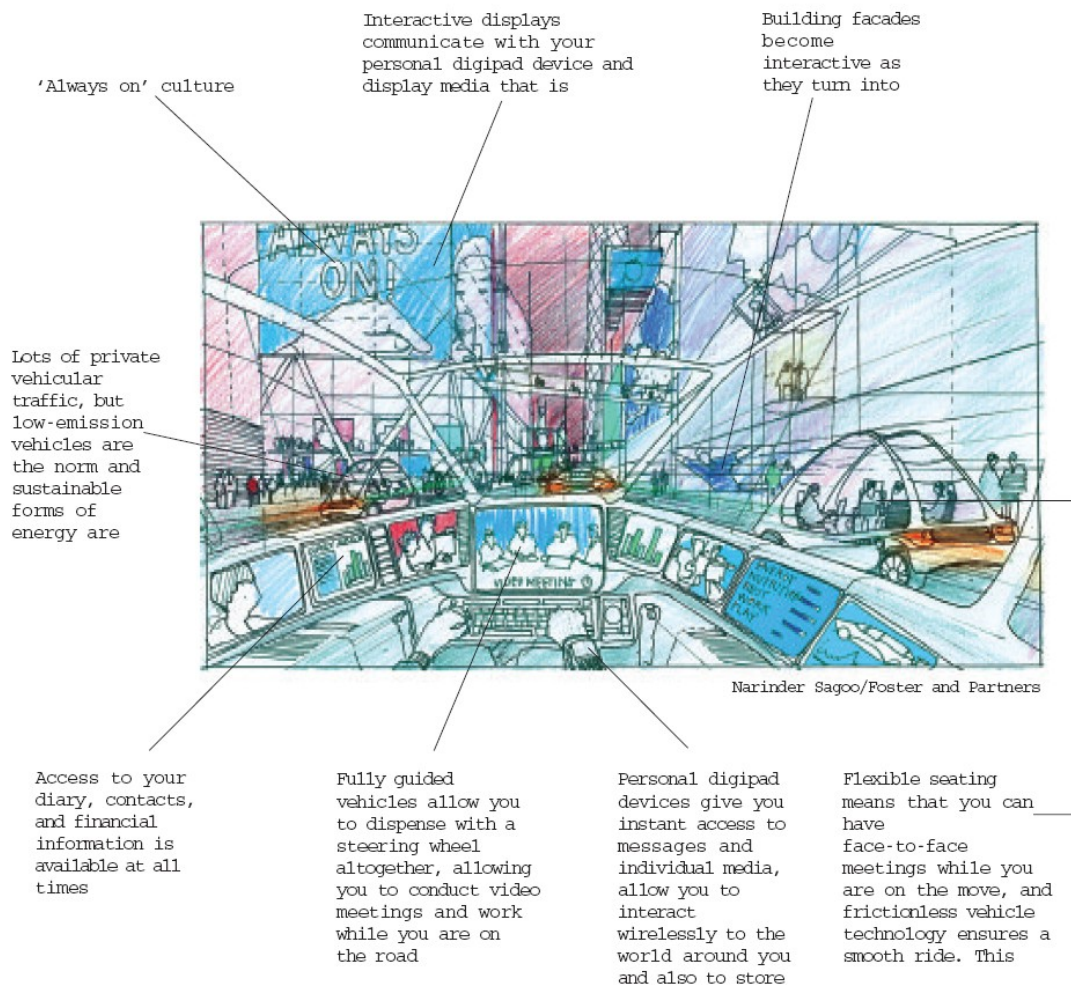
(http://www.foresight.gov.uk/Intelligent%20Infrastructure%20Systems/2055_Perspective_Process.pdf)

The following scenarios are described:

- Perpetual Motion
- Urban Colonies
- Tribal Trading
- Good Intentions



Perpetual Motion



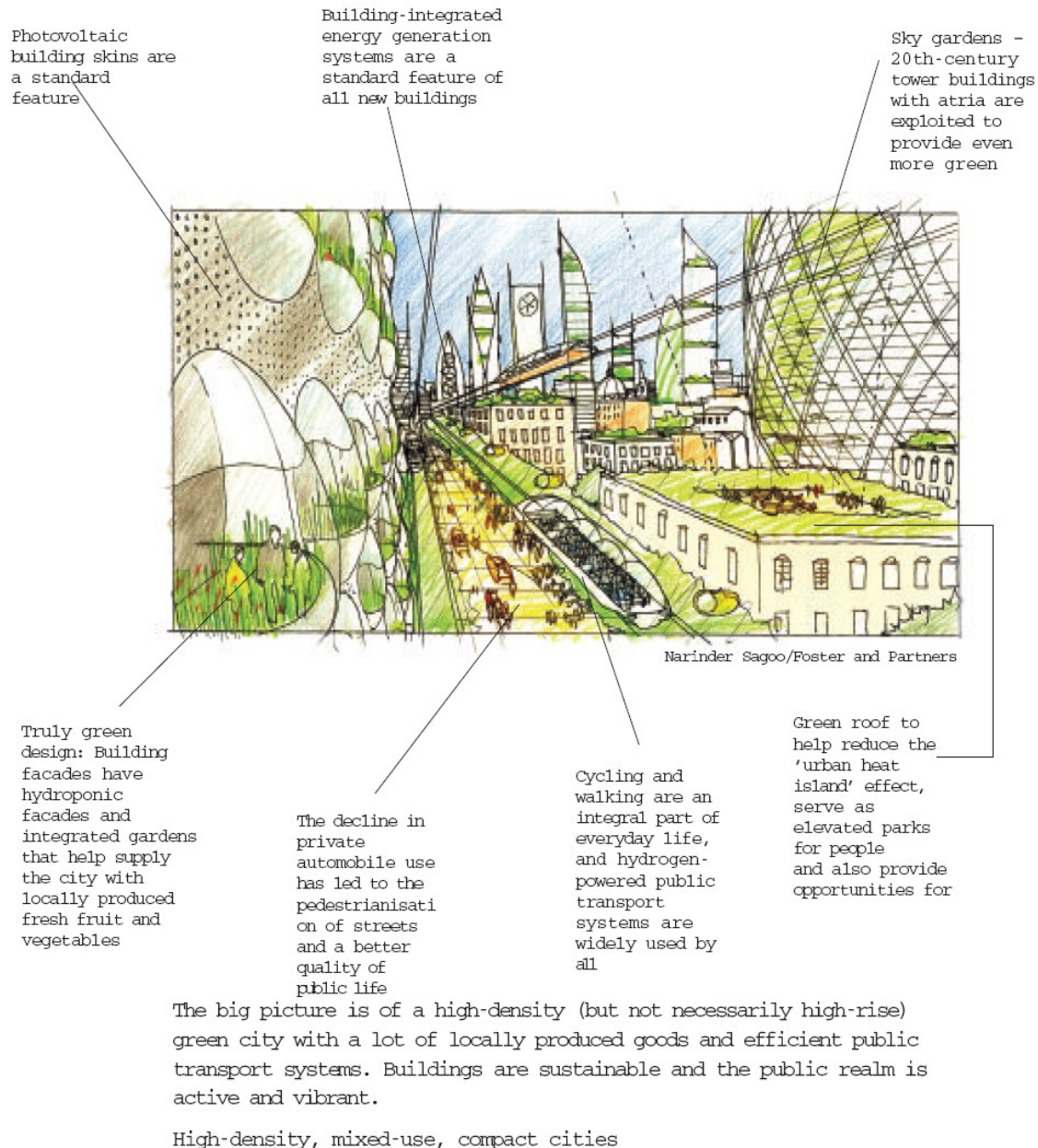
The big picture is of a very busy city with lots of private car traffic, all running on clean forms of energy. Everyone is plugged into the grid and is 'always on', always in touch, and ready, willing and able to travel using clean forms of energy.

High-density cities and low-density suburbs

This scenario describes a society driven by constant information, consumption and competition. In this world, instant communication and continuing globalisation have fuelled growth: demand for travel remains strong. New, cleaner, fuel technologies are increasingly popular. Road use is causing less environmental damage, although the volume and speed of traffic remains high. Aviation still relies on carbon fuels and remains expensive. It is increasingly replaced by 'telepresencing' technology (for business) and rapid train systems (for travel).

Urban Colonies

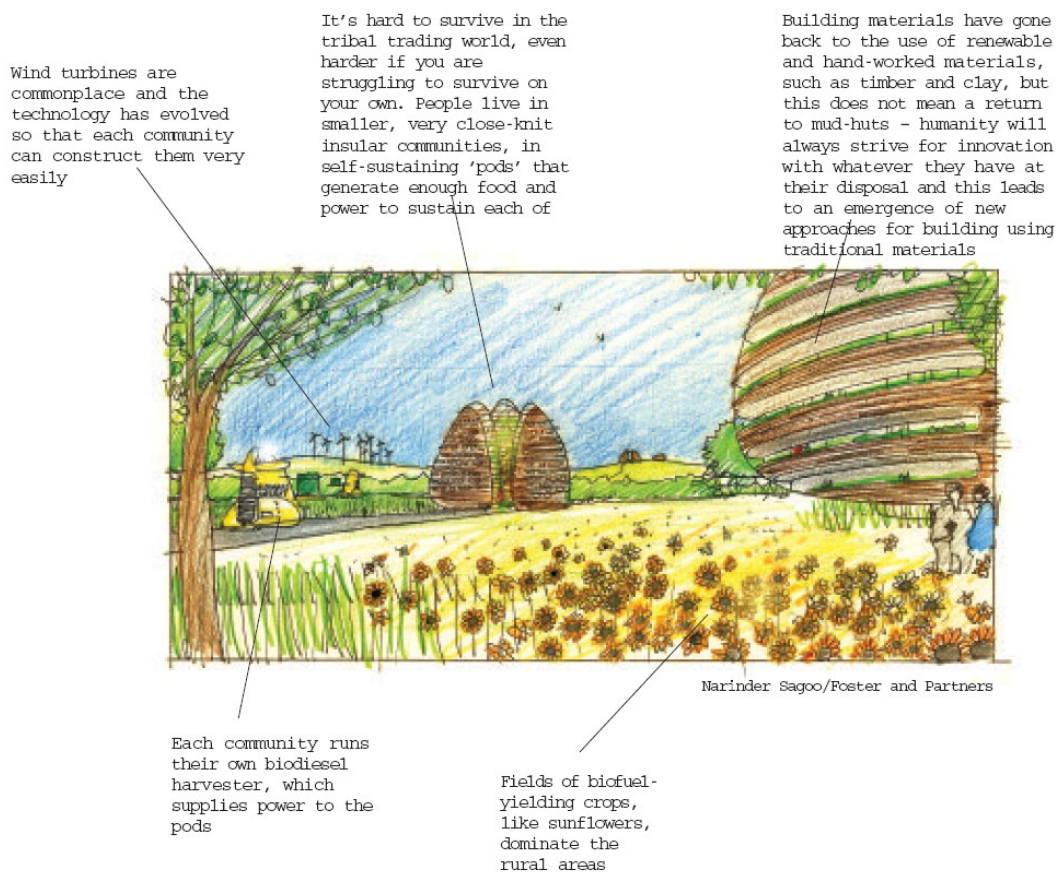
An artist's impression of Urban Colonies in 2055



In Urban Colonies, investment in technology primarily focuses on minimising environmental impacts. In this world, good environmental practice is at the heart of the UK's economic and social policies; sustainable buildings, distributed power generation and new urban planning policies have created compact, sustainable cities. Transport is permitted only if green and clean – car use is still energy expensive and is restricted. Public transport – electric and low-energy – is efficient and widely used. Competitive cities have the IT infrastructure needed to link high-value knowledge businesses, but there is poor integration of IT supporting transport systems. Rural areas have become more isolated, effectively acting as food and bio-fuel sources for cities. Consumption has fallen. Resource use is now a fundamental part of the tax system and disposable items are less popular.

Tribal Trading

An artist's impression of Tribal Trading in 2055



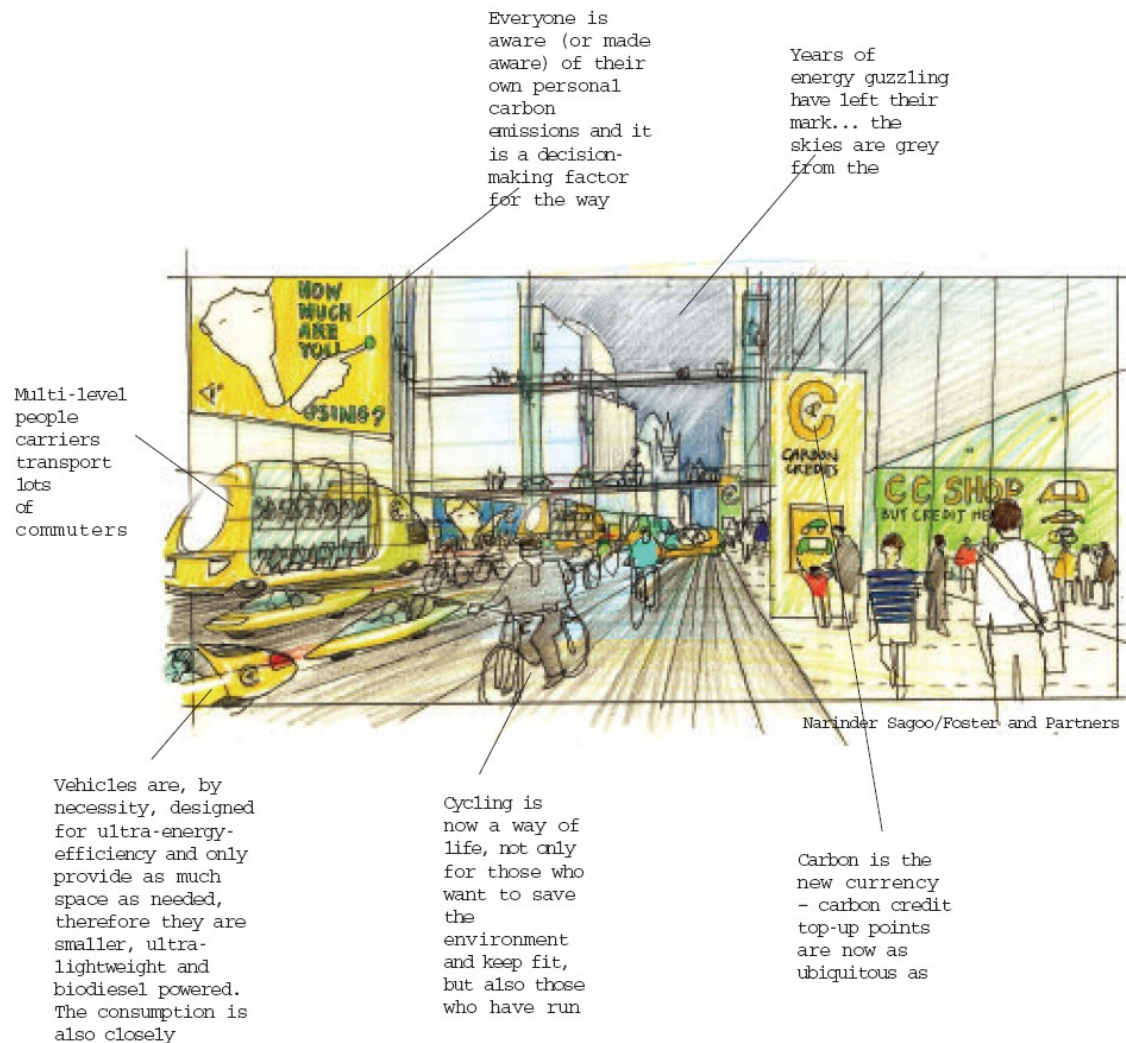
The big picture is of a world that has undergone a huge energy crisis and has achieved tranquil equilibrium through simple lifestyles that no longer rely on being supplied power through a national grid. Former city dwellers still need to live in communities where they are in close proximity with others. These dense social conditions allow the community to share resources more efficiently and help to preserve the maximum amount of green areas for agricultural use.

Empty cities and clustered, compact rural housing

Tribal Trading describes a world that has been through a sharp and savage energy shock. The world has stabilised, but only after a global recession has left millions unemployed. The global economic system is severely damaged and infrastructure is falling into disrepair. Long-distance travel is a luxury that few can afford and, for most people, the world has shrunk to their own community. Cities have declined and local food production and services have increased. Canals and sea-going vessels carry freight: the rail network is worthwhile only for high-value long-distance cargoes and trips. There are still some cars, but local transport is typically by bike and by horse. There are local conflicts over resources: lawlessness and mistrust are high. The state does what it can – but its power has been eroded.

Good Intentions

An artist's impression of Good Intentions in 2055



The big picture is of a big city where people's lifestyles are determined by a strict and enforced scheme of carbon consumption control. Biofuel is the primary alternative form of energy, but the need to reduce energy consumption is now a matter of survival in a rapidly degrading environment. Cars are lighter, smaller and more efficient, and more and more people are cycling, even for long distances.

High-density cities and empty suburbs

This scenario describes a world in which the need to reduce carbon emissions constrains personal mobility. A tough national surveillance system ensures that people travel only if they have sufficient carbon 'points'. Intelligent cars monitor and report on the environmental cost of journeys. In-car systems adjust speed to minimise emissions. Traffic volumes have fallen and mass transportation is used more widely. Businesses have adopted energy-efficient practices: they use sophisticated wireless identification and tracking systems to optimise logistics and distribution. Some rural areas pool community carbon credits for local transport provision but many are struggling. There are

concerns that the world has not yet done enough to respond to the human activity which has caused the environmental damage. Airlines continue to exploit loopholes in the carbon enforcement framework. The market has failed to provide a realistic alternative energy source.

3.25 Millennium Assessment Scenarios, by Millennium Ecosystem Assessment

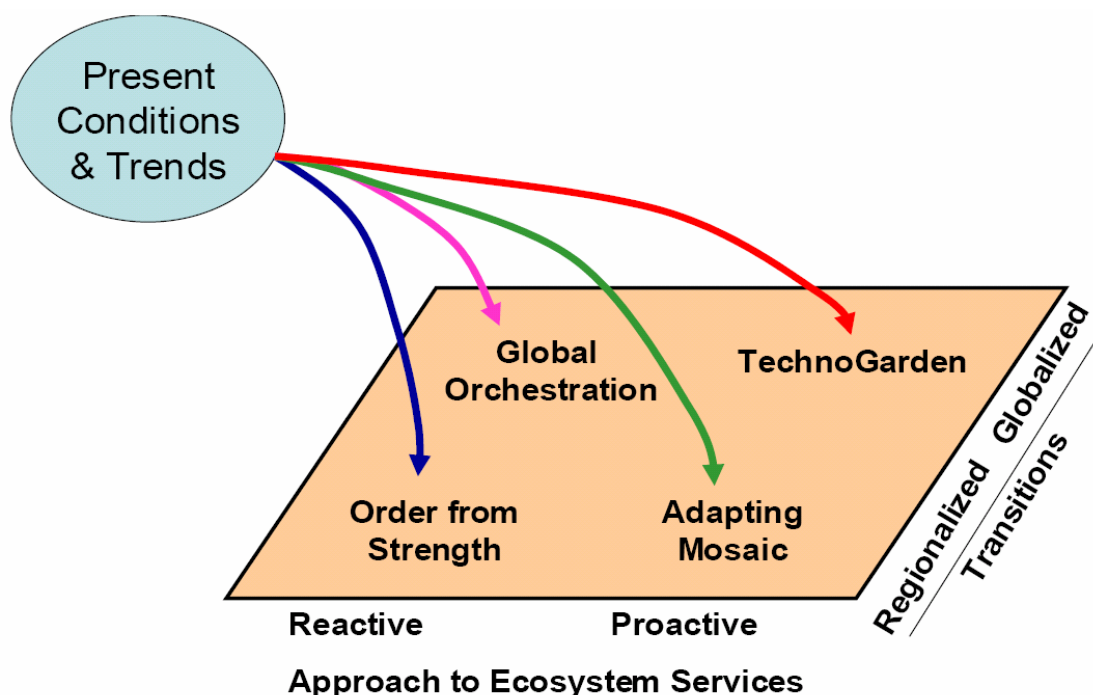
From Millennium Assessment Scenarios

By Stephen Carpenter, University of Wisconsin, USA and Prabhu Pingali, FAO, Italy, Co-Chairs of the Scenarios Working Group, Millennium Ecosystem Assessment, 2005.

(<http://www.millenniumassessment.org/documents/document.332.aspx.pdf>)

The following scenarios are presented:

- Global Orchestration
- Order from Strength
- Adapting Mosaic
- TechnoGarden



Global Orchestration

This scenario depicts a worldwide connected society in which global markets are well developed. Supra-national institutions are well placed to deal with global environmental problems, such as climate change and fisheries. However, their reactive approach to ecosystem management makes them vulnerable to surprises arising from delayed action or unexpected regional changes. The scenario is about global cooperation not only to improve the social and economic well-being of all people but also to protect and enhance global public goods and services (such as public education, health, and infrastructure). There is a focus on the individual rather than the state, inclusion of all

impacts of development in markets (internalization of externalities), and use of regulation only where appropriate. Environmental problems that threaten human well-being (such as pollution, erosion, and climate change) are dealt with only after they become apparent.

Order from Strength

This scenario represents a regionalized and fragmented world concerned with security and protection, emphasizing primarily regional markets, and paying little attention to the common goods, and with an individualistic attitude toward ecosystem management. Nations see looking after their own interests as the best defense against economic insecurity. They reluctantly accept the argument that a militarily and economically strong liberal democratic nation could maintain global order and protect the lifestyles of the richer world and provide some benefits for any poorer countries that elect to become allies. Just as the focus of nations turns to protecting their borders and their people, so too their environmental policies focus on securing natural resources seen as critical for human well-being. People in this scenario see the environment as secondary to their other challenges. They believe in the ability of humans to bring technological innovations to bear as solutions to environmental challenges after these challenges emerge.

Adapting Mosaic

This scenario depicts a fragmented world resulting from discredited global institutions. It sees the rise of local ecosystem management strategies and the strengthening of local institutions. Investments in human and social capital are geared toward improving knowledge about ecosystem functioning and management, resulting in a better understanding of the importance of resilience, fragility, and local flexibility of ecosystems. There is optimism that we can learn, but humility about preparing for surprises and about our ability to know all there is to know about managing socioecological systems. Initially, trade barriers for goods and products are increased, but barriers for information (for those who are motivated to use it) nearly disappear due to improving communication technologies and rapidly decreasing costs of access to information.

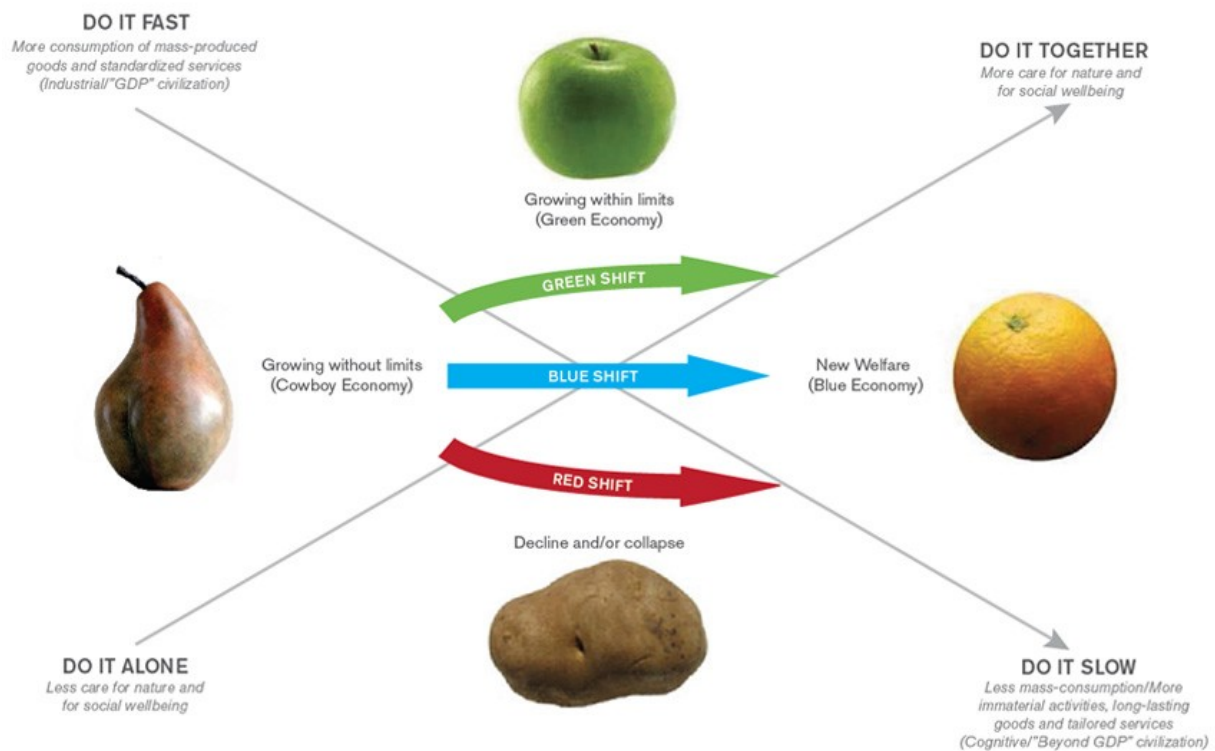
TechnoGarden

This scenario depicts a globally connected world relying strongly on technology and on highly managed and often-engineered ecosystems to deliver needed goods and services. Overall, eco-efficiency improves, but it is shadowed by the risks inherent in large-scale humanmade solutions. Technology and market-oriented institutional reform are used to achieve solutions to environmental problems. In many cases, reforms and new policy initiatives benefit from the strong feel for international cooperation that is part of this scenario. As a result, conditions are good for finding solutions for global environmental problems such as climate change. These solutions are designed to benefit both the economy and the environment.

4. Delphi Process

4.1 1st Delphi Survey (September 2010)

A first round of DELPHI survey has been done putting online the “paradigm shift analyzer” background paper and the following snapshot illustration of the four alternative scenarios:



For each scenario the online DELPHI survey presented a short portrait, the indication of upward, stable or downward trends for a number of key drivers (population, urban settlements, rural land, technology, GDP, energy consumption, transport, climate change, biodiversity, governance) and educated guesses of the rates of change of the same variables.

The experts invited to the survey were asked to rank the consistency and likelihood of the scenarios, and to give their free comments (open questions) on the scenario portrait and the trends presented for the key variables.

4.1.1 List of participants

The first round of the DELPHI survey has engaged 90 experts, listed in the table below:

Names of the 90 participants to the survey	
Name	Institution
Andrea Bigano	FEEM
Valentina Bosetti	FEEM
Angela Köppl	Austrian Institute of Economic Research
Frank Convery	University College Dublin
Milan Scasny	Charles University Environment Center, Prague, CZE
Jan Kovanda	Charles University in Prague, Environment Center
Lukas Recka	CUEC
Andrew Barton	Charles University Environment Center
Brieuc Bournoux	Enerdata
Daniela Kletzan-Slamanig	WIFO
Jana Szolgayova	IIASA
Sabine Fuss	IIASA
David Vackar	Charles University in Prague, Environment Center
Emanuele Massetti	FEEM
Hannes Bottcher	IIASA
Katharina Köberl	WIFO
Leduc Sylvain	IIASA
Renato	FEEM
Sebastian Petrick	Kiel Institute for the World Economy
Alvaro Calzadilla	Institute for the World Economy (IfW)
Artem Korzhenevych	Kiel Institute for the World Economy
Félix Hernández Álvarez	CCHS-CSIC
Ina Meyer	Austrian Institute of Economic Research - WIFO
Klepper	Kiel Institute for the World Economy
Petr Havlik	IIASA
Bernd Münier	NERI
Brigitte Wolking	Wegener Centre
Claudia Kettner	WIFO
John Broderick	Manchester Business School
Mercedes Bleda	Instituto de Políticas y Bienes Públicos CCHS CSIC
Larry Willmore	IIASA
Alejandro Caparrós	CSIC
Daiju Narita	IfW
Dana Abi Ghanem	University of Manchester
Detlef van Vuuren	Netherlands Environmental Assessment Agency
Efrain Larrea	MCRIT

Names of the 90 participants to the survey	
Elina Hiltunen	Finpro
Jennifer Coronado	mcrit
Jennifer Jarratt	Leading Futurists, LLC
Jose L. Oviedo	Consejo Superior de Investigaciones Cientificas
Laura Gutiérrez Vázquez	MCRIT
Marta Calvet	MCRIT
Nati Franco Cherta	MCRIT
Rafa Rodrigo	MCRIT
Sonja Peterson	Kiel Institute for the World Economy
Alan McDonnell	Anonymous
Alessandro comai	UPF
André Francisco Pilon	University of São Paulo
Bob Harrison	ER Harrison & Associates, Inc.
Diego Ruvalcaba	IAPEM
Isidre Bortalba Ribalta	MCRIT
J Stephenson	-
Karlheinz Steinmueller	Z_punkt GmbH
Klaus Æ. Mogensen	Copenhagen Institute for Futures Studies
Marcel Bullinga	futurist & keynote speaker at www.futurecheck.com
Miguel Angel Pérez Wong	UNAM
Andreu Ulied	MCRIT
Bertrand Chateau	Enerdata
Dumas	CIREN/CIRAD
Enrica	FEEM
Frédéric Gherzi	SMASH/CIREN
Henrik Gudmundsson	Technical University of Denmark
Michela Catenacci	FEEM
Paola Ovando	CSIC
Roberta Pierfederici	FEEM
Ville Kaarne	University of Tampere
Alper Alsan	Siemens Turkey
Andrea Ricci	ISIS
Bettina Kretschmer	Kiel Institute for the World Economy
Minh	CIREN, CNRS
Olivia Bina	Instituto de Ciências Sociais da Universidade de Lisboa
Per Homann Jespersen	Roskilde University, DK
Pero Micic	FutureManagementGroup AG
R Gerlagh	Tilburg University
Rob Dietz	CASSE
Fabio Sferri	Fondazione Eni Enrico Mattei - FEEM
Giovanna Giuffrè	ISIS

Names of the 90 participants to the survey	
Jonathan Moyer	Pardee Center for International Futures University of Denver
Riccardo Enei	ISIS - Institute of studies for the Integration of Systems -
elena claire ricci	Fondazione Eni Enrico Mattei
Bob van der Zwaan	ECN, Columbia University, Johns Hopkins University
Carlo Sessa	ISIS
Pablo del Río	CSIC
Judkiewicz Daniel, Michel	Xland sprl
Franz Sinabell	WIFO
Markku Vantunen	Finpro
David Somekh	ESQH (European Society for Quality in Healthcare), Healthcare Futures Office, Lisbon
Kurt Kratena	WIFO
Craig Stevenson	HCT
Oriol Biosca	MCRIT

4.1.2 Scenario portraits





The following pages reproduce the scenario portraits and the schemes of key drivers as presented in the online DELPHI questionnaire:

Growing beyond limits scenario features the strengthening of corporate capitalism and market mechanisms, pursued globalization of goods and financial markets, a new technological wave in the form of ICT, nano-technologies and biotechnologies.

The *Growing within limits* scenario assumes that a low-carbon economy and adequate biodiversity protection can be achieved with currently identifiable technologies and at moderate economic costs without damaging opportunities for human development, provided that a number of barriers to achieving the right policy conditions and institutional settings are overcome.

The present measurement of growth is abandoned in the *New welfare* scenario. A new frame is set up to account features of wellbeing "beyond GDP", including self-production and services rendered by nature, taking into account the realities that do not pass through the market or get irrelevant evaluation by a market. A new techno-economic and social paradigm emerges

The key question with respect to *turbulent decline* is whether the growth in material flows could remain within the limits for climate change, natural resources' availability, global ecosystems' health and biodiversity loss, as well as help to alleviate global poverty. The answer would be negative, and the world is set to collapse.

	 Pear World	 Apple World	 Orange World	 Potato World
Population	↑↑	↑	↔	↑↑↑
Settlements: Urban society	↑	↔	↓	↑↑
Rural land overexploitation	↑	↔	↓	↑↑
Technology	↑↑↑	↑	↑	↔
GDP	↑↑	↑	↔	↓↓
Energy consumption	↑↑	↑	↓↓	↔
Transport	↑↑	↑	↔	↓
Climate change	↓	↓↓↓	↓↓↓	↔
Biodiversity	↔	↑	↑↑	↓
Governance	↓	↑	↑↑	↓↓

Growing beyond limits: the Pear World paradigm



The driving forces

The technological revolution

The technological revolution allows for clean energy production, health innovations, environmental and green techs... globally relieving pressure on environment. While energy consumption will still grow at a high pace (even if energy intensity will continue to progressively decline), released emissions per unit of energy production will fall down increasingly faster due to technological innovation. Transport will still grow along with economy, invalidating the decoupling paradigm, but this does not matter anymore as vehicles have become clean and emissionless.



The world shape

Irregular shape, evoking north-south disequilibriums

The pear is irregular in its shape evoking disequilibriums in different parts of the world, both economically and socially. Some countries, regions, even neighborhoods will keep progressing economically while others will have substantial difficulties to develop. Countries *growing beyond limits* have GDP annual growth rates ranging between 3% and 6% depending on the level of maturity of their economies, while lagging countries show very fluctuant instable patterns of growth, with poor average rates over time.



The human landscape

Soft and smooth pear peel evoking cultural uniformity

A close look onto the surface of a pear shows a uniform smooth pear peel landscape, evoking progressively uniform values and habits all over the world. Globalization and increased mobility of people (migrations, global business, leisure travel) increase the trend towards social homogenization of world societies. Minorities helplessly see their identities diluted, while global homogeneous values spread around.

	Trend 2010-2050	Scenario snapshot 2050	Rate of change
Population	↑↑	9300 millions in 2050	Population yearly growth rates from 1'3% in 2010 to 1% in 2030 and 0'5% in 2050
Settlements: Urban society	↑	From 50% urban population in 2010 to 65% in 2050.	65 million urban residents more per year between 2010 and 2050.
Rural land overexploitation	↑	Land for bioenergy production 900 mil.ha in 2050. (7% global land)	2% increase in agricultural land, 1% increase in meadows and 3% decrease in forests
Technology	↑↑↑↑	-Gene therapy-Brain download- Bioengineered animals-Customized food - Fusion power-Robot assisted world	from 2% to 5% GDP devoted to R&D investment in growing beyond limits countries
GDP	↑↑↑	- Global GDP in 2050 is fivefold 2010's.- Chinese GDP per capita converges with Europe's at \$60.000	3% GDP yearly growth rate for developed regions, 6% for developing.
Energy consumption	↑↑↑	Energy yearly consumption in 2050 is four times fold 2010's.	Energy intensity yearly decrease (Δenergy/GDP) from -0'8% in 2010 to -1'5% in 2030 and -2'5% in 2050
Transport	↑↑↑	Transport increases sharply due to high increase in GDP and clean vehicles.	Transport grows over the economy.
Climate change	↓	World GHG emissions in 2050 are 25% lower than in 2010	Emission factors yearly decrease (Δemission/energy) from -0'3% yearly to -2% in 2030 and -6% in 2050.
Biodiversity	↔	Artificially induced biodiversity growth	30.000 species are recovered or engineered per year
Governance	↓	Mixture of corporate driven liberal democracies and totalitarian regimes	10 new lobbyocracies per year until 2050 (50% from previous democratic regimes)

Growing within limits: the Apple World paradigm



The driving forces

The social democratic revolution

The *Global Green New Deal* is a set of new institutional conditions that are created to spur off the shift towards fundamental transitions that will help bring a "green" economy. Regulations as well as citizen behavioral changes contribute to decrease progressively energy intensity, as societies turn from being mostly consume driven to being mostly service and knowledge oriented. GDP growth therefore becomes increasingly independent from energy demand. Innovation contributes to reducing GHG emissions from power generation as well. Climate change threat progressively banishes. Dietary changes and increased efficiency of agriculture relieve land claim pressure.



The world shape

Regular shape, evoking a more equilibrated world

The apple is spherically shaped, evoking a more equilibrated world, both economically and socially. Poor nations increase their wealth in a steady consistent way, and steered development cycles generate low social disparities. Rich nations devote significant aid to developing countries, especially through skills, knowledge and technology transfers. Countries growing within limits have average GDP annual growth rates ranging between 1'5% and 3%, decreasing as they become more mature economies.



The human landscape

Soft and smooth apple peel evoking cultural uniformity

A close look onto the surface of an apple shows a uniform smooth peel landscape, evoking progressively uniform values and habits all over. Multilateral governance and interregional cooperation promote good understanding among different cultures, increasing the trend towards progressively shared social and cultural values, diluting minority identities in favor of common progressive ideals.

	Trend 2010-2050	Scenario snapshot 2050	Rate of change
Population	↑	8600 millions in 2050	Population yearly growth rates from 1'3% in 2010 to 0'8% in 2030 and 0'3% in 2050
Settlements: Urban society	↔	From 50% urban population in 2010 to 57% in 2050.	35 million urban residents more per year between 2010 and 2050.
Rural land overexploitation	↔	Land for bioenergy production 500 mil.ha in 2050 (4% global land)	Agricultural land and meadows stable. Increased agricultural yields. Forests increase 2%.
Technology	↑	-Carbon capture -Energy grid storage - Fuel-cell -Aquaculture - Automated driving.	2% GDP devoted to R&D investment in growing within limits nations
GDP	↑	- Global GDP in 2050 is twofold 2010's. - Maghreb GDP per capita converges with Europe's at \$45.000	2% GDP yearly growth rate for developed regions, 4% for developing.
Energy consumption	↑	Energy yearly consumption in 2050 is the twofold as in 2010's.	Energy intensity yearly decrease ($\Delta_{\text{energy/GDP}}$) from -0'8% in 2010 to -1'7% in 2030 and -4% in 2050
Transport	↑	Transport increases due to increase in GDP.	Transport grows along with economy, approximately at the same rate.
Climate change	↓↓	World GHG emissions in 2050 are 50% lower than in 2010	Emission factors yearly decrease ($\Delta_{\text{emission/energy}}$) from -0'3% yearly to -1% in 2030 and -4'5% in 2050.
Biodiversity	↑	Biodiversity is protected through legislation and citizen awareness	Stable.
Governance	↑	United Nations as an operative institution for global governance.	10 new democracies per year between 2010 and 2050

New welfare: the Orange World paradigm



The driving forces

Welfare beyond economic growth

The *New Welfare* scenario is the result of a deep behavioral social mutation, with people becoming more concerned about wellbeing and quality of life than economic wealth. Hedonism mixes up with new "social innovative" mechanisms to satisfy new social community needs. Material consume is reduced; barter becomes common. Info, digi, cyber, holo and other immaterial high-tech technologies are extremely successful, while mechanical elements progressively substitute energy driven mechanisms: it is the age of the crank, the spring, the pedal and the ladder. New eco-cultural paradigms emerge, changing the human-nature interaction, from "exploitation" to "gardening". Education and research are at the center of social values.



The world shape

Regular shape, evoking an equilibrated world

An orange is spherically shaped, evoking a world that tends to progressively harmonize different regions, becoming more equilibrated in the mid and long term. As there will be mostly small scale local economies, highly self-sufficient but well connected to networks, societies will more easily steer stable economic frameworks with little perturbations. The economy will be operating with the minimal levels of production and consumption necessary for a high quality of life, using new GDP measures where indicators such as quality of life and ecosystems' health will gain predominantly weight.



The human landscape

The wrinkled orange peel evoking cultural diversity

A close look onto the surface of an orange shows a soft but wrinkled peel, non homogeneous but still harmonious. This is the social spirit of the *New welfare* scenario: a world recognizing and promoting differences on communities as an enriching element to society, a rich mixed salad with an "earthly" dressing. People's attachment to institutions and nations, which was one of the bases of industrial organization, is not essential anymore. There will be mostly small scale local communities, connected to the rest of the world through social networks. Multi-level governance with bottom-up participatory approaches will largely diminish national and global powers.

	Trend 2010-2050	Scenario snapshot 2050	Rate of change
Population	↔	8000 millions in 2050	Population yearly growth rates from 1'3% in 2010 to 0'5% in 2030 and 0'2% in 2050
Settlements: Urban society	↓	From 50% urban population in 2010 to 45% in 2050.	3 million urban residents more per year between 2010 and 2050.
Rural land overexploitation	↓	Land for bioenergy production 500 mil.ha in 2050 (4% global land)	1% decrease in agricultural land, 1% decrease in meadows and 2% increase in forests.
Technology	↑	- Telemedicine - Ubiquitous computing - Countryside sensors - Precision bio farmin	2% GDP devoted to R&D investment in growing within limits nations
GDP	↔	- Global GDP about 30% higher in 2050 than in 2010.	0'5% GDP yearly growth rate for developed regions, 1% for developing.
Energy consumption	↓↓	Energy yearly consumption in 2050 is one third of 2010's.	Energy intensity yearly decrease (Δenergy/GDP) from -0'8% in 2010 to -2% in 2030 and to -5% in 2050
Transport	↔	Transport drops sharply due to locally based societies and drop in GDP	Decoupling of transport and economy
Climate change	↓↓↓	World GHG emissions in 2050 are 85% lower than in 2010	Emission factors yearly decrease (Δemission/energy) from -0'3% yearly to -1% in 2030 and -3% in 2050.
Biodiversity	↑↑	Reintroduction of extinguished spices. Social awareness helps preserve environmental values.	15.000 species are recovered per year
Governance	↑↑	Networked society, bottomup governance based on human capital rather than institutions.	10 new peaceful anarchies per year between 2010 and 2050

Turbulent decline: the Potato World paradigm



The driving forces

Failure to sustain global economic growth

Market forces are dominant. Most services are privatized or franchised. Energy shortages, lack of innovation, and low emotional social conditions make service providing inefficient at all scales: services to people, to enterprises, mobility services and goods production. R&D budgets are almost residual. Energy intensity breaks its decreasing trend and starts increasing after 2030, implying that more energy is needed to produce single units of GDP. Technologies become old, but investigation is mostly deployed to new "evading from reality" techs such as emotion controllers or virtual reality devices. Both inefficient transport vehicles and inefficient power generation increase emission factors, aggravating the problem of climate change. Polluted environment and toxic atmosphere accelerate biodiversity destruction.

The world shape

The world shape: very irregular shape evoking highly fragmented world

The potato world is irregularly shaped, evoking a much disequibrated world, both economically and socially. It is a world in crisis. Protectionism in different regional economies induces disparate economic evolutions for different nations and continents. Disparities become more evident. There is a global draw back in the global economy, with fluctuations and unstable regimes. Wealthier people get in control of governments in some parts, military in some others, even religious leaders, with many democracies tending to evolve towards lobbycracies and autocracies. Average annual GDP growth rates are negative in most regions, but in some, economic growth is extremely high (over yearly 5%).

The human landscape

The human landscape: rough potato skin evoking the importance of differences

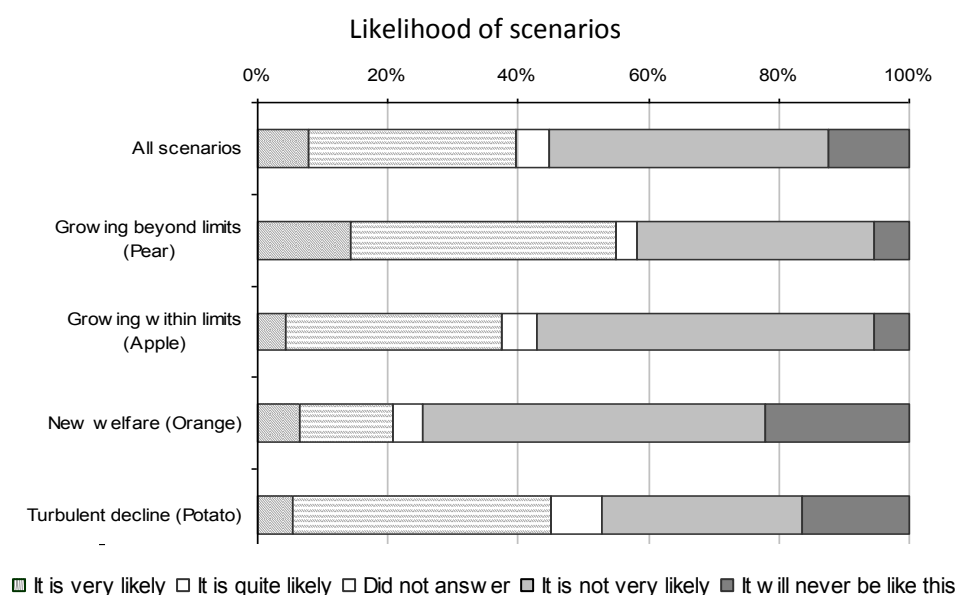
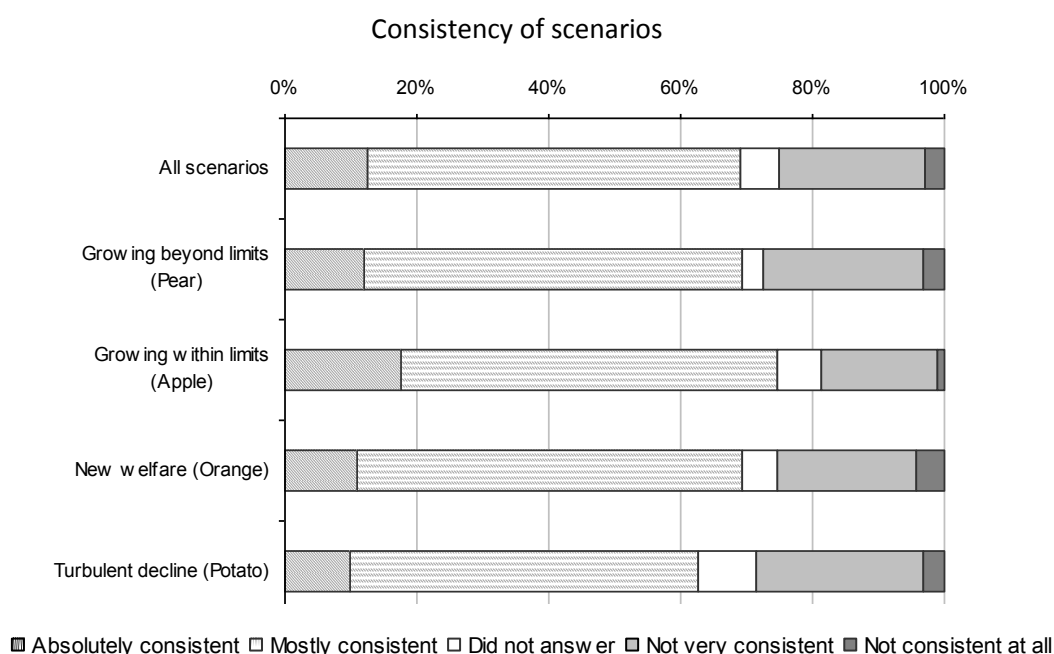
A close look onto the surface of a potato shows a rough skin with wrinkles, with different local topographies from one point to another. These differences in local topologies evoke a world where the social setting stays mostly heterogeneous. Everyone goes back to his own corner of civilization. Protectionism becomes the common rule, flows of people and information become more difficult, and as a consequence, societies tend to enforce their identities and sometimes they are confronted to their neighbor's, generating conflicts. It is a world of nations, micronations and city-states. The spiritual dimension gains importance at the center of people's life, even if believes are in own personal "inspirations" rather than in "God".

	Trend 2010-2050	Scenario snapshot 2050	Rate of change
Population	↑↑↑↑	11.000 millions in 2050 concentrated in less developed areas	Population yearly growth rates from 1'3% in 2010 to 1% in 2030 and back to 1'3% in 2050
Settlements: Urban society	↑↑	From 50% urban population in 2010 to 74% in 2050.	120 million urban residents more per year between 2010 and 2050.
Rural land overexploitation	↑↑	Land for bioenergy production 250 mil.ha in 2050 (2% global land)	1% increase in agricultural land, 1% decrease in forests.
Technology	↔	- Emotion control devices - Telepathy - Immersive virtual-reality worlds -Self-designed babies	From 1'5% GDP devoted to R&D investment in 2010 to 0'5% GDP
GDP	↓↓	- Global GDP in 2050, 25% lower than 2010. - 0'5% of world population holds 95% of global wealth	-0'5% GDP yearly growth rate for developed regions, -1% for developing, +5% for some microstates.
Energy consumption	↔	Energy yearly consumption in 2050 is the 75% as in 2010's.	Energy intensity yearly decrease ($\Delta_{\text{energy}}/\text{GDP}$) from -0'8% in 2010 to -1% in 2030 but back to +1% in 2050
Transport	↓	Transport drops due to drops in GDP, difficulties in long-distance travel and energy shortage	Decreases at the rate of economy.
Climate change	↔	World GHG emissions in 2050 are 15% lower than in 2010	Emission factors yearly decrease ($\Delta_{\text{emission}}/\text{energy}$) from -0'3% yearly to -0'5% in 2030 but back to +1% in 2050.
Biodiversity	↓	Biodiversity is threatened due to turbulent times and little social awareness	30.000 species disappear per year
Governance	↓↓	Fragmentation of nations. Nationalisms. Conflicts due to resource scarcity	10 new micronations and city-states per year between 2010 and 2050

4.1.3 Summary of results

Next figures summarise the results of the survey.

- 70% of participants thought scenarios were absolutely consistent or mostly consistent, being the “Growing within limits” scenario the one with a higher agreement level.
- The “Growing beyond limits” scenario appears to be the most likely of all, followed by the “Turbulent decline” scenario, both with around 50% participants stating they are very likely or quite likely. The “New welfare” scenario is only likely according to 20% of participants.

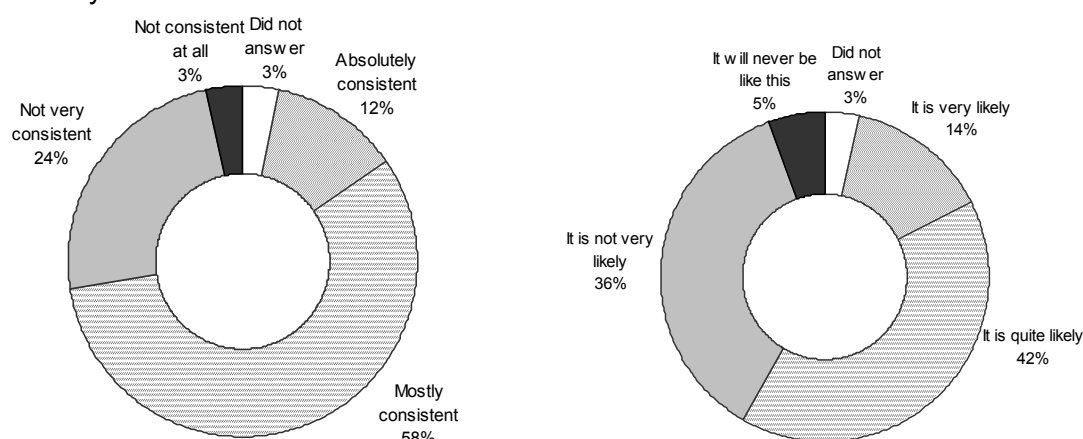


Growing beyond limits: the Pear World paradigm



Growing beyond limits scenario features the strengthening of corporate capitalism and market mechanisms, pursued globalization of goods and financial markets, a new technological wave in the form of ICT, nano-technologies and biotechnologies.

Consistency and likelihood of the scenario:



Expert opinions

- This scenario is overoptimistic, in particular regarding the limited impact of the rebound effect on energy consumption and the ability of technological progress to compensate the detrimental effects of growth (Artificially induced biodiversity growth sounds like science fiction to me) (Andrea Bigano, FEEM)
- Main concern would be about four fold increase in energy consumption by 2050. Some assumptions about real price embedded there, but if we get real prices rises and/or shocks of significant duration, then consumption will be scaled back. Assumptions that world GHG emissions will be 25% lower in 2050 implies a huge de-linking of CO2 and energy - again the price assumption for CO2 and its coverage missing. (Frank Convery, University College Dublin)

- A cross check with BaU scenario of World Energy Outlook would be valuable, as it seems that drivers and assumptions are comparable. Growth rates for developed countries seem rather at the high end. (Angela Köppl, Austrian Institute of Economic Research)
- The Biodiversity seems to be too optimistic under these conditions. (Lukas Recka, CUEC)
- Consistency: A little bit more could be expanded on the explanation on the globalization assumptions. (Jana Szolgayova, IIASA)
- I will first evaluate plausibility and then comment on consistency: I think that population and settlement assumptions are ok, but that the outlook on technological improvements is overly optimistic. As a result, I think that land use change and climate change will fare worse than assumed to account for the sharp increase in energy, transport and food demand. For governance, I think it is ok to assume strengthening of corporate capitalism and market mechanisms. However, I see a potential inconsistency in the convergence and homogenization of societies and values etc on the one hand, and the apparent heterogeneity resulting from the assumption that some countries will keep progressing, while others start to lag more and more behind. (Sabine Fuss, IIASA)
- It seems very unlikely that the world will remain the same under this scenario, but most of people in the planet do not see this potential catastrophic scenario. People care about their own well being and they do not have in mind the well-being of others. I do not think that GDP will grow so fast in this scenario, in case it happens. I am not sure about forest reduction. In summary, I see this scenario very likely in the near future, but somehow it will collapse and will turn to one of the other scenario, most likely the potato one. However, there are some of the vital signs of the scenario that I do not think will occur in the near future. (Jose L. Oviedo, Consejo Superior de Investigaciones Científicas)
- A wholly unfeasible vision, but one that is nevertheless likely to be followed by the world's governments (Andrew Barton, Charles University Environment Center)
- Growth rates for developed countries seem too high. In order to reach emission reductions despite the strong growth in energy consumption (regional differences???) some technological leap-frogging seems necessary. A description of technologies and energy sources as well as transport modes used is missing. Governance structures not very likely. (Daniela Kletzan-Slamanig, WIFO)
- Represents an extreme w.r.t. to some aspects, esp. some individual technologies you name. The least plausible feature (though still plausible) is the extensive drop in carbon emissions. (Sebastian Petrick, Kiel Institute for the World Economy)
- Not clear why governance should decline. Also not clear why population should increase fast with high growing GDP. The link is usually the opposite. The population estimate is not that high at 2050 and it is consistent with stabilization around 9 billions. This is the scenario that we currently use to build our model scenarios. The GDP per capita scenario of China is not consistent with the World GDP. Higher world GDP seems to be necessary to accommodate such a strong expansion of China. With a very similar GDP expansion it is possible to reduce dramatically climate change by investing in carbon free technologies. 2-3% of global GDP can stabilize

emissions. Economic growth and the environment can coexist. Technical progress can alleviate land overexploitation. (Emanuele Massetti, FEEM)

- Urban society: I think under this scenario it will be probably higher, can reach even 70-80%. I would say Technology progress is little bit unrealistic (e.g. customized food, fusion, robots). Climate change: If energy and transport go up, 25% lower emissions are not very probable in this scenario. Biodiversity: 30 000 species recovered or engineers is not realistic. Artificially induced biodiversity growth can be caused only by biotic introductions and invasions under this scenario. (David Vackar, Charles University in Prague, Environment Center)
- It is very difficult, and futile, to make any scenario about rural land, technology, GDP, energy... at early forty years (Félix Hernández Álvarez , CSIC)
- The most problematic assumptions from my viewpoint: 1. Trend towards social homogenization of world societies: not likely under the other assumptions on irregular shape and evoking north-south disequilibriums. This point (human landscape) is actually not visible in the list of vital signs and seeds. What about the armed conflicts? 2. Artificially induced biodiversity growth (30.000 species are recovered or engineered per year): by no means in 2050 3. What about aging? Will the robots fill the empty vacancies in 2050? (Artem Korzhenevych, Kiel Institute for the World Economy)
- The realization of a crucial technological breakthrough to sustain the growth in energy consumption without jeopardizing equilibrium in ecosystems is questionable and not very likely, the same holds for artificially biodiversity growth. Transport growth will correlate with increased material consumption and thus, due to natural limits of resources, will raise prices. This might hamper GDP growth as predicted. In total, the scenario is mostly consistent if technology overcomes the several adverse repercussions with the natural environment that stems from too high energy and resource consumption. (Ina Meyer, WIFO)
- Population and urbanization is ok. Land use change possible, but not clear why (Klepper, Kiel Institute for the World Economy)
- I think there is some degree of contradiction between: i) increasing social homogenization of world societies and ii) increasing totalitarian regimes. If global homogeneous values are spread and they support democratic regimes, totalitarian regimes should not increase. Related with this, it could be more evident a club convergence, where similar countries tend to converge to the same social values. Which could differ with respect to another club. (Alvaro Calzadilla, Kiel Institute for the World Economy)
- Technologies for decoupling are not explicitly listed (only fusion power?, no CCS?, which vehicles etc.); for most 'vital signs' it has to be questioned, if the assumptions of this scenarios can be dealt with in other models than in the metamodel (Claudia Kettner, WIFO)
- GDP growth is limited due to financial and economic crisis, collapse is very likely in my view, it might be that energy and transport will therefore not increase in the way projected in the scenario. GHG mitigation will not be sufficient to reduce GHG emissions in the way the scenario suggests. The same holds for biodiversity which is constantly decreasing. (Brigitte Wolking, Wegener Centre)

- How a cowboy economy? May result in a reduction of 25% in GHG emissions? Inconsistent with respect to other BAU scenarios (see IEA 2010 ETP, WEO2009, RECIPE: WITCH, REMIND, IMACLIM) How can the intensity factor offset the scale factor? This is unlikely and at odds with other BAU scenarios in other projects/modelling work. What about energy technologies? Are we having an environmentally-related technological revolution? If yes, (which seems to be the case), then which energy technologies we have in mind should appear more explicitly (CCS, RES, ELVs, FCVs?). What do clean vehicles stand for? Hybrids, FCVs, ELVs, biofuels? Why do clean vehicles lead to an increase in transport? Some variables are interrelated and, in turn, depend on other variables. I miss a discussion of trends in the interrelationships between variables. For example, what type of energy, environmental and climate policies can we expect in this scenario (strong energy efficiency, high CO2 prices?)? This could be included in governance. Only strong policies can attain the technological revolution which leads to a reduction in energy and emissions. This is unlikely. Furthermore: this is unlikely to happen in a cowboy economy in my view. (Pablo del Río, CSIC)
- The technology part in the table should highlight results concerning transport, since the storyline tells us that 'vehicles have become clean and emissionless?'. 'Artificially induced biodiversity growth' is unlikely. (Alejandro Caparrós, Centro Superior de Investigaciones Científicas)
- There could be a contradiction between the still unequal shape of the world and on the other hand globalization leading to a more equal world? Globalization and increased mobility of people not necessarily threatens minorities, as it on the other hand leads to people seeking back to their roots, national differences etc. (Bernd Münier, NERI)
- This scenario might better acknowledge the growth of new authoritarian modes of capitalist expansion, such as found in Singapore and China. I'm not sure that 'totalitarian regimes' is fair representation, but neither are the freedoms and possibilities for association found in liberal democracies present. (John Broderick, Manchester Business School)
- The assumed technological change (clean, abundant energy) in my opinion is unrealistic. (Larry Willmore, IIASA)
- I don't think it's likely that fusion power can be installed on a large scale by 2050. Artificially induced biodiversity growth sounds also very unlikely, and I don't even know if it's a good thing (if it could be implemented without negative side effects). (Daiju Narita, Kiel Institute for the World Economy)
- I would expect more increases in transport and a decrease in biodiversity. Consistent with this view is that engineered species are only of scientific and medical interest, so there would be decreasing biodiversity as more species are under threat or more become extinct. (Dana Abi Ghanem, University of Manchester)
- Population: evidence seems to suggest that high economic growth and population growth do go together: rich people, highly educated females do not want a lot of kids. I am therefore not so sure that this scenario has necessarily more population than the Growing within Limits or the Orange world variant. Biodiversity: Although the positions of the scenarios compared to each other are correct... the arrows will have to be less optimistic (partly depending on how one defines biodiversity). All studies (see e.g. MA) indicate that it will be very hard to reverse trends. For governance: The level of trust of this world to occur needs to be really high. Markets can only

function in a controlled environment - and markets do create a form of governance. Would not use an arrow pointed down therefore. 'Lobbycracies' are also not necessarily a low governance form... it is just different from democracy. For climate change, I am a little surprised by the optimism. Why does this world care so much on reducing global emissions? (Detlef van Vuuren, Netherlands Environmental Assessment Agency)

- Achieving fusion power at mass level in 40 years seems too optimistic. The benefits of cheap and clean energy are not likely to emerge for a few decades. Thus the scenario seems consistent but not too plausible in this time horizon. (Efrain Larrea, MCRIT)
- I think this is overoptimistic about what technology can do. It seems a little inconsistent not to assume specific carbon saving technologies and yet have emission reductions with so much growth. (Sonja Peterson, Kiel Institute for the World Economy)
- Commercial interests now have a controlling effect over most of the worlds democratic systems, growth will therefore be a key priority whilst half measures are pursued towards green issues with reliance on geo engineering and new technologies to clear up the environmental damage rather than a no growth scenario. Increased energy efficiency and new sources of energy will play a positive role seeing strategic energy sources moving away from the Islamic belt. China's rare earth monopoly appears likely to be overturned by cheap space flight. I would agree with a robot assisted world but the downside is a massive rise in unemployment among the unskilled , likely to hit the developing world worst or states with poor education systems leading to political instability and a ready made source of foot soldiers for radical religion/politics/organised crime. (Alan McDonnell, anonymous)
- I believe the trend is a likely one, especially in response to the global malaise and the inability or unwillingness of current government structures to engineer change to compensation, pension, health care and social service costs. The balancing factor in this scenario is aggression based on those countries that move to totalitarianism seeking to acquire the wealth and technology of neighbours who elect to open free markets and capitalize on R&D. This scenario also plays to the base instinct of self-preservation and minimizes the need for social good by individuals, and not just government or organizations; e.g., giving to charity, extending wealth to have-not or in-need nations, etc. the emissions in the seeds is one area of doubt; with free economies, especially in developing countries, i see emissions going up with the increase in urbanization and increase in produced goods. (Bob Harrison, ER Harrison & Associates, Inc)
- Technologically too optimistic: My estimate is that neither brain downloads nor fusion energy are feasible till 2050; too optimistic also about yearly increases in energy efficiency Too optimistic about Chinese GDP And I do not think that economic globalisation will lead to the cultural homogenisation, described in the human landscape. BUT: I may err. And it might work well as a scenario nevertheless. (Karlheinz Steinmueller, Z_punkt GmbH)
- I find this scenario incompatible with a reduction in GHG emissions. Even though any particular technology becomes more energy-efficient, there will likely be a growth in household energy consumption because of an increased number of gadgets/vehicles, particularly in the developing nations. A larger population can also offset technology gains. Also consider GHG emissions from livestock as more people will eat meat. A 2% increase in agricultural land seems low for a 50% population increase, even with advances in agricultural technology, particularly as you have growth in bioenergy area. P.S.: Some proofreading required, e.g. 'peel' -> 'peel', 'vital sings' (this

box) -> 'vital signs' and '0'8%' -> '0.8%' . (Klaus Æ. Mogensen, Copenhagen Institute for Futures Studies)

- This vision seems to reinforce a 'Networked Society', which people permanently connected, and virtual communities becoming dominant. Machines become more intelligent, even sensitive, and human bodies are empowered by artificial devices. It evokes 'Big Brother' antiutopian images, with personal intimacy being diminished. In this respect, dichotomies like urban or rural, young and old, even natural and artificial tend to be less meaningful. It seems a risky and vulnerable world, actually living beyond limits. The key question is then if self-organisation is likely to happen. It seems close to USA traditional economic paradigms. (Andreu Ulled, MCRIT)
- GDP growth assumptions seems highly unrealistic on such a long period, both for developed countries even with a new Kondratieff cycle (growth potentials based on active population and productivity increase are much lower) and for emerging countries altogether. China, which accounts today for a large share of the increase in emerging countries, will face huge ageing problems after 2030. In VLEEM, the potential growth of GDP in 2050 against 2000 was evaluated maximum 4,5 times. Change in road transport technologies cannot occur fast enough to make undecoupled mobility trends possible for the next 20-30 years. Forget about fusion by 2050. (Bertrand Chateau, Enerdata)
- A scenario is a consistent image of the world, but as low likelihood. Besides its realization depends on unpredictable political/cultural changes. (Dumas, CIRED/CIRAD)
- Two main problems with this vision: 1- there is no sign that the homo economicus is triumphing as it assumes it is. Some nationalisms + the broader and deeper clash of civilisations à la Huntington (that arguably exists to some degree at least) are major forces at work against this triumph. Its do-it-alone dimension would also raise opposition, although possibly not disruptive enough to prevent it from unfolding. 2- it seems extremely optimistic on the potential of technology to solve the resource scarcity problem! Fusion by 2050 is unthinkable, and any energy 'solution' short of it is bound to fail putting an end to the conflict on fossil resources. Then again it is hard to envision what could be done in the medium to long term with the kind of R&D investment foreseen--2 to 5% GDP is absolutely massive, and raises strong institutional issues. Incidentally the recovery of 30.000 species a year seems far-fetched? And in what habitat could these species be reintroduced? Or are we talking zoos (broadly understood)? But I am certainly no expert on this. (Frédéric Gherzi, SMASH/CIRED)
- I do not believe GHG emissions will drop so much or especially that decline in biodiversity is halted in an artificial way; constructed species may take out others rather than supplement them. (Henrik Gudmundsson, Technical University of Denmark)
- The scenario for climate change seems quite optimistic, although technology innovation and progress could effectively help to contain and reduce carbon emissions. I am a little bit concerned about the possibility to undergo such a technological revolution in the next 50 years, considering not only the existing technical barriers and bottlenecks, but also the factors which could prevent the diffusion into the market of innovative (carbon-free technologies). (Michela Catenacci, FEEM)
- 900 mill ha represent 23% of current forest area (near to 3 868 million ha), and 18% of current agricultural land area. Population grow from current 7.000 million inhabitant to 9,300 by 2050

Land demand for food may hardly compete with land for bioenergy in that scenario, thus a decrease of only 3% in forest area seems to be too optimistic. Technological innovations should be widely extended and being available for developing and developed countries. There is no mention to water resources. (Paola Ovando, CSIC)

- The impact of the developments on nature and environment are not consistent. Especially, the change in climate change is not plausible. (Alper Alsan, Siemens Turkey)
- Urban society: 65% urban population in 2050 is probably underestimated - 70% seems more likely Technology: 2-5% R&D expenses is a wide bracket - my guess is the actual value will be closer to 2% (lower bracket) GDP: 3% consistently over the period for developed economies seems high (and subsequently China may not only converge, but overtake Europe) Transport: some (minor) decoupling might happen. (Andrea Ricci, ISIS)
- Greatest concern: the apparent stability envisaged under this scenario: Re. technological revolution: the scenario seems over-optimistic. There is no space for defaults, crises. Even accepting that efficiency gains are erased by constant growth is not enough. What about absolute limits to material consumption? and things that 'can go wrong': GMOs? nanotechnology? This also needs to link to the second theme: irregular shape: essentially lack of global justice (but also within nations) and the risks of social unrest that this entails and that the above drivers are likely to enhance by marginalising and increasing the gap between haves and have nots. Other: 'GDP' is this not optimistic? again, am thinking of introducing inevitable crises (and this is essentially based on past trends: economic crises have been increasing in frequency and scale). 'settlements' wonder if 65% is a conservative figure for this scenario? Governance, I suggest we refer to the notion of post-democracies rather than liberal democracies 'Transport grows over the economy.' meaning? transport grows at a speed that is greater than that of the economy? (Olivia Bina, Instituto de Ciências Sociais da Universidade de Lisboa)
- Even though this is a quite consistent scenario, it is wishful thinking with respect to the speed of technological development. Fusion power will be necessary to have such an increase in energy consumption, and we will have to rely on this to be invented soon to embark on such a mission. If fusion energy is available at an affordable price the only place where fossil fuels might be necessary in 2050 are in transport - and with clean vehicles why then only a 25% decrease in GHG? (Per Homann Jespersen, Roskilde University, DK)
- Very unlikely that GHG emissions will decrease and that biodiversity can be induced, unless very strong policies are enforced. (R Gerlagh, Tilburg University)
- The entire vision is dependent on the technology row. Even if we are able to develop the necessary technologies to support increasing populations and increasing consumption, there is no assurance (and little precedent) for applying those technologies in sustainable endeavours. (Rob Dietz, CASSE)
- In my opinion the projections about GDP are quite optimistic. Probably also the role of innovation technology is overestimated in this scenario. (Fabio Sferra, Fondazione Eni Enrico Mattei – FEEM)
- It seems to me rather optimistic on the social and environmental consequences of market driven forces steadily governing the world policies. Beside the slower growth of developing countries,

developed countries/economies in transition would face a degradation of their quality of life in term of health (air quality, diet, stress) and in social term (fears, conflict, education, freedoms of expression). In addition, the picture does not represent the consequences of war among world regions for natural resources and of increase of migrations for war/environmental events. (Giovanna Giuffrè, ISIS)

- The ultimate driver of technology is the problem for me. It makes sense w/ the 'Go Fast' axis, but not the go it alone part. Also, the artificially induced biodiversity growth seems odd. You also spell 'signs' incorrectly in the description of this box. (Jonathan Moyer, Pardee Center for International Futures University of Denver)
- This scenario, which can be considered a sort of BAU technologically oriented, i.e. with a stronger influence of technological development, appears to be ?not very consistent? and ?it is not very likely? to happen, as far as its main outcomes are concerned. Concerning the former aspect, the internal consistency of the hypothesis, the correlation between technological innovation and climate change impacts (with a strong reduction in GHG emissions) is questionable. For example, looking at transport trends, the statement that ?transport will keep growing along with economy, but this does not matter anymore as vehicles have become clean and emissionless?, appears to be too optimistic. The analysis in UK on how to build a low-carbon economy at 2050, carried out by the UK governmental Committee on Climate Change , pointed out that ?The carbon efficiency of vehicles using fossil fuels can be increased by 30-40%. But there are absolute physical limits to what can be achieved through these improvements and, given underlying demand growth, efficiency improvements will not themselves be sufficient to reduce carbon emissions to the extent needed?. Building a low-carbon economy ? the UK?s contribution to tackling climate change (UK Committee on Climate Change, 2008). Concerning the latter aspect, the plausibility of the outcomes, the impression is that the resulting scenario in growing beyond limits is by far too optimistic. After all, the only setback in this scenario is represented by the homogenization of the societal cultural values (driven by globalization) and a certain reduction in the quality of democracy, which in itself may be a worthwhile price to be paid (at least for the developing countries) for having higher GDP level, more energy consumption, GHG reduction, improved biodiversity, urbanization growing trends, higher technological development, etc. (Riccardo Enei, ISIS - Institute of studies for the Integration of Systems)
- What I do not see as consistent is the very positive/optimistic vision of human activities and achievements with respect to science and technological advance coupled with the incapability of achieving positive results socially or politically. (Elena Claire Ricci, Fondazione Eni Enrico Mattei – FEEM)
- While initially having designed this scenario 'quite likely', I changed it to 'not very likely' when seeing the technology progress assumptions. For example, I think by 2050 there will be no commercial use of fusion power, certainly not on any significant industrial scale - perhaps a prototype fusion reactor will have been developed by then, if and only if the forthcoming decades prove highly successful for fusion research, e.g. at ITER. Also the GDP and energy consumption levels are very high for 2050; lower values are more likely I think. Of course, the future is intrinsically unsure - so this scenario cannot be entirely excluded either. (Bob van der Zwaan, ECN, Columbia University, Johns Hopkins University)
- The scenario fails to recognise that increasing efficiency due to better technology, without any change to behaviour and policy regulation to cap the volumes of demand, will lead to a growing

consumption of anything, and an increase probably of absolute emissions (they could be offset only if really technology alone will achieve the 'zero emission' and 'zero waste' targets, which is doubtful) and surely of a number of social problems associated to an increasingly unequal society, as well as other problems (e.g. congestion in the transport sector). (Carlo Sessa, ISIS)

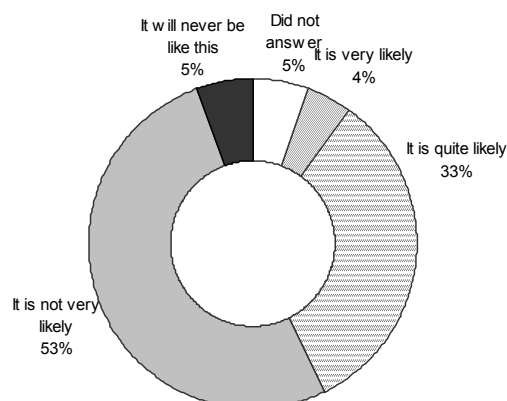
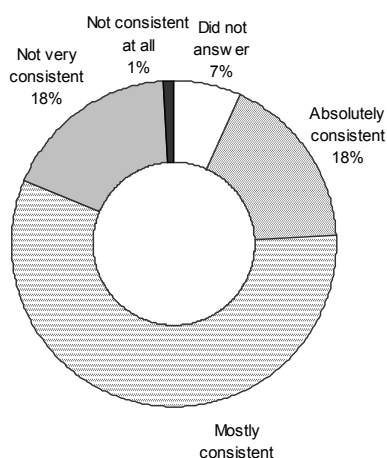
- I believe it to be a plausible scenario but it should actually also stabilize population (and avoid large growth) and drastically limit the overexploitation of rural resources for energy. (Judkiewicz Daniel, Michel, Xland sprl)
- I don't believe that Chinese GDP per capita converges with Europe already 2050. Others seem to be ok! (Markku Vantunen, Finpro)
- Broadly agree 6 of the trends. Rural land: omits effect of reduced water supplies globally: rural land usage on balance shrinks (contributing to increase in urban sizes due to population migration Transport: clean vehicle development overestimated. Investment in hydrocarbon fuels and related products too high Climate change: myth of climate change exposed. Emissions up 10% on 2010 Biodiversity: natural decline will outstrip artificial developments (commercial developments will not be as diverse as species lost) (David Somekh, ESQH).
- I think if you look to Indian estimates, population is seen to be higher in 2050, as it is a concern of theirs, I suggest their data may be closer to trend. Urbanization: I believe urbanization will continue, but perhaps at lesser rates, With the advance of technologies, I am not sure that it is even necessary, but for contributions to GDP, but technologies may make this less necessary. Advances in neuro-sciences, for the good and bad will be substantial. If the global economy increases five fold during the next four decades, I find it implausible that the Chinese per capita GDP could increase 15 fold. There seems no basis for this and they will be in the middle of a demographic decline at least 15 to 20 years prior to that. With growth in income in the developing world their will be greater energy intensity, and higher units per unit of GDP, a four fold increase during such a period of time might be in line with the purported explosion in global middle class growth dynamics. The real question is that explosion a possibility, under such a short period of time. If energy increases four fold how will emissions decrease 25% under 2010 levels, even under the cleanest of technologies rolled out during the period? Biodiversity, interesting, but many cannot even get their heads past GMO to feed a exploding global human population, how will the reaction be to the introduction or engineering of species. But, yes, likely, as will the acceptance of GMO become. Under the timeframe, things will have slowly progressed. (Craig Stevenson, HCT).

Growing within limits: the Apple World paradigm



The Growing within limits scenario assumes that a low-carbon economy and adequate biodiversity protection can be achieved with currently identifiable technologies and at moderate economic costs without damaging opportunities for human development, provided that a number of barriers to achieving the right policy conditions and institutional settings are overcome..

Consistency and likelihood of the scenario



Expert opinions

- The major weaknesses in terms of plausibility of this scenario are its political and social sustainability. Politically you need a world ruled by very determined angels for the next 50 years. Democracy paradoxically would be an issue because there will be always a political party willing to support who do not share such views, and there will never be complete consensus. A major shift of sovereignty to the UN is also very unrealistic. Even assuming that the political side is fixed, the motive for economic activity remains personal wellbeing. Unfortunately we are not naturally altruistic and free riding will appear. Only well geared policies can steer selfish individual actions towards more socially efficient outcomes, but it is not of this world to assume that a better world will materialise because everybody is turned good by magic. This scenario can be conceived only as the unrealistic end of a spectrum, the reality will be more nuanced. (Andrea Bigano, FEEM)

- No clear why the dynamics of urbanism are so different from Pear scenario. This trend seems very embedded and not clear what the Apply scenario will do to change it, unless it is the bioenergy production element. The technology requirements of the Apple scenario seem to be at least as demanding as for the Pear, so not clear that less spending and effort in this area makes sense (Frank Convery, University College Dublin)
- The assumption that Maghreb GDP per capita converges with Europe's per capita GDP is a strong assumption from my view. Acceleration on energy productivity (energy/GDP) and strong decrease of emission intensity between 2030 and 2050 is not plausible to me in this extent. (Angela Köppl, Austrian Institute of Economic Research)
- I don't believe that United Nation could be an operative institution for global governance. (Lukas Recka, CUEC)
- Consistency: The scenario is the most consistent one so far. Likelihood: However, the probability of the necessary assumptions is extremely low from my point of view, e.g. such a significant decrease in GHG emissions...(Jana Szolgayova, IIASA)
- Concerning consistency, I think this scenario is much more consistent regarding the signs/seeds than the previous one. I see no major problems. Of course, the likelihood of this scenario is not higher compared to the previous one, as it has very optimistic assumptions concerning the change in the behaviour of people. I think that even in the medium term we still have to make a distinction between countries e.g. in Europe, where such changes are more likely and countries such as China, which will prioritize growth for the foreseeable future. The governance assumption with the UN as the governing body is also debatable. (Sabine Fuss, IIASA)
- This scenario is definitely desirable but I am not sure how to achieve it. It is hard for me to see 4% GDP growth for developing countries and -4.5% decreases in emissions. Also, if meadows and agricultural land remains stable, where does the increase of forestland come from? From urban land? I doubt that could be it. Apart from this, I think that this scenario is consistent and there should be ways to achieve it, but I am not sure if the two signs I just commented could happen in the apple world. (Jose L. Oviedo, Consejo Superior de Investigaciones Científicas)
- The urban population might be higher in this scenario than in the previous one. You also assume that transport need will be lower here, which is contradictory by the facts that urban population will be lower. (Bougnoux, Enerdata)
- The scenario is predicated on cooperation and common understanding between nation-states and surrendering certain amounts of sovereignty to the United Nations; this is a highly unlikely scenario as countries compete for a shrinking pool of resources. (Andrew Barton, Charles University Environment Center)
- As in previous section: add information on technologies. R&D expenditure seems too low for this scenario. (Daniela Kletzan-Slamanig, WIFO)
- This world requires a lot of technological innovation. More than in the pear world. . (Emanuele Massetti, FEEM)

- The apple scenario could be likely if industrialized economies would gain and exert more global responsibility (low-carbon technology transfers, lower demand for energy intensive goods from non-industrialized countries (low-carbon imports, e.g. meat etc.)). This development is, however, set back due to the economic crisis and, on top, due to demographic problems in industrialized countries. This barriers should of course be overcome, to make it more likely. (Ina Meyer, WIFO)
- Same conceptual problems as in the fast growth scenario above! GDP convergence across countries is likely to be mathematically impossible at such low growth rates (unless there are negative ones in rich countries). Energy intensity improvements of 4% are difficult to imagine (examples??). Climate change entirely possible if supported by policies. But this is also possible in a fast growth scenario! Governance seems very optimistic. (Klepper, Kiel Institute for the World Economy)
- The GDP growth rates in developed and developing countries used in this scenario seems to slower the convergence between rich and poor countries compared to the 'growing beyond limits' scenario. I think technology will play an important role in this scenario. (Alvaro Calzadilla, Kiel Institute for the World Economy)
- Why is this scenario only regarded as a transitional state - to me it seems more likely than the 'orange' scenario; regarding the vital signs, one could think of a further increase in energy efficiency, the same holds true for decoupling of (motorised)transport and economic growth. (Claudia Kettner, WIFO)
- Population growth seems more likely than in the pear scenario. reduction of GHG emissions of 50% relative to 2010 seems not likely to me because it takes several decades especially in transport (spatial planning etc.) that policies have an effect. (Brigitte Wolkinger, Wegener Centre)
- 'Regulations as well as citizen behavioural changes' Behavioural changes are spurred by regulations. Example of the critique made in the pear scenario about the need to provide a more clear treatment of the interrelationships between variables. It is not clear to me how the following are related among each other (direct effects and feedback loops): energy efficiency, structural change, regulations and behavioural changes. 'Identifiable technologies' is too vague to be useful. Innovation economics and other innovation approaches use terms for the different stages of the technological change pipeline. These stages have different drivers, maturity levels and implications in terms of deployment horizon and public policies. 'Identifiable' is not used. 'Provided that a number of barriers to achieving the right policy conditions and institutional settings are overcome'. Confusing and maybe wrong direction of causality: it is precisely policies which will help overcome these barriers. Same comments as in PEAR regarding the more explicit mention of energy technologies. '10 new democracies'. In general: 200 countries, many with democracies at the national and subnational levels. $10 \times 40 = 400$ new democracies overall seems too much. 'Transport increases due to the increase in GDP' But societies become less transport intensive since they are more knowledge-oriented (although more service-oriented)? (Pablo del Río, CSIC)
- 2% of GDP devoted to R&D is not enough to achieve the Green New Deal. (Alejandro Caparrós, Centro Superior de Investigaciones Científicas)

- Not sure that the rates of expansion and final figures add up here? 4% p.a. GDP growth is nearer a 5x increase for developing economies. Looks unlikely that the climate change prediction, based on gradual linear decline to 50% below 2050 would actually avoid 2 degrees warming if cumulative emissions trajectories are accounted for. The would require much greater reductions in developed economies. UN providing effective governance also problematic in the face of traditional expansionary economic model and hence orientation of corporate entities and the consumer societies they manufacture. (John Broderick, Manchester Business School)
- This scenario appeals to me, and I do believe it is possible. But I doubt that political constraints will allow it to happen. (Larry Willmore, IIASA)
- It's not plausible that the United Nations will become an operative institution for global governance. (Daiju Narita, Kiel Institute for the World Economy)
- Seems like I have seen this world before :-) (Looks pretty similar to our publication). (Detlef van Vuuren, Netherlands Environmental Assessment Agency)
- Convergence of developing countries will increase the need of food, so agricultural land and meadows most likely will have to grow. However, this will affect negatively on biodiversity. (Efrain Larrea, MCRIT)
- Ideal scenario but I see it a bit hard to find. There are aspects that are working now but I think in 40 years will not be achieved for example to protect biodiversity (Laura Gutiérrez)
- Especially the climate change, biodiversity and governance assumptions seems unrealistic. (Sonja Peterson, Kiel Institute for the World Economy)
- Corporate interests are far too strong worldwide to enable this scenario to be plausible, it will be a coherent political platform of opposition to the economic global elite, but unlikely without an overturning of the current political/economic world system, perhaps after 30 years of agitation or civil disobedience. (Alan McDonnell, anonymous)
- I think we are moving to a much better frame of reference re responsibility for mitigating pollution. In my experience, though, the measures taken to enforce such change are often at the expense of productivity, coupled with an increase in regulatory costs. Developing countries have also already noted it is 'their turn' to pollute to catch up with the modernization of the USA and Western Europe, and will be less likely to curb emissions unless the technologies developed in the west are provided, and also if they also increase productivity. Peak oil will play into the commodification of alternates as noted above. Unequal treaties such as the Kyoto initiative (that exempted developing countries while punishing leading economies) are doomed to failure, and will set back green initiatives, especially in cyclic recession economies. (Bob Harrison, ER Harrison & Associates, Inc.)
- Again not sure about transport or energy. Do like the use of fruit as analogies (J Stephenson, anonymous)
- This is a rather consistent wishful scenario. It assumes a real paradigm shift in human behaviour and policy making. This is perhaps possible, but not very likely. One could argue about certain points: Whether CCS will ever work, whether so much land should be assigned to bioenergy

production - and whether the UN is the right kind of institution for global governance. BUT: A useful and clear image of the future. (Karlheinz Steinmueller, Z_punkt GmbH)

- I would love to think that the future will be like this, but I find the likelihood of an effective 'Global Green New Deal' rather slim. The trend for the last couple of decades has been greater polarization, greater conflict between ideologies and religions, and weaker global governance. I doubt this will change much any time soon. (Klaus Æ. Mogensen, Copenhagen Institute for Futures Studies)
- It assumes an optimistic view on the capacity that political institutions will have to define adequate limits and rhythms on technologic development, at world level. One key driver for technology is public expenses on military. Maybe this vision -as well as others, should be completed with a description of the evolution of technologies applied to military, and the international organisation capacity to reduce or remove conflicts and wars. Is a traditional European vision: Western European countries in the sixties, for instance. (Andreu Ulied, MCRIT)
- Same remark as previously for transport: a change in transport paradigm is unavoidable, otherwise negative feed-backs on economic growth will be very strong. A real problem about the global governance! (Bertrand Chateau, Enerdata)
- 'United Nations as an operative institution for global governance', '10 new democracies per year between 2010 and 2050' (anyone bold enough to predict the 2011 crop?!), this is the hardest bit to swallow, but if it did happen then the vision could unfold. (Frédéric Gherzi, SMASH/CIREC)
- A bit too naive and harmonious. GHG is not 50% lower in 2050, and biodiversity is not "stable" through the period with this amount of population growth (perhaps more likely to stabilize after 2050 if program are in place and population is stabilized). UN will not work like that but maybe some field will be governed by have globally enforceable institutions. (Henrik Gudmundsson, Technical University of Denmark)
- I am not sure human beings are ready for such an optimistic path. It would need an integrated effort of all countries (OECD, fast growing and developing countries), with a high 'willingness to pay' to ensure a better world for future generation. (Michela Catenacci, FEEM)
- Clean energy production and environmental services should be drive world-wide economics. It would need world-wide efforts to strengthen the role of international institutions like UN, while reducing the influence of corporation. There is no mention to investment on education, which seem to be key factor for this scenario. No mention to the consequence of current GHG emissions on future climate equilibrium. (Paola Ovando, CSIC)
- UN should be restructured for this scenario to thrive. (Alper Alsan, Siemens Turkey)
- Rural land: 2% forest increase seems ambitious GDP twofold growth is low Climate change: I am afraid that even 50% is optimistic (Andrea Ricci, ISIS)
- Main concerns/questions: - should we assume the rich will be leading the green revolution this time round? - not sure that 1) knowledge/service economies can truly support humanity, 2) rich countries will want to help poorer ones (i.e. no obvious link between green and social consciences). Re Driving forces: 'green economies' - we should not assume these will be the

OECD ones then helping the non-OECD (see your world shape) - cf. <http://www.euractiv.com/en/enterprise-jobs/europes-green-revolution-patchy-start-news-498046> 'as societies turn from being mostly consume driven to being mostly service and knowledge oriented.' how plausible is this? Is it not the case that current OECD-type countries can contemplate (and are still far from) knowledge society futures because other parts of the world produce what we need for a living? Can we all engage in knowledge and services? 'Climate change threat progressively banishes.' or: progressively 'reduced'? This otherwise seems rather too optimistic - cf IEA scenarios and their CO2 implications, compared to where we are today (i.e., to banish CC, the change would need to be greater than possibly envisioned in this scenario?). Re: world shape: 'Rich nations devote significant aid to developing countries' - is this a little optimistic? Currently, following a decade (1990s) of extreme wealth accumulation in rich nations, we are faced with likely failure to meet the MDGs. Equally, technological transfer has been very poor if we look at the case of CC-related pleas and pledges. Green shift does not equate to a shift in social values/consciousness, or can we assume it does? What would explain a departure from past trends? Or should/can we assume 'something' will happen in this, desirable, direction? RE: human landscape 'diluting minority identities in favour of common progressive ideals' - are we therefore still assuming that the world economies and societies will be shaped and driven by multinationals? Other: Urban settlement - why do we assume such small shift? especially if the idea is a knowledge and service society? surely we will all be in urban environments? Technology: shouldn't this have two arrows?! CC trend/arrows - seems overly optimistic. Governance: need an explanation as to why green leads to a significant (consider current problems!) improvement in global governance. (Olivia Bina, Instituto de Ciências Sociais da Universidade de Lisboa)

- The civilized scenario for climate conscious people. The political development not very likely - that the nation states would give away sovereignty to a global political body will not appear without a significant crisis. And 400 new democracies by 2050???? (Per Homann Jespersen, Roskilde University, DK)
- No way population will stay so low. No way that powerful countries will hand over power to the UN. No reason to assume that the citizen of the US will turn green. And as they don't, the developing countries will not want to. (R Gerlagh, Tilburg University)
- This is the 'have your cake and eat it too' vision. It assumes we can have 'green' GDP growth that is decoupled from throughput of material and energy. Although material and energy cost per dollar of economic output has been decreasing, the savings have been completely swamped by aggregate growth. In other words, time and time again throughout history, we have used any efficiency gains to increase the scale of economic activity -- this approach will not end in a stable or sustainable system. (Rob Dietz, CASSE)
- As impression, much of the success of the green growth policies will depend on how many elements of sustainable growth will be included in the green economy packages. De-carbonizing the energy supply plays a critical role for reaching climate change targets but it might create other unwanted environmental consequences and conflicts might rise over others natural resources (water, lithium..) (Giovanna Giuffrè, ISIS)
- Again, the drivers, of the scenario don't seem entirely plausible. I see this kind of a scenario coming about due to some global constraint, and then a move towards this more sustainable future. (Jonathan Moyer, Pardee Center for International Futures University of Denver)

- This scenario appears to be 'mostly consistent' in its assumptions and 'it is quite likely' to happen. The good GDP growth associated with the development of green technologies (and the related green economy patterns) could reasonably ensure population growth and a relative decline in urbanization trends. In terms of general plausibility, may be a more pronounced trade-off between higher GDP growth rates (in particular in the developing countries) and the strong GHG reduction should be taken into account. It is likely to happen in fact that the higher GDP growth rates in developing countries will be associated with higher motorization rates (even in presence of the relative halt in urbanization trends) and all that could increase GHG emissions to an extent less optimistic of what projected. (Riccardo Enei, ISIS - Institute of studies for the Integration of Systems)
- Economic and Environmental objectives and also technological and social-political and governance skills are well balanced and more credible. (Elena Claire Ricci, Fondazione Eni Enrico Mattei)
- The technology developments suggested here are quite feasible, which is why I denoted this scenario with 'quite likely'. Reducing GHG emission by 50% in 2050 is a very tough call, but it is needed in order to stabilize the climate. From an optimistic point of view, I believe these emission reductions are possible, even while they require a very substantial overhaul - if not revolution - of the entire energy system. With the mass-scale implementation of carbon-poor technologies as we know them today, and under a stringent international climate regime, such an emissions abatement is feasible. (Bob van der Zwaan, ECN, Columbia University, Johns Hopkins University)
- To achieve a 'green world' the contribution of citizens' behavioural changes is mentioned, but it is not clear at all if and how the behavioural changes can happen. It would require either big investments to improve awareness, education etc, as well as policy measures to stimulate new behaviours, and really bottom up changes of lifestyles. Lacking this bottom up changes, the scenario is not very likely to achieve the stated goals (they could not be achieved only with good cooperation between the nations without more radical changes in the institutions, at national and international level, to empower more directly civil society - citizens, NGOs - and engage them in pursuing the environmental and social goals). (Carlo Sessa, ISIS)
- This scenario is very appealing on the ethical governance aspect while greening the general behaviour and saving the planet. Nice but, to my opinion, premature in 2050. I believe that is possible but further down the road, timewise. Besides, I would predict, in the case of this scenario, a population stabilization vs. growth. (Judkiewicz Daniel, Michel, Xland sprl)
- The current technology is not enough for low-carbon economy. World GHG emission is on 30% lower in 2050 (Markku Vantunen, Finpro)
- The fundamental problem with this model is that it assumes a global culture that has never existed (i.e. an economy based on philanthropic, long term, democratic and socially responsible precepts). Previous scenarios e.g. in science fiction, have posited that the only stimulus to such a change from the greedy, exploitative and power hungry roots of the majority of current entrepreneurship would be a global catastrophe following which the remnants of mankind would agree that in the future 'there must be another way'. (David Somekh, ESQH).

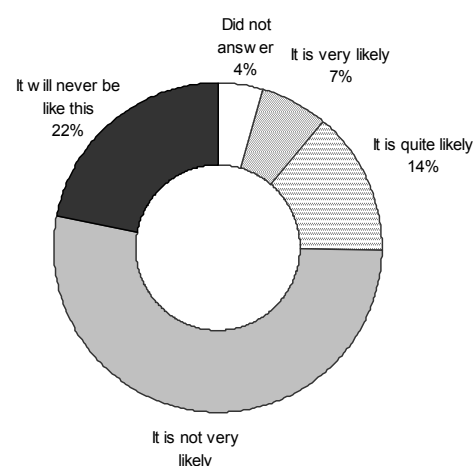
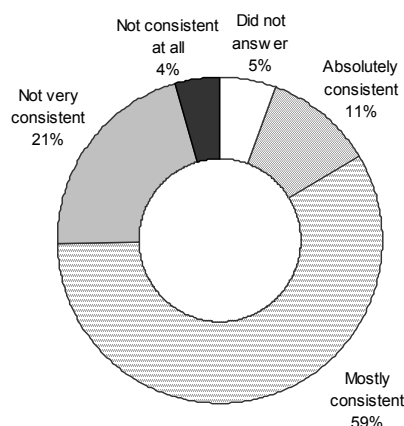
- Population will be higher. Despite advances in living standards it will take a considerable amount of time to address income inequality within nations let alone between nations. Most likely production will become much more efficient, in all forms of inputs that go into that production over the time. Productivity and efficiency will have to move toward some sort of Moore's law just to keep pace, let alone materially advance the human peoples. Such a perspective toward green and efficiency, although disparities between opportunities and implementation globally will lay the stage for the further progress of man over a longer timeframe. Global institutions and cooperation will have to assist more in the world, to realize exactly what lies within their self interest during this period, as institutions evolve to support the global development trajectory for the longer term. (Craig Stevenson, HCT).

New welfare: the Orange World paradigm



The present measurement of growth is abandoned in the New welfare scenario. A new frame is set up to account features of wellbeing "beyond GDP", including self-production and services rendered by nature, taking into account the realities that do not pass through the market or get irrelevant evaluation by a market. A new techno-economic and social paradigm emerges.

Results of the survey:



Expert opinions

- This is even more unrealistic than the apple scenario. Again a planetary cultural shift so pronounced is not of this world. I may sound cynical, but this is way beyond the end of the green spectrum. (Andrea Bigano, FEEM)
- How can you possibly reach population growth stabilization? (Valentina Bosetti, FEEM)
- This assumes a transformational shift away from individual greed and the human propensity for violence, so alas very unlikely. As earlier, the soft and hard technologies required to make this work don't exist so we would need to invest heavily, although a re-balancing of R&D away from military might allow the transformation with a shrinking R&D budget. (Frank Convery, University College Dublin)

- It is simply too ideal world :) Maybe in 200 years. There is the same value by Rural land overexploitation as in the Green Apple World(500 mil.ha in 2050). It is really decreasing? In this case? (Lukas Recka, CUEC)
- This scenario is the least probable; the assumptions are very specific (Jana Szolgayova, IIASA)
- The consistency is not the problem with this scenario, it's the plausibility: it is hard to imagine that people, who just experience the beginnings of an improvement in their standards of life (e.g. in China) will want to stop developing along this line and go back to live in small communities, suddenly attaching higher values to the environment. I think the assumptions on signs/seeds are too extreme as well. For example, why does population stop growing at all? And this all until 2050? Maybe the assumptions of this scenario can be tamed a bit to make it more marketable... . (Sabine Fuss, IIASA)
- I think this is the most consistent and likely scenario. Only a few things: I am not sure if it is possible to recover 15.000 species per year, mostly taking into account the slow growth of GDP so that few funds are available for this type of environmental interventions. I am also not sure about the peaceful anarchies. How does that work? (Jose L. Oviedo, Consejo Superior de Investigaciones Cientificas)
- I do not believe in that assumption: (Bougnoux, Enerdata)
- Material consumption is not likely to decrease until a reduction in standards of living is forced upon humanity. The current capitalist model of increased consumption and continual growth is too deeply ingrained to permit a scenario where humanity and the developed world in particular is able to look beyond economic wealth. (Andrew Barton, Charles University Environment Center)
- Technologies and R&D rate described do not seem consistent with the rest of the scenario. New forms of social cooperation including some aspects of subsistence and material de-growth seem desirable. What about sectoral shifts, regional disparities, (un)employment caused by the change in consumption and production patterns, how are the adaptation and the development for less-developed regions managed? (Daniela Kletzan-Slamanig, WIFO)
- With such low GDP growth and population increase it is not possible to reach any objective. (Emanuele Massetti, FEEM)
- Energy: Going to one third of current consumption in 40 years seems very unrealistic...despite it is only scenario. Biodiversity: 15 000 species recovered per year cannot be even monitored (given the miracle of achieving this goal). This number was probably estimated as 1 species recovery per 10,000 square km of land surface area on average. However, destruction in e.g. tropical forests could be irreversible. It would be probably more appropriate to talk about populations - i.e. 15.000 populations recovered per year. This is maybe more realistic as several recovered populations can belong to the same species. This would cover also marine populations. (David Vackar, Charles University in Prague, Environment Center)
- Drastic decrease in consumption and production is not consistent with high GDP levels, and low R&D investment share. I cannot consume the idea of a peaceful anarchy. (Artem Korzhenevych, Kiel Institute for the World Economy)

- This scenario is from my point of view highly desirable but not very likely because due to the internationalisation of trade and communication homogenization will gain ground thus threatening diversity and local communities. There will probably remain niches for local communities within a globalised world. (Ina Meyer, WIFO)
- Local production is inconsistent with high technology developments and convergence of incomes. The food production basis can not be secured through local production. (Klepper, Kiel Institute for the World Economy)
- GHG emission reductions seems to be quite optimist. I think technology will play an important role in this scenario. Club convergence could make a difference. (Alvaro Calzadilla, Kiel Institute for the World Economy)
- Technologies: no low carbon technologies are addressed; no increase of mobility (especially when also considering developing countries) extremely unlikely as well as low GDP growth rates in developing countries; not described how the reduction in energy consumption is achieved; for me this is not a stable scenario, I'm also not so sure if we should define this scenario as the new welfare paradigm. (Claudia Kettner, WIFO)
- In my view urban concentration should increase in this scenario. GHG emissions decrease of 85% seems too unrealistic for me. As well as the recovery of ecosystem with the rate mentioned in the scenario. (Brigitte Wolking, Wegener Centre)
- 2% of a slowly growing GDP is not enough to achieve a society where 'Education and research are at the centre of social values'. Reducing the share of urban population in a world where population grows will increase emissions. Cities are generally more efficient. I do not think that we will see '10 new peaceful anarchies per year between 2010 and 2050'. New GDP measures should not only appear in this scenario, these measures should also appear in the Apple scenario. (Alejandro Caparrós, CSIC)
- Very substantial change from present day. Possible and consistent scenario but by 2100 not 2050. (John Broderick, Manchester Business School)
- Unless we all choose to emulate the Amish, this will not happen. (Larry Willmore, IIASA)
- I don't think a anarchical world like this could support an increased population and achieve enhanced prosperity compared to the present. (Daiju Narita, Kiel Institute for the World Economy)
- Evoking the impact of new digital technologies makes this scenario more consistent. though less likely than the growing beyond limits, it is plausible. on the social level, increase conflicts and a trend towards multiculturalism means that this scenario more likely reflects social relations in the future. (Dana Abi Ghanem, University of Manchester)
- Population growth does not have to be low in this world. First of all, it will be hard to get this implemented everywhere (globally) at the same time. Second, given the lower income incentives might be less to have less children. For global emissions, I have similar feelings. That this may lead to very sharp emission declines for certain groups in high income countries I can easily see. I

doubt, however, whether it can be implemented so ambitiously everywhere. (Detlef van Vuuren, Netherlands Environmental Assessment Agency)

- Reduction of 85% of GHG for 2050 seems too much, it would mean a far too radical change of everything. This scenario does not seem very likely because of the big changes it needs. (Efrain Larrea, MCRIT)
- I do not look very feasible, given that society should make some very drastic changes. (Laura Gutiérrez, MCRIT)
- I am not sure the assumed GHG reductions are consistent with the other assumptions. (Sonja Peterson, Kiel Institute for the World Economy)
- Cultural and religious factors are far too strong for this scenario. As long as people are willing to die for religions and social networks are culture based, different cultural groups will compete for scarce resources and will demonise each other in this process. (Alan McDonnell, anonymous)
- Fertility per female in the Middle East, India and related countries hovers around 7.0, and that culturally will not change much. China is also abandoning its 1.0 per family edict, but they've already sown the seeds of disaster with their birth gender inequity. Social and religious perspectives will continue to separate peoples, and we would have to integrate a major theatre war to eliminate one or more factions in several areas of the world (think Sub-Saharan Africa and tribal strife- until one side or the other 'wins' via genocide, the problem will persist- the defeated will also be the next generation of terrorists in those countries). Multi-nationals will resist localization, as will government institutions with a vested interest in regulating the lives of their constituents. Nice to consider a world like this, but I sense it contravenes the basic greed of human nature... (Bob Harrison, ER Harrison & Associates, Inc.)
- Nice idea but wellbeing will also be linked to earnings and consumption in a capitalistic democracy(s) Unless you can demonstrate a new democracy leading to a new form of capitalism (J Stephenson, anonymous)
- This is a really radical scenario with so much of behavioural change, that I even considered assessing it as 'never'. An objection: localism usually implies closed minds, closed minds imply distrust for others - are 'peaceful anarchies' feasible with homo sapiens? I doubt it. BUT: good to have other measures as old-fashioned GDP! (And I advocate already for many years the idea of 'gardening the planet'.) (Karlheinz Steinmueller, Z_punkt GmbH)
- I think such a society is most likely to grow from bottom-up initiatives in the wake of a near-total collapse or decline of capitalist economy and political/military superpowers, as an extension of the current open source movement and 'maker culture'. I doubt local communities will be very strong; I rather think we will see strong 'global villages' where like-minded people share ideas and immaterial wealth in global networks. Local communities will mostly be about providing material goods and services, which will be less important in a highly networked world where immaterial goods are more important than material ones. Given that I think a global crisis of the current world order is required for this scenario to come true, I find it somewhat too optimistic; much will be lost before (if) we get there. (Klaus Æ. Mogensen, Copenhagen Institute for Futures Studies)

- It is not very likely in the short time. Seeds are there however, in the education systems, and also new consumption patterns emerge slowly. Since it requires deep changes in human values -with cooperation becoming more relevant than competition, basic aspects in human life, like safety, must be guaranteed. Is feasible a world with some regions becoming like 'oranges' while others remain like 'pears', or 'potatoes'? The vision is close to some valleys and coastal zones on rich countries, like the south of France, the north of Italy, and the Alps, the Stockholm archipelago. (Andreu Ulied, MCRIT)
- Unfortunately, the process through which this new welfare would happen is missing in the description and this brings some scepticism on the internal consistency and likelihood. If new welfare comes out from a succession of severe socio-economic and political crisis within and across world regions, the process leading to such a drastic change would probably be of a bottom-up nature, without worldwide coordination (may be severe conflicts) leading to very different situations across the world, anyone finding its own 'new' welfare. We are far away from the orange... Do not forget that 'new welfare' may look very ugly for a lot of people today! (Bertrand Chateau, Enerdata)
- Compared with the other scenarios, this seems to be more utopian and optimistic, especially concerning such a high technical change, in a fragmented/rural world. How the world is fragmented, or not is also not very well explained. (Dumas, CIRED/CIRAD)
- This is a beautiful vision but a utopia, in flagrant contradiction with many of the traits deeply anchored in the human nature. '10 new peaceful anarchies per year' !! (Frédéric Gherzi, SMASH/CIRED)
- Simply hard to imagine: greed, laziness, fantasy, technology and innovation is out there now and will need to be channelled in extremely different ways through completely new philosophies and institutions with control over minds and matter; how does that fit with liberal ideas, and ideas of 'human capital'? Motor cars and aeroplanes were first invented in bicycle workshops, see what I mean? (Henrik Gudmundsson, Technical University of Denmark)
- I agree with the crucial role of education and research to ensure an equilibrated development. I am a little bit concerned about the governance form (peaceful anarchies are the only form which can ensure this kind of scenario?) (Michela Catenacci, FEEM)
- Population growths, as well as land for bioenergy, but global equilibrium results in a decrease in meadows and agricultural land, with no mention to increases in agriculture yields. Biodiversity : It would need a high-technology society; the clonation problem should be overcome, and also that environmental scenarios become world-wide economic drivers No mention to the consequence of current GHG emissions on future climate equilibrium (Paola Ovando, CSIC)
- This one is my preferred scenario. The global GDP and energy consumption figures sound not plausible. They should be higher... (Alper Alsan, Siemens Turkey)
- Settlements: i believe stability at 50% is more realistic GDP: 50% seems more realistic energy: too optimistic! cut by half (already a tall order...) Transport: 'sharply' is probably optimistic (Andrea Ricci, ISIS)

- Some suggestions: 'a deep behavioural social mutation' would consider adding a change in consciousness and a rise in empathy (after Rifkin's empathic society). 'Education and research are at the centre of social values.' would consider adding arts: less material concerns can lead also to greater powers of expression, not only greater spiritual pursuits. (Olivia Bina, Instituto de Ciências Sociais da Universidade de Lisboa)
- The deep-ecology scenario, where individuals become so civilized that totally new (or old village) forms of governance will appear. What should be the driving force for that? The next IPCC-report, making people realize that this cannot go on? Again, such a radical change will not take place without some profound crisis. (Per Homann Jespersen, Roskilde University, DK)
- This paradigm is Star Trek, straight from Hollywood. Some trekkies may believe we reach this stage after we reach warp. (R Gerlagh, Tilburg University)
- It will be a tough process gaining the public awareness and political backing necessary to implement this vision, but it's the most hopeful way forward for developing a sustainable, fair and efficient economy. In light of the ample evidence of ecological overshoot, the social changes associated with this vision would be a welcome shift. (Rob Dietz, CASSE)
- Energy consumption decreases too much in this scenario. I think this is not realistic in particular in the short term. This scenario requires strong innovation in the energy sector. (Fabio Sferra, Fondazione Eni Enrico Mattei – FEEM)
- As Governance driver, more than anarchies I would see the 'participatory democracies' and, the even is evolved in a more open way, I would see an increase role for regional/global institutions. An key question might be which/what can make developed countries and economies in transition to slow down their consumption of natural resources, with the unavoidable consequences at economic level. This shift might be promoted by regional/local actors after a economic/social/natural crisis. (Giovanna Giuffrè, ISIS)
- I don't know why population is lower in this scenario. I would imagine it higher here than in the apple, which focuses on equitable development. (Jonathan Moyer, Pardee Center for International Futures University of Denver)
- This scenario appears to lack of internal consistency, being at the same time quite likely to happen. The way to solve this logical contradiction is to address the technological development. The slow economic growth could be not entirely consistent with the higher growth in sophisticated technologies (sustained by up to 20% of global GDP allocated to technological development compared to the 2010 level). Given the overall economic slowdown, the opportunity costs of the resources allocated to R&D should be high: what and who will pay the bill ? But given that, this scenario is quite likely to happen. In presence of such radical changes in cultural values and attitudes at world level, everything becomes possible: to reduce the trend towards urbanization, with lower consumption levels and corresponding energy consumption and emissions, to improve the world governance and biodiversity. (Riccardo Enei, ISIS - Institute of studies for the Integration of Systems)
- The driving forces are important and likely to arise and develop, though the results are a bit too drastic especially if the scenario is 2010-2050. Behavioural changes are likely and needed but

organizational structures - especially the attachment to instructions and nations - have strong inertia. (Elena Claire Ricci, Fondazione Eni Enrico Mattei)

- With barter becoming very common and with markets partly being phased out for economic activity I was close to writing that it will never be like this in this scenario. Some idealism, however, initially kept me in ticking 'not very likely'. When I read 'reintroduction of extinguished spices' though, I realized that this scenario is unfortunately totally unrealistic (both when reading 'spices' and 'species'). GDP will at least be twice higher than today's, I think, when no global disaster occurs. A one third energy consumption in 2050, alas, is not going to happen, I'm afraid... (Bob van der Zwaan, Columbia University, Johns Hopkins University)
- The scenario is clearly optimistic, it shows a view where the current signs of pressures towards a better world a 'beyond GDP' way of life - which are increasingly seen in the wealthier societies - will spread and contaminate also China, India and other big economies in the world in the coming decades. To achieve this, we will need a number of paradigm shifts: a) in technology, from katabolic/fast technologies to metabolic/slow technology, i.e. from energy/capital intensive technologies to brain/human intensive technologies; b) in economy, from classical profit-making/competitive to social/cooperative economy and from hyperconsumerism to a steady-state economy. It will be increasingly understood that profit-making business is not the only effective way people can work together to provide important services (including knowledge production). The power and weight of the big corporations in the economy will be diluted, with a growing share of social enterprises, and the same nature of the corporations will change, with increasing democracy and participation of the workers in the ownership and management of the corporations c) in policy, away from the current top-down and hierarchical structure of powers towards more community based management of common pools of natural resources, social heritage and public services across the world, in a multi-governance framework which will help to coordinate policies at different levels - where new local, national and international institutions will have all an important role to play. In the scenario signs/trends above, give more emphasis to technology too (2 or even 3 arrows), because a different but not less important contribution will come from technology (as compared to the 'peer world' scenario). By the same token, the pattern of urbanisation should be better described: it is not true that in the new welfare society part of the population will return to live in rural environment, I think the current strong urbanisation trends will continue, but in the welfare society we will be able to build polycentric networks of cities instead of sprawling or big monocentric cities as it is now. (Carlo Sessa, ISIS)
- This is the triumph of local development, bottom up vs. top down, social values vs. profit. A somewhat high tech middle age society. Very socially appealing but probably utopic at the time horizon (Judkiewicz Daniel, Michel, Xland sprl)
- From 50 to 45% urban population is not possible in 2050 Energy consumption cannot decrease so fast 85% GHG emission drop is not very likely. (Markku Vantunen, Finpro)
- The paradigm suffers from the same potential criticism as the apple scenario, but has much greater credibility, in the sense that there are already the seeds of such behaviour and a minority interest in the possibility of a more sustainable grass-roots, network based existence (open software, permaculture etc). It remains for me a possible, if not probable scenario, but within 40 years would be running in parallel with the pear scenario, not yet displacing it, but gaining ground as an alternative lifestyle. (David Somekh, ESQH).

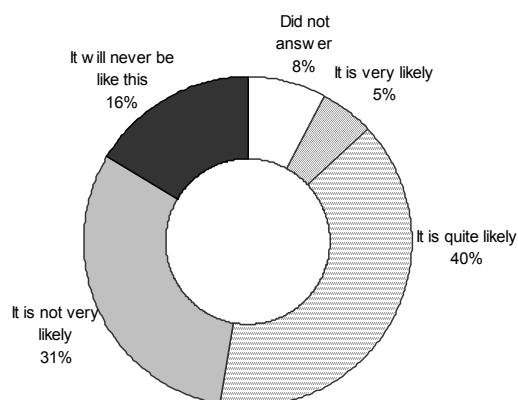
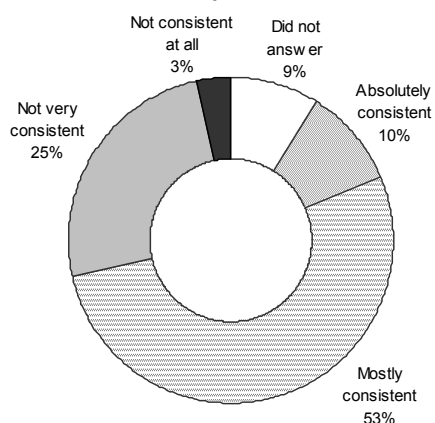
- During this period the groundwork for such could be laid. It is really a matter of necessity as advances in technology, not least robotics comes to make the human irrelevant. If this comes to be the case, other occupations for the human could be required, leading to a new renaissance in the arts and sciences were it to be designed correctly. Under such a system new measures introduced into GDP could occur, but would need be considered carefully. Still, before reaching such a possibility, without it being a new North South point of friction or inequality need to occur which is why, although we may see elements of such, it will not occur within the given timeframe although its foundations could be laid. (Craig Stevenson, HCT).

Turbulent decline: the Potato World paradigm



The key question with respect to turbulent decline is whether the growth in material flows could remain within the limits for climate change, natural resources' availability, global ecosystems' health and biodiversity loss, as well as help to alleviate global poverty. The answer would be negative, and the world is set to collapse.

Results of the survey:



Expert opinions

- The overall idea resembles what could be the pessimistic lower end of the spectrum of possible future worlds, but there are serious problems of consistency: I do not understand the arrows for GDP: if Global GDP is about 30% higher in 2050 than in 2010, why are they pointing down? Also, emissions should be increasing in this world, if global GDP is increasing and there is no particular incentive to green innovation and to improve energy efficiency. (Andrea Bigano, FEEM)
- Key drivers for slowing growth in population are rising income and education. Since these are both likely to decline under this scenario, we could expand re-covering of population growth. Don't see why transport should de-link from GDP, and with slow down of capital replacement, emissions reductions not likely (Frank Convery, University College Dublin)

- The description above does not follow the description of indicators in the table: e.g. energy intensity Working through the four scenarios it seems to me that the description of the scenarios is not always mirrored in the description in the table (with the arrows) (Angela Köppl, Austrian Institute of Economic Research)
- The trends are ok, but Scenario snapshot 2050 and Rate of change come from the Orange World!! (Lukas Recka, CUEC)
- Consistency: There are several aspects that appear contradictory: For example, assuming a global draw back in the global economy assumption at the same time as the dominance of market forces is expected. Moreover, the market dominance would imply industry being motivated to improved the technologies used, which would lead do higher R&D spending if the current technologies are not sufficient. At the same time it is not clear, if the technology is not improved, and energy use is not affected how the desired reductions should be reached even without a population increase. Moreover the assumption of a drastic decline in the GDP may not be consistent with such the population increase. Likelihood: Due to the perceived inconsistency it is difficult for me to assess the likelihood of this scenario. In general I feel the suggested scenarios are all too extreme cases and the a realistic compromise scenarios is lacking. I think this may have a serious impact if these scenarios are used as inputs for other models. (Jana Szolgayova, IIASA)
- This scenario suffers from many inconsistencies, which makes it look less probable to me. For example, the assumptions that market forces are dominant, , most services are privatised, there are energy shortages, a lack of innovation and low social conditions are all ok. However, in a market-oriented world with many inefficiencies, there would be a lot of demand for improvements and incentives to make a profit of the situation. Therefore, it is surprising that there is no innovation, not even R&D and so much protectionism. Looking more closely at the seeds/signs, more inconsistencies abound: why are emissions lower by 85% in 2050 compared to 2010 in such a horror world, where energy intensity is rising substantially (why is that by the way? Do they dislearn in some way?) and population is exploding? Same goes for biodiversity assumptions and governance. In general, I think that all four scenarios are a bit too extreme. I see that the purpose is for them to lie in these four quadrants, but it would make them look more probable if some of the signs/seeds could be tuned down a bit. (Sabine Fuss, IIASA)
- I do not think this will happen in the next century. Maybe in a far future, but so far I think economies will manage to survive although quality of life will decrease for all world habitants. This will be a catastrophic scenario in a far future and will not last for long since it will lead irreversibly to state of collapse throughout the world economies. I am not sure what the real consequences for society will be in the long term. (Jose L. Oviedo, Consejo Superior de Investigaciones Cientificas)
- The GDP growth in this scenario should be lower. In my understanding, it is assumed here that the world will be in crisis for decades (riots, war...). Economic growth is not compatible with this scenario for me. (Bougnoux, Enerdata)
- Unfortunately the most likely scenario given the world's total lack of ability to reach a consensus on pressing sustainability issues, but it's inconsistent in that energy consumption will continue to

increase as what remains of the world's fossil fuel deposits are dug up and burned. (Andrew Barton, Charles University Environment Center)

- Same trends and characteristics as the previous scenario!?! same trends and characteristics as the previous scenario!?! (Daniela Kletzan-Slamanig, WIFO)
- The table above is the same as in the Orange scenario - which is supposedly not deliberate... (Sebastian Petrick, Kiel Institute for the World Economy)
- Technology again doesn't seem very plausible. Energy consumption decline can be plausible under this turbulence scenario (i.e. drops because of local shortages). Biodiversity: again refer rather to populations of species: currently we are not able to measure exactly yearly rate of species decline. This scenario seems to be not very consistent but relatively plausible. (Emanuele Massetti, FEEM)
- I would keep the technological development ongoing in this scenario, but stress the resource scarcity. I would drop the discussion of spiritual dimension here, or add it to all other scenarios. (Artem Korzhenevych, Kiel Institute for the World Economy)
- A dominant market economy and, at the same time, a lack of innovation and low emotional social conditions seems to be contradictory as with market opportunities incentives to innovate usually rise. Old technologies and high rates of pollution better match with centrally planned economies rather than with market forces, as to historical facts. The described fragmentation of the world does not seem to be very likely due to the achieved level of internalisation. (Ina Meyer, WIFO)
- I do not understand what the drivers of this scenario are supposed to be. The phenomena could serve as a plot for a catastrophic movie. However, there is no mentioning of where the failure has its origin. (Klepper, Kiel Institute for the World Economy)
- I think that differences between rich and poor countries should be larger in this scenario. (Alvaro Calzadilla, Kiel Institute for the World Economy)
- It is very unlikely that energy intensity and emission intensity - globally - start to increase in the future (why should already developed low carbon technologies no longer be employed?); decline in transport along the decline of economic activity not very likely. (Claudia Kettner, WIFO)
- In my view population will not grow in the manner described due to social, economic and ecological limits. Increasing social and economic gaps are very likely. (Brigitte Wolkingner, Wegener Centre)
- I think that forests would decrease more than 1% in this scenario (especially compared with a 3% decline in the Pear scenario). (Alejandro Caparrós, Centro Superior de Investigaciones Científicas)
- 'Market forces' would not tolerate energy shortages or retrenchment - a greater sense of militarism and expansion seems more likely and consistent. (John Broderick, Manchester Business School)

- This scenario is business as usual with no technological breakthroughs. I am tempted to say even that this is 'very likely', but I don't want to be so pessimistic. Social scientists (I include myself) are not good prophets. (Larry Willmore, IIASA)
- Technology forecast sounds like highly implausible (is 'telepathy' a technology in the first place?). (Daiju Narita, Kiel Institute for the World Economy)
- I'm not sure what is meant by 'even if believes are in own personal 'inspirations' rather than in 'God''. (Dana Abi Ghanem, University of Manchester)
- GDP assumptions seem to be really pessimistic. Negative growth for sustained periods over time is really below what we have seen. On climate change.... in combination with the point above, I really do not expect this world reducing emissions. (Detlef van Vuuren, Netherlands Environmental Assessment Agency)
- Not the best scenario for the world, but given the present circumstances we are addressing to this. (Laura Gutiérrez, MCRIT)
- This scenario is far too pessimistic regarding the impact of technology, there will be several singularities soon, self modification of genes, ubiquitous robotics and very powerful energy storage devices will have huge impacts. These impacts will be most likely to be localised, cultural and economic factors will lead to wide diversification in affects across the world, some areas will actively reject them. (Alan McDonnell, anonymous)
- I almost noted it as 'not very likely' and it is a 50-50 in my mind. I do not see the population rising to this level; social and political systems in threat will unfortunately mitigate the numbers through conflict, famine, poor response to natural and man-made disasters, etc. The last two years have been a foreshadowing of this scenario, and one can see finger pointing, increased greed, the fragmentation of systems as people fight for advantage, and the demoscclerosis of western politics; e.g., being concerned with one's own piece of the pie instead of the whole pie in general. in this scenario, i also see the USA becoming more xenophobic, which is to the detriment of the developing world, and which will increase strife. Not a happy place, but we've seen snippets of it already. (Bob Harrison, ER Harrison & Associates, Inc.)
- This might be something we have to pass through to get to the Pear scenario (J Stephenson, anonymous)
- This is an easy to write crisis scenario, highly consistent with some exceptions. If everything goes down: How can population grow so much? (Many would die from famine, lack of health care, and sanitation, lack of water, destruction of the environment - and the many local/regional conflicts/wars.) In a way, it is not enough decline in this scenario. Fortunately, I am a sceptic also with respect to pessimistic visions... (Karlheinz Steinmueller, Z_punkt GmbH)
- Unfortunately, the most likely scenario, apart for the reduction in GHG emissions. I think this scenario will see a substantial growth in emissions. In this scenario, I think we will see some very powerful multinational corporations that use transfer pricing and other tricks to avoid paying taxes anywhere. Intellectual property rights will most likely be heavily enforced by corporate lawyers, stifling technological and cultural dissemination and development. (Klaus Æ. Mogensen, Copenhagen Institute for Futures Studies)

- The increase in population is unclear. Maybe the evolution overtime and the distribution across territories must be further described, since actual tendencies seems contrary to these assumptions. The visions is close to Europe in between 1919 and 1940. (Andreu Ulied, MCRIT)
- I do not understand the consequences of this scenario above. In such a scenario there will be some leaders, with a high growth, probably giant countries like China , India, maybe the US, and losers like EU for instance. Available resources will mostly be captured by the leaders, while the rest of the world will go down to hell...Within the latter, there will be always a small number of privileged people capturing a great share of the wealth. Such a scenario is certainly not driving the demography so high, all the reverse: wars, lack of health, food problems, fear, no trust in future (Bertrand Chateau, Enerdata)
- Increase in agricultural land could be more pronounced with such a scenario. This scenario is pessimistic, but having transport decrease so soon globally seems strange to me. It should better be inequitably spread, but still increasing. (Dumas, CIRED/CIRAD)
- This scenario is mostly consistent but not very likely because of its GDP decline (I assume this is conventional GDP). This is perhaps too conservative thinking but it would appear that even the dramatic 20th century has barely slowed down our economic growth. Of course the stress on our environment has grown in such a way that we might reach thresholds, with catastrophic consequences, but to the extent of such a GDP loss compared to the 3 other scenarios? Hardly believable, especially without link with the population (that has the highest growth in this scenario): today's undergraduate will head the economy in 2050, they should do better than what is envisioned with the 'manpower' that is projected. I do not think that it is necessary to go to such extreme to make this 4th vision a repulsive one; even a 1% yearly GDP growth can probably easily be balanced, as a gain, by the losses incurred in beyond GDP dimensions to welfare. To be discussed. (Frédéric Gherzi, SMASH/CIRED)
- Something like that, but again I cannot see it lead to lower GHGs, as effort to exploit easy and dirty sources of energy probably would occur broadly; same possibly with transport although perhaps less so, With 11.000 million people, that will all try to move away; transport will not be a result of wealth but a necessity to escape frustration and seek opportunity elsewhere. (Henrik Gudmundsson, Technical University of Denmark)
- I think this scenarios combines too many pessimistic views. before the general collapse, one of the considered (negative) dynamics would probably bring to a general reaction towards a change of direction. (Michela Catenacci, FEEM)
- Seem to be the business as usual scenario (at least if the current economic crisis is considered. land use scenario seem to be not consistent since agricultural land increases 1% by 2050 in detriment of forest (1% decrease) but population increases to 11.000 inhabitants which in 18% higher than population in the pear world vision, but decrease in forest at the potato scenario represents just 33% of the decrease that is expected at the pear scenario. (Paola Ovando, CSIC)
- This is where we can end up with if we do not act. Vital signs are a little bit overestimated but are good to scare people. (Alper Alsan, Siemens Turkey)

- Technology: seems a little too Science Fiction to me Energy: with energy intensity back to 1% in 2050 (which seems credible to me), then however 75% of consumption is too low Climate change: to be consistent with my remark on energy, I think 15% reduction is too much - Stability? (Andrea Ricci, ISIS)
- Re Drivers: 'Energy shortages, 'and food shortages? 'lack of innovation, why? and why such a decline in GDP (in the arrows section)? is it because of protectionism? Editorial comment: 'The spiritual dimension gains importance at the centre of people's life, even if believes are in own personal 'inspirations' rather than in 'God'.' I would take out 'even if' because there is a clear difference between spirituality and religiosity, let alone the 'high religions' SUGGESTION: Perhaps we should include a 'quality of life' indicator in the final summary tables? Currently the only meaningful indicator is GDP (!) and that is very limited, as discussed in the background paper extensively. (Olivia Bina, Instituto de Ciências Sociais da Universidade de Lisboa)
- This is the type of crisis that might seed a revolutionary change to the apple or orange scenario - the nations of the world not being able to solve fundamental questions of economic sustainability, not being able to provide technological solutions, not being able to meet fundamental needs, not being able to give any hope. (Per Homann Jespersen, Roskilde University, DK)
- Only the GDP decline combined with emission decline I consider not necessarily probable. Recall that GDP only measures man-made value. No need to assume we can't produce more in a more polluted and factionalized environment. I don't see the need for collapse. It may just be not a nice world to live in, but then, what is? (R Gerlagh, Tilburg University)
- If we can't make the changes required for the Orange World Paradigm, then we'll all be scrounging for potatoes. (Rob Dietz, CASSE)
- The population grows too much. Too many differences across countries (in contrast with to the current globalization trend). The role of energy innovation is underestimated. (Fabio Sferra, Fondazione Eni Enrico Mattei – FEEM)
- Even in this scenario, I would see an increase on technology use. Taking into account the population growth, it not very clear today why energy consumption and emissions should always lower than 2010. The question of migrants might be mentioned and the mix with some elements of the 1 scenario would make it more plausible to me. (Giovanna Giuffrè, ISIS)
- Basically, everything falls apart. I just don't really understand the deeper drivers of the lack of innovation and the low energy availability. Spell that out. (Jonathan Moyer, Pardee Center for International Futures University of Denver)
- This scenario appears to mirror the Growing beyond limit one. While the latter represents an optimistic BAU, the former represents the pessimistic version of what could happen following the BAU trends. In both cases, the hypothesis seem to be not very consistent, while the Turbulent decline results are likely to happen, provided that a certain inconsistency is solved. The most important one appears to be the statement that 'market forces are dominant?', embedded in a context (a storyline) characterized by strong protectionism and economic downturn. In principle, it could be possible that the market mechanisms and its intrinsic logic, left free to dominate, may lead to disasters. But this should be better explained. My feeling is that the

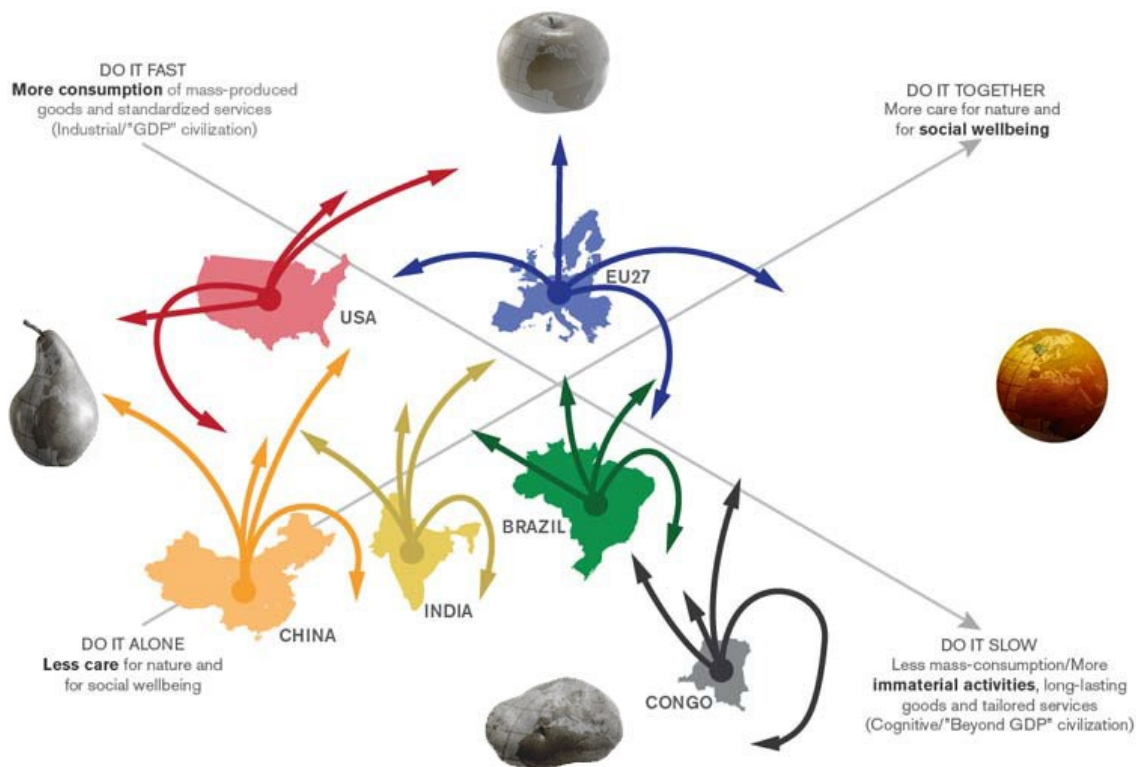
market forces unleashed, including service privatization, etc, has led to a global market in which the barriers to trade and production factors circulation are in general unconstrained (what we know as globalization). The reaction to all that may lead to radical different production patterns (localism, protectionism) at the condition that the underlying logical chain of events is explained. Given that, all the rest is likely to happen: from GDP reduction to less energy consumption and GHG emissions. Nationalisms can reasonably lead to major conflicts. (Riccardo Enei, Institute of studies for the Integration of Systems)

- Too pessimistic view on the human nature and its capabilities both social/ethical and scientific/technological. A very extreme case that is not very credible. (Elena Claire Ricci, Fondazione Eni Enrico Mattei)
- The population assumption in this scenario is probably too high (my pick for an absolute maximum would be 10 billion, with a more likely value of around 9 billion). Whereas unfortunately a scenario of significant collapse would be quite likely, in my opinion it would be of a different nature. For example, I would energy see increased by a factor of 3 or so, and correspondingly a substantial increase in GHG emissions and concentrations; the climate change results hereof would be clearly experienced in 2050, while the true scale of the problem would become apparent a century later. The internal consistency of this scenario is quite limited, I think. (Bob van der Zwaan, ECN, Columbia University, Johns Hopkins University)
- This is clearly a pessimist scenario, but I consider it 'quite likely' as the optimistic 'new welfare' scenario. Indeed, the world could well go in this direction in the next decades, and all of us and the new generations experience a new dark age that however could be more dramatic and short than the dark age followed to the fall of the roman empire, leading to radical and eventually positive changes of and for humankind in 2050. This would be the 'red transition' to a new welfare world, which would be in some respects similar to a new welfare world achieved through the 'green' or 'blue' transitions (i.e. through intentional changes led by policies), but at a lower level of wealth for all. This transition scenario is likely because only crisis - actual or perceived - produce real changes. (Carlo Sessa, ISIS)
- While this may be what happens in the short term, I cannot imagine that mankind will not be smart enough to depart from that scenario in the next ten years. (Judkiewicz Daniel, Michel, Xland sprl)
- ¿Lack of innovation?. But if market forces are dominant, and the empirical literature in innovation economics has shown that a main incentive for innovation comes from market forces (the other is technology-push), then there would be a lot of innovation. It may be appropriate to add ¿lack of clean energy innovation?. Market forces lead to high GDP growth this is a precondition for high R&D investments. In turn, the ¿energy shortages? (together with high GDP growth) lead to an increase in the price of energy inputs, which provides an incentive for energy efficiency and clean technologies, both from a supply-push and demand-pull perspective. In contrast, the scenario envisages: low GDP growth rates, insignificant R&D and increase in energy intensity. (Pablo del Río)
- The scenario is quite consistent, but the values of the signs are a bit too extreme. (Markku Vantunen, Finpro)

- This doomsday scenario is plausible, but if market forces still dominate, technology will have developed more on the lines predicted for the 'pear' scenario, not as proposed here. Emissions are not necessarily linked to global GDP (large numbers of poor people in urban settings will not produce less) therefore emissions here might be 20% up on 2010. Fragmentation if progressive could lead to a 'tipping point' with a very different scenario, with a large-scale breakdown of societal structure with regression to 'dark ages' feudalism. (David Somekh, ESQH).
- Although growing constraints are being placed upon the world's resources, even before purported middle class growth dynamics are factored in, such a scenario seems to me highly unlikely. Stakeholders, although blind at present, will slowly awake to burgeoning realities and work to incentivise solutions to the problems the world is confronting in lockstep with the advance of technologies, if under less prosperous terms than has been recently imagined. Moderate rises in global income on a more universal basis will translate into greater strains on the world's water and land resources. Greater investment, composition of GDP and growth need be engineered around such issues as illustrated above and most likely will be. Again, the real issue is the dispersion of technologies and their use, and ability to be used, which is why spreading out investment and growth opportunities at present is of the greatest importance rather simply championing large markets as the source of future business growth. Development need be more spread around to ensure the opportunity and capital base to avert the problems listed above. The use of resources, across the board will be higher, hopefully movements toward the efficient re-use of resources will begin to become more commonplace as well, further providing support to a longer term trend of global development, and advances in living and income standards over a more extended period of time. (Craig Stevenson, HCT).

4.2 2nd Delphi Survey (October 2010)

A second round of the DELPHI survey has been done putting online again the following snapshot illustration of the four alternative scenarios, including this time a number of key regions of the world and the directions that each region is assumed to take towards which quadrant in each alternative scenario:



For each scenario the online DELPHI survey presented a short portrait of the regional evolution patterns

The experts invited to the survey were asked to rank the consistency and likelihood of these regional patterns, and to give their free comments (open questions) on the scenario portrait.

4.2.1 List of participants

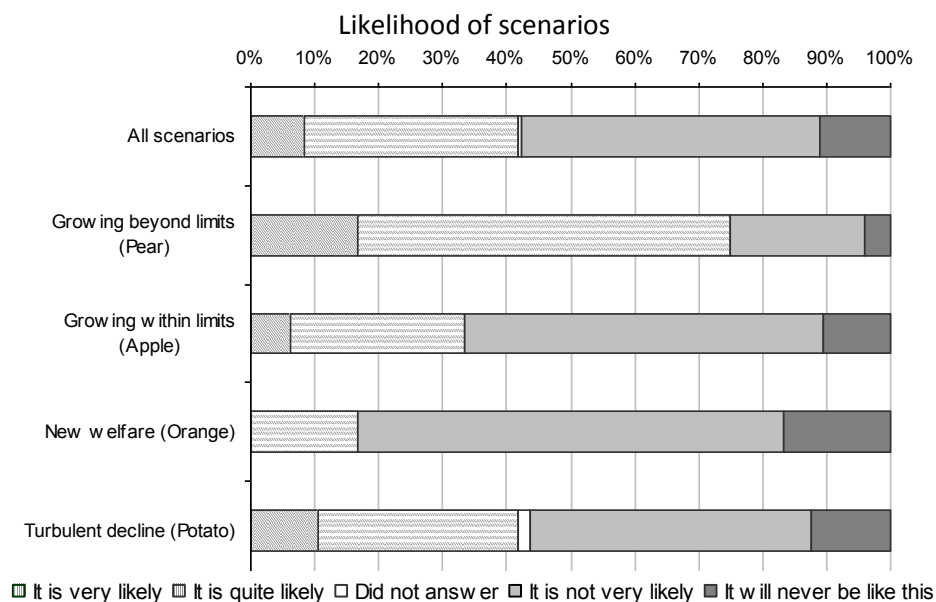
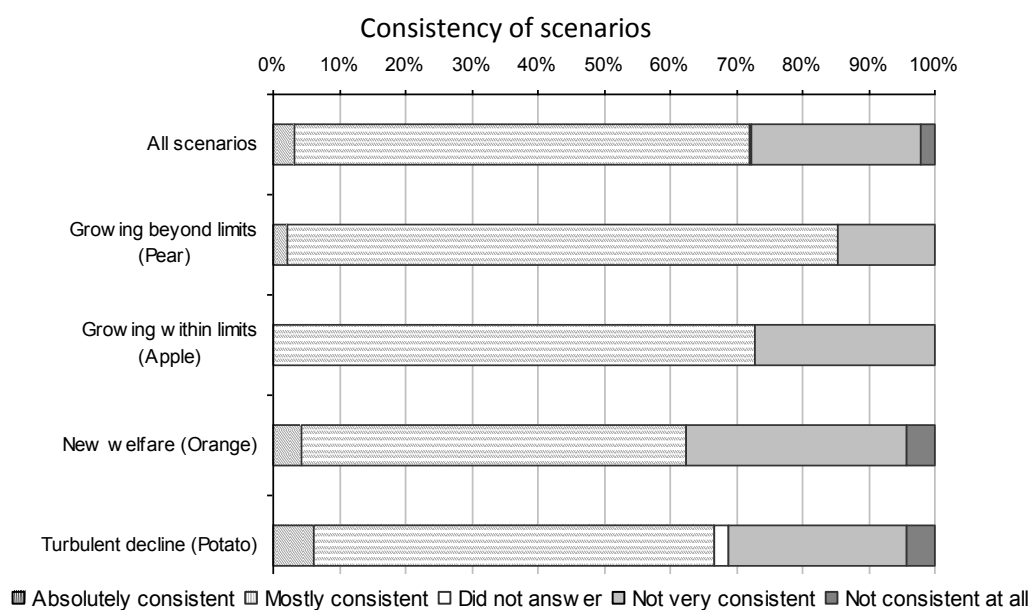
The second round of the DELPHI survey has engaged 50 experts, listed in the table below:

Names of the 50 participants to the survey	
Name	Institution
Jonathan Moyer	University of Denver
Andreu Ulied	MCRIT
Dana Abi Ghanem	University of Manchester
Sonja Peterson	Kiel Institute for the World Economy
Sebastian Petrick	Kiel Institute for the World Economy
Karlheinz Steinmueller	Z_punkt GmbH
David Somekh	ESQH
Jan Kovanda	Charles University Environment Center
Laura Gutiérrez Vázquez	Mcrit
Nati Franco	Mcrit
Emanuele Massetti	Fondazione Eni Enrico Mattei - FEEM
Elena Ricci	Fondazione Eni Enrico Mattei - FEEM
Larry Willmore	IIASA
Olivia Bina	Instituto de Ciências Sociais da Universidade de Lisboa
Jennifer Jarratt	Leading Futurists, LLC
Valentina Bosetti	Fondazione Eni Enrico Mattei - FEEM
Katharina Köberl	Austrian Institute of Economic Research – WIFO-
Bob Harrison	ER Harrison & Associates, Inc.
Andrea Bigano	Fondazione Eni Enrico Mattei - FEEM
Daiju Narita	Kiel Institute for the World Economy
Fabio Sferra	Fondazione Eni Enrico Mattei - FEEM
Enrica De Cian	Fondazione Eni Enrico Mattei - FEEM
Frédéric Gherzi	SMASH/CIRED
Roberta Pierfederici	Fondazione Eni Enrico Mattei - FEEM
Paola Ovando	CSIC
Renato Rosa	Fondazione Eni Enrico Mattei - FEEM
Giovanna Giuffrè	ISIS
Angela Köppl	Austrian Institute of Economic Research – WIFO-
Riccardo Enei	ISIS
Brieuc Bougnoux	Enerdata
Bertrand Chateau	Enerdata
Carlo Sessa	ISIS
Jose L. Oviedo	CSIC
Alvaro Calzadilla	Kiel Institute for the World Economy
Eric Mañé	Quality Institute

Names of the 50 participants to the survey	
Michela Catenacci	Fondazione Eni Enrico Mattei - FEEM
John Broderick	Manchester Business School
Elina Hiltunen	Finpro
Sabine Fuss	IIASA
Bernd Münier	AU/NERI
Alejandro Caparrós	CSIC
Detlef Van Vuuren	Netherlands Environmental Assessment Agency
Gernot Klepper	Kiel Institute for the World Economy
Claudia Kettner	Austrian Institute of Economic Research – WIFO-
Henrik Gudmundsson	Technical University of Denmark
Kurt Kratena	Austrian Institute of Economic Research – WIFO-
Brigitte Gebetsroither	Wegener Center

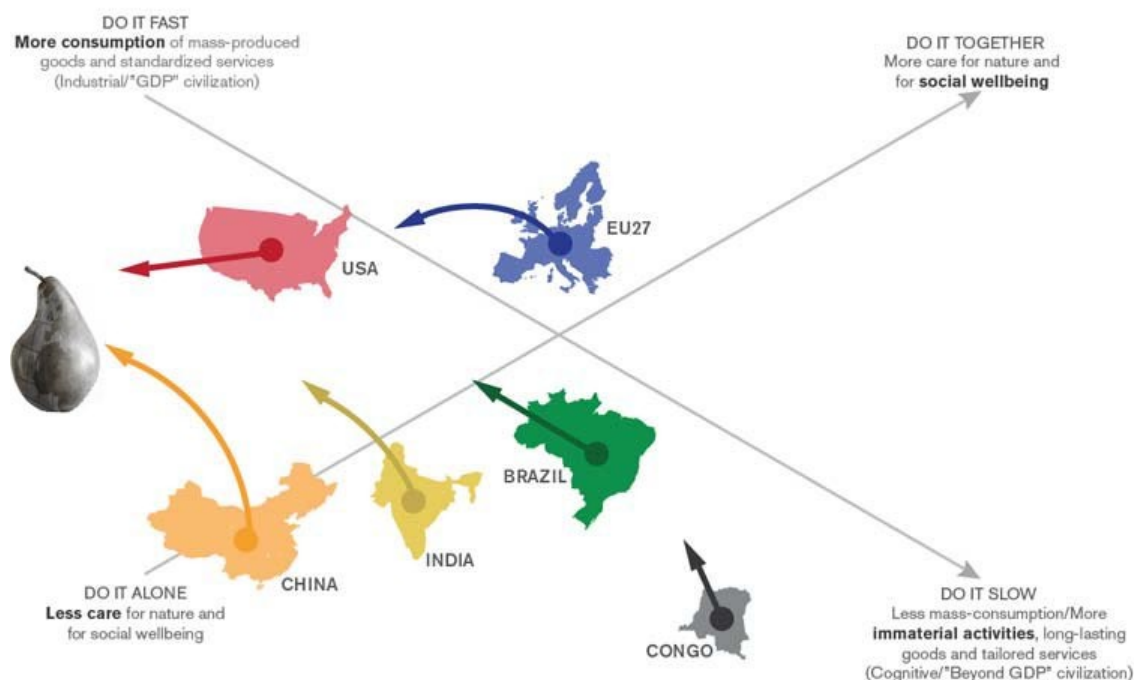
4.2.2 Summary of results

Next figures summarise the results of the survey.



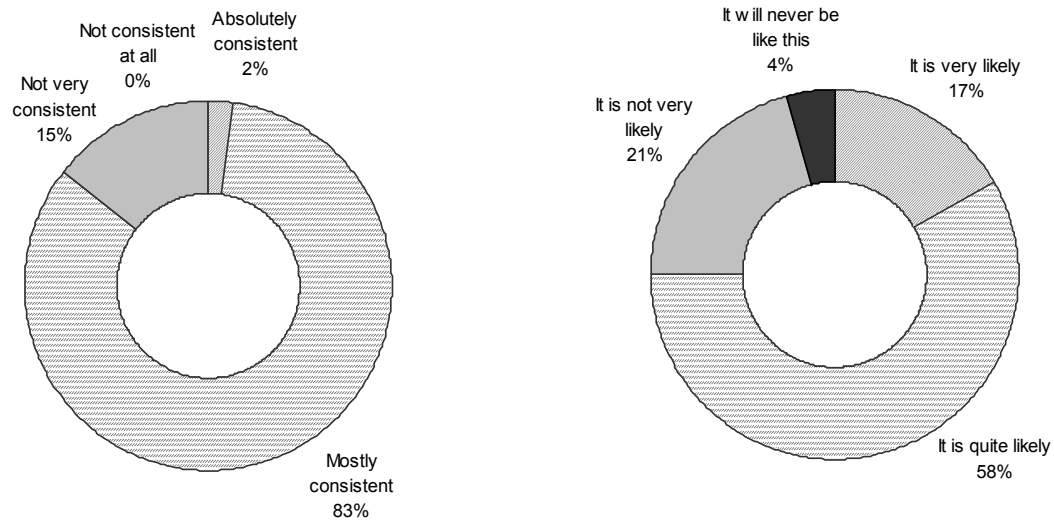
Growing beyond limits: the Pear World paradigm

Growing beyond limits scenario features the strengthening of corporate capitalism and market mechanisms, pursued globalization of goods and financial markets, a new technological wave in the form of ICT, nano-technologies and biotechnologies.



Global growth towards an increasingly unequal world: USA remains in a Pear World. Wealth levels go up for most Americans, mostly due to technological development, but social inequities and environmental impacts also grow. The rest of the world regions move towards the Pear World following their own paths. China, India and other emerging economies shorten distances with USA and Europe at the cost of increasing internal inequities and environmental unbalances (Asia's GDP per capita moves from being 16 times lower than North America's in 2010 to only 4, and in relation to Europe's from 8 to 2). The world economic differences still remain high, with undeveloped regions like Africa being unable to grow fast enough. European economic development remains lower than the other world regions either because social and welfare policies consume excessive resources or because the lack of capacity of public institutions to be adjusted. Demographics in underdeveloped countries keep uncontrolled, and population in developed countries is increasingly old. World population is 9.600 millions in 2050, with increasing north-south migration tensions. The risk of political and military conflicts is high.

Results of the survey:



Expert opinions

- Is not obvious to me that in the Pear World all regions move towards the Pear, many could move towards the Pear (USA, China) other remain the same or move towards Apple (Europe?, India), others remain or fail into Potato (Congo, Brasil?) or even move towards Orange (Europe?, Brasil?). So we could imagine a more pessimistic and a more optimistic evolution towards a Pear World where regions move in separate directions. (Andreu Ulled, Mcrit)
- I think it is likely that the US will not do better than Europe which seems to be assumed here. (Sonja Peterson, Kiel Institute for the World Economy)
- Wealth levels go up for most Americans, mostly due to technological development, but social inequities and environmental impacts also grow.' in general I think you will have to emphasise more the rise in inequality and thus poverty, as income and wealth continue to concentrate in few hands. It seems unlikely that the EU might shift 'backwards' towards this scenario, unless a serious change in politics and values occurs. Reactions to recent austerity plans suggest a mixed approach. This scenario continues to look as if by 2025 it will merge with potatoes. (Olivia Bina, Instituto de Ciências Sociais da Universidade de Lisboa)
- Instability economically and the inequity of distribution may induce countries to become more isolated in both goods and energy development and consumption. Trends in higher education, especially in the US, indicate those immigrating for advanced degrees are going back to home countries; thus the development of those countries will increase and also prompt more 'independence'. (Bob Harrison, ER Harrison & Associates, Inc.)
- The regional evolutions appear reasonably consistent and likely in terms of their internal logic. However, there are some tensions with the 'driving forces' paradigm below, which sounds more optimistic overall than in its regional specifications, and with 'the human landscape', which seems to point to more homogeneity and less social strain than what transpires from the regional evolutions above.(Andrea Bigano, FEEM)

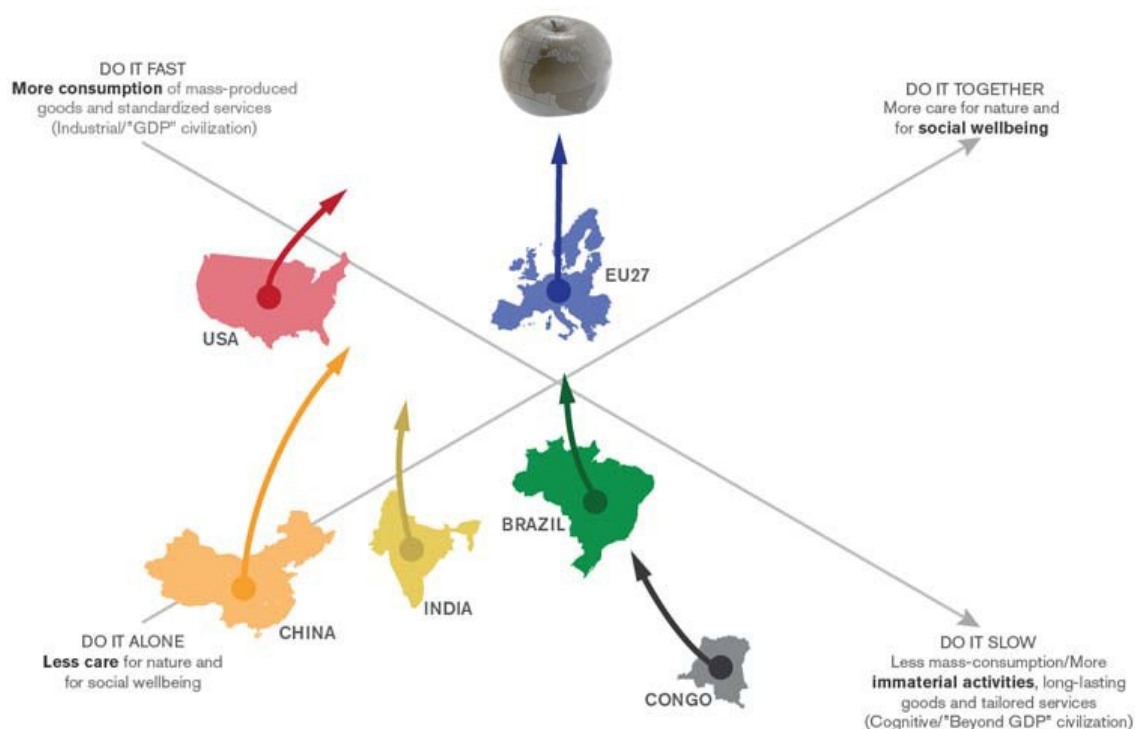
- Unclear what drives technical progress to tackle the climate change issue, if the pear world is characterized by 'less care for nature'? What would be even more consistent: the absence of any global governance forbids any significant climate policy, climate changes gradually occur, and countries focus on adaptation--which they manage better or worse depending on their growth and technical progress. (Frédéric Gherzi, SMASH/CIRED)
- The economic growth of China and India not necessarily couples with a worsening of environmental unbalances, especially considering improvements in energy intensity and green techs, which characterize the Pear scenario. In rich countries the economic development path led to more concern about environmental issues and social equity, maybe we could expect the same change in emerging countries. (Roberta Pierfederici, FEEM)
- Quite likely, even if not sustainable in long run. However, I would not see the world's regions moving all together on the same path: Europe might remain in the Apple World and some emerging economies (es. South Africa, China, Brazil) might join this scenario whereas others might move to Pear World. (Giovanna Giuffrè, ISIS)
- I am not convinced that the catching up process could evolve as outlined (Angela Köppl, WIFO)
- All regions are naturally tempted by growing without care about limits (why it seems mostly consistent). But limits exist and will not allow all regions to grow that way. Fighting for limited resources is unavoidable, and there will be little winners and a lot of losers. (why it will never be like this) (Bertrand Chateau, Enerdata)
- I think that the tensions created by a convergence of all regions of the world to a Pear World paradigm will explode before such convergence can really happen. Much depends from which form of energy will be mostly exploited at 2050. If the energy sources will become less concentrated (renewable, new reserves of gas) there will be the opportunity for more diverse regional evolutions. (Carlo Sessa, ISIS)
- I do not understand why these regions have been selected. Do we have to assume that regions and countries within the same region are going to move together to the same scenarios? I do not see this happening in EU27 if moving towards the Pear. If everyone moves to the pear, I think that at least one will necessarily fall into the potato. In other words, everyone moving to the pear means collapse to me, and collapse happens in the potato.
- Within region inequalities should also increase (Alvaro Calzadilla, Kiel Institute for the World Economy)
- You are not providing information on the dynamics which drive technical transfer and technology spill-over. Those effects could affect the success and timing of development of different regions of the world. (Michela Catenacci, FEEM)
- I would take out the word 'excessive' in the line describing Europe's situation. (Alejandro Caparrós, CSIC)
- I think you have to be very careful in describing so explicitly where you think that currently nations are. In someway, the USA might be placed somewhere - but within the USA you have

communities that work as apple, potato and other vegetable/fruit. The storylines of the future are caricatures.... current countries are not, and a rich combination of people, trends and visions. (Detlef van Vuuren, Netherlands Environmental Assessment Agency)

- I can not see, how these developments can coexist in the light of increasing scarcity of natural resources. In addition, the economic consequences of practically all countries moving towards higher incomes and more resource intensive growth will a drastic shift in the international division of labor. As a consequence, the notion of cheap labor-intensive goods in exchange for high-technology will be inconsistent with such a world. This world does not seem to have resource constraints. I find it unlikely that this world will emerge without drastic changes in relative prices of resources and goods. As a consequence I do not think that all major economies can move in such a direction. (Gernot Klepper, Kiel Institute for the World Economy)
- More details on technologies and energy sources as well as transport modes would be necessary (which combination of technologies allows for a decoupling between emissions and energy)? (Claudia Kettner, WIFO)
- I do not like the formulation 'European economic development remains lower than the other world regions either because social and welfare policies consume excessive resources ...'. What is 'excessive'? Perhaps to maximize growth, but not necessarily to ensure stability or mitigate conflicts. (Henrik Gudmundsson, Technical University of Denmark)

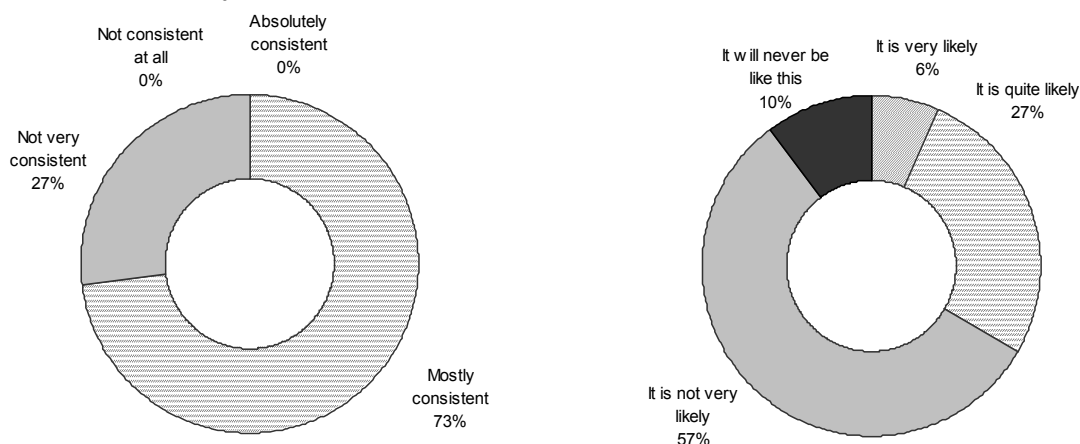
Growing within limits: the Apple World paradigm

The Growing within limits scenario assumes that a low-carbon economy and adequate biodiversity protection can be achieved with currently identifiable technologies and at moderate economic costs without damaging opportunities for human development, provided that a number of barriers to achieving the right policy conditions and institutional settings are overcome..



Convergence towards a global green and inclusive economy: Europe and USA move towards the Apple World, becoming closer societies. India follows the USA path, facing social and territorial serious unbalances. Brazil follows closer the European path with more intensive wealth redistribution policies. China undertakes political reform. Africa moves similar to India, still with a much lower development level. Demographic trends become more stable worldwide as wealth redistribution throughout regions increases opportunities for developing countries helping to control fertility, while more socially involved systems in developed countries tend to increase fertility. There are lower migration tensions. World population is 8.750 millions in 2050. Economically, Europe grows much faster than the USA as it is successful in its "green-smart economy" strategy, and is able to take profit of its know-how, catching up in terms of GDP per capita in 2050 at around \$60.000. World inequities reduce to halve of today's, largely thanks to technologic development on ICT and biomedicine. At the same time that there is a relative improvement of the environmental impacts of human activities, there is a process of cultural homogenization.

Results of the survey:



Expert opinions

- Some aspects in the scenario description require radical changes beyond business as usual evolutions, so they are not very likely even if theoretically consistent, e.g. the European economic and technologic success or the political reform in China, following the traditional Western democracies. The economic convergence and increasing social and political stability seems consistent with both ecologic sustainability and a more homogenous international culture, in line with the 'internationalistic' visions both of marxists and capitalists ideologies. (Andreu Ulled, Mcrit)
- 'World inequities reduce to halve of today's, largely thanks to technologic development on ICT and biomedicine.' Not thanks to more active political economy approaches favouring distribution of income? If India follows the US example it is unlikely that it will move to apple, unless you are thinking of a leap-frogging scenario - but please explain in what areas. 'China undertakes political reform. ' this is very vague. China and India being such large percentage of world population - their development path should be explained more clearly. (Olivia Bina, Instituto de Ciências Sociais da Universidade de Lisboa)
- Unless we develop cellulose based energy technologies, and until developing countries move past their perceived need to pollute to catch up in industrial terms, the greening of the world will suffer as the demand for fossil fuels and expansion to serve economic needs will take precedence (Bob Harrison, ER Harrison & Associates, Inc.)
- The internal logic of regional developments is fine, but this scenario is way too optimistic. (Andrea Bigano, FEEM)
- 'World inequities reduce to halve of today's' (1) should be more precise (what indicator do the authors have in mind?) and (2) has massive general implications in terms of growth differentials for the developed and developing countries--something that might be hard to back up with credible figures. (Frédéric Gherzi, SMASH/CIREN)

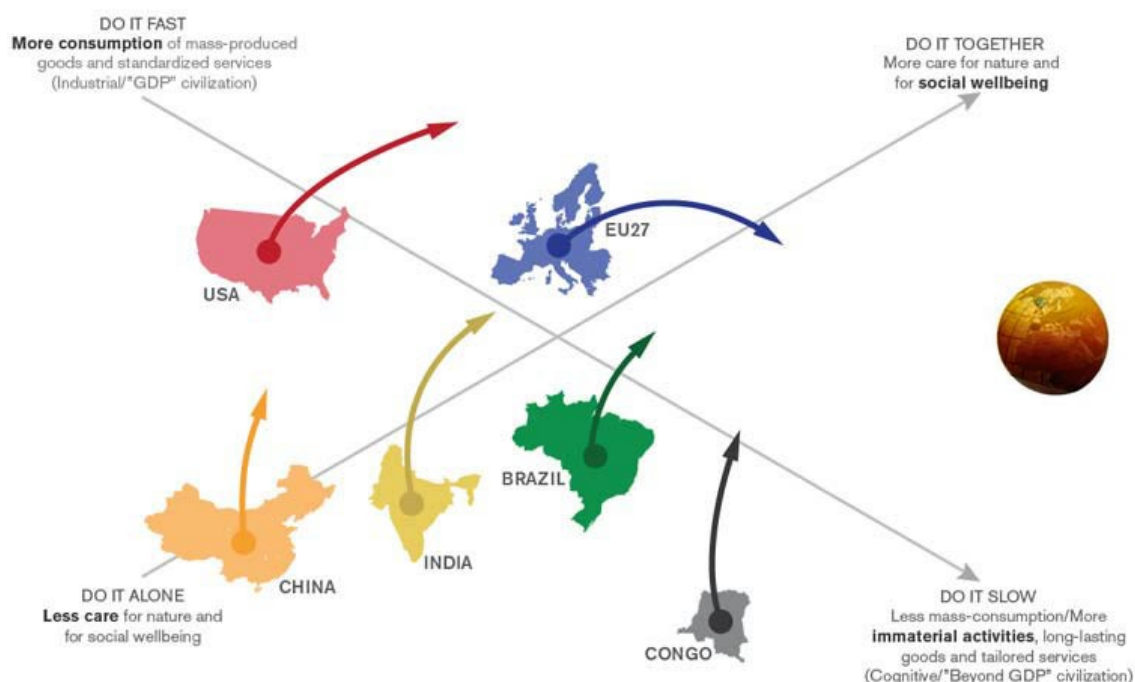
- It is not clear why i.e. Brazil follows the development path of Europe or Africa follows India and so on. In my opinion the changes in fertility illustrated in the scenario require a wider time span, usually more than one generation. People need time to become aware of economic and social changes occurred and then to modify their family planning. (Roberta Pierfederici, Feem)
- More than EU/USA, I would imagine China/Brazil leading the development of a green market in Asian and South America regions. These political choices might be driven by those investments clearly convenient from a economic and environmental point of views and might be stimulated by national/ regional needs more than international pressures. (Giovanna Giuffrè, ISIS)
- The only aspect not very consistent is the lagging of the US economy with respect to the EU level. Being the green-smart economy trained by environmental friendly technological developments, it is unlikely that the US still strong technological endowment will be useless (particularly, if associated to a strong political commitment, e.g. the Obama's green revolution) (Riccardo Enei, ISIS)
- I doubt that Europe can take the lead of the green-smart economy. My feeling is that the more concerned about limits is China, and that China is able to take the lead in such a scenario (Bertrand Chateau, Enerdata)
- This is the most positive scenario. An overall convergence should be facilitated by a shift in current international relations, towards a greater role of G20 cooperation and the implementation of green and smart strategies in the different regions. The growth of Europe seems however too optimistic: we will remain an aged society, and this will have a negative impact on productivity. (Carlo Sessa, ISIS)
- Again same questions than in the previous scenario. For me it is unlikely that all countries and regions move to the same world. Maybe, for the potato or even for the orange, but in this latter case, demographic growth should decrease considerably. (Jose L. Oviedo, CSIC)
- The time horizon is important for the likely occurrence of all scenarios. For example, I think that this scenario is not likely in the short run but quite likely in the medium or long term. (Alvaro Calzadilla, Kiel Institute for the World Economy)
- Not sure Europe will have the internal cohesion and the institutional support which will be necessary to succeed in a green-smart economic strategy and to achieve the higher economic growth. (Michela Catenacci, FEEM)
- Reliant on the assumption that the economic parameters are achieved without substantial negative ecological consequences. Not as plausible as other scenarios. (John Broderick, Manchester Business School)
- USA will stick to the pear scenarios, the poor countries demand their right to be in the pear scenario, as their wealth increases. (Elina Hiltunen, Finpro)
- I don't think that Europe is going to grow 'much faster' than the US. (Alejandro Caparrós, CSIC)
- A simple inconsistency lies in the fact that a convergence of incomes at growth rates (I presume these are total economy wide and not per capita) given here will achieve a more balanced

regional distribution only over extremely long time horizons (this is simple algebra, overcoming a tenfold difference in comes with a 1.5 percentage points growth differential will take time!!). (Gernot Klepper, Kiel Institute for the World Economy)

- Description of low carbon / energy efficient technologies should be provided. (Claudia Kettner, Wifo)

New welfare: the Orange World paradigm

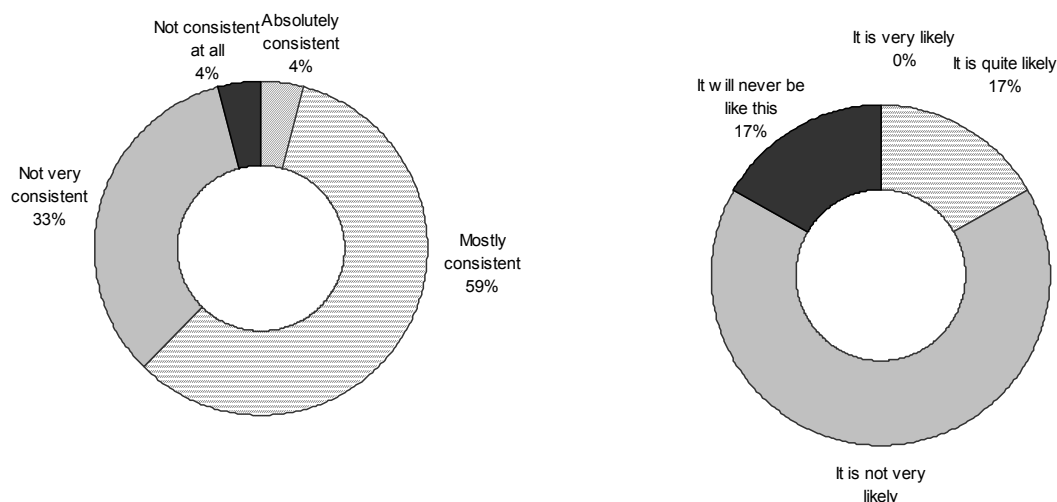
The present measurement of growth is abandoned in the New welfare scenario. A new frame is set up to account features of wellbeing "beyond GDP", including self-production and services rendered by nature, taking into account the realities that do not pass through the market or get irrelevant evaluation by a market. A new techno-economic and social paradigm emerges



Phased transition towards a more equitable and sustainable post-growth ("beyond GDP") society:

Europe leads the rest of the world towards a more balanced and less materialistic, knowledge-based and decentralized Orange World, following particular evolutions. While Brazil is able to follow a balanced development process, China still needs to accept some inequities to increase their growth at least in the short-term. With a global economy becoming more knowledge-intensive, India's advantages grow and its development pace increases. Africa growth is higher in this vision since it can take advantage of environmentally friendly and less capital intensive technologies, for instance in food growing and processing. Economic disparities among countries drop to one third of today's. GDP per capita in Latin America is some \$19.000 by 2050 as opposed to current \$3000, while Africa's GDP per capita is \$8500 by 2050 as opposed to today's \$1000. The increase in wealth of developing countries is parallel to the demographic stabilization.

Results of the survey:



Expert opinions

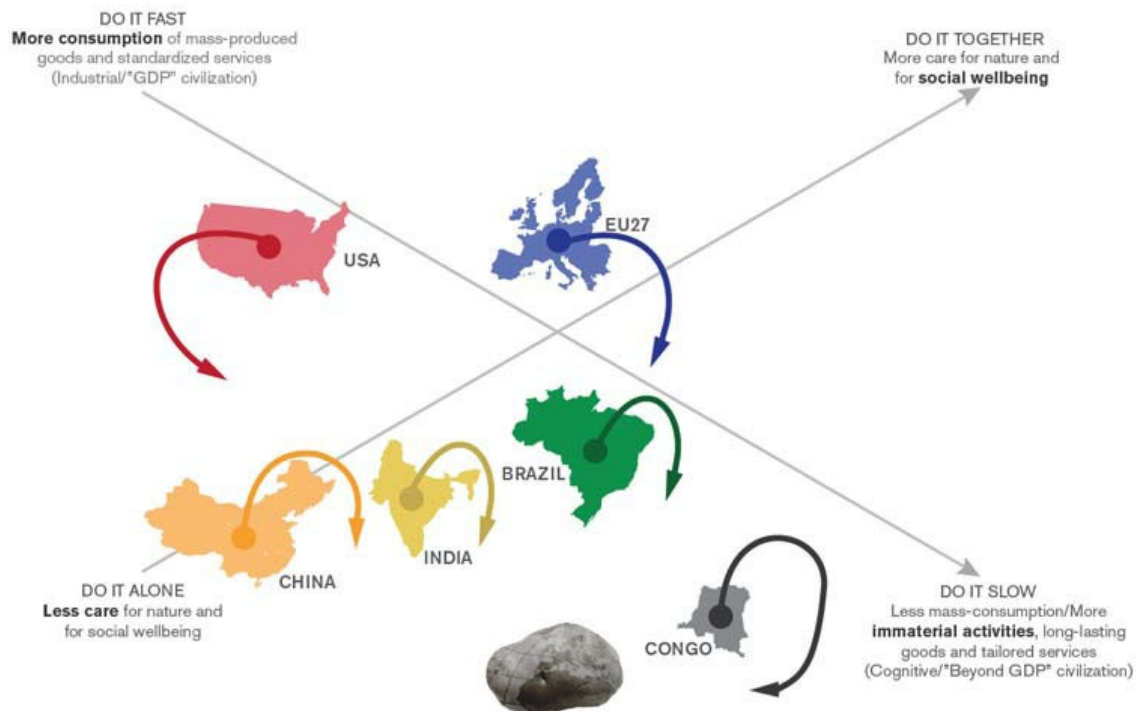
- The scenario implies that regions move towards the Orange region passing through the Pear and the Apple. It seems not possible, according to the scenario, horizontal moves directly to the Orange World. This can be disputed, since different regions may have very different paths. For instance, India could move directly to the Orange less materialistic World. On the other hand, is not obvious that all regions could move simultaneous towards the Orange World: if Europe and USA succeed moving fast towards this vision then the development opportunities of less developed regions can be reduced in the short and medium term.(Andreu Ulled, Mcrit)
- This scenario hard to find in local circumstances and social economic today. (Laura Gutiérrez, Mcrit)
- Not clear why China should follow a development pattern different from Brazil and Africa. If there is an area of the world in which there is high income inequality that is Latin America. (Emanuele Massetti, Feem)
- 'Europe leads the rest of the world towards a more balanced and less materialistic, knowledge-based and decentralized Orange World, ' this is a very western/Eurocentric interpretation of current trends. While the EU and OECD are indeed discussing 'beyond GDP' the values and mechanisms which characterise this scenario are just as evident in movements within the Global South (notably Latin America, India), although admittedly these tend to be grassroots and bottom up. China: can China really survive another 40 years of industrialisation given current 'externalities'. And where will it get resources to pursue this path, if all other 'providers' shift model? The USA does not make it? I can see why you are reticent on this one. But again, grassroots movements in the US have been equally radical. The question will be whether they rise to defeat current power structures more favourable to the pear and apple scenarios. (Olivia Bina, Instituto de Ciências Sociais da Universidade de Lisboa)
- The fact that Africa could undergo faster development by adopting environmental friendly technologies seems a very unlikely course of actions. (Valentina Bosetti, Feem)

- I see this as the most desired vision of the future; reluctant to think it will transpire given the chronic political, tribal and ethnic conflicts hampering equity, and also inducing regional conflict to seize desired goods, services, land or people. unless and until graft and corruption are dealt with in some fashion, little chance actual people of good will and interest will prevail. (Bob Harrison, ER Harrison & Associates, Inc.)
- Again, the regional developments are internally consistent, but are based in unlikely premises. I assume that the figures on regional economic growth are merely exemplificative, as any other impressive jump of developing countries would do. (Andrea Bigano, FEEM)
- Not sure what is meant by GDP in the description, is it the updated indicator or the traditional one? A factor 8,5 in 40 years is a 5,5% growth in per capita productivity, which means Africa starts developing like China and India in a few years... Many institutional barriers to that. (Frédéric Gherzi, SMASH/CIREN)
- In a knowledge-based world economy a decentralized development pattern is possible, but on the other hand geographical clusters could occur, due to a lack of global or regional knowledge spillovers, accumulating wealth where developed knowledge-based industries already exist. .(Roberta Pierfederici, FEEM)
- I can hardly imagine all the world's regions moving toward the Orange world. However, I can easily picture "orange slices" in some wealthy and happy part of the developed world, especially in those countries where the basic needs of food and sanitations are satisfied. (Giovanna Giuffrè, ISIS)
- Is there any valid reason why the old Europe should lead such a process ? If the pre-conditions for the New Welfare scenarios are rooted in high technological developments and anti-materialistic thoughts and paradigms, they could emerge in other OECD societies as well, e.g. the USA. (Riccardo Enei, ISIS)
- If the concept of 'new welfare' come though, it is most likely that it comes from Europe. (Bertrand Chateau, Enerdata)
- Why Brazil should converge in this scenario towards the Orange World paradigm and not China and India? The latter countries were dominated in the past by decentralised modes of production, which are partially still there (village communities in India): why not imagine a reverse in their industrialisation trends from urban concentration towards a new wave of decentralisation facilitated by ICT technologies and by more harmonious development policies of the China and India governments? (Carlo Sessa, ISIS)
- Why Europe is the leader to the orange world? I do not see this happening given the current trend. Why other regions will follow Europe? Right now, it is clear that China, US and India do not follow Europe. Why would they change their mind? Maybe if Europe moves to the orange, other regions and countries will take the chance to move to the pear to get faster and larger growing. I see very difficult to make countries agree about an new GDP measurement, although this is not a reason to give up. I think the transitions between scenarios for different regions will be much more complex, and, I insist, somehow, some regions or countries will fall into the potato world. (Jose L. Oviedo, CSIC)

- Consistent but very short period of time for this degree of transformation. (John Broderick, Manchester Business School)
- Hopefully, this would happen! (Elina Hiltunen, Finpro)
- Note that I picked 'not very likely' as a personal opinion - and not to say that I think the scenario has not improved from its previous version. Because I think it has improved and is more realistic than before. (Sabine Fuss, IIASA)
- I am afraid it is too optimistic for Africa. I hope that the future will prove me wrong. (Alejandro Caparrós, CSIC)
- I cannot see how this world can be consistently described with a social welfare measure such as GDP. Per capita incomes will drop in such a world, being potentially replaced by non-monetary wellbeing. But the numbers given make no sense. The closing of the income gap between rich and poor countries will be made almost impossible if countries move towards self-sufficiency. (Gernot Klepper, Kiel Institute for the World Economy)
- Such a pronounced shift over a relatively short time horizon is very unlikely; some details are not very consistent (Claudia Kettner, Wifo)

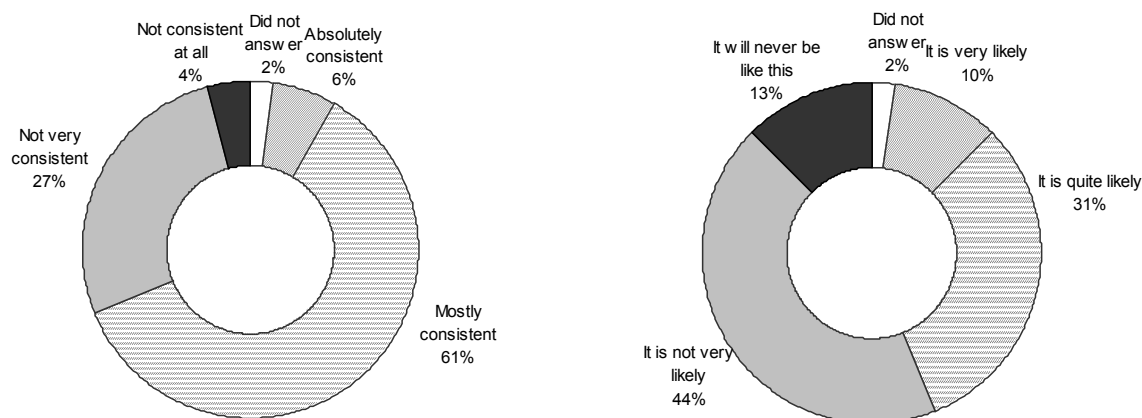
Turbulent decline: the Potato World paradigm

The key question with respect to turbulent decline is whether the growth in material flows could remain within the limits for climate change, natural resources' availability, global ecosystems' health and biodiversity loss, as well as help to alleviate global poverty. The answer would be negative, and the world is set to collapse.



Global stagnation and conflicts in a resource constrained world: An excessive optimism on technologic progress combined with the incapacity of developed societies to move towards less materialistic behaviors, in a context of resource scarcity and environmental serious constrains, leads the world to a general crisis pushing most regions towards the Potato World. World disparities initially decrease (20% until 2030), but recover to today's levels by 2050. In the case of USA and China, it is mostly a technologic failure driving the crisis; in India it's the incapacity to successfully accommodate economic growth in a low organized society; in other regions like Europe reasons maybe more complex and be induced by the failure of the rest of the economies. Political conflicts require higher investments on military, and many wars emerge at different corners of the World. Demographics become uncontrolled in Asia and Africa: by 2050, Asia alone is already as populated as the world is today (6.800 millions). USA's GDP per capita increases 50% by 2030, to go down, back to 2010's levels by 2050.

Results of the survey:

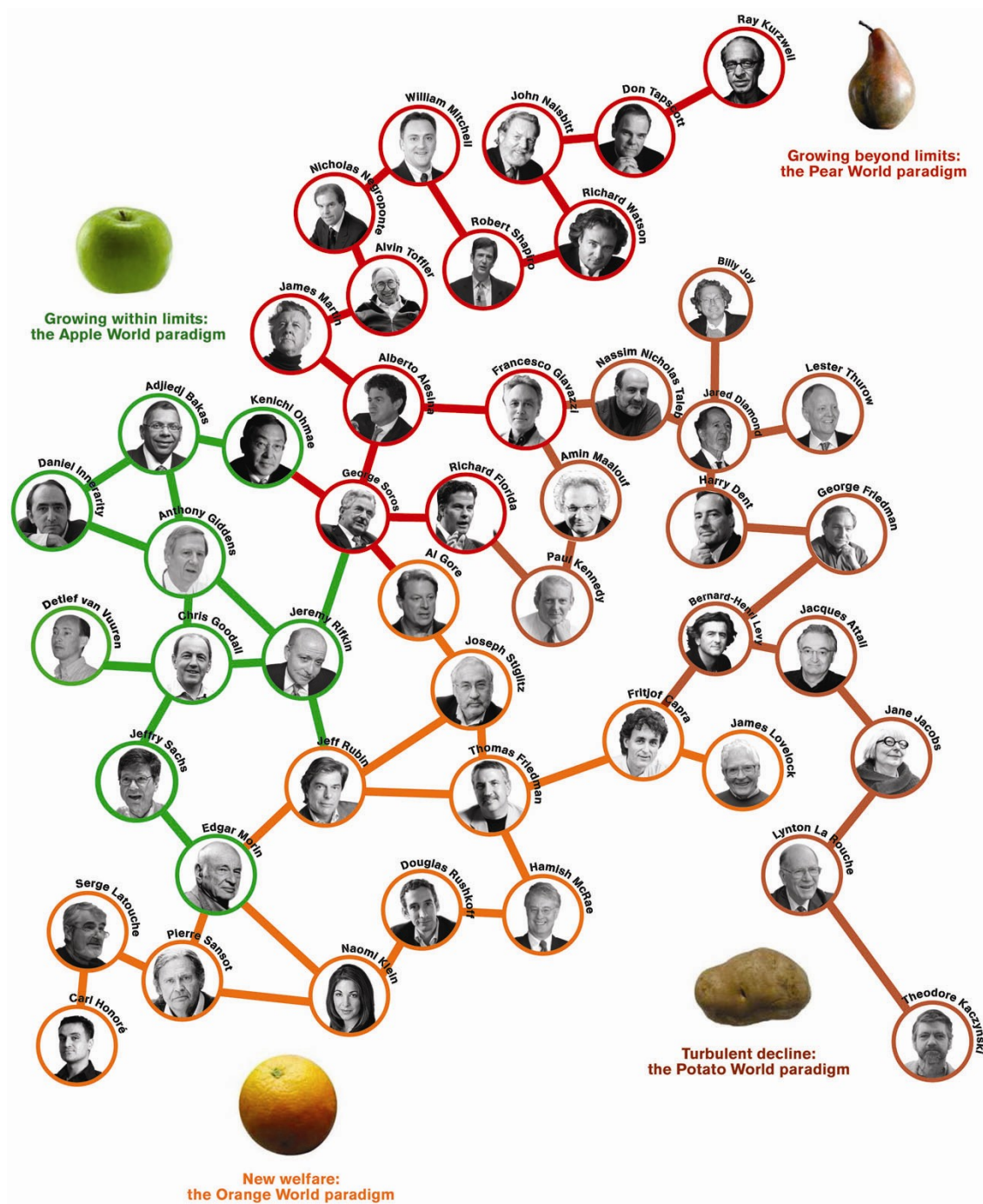


Expert opinions

- All regions have to fall simultaneously into the Potato world? In the rational of the scenario seems likely since resource scarcity or environmental serious constrains exists, but it also can be argued, in a less extreme vision, that if Europe and USA fail and fall into turbulent decline, emerging regions like China or India could keep growing even at a lower speed, while Brazil and Congo may have contradictory evolutions: Brasil could move towards the Pearl World like China or India, while Congo could fail, for instance..(Andreu Ulled, Mcrit)
- I am not sure whether the uncontrolled population growth in Africa and Asia fit in this scenario. (Sonja Peterson, Kiel Institute for the World Economy)
- I think its a very interesting and challenging analysis but I feel that I need more time to digest the ideas and to consider my response to them. (David Somekh, ESQH)
- The particular shape of the arrows in the figure it is not convincing (Europe will first move to the left and then down. (Emanuele Massetti, FEEM)
- Market forces prompt inequity, as those with power and money can secure goods at the expense of others, and also influence political decisions that are adverse to many others. I think we may hit global bottom at some point, retool, and then rebound- the drop and recovery will be messy, though, and will affect all of us dramatically. (Bob Harrison, ER Harrison & Associates, Inc.)
- I am not entirely convinced that, in such a depressing world, were wars and environmental pollution severely limit the hopes for future generations, demographics will be so rampant in Asia and Africa. There might be a lack of commitment to birth control both in terms of policies and in terms of personal attitudes, but bleak perspectives (and perhaps endocrine disrupting pollution) may partially compensate for that. I would trim those population figures a bit. (Andrea Bigano, FEEM)
- Hard to believe that the population in Asia will reach 6.8 billions in 2050. (Fabio Sferra, FEEM)

- For the US, -33% in 20 years means a -2% growth rate, wow. It is a good thing we decided we would not try our hand at modelling the potato world. (Frédéric Gherzi, SMASH/CIRED)
- Demographic transition is the result of past education policies, and will continue during the coming decades whatever the economic crisis. Same comment than for Pear scenario: there will be winners (Pear) and losers (potato) at the same time if the limits issue is not taken seriously and consistently worldwide. (Bertrand Chateau, Enerdata)
- The scenario seems consistent, and perhaps it is likely, but let be a little more optimistic (for this reason I choose 'not very likely'). (Carlo Sessa, ISIS)
- Some regions could face this scenario. However, I do not think that all regions will move to the potato world. (Alvaro Calzadilla, Kiel Institute for the World Economy)
- To some extent overlooks the internal disparities and inequalities within regions. More likely to find common social dislocation and (extreme?) internal stratification with global elite. (John Broderick, Manchester Business School)
- Financial crisis; debts may also play a role (Detlef van Vuuren, Netherlands Environmental Assessment Agency)
- This world completely ignores the balancing mechanism of global markets and a global economy. Such a development could emerge as an extreme event of a more or less complete breakdown of national and international institutions. However, if such an event may happen, there is not way in predicting the emergence of economic trends as described below. The dynamics and the long-term results of collapse are not predictable. Essentially, this world view is one of world war, not necessarily with military weapons, but with other means of warfare, i.e. uncooperative and myopic behaviour of governments. (Gernot Klepper, Kiel Institute for the World Economy)
- Description of technology development not very plausible (Claudia Kettner, WIFO)

5. PASHMINA Qualitative Scenarios



5.1 Overview of the four explorative scenarios

This section of Deliverable 1.1 presents the narratives of four **PASHMINA** explorative scenarios, namely:

- **Growth without Limits**, based on the “pear world” DELPHI scenario (Business As Usual – BAU)
- **Growth within Limits**, based on the “apple world” DELPHI scenario (shift to low carbon economy)
- **Stagnation in a resource constrained world**, based on the “potato world” DELPHI scenario (shift to a resource constrained world)
- **Beyond Growth**, based on the “orange world” DELPHI scenario (shift to a paradigm of prosperity beyond growth)

The four scenarios take therefore into account the scenarios assessed with a number of PASHMINA consortium and external experts, engaged in the DELPHI survey, and discussed at the PASHMINA Barcelona Workshop of 29-20 September 2010.

In addition, key readings (highlighted in the bibliography at the end of the deliverable) have been used to excerpt descriptions and illustrate the features and details of the different scenarios, also with the help of boxes inserted into the main narratives. The latter are presented from the point of view of an “observer” living in the future world, at a time horizon around 2050.

The following two tables present an overview of the four explorative scenarios, showing:

- the fundamental features (“rationales”) that differentiate most the scenarios, i.e. the type of shift, energy transition, climate challenge and “totemic” measurement of progress which characterize each of them. The latter refer to the dominant criteria against which the whole ensemble of societal actors – experts, policy makers, media, business and citizens – are assumed in the different scenarios to compare and measure the progress of society.
- The dominant population, land use, energy, technology, environmental, social and governance drivers featuring each scenario.

The elements mentioned in the tables are extensively described in the scenario narratives presented in the following sections 5.2 to 5.5.

Pathways of transition towards a “beyond growth” society

Regime shifts of the amplitude envisaged in the explorative scenarios, and especially the **paradigm shifts** described in the “beyond growth” scenario, can be driven by collapse or through conscious and integrated changes in worldviews, institutions and technologies. To a certain extent, people can design the future they want by creating a new vision and new goals. If societal goals shift from maximizing growth of the market economy to maximizing sustainable human well being, different institutions will better serve these goals.

It is important to recognize, however, that a transition has to occur in any case and that is almost certainly be driven by global crises, as climate change, declining oil supplies, pollution, biodiversity loss and the loss of life-sustaining ecosystems services. Whether these crises lead to stagnation, decline or collapse (as described in the PASHMINA stagnation scenario or in several others) followed by ultimate rebuilding or to a relatively smooth transition to a sustainable and desirable future (as described in the PASHMINA “growth within limits” scenario or in several others) depends on people’s ability to anticipate the required changes and to develop new cultures and institutions.

The Beyond Growth scenario – the last and more extensively described scenario presented in this deliverable – is the endpoint of this transition.

Table 1 – Key features of the four explorative scenarios

	Shift	Energy Transition	Climate challenge	"Totemic" measure of progress
Growth without limits	None	<i>Enduring fossil fuel and longer-term (beyond 21st century) transition to nuclear civilization:</i> Fossil-fuel civilization continues during the 21 st century, thanks to the discovery and exploitation of new oil and natural gas resources, and clean coal penetration in the power and industry sectors, coupled with staggering improvements in energy efficiency in all sectors. Safer nuclear power plants as small as a few hundred megawatts, together with some larger nuclear plants, will contribute with an increasing share to the world energy mix during the century, together with an increasing share of hydroelectric power generation and other renewable energy (solar, wind). The transition beyond fossil fuels will be moved to the 22 nd century, when energy will be produced from solar, hydro and nuclear sources, the latter thanks to the commercial exploitation of nuclear fusion plants. World energy consumption continues to grow fast.	<i>Reassessment of the climate challenge:</i> Advancements in climate change modeling and research reverse the mostly negative assessment dominant at the beginning of the 21 st century, proving that global warming is independent from anthropogenic sources. CO2 levels in the atmosphere continue to grow, but they follow a logistic curve and stabilize at a level of about 430 ppm. Some climate mitigation and adaptation measures, including Carbon Capture and Storage (CCS) at the larger fossil-fuel powered plants, are enough to control the situation.	Gross Domestic Product (GDP)
Growth within limits	To low carbon economy	<i>De-carbonization of the global economy:</i> The shift away from the most polluting fossil fuels (oil, carbon) is right on the way, with their shares in the world energy mix disappearing towards the end of the 21 st century. Old and new reserves of natural gas (the latter much more diffused thanks to the advancement in extraction technologies) continue to be exploited for macro- and micro-generation, with larger gas powered plants coupled with Carbon Capture and Storage devices to curb their emissions. Nuclear energy plays a minor but still significant role (about 10% of the world energy mix). Hydro and other renewable energy sources are fully exploited - the latter mostly by means of large scale solar plants and off-shore wind farms connected to improved transmission grids – to the extent that they cover about 50% of the world energy supply. Factor 4 to 10 energy efficiency improvements are introduced in all sectors. A successful introduction of hydrogen transport technologies (infrastructure and vehicles) reduces significantly the oil consumption by the road transport sector, and the production of second generation biofuels provided a smaller but still important share of fuels. World energy consumption grows slower, thanks to the spectacular energy efficiency improvements.	<i>The "climate capitalism" response:</i> The whole world economy is directed during the 21 st century to tackle the climate challenge, which confirms itself to produce dramatic changes and to be dependent on anthropogenic causes. The dominant paradigm becomes climate capitalism, a business model which squares capitalism's need for continual economic growth with substantial shifts away from carbon-based industrial development. Thanks to the spreading of regulated and voluntary carbon markets, strong international climate agreements and other measures universally implemented at regional, national and local level across the world, climate capitalism successfully produce a relatively rapid de-carbonization of the global economy. This is already visible at the 2030 horizon, when the level of GHG in the atmosphere start to decrease towards the "virtuous" target of 350 ppm, which is achieved before the end of the 21 st century.	GDP and GHG emissions

	Shift	Energy Transition	Climate challenge	"Totemic" measure of progress
Stagnation	To a resource constrained world	<i>Energy transition's failure:</i> The energy transition fails. During all the 21 st century the world is still heavily dependent on fossil-fuels, with an increasing share of coal and heavy carbon and other natural resource reduction constraints which greatly limit the freedom to produce and consume. High carbon prices, rather than creating a wave of investment in renewable energy, help to boost the renaissance of nuclear energy as the solution to climate change in a carbon-constrained world. Alongside nuclear, most investment goes into Carbon Capture and Storage.	<i>Climate change constraining growth and affluence:</i> As climate change itself progresses during the 21 st century, periodic crises from hurricanes, sea-level rise, droughts and the large-scale movements of climate refugees serve to keep climate change on the agenda. Some efforts are made to mitigate carbon emissions, but there is nothing like the coherence, in the way these efforts combine, necessary to turn them into something which could create the transformational effect to decarbonize the global economy. Carbon markets do, however, ultimately deliver real reductions in the overall GHG emissions.	GDP and external costs
Beyond Growth	To prosperity beyond growth	<i>Transition to solar civilization:</i> A full shift from fossil-fuel to solar-based civilization is achieved during the 21 st century, thanks to radical changes in energy technologies and infrastructures, in global production and consumption patterns, and in the way increasingly cosmopolitan citizens contribute to change their values, lifestyles and the institutions that govern their life towards sustainability. The contribution of nuclear power to the world energy mix remains marginal, also because the prospects to shift to nuclear fusion proves to be illusory. The combined impulse of technological and lifestyle changes allow to shift to a lower energy density society, fully exploiting small scale renewable energy plants connected by means of smart grids to number of energy efficient appliances, products and solutions (e.g. passive housing), that are able to satisfy an however reduced consumption and travel demand. Consumption and travel needs are reduced due to a pervasive change of lifestyle, supported by radical changes of urban infrastructure, working life and goods and services delivery schemes. Large scale solar, wind and hydro-power plants, as well as gas powered plants which are needed to complement the intermittent renewable energy sources, are still present and important, but they play a smaller role than in the low carbon economy (growth within limits) scenario, due to the dominant role of small scale energy production and of more self-reliant consumption units. World energy consumption decline, due to the diffusion of more energy efficient technologies and solutions, and the less energy-intensive consumption lifestyle of the more affluent populations (towards the end of the 21 st century "affluence" is measured differently – in terms of capabilities and freedom to access to well being needs – and more evenly distributed in the different regions of the world).	<i>A mix of regulatory, technological and cultural change response:</i> The greenhouse gas emissions declines more sharply than in any other scenario, as a result of the global reduction of energy consumption and the increasing share of renewable energy in the world energy mix. The climate challenge is therefore tackled strongly, both on the supply and demand sides, thanks to a mix of stronger international regulation and investment flows (the latter targeted to climate mitigation and adaptation actions in the context of a fully fledged "Climate Marshall Plan"), boosting of solar and energy efficiency technologies, radical change of infrastructures and urban and rural lifestyles, and the transformation of cultures from consumerism to sustainability across the world.	Well being and sustainability indicator(s)

Table 2 – Blueprint of the four explorative scenarios

<i>Growth without limits</i>	<i>Growth within limits</i>	<i>Stagnation</i>
<ul style="list-style-type: none"> ▪ New reserves of fossil fuels (oil and gas) ▪ Strengthening of the economic globalization ▪ New technological wave in the form of ICT, nano-technologies and biotechnologies ▪ Neo-liberal policy milieu, increased corporate power and privatization of commons ▪ From democracy to “lobbycracy” ▪ Lifestyles continue to be shaped by hyper-consumerism ▪ Multilateral agreements on the post-Kyoto climate regime are not found: climate anarchy ▪ Increased energy consumption, especially in the emergent economies ▪ Increased share of renewable energy in the 2050 world mix (35%) ▪ Increased share of nuclear energy too (about 15%) ▪ Continued exploitation of fossil fuels (50% of the 2050 mix), complemented by Carbon Capture and Storage to reduce the CO2 emissions ▪ Increased inequality, between and within nation states ▪ Technological fix: technology alone is assumed to save us from the most severe climate change impacts and disruptions of ecosystems services ▪ Continued urban sprawl and car-dependent commuter travel ▪ Increased urban land consumption ▪ A landscape of large shopping malls and low density suburban and per-urban developments ▪ Diffusion of increasingly fuel efficient vehicles; hybrid vehicles ▪ Energy efficiency gains in the housing sector are offset by the increase of average flow per capita and the number of single households ▪ Increased CO2 emissions and global warming change above 2° C. ▪ Increasing international food trade and demand met by continued “green revolution” successes ▪ Increasing agriculture yields due to the introduction of new, scientific research based (including GM) crop varieties ▪ Increasing environmental and social costs of large-scale “agribusiness” ▪ Local food security is not achieved in several developing countries 	<ul style="list-style-type: none"> ▪ Global “climate capitalism” business model ▪ Carbon taxation ▪ Global and regional Emission Trading schemes ▪ New and expanded Clean Development Mechanisms ▪ Private companies approaching climate change as a “Corporate Social Responsibility” issue ▪ Carbon Disclosure Projects and global investors’ funding directed to climate friendly companies ▪ Voluntary carbon offset markets ▪ Personal Carbon Allowances (PCA) ▪ “Carbon leakage” and “carbon colonialism” is avoided with appropriate incentives for “win-win” North-South projects ▪ World Bank decarbonizes its lending program ▪ Networks of transit oriented cities: main urban cores and satellite towns connected by fast and regional trains (TODs) contribute to reduce individual car journeys ▪ Energy efficient housing: retrofitting of old buildings and new passive houses ▪ Energy efficient industry ▪ Breakthrough improvement of the electricity sector: smart grids and super-grids ▪ Investment in High Speed trains and urban transport infrastructure ▪ Improvement of vehicles’ efficiency ▪ Diffusion of fuel cells technology, hybrid vehicles and vehicles fuelled by bio-methane and hydrogen ▪ Limited diffusion of electric cars (niche markets) ▪ ITS applications for smart travel ▪ Eco-labeling, eco-design and sustainable criteria in the production processes ▪ Unemployment and wealth distribution is poorly improved ▪ 50% of the world energy mix is based on renewable forms of energy by 2050 ▪ Around 10% of the energy mix is based on nuclear energy ▪ The remaining 40% is based still on fossil fuels (mainly natural gas), but CO2 emissions are curbed introducing Carbon Capture and Storage (CCS) techniques ▪ Better integration of WTO agreements and Multilateral Environmental Agreements (MEAs) ▪ Sustainable management of forest, agricultural land and waters through the exchange of good practices and funding of green projects ▪ Transformation of EU and U.S. subsidies to agriculture into “green box” subsidies directed to organic farming and nature conservation ▪ Increased agriculture yields, due to the diffusion of improved land use practices ▪ Reduction of post-harvest losses and meat consumption in the more affluent countries ▪ Effective implementation of Biological Diversity conventions 	<ul style="list-style-type: none"> ▪ Delayed response to climate change and global environmental resource constraints ▪ Kyoto regime is not immediately followed by any other international carbon regulation regime ▪ Investments in carbon markets and targets are dismissed ▪ Pressures to prioritize support to “old manufacturing” (e.g. car companies) are dominant ▪ Recurrent climate impacts of ever greater magnitude start eventually to provoke urgent measures ▪ Rising carbon prices ▪ Large biofuels plantations ▪ Destruction of biodiversity, increased diffusion of GM crops ▪ Renaissance of nuclear energy ▪ More investment in Carbon Capture and Storage ▪ Increasing carbon colonialism shape the North-South relationships ▪ Personal Carbon Allowances (PCA) schemes proliferate everywhere ▪ Environmental NGOs are largely co-opted into a world ruled by global finance ▪ Increased poverty and climate induced migrations

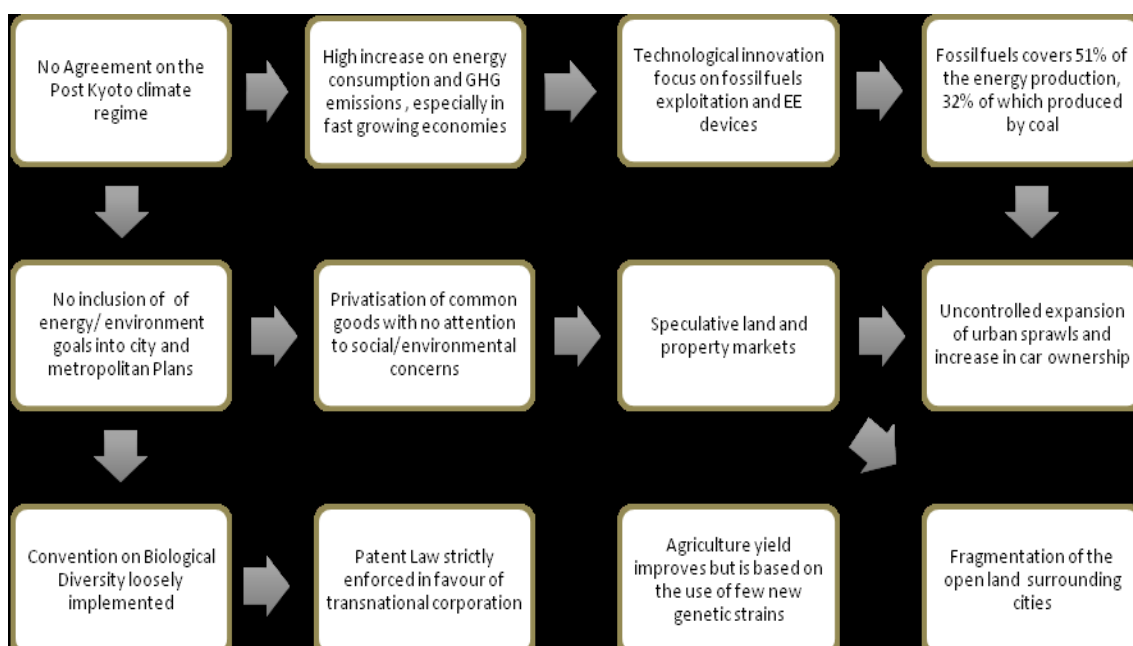
Beyond Growth	
<ul style="list-style-type: none"> ▪ From “empty” to “full world” perception ▪ Redefine well being and sustainability metrics ▪ Smart security policy (to ensure the well being of populations during the transition) ▪ New paradigm of “nature” technology (the “blue economy” business model) ▪ Expand the “commons” sector and commons-based peer production ▪ Common asset trusts: e.g. Earth Atmospheric Trust ▪ Climate Marshall Plan (as an evolution of the Clean Development Mechanism) ▪ Internet and the networked information economy ▪ Networked public sphere ▪ Steady-state economy ▪ Stocks of longer-lasting goods better than flows of short-lived goods ▪ Recycling goods and sharing services (e.g. car sharing) ▪ Reducing work time ▪ “Low GDP” man lifestyle and its reduced environmental impacts ▪ Shifting from profit-making to social entrepreneurship and innovation ▪ “Democratization of Wealth”: employee ownership and participation ▪ A growing “free/open source” sector as a new core engine of the economy (instead of proprietary technology) ▪ Economic localization ▪ Re-localizing business ▪ Localizing money and finance ▪ Controlling the Transnational Corporations (TNCs) ▪ Taxes for localization/Ecological Tax Reform ▪ Rewriting the World Trade rules: towards a new General Agreement of Sustainable Trade (GAST) ▪ A new politics to deliver the transition to a “beyond growth” society ▪ Deliberative democracy and self-government ▪ Global and local democracy; the emerging “glocalization” 	<ul style="list-style-type: none"> ▪ “Earth Jurisprudence”: towards a world constitutional chart for human and nature’s rights ▪ Geo-political dimension: A new “a-polar” and globally interdependent world ▪ A “rawlsian society”: the property-owning democracy as the ideal model to deliver a new welfare and social justice ▪ Introduction of citizen/basic income coupled with active participation and civic duties ▪ Polycentric networks of compact and resilient cities ▪ TravelSmart and LivingSmart campaigns ▪ Mixed-land use and “slow” towns ▪ Reduced short and long-distance travel need ▪ More collective, less individual (car dependent) transport ▪ Reduction of global energy consumption ▪ More renewable energy produced mostly by small-scale plants ▪ Smart grids ▪ “Negawatt” culture and lifestyle ▪ Second generation biofuels ▪ Better prospects for electro-mobility (niche markets for electric city cars) ▪ Local food production as a global solution/food sovereignty ▪ Foodshed-specific quotas and guaranteed farm-gate prices ▪ More local (and organic) farming ▪ More farmers’ markets ▪ Urban food gardens ▪ Residual global food trade according to the Fair Trade Miles approach ▪ Local food security is achieved everywhere

5.2 Growth without limits: global convergence towards an increasingly unequal world

The scenario features a further strengthening of **economic globalization**, with the ever-increasing integration of national economies into a giant one-size-fits all global economy through trade and investment rules and privatization, aided by a new technological wave in the form of ICT, nano-technologies and biotechnologies, and driven by corporate power. This scenario assumes therefore a continuing increase in market-delivered goods and services, basically driven by the same entrepreneurial and market dynamics which the world has experienced over the previous decades, and with the rapid growth in some major world regions, notably China. The current sharp deterioration of global economic activity due to the worldwide crisis, affecting in particular the developed world, can be factored in the scenario assuming a downward revision of GDP over a number of years at the beginning of the projections, followed however, after the downturn, by a global GDP figures recover, due to a new wave of growth which continues virtually unchanged over the remainder period up to 2050.

In the “growth without limits” scenario, economic prosperity is based on the assumption that the necessary knowledge and technology solutions to address environmental challenges and energy crisis emerge as needed, and are primarily the results of private efforts and commercial investments. This allows to overcome the energy shortage and environmental constraints, and to continue the global world growth beyond those that nowadays are perceived energy and environmental limits. A scheme of the assumption of drivers’ interaction underpinning the scenario is presented below:

Table 3 - The scheme of drivers interaction in the ‘Growth without limits’ scenario



In a nutshell, the lack of an international “post-Kyoto” agreement is assumed to enable a continued growth in energy consumption and GHG emission, partially offset by technological innovation that remains focused upon fossil fuels exploitation (mainly coal and gas with carbon capture technology) and energy efficiency. In the urban environment, privatization of common goods is assumed to continue, in a context of loose urban planning and uncontrolled urban sprawl boosted by speculative land and property markets. The convention on biological diversity is loosely implemented, patent protection regimes – virtually providing US and European transnational corporations with WTO-enforceable global patent rights – are enforced and the common rights of indigenous communities to genetic and biological resources are ignored. This affects global agriculture development, with an increase of agriculture yields based on the use of few new genetic strains. Rural land around cities is also increasingly fragmented due to the impact of urban sprawl.

Based on these main assumptions, the “growth without limits” scenario is described below giving first a snapshot of its economic, environmental and social features, and then deepening the aspects related to the land use-transport-energy nexus in the following sections.

Economy

After an initial period of crisis, many countries in the ‘growth without limits’ picture enjoy economic prosperity: the yearly **rate of GDP growth** ranges between 2% and 7% depending on the level of their economic maturity, resulting in global growth rates for the world between 4,2% and 3,7% along the whole period. In the fast developing countries growing urbanization contributes to create urban mega regions, with significant new market and job opportunities, affordable industrialized food and basic services (hospital, education) attracting important shares of previously rural populations. Conversely, countries that fall outside the international trade flows for political or economic reasons show very unstable patterns of growth, with low average rates over time and with high risks of regional conflicts and social unrest.

Consumption in 2050 is four times that of 2010. Such increase is driven by population and economic growth, widespread neo-liberal policies which continue to foster market liberalization and privatization of common goods across the world, with minimal international regulation, and finally by a lifestyle that continues to be shaped by hyper-consumerism. Concerning **food production**, the rapid rate of technological development and investment in agricultural research leads to substantial yield increases, rendering large expansion in new crop areas unnecessary. This result is however achieved by highly reducing the quality and the biodiversity of production that is mainly managed by transnational corporations.

Environmental impacts

The key environmental issue is to what extent the growth in material flows needed to support the increased production of goods and services for the market overtakes natural limits thus provoking dramatic climate change events, reducing natural resources’ availability and causing large migrants’ flows.

In this scenario the current WTO rules remain substantially unchanged, with the prevalence of provisions strengthening further liberalization of world trade and corporate powers, and technology alone is assumed to save us from the more severe climate change impacts and the breakdowns of regional ecosystem services. It is assumed indeed that a new and partially unexpected wave of inventions promoted by the liberal market dynamics prevent the world to slide on a decline path, even without green policies or changes of consumption’s behaviors.

Social impacts

The 'growth without limits scenario' was associated in the DELPHI survey to a "pear", which with its irregular shape evokes disequilibrium in different parts of the world, both economically and socially. Some countries, regions, even neighborhoods keep progressing economically while others have substantial difficulties to develop. As a result, income distribution within words regions as well as within the same regions and cities is very unequal, leading to an increase in disparities among those who have/have not.



The lack of inclusive policies increases spatial disparities in wealth, opportunities and quality of life across various parts of the cities, regions, countries and exacerbates divisive factors like fear, anxiety and insecurity. The consequences are different in developed and developing countries. In developed countries, car-dependant lifestyles are associated with the worsening of air quality and with the development of health problems such as obesity, respiratory disorders, aggravated asthma symptoms. In developing countries, it leads to a growing number of slums dwellers with poor access to local water, sanitation and exposed to an increasing risk of infectious diseases.

However, at the same time, global information networks and increased mobility of people (migrations, global business, leisure travel) increase the trend towards the adoption of modern lifestyles and cultural uniformity across world societies, and this is evoked by the soft and smooth pear peel. A hyper-consumption attitude spreads across the world's regions, globalization brings cultural uniformity and markets tend to deliver standardized products. People all over the world are connected though trade and communication flows. Electronic communication allows ideas, information but also misinformation to be rapidly propagated and shared. In most countries, minorities helplessly see their identities diluted, while global homogeneous values spread around. In least developed countries, the lack of essential services coupled with the impacts of resource intensive development on ecosystems create social unrest and open the door to the escalation of violence.

The main references used to elaborate the "growth without limits" scenario narrative are listed in the footnote.¹⁸ The following tables show the key scenario's features at a glance, by giving:

- The values of key variables in 2010, the projection of current trends at the 2050 horizon (trendline), and the values considered for the "growth without limits" scenario in the WP1 meta-model analysis (Table 4);
- The assumptions of drivers evolution considered in the Delphy Survey (Table 5)

¹⁸ Main references for this Scenario: UN - Habitat 'State of the World Cities 2010/2011 Bridging the urban divide', 2008; UN World ; 'Urban Population Prospects 2009 Revision: Highlights', 2009; Natural England 'Global Drivers to 2060', 2009; Energy Research Centre of the Netherlands 'The next 50 years: four European energy scenarios', 2005; EEA Report 'Urban Sprawl in Europe – The ignored challenge' EEA Report10/2006 Copenhagen, 2006; EC Project 'PACT- Pathways for Carbon Transitions <http://www.pact-carbon-transition.org/>; IEA 'Energy Technology Perspectives, Scenarios & Strategies to 2050', 2008.

Table 4 The vital signs for the 'Growth without limits Scenario'

VITAL SIGNS		2010	Trendline (2050)	Growth beyond limits
Population	(million inhabitants)	6910	9214	9581
Settlements: Urban society	(% of people living in cities)	50%	69%	70%
Rural land overexploitation	Arable (% over total land)	12%	12%	14%
	Meadows (% over total land)	26%	26%	27%
	Forests (% over total land)	31%	30%	28%
	Biofuels (% over total land)	0%	4%	7%
	Other (% over total land)	31%	28%	24%
Technology	(% of R&D investment over GDP)	1,9%	2,0%	3,5%
GDP	(2010 = 100)	100	311	475
Wealth disparities	(GDP/capita dispersion relative to mean)	2,3	1,7	1,4
Energy consumption	(MTOE, 2010 = 100)	100	238	407
Transport		100	With economy	More than economy
Climate change	(Mtones CO ₂ , 2010=100)	100	213	186
Biodiversity	(% yearly change in the number of species)	-0,07%	-0,08%	-0,17%
Governance	(forms of government)	93 democracies, 50 anocracies, 20 autocracies	130 democracies	103 liberal democracies

Table 5 The scheme of drivers evolution in the 'Growth without limits Scenario'

	Trend 2010-2050	Scenario snapshot 2050	Rate of change
Population	↑↑	9300 millions in 2050	Population yearly growth rates from 1'3% in 2010 to 1% in 2030 and 0'5% in 2050
Settlements: Urban society	↑	From 50% urban population in 2010 to 65% in 2050.	65 million urban residents more per year between 2010 and 2050.
Rural land overexploitation	↑	Land for bioenergy production 900 mil.ha in 2050. (7% global land)	2% increase in agricultural land, 1% increase in meadows and 3% decrease in forests
Technology	↑↑↑↑	-Gene therapy-Brain download-Bioengineered animals-Customized food - Fusion power-Robot assisted world	from 2% to 5% GDP devoted to R&D investment in growing beyond limits countries
GDP	↑↑	- Global GDP in 2050 is fivefold 2010's.- Chinese GDP per capita converges with Europe's at \$60.000	3% GDP yearly growth rate for developed regions, 6% for developing.
Energy consumption	↑↑	Energy yearly consumption in 2050 is four times fold 2010's.	Energy intensity yearly decrease (Δenergy/GDP) from -0'8% in 2010 to -1'5% in 2030 and -2'5% in 2050
Transport	↑↑	Transport increases sharply due to high increase in GDP and clean vehicles.	Transport grows over the economy.
Climate change	↓	World GHG emissions in 2050 are 25% lower than in 2010	Emission factors yearly decrease (Δemission/energy) from -0'3% yearly to -2% in 2030 and -6% in 2050.
Biodiversity	↔	Artificially induced biodiversity growth	30.000 species are recovered or engineered per year
Governance	↓	Mixture of corporate driven liberal democracies and totalitarian regimes	10 new lobbyocracies per year until 2050 (50% from previous democratic regimes)

5.2.1 Changes in urban land use and transport: continued urban sprawl

Between 2010-2040, world population growth is concentrated in urban areas, in stark contrast with the pattern that prevailed between 1950 and 1975, a period characterized by a much more balanced split between urban and rural areas¹⁹. The spatial planning policies are heavily influenced by commercial interests of transnational corporations, and they are mostly aimed to support the increasing global competition among world's cities. Increasingly weak international, national and regional policies fail to offer coordination and guidance to cities and mega cities whose economic powers override their political competences.

Urban sprawl emerges as common feature of spatial development, driven by the rise of urban population (65% of urban resident in 2050), the loosening of land regulations with a lack of control over peri-urban areas increasingly left to speculative land development, the expansion of infrastructure, technologies and services, as well as greater population mobility (UN HABITAT State of the World's Cities 2010/2011). By relying more and more on importing goods, urban consumers are – often unconsciously but not less effectively – overexploiting natural resources and ecosystem services in other parts of the world. Urban over-consumption produces pollutants whose impacts are themselves spread out to increasingly large areas. The degradation of local ecosystem services affects especially those who can't afford to purchase alternatives, thus leading to increasing problems of environmental justice.

The urbanization process is then characterized by the rise of massive scale settlements in the form of mega-urban regions, whereas isolated cities and rural areas register a steady decline. Urban sprawl creates urban regions formed by concentric low-density suburban rings around a monocentric city core, with workplaces and consumption opportunities concentrated in the central area or in suburban centers (e.g. office districts near international airports, shopping malls in the periphery, etc.), while the population inhabits rings of decreasing density. This form generates high volumes of car-dependent traffic, whereas alternative forms of public transport are difficult to provide at such low density levels. The concentration of workplaces and consumption opportunities in the city centre or in suburban centers causes congestion during daily or weekly rush hours.

SEED OF CHANGE Bursa Istanbul Example

'In Istanbul Province, urban sprawling was driven by the growth of population, the decentralization of the large and polluted industries from the city towards to the peripherals, the increase on the land prices in the centre, the creation of the new motorway. While the settlement areas were 11% in 1990 this figure reached to 16% in 2005 and the agricultural areas decreased to 23% from 27% within the same period (Geymen and Baz, 2007). The sprawling has entailed an array of social economic and environmental problems such as: an increase of urban pressure on the natural sources in the north, occupation of the public land around the basins, insufficient land use, traffic jams, increase on transportation and public service costs, apparent social and location separation'.

The Urban Sprawl Model for an Affected Metropolis: Bursa Istanbul Example Eryilmaz, S.S., Cengiz, H., Eryilmaz, Y., 44th ISoCaRP Congress 2008

In developed countries, the trend towards urban sprawl that emerged in late 1950 and accelerated by the end of 1990s, continues to be associated to economic growth and the development of urban land²⁰.

¹⁹ More specifically, by 2050 urban dwellers are likely to account for 86% of the population in the more developed regions and 67% in the less developed regions ref.UN -Habitat 'State of the World Cities 2010/2011 Bridging the urban divide', 2008.

²⁰ During those years, European cities have expanded on average by 78% whereas the population has grown by 33% and during those years the rapidly increase of urban areas and infrastructures consumed more than 8000 km², about the size of Luxemburg. Ref.EEA Report 'Urban Sprawl in Europe – The ignored challenge' EEA Report10/2006 Copenhagen, 2006.

SEED OF CHANGE

China's National Highway 110: sprawling blockage that stretched for 100 kilometres

'The mess began August 13th when road works cut capacity on the main artery for coal and other freight traffic from north-western China into the capital. Within a day, the traffic volume had become unmanageable. At its peak the snarl stretched for about 100 kilometres, authorities said. When they were not standing still, drivers could advance at what literally approximated a snail's pace: ranging from one half kilometre to two kilometres per day. Adding to stranded motorists' frustration was the price-gouging undertaken by local merchants and the impromptu salesmen who set up shop nearby. They were quick to take advantage of the captive market'.

The Economist – Asian View

<http://www.economist.com/blogs/asiaview/2010/08/great-chinese-traffic-jam>

In the least developed countries, urban sprawl is driven by intense internal migrations from poor rural areas to growing and increasingly unequal urban settlement and it creates a divided urban environment featured by: 1) informal and illegal patterns of diffuse peri-urbanization, combined with lack of infrastructure, public facilities and basic services; 2) new towns for high to middle-income groups, with highly valued commercial and retail complexes accessible only by individual transport.

The uncontrolled city expansion coupled with growing transport demand accelerates energy and land consumption, which in turn leads to rising greenhouse gas emissions, air and noise pollution. Transport remains mainly based on fossil fuels. Energy efficiency gains in this sector are achieved thanks to the increasing use of Information

Technology Systems (ITS) and highly improved fuel performances, the latter achieved with the use of turbochargers, fuel injection and electronic methods of engine control.

The use of hybrid vehicles and advanced improved diesel engines and vehicles is now diffuse. They are made lighter and more efficient thanks to new materials and more compact engines.²¹ However, technological improvements in the transport sector is offset by the growth in the volume of road transport, as an unintended effect of the increased efficiency, easiness and comfort of travelling by car (rebound effect).

5.2.2 Changes in energy and climate: continued fossil fuels exploitation

The world energy mix continues to be dominated by **fossil fuels**. Energy production is still mostly based on fossil fuel technologies (coal, oil and gas), complemented by **Carbon Capture and Storage (CCS)** technologies that help to abate greenhouse gas emissions. These technologies are expensive, and thus contribute to raise fossil fuel prices compared to the 2010 prices, maintaining them relatively high throughout the period to 2050. This in turn helps to develop a minor but increasingly significant share of **renewable energy technologies** (from 9% in 2010 to 34,6% in 2050). **Nuclear energy** increases its weight (from 5,7% in 2010 to 14,3% in 2050).

The scenario considers five reasons that make the transition from fossil to non-fossil supply much more difficult than is commonly realized: scale of the shift required; lower energy density of replacement fuels; substantially lower density of renewable energy extraction; intermittence of renewable flows; and uneven distribution of renewable energy resources. These are all reasons that contribute in this scenario to lock the global energy system still into the continued exploitation of fossil fuels as the core energy source up to 2050, with a partial substitution of natural gas and clean coal for the declining share of oil, and an increasing but not transformational role of renewable energy. Concerning the latter, the scenario repudiates another myth concerning renewable conversions, i.e.

²¹ IEA 'Energy Technology Perspectives, Scenarios & Strategies to 2050', 2008

the expectation of a near-automatic decline in their cost with increasing volume. This trend is common for most techniques undergoing commercialization, but not inevitable: if it were, we would already have had inexpensive electric cars for decades.²² The costs of many renewable techniques have actually been increasing.

Nuclear electricity generation plays also a key role in this scenario, and it complements well other renewable sources in the transition to a non fossil fuel world.²³ The latter is half-way in 2050, but could be fully achieved at a more distant horizon (e.g. 2100), when also nuclear fusion prospects become more realistic. Overall, energy systems remain centralized, based on large power generation structures and on a growing share of nuclear power.

The following tables show respectively the world energy mix and the evolution of energy intensity in different regions of the world assumed for the “growth without limits” scenario, compared with business as usual projections:

Table 6: Growth without limits - the World Energy Mix

World Energy Mix	Trend line			Growth beyond limits	
	2010	2030	2050	2030	2050
% of fossil	85,3%	72,0%	60,9%	68,8%	51,0%
% of oil	34,4%	24,6%	17,7%	21,9%	10,1%
% of coal	27,7%	29,2%	28,3%	31,8%	32,6%
% of natural gas	23,3%	18,1%	15,0%	15,1%	8,3%
% of nuclear	5,7%	7,1%	9,0%	8,9%	14,3%
% of renewables & biomass	9,0%	20,9%	30,0%	22,2%	34,6%

Table 7 : Growth without limits - Energy Intensity

Energy Intensity (Mton/M\$) in constant 2005\$	Trend line			Growth beyond limits	
	2010	2030	2050	2030	2050
EU27	0,13	0,11	0,09	0,12	0,11
Russia	0,55	0,45	0,35	0,43	0,31
Africa	0,30	0,28	0,25	0,30	0,29
Asia	0,27	0,24	0,21	0,24	0,21
Latin America & Caribbean	0,28	0,23	0,20	0,24	0,21
Northern America	0,18	0,14	0,11	0,15	0,14
Oceania	0,52	0,35	0,20	0,36	0,22
World	0,22	0,19	0,17	0,20	0,19

²² R. Prud'homme 'Electric Vehicles: a tentative economic and environmental evaluation', 2010

²³ This conclusion is based on the high capacities of nuclear power plants and on the high load factor of fission-powered generation. The largest nuclear plants surpass 5 GW, the largest turbogenerators are about 1,5 GW, yet new reactor designs would make units as small as a few hundred megawatts commercially profitable. By contrast, typical large wind turbines rate below 5 MW, and by 2005 the largest PV assemblies were on the order of 4-6 MW of peak power. Well-run nuclear power plants can operate 95% of the time, compared to typical rates of 65%-75% for coal-fired stations, 40% - 60% for hydrogenation, and 25% for wind turbines. A reliable, predictable, high-capacity, high-load mode of electricity generation would be a perfect complement to various renewable conversions that share the attributes of low-capacity, moderate-load, and often unpredictable intermittent operation.

SEED OF CHANGE DEEPWATER HORIZONT OIL SPILL

'A huge explosion on BP's Deepwater Horizon oil rig in the Gulf of Mexico killed 11 people on the night of 20 April 2010. Rescue efforts initially focused on saving the surviving 115 workers from the burning platform, about 50 miles from the coast. As the platform, collapsed into the sea, the environmental cost started to become clear as with reports of vast amounts of crude oil gushing from the broken well head.(..) BP has claimed repeatedly there is no way of measuring the scale of the leak and an early estimate of 5,000 barrels a day turned out to be way too low. Scientists subsequently estimated the leak at up to 40,000 barrels of a day partly based on live webcast of the oil head, released reluctantly by BP after pressure from US politicians such as Republican Senator Ed Markey. But experts later revised this estimate upwards up to 70,000 barrels of oil a day. Estimates of the volume of oil already discharged vary between 73m and 126 million gallons, making the Deepwater Horizon oil spill already the largest in US waters..(..)'

<http://www.guardian.co.uk/environment/2010/jul/01/bp-deepwater-horizon-oil-spill>

Concerning **energy production**, the challenge is the replacement of oil whose global production started to fall steadily from 2015, as new projects failed to replace depleted fields, creating an energy shortfall. This has encouraged the offshore drilling and the exploitation of unconventional fossil fuels with consequent high risk of environmental accidents. The main evolution that can be seen in Europe is a gradual penetration of coal in the power and industrial sectors, primarily in the form of syngas. In non-OECD countries, coal provides a local source of employment and government policies in several of the

largest economies encourage this widely available, low-cost energy option. The share of energy produced by unconventional gas and nuclear power is also substantially increased, and it contributes to reduce energy's shock consequences. The proliferation of nuclear powers creates however tensions and dividing lines between countries.

The following figure shows instead the evolution assumed for the total **primary energy consumption** in different regions of the world until 2050:

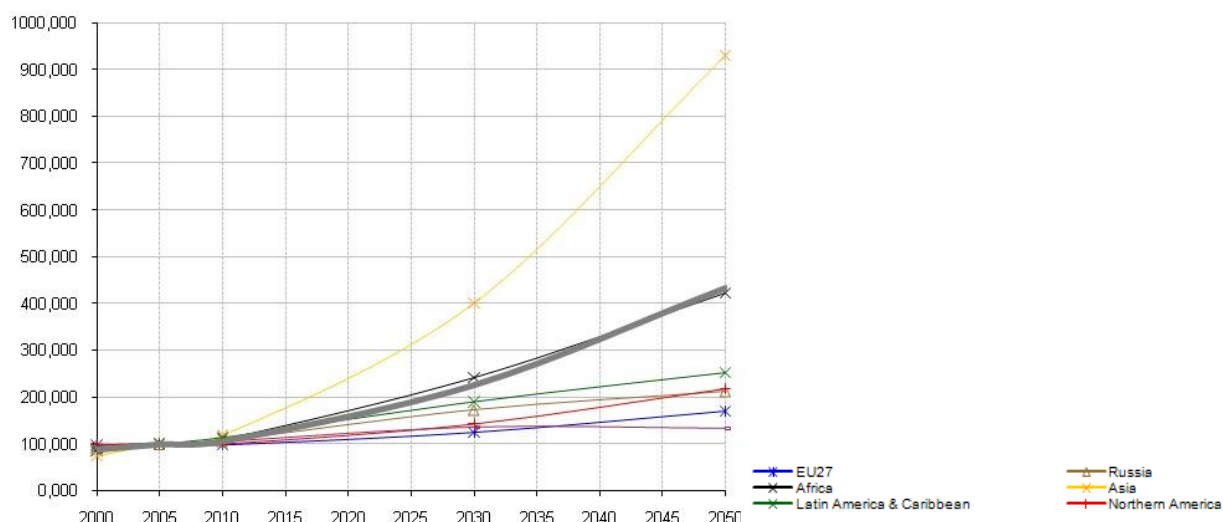


Figure 1: Growing without limits- Primary Energy Consumption (2005=100)

Concerning energy consumption in the **housing sector**, technology innovations and energy efficiency measures are offset by the increase of average floor per capita and the number of single households. Rising temperatures due to severe climate change affect investments in the built environment later in the decade. In OECD countries, the balance between cooling and heating demand is fundamentally altered, ultimately leading to full electrification of residential and services buildings where a dual distribution network for gas and electricity in many parts of Europe is no longer economically

justified.²⁴ The use of electric appliance rises in developed and developing countries alike, but no agreement is signed on their efficiency standards and the pressure to save energy is not supported by political or economic forces. The social and economic divisions are highlighted by the fact that by 2030 1.3 billion people still lack access to electricity in 2030 compared with 1.5 billion of 2009.²⁵

Concerning energy consumption in the **transport sector**, the improved transportation links and the enhanced mobility boosted by the urban sprawl trends (see section 5.2.1) translate into higher car ownership, whereas public transport remains marginal due to the inefficiencies of providing the service in low-density areas. As a consequence, many urban settlements are locked into a path of car-and-oil dependency.

Concerning the consequences on climate change, the continued exploitation of fossil fuels, only partially offset in this scenario by effective CCS measures, produces the evolution of CO₂ emissions shown in the figure below:

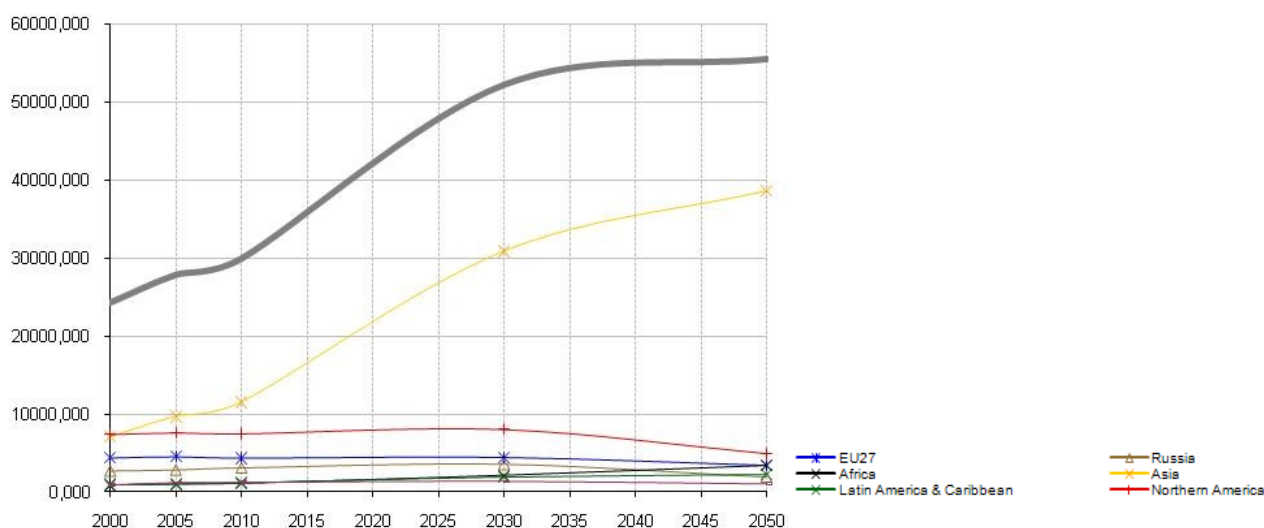


Figure 2: Growing without limits - CO₂ Emissions (Million tons)

Emissions keep high, and show a trend towards stabilization only towards the end of the period. This may eventually lead to world average temperature change above 2° C.

The conventional view, based on the IPCC assessment²⁶, is that such major climate change will have a global impact, unevenly affecting ecosystems and human health throughout the world. An increased number of extreme weather events (drought, flooding), coastal erosion, warming impacts on agriculture, will combine to cause severe consequences on the life and health of millions of people. Increased temperatures will further affect the physical, chemical and biological properties of freshwater lakes and rivers, with predominantly adverse impacts on many individual freshwater species, ecological communities diversity, and water quality. In coastal areas, sea level rise exacerbates also water resource constraints, due to increased salinization of groundwater supplies.

However, any forecast of additional warming that might take place by the year 2050 relies on a set of highly uncertain assumptions. Moreover, there is currently a 2 order of magnitude range in the estimates of the costs of global warming (0,2% - 20% of annual Gross World Product) produced by a

²⁴ ECN 'The next 50 years: four European energy scenarios', 2005.

²⁵ IEA, UNDP, UNIDO 'Energy Poverty: How to make modern energy access universal?' 2010 IEA, UNDP, UNIDO for 2010 UN MDG.

²⁶ IPCC 'Special Report on Emission Scenarios – Summary for policymakers' IPCC, 2007

number of international studies, pointing to outcomes ranging from a negligible obligation to an unprecedented global economic burden. This does not offer any confidence-inspiring foundation for rational policy making, and for this reason we simply assume in the global growth scenario – fairly optimistically – that climate change will not matter so largely on the future destiny of world economy, and has therefore only a negligible impact on the destiny of the world economy.

5.2.3 Changes in rural land use and biodiversity: increasingly global food production

The urbanization process involves a steady decline of rural population in developed as well as developing countries²⁷. This shift involves drastic changes in those countries that have been characterized by a large rural population and an agriculture-based economy, and that are not endowed with other resources (e.g. oil, mining).

Under this scenario, the agriculture aim is to produce a larger quantity of food, the price of which is kept down through further trade liberalization, open markets and investment in transport infrastructure. Agriculture becomes therefore highly mechanized and specialized through the extensive use of few new varieties of genetic strains with improved performance, patented and produced by large multinational companies. Countries across the world are increasingly being forced to compete to produce each other's food as cheaply as possible and at the expense of domestic production. Local food security is being swapped for mandatory international trade rules that are biased towards agribusiness, industrial production and long-distance transport. Thus, meat and cereal consumption increases significantly in Asia, whereas OECD countries are distinguished for more diversified diets, and sub-Saharan Africa countries are marked by gaps in food availability and a more root and tuber-oriented diet. Meat is produced by intensive business that process thousands of animals on centralized factory farms, transport them vast distances to abattoirs, and sell their products on the international market.

The increasing international food trade and demand is satisfied mostly by increasing agricultural yields, and this helps to cap the growth of needed agricultural land. The share of agricultural land is however higher than the business as usual projections in all the different regions of the world, as it is illustrated in the table below:

Table 8 Growing without limits- Land Use: Agricultural land (% over total)

Landuses. Agricultural land (% over total)	Trend line			Growth beyond limits	
	2010	2030	2050	2030	2050
EU27	29%	30,33%	29,94%	32,53%	33,61%
Russia	8%	7,96%	7,86%	8,54%	8,82%
Africa	8%	8,94%	8,82%	9,59%	9,90%
Asia	17%	18,48%	18,24%	19,82%	20,47%
Latin America & Caribbean	8%	8,87%	8,75%	9,51%	9,83%
Northern America	12%	12,76%	12,60%	13,69%	14,14%
Oceania	5%	5,79%	5,71%	6,21%	6,42%
World	12%	12,40%	12,24%	13,30%	14%

The “global food scenario” extrapolates the success of the “Green Revolution” - as the introduction of new, scientific-research-based varieties has been called – which resulted in substantial increases in

²⁷ In developed regions is expected to reach 13.8% by 2050, in the less developed and in the least developed countries these trends change from to 54.9% and 70.8% of rural population in 2010 to, respectively, 34.1% and 45.3% in 2050

yields, initially in rice and wheat, in Asia and Latin America. The term “Green Revolution” is often limited to describing these changes in those regions in the 1960s and 1970s, but the growth in yields has continued throughout the last forty years, and has, with varying degrees, occurred around the world. More than eight thousand modern varieties of rice, wheat, maize, other major crops, and root and protein crops have been released over the course of this period by more than four hundred public breeding programmes.²⁸

The agricultural research that went into much of the Green Revolution did not involve **biotechnology** – that is manipulation of plant varieties at the genetic level through recombinant DNA techniques. Rather it occurred at the level of experimental breeding. In the developed world, however, much of the research has been focused on the use of biotechnology to achieve more targeted results than breeding can. This research has been heavily based on private-sector investment and has resulted in more private-sector ownership over the innovations. In the “global food” scenario this trend continues and is strengthened through the delivery of the most optimistic promises of biotechnology, with significant improvements in yields as well as in health effects, quality of the foods grown, and environmental effects. Plants engineered to be pest resistant are widely diffused, decreasing the need to use pesticides, and they help to produce ever-higher yields without increasing tilled acreage, reducing the pressure for deforestation. Moreover, in this scenario, plants are increasingly engineered to carry specific nutritional supplements, like golden rice with beta-carotene, so as to introduce necessary nutritional requirements into subsistence diets.

However, any benign story of growth of Genetically Modified (GM) crops in the developing world and in the developed world²⁹ is accompanied by some unavoidable drawbacks affecting the environmental and social costs of the global agribusiness model of production.

Concerning the environmental costs, intensive food production for export relies heavily on use of artificial fertilizers, pesticides and herbicides, particularly as importers demand high cosmetic standards for high-value products such as fruit, vegetables and flowers. Agricultural chemicals contaminate water, harm wildlife, and, through their widespread residues in food, animal feed and drinking water, pose a risk to human and animal health. The large scale pattern of monoculture associated with their use cause massive soil erosion, destroy natural habitats and reduce biodiversity. Nitrate pollution from unsustainable agricultural practices is the main factor behind eutrophication of marine waters. The only substantial response to mitigate all these impacts is again mostly technological, with the increasing use of genetically modified crops and organisms, and more resistant plants. However, this reveals itself not sufficient to avoid the harmful environmental impacts, but only to adapt agriculture production to worsened conditions.

Another range of environmental costs associated with intensive export-oriented agriculture arises from the packaging of food and its distribution over large distances. These costs include the pollution that is a direct consequence of burning fossil fuels to power lorries, ships and aircrafts, as well as the impacts of constructing vehicles and transport infrastructure, and extracting crude oil and other resources required for transport fuel.³⁰ These externalities are there whatever technology is used – GM or not – to produce the agriculture products.

²⁸ Cfr. R. Evenson, D. Gollin, ‘Assessing the Impact of the Green Revolution’, 1960-2000, Science 300 May 2003: 758-762.

²⁹ In this scenario even the current limitations imposed by the European Union on all GM food sales is eventually released.

³⁰ There is no simple measure of this range of impacts, but for an indication it is revealing to compare the CO₂ emissions arising from transportation of just one product: distributing a kilogram of apples from New Zealand to the UK consumer results in 1 kg of CO₂ emissions, more than twenty times the level of emissions caused by distributing a kilogram of locally sourced apples through a home-delivery fruit and vegetable box scheme cfr. Quoted in M. Woodin, C. Lucas, *Green Alternatives to Globalisation – A Manifesto*, Pluto Press 2004 page 150

As regard the social costs, the mechanization, the increased use of chemicals, and ultimately the use of non-reproducing proprietary seed leads to a full incorporation of the agriculture sector world-wide into the capitalist form of production. The social consequences are relevant: the further growth of large-scale “agribusiness”, that is, mechanized, rationalized industrial-scale production of agricultural products, and more important of agricultural inputs, replaces in the global food scenario the family farm and the small-scale, self-sufficient farm, everywhere in the world. As scientific development and chemical applications increases, the seed as input becomes separated from the grain as output, making farmers dependent on the purchase of industrially produced seed. This further removes farm work from traditional modes of self-sufficiency and craft-like production to an industrial mode. The industrialization of agriculture creates dependencies in the periphery on the industrial-scientific core of the global economy, made of few transnational corporations producing the seed used everywhere.

This change towards an industrialized agricultural sector disproportionately affects people in developing countries. At the beginning of the 21st century, while on average 5% of the population in the EU countries (with the notable exception of Poland) are farmers, the majority of people in the developing world is still depending on this sector for their livelihood: 75% in China, 77% in Kenya, 67% in India, and 82% in Senegal. The developed world’s experience is a foretaste of what can happen in developing countries as their agriculture systems are liberalized: already, between 1985 and 1995 in Brazil, 5 million farmers left the land.³¹ Similarly in China, rapid urbanization was placing 400 million rural livelihoods at risk.

In the global food scenario, the erosion of localized patterns of production and consumption has a serious impact on the environment and health of rural economies of the developed world, but in much of the developing world, the loss of local food security is also a matter of life or death. Farmers in many South African states are forced by their governments – often following World Bank and IMF structural adjustment policies – to give up cultivating anything but maize, which can be exported and is very productive in a good year. However, traditional crops such as sorghum and millet are much better at coping with fluctuations in moisture and would provide some protection from the increasingly serious drought problems. International action, whether through the WTO, the World Bank or the IMF, is assumed to enslave developing countries to volatile international markets for monoculture cash crops and destroying their ability to provide for local needs. In a nutshell, increased international food trade doesn’t provide an answer to food poverty in this scenario: where hunger continues to exist, what is often lacking is not food, but access either to money to buy it or the land on which to grow it.

Finally, GM-based crops continue to be criticized in relation to their unpredictable environmental and health risks. The increasing diffusion of monocultures, lacking the genetic diversity of locally used varieties, makes the whole agricultural sector more susceptible to catastrophic failure. There is also a substantial fear of contamination of existing varieties, unpredictable interactions with pests, and negative effects on indigenous species. The consumers’ concerns have to do also with quality and aesthetic attraction to artisan-mode agricultural products and aversion to eating industrial outputs.

³¹ Cfr. K. Ainger 2003, *The new peasants’ revolt*, New Internationalist, 353, pp.9-13

5.3 Growth within limits: a global low carbon economy

The scenario features a radical shift towards a **low carbon economy**, in response to climate change and other environmental challenges. Responses to climate change are assumed in this scenario - if they are to be effective - to mobilize all actors in the business, financial and policy community to bring about a transformation to a low-carbon economy: we have the first instance of societies collectively seeking and achieving a dramatic transformation of the entire global economy.

The result of decarbonising the economy is what is called **climate capitalism**³²: a business model which squares capitalism's need for continual economic growth with substantial shifts away from carbon-based industrial development. The key question is whether capitalists can find the means for doing new business in a way that helps to achieve decarbonisation. They need to be able to do this in a way which brings on board those that will be doing less business in a low carbon economy, or at least to provide enough growth overall for policy makers to be able to override their resistance. Indeed, by the time when the Kyoto Protocol has been agreed in 1997, it had become absolutely normal to think that the appropriate way to deal with climate change is not so much to focus on restricting fossil fuel use, but on the creation of new markets. Governments, international organizations and private actors were all focused on new investment opportunities. The term "**carbon market**" was coined to describe the totality of these sorts of approaches to climate change. What they have in common is that they all turn carbon into a commodity that can be traded.

Markets, in other words, are made to work for the environment. Two main mechanisms are particularly important here: on the one hand **environmental taxation** measures, where the government imposes taxes on particular pollutants like carbon dioxide; on the other **emission trading** schemes, where an overall emission limit is decided, a number of permits adding up to this limit are distributed to actors according to some principle of distribution, and then actors are allowed to trade the permits amongst themselves. With both measures, the main rationale is that they leave the decisions about how to achieve particular environmental goals up to individuals and companies. Governments set either general incentives (in the cases of taxes) or overall limits to pollution levels (in the case of emission trading) and leave markets to work out who will reduce emissions when and where.³³

Emission trading emerges in this scenario as the preferred option, as new taxes are never popular with the public, especially if they are introduced without compensating them with a reduction of labour taxes. Moreover, in a open global economy, the prospect of relocation of business outside any carbon taxed enclave also means that "carbon leakage" might occur, whereby a tax would simply have the effect of driving the most polluting companies or parts of the production overseas, resulting in no overall reduction in emissions.

Carbon market mechanisms, started since the late 1990s (see box below), are assumed to become the usual business practice in this scenario, as companies continue to see many different types of risks to their business in relation to climate change.

³² Cfr. Peter Newell and Matthew Paterson, *Climate Capitalism: Global Warming and the Transformation of the Global Economy*, Cambridge University Press, 2010.

³³ World Bank, *Greening Industry: New Roles for Communities, Markets and Governments*, New York, Oxford University Press, 2000.

Carbon Markets

"Emissions trading was already an unstoppable reality since the late 1990s, when it has been included in the Kyoto process¹, and it has found the interest of a whole range of private market actors: companies such as EcoSecurities (1997), CO2e.com (2000) and Point Carbon (2000), and existing banks, such as Barclays or Dresdner Kleinworth, which developed their carbon credit offices and activities. The **Emission Trading System (ETS)** introduced in the Kyoto Protocol is a relatively simple instrument: the Protocol establishes the basic unit of account – the Assigned Amount Unit (AAU). Each AAU is worth one tone of carbon dioxide equivalent (tCO2e). Each country has a certain number of AAUs depending on its target under Kyoto. Each country then aims to keep its average emissions for the 2008-2012 period within that number of AAUs. If they can't achieve this, however, they can buy AAUs from other states that have over-complied with their targets, and thus have spare AAUs to sell. Since its initial insertion into the Kyoto protocol, emissions trading schemes have spread to other sites, including in particular Europe, where since 2005 the European Union's Emission Trading Scheme is in place. Carbon emission trading continued to mushroom once the dominant financial actors realized its potential as a new market, with its derivatives, options, swaps, insurance, and so on, seeing this as a profitable enterprise. Here, the point to underscore is that emission trading "gained traction" because of the intertwining of the need to that policy makers had for flexibility in meeting commitments and the realization by financial institutions that the emission market could be the site of significant growth and profits.

The Kyoto process introduced also some important government backed mechanisms as well: the Joint Implementation (JI) and the **Clean Development Mechanism (CDM)**. JI applies between Northern countries (referred to as Annex B countries in Kyoto jargon) and the CDM enables investments in Southern countries to be credited to Northern countries. Both work on a broadly similar basis: any country in the North, or one of its companies, with an obligation to reduce emissions under the Kyoto protocol, invests in projects in another country. The investing country can then claim the emissions reduced against its own target. However, following the tendency emerged early since their first implementation, investments in CDM projects, and this in Southern countries, have grown much faster than those in JI projects, mostly because of the stark fact that emissions in the South were simply much cheaper than in the North, so pursuing reductions there was much more cost-effective overall.

Besides the regulated markets under the Kyoto rules – ETS and mostly the CDM operation – **voluntary carbon offset markets** started since the early 1990s – actually preceding the regulatory carbon markets – and they continued to grow spectacularly since 2001, when they started to emerge at the global level. The voluntary market has a structure which is fairly similar to the CDM market. Typically, there is a "project developer" in a country in the South, and a "project originator" in the North. The latter channels money from companies and individuals in the North wishing to offset their emissions, into the Southern project developer, in return for carbon credits which are then passed on the Northern investors. In the CDM, a central aspect of the creation of the market is the process by which a project is declared to have reduced overall emissions, and credits are issued, which is tightly regulated through a central regulatory board. A key difference in the voluntary market is that no such centralized means of issuing credits exists. While the CDM market "product" is the Certified Emission Reduction (CER), the equivalent in the voluntary market is the Verified Emission Reduction (VER). Both are equal to one tone of CO2 equivalent, but whereas to establish that a project produces a particular amount of CERs in the CDM is based on standard procedure and a central regulator, a number of different standards and certification schemes have been elaborated by various organizations to certify the validity of the VER calculations.

Since the beginning the two types of carbon markets – voluntary and in compliance to the CDM – have co-existed and shaped one another. Voluntary markets are the result of entrepreneurial activity by environmental NGOs as well as private firms spotting opportunities for new market development, and many of these firms operate also in the carbon markets established by governments or under the Kyoto protocol. Indeed, the two sorts of market are often connected, as projects that fail to quantify for registration with the CDM may end up on the voluntary market that imposes less stringent criteria. At the beginning, in the year 2007, trades in the voluntary markets were worth \$331 million, only a tiny fraction of the size of regulated markets which dominated global carbon markets with around \$62 billion in the EU ETS and CDM combined."

Peter Newell and Matthew Paterson, *'Climate Capitalism: Global Warming and the Transformation of the Global Economy'*, Cambridge University Press, 2010.

Companies face indeed risks of incurring costs from later regulation if they do not plan for them well before; risks to their reputation and thus of potential market losses if they are seen as unresponsive to societal demands; risks of legal liabilities if they are seen to cause damages to others by refusing to cap their emissions; and risks of losing out on new market opportunities.³⁴ They increasingly accept therefore that they have both environmental and social responsibilities to their employees, to the communities that host them and to society more broadly. While in many examples of Corporate Social Responsibility the risk is to a company's reputation with its customers, in climate change, one of the principal pressures comes from investors. Those with pensions or life insurance funds, the base for most of the world's investment capital, exert a far greater influence than consumers can. It is clear that – in a neoliberal context that still features this scenario – mobilizing the money of private investors, most of whom are large institutional investors, is crucial to achieving the transformation to a low carbon economy.

Besides environmental taxes and emission trading, these mechanisms include, for instance, the **Carbon Disclosure Project (CDP)**. A project founded in 2001 whereby investors (led by the insurers, but joined by banks and pensions funds) has attempted to shape the activities of other companies by getting them to disclose their carbon intensity and their strategies to limit emissions.³⁵ In this scenario, the voluntary reporting to the CDP actually becomes a common business practice, with an increasing number of investors that are reluctant to invest in companies which are either carbon intensive or are doing nothing about their emissions. This trend drives transitions toward greening the industries: in what sort of energy companies procure, how they design and operate their buildings, what transport systems they favor for their business and employees, how they manage their wastes, etc.

Summing up³⁶, in this scenario various elements of *climate capitalism* develop fully and are able to produce a relatively rapid decarbonisation of the global economy, already visible at the 2030 horizon. Through mechanisms such as the Carbon Disclosure Project and other reporting standards, institutional investors are able to lead a global process of investment in renewable energy, energy efficiency and conservation, carbon capture and storage, advanced public transport and urban infrastructure reform, which collectively produce rapid shifts away from fossil fuels, prevent a switching back to coal as gas runs out and secure the carbon from remaining fossil fuel use in underground, geologically viable storage sites. They are aided by regulators of financial markets who force companies to disclose their CO₂ intensity, by governments who give indications of the rising price of fossil energy through taxation reforms and who send appropriate signals through the carbon allowances allocated and auctioned in the various markets in Kyoto and in its successors regime, as well as through national and regional policy. These decisions by governments create scarcity in carbon allowances and thus produce reliably high carbon prices, give a clear steer to business about future opportunities and create big incentives to find alternatives to fossil fuels. The logic of carbon markets is expanded with the creation of Personal Carbon Allowances (PCA), thus creating similar incentives to

³⁴ It is worth mentioning here an impressive group of 150 of some of the world's best known companies (Including Volkswagen, Shell, Nokia, Kodak, Philips, HSBC, General Electric, Nestle, Adidas, Nike, Rolls Royce, DuPont, Johnson & Johnson and Tetra Pak, among many others which signed the "Bali Communiqué on Climate Change" in December 2007, endorsing statements such as the following: "*The shift to a low carbon economy will create significant business opportunities. New markets for low carbon technologies and products worth billions of dollars will be created if the world acts on the scale required. In summary, we believe that tackling climate change is the pro-growth strategy. Ignoring it will ultimately undermine economic growth.*"

³⁵ The CDP had already \$57 trillion of assets behind it in November 2007 (quoted in P. Newell, M. Paterson, *Climate Capitalism*, page 29). The CDP is effectively a consortium of investors who write annually to corporations listed on stock exchanges, with a questionnaire asking them to report on their CO₂ emissions, the business and other risks they perceive from climate change or measures to mitigate it, and their strategies for limiting their emissions. They publish the reports as well as the data provided by companies, and do summary analysis on trends.

³⁶ The following paragraphs describing the scenario features are mostly excerpted from the "climate capitalist utopia" scenario described in P. Newell, M. Paterson, 2010.

change behavior amongst individual consumers and driving demand for low-carbon products and services.

At the same time, the emission trading works as their early designers hoped, reducing substantially the costs of meeting emissions targets, thus enabling both the pursuit of more aggressive targets and the buy-in by a progressively wider range of actors. The original rationale of emission trading as a mechanism for redistributing resources from larger to smaller polluters and from rich to poor is realized. A switch in the approach of developing countries is also facilitated by their increasingly positive experience with the Clean Development Mechanism. This becomes an effective way to channel investment by Northern governments and institutional investors into emerging markets. These investments are increasingly focused on “win-win” projects in renewable energy and energy efficiency, and less and less in forestry projects, thus overcoming worries about “carbon colonialism” and pacifying internal critics that long-lasting social benefits are not accruing to those countries.³⁷ The CDM is reformed to expand the range of possible investments from individual projects towards sectoral reform and even whole policy reform programmes.

The World Bank likewise “decarbonizes” its lending program³⁸, realizing the need to shift completely away from lending for fossil fuel projects in order to be a credible leader on climate change. This is driven both by the returns to be gained from rapidly developing renewable markets, the cue it takes from its main funders that are also investing heavily in these areas, the demand for sustainable energy options in developing countries and NGOs pressuring the World Bank. Northern tax payers are no longer willing to allow their money to be used to underwrite financial backing for fossil fuel projects when they are trying hard to reduce their own emissions through domestic measures. This enables Northern investments to contribute to wholesale structural reforms in the South away from reliance on coal and oil, and thus enables developing countries to “tunnel through” to a low carbon economy.



The emergence of the low carbon economy also contributes significantly to poverty reduction in the South, opening up an array of new employment and training opportunities, new sources of revenue and ultimately contributes to the reduction of global inequalities. This is why, in the DELPHI survey, the “growth within limits scenario” was associated to an “apple”, which with its spherical shape evokes a more balanced world, both economically and socially. The smooth apple peel evokes also a landscape of progressively uniform values and habits spreading all over the world, facilitated by a climate of global cooperation which promotes understanding among different cultures.

Poor nations increase their wealth in a steady consistent way, and more balanced international and national development patterns generate lower social disparities. Rich nations devote significant aid to developing countries, especially favoring skills, knowledge and technology transfers. However, wealth distribution is not the primary challenge and target in this scenario – especially at the urban level where unemployment and inequality continue in many instances to increase (see section 5.3.1 below)

³⁷ A number of reforestation projects in Southern countries, although funded under carbon market mechanisms, have shown negative social impacts upon local population that project developers did not take into account, for instance evicting families, often violently, who had been farming the land for decades. A typical stance of “carbon colonialism” is displacing the costs of carbon emissions in the North onto people in the South by fixing them in a position as tree planters, instead of giving them the opportunity to develop better uses of their own land. Carbon colonialism is therefore a new way of acquiring land and resources in poor countries to sustain profligate consumption of the rich.

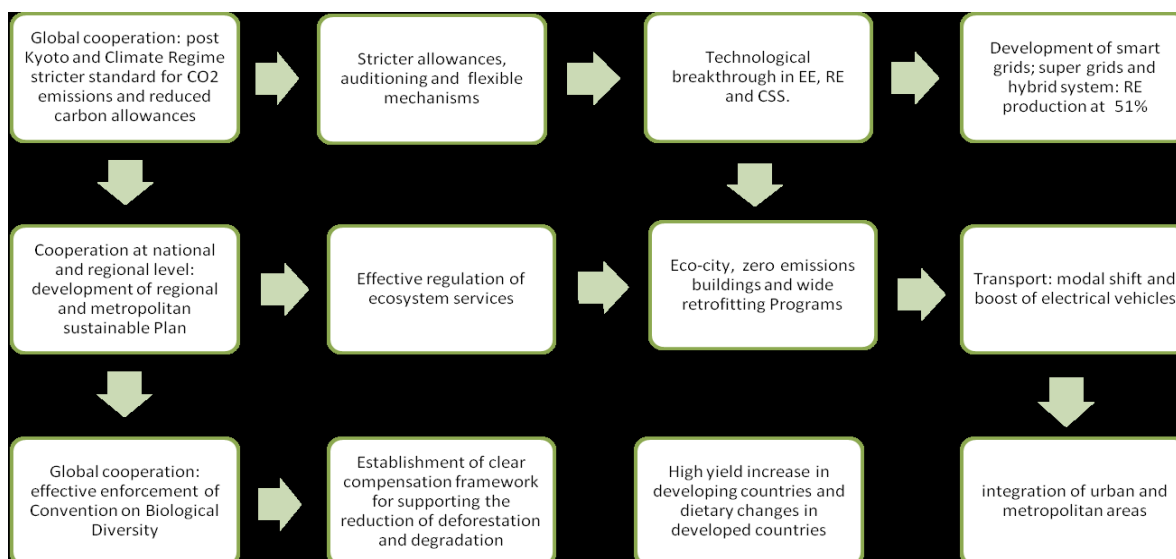
³⁸ Currently the World Bank still invest heavily in fossil fuel projects, despite the mounting evidence that climate change significantly exacerbates the welfare of its main clients: the poor. For instance in 2008 the World Bank invested in a 4000-megawatt coal-fired power plant in Gujarat, India, which will emit more carbon dioxide annually than the whole of Tunisia (cfr. C. Swann, “Zoellick fossil fuel campaign belied by World Bank’s Tata loan”, *Bloomberg.com*, 10 August 2008).

– as the main challenge remains de-carbonizing the economy for the sake of a greater environmental health of the planet.

Two key challenges with respect to the global environment are indeed successfully tackled in this scenario, namely ensuring sustainable energy supply while avoiding dramatic climate change, and ensuring global food security while preventing dramatic biodiversity losses. Of course, there are other concerns to be taken into consideration too: water scarcity, depletion of fish stocks, acidification of the seas, risks associated with new technologies, such as nano-particles, genetically modified organisms, nuclear energy waste and risk etc.

However, the perhaps most significant challenge in this scenario is to create appropriate institutional conditions to spur off the shift to innovation and fundamental transitions that help bring about a “green” low carbon economy. An integrated approach is pursued, thanks to strong international cooperation based on effective policies, which require long-term targets of climate change mitigation and biodiversity protection, and the definition of strict regulations to reach them. A scheme of the assumption of drivers’ interaction underpinning the scenario is presented below:

Table 9 The scheme of drivers’ interaction in the ‘Growth within limits Scenario’



In a nutshell, the “growth within limits” scenario assumes that a low-carbon economy, as well as adequate biodiversity protection, can be achieved with currently identifiable technologies and at moderate economic costs. The plausibility of this scenario rests on the assumption, common to many advocates of the neoliberal approach to climate change, that the key to decarbonisation is to set appropriate carbon prices. The plausibility of the scenario also depends politically on an awkward alliance of technocratic civil servants, opportunistic environmental NGOs and profit-seeking financiers. A “Global Green New Deal” has been already advocated by a range of actors in the global arena. The first step in this direction is to define clear and mandatory targets endorsed by the world community of policy makers. A joint international decision on a “politics of limits” – to foster more sustainable investments, stimulate innovation and bring environmental concerns to the core of political decision making – is called for. Citizens could take up the challenge at a local and personal level, triggered by the notion that lifestyle changes in dietary patterns, energy use and transport patterns can contribute very significantly to decrease the environmental pressures and improve people’s health.

Countries in the growth within limits scenario have average GDP annual growth rates ranging between 4% and 5,5%, with smaller growth rates for the more mature economies. The following tables show the key scenario's features at a glance, by giving:

- The values of key variables in 2010, the projection of current trends at the 2050 horizon (trendline), and the values considered for the "growth within limits" scenario in the WP1 meta-model analysis (Table 10);
- The assumptions of drivers evolution considered in the Delphy Survey (Table 11).

The main references used to elaborate the "growing within limits" scenario narrative are listed in the footnote.³⁹

Table 10 - The Vital signs in the 'Growth within limits scenario'

VITAL SIGNS		2010	Trendline (2050)	Growth within limits
Population (million inhabitants)		6910	9214	8772
Settlements: Urban society (% of people living in cities)		50%	69%	66%
Rural land overexploitation	<i>Arable</i> (% over total land)	12%	12%	12%
	<i>Meadows</i> (% over total land)	26%	26%	26%
	<i>Forests</i> (% over total land)	31%	30%	32%
	<i>Biofuels</i> (% over total land)	0%	4%	4%
	<i>Other</i> (% over total land)	31%	28%	26%
Technology (% of R&D investment over GDP)		1,9%	2,0%	3,3%
GDP (2010 = 100)		100	311	371
Wealth disparities (GDP/capita dispersion relative to mean)		2,3	1,7	1,2
Energy consumption (MTOE, 2010 = 100)		100	238	219
Transport		100	With economy	Slightly under economy
Climate change (Mtonnes CO ₂ , 2010=100)		100	213	117
Biodiversity (% yearly change in the number of species)		-0,07%	-0,08%	0,00%
Governance (forms of government)		93 democracies, 50 anocracies, 20 autocracies	130 democracies	150 socialdemocracies

Table 11 - The scheme of drivers evolution in the 'Growth within limits scenario'

	Trend 2010-2050	Scenario snapshot 2050	Rate of change
Population	↑	8600 millions in 2050	Population yearly growth rates from 1'3% in 2010 to 0'8% in 2030 and 0'3% in 2050
Settlements: Urban society	↔	From 50% urban population in 2010 to 57% in 2050.	35 million urban residents more per year between 2010 and 2050.
Rural land overexploitation	↔	Land for bioenergy production 500 mil.ha in 2050 (4% global land)	Agricultural land and meadows stable. Increased agricultural yields. Forests increase 2%.
Technology	↑	-Carbon capture -Energy grid storage - Fuel-cell -Aquaculture - Automated driving.	2% GDP devoted to R&D investment in growing within limits nations
GDP	↑	- Global GDP in 2050 is twofold 2010's. - Maghreb GDP per capita converges with Europe's at \$45.000	2% GDP yearly growth rate for developed regions, 4% for developing.
Energy consumption	↑	Energy yearly consumption in 2050 is the twofold as in 2010's.	Energy intensity yearly decrease (Δenergy/GDP) from -0'8% in 2010 to -1'7% in 2030 and -4% in 2050
Transport	↑	Transport increases due to increase in GDP.	Transport grows along with economy, approximately at the same rate.
Climate change	↓↓	World GHG emissions in 2050 are 50% lower than in 2010	Emission factors yearly decrease (Δemission/energy) from -0'3% yearly to -1% in 2030 and -4'5% in 2050.
Biodiversity	↑	Biodiversity is protected through legislation and citizen awareness	Stable.
Governance	↑	United Nations as an operative institution for global governance.	10 new democracies per year between 2010 and 2050

³⁹ Main References for this Scenario: Peter Newell and Matthew Paterson, "Scenario 1 – Climate Capitalism Utopia", in P. Newell, M. Paterson, 2010, Club of Rome 'Growing within limits' A Report to the Global Assembly 2009 of the Club of Rome, 2009; Greenpeace and European Renewable Energy Council 'Energy Evolution: a sustainable energy outlook', 2008; IBM 'Intelligent Transport' how city can improve mobility'2009; IEA 'Energy Technology Perspectives, Scenarios & Strategies to 2050', 2008;

5.3.1 Changes in urban land use and transport: the transit - oriented city

In the Growth within limits scenario, the population increases mostly in urban areas that are able to develop in a more sustainable and inclusive way, attracting an increasing share of residents and other city users (business or leisure visitors, commuters). The spatial planning policies are driven by holistic approaches implemented with a coordinated action of local, regional, national and international actors.

By 2020 local governments have a radically different perception of the value of natural assets. Previously local authorities, although they recognized the importance of the environment, considered that it could be sacrificed for the sake of the economic growth. From 2020 onwards, the environmental performances became the first priority for cities, and megacities, also for attracting investments and competing with other cities. The shift to renewable energies and the implementation of energy efficiency measures, both rise to the top of the political agenda. The coordination between different levels of government through the adoption of sustainable Regional and Metropolitan plans favor the integrated development of cities and of the surrounding rural areas, whereas the inclusion of climate change and energy as cross cutting policies within the cities' departments enable a better integration and guidance of urban policies in different sectors: transport, built environment, services provision and management of biodiversity.

Both old and new cities are renewed on the grounds of green urbanism principles, where the use of technologies, new materials and creative knowledge contributes to reduce energy consumption, water use and waste production. The creation of interconnected infrastructures among those systems creates a 'virtuous circle' able to reduce the consumption of energy and natural resources. OECD countries engage in expanding the inner city areas whereas the emerging countries are able to manage massive urbanization processes. Many OECD countries witness activities directed to the revitalization of the city centre and the recovery of previous industrialized areas, together with a progressive redistribution of productive, social and political functions among different centers across the region. A

SEED OF CHANGE Curitiba, Sustainable Urban Planning

'Curitiba is an excellent example of sustainable urban planning. The city registered a growth of population of 361,000 in 1960 to over 1.8m in 2008 beyond the pollution and congestion typically associated with urban growth. While the population density between 1970 and 2008 tripled, average green area per person increased from 1m² to over 50m². Key to this success was the adoption of a "radial linear-branching" pattern of urban development, encouraging a diversion of traffic from the city centre and the establishment of housing and industry along the radial axes. Curitiba now has the highest usage of public transport in Brazil (45% of journeys). Excessive fuel consumption due to traffic congestion was 13 times less per capita in Curitiba in 2002 than in Sao Paulo and four times less than in Rio de Janeiro. Less pollution brings measurable health benefits, greater energy efficiency and improved public transport'.

UNEP, 'A Brief for Policymakers on the Green Economy and Millennium Development Goal', 2010.

turning point is the concomitant affirmation of an 'Asian eco-urbanism' that starts in China and rapidly develops in the megacities of emerging countries. China's investment in eco-city is a way to manage the huge migratory movement that characterizes the country in the mid 2020, leading to the creation of 400 new towns. In order to avoid the replication of those externalities that chronically affected the megacities reducing their competitiveness, the new imperative is to find the right balance between economic, quality of life and environmental concerns.

In most countries new buildings have to comply by 2020 with 'low consumption' standards – that is a consumption of 30-50 kWh/mq, 70% more efficient than the 2000 consumption levels - and with passive house standards by 2030. In line with this, many OECD countries start programs to retrofit old dwellings and thus decrease energy consumption in existing building by more than 50% compare with

2010 performances. The integration of solar panels into building is highly favored through the creation of specialized Energy Service Companies, and by the allocation of subsidies.

More than 60% of waste is recycled and domestic water is kept below 120 liters per person each day, with more than half supplied by rain capture and recycled grey water. The most advanced cities build infrastructures to convert sewerage from the apartments into heat energy and biogas used to fuel district heating plant and public transport vehicles, following the first pilot experiment of Hammarby District (Stockholm). Solid waste resulting from the processing of sewage is composted and used in foresting. To facilitate recycling processes, urban waste is increasingly collected through networks of underground pipes to central points of collection.

The dominant urban structure, especially in Europe (but notably also in China), is a network of compact and dense city cores, connected by means of rapid transport infrastructure – mainly high speed trains and, less preferably, highways – which provide for comfortable inter-city travel within a day. Employment, consumption and residential districts are distributed within the different urban cores, while high quality and fast public transport can be provided between the cities thanks to the density of demand. This helps to reduce congestion problems common to the urban sprawl form, especially because individual car use is usually restricted within the urban cores. The network form is replicated at the regional scale, whereby the development of satellite towns connected to a large central urban core by means of fast and frequent public transport (the so-called Transit Oriented Developments – TODs) facilitates sustainable transport.

In order to drastically reduce the car journeys, zoning ensures the presence of daily services within walking distances, whereas higher urban functions (offices, shopping malls, etc.) are mostly concentrated in urban cores. Many cities have built dense capillary public transport networks, using light railway line, metro, rapid bus services. The service is complemented with facilities for promoting cycling, car sharing and car pooling. In Europe, car sharing is generalized and coordinated through a wide network of cities – and coordinated with long distance High Speed Train transport – making it convenient for urban dwellers not to own a car, as car sharing combines with HST mostly cover both their local and long distance travel needs.

SEED OF CHANGE
Singapore Multimodal e-payment

'Singapore next generation of multimodal e-payment system dubbed Symphony for e-Payment. Based on contactless E-Purse Application standard, the system allows multipurpose stored value (MPSV) cards to be used for transit (bus, metro, vehicle congestion charge) as well as for non transit purposes such as micropayment. In addition, it provides support for multiple (CEPAS compliant) card issues, increasing choice and convenience for the public commuter'.

IBM, 'Intelligent Transport: how city can improve mobility', 2009.

As regard transport technologies, at first, improvements are registered in conventional vehicles fuel efficiency, in the use of hybrid vehicles and in advanced diesel technologies, thanks to the concerned actions of automakers, fuel producers, governments and consumers. International agreements set a progressive standard on emission for all new vehicles, establishing the limit of 120g/km CO₂ by 2012, followed by a limit of 100g/km CO₂ by 2020. During a second phase, the private use of cars is highly reduced and vehicles are mainly hybrids or fuelled by biomethane and hydrogen, thanks to the diffusion of fuel cells technology, whereas electric cars are only a niche market (see box in section 5.3.2).

To reach these energy saving goals, all cities become 'smarter' with Information Technology System (ITS) applied to all sectors, especially transport. Technologies are used to collect more and better data, analyze more intelligently and connect data through effective networks. The information is readily available through iPhone devices and influences customers' behaviors. Through the implementation of

multimodal plans, ITS systems enable a better integration of transport services and strategies within and between different levels of government.

For transport, new functionalities are added to the ones developed in the first decade of the 21st century, such as integrated fare management, traffic prediction, travel information and advisory services, road user charging and variable parking pricing. The new generation of ITS follows indeed a 'customers oriented approach' and is directed to produce an integrated service delivery. Web-based journey planning is provided through mobile phones and other mobile devices such as PDAs. Smart cards are used to pay for integrated transit services (public transport and congestion charges) as well as for small purchases. Through cell phones tracking, systems are set to offer accurate and update information on roads conditions, preferable speeds and alternatives transport modes and to allow public transport prioritization at intersections.

ITS systems are used as well for integrating all infrastructures services, especially in newly built-up cities. Following the pilot example of Masdar city, urban planning increasingly exploits geographical information systems (GIS) to increase energy savings and reducing carbon emissions either in the construction and in the building maintenance and operation phases. GIS-based modeling helps to track costs, schedules, carbon emissions and has been also used to calculate where it would be better to place critical infrastructural centers (energy production, recycling, transport). GIS systems also helps to visualize the overall energy and water consumption for the city, and enable residents to see immediately the resources they consume. Similarly, the use of a 'smart grid' with two-way digital communication allows electricity generators to regulate electric appliances in consumer's homes and in offices, thus leading to significant savings and reduced energy demand.

Along with these developments, the eco-design and the inclusion of sustainable criteria in production processes is increasingly required by international agreements and by standardization bodies. The extensive use of crosscutting technologies, coupled with greater attention for the quality of the environment, combine to improve urban services and citizens' quality of life. More and better services are provided with fewer impacts on resources. A marked reduction in the number of private cars releases public space once used to park vehicles, allowing for larger pavements and more green public space, which is especially beneficial for children and senior citizens who have limited mobility and depend on the quality of local public space. The provision of green areas and reduced fuel combustion lead to improvements in air quality and a decrease of related health risks.

However, the care for the environment embodied in the growth within limits scenario has not always been accompanied by a similar care for the social aspects of the transition, such as employment, health care and wealth distribution. Several countries where the policy packages did not include dedicated policies to promote the reallocation of labor across sectors, and facilitate the creations of new skills requirements, lag behind and register a growth in unemployment rates.

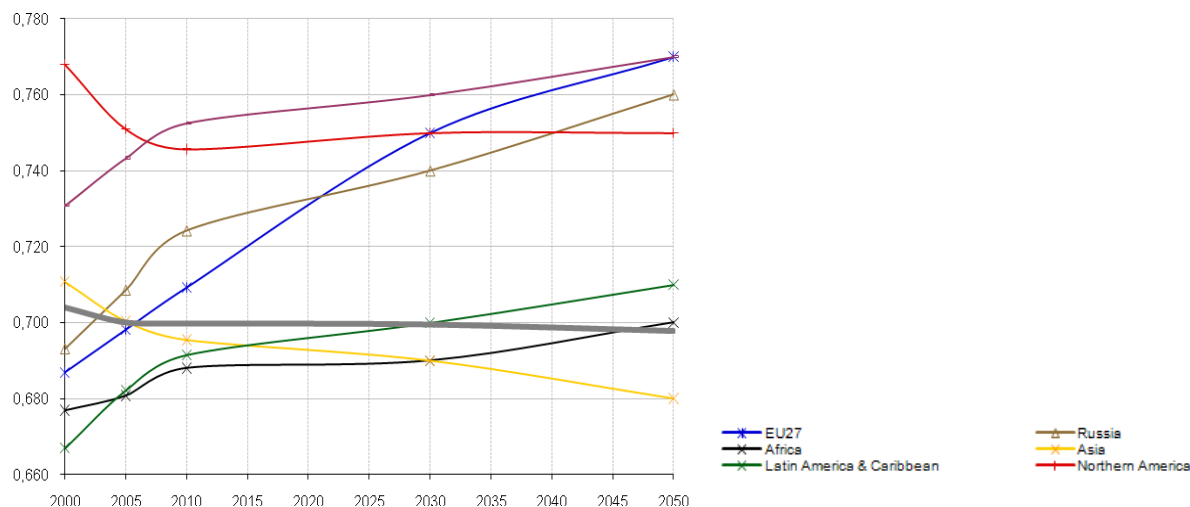


Figure 3 Growth within limits - Employment rate (% working over 15-64)

In some OECD regions – in Europe as well as North America - the concomitant rise of unemployment rates and aging of population contributes to create an impoverishment of the lifestyle for millions of citizens. The situation risks to degenerate in social clashes among citizens who feel excluded from the globalization process, and the growing community of immigrants that bring new habits and cultural inputs within the traditional city landscape. In some areas, groups of people are emerging who do not manage or refuse to keep track of the fast technological changes and feel excluded from the transformation process. In some cases, this behavior is a reaction against the ever-growing control over citizens' private life. As organised crime and terrorism are still among the most challenging problems, the use of ITS is in many cases employed for surveillance purposes and to register most of the citizens daily choices: when and where they travel, what they consume, what they do in their working life, etc. In those countries where data protection legislation is not strictly enforced, commercial companies continue to use customers' data profiles to conduct aggressive marketing campaigns.

In developing countries and emerging economies, the new development goal is to create 'a city beyond slums': technologies are used to upgrade slums areas and improve vulnerability to natural hazard. However, the change is successfully implemented solely in a limited number of cases where the urban policy takes into account ways to reduce income inequality and spatial fragmentation.

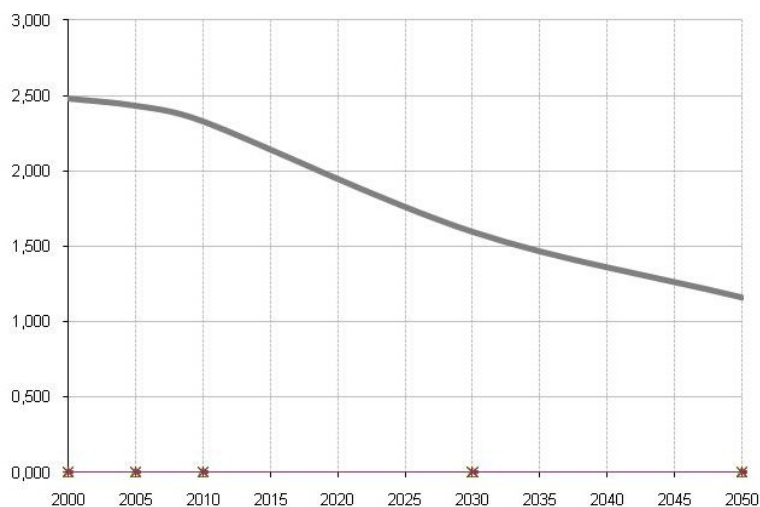


Figure 4: Growth within limits - Economic inequality (GDP Cap _ stand _ Dev/World GDP Cap)

5.3.2 Changes in energy and climate: large scale decarbonised energy supply

The main feature of the low carbon scenario is the relatively rapid shift from a fossil fuel based economy to one based on energy efficiency and renewable energy. Perhaps over a 20-30 year time period, global demand for energy stabilizes because of the rapid uptake of efficiency technologies, switching away from car dependence, changes in building codes and practice towards “zero emissions” buildings. At the same time, the fuel mix in the global economy moves from 90% based on coal, oil and gas, to being 50% based on renewable forms of energy; the rest is produced by a mix of nuclear energy and fossil fuels, as it is shown in the table below:

Table 12 Growth within limits - the World Energy Mix

	Trend line			Growth within limits	
World Energy Mix	2010	2030	2050	2030	2050
% of fossil	85,3%	72,0%	60,9%	62,5%	38,1%
% of oil	34,4%	24,6%	17,7%	19,8%	7,3%
% of coal	27,7%	29,2%	28,3%	24,7%	16,2%
% of natural gas	23,3%	18,1%	15,0%	18,0%	14,5%
% of nuclear	5,7%	7,1%	9,0%	7,8%	11,8%
% of renewables & biomass	9,0%	20,9%	30,0%	29,7%	50,1%

The energy intensity gains also improve significantly in all world regions:

Table 13 Growth within limits - Energy Intensity

Energy Intensity (Mton/M\$) in constant 2005\$	Trend line			Growth within limits	
	2010	2030	2050	2030	2050
EU27	0,13	0,11	0,09	0,09	0,05
Russia	0,55	0,45	0,35	0,40	0,25
Africa	0,30	0,28	0,25	0,25	0,22
Asia	0,27	0,24	0,21	0,23	0,16
Latin America & Caribbean	0,28	0,23	0,20	0,24	0,22
Northern America	0,18	0,14	0,11	0,13	0,07
Oceania	0,52	0,35	0,20	0,32	0,12
World	0,22	0,19	0,17	0,18	0,13

The vast majority of emissions from remaining fossil energy sources are removed from the atmosphere through various types of carbon capture and storage or atmospheric sequestration projects. The costs of these latter projects reduce to such an extent that the setting of carbon prices is sufficient to make them viable (which is not currently the case) and the technical barriers to their diffusion are overcome. The ambition was indeed to reduce GHG emissions by around 50% by 2050, achieving the target by means of rapidly increasing energy efficiency, replacing fossil-fuel technologies as far as possible by zero or low-carbon technologies, and by introducing carbon-capture-and-storage (CCS) techniques to eliminate the emissions of residual fossil fuel based energy production (i.e. mainly natural gas). However, even if developed countries almost eliminate GHG emissions, and Asia only emits half as the baseline indicates, GHG emissions will globally increase and the scenario returns a 26% increase in GHG by 2050.

A key step in this energy transition is the further revision of the Kyoto Protocol where the signatories plus the United States agree upon stricter standard for CO₂ emissions and reduced carbon allowances. A new carbon-reduction regime has established a new set of flexible mechanisms, which stimulate financial support as well as technological transfer and capacity building exchange. The signature of assisted trade agreements with Emerging and Developing Countries further encourages the channeling of both government and private resources towards the development of new energy technologies. The adhesion of BASIC countries (Brazil, South Africa, India, China) to the new carbon reduction regime, driven by the growth of environmental problems in their local economies, accelerates the changes and multiplies its effects. The decision opens enormous potential in export markets for technological industries, favouring the mass deployment of new technologies and a consequent rise in investments on Research & Development by private industries. In this Scenario, on average 3,3 % of the world GDP is invested in Research and Development.

The potential for increasing energy efficiency is considerable, but its realization requires ambitious standards for appliances, vehicles and new houses, with respect to energy consumption, and extensive retrofitting of buildings to improve insulation. There is also large scope to reduce GHG emissions from power generation. Development of a connecting super grid on a continental scale in Europe and America combined with smart grids at local scale facilitate penetration of large-scale renewable production, but also allow for a combination with decentralized power generation (reducing the variability problems of relying only on decentralized renewable sources). This also requires storage systems and assurance of grid access. In the transport sector, energy efficiency only may hardly reduce emissions, due to the rebound effect (more efficient vehicles are cheaper to run and therefore used

more to travel). In the long term, thus, the scenario envisages a radical shift to hybrids and hydrogen vehicles.

In a nutshell, the energy transition is therefore featured by two complementary drivers: first, the application of energy efficiency measures on the demand side and second, the boost of renewable energy and post-carbon technologies on the supply side, with large scale solar, wind and electricity grid upgrading projects. The growth of energy consumption is still significant – as world population and economic activities continue to expand, causing an increase in consumption compared to 2010 levels – but is nearly halved compared to that of the “growth without limits” scenario. The scenario does not envisage a radical shift to more sober citizens’ lifestyles, nonetheless, energy demand is drastically contained in emerging countries and reduced in OECD by the improving efficiency of resource use (“dematerialization”), and the adoption of energy conservation measures in all sectors. For the building sector the measures implemented concern the development of a eco-planning policy and the adoption of sustainable construction techniques (insulation, retrofitting, double/triple glazing as well as zero-emission buildings).

Transport within the city is highly modified thanks to the diffusion of more dense and transit-oriented city structures and the effective adoption of measures that favor a shift towards collective and environmental friendly transport modes. By 2030, the European Union achieves the objectives set out in the EU-Technology Platform on Biofuels, covering one quarter of its road transport fuel need with clean and CO₂-efficient biofuels, with a substantial part provided by a competitive European industry. This significantly decreases the EU fossil fuel dependence. Furthermore, a successful introduction of hydrogen into the energy system reduces the total oil consumption by the road transport sector by 40% between now and 2050. On the pathway towards a full implementation of hydrogen transport technologies, the EC HyWays Roadmap estimates that in 2030 there would be 16 million hydrogen cars and the total cumulative investment for infrastructure built-up would amount to €60 billion.⁴⁰ Electric cars are considered instead only a niche market option (see box).

Why electric cars are not relevant in the picture?

‘On the basis of the available information on costs and performances, it appears that the present electric car fares much less well than a standard classical fuel car. Over the lifetime of a car, it will cost some 12.000 € more to the consumer, and 14.000 € more to society. It is hard to justify such enormous surcosts by the CO₂ gains that will be produced. Assuming the average EU CO₂ content of electricity, the CO₂ gain of an electric car operating 10.000 km during 15 years will be about 8 tons. A possible future 30% decline in electric car cost and in battery costs, plus a 100% increase in electric efficiency (from 5 to 10 km/kWh), plus a 12% per year increase in the price of oil (up to 370\$ per barrel in 2025) eliminates the consumer surcost but not the socio-economic cost. One parameter deserves a particular attention: mileage. The more km per year an electric car is driven, the more economic (or, more precisely, the least uneconomic) it is. But mileage it is constrained by the limited range (150 km) of electric cars. This means that the electric car market can, if anything, only target the cars driven many km per year in the form of small trips. This is only a fraction (about 10% according to industry estimates) of the automobile market. The idea that the electric car could be a general substitute to the fuel car is not acceptable. It can only, at best, be a niche market.’

Rémy Prud’homme, ‘*Electric Vehicles: a tentative economic and environmental evaluation*’, 2010.

Concerning the industrial sector, significant energy gains are derived from the introduction of energy efficiency measures for motors, pumps, boilers and heating systems. Breakthrough technologies allow the adoption of new and more efficient processes and materials among which: advanced membranes that can replace distillation in some petrochemical process, ‘direct casting’ in iron and steel and the use of bio feedstock in the petrochemical industry to replace oil and natural gas.⁴¹

⁴⁰ EC HyWays Project: <http://www.hyways.de/>

⁴¹ IEA ‘*Energy Technology Perspectives, Scenarios Analysis*’, 2006

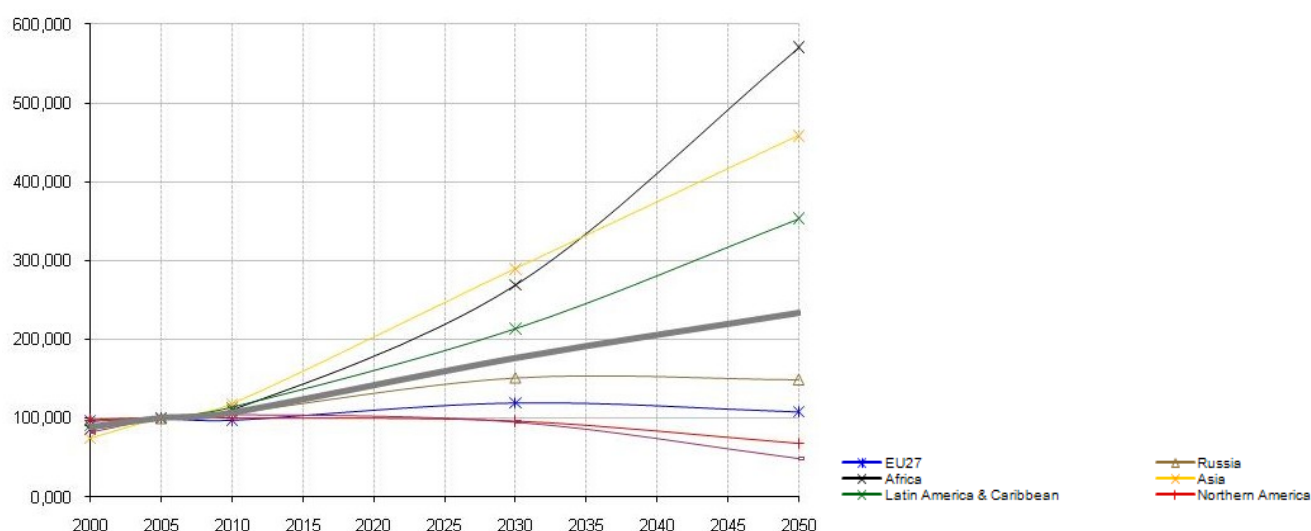


Figure 5 Growth within limits - Primary Energy Consumption (2005=100)

SEED OF CHANGE DESERTEC Project

'The Desertec Project has been among the first to propose and realise a super grid in the EUMENA (Europe, the Middle East, North Africa) that connected Concentrated Solar Plants installed in the deserts, supplemented with wind and hydro powers. The evolution has highly contributed to promote economic development and local jobs in the north Africa regions'.

Desert Project: <http://www.desertec.org/>

The majority of countries phase out all subsidies to fossil fuels and establish legally binding targets for renewable energy production. This evolution is accompanied by a structural reform of the electricity market. Investments in renewable energies are encouraged with the provision of stable and defined returns for investors, for example through the implementation of feed-in tariff and a priority of access to the grid for renewable power generators. New grid technologies include micro grids, smart grids and efficient large-scale super grids. They are all able to ensure a balance between fluctuation of energy demand and supply by supporting and interconnecting with each other. The adaptation and transformation of the grid network as well as technological innovations to solve the concentration of supply were required to achieve these breakthroughs improvements in the production and use of electricity. Blackouts are avoided as the smart grid rely

on a portfolio of flexible energy providers such as solar plus gas, geothermal, wind sources which are as a whole able to satisfy the load during both day and night. Also in the field of energy supply, IT plays an important role by providing the opportunities to rapidly collect data, optimize uses and provide solutions. 'Virtual power plants' are created which 'processes data from many decentralized power stations, compare them with predictions of power demand, generation and weather conditions, retrieves the available power market prices and then intelligently optimizes the overall power activity.'⁴²

Smart grids and super grids are highly developed in OECD as well as in emerging economies. The first super grids were those realized for interconnecting the large wind turbines based power in the North sea, and the connection between northern Africa Concentrated Solar Power Plant and Southern Europe.

⁴² Greenpeace and European Renewable Energy Council 'Energy Evolution: a sustainable energy outlook', 2008

In the case of least developed countries, hybrid systems, connected through micro-grids, offer a unique opportunity to allow access to electricity and clean cooking facilities for millions of people. In these countries, UN Millennium Development Goals for fighting energy poverty are achieved, and allow now clean cooking facilities access for a larger share of population. Better energy access means a significant improvement of living standards and health: previously the 'energy poor' relied on oil based lighting sources such as kerosene lamps which were costly, inefficient and subjected to fire hazard, whereas indoor air pollution due to the use of coal, firewood and dung for cooking, lighting and heat caused in 2010 the death 1.6 people a year⁴³. The MDGs are more effectively reached where the provision of electricity services is accompanied by measures promoting micro credits and employment. In this scenario the diffusion of renewable energy technologies makes more efficient and cheaper the exploitation of renewable resources, but these remain obviously dependent on their uneven distribution in the different regions.

A general pattern is however observed, with hydro-power, wind, biomass giving the major contribution in the first decades of the 21st century, whereas, in a subsequent period, geothermal, photovoltaic and solar thermal takes the lion share of renewable energy, with a notable contribution of wave and tidal energies too⁴⁴. The second energy source is coal (16%) that is increasingly produced with CO₂ Capture and Conservation technology and with system for Coal Gasification Combined Cycle (IGCC). These technologies play a crucial role for the development of fast growing countries such as China, India, South Africa. On the ground of the new climate commitments, these countries heavily invest in order to create the substantial CCS infrastructures and successfully implement legal frameworks establishing the regulation, permitting, safety and liability issues.⁴⁵

Natural Gas played an important transitional role from carbon to post carbon technologies and in 2050 cover a 14,5% of the energy market. Nuclear power (11%) shows a limited growth in emerging economies and a slight decline in OECD countries. Research and investments focus on reactor safety, safe storage of spent fuel and irradiated material. Fusion technologies make a progress, but are still far from the commercial stage. Hydrogen is produced from off-peak electricity generated in nuclear plants, gas and in the most advanced countries by using biological agents (microbes/algae).⁴⁶ The development of hydrogen storage and distribution infrastructure contributes substantially to lower down the GHG emissions from the transport sector.

The combination of national and international measures for reducing energy demand as well as for decarbonising energy production reduces drastically GHG Emissions. However, climate change effects are perceived by the most vulnerable countries, and adaptation policies need to be implemented by a large number of countries.

⁴³ In 2010, more than 1.4 billion people worldwide lack access to electricity: 585 million in Sub-Saharan Africa (including 76 million in Nigeria, and 69 million in Ethiopia) and most of the rest in developing Asia (including 400 Million in India and 96 million in Bangladesh). Some 85% of those beyond access live in rural areas. IEA, UNDP, UNIDO *'Energy Poverty :How to make modern energy access universal?'*, 2010

⁴⁴ A comparison of the Renewable Energy National Action Plans (NREAP) submitted by EU countries in 2010 highlight as the majority of countries rely on biomass, hydro and wind to reach the 2020 renewable energy targets. JRC *'Renewable Energy Snapshots'*, 2010.

⁴⁵ Shell international BV *'Shell Energy Scenarios to 2050'*, 2008

⁴⁶ IEA *'Energy Technology Perspectives, Scenarios & Strategies to 2050'*, 2008

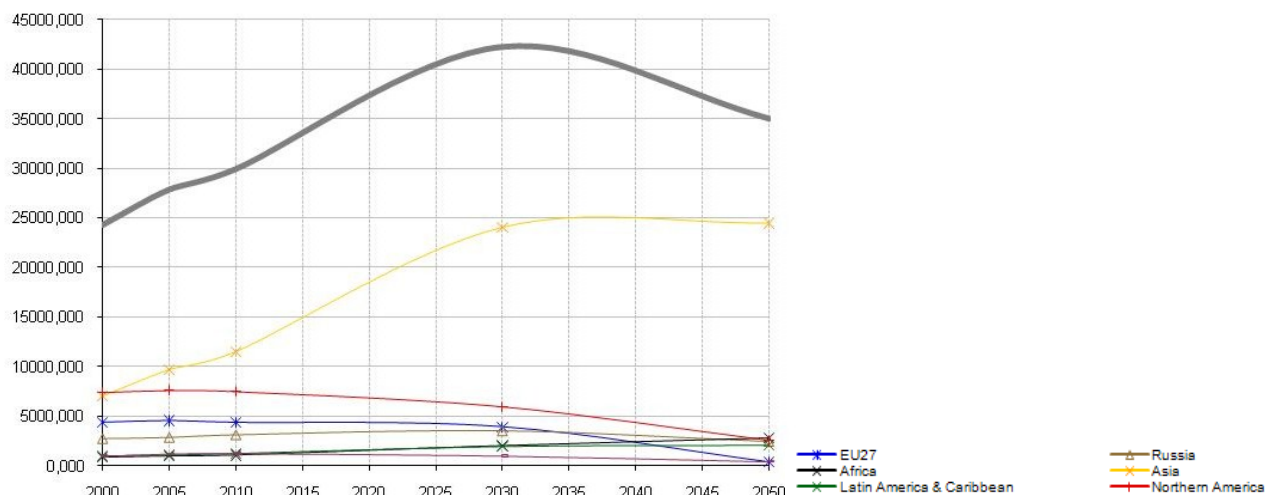


Figure 6 Growth within limits - CO2 Emissions (Millions tones)

5.3.3 Changes in rural land use and biodiversity: sustainable land management

Given the increase in global population, food production inevitably increases in this scenario. However, further increases in yield, the reduction of post-harvest losses, dietary changes towards less animal protein intensive consumption lead to the required reduction in the land claimed for agriculture. In 2010 meat consumption was responsible for the use of 80% of global agricultural land. As the average meat consumption in high-income countries is above an healthy level, a transition towards less meat-intensive diets is assumed to be the most effective way of reducing demand for land, with the shift spurred off from an increase in price coupled with the adoption of more sustainable lifestyle and diets.

In this scenario – as compared with the “Growth without limits” one - there is a less pronounced migration from the rural to urban areas. The diffusion of sustainable agriculture and land management projects in developing countries allow the creation of new rural jobs, reduce poverty and enhance the rural community cultures. The success in implementing climate change mitigation and adaption policies contribute to reduce climate change impacts, thus limiting the forced migration from rural areas.

The international trade framework is not overhauled as in the “beyond growth” scenario (see chapter ...). However, international cooperation is reshaped for reaching the goal of reducing GHG emission, and the private sector is increasingly forced to adopt rigorous sustainability standards. The

Green Box Subsidies

“The remedy that is normally suggested to stop the North generating and dumping surpluses and reduce the impact of its overly intensive agricultural methods is to decouple subsidies from production levels and use them instead to support a range of environmental and rural development schemes. On the face of it, these reforms appear to be an obvious means of removing incentives for overproduction and limiting environmentally damaging farming practices. Despite resistance from some EU member states such as Germany and France, the pressure to reform the Common Agricultural Policy (CAP) along these lines has been mounting over the years. A reform package was finally announced in June 2003, which promised some reductions in price support, a partial decoupling of subsidies from production levels and the amalgamation of the CAP’s complex system of product specific subsidies into a “single farm payment”. The payments will be related to farm size and conditional on “cross-compliance” with a list of 18 environmental, food safety and animal welfare objectives.”

Michael Woodin and Caroline Lucas, ‘Green Alternatives to Globalization: A Manifesto’, Pluto Press, 2004.

WTO Trade Treaties are reviewed in order to embody the precautionary principle in its rules and to permit trade restrictions based on the grounds of environmental considerations. A step further is the alignment of WTO Treaties and Multilateral Environmental Treaties (MEAs), whose compliance is greatly increased since the establishment World Environment Organization (WEO). The WEO integrates for the first time the decision making process of existing regimes in order to form common 'world environmental rounds' and, then, provides a world dispute settlement body and the common legal regime across a range of environmental issues⁴⁷. Among the others measures implemented is the transformation of the EU and USA subsidies to agriculture to "green box" subsidies, strictly directed to organic agriculture and nature conservation (see box).

New effective instruments implemented in the context of the Convention on Biological Diversity (CDB) and the Kyoto Protocol - among which the provision of financial compensation for supporting the Reduction of Deforestation and Degradation and enhancement of forest carbon stocks in developing countries (REDD+)⁴⁸ - complete the framework. A Green Development Mechanism (GDM), set up in the post-Kyoto climate regime, builds up on the experiences with the Clean Development Mechanism (CDM). Similarly to the CDM, the Mechanism aims at providing financial payments for verified emissions reductions from forested lands management and offers incentives to invest in low carbon paths. Under the GDM eligible projects are those concerning preservation and conservation of forest, sustainable land management and enhancement of forest carbon stocks, and the use of land for small and/or organic farming. These new instruments greatly facilitate the transfer of financial resources, technologies and capacity building from developed countries to biodiversity rich developing countries. The combination of market based instruments and environmental regulations stimulates a broader set of ecological property rights regimes that encourages business, states and individuals to adjust their practice and consumption. The rise of an effective international environmental regime favors the greening of the supply chain where more attention is dedicated to food and products produced with biodiversity land management practices, and engaging the local communities.

Beside sustainable forest management and eco-agriculture, the green development strategy includes a wide array of initiatives to improve biodiversity, such as the promotion of bio-mimicry, sustainable fisheries, aquaculture, payments for watershed protection, bio-prospecting for genetic resources, habitat banking, biodiversity management services, sport hunting and fishing, and ecotourism as part of a broader concept of economic development. The main challenge is to keep the biodiversity goals while improving the food security for a growing population. As shown in the table below, the agricultural land remains stable at 12% over the total land, however, an increased productivity is achieved by filling the so-called yield gap in low income countries through the improvements of the agricultural inputs and the diffusion of appropriate technologies and management practices.

In the "growth within limits" scenario – contrary to the "growth without limits" scenario which relies massively on biotechnology and GMOs - the production improvements are pursued in compliance with environmental goals and with a policy process which actively engage farmers and indigenous population. The increase of agricultural productivity is mostly achieved through the extension of improved land use practices to small holder farmers in developing countries, including integrated crop management. As reported in UNCTAD- UNEP Report 'Organic Agriculture in Africa' these practices are able to produce improvements on different, and equally important, levels: they increase both the amount of food produced and the yields of food crops/livestock, produce benefits for the natural environment (soils, water, fertility) and have positive impacts on social and human capital by

⁴⁷ Sebastian Oberthür; Thomas Gehring 'Reforming International Environmental Governance: An Institutionalism Critique of the Proposal for a World Environment Organisation' International Environmental Agreements, Volume 4, Number 4 2004

⁴⁸ UN REDD Programme <http://www.un-redd.org/AboutREDD/tabid/582/Default.aspx>

enhancing community cooperation and the knowledge, skills and health of farmers. Furthermore, sustainable agriculture projects contribute to raise farmers income, by improving their access to the food markets⁴⁹.

Table 14 Growth within limits - Land Use Agricultural land (% over total)

Landuses. Agricultural land (% over total)	Trend line			Growth within limits	
	2010	2030	2050	2030	2050
EU27	29%	30,33%	29,94%	29,35%	28,72%
Russia	8%	7,96%	7,86%	7,70%	7,54%
Africa	8%	8,94%	8,82%	8,65%	8,46%
Asia	17%	18,48%	18,24%	17,88%	17,49%
Latin America & Caribbean	8%	8,87%	8,75%	8,58%	8,40%
Northern America	12%	12,76%	12,60%	12,35%	12,08%
Oceania	5%	5,79%	5,71%	5,60%	5,48%
World	12%	12,40%	12,24%	12%	12%

The increase of funding for land management promotes the exchange of knowledge and technologies (including an however limited GM production) among developed and developing countries. More support to agricultural R&D and agricultural knowledge extension programmes may lead to a 40% increase in the yield improvements rate with respect to the 2010 level, and a 60% increase if accompanied by the complementary implementation of policies directed to improve irrigation, drinking water supply and education. The rise of rural communities and networks can stimulate the construction of infrastructures such as transport systems, irrigation systems, water supply and promote the use of information communication technologies.

The productivity is increased also through the reduction of post harvest losses. Estimates for the year 2010 show that losses vary from 2 and 23% from production to retail sites for developed countries, depending on the commodities, and grow up to 50% in developing countries. A number of measures are introduced with green policies implemented at regional and local level, to drastically reduce the post harvest losses: enhancing knowledge of farmers on timing of harvests, improvements of storage practices and infrastructure from field to market, and raising consumers awareness.⁵⁰

In a nutshell, the “growth within limits” scenario envisions the development of a more diversified agriculture. Mono-cropping farming systems for the export market maintain an important share, but they are not as dominant as in the ‘growth without limits’ scenario. A limited trend of agricultural intensification with the use of genetically modified crops, locally engineered, is only registered in eastern Europe, Latin America, Asia.

⁴⁹ UNCTAD – UNEP ‘Organic Agriculture and Food Security in Africa’, 2004.

⁵⁰ Club of Rome ‘Growing within limits’ A Report to the Global Assembly 2009 of the Club of Rome’, 2009.

5.4 Global stagnation and conflicts in a resource constrained world

The scenario is a rather darker one, featuring a period of global stagnation followed by a scenario of “**decarbonised dystopia**” pushed by a delayed response to climate change and global environmental resource constraints.⁵¹

The financial crisis that began in 2008 is followed by a prolonged period of economic downturn and recurrent financial crises, whose main effect is to force companies and financial investors into even shorter time-frames for securing returns on their investments rather than taking a risk on buying into longer-term decarbonised scenarios. The Kyoto regime is not immediately followed by any other international carbon regulation regime, and the focus returns to more cautious and predictable source of funding and corporate strategy oriented towards keeping the fossil fuels economy buoyant for as long as possible. Governments cease to invest therefore in carbon markets and the aggressive targets that might sustain interest in them do not materialise. Pressures to prioritise support to “old manufacturing” – such as car companies – or to resist to “new deal” demands for a windfall tax on oil and gas companies, especially in time of financial crisis, are heeded and pressure on these sectors to reform dissipates. Carbon markets remain and the voluntary offset market in particular continues to serve a niche market, but they remain small and do not produce any transformational effects on carbon emissions.

In the debates about what to replace Kyoto with, the U.S. gets fixated with making sure that whatever regime exists, it looks like an American-led one, as opposed to the “Euro-centric” regime which Kyoto had come to be seen in the USA. So the results become an incoherent mess rather than an expanded, coherent architecture. Similarly, the North-South struggles that have characterised climate negotiations since the beginning continue in stalemate. Developing countries, even rapidly developing ones like China, continue to refuse any sort of limitation on their expansion of fossil energy use, and the U.S. correspondingly refuses to set any ambitious targets for itself. No one finds creative ways round this impasse. As the carbon markets falter, shareholders activists and NGOs fail to persuade investors that they should be more proactive or companies to see climate change as central aspect of Corporate Social Responsibility, since fossil fuels remain too cheap and ubiquitous for investors and business to ignore. Efforts by environmental NGOs to forge coalitions with different parts of business as a consequence largely fail.

As climate change itself progresses, periodic crises from hurricanes, sea-level rise, droughts and the large-scale movement of climate refugees serve to keep climate change on the agenda. The response of the insurance industry is to withdraw coverage from ever more areas of the world, rather than use its power to invest in renewable energy. Some efforts are made to mitigate carbon emissions, and countries do manage to depart from the “business-as-usual” emission path, but there is nothing like the coherence, in the way these efforts combine, necessary to turn them into something which could create the transformational effect to decarbonise the global economy seen in the “growth within limits” scenario.

Cynicism and fatalism starts to set in about the possibility of doing anything except adapt to whatever climate change has to offer. However, the recurrent climate impacts of ever greater magnitude start

⁵¹ The scenario narrative is based on “Scenario 2 – Stagnation” and “Scenario 3 – Decarbonised dystopia” presented in P. Newell, M. Paterson, 2010.

eventually to provoke panic measures. Urgency is invoked to legitimise the implementation of the fantasies of a number of scientists – to install large mirrors in the sky which reflect back incoming radiation from the sun, to spread iron filings in the ocean to accelerate the rate at which the sea absorbs CO₂, to artificially create cloud cover, etc.. The rising price of carbon helps to make these measures seem reasonable, while the military supports such measures, having interpreted climate change as a security threat needing such a response, and fears about climate-induced immigration fuel populist measures by governments.

In terms of investments which produce decarbonisation in this dystopian scenario, money pours into biofuels both in the North and in the South, producing large mono-crop plantations with appalling working conditions, the destruction of biodiversity, and price rises of key food crops which place them beyond the reach of the poor. Biotech companies realise that carbon markets are a means to sell the genetically modified (GM) trees that they have already cultivated, which grow much faster than conventional trees and are able to absorb considerably more CO₂ and over longer periods of time, while drought-resistant GM crops are held out as a solution for farmers seeking to adapt to the consequences of climate change. The rapid climate change, combined with the delay in deciding and implementing other mitigation measures, provides a window to roll out biotech on an unprecedented scale, as a main adaptation measure. Moreover, high carbon prices, rather than creating a wave of investment in renewable energy, help to boost the renaissance of nuclear energy as the solution to climate change in a carbon-constrained world. As in the past, new plants are sited predominantly in remote and poorer areas where the opposition can more easily overcome.

Alongside nuclear, most investment goes into carbon capture and storage (CCS). The lack of investment in renewable energy means the benefits of decarbonisation in developing countries are not realised. The spread of small-scale, decentralised technologies, not requiring an elaborate electricity grid, which could radically increase access to electricity services among the rural poor, does not occur. Micro-energy projects at the village level to meet local basic needs (rather than fuel a new consumer class in countries like India and China) fall by the way-side. Instead, developing countries get large-scale investments in coal plants with CCS and in nuclear, benefiting primarily urban elites and large transnational business.

The development of the Clean Development Mechanism end up locking most developing countries precisely into a dynamic of carbon colonialism. The large powerful ones – China, India and Brazil in particular – are able to insulate themselves from this dynamic, or rather their elites are able not only to insulate themselves, but rather to profit from it, increasing both their wealth and power relative to the rest of their societies. Investment through the CDM still predominantly goes to a handful of countries, and more low-hanging fruit such as hydrofluorocarbon or methane capture projects are found. Reforms of the CDM open up much greater possibilities for forestry projects, which lock large areas of the developing world into the status of being a heritage park for carbon sequestration or host to large-scale forest plantations. Those inhabiting forest areas that attract money from carbon finance are driven off the land their ancestors have occupied for centuries in a rush to cut emissions and make money whatever the social cost. The voluntary carbon offset market similarly increases its focus on forestry projects. Large populations in the South become therefore increasingly consigned in the role of guarding forests, while people in the North continue to enjoy high-consumption lives.

Governments shift the burden of implementing carbon cuts squarely onto individuals. Personal Carbon Allowances (PCA) schemes proliferate, but end up operating more as surveillance schemes, enabling the state to monitor personal behaviour ever more intensively, rather than produce egalitarian outcomes. The rich manage to buy up extra credits easily, following the well-known maxim that “the poor sell cheap”. The poor get locked ever further into fuel poverty, decarboinising through not

consuming, selling surplus allowances for a pittance while experiencing lives that are more and more intrusively monitored.

In this scenario, environmental NGOs are largely co-opted into a world ruled by global finance. Elites in the South are also co-opted into this ruling coalition, bought off by creaming off the benefits of large-scale projects and the political pay-off of the power that these bring. We assist therefore in this scenario to the extension of neoliberalism that has operated for the most part to date – highly inegalitarian, creating great vulnerabilities for those on the economic margins and concentrating wealth and power in the hands of few. Carbon markets do, however, ultimately deliver real reductions in the overall GHG emissions, but in ways which do not spread benefits beyond the core of the carbon economy.

This is a world in which the insurance industry responds to rises in climate-related damage by withdrawing cover from people living in vulnerable and fragile environments, in which inequalities associated with fuel poverty are exacerbated as prices rise, but no redistribution is forthcoming. Climate refugees are correspondingly treated with contempt, either refused access at all or held in camps for years as “illegal aliens”.

The following tables show the key scenario’s features at a glance, by giving:

- The values of key variables in 2010, the projection of current trends at the 2050 horizon (trendline), and the values considered for the turbulent decline scenario in the WP1 meta-model analysis (Table 15);
- The assumptions of drivers evolution considered in the Delphi Survey (Table 16).

Table 15 : The Vital signs in ‘Turbulent Decline’

VITAL SIGNS		2010	Trendline (2050)	Turbulent decline
Population	(million inhabitants)	6910	9214	10988
Settlements: Urban society	(% of people living in cities)	50%	69%	76%
Rural land overexploitation	Arable (% over total land)	12%	12%	13%
	Meadows (% over total land)	26%	26%	26%
	Forests (% over total land)	31%	30%	27%
	Biofuels (% over total land)	0%	4%	2%
	Other (% over total land)	31%	28%	32%
Technology	(% of R&D investment over GDP)	1,9%	2,0%	1,0%
GDP	(2010 = 100)	100	311	162
Wealth disparities	(GDP/capita dispersion relative to mean)	2,3	1,7	2,3
Energy consumption	(MTOE, 2010 = 100)	100	238	170
Transport		100	With economy	With economy
Climate change	(Mtones CO ₂ , 2010=100)	100	213	163
Biodiversity	(% yearly change in the number of species)	-0,07%	-0,08%	-0,34%
Governance	(forms of government)	93 democracies, 50 anocracies, 20 autocracies	130 democracies	60 autocracies

Table 16 The scheme of drivers evolution in the ‘Turbulent Decline’

	Trend 2010-2050	Scenario snapshot 2050	Rate of change
Population	↑↑↑↑	11.000 millions in 2050 concentrated in less developed areas	Population yearly growth rates from 1'3% in 2010 to 1% in 2030 and back to 1'3% in 2050
Settlements: Urban society	↑↑	From 50% urban population in 2010 to 74% in 2050.	120 million urban residents more per year between 2010 and 2050.
Rural land overexploitation	↑↑	Land for bioenergy production 250 mil.ha in 2050 (2% global land)	1% increase in agricultural land, 1% decrease in forests.
Technology	↔	- Emotion control devices - Telepathy - Immersive virtual-reality worlds -Self-designed babies	From 1'5% GDP devoted to R&D investment in 2010 to 0'5% GDP
GDP	↓↓	- Global GDP in 2050, 25% lower than 2010. - 0'5% of world population holds 95% of global wealth	-0'5% GDP yearly growth rate for developed regions, -1% for developing, +5% for some microstates.
Energy consumption	↔	Energy yearly consumption in 2050 is the 75% as in 2010's.	Energy intensity yearly decrease (Δ energy/GDP) from -0'8% in 2010 to -1% in 2030 but back to +1% in 2050
Transport	↓	Transport drops due to drops in GDP, difficulties in long-distance travel and energy shortage	Decreases at the rate of economy.
Climate change	↔	World GHG emissions in 2050 are 15% lower than in 2010	Emission factors yearly decrease (Δ emission/energy) from -0'3% yearly to -0'5% in 2030 but back to +1% in 2050.
Biodiversity	↓	Biodiversity is threatened due to turbulent times and little social awareness	30.000 species disappear per year
Governance	↓↓	Fragmentation of nations. Nationalisms. Conflicts due to resource scarcity	10 new micronations and city-states per year between 2010 and 2050

5.5 Global transition towards a “beyond-growth” society

5.5.1 Fundamental reasons underpinning the transition

The scenario features a global shift towards a **new economic, social and cultural paradigm of prosperity and well being**.

To put this shift in context, we need to start from the current dominant worldviews and institutions. They emerge from the early industrial revolution, when the world was still relatively empty of humans and their built infrastructure. Current ideas about what is desirable and what is possible were forged therefore in an “**empty-world**” context. Cheap fossil fuels have provided the abundant energy necessary to economic growth over two centuries – first in the “western” world and then in the new emergent economies of China, India and other developing countries - and helped societies overcome numerous resource constraints. As a result, the world is changed now dramatically, becoming a “**full world**”, where increasingly complex technologies and institutions, mounting resource constraints, and a decreasing energy return on investment have made human society more brittle. Prevailing worldviews, institutions and technologies are failing to meet humanity’s needs in a rapidly changing world. This failure is increasingly acknowledged, calling for a new regime of collective institutions to govern the planet Earth as a common pool of resources available to the humankind, not as an unlimited reserve of resources.

Three fundamental reasons why the current regime of economic growth fails to serve humanity in a full-world context are becoming increasingly clear, and shared by leading intellectuals, policy makers and social leaders. These reasons lag behind the change towards a new welfare society - that we assume will start as soon as will be realized that the protracted financial, economic and ecological crisis, started in the year 2008, can be solved only with an epochal shift to a new global regime:⁵²

- The first reason is that unlimited increases in resource and energy use are physically impossible on a finite planet. The ecological capacity of Earth is not expanding, while humanity’s footprint is. The traditional economics view that prosperity can be only achieved with a perpetual growth model is challenged, due to the natural world limits. The need for a fundamental rethinking of modern economics and business model is perhaps most eloquently put by Paul Hawken, Amory Lovins and Hunter Lovins in their book *Natural Capitalism*. All economic production requires the transformation of raw materials and energy, making these inputs less available to serve as the structural building blocks of the ecosystems that provide life-support services for all living species. The use of fossil fuels not only depletes a non renewable resource, it also creates waste emissions that further degrade ecosystem function;
- The second reason is that unlimited increases in resource and energy use do not continue to increase well being. Unlimited conventional economic growth, measured with the growth in GDP, is not only impossible. It is undesirable. GDP measures marketed income, not welfare. The experience of US and the Western society shows that beyond a certain GDP per capita threshold, life satisfaction does not growth, and even declines, as per capita income continue to grow. What is really needed is to provide satisfying lives with less economic activity, raw materials, energy, and work required. When GDP rises faster than life satisfaction, this

⁵² These three reasons are clearly stated in the contribution of Robert Costanza, Joshua Farley and Ida Kubiszewski to the Worldwatch Institute *State of the World 2010* report.

efficiency declines. For affluent (in GDP terms) societies lower GDP growth – no growth or even de-growth – would not make people worse off but would instead lower resource depletion, energy use, and ecological impacts. People would be better off because they would have more time and resources to invest in public, non-consumption goods produced by natural and social capital. The challenge is therefore how to get started on a new course. Obviously nobody can expect that still not affluent (in GDP terms) societies as the China and India giant economies take the initiatives on non-growth thinking, as fast industrialization and GDP growth is currently the key mantra for their societies. However, there are already signals of growing inequality and decoupling from life satisfaction in China, and the Indian society is still heavily based on different norms, values and visions, well represented by the Mahatma Gandhi's thoughts.⁵³ If it looks rather unlikely that any major industrial country can lead the way towards a “beyond growth” society, a rich, well-educated group of countries eventually can. For instance, Scandinavia in Europe, with a small population and ample resources, is leading the way, demonstrating the feasibility of a vision of what the good life in a “beyond growth” economy would look like: less hours worked, less stuff, less stress, more time with family and friends, more time for civic engagement, more leisure. This can function as a model for future society to which other less affluent regions and cultures around the world may be able to gradually converge in the longer-term, with obvious differences and adaptations required by the different geographical, environmental and cultural contexts;

- The third reason is that global market institutions enhance economic growth but are poorly adapted to the need of pursuing prosperity and well being in a full-world context. Market institutions deal well only with private goods and services, but they often provide these at the expense of public goods and services – such as education, infrastructure, public health, and ecosystems services – that would most significantly improve quality of life. In the global market regime, many governments adopt neoliberal policies that promote growth in market goods at the expense of non-market, common goods that are generated by healthy ecosystems. An alternative regime recognizes instead these market failures, calling for collective institutions to govern the planet Earth as a *common pool of resources* available to the humankind, not as an unlimited reserve of resources.

In the “full world” context, the whole planet Earth should be seen as a package of interdependent natural and man-made resource systems. Any resource system in this package is provided by some kind of institution – a firm, a national, regional or local institution or collective institutions and rules of self-governance – with the support of “producers” – i.e. anyone who actually constructs, repair or takes actions that ensure the long-term sustenance of the resource system itself. To govern any single resource system – and the whole package as well – there is the need of a new regime of collective institutions which can help to establish a fair, orderly, and efficient method of allocating resource units. Otherwise the users of any single resource system – and the humanity for the whole planet Earth as well – will have little motivation to contribute to the continued provision and maintenance of the system itself. Aside a new governance regime, a new cultural paradigm should emerge to adapt to a full world context, whereby people will start to see themselves as multiple users dependent for their living on a given set of natural and man-made common pool of resources⁵⁴, and as such jointly affected by almost everything they did, rather than dependent only on the individual consumption of increasingly superfluous goods and services. Each individual – in this new paradigm – should increasingly take into account also the choices of others when assessing personal choices.

⁵³ See M. Gandhi, *Hind Swaraj and Other Writings*, New Delhi, Cambridge University Press, 1997.

⁵⁴ The concept of “man-made” common pool resources may be enlarged to include not only infrastructures but also common pools of human and knowledge capital.

5.5.2 The main avenues of change towards a beyond growth society

The transition envisaged in the beyond growth scenario can be seeded and stimulated through the action of the following five avenues or “pillars of change”:⁵⁵

1. Redefine well being and sustainability metrics.
2. Reduce complexity, increase resilience and spread a new paradigm of “nature” technology.
3. Expand the “commons sector”.
4. Use the Internet to remove communication barriers, improve democracy and enable a new model of social production.
5. Ensure the well being of populations during the transition.

5.5.2.1 *Redefine well being and sustainability metrics*

In the full world context, it is recognized that the goal of an economy is to sustainably improve human well being and quality of life. Material consumption and GDP are merely means to that end, not ends in themselves. Such reorientation leads to specific tasks. For a start, efforts are made in the scientific and policy communities to identify what actually contributes to human well being and include the substantial contribution of natural and social capital, both of which are increasingly under stress. A more clear distinction is done between real poverty (in terms of low quality of life) and merely low monetary income. Many effort underway since the 20th century to develop better well being measures will eventually succeed, providing and building international consensus over an operational set of alternative measures of prosperity, well being and sustainability (see box). A new frame is set up to account features of well-being “**beyond GDP**”, including self-production and services rendered by nature, taking into account the realities that do not pass through the market or get irrelevant evaluation by a market. The analysis of saturations (e.g. traffic, overexploitation of land, etc) and compulsory expenses is also developed in order to offer a better evaluation of citizens’ quality of life.

“What we measure affects what we do”: State of the art and prospects of measuring progress beyond GDP

“Whatever you may think progress looks like – a rebounding stock market, a new house, a good raise – the governments of the world have long held the view that only one statistic, the measure of gross domestic product, can really show whether things seem to be getting better or getting worse. GDP is an index of a country’s entire economic output – a tally of, among many other things, manufacturers’ shipments, farmer harvests, retail sales and construction spending.”

“For decades, academics and gadflies have been critical of the measure, suggesting that is an inaccurate and misleading gauge of prosperity. What has changed more recently is that GDP has been actively challenged by a variety of world leaders, especially in Europe, as well as by a number of international groups, like the OECD. Simon Kuznet, the inventor of so-called national accounts in the 1930s, actually worried that the nation’s economic activity might be mistaken for its citizens’ well being. Most criticism of GDP have tended to fall into two distinct groups. The first group maintains the GDP itself need to be fixed. This might entail, for starters, placing an economic value on work done in the home, like housekeeping and child care. Activities that are currently unaccounted for, like cooking dinner at your own stove, could also be treated the same as activities that are now factored into GDP, like food prepared in a restaurant. Another fix might be to cease giving only positive values to events that actually detract from country’s well-being, like hurricanes and floods; both boost GDP through construction costs. The second groups of critics, meanwhile, has sought to recast the criticism of GDP from an accounting debate to a philosophical one. The argument goes like this: Even if GDP was revised as more modern, logical “GDP 2.0”, our reliance on such a measure suggests that we may still be equating economic growth with progress on a planet that is possibly overburdened already by human consumption and pollution. The only way to repair such an imbalance would be to institutionalize other national indicators (environmental, say, or health related”) to reflect the true complexity of human progress. Just how many indicators are required to assess societal health – 3? 30? 300? – is something economists have been struggling with for years as well”. So far only one measure has succeeded in challenging the hegemony of growth-centric thinking. This is known as the Human Development Index (HDI), which turns 20 this year. The HDI is a ranking that incorporates a nation’s GDP and two other modifying factors: its citizens’ education, based on adult literacy and school-enrollment data, and its citizens’ health, based on life-expectancy statistics. The HDI, however, which happens to be used by the United Nations, has plenty of critics. For example, its three-part weightings are frequently criticized for being arbitrary; another problem is that minor variations in the literacy rates of developed nations, for example, can yield significant differences in how the countries rank.”

"One economist who helped create the HDI was Amartya Sen, a Nobel laureate in economics who teaches at Harvard. When I met with Sen on a recent evening in New York (...) Sen told me he thinks the index has been extremely useful for tracking the progress of the world's poorer nations. But since its debut in 1990, Sen said, the world has changed. There are much better survey data now, which allow for new types of economic and social measurement. What's more, he added, the problems associated with climate change and sustainability have become far more pressing. These were two of the reasons that, a couple of years ago, Sen joined the Nobel laureate Joseph Stiglitz and the French economist Jean-Paul Fitoussi on a commission established by President Nicolas Sarkozy of France to consider alternatives to GDP." (...) "The Stiglitz-Sen-Fitoussi Commission, as it eventually came to be known – its official title was the Commission on the Measurement of Economic Performance and Social Progress – grew to about two dozen members and met in Europe and the US several times in 2008 and 2009. (...) *We very quickly came to a consensus that you weren't going to get one number for a new GDP number, but that it would have been nice*, Stiglitz told me. In fact, the commission endorsed both main criticisms of the GDP: the economic measure itself should be fixed to better represent individuals' circumstances today, and every country should also apply other indicators to capture what is happening economically, socially and environmentally. (...) The question is: How many measures beyond GDP – how many dials on a new dashboard – will you need? Stiglitz and his fellow academics ultimately concluded that assessing a population's quality of life will require metrics from at least seven categories: health, education, environment, employment, material well-being, interpersonal connectedness and political engagement. They also decided that any nation that was serious about progress should start measuring its "equity" – that is, the distribution of material wealth and other social goods – as well as its economic and environmental sustainability."

"Environmental and sustainability indicators offer a few good examples of how big the challenge is. A relatively easy first step, several members of the Stiglitz commission told me, would be to build in a "depletion charge" to GDP for the natural resources – oil, gas, timber and even fisheries – that a country transforms in dollars. At the moment, we don't do this; it's as if these commodities have no value until they are extracted and sold. Geoffrey Heal, a professor at Columbia who worked on the environmental aspects of the commission's report, told me that including resource depletion in the national accounts – something the U.S. considered in the early 1990s and then abandoned for political reasons – could be implemented within a year if the world's developed nations agreed to it. After that, he suggest, a next step might be to subtract from GDP the cost of the health problems – asthma and early deaths, for instance – caused by air pollutants like sulfur dioxide. But environmental accounting gets more difficult. *"We can put monetary values on mineral stocks, fisheries and even forests, perhaps"* Heals says. *"But it's hard to put a monetary value on the alteration of the climate system, loss of species and the consequences that might come from those"*. What the Stiglitz commission ultimately concluded was that it's necessary to make a few sustainability dials on the dashboard simply raw data – registering things like a country's carbon footprint or species extinctions – until we figure out how to give the effects approximate monetary values. May be in 10 years, Heal guesses, economists would be able to do that. To Heal, making a real and rapid effort at calculating these costs and then posting the information is imperative. According to Heal, we have no sense of how much "natural capital" – our stocks of clean air and water and our various ecosystems – we need to conserve to maintain our economy and our quality of life. *"If you push the world's natural capital below a certain level,"* Heal asks, *"do you so radically alter the system that it has a long-term impact on human welfare?"* He doesn't know the answer. Yet, he adds, if we were to pass that point – and at present we have no dials to indicate whether we have – then we couldn't compensate for our error through technological innovation or energy breakthroughs. Because by then it would be too late."

"As difficult as it might be to compile sustainability indicators, it's equally challenging to create measures that describe our social and emotional lives. In this area, there is a fair amount of skepticism from the academic establishment about putting happiness onto a national dashboard of well-being. Stiglitz and his colleagues nevertheless concluded that such research was becoming sufficiently rigorous to warrant its possible inclusion. (...) Stiglitz pointed to the work of the Harvard professor Robert Putnam, who served on the Stiglitz-Sen-Fitoussi commission, which suggests that losing a job can have repercussions that affect a person's social connections (one main driver of human happiness, regardless of country) for many years afterwards. (...) When I asked Putnam whether government should be in the business of fostering social connections, he replied, *"I don't think we should have a government Department of Friendship that introduces people to one another"*. But he argued that just as registering the social toll of joblessness would add a dimension of urgency to the employment issue, it seemed possible that measuring social connections, and putting those measures on a national dashboard, could be in society's best interest. It seems conceivable, in fact, that including various measures of social connection and emotional well-being on a national dashboard could lead to policies quite different from what we have now. *"There is an enormous inequality of suffering in society,"* Daniel Kahneman told me recently. By his estimate, *"if you look at the 10 percent of people who spend the most time suffering, they account for almost half of the total amount of suffering"*. Kahneman suggested that tremendous social and economic gains could therefore be made by dealing with the mental-health problems – depression, say – of a relatively small fraction of the population. At the same time, he added, new measures of emotional well-being that he has been working on might soon give us a more enlightened perspective on the complex relationship between money and happiness. Currently, research suggests that increased wealth leads us to report increased feelings of satisfaction with our lives – a validation, in effect, that higher GDP increases the well-being in a country. But Kahneman told me that his most recent studies, conducted with the Princeton economist Angus Deaton, suggest that money doesn't necessarily make much of a difference in our moment-to-moment happiness, which is distinct from our feeling of satisfaction. According to their work, income over \$70000 does nothing to improve how much we enjoy our activities in a typical day." "Over the past few months, the recommendations of the Stiglitz-Sen-Fitoussi commission have been taken up for debate by the EU's statistical office as well as by the Paris-based OECD. To Stiglitz and his colleagues, an ideal outcome would be a consensus by these international agencies – and, in turn, the world's governments – to start measuring progress through a dashboard with a dozen or so dials, moving the focus away from GDP and onto other aspects of the economy, society and environment."

Jon Gertner, 'The Rise and Fall of the GDP', The New York Times, May 13, 2010.

5.5.2.2. **Reduce complexity, increase resilience and spread a new paradigm of “nature” technology**

History offers lessons about the collapse of societies as well as examples of successful adaptation.⁵⁶ While environmental factors often contribute to societal declines, it is cultural and institutional resiliency and adaptability that mostly influences a society's chances of survival. Resilience depends on cultural values as well as the ability of political, economic and social institutions to respond. Maintaining resilience in a full world definitively means shifting the emphasis away from growth, optimization and expansion towards resilient strategies, sufficiency and sustainable prosperity. A new eco-cultural paradigm emerges, changing the interaction between humans and nature, from “exploitation” to “gardening”. A gardener is a guard of nature. She/he is not running away, leaving the weed invading the garden. She/he accepts the responsibility of modeling nature and, this is the important point, she/he takes pleasure and accomplishment as an artist, because, ultimately, gardening is an art. This shift of paradigm implies, for instance, reshaping of the cities, common transportation, enormous water supply public works, greening the roofs and/or covering them with solar cells. It includes also reshaping of agriculture and fisheries, as well as of a number industrial activities. Planetary gardening returns to smaller units, but continuing to exploit the inputs of science in the sustainable management of ecosystems. The key breakthrough is starting to mimicking the way nature works in the technological production, not simply using natural resources to feed energy-intensive and waste-emitting processes. Indeed, production can be based on three key operating principles of the natural world that allow business to apply the intelligence of natural system to human artifice:

- **Waste equals food:** In nature, the processes of every organism contribute to the health of the whole. One organism's waste becomes food for another, and nutrients flow perpetually in regenerative, cradle-to-cradle cycles of birth, death, decay, and rebirth. Design modeled on this virtuous cycles eliminates the very concept of waste: products and materials can be designed of components that return either to soil as a nutrient or to industry for remanufacture at the same or even a higher level of quality.
- **Use current solar income:** Nature's cradle-to-cradle cycles are powered by the energy of the sun. Trees and plants manufacture food from sunlight – an elegant, effective system that uses Earth's only perpetual source of energy income. The wind, a thermal flow fueled by sunlight, can be tapped and along with direct solar collection can generate enough power to meet the energy needs of entire cities and regions.
- **Celebrate diversity:** Healthy ecosystems are complex communities of living things, each of which has developed a unique response to its surroundings that work in concert with other organisms to sustain the system. Each organism fits in its place, and in each system the most fitting survive. Abundant diversity is the source of an ecosystem's strength and resilience. Business can celebrate the diversity of regional landscapes and cultures and grow even more effective as they do so.

With these three principles in mind, the goal of cradle-to-cradle design is a delightfully diverse, safe, healthy, and just world, with clean air, water, soil, and power – economically, equitably, ecologically, and elegantly enjoyed. Following this cradle-to-cradle approach, a new business model and nature technology paradigm to cope with the times of crisis is proposed in the Gunter Pauli book “**The Blue Economy**”, named Report to the Club of Rome for the year 2010 (see box below)⁵⁷.

⁵⁶ Main sources include: Jared Diamond, ‘*Collapse: How Societies Choose to Fail or Succeed*’, New York, Viking, 2005; Robert Costanza, Lisa J. Graumlich and Will L. Steffen, eds., ‘*Sustainability or Collapse? An Integrated History and Future of People on Earth*’, Cambridge MA: The MIT Press, 2007.

⁵⁷ Gunter Pauli, ‘*The Blue Economy: 10 Years, 100 Innovations, 100 Million Jobs*’, Report to the Club of Rome, Paradigm Publications, 2010.

The Blue Economy: cultivating a new business model

"Up to now, the model driving our economies depended on perpetual growth, requiring ever more resources and investments. This model has inherent flaws. It leads to unjust societies, highly skewed and exploitative economies, and devastated ecosystems. The business model that defines corporate environmental responsibility in terms of size of investment, and defines corporate success as increased shareholder value and grandiose executive compensation, must be replaced. The new economy must be more effective and more collaborative. It must become truly sustainable, introducing innovations that permit less investment, generate more revenues, and build the strengths of a community and builds up social capital – not debt. This is the business framework that will drive the new Blue Economy. This is the framework that will seek out and define true sustainability for all living species on Earth."

"The prevailing economic model predicates that scarcity is the major limitation. Industry searches for ever higher agricultural yields and manufactory outputs, demanding that the Earth and human labor produce more. We must re-evaluate this notion and begin to more fully utilize what the Earth and labor produce, rather than demanding more materials and more output. It is time to end the insatiable quest for ever lower costs that drives business towards economies of scale through megamergers and acquisitions financed by billion dollar loans. It is time to adopt broad-based innovative strategies that generate multiple revenues and greater cash flows while creating more jobs. It is time for a Blue Economy."

"The shift from the model of core businesses based on a single core competence and economies of scale to a framework of multiple businesses with aligned economies of scope may sound unrealistic to the executive trained by any leading business school. However, the current global crisis highlights the need for an framework of economic development that is based on fundamental innovation and that will generate desperately needed jobs while sustainably addressing the needs of the earth and all its citizens. This "blue" approach is not only viable, it has already begun to take root. Four years of research has identified a portfolio of 100 innovations including whole systems models that have the potential to generate as many as 100 million jobs worldwide over the next 10 years."

"The first set of innovations, all proven and benchmarked at a remarkable scale, cascade nutrients and energy the way ecosystems do. This means that everything contributes according to its capacity, and everything stays in the nutrient stream – even waste is not wasted. Instead of contrived scarcity and shortages, what we see in the new economic framework is abundance – of food, energy, jobs, and revenue."

"The new "blue" business framework will work with what is locally available to generate multiple revenues and respond to basic needs. This mirrors the evolutionary path of nature. Indeed, just as ecosystems evolved to ever more efficient nutrient and energy cycles, bringing ever more diversity while developing resilience, flexibility, and performance, the Blue Economy will increasingly rely on less energy and provide more diversity through innovations brought to the market by ever more entrepreneurs fortified with a vision of real sustainability and prepared to take the risks. More players will be encouraged to respond to critical needs, linking the triangle of innovation, sustainability, and entrepreneurship away from scarcity and into abundance. Debt becomes social capital, external costs become opportunities to differentiate on the market."

"Re-imagining our economic future requires entrepreneurs in science, social affairs, business, environment, and culture. The incapacity to imagine meaningful jobs and to provide worthy challenges to a whole generation equates to telling the young that there is no future for them, that their generation is lost. With over one billion young people entering the labor market in the next decade, we must move toward a Blue Economy, based on what we have and what we can share with those who have not."

Gunter Pauli, *'The Blue Economy: Cultivating a New Business Model for a Time of Crisis'*, 2010.

The key of this new business model is not simply to rebalance the relationship between human activities and technologies and the natural environment on the Earth, but really for humanity to start to work as the nature works, recycling a cascade of residuals of humans' production as the natural ecosystem do with their cascades of nutrients and energy, abating and even zeroing emissions and waste. This was done in the past history at local scale - for instance with the silkworms production in China - but the paradigm shift would be now to do this at a global scale, connecting inherently local production processes, which mimic the ways ecosystems use energy and re-use waste to produce their outcomes, into global networks exploiting the same natural technology across the planet. In the beyond growth scenario we assume that the short list of 100 innovations presented in the Blue Economy perspective (together with many others that we cannot still envisage) are all successfully implemented, and they contribute to create 100 million of new jobs fairly distributed in the world, as claimed in the Pauli's report. This short list of 100 innovations draws inspiration from the ability of ecosystems to always evolve to higher levels of efficiency, to cascade nutrients and energy, to leave nothing to waste, to utilize the abilities of all contributors, and to respond to the basic needs of all.

5.5.2.3. Expand the “commons sector”

During the transition to a new regime, it is important to greatly expand the “commons sector” of the economy, the sector responsible for managing existing common assets and creating new ones. Some assets, such as resources created by nature or by society as a whole, should be held in common because this is more just. Other assets, such as information or ecosystems structures (for example, forests), should be held in common because it is more efficient. Still other assets, such as essential common-pool resources and public goods, should be held in common because this is more sustainable. One option for expanding the commons sector is to create “common asset trusts” at various scales. At a global scale, “climate Keynesianism”, a variant of climate capitalism considered in the low carbon economy scenario (see chapter 5.3), can help to create a **Earth Atmospheric Trust** which contributes to massively reduce global carbon emissions while also reducing poverty. More generally, common pool resources – already mentioned in the introduction to this scenario – should be clearly identified and properly managed (see box).

Common Pool Resources (CPRs)

The term “common pool resources” (CPR) refers to a natural or man-made resource system that is sufficiently large as to make it costly to exclude potentially beneficiaries from obtaining benefits from its use. Resource systems - fishing grounds, groundwater basins, grazing areas, irrigation canals, bridge and road infrastructure, urban roads and spaces, mainframe computers, streams, lakes, oceans and other bodies of water, to name a few - are best thought of as stock variables (natural or man-made capital) that are capable, under favorable conditions, of producing a maximum quantity of a flow variable (resource units) without harming the stock or the resource system itself. Resource units are appropriated by multiple users simultaneously or sequentially, according to open access or some other socially established rule.

The resource units themselves are not subject to joint use or appropriation. The fish harvested by one boat are not there for someone else. The water spread on one farmer’s fields cannot be spread onto someone else’s fields. Thus, *the resource units are not jointly used, but the resource system is subject to joint use*. This helps to draw a fundamental distinction between CPRs and purely public or collective goods. “Crowding effects” and “overuse” problems are chronic in CPR situations, but absent in regard to pure public goods (as for instance a meteorological information service, where one’s use of a weather forecast does not subtract from the availability of that forecast to others). The subtractability of the resource unit leads to the possibility of approaching the limit in the number of resource units produced by a CPR. When the CPR is a man-made structure, such as a bridge, approaching the limit of crossing units will lead to congestion. When the CPR is a biological resource, such as a fishery or a forest, approaching the limit of resource units not only may produce short-run crowding effects but also may destroy the capability of the resource itself to continue producing resource units. It is important to note that any investment done to improve the resource system produce a benefit which is simultaneously available to all users – and in this sense the resource system is a “common good” – as it is costly (and in some cases infeasible) to exclude single users from improvements made to the resource system itself. All users may benefit from maintenance performed on an irrigation canal, a bridge, or a computer system whether they contribute or not.

As a matter of fact, when users act freely and independently – the so-called open access rule of behavior - the total net benefits they obtain from the resource system usually is less than could have been achieved if they had coordinated their strategies in some way. This means, in practice, that as long as the users of a same common pool of resources stay “unorganized”, they cannot achieve a joint return as high as they could have received if they had organized in some way to undertake collective action.

There are basically three avenues for regulating the access to a limited pool of common resources: two of them were envisaged as the “only” alternatives to the tragedy of the open access to commons by Garret Hardin (cfr. Harding, G. 1968. *The Tragedy of the Commons*, Science, 162: 1243–8), being respectively what he called “a private enterprise system” (market ruling) on one hand or “socialism” (state ruling) on the other hand. A third way includes not a one fits for all solution – as both the privatization or the central regulation from a state authority are – but a range of empirical solutions of “self-government” that can be found in the real world. These solutions engage groups of actors (e.g. citizens, fishers, farmers, etc.) who are in an interdependent situation, in organizing and governing themselves, and building “bottom-up” institutions and rules of cooperation, sometime with the support of local authorities and, less frequently, fitting in a formal multi-governance framework.

Elinor Ostrom, ‘*Governing the Commons: The Evolution of Institutions for Collective Action*’, Cambridge University Press, 1991.

5.5.2.4. **Use the Internet to remove communication barriers, improve democracy and enable a new model of social production**

Unlike with television and other broadcast media, very low technological and financial barriers exist to establishing a presence on the Internet. This has the effect of decentralizing the production and distribution of information by returning control to the audience, providing a venue for dialogue instead of monologue. Opinions and services that were previously controlled by small groups or corporations start now to be shaped by the entire population. The community of those using Internet actively is expected to increase constantly from the current share of about one fifth (in the U.S. and other Western countries) to the majority of the population, and this will be facilitated by the cohorts of the young “Internauts” becoming adult. As a result, television news networks, sitcoms and Hollywood production are increasingly replaced by e-mail, Wikipedia, You Tube, and millions of blogs and forums – all created by the same millions of people who are the audience for the content. This ultimately leads to the emergence of a **networked information economy** in the most advanced economies, shifting them away from the paradigm of industrial information economy still prominent at the beginning of the 21st century (see box).

Industrial vs Networked Information Economy

“In the industrial economy in general, and in the industrial information economy as well, most opportunities to make things that were valuable and important to many people were constrained by the physical capital requirements of making them. From the steam engine to the assembly line, from the double-rotary printing press to the communication satellite, the capital constraints on action were such that simply wanting to do something was rarely a sufficient condition to enable one to do it. Financing the necessary physical capital, in turn, oriented the necessary capital-intensive projects toward a production and organization strategy that could justify the investments. In market economies, that meant orienting toward market production, whereas in state-run economies that meant orienting production toward the goals of the state bureaucracy. In either case, the practical individual freedom to cooperate with others in making things of value was limited by the extent of the capital requirements of production.

In the networked information economy, the physical capital required for production is broadly distributed throughout society. Personal computers and network connections are ubiquitous. This does not mean that they cannot be used for markets, or that individuals cease to seek market opportunities. It does mean, however, that whenever someone, somewhere, among the billion connected human beings, and ultimately among all those who will be connected, wants to make something that requires human creativity, a computer, and a network connection, he or she can do so alone, or in cooperation with others.

The result is that a good deal more that human beings value can now be done by individuals, who interact with other socially, as human beings and as social beings (e.g. NGOs) – “doing it together” – rather than as market actors through the price system – “doing it alone”. Sometimes these nonmarket collaborations can be better at motivating effort and can allow creative people to work on information projects more efficiently than would traditional market mechanisms and corporations. As a result, there has been a flourishing nonmarket sector of information, knowledge and cultural production, based in the networked environment, applied to anything the many individuals connected to it can imagine, and whose outputs, in turn, are not treated as exclusive property.”

Yochai Benkler, *‘The Wealth of Networks: How Social Production Transforms Markets and Freedom’*, Yale University Press, 2006.

In a nutshell, the networked information economy improves the practical capacity of individuals along three dimensions: 1) it improves their capacity to do more for and by themselves; 2) it enhances their capacity to do more in loose commonality with others, without being constrained to organize their relationship through a price system or in traditional hierarchical models of social and economic organization; and 3) it improves the capacity of individuals to do more in formal organizations that operate outside the market sphere.

The first implication of this new state of affairs is the **enhanced autonomy of people**, as individuals can do more for themselves independently of the permission or cooperation of others – seeking the information they need and creating their own expressions with substantially less dependence on the

commercial mass media – and, no less importantly, they can do more in loose affiliation with others, rather than requiring stable, long-term relations, like coworker relations or participation in formal organizations, to underwrite effective cooperation.

The second major implication of the networked information economy is the shift it enables from the mass-mediated public sphere to a **networked public sphere**. This shift is based on the increasing freedom individuals enjoy to participate in creating information and knowledge, and the possibilities it presents for a new public sphere to emerge alongside the commercial, mass-media market.

The rise of individuals' autonomy and democracy in the information networked environment can be stimulated and facilitated by explicit public policies aiming to create an adequate institutional environment, such as, for instance, municipal funding of neutral broadband networks, state funding of basic research, and possible strategic regulatory interventions to negate monopoly control over essential resources in the digital environment.

Empowering People in the Public Sphere

“Commercial mass media that have dominated the public spheres of all modern democracies have exhibited a series of failures as platforms for public discourse. First, they provide a relatively limited intake basin – that is, too many observations and concerns of too many people in complex modern societies are left unobserved and unattended to by the small cadre of commercial journalists charged with perceiving the range of issues of public concern in a given society. Second, particularly where the market is concentrated, they give their owners inordinate powers to shape opinion and information. Third, whenever the owners of commercial media choose not to exercise their power in this way, they tend in any case to program toward the inane and the soothing – what more easily attracts an anonymous and passive audience – rather than toward that which is politically engaging, and they tend to oversimplify complex public discussions. The networked public sphere emerged on the background of these limitations of the mass media, gaining momentum and enabling many more individuals to communicate their observations and their viewpoints to many others, and to do so in a way that could not be controlled by media owners and was not as easily corruptible by money as were the mass media. A wide range of mechanisms – starting from simple mailing list, through static Web pages and the emergence of writable Web capabilities – were increasingly embedded in a social system for the collection of politically salient information, observations, and comments, and provided an open platform for discourse. Individuals became less passive, and the various formats of the networked public sphere provided anyone with an outlet to speak, to enquire, to investigate, without need to access the resources of a major media organization.

Yochai Benkler, *The Wealth of Networks: How Social Production Transforms Markets and Freedom*, Yale University Press, 2006.

The third major implication of the networked information economy is the emergence of a **new model of social production** as a core engine of the economy, a growing “free” sector. This is best typified by the emergence of free and open-source software at the turn of the 21st century – with many thousands of loosely networked free software developers competing with Microsoft at its own game and producing a massive operating system-GNU/Linux. As computers become cheaper and as network connections become faster, cheaper and ubiquitous, these large-scale cooperative efforts of peer production of information can scale up to much larger sizes, performing more complex tasks than are possible in the past nonprofessional/nonmarket production into every domain of information and cultural activity – from peer production of encyclopedias (e.g. Wikipedia), to news and commentary, to immersive and interactive entertainment. There is a profound economic logic underpinning this phenomenon, that is the zero marginal cost of disseminating knowledge products when they have been produced the first time (see box below).

Basic Economics of Information Production

"There are no noncommercial automobile manufacturers. There are no volunteer steel foundries. You would never choose to have your primary source of bread depend on voluntary contributions from others. Nevertheless, scientists working at noncommercial research institutes funded by nonprofit educational institutions and government grants produce most of our basic science. Widespread cooperative networks of volunteers write the software and standards that run most of the Internet and what we do with it. Many people turn to National Public Radio or the BBC as a reliable source of news. What is about information that explains this difference? Why do we rely almost exclusively on markets and commercial firms to produce cars, steel, and wheat, but much less so for the most critical information our societies depend on? Is this a historical contingency, or is there something about information as an object of production that makes nonmarket production attractive?"

"Information is non rival. Once a scientist has established a fact, or once Tolstoy has written *War and Peace*, neither the scientist nor Tolstoy need spend a single second on producing additional *War and Peace* manuscripts or studies for the one-hundredth, one-thousandth, or one-millionth user of what they wrote. The physical paper for the book or journal costs something, but the information itself need only to be created once. Economists call such goods "public" because a market will not produce them if priced at their marginal cost – zero. In order to provide Tolstoy or the scientist with income, we regulate publishing: We pass laws that enable their publishers to prevent competitors from entering the market. Because no competitors are permitted into the market for copies of *War and Peace*, the publishers can price the contents of the book or journal at above their actual marginal cost of zero. They can then turn some of that excess revenue over to Tolstoy. Even if these laws are therefore necessary to create the incentives for publication, the market that develops based on them will, from the technical economic perspective, systematically be inefficient."

"As Kenneth Arrow put it in 1962, *precisely to the extent that property is effective, there is underutilization of the information*. Because welfare economics defines a market as producing a good efficiently only when it is pricing the good at its marginal cost, a good like information (and culture and knowledge are, for purposes of economics, forms of information), which can never be sold both at a positive (greater than zero) price and at its marginal cost, is fundamentally a candidate for substantial nonmarket production".

Yochai Benkler, *'The Wealth of Networks: How Social Production Transforms Markets and Freedom'*, Yale University Press, 2006.

So low are marginal costs of digital products that there is indeed a growing "free" sector. Efforts are made to enforce patents and copyright protection in an attempt to restrict access and enable companies to hold on to profits; but the logic of technological progress is difficult to resist. Systems of copy protection codes are cracked and goods "liberated". In some cases free access is supported by advertising – and in so doing the "free" sector is complementary to the market sector – in others it is genuinely free, as with "freeware" or "shareware" computer programs. The Internet has already provided free access to almost unlimited information, not only books, encyclopedias, dictionaries, newspapers, but increasingly to on-line journals. Whether legally or not, music and films are downloaded free. Some service providers provide unlimited free storage space. Phone calls can cost only a fraction of what they used to and, when using computer links, are increasingly free. Emails and instant messaging also provide effectively free communications. And the young generation is the most accustomed to all this.

5.5.2.5. Ensure the well being of populations during the transition.

It is recognized as well that any reduction in economic output and consumption accompanying the shift to a new regime has to fall on those who are hurt the least – that is, the wealthy. Appropriate monetary policies are put in place to enhance employment, moderate the gap in income, restore the natural environment, and invest more in public goods while consumption decreases. For example, ecological tax reforms are implemented to change the consumption patterns, taxing the wealthy because they pollute more, while reducing taxes on social security or other benefits, which benefit those who rely more fully on those payments. At the global level, a fraction of the funds gathered from emission trading and concentrated in the common asset trust for protecting the atmosphere are used

to assist developing countries in reducing poverty. More generally, a broader understanding of global security issues is needed.

Smart Security Policy

“Understanding how social, economic and environmental conditions can undermine human security and may even translate into conflicts and instability requires a broader definition of security, one that understands the influence of economic, demographic, and environmental pressures that cannot be resolved by force of arms. ... Traditional security perspectives remain dominant in most national budgets. In 2008, the world spent almost \$1.5 trillion for military purposes – the largest amount since the end of World War II and many times more than is available for human security priorities. Western countries did increase their development aid to \$120 billion in 2008, up from \$52 billion (in current dollars) 10 years earlier. Aid by non-Western donors and multi-lateral agencies brings the total for development assistance to about \$139 billion. This still leaves a military-to-aid budget ratio of more than 10 to 1. Budgets for climate change are also increasing but are still small compared with military budgets.”

“Policies that defuse conditions that may lead to grievances and disputes represent **smart security policy**. A robust and comprehensive approach to creating a more stable world entails measures designed to stop environmental decline, break the stranglehold of poverty, and reverse the trend toward growing inequity and social insecurity that all too often breeds despair. There are a number of concepts and initiatives that create goodwill and foster cooperation around shared needs and interests and thus contain the seeds for a recalibrated security policy:

- **Millennium Development Goals (MDGs):** A sustainable security policy will need to work to lessen human vulnerability and improve social and economic well being. While not couched in the language of security, this goal finds expression in the Millennium Development Goals – some 21 targets of slashing poverty and hunger, combating health threats, and improving primary education to be achieved mostly by 2015. The MDGs need a major boost in resources and commitment, especially in the face of the global economic crisis that threatens to reverse earlier progress on several goals.
- **Curbing energy and materials appetites:** An alternative energy policy geared toward developing renewable resources and boosting efficiency is not only essential for reducing environmental impacts and greenhouse gas emissions but can be a tool for peace in that it helps to lower the likelihood of resource conflicts. Reducing materials throughput is similarly key to lessening the likelihood of these conflicts.
- **Environmental peacemaking:** While environmental degradation can contribute to conflicts, environmental cooperation also holds great potential as a peacemaking tool. If well managed, cooperative efforts around shared ecosystems and natural resources can build trust and establish collaborative habits, especially if government contacts are augmented by vibrant civil society dialogue. The notion of blending ecology and transboundary politics has been put into practice, to some extent, in two specific areas: river basin management among riparian nations and border-straddling peace parks.
- **Peacekeeping and environmental restoration:** United Nations peacekeeping and post-conflict efforts increasingly take into account environmental dimensions. Some 11 peacekeeping missions in countries like the Democratic Republic of the Congo, Sudan (Darfur), Liberia, Georgia, Lebanon and Timor-Leste have participated in tree planting efforts. U.N. officials recognize that traditional peacekeeping alone is unlikely to have lasting success without these and such environment-related efforts as rehabilitation, recycling, disaster relief, flood protection and water quality.
- **Disaster and health diplomacy:** Disasters that strike in active or latent conflict zones may inflict suffering that cuts across the divides of conflict, often triggering goodwill and possibly changing the political landscape. Common relief and reconstruction needs offer opportunities for collaboration, which in turn can build trust, break ingrained conflicts dynamics, and perhaps facilitate reconciliations among adversaries. Conceptually similar to disaster diplomacy, the notion of health diplomacy has been proposed as a way to generate goodwill by providing medical assistance to other countries, improving relations, and resolving conflicts, as well as advancing common public health objectives.
- **Greening employment:** Much of the green jobs discussion has focused on industrial countries and a handful of emerging economies with regard to high-tech sectors like wind and solar energy or electric vehicles. But green jobs also offer important opportunities for poverty reduction and livelihood promotion in developing countries. This involves support for recycling and composting efforts and investments to protect biodiversity, restore degraded farmland and watersheds, and make farming more organic and climate resilient.

Michael Renner, ‘Broadening the Understanding of Security’, in Worldwatch Institute, State of the World, 2010.

5.5.3 The shift from growth to steady-state economy

All the pillars of change and dynamics presented in the previous chapter may be combined together, at global and smaller scales, to produce a new economic, technological, social and geopolitical “beyond growth” reality.

First and foremost, in the beyond growth scenario we will have to move to something more like the steady-state economy proposed by economist Herman Daly in the early 1990s.⁵⁸ Herman Daly was not the first, as many economists have long envisioned the evolution of progress, growth and capitalism into something quite different. Adam Smith describes the system as reaching a plateau, when the accumulation of riches will be “complete”, bringing about a deep and lengthy decline. John Stuart Mill expects the momentary arrival of a stationary state, when accumulation will cease and capitalism will become the staging ground for a kind of associational socialism. Schumpeter thought the system would evolve into managerial socialism. John Maynard Keynes writing eighty years ago looked forward to the day when the “economic problem” would be a thing of the past: “Suppose that a hundred years hence we are eight times better off than today. Assuming no important wars and no important increase in population, the economic problem may be solved. This means that the *economic problem* is not – if we look into the future – *the permanent problem of the human race*.”⁵⁹ Keynes foresaw a world in which society had outgrown the need for growth and where the principal costs of that growth lie not with the environment but how its pursuit distorted human virtue and morality. Today, many argue that growth is causing both environmental and social degradation, shaping cultures of consumption which in turn lead to more growth.⁶⁰ Since we are approaching Keynes’s “100 years hence” and “eight times better off”, the beyond growth scenario definitively question the rationality and priority of endless, limitless economic growth. But how we can envision the transition to a steady state when, as Murray Bookchin, the American social ecologist and libertarian philosopher said, “capitalism can no more be persuaded to limit growth than a human being can be persuaded to stop breathing?”⁶¹

Four possible answers are given below, including:

- Material living standard from using stocks of longer-lasting goods and sharing services, rather than consumption of short-lived goods;
- Reducing work time as a pathway to sustainability;
- Shifting from profit-making to social entrepreneurship, and
- Shifting from market-based to a new model of social production (peer production)

5.5.3.1 Stocks of longer-lasting goods better than flows of short-lived goods.

A first answer would be envisioning a new business model where the use of earth’s finite mineral and agricultural resources is prevented from growing, and innovation and change are therefore concentrated on using finite resources more effectively for the benefit of humankind.

In this new business paradigm, we will need to think of material living standards as given by the stock of goods in use, rather than the rate of flow from consumption to waste. The faster things wear out

⁵⁸ H. Daly, *Steady-state Economics* Washington DC: Island Press, 1991.

⁵⁹ J. M. Keynes, *Economic Possibilities for our grandchildren*, N&A and Saturday Evening Post, 1930.

⁶⁰ Bartolini 2010.

⁶¹ M. Bookchin, *The Ecology of Freedom*, Oakland, CA: AK Press, 2005.

and need replacing, the more they contribute to the flow and to waste. If material living standards depend on the goods we have in use, then each thing that wears out is a subtraction from that. Rather than serving as consumers, helping business to keep sales up, we need incentives to build and maintain longer-lasting goods of every kind.

Clearly any systems tackling material living standards as to treat rich and poor countries differently.⁶² Any regulatory system – e.g. the carbon regulatory system - has to include policies for “contraction and convergence” or “cap and share”. Both approaches propose a year-on-year contraction in permitted emissions levels, leading to an eventual convergence on equal per capita emissions across the planet.⁶³ It would be a mistake to think that such steady-state business model would mean stagnation and lack of change. On the contrary, trying to get more from the limited resources available has always been one of the fundamental drivers of innovation and technical change. Fixing limits on resource consumption and emissions would require innovation as never before. Continued rapid technological advances, such as digitization, electronic communications and virtual systems, can contribute to create new “weightless” sectors of the economy, making it much easier to combine high living standards with low resource consumption and emissions.

5.5.3.2 Reducing work time as a pathway to sustainability

A second answer is related to time use, an aspect that is rarely featured in the economy outlooks.⁶⁴ To build a beyond growth society, the rich nations of the world must immediately begin to trade advances in labour productivity for free time instead of additional purchasing power. And people must understand that doing so will not be a sacrifice. Rather it will mean substantial improvements in the quality of life. There is a simple economic law that might be called the growth imperative. Technical progress consistently makes it possible to produce more product per hour of labour expended. The point is then simple: to keep everyone employed at the current number of hours while productivity increases, it is necessary to simply produce and consume more. It is unlikely that scientific progress and increases in labour productivity are going to stop. Therefore in order to limit consumption to current levels (or lower), it will be necessary either to lay off a portion of the workforce or to reduce everyone’s working hours. In the beyond growth scenario, for the whole humanity to survive and to let people in developing countries somehow achieve a secure and modest comfort, material economic growth in rich nations simply must be limited. Yet this must be done without stopping the progress of science and the advance of productivity and without casting millions into the hell of unemployment. Ultimately, this can only be done by trading gains in productivity for time, by reducing the hours of labour and sharing them equitably. All this means limiting greed, understanding that a life less rich materially but more rich temporally is not a sacrifice, finding new indices of success that supplant the gross domestic product, and providing real freedom to workers so that their choice to limit their hours does not come at the cost of being fired and losing their livelihoods and health care. There are human benefits to working less. Long hours of work are stressful, undermine family functioning and social connections, and cause physical and emotional illness. People who work too much are unable to engage in other activities, primarily social ones, that improve their well being. It is important to note also that the environmental benefits of reduced work time are myriad and include: 1) less need for convenience products and services which save time (e.g. fast food, use of highly packaged and processed food, drying clothes on a clothesline rather than in dryer, etc.); 2) more time to reuse and recycling, as separating and selecting wastes takes time; 3) time to choose slower and energy-friendly forms of transport, including walking, cycling, or public transit rather than driving, or to take trains

⁶² For instance, India, producing 1,6 tonnes of carbon per person annually, cannot be treated the same as the U.S., producing 24 per person.

⁶³ Emissions in the North would thus decline while those in South grew, albeit at a slowed rate.

⁶⁴ This section is mostly based on two contributions included in the 27th Edition of the Worldwatch Institute State of the World ,2010, respectively from Juliet Schor, *Sustainable Work Schedules for All*, pages 91-95 and John de Graaf, *Reducing Work Time as a Path to Sustainability*, pages 173-177.

rather than planes; 4) time to make careful choices, including for certified products, organic food etc. Also from the business standpoint there are potential benefits in reducing work schedules, The key point for business is competitiveness, and here the issue is not how many hours each individual person spend on the job but how productively those hours are worked and how they are compensated. If shorter hours come courtesy of productivity growth, that is a trade-off of income for time, and it can be cost-neutral. As a matter of fact, across nations, similarly competitive countries have significant divergences in hours of work. Moreover, shorter hours can enhance productivity as work intensity rises, and better schedules reduce employee stress and improve retention and morale. Last, but not the least, shorter hours can also reduce joblessness, which after the financial crisis of 2008 is rising in many places.⁶⁵ The major obstacle to hours reduction, in the U.S. and in other OECD countries, has been that health insurance is paid per employee, which means it costs employers much less to hire fewer people and work them longer. If there were a single-payer health care system, or even if business pro-rated medical and other benefits and government helped finance the remainder, shorter hours would be much more effective. The beyond growth scenario assumes that such new social welfare mechanisms are put in place, and the “downshifting” trend of reducing work time, already evident at the turn of the 21st century, is continued.⁶⁶ The result is a slower, saner pace of life that is good for people and the planet, with a growing share of the population adopting the “low GDP man” lifestyle as opposed to a shrinking share of population that continue to live as a “high GDP man”.

High-GDP Man vs Low GDP Man

“Consider the lives of two people – let’s call them High-GDP Man and Low-GDP Man. High-GDP Man has a long commute to work and drives an automobile that gets poor gas mileage, forcing him to spend a lot on fuel. The morning traffic and its stresses aren’t too good for his car (which he replaces every few years) or his cardiovascular health (which he treats with expensive pharmaceuticals and medical procedures). High-GDP Man works hard, spends hard. He love going to bars and restaurants, likes his flat-screen televisions and adores his big house, which he keeps at 71 degrees year round and protects with a state-of-the-art security system. High-GDP Man and his wife pay for a sitter (for their kids) and a nursing home (for their aging parents). They don’t have time for housework, so they employ a full-time housekeeper. They don’t have time to cook much, so they usually order in. They are too busy to take long vacations.”

“As it happens, all those things – cooking, cleaning, home care, three-week vacations and so forth – are the kind of activity that keep Low-GDP Man and his wife busy. High-GDP Man likes his washer and dryer; Low-GDP Man doesn’t mind hanging his laundry on the clothesline. High-GDP Man buys bags of prewashed salad at the grocery store; Low-GDP Man grows vegetables in his garden. When High-GDP Man wants a book, he buys it; Low-GDP Man checks it out of the library. When High-GDP Man wants to get in shape, he joins a gym; Low-GDP Man digs out an old pair of Nikes and runs through the neighborhood. On his morning commute, High-GDP Man drives past Low-GDP Man, who is walking to work in wrinkled khakis.”

“By economic measures, there is no doubt High-GDP Man is superior to Low-GDP Man. His salary is higher, his expenditures are greater, his economic activity is more robust. You can even say that by modern standards High-GDP Man is a bigger boon to his country. What we can’t really say for sure is whether his life is any better. In fact, there seem to be subtle indications that various “goods” that High-GDP Man consumes should, as economist put it, be characterized as “bads”. His alarm system at home probably isn’t such a good indicator of his personal security; given all medical tests, his health care expenditures seem to be excessive. Moreover, the pollution from the traffic jams near his home, which signals that business is good at the local gas stations and auto shops, is very likely contributing to social and environmental ills.”

Jon Gertner, *‘The Rise and Fall of the GDP’*, The New York Times May 13, 2010

⁶⁵ In the U. S., in the aftermath of the financial collapse of 2008, reductions in the hours of work have spread throughout the private, public and non-profit sectors. Employers have attempted to avoid lay-offs by instituting company-wide cutbacks in schedules, and other work reduction measures. Since the recession began, average weekly hours have fallen by nearly an hour (source U.S. Bureau of Labor Statistics)

⁶⁶ For more than a decade, a significant fraction of the U. S. population has been making voluntary lifestyle changes that give them more time off the job. They are shifting to part time, opting out of paid employment altogether, or changing to positions with less demanding schedules. A subset within the downshifting group has taken the lifestyle change farther – embracing voluntary simplicity, a way of living that requires little income and is therefore usually associated with short hours of paid work.

5.5.3.3 *Shifting from profit-making to social entrepreneurship*

A third answer would be envisioning a shift from the commercial-profit making paradigm to a new social production paradigm, following which we will have to re-think and reinvent some of our basic social industries such as health, care, education, transport and – beyond the social industries – our lifestyles. The more progressive and ultimately more successful companies will progress from a consumer/market led approach to a people/social-led approach. Social innovation and entrepreneurship will become the dominant paradigm in the “beyond growth” society.

Already today **social innovation** seeks new answers to social problems by identifying and delivering new services that improve the quality of life of individual and communities. In so doing, “social innovation” is distinct from “economic innovation” because it is not about introducing new types of production or exploiting new markets in themselves, but it is about satisfying new needs not provided for by the market (even if markets can intervene later), answering to global challenges – unemployment, ageing, climate change, poverty alleviation – as well as to small, local needs, such as creating a community garden. Whereas “commercial entrepreneurship” makes for-profit business pursuing as primary objective economic value and its appropriation, “**social entrepreneurship**” aims primarily at addressing and satisfying unmet social needs, putting social value creation at the heart of its mission in order to improve individuals’ and communities’ lives and increase their well-being (see box below).

A Growing Movement

“Social entrepreneurs existed long before they were labeled as such. Since the Grameen Bank and its founder Muhammad Yunus were jointly awarded the Nobel Peace Prize in 2006, however, media coverage of this growing phenomenon and accompanying accolades have made social entrepreneurs highly visible. Grameen provided an early model of a Social Entrepreneurial Initiative (SEI) when in the late 1970s it started offering credit to the poorest of the poor in rural Bangladesh without the borrowers needing to provide collateral for their loans. The Bank’s micro-credit programme expanded rapidly, and by mid-2009 nearly 8 million people were receiving loans, 97 of whom were women.”

“While definitions vary, social entrepreneurship can generally be seen as a label for initiatives that proactively address social or environmental issues through of a product or service that directly or indirectly catalyzes social change. To ensure that change is sustainable, a large part of what social entrepreneurs do is challenge or disrupt existing institutions. As used here, the term institutions includes taken-for-granted collective behaviors such as consumption that dominate daily routines. Excessive consumption, environmentally unsustainable practices, and a culture of individual private gain over shared community or public benefit are just some of the institutionalized behaviors that social entrepreneurs seek to change.”

“One of the most powerful ways that social entrepreneurs are able to bring about change is by challenging accepted ways of doing and demonstrating alternatives. In Egypt, for example, the SEI Sekem challenged the automatic acceptance that desert land far from the Nile could not be made fertile, and it overturned conventional thinking about the necessity of chemical pesticides. Founded by Ibrahim Abouleish in 1977 with the intention to “heal the land and its people”, today Sekem is a multi-business company with more than 2.000 employees; it encompasses seven for-profit companies producing organic food products, cotton, textiles, and medicinal herbs and includes a range of nonprofit entities – from education to health facilities for its staff and their families to a research and development institute and a university. Similarly, Waste Concern in Bangladesh proved that Dhaka’s waste problem could be turned into a resource by taking a radical new approach to waste processing and collection. The founders set-up small-scale composting plants that employed waste-pickers to collect and process the compost. Instead of burning or flaring solid waste, they created fertilizer from organic and enriched compost, which reduced pollution while creating jobs.”

“SEIs that specifically address the issue of conscious consumption are being seen more often. One example is the fair trade movement. Small handicraft fair trade outfits have existed in the U.S. and the UK for more than 50 years., but it has been SEIs such as Transfair USA, founded in 1998, that helped to establish fair trade labels for a much wider range of products. And Rug-mark, founded in 1994, combines a campaign to end child labor with certification for ethically produced rugs. These groups and the many SEIs promoting and supporting organic coffee producers, poor country artisans, and the like have made social entrepreneurship a global commercial phenomenon.”

Johanna Mair and Kate Ganly, ‘*Social Entrepreneurs: Innovating Toward Sustainability*’, in Worldwatch Institute’, State of the World Earthscan, 2010.

The economy will increasingly operate therefore with a very different system, one which is geared to the needs of people and ecosystems and it is not driven by market forces of the profit motive (although it will continue to have a place for them). As already pointed out above, it must be a steady state economy operating with the minimal levels of production and consumption necessary for a high quality of life, with a much lower growth – or even zero or de-growth – of GDP, compensated by an improvement of “beyond GDP” quality of life and ecosystems’ health indicators. The building blocks of such economy will be mostly small scale local economies, highly self-sufficient in terms of energy and materials inputs but well connected in a global communication network. There will be a multi-level governance system, where the bottom layer will be populated by mostly cooperative and participatory local systems, whereby people in small communities control their own affairs, largely independent of the state and of the much-diminished national and global powers.

This is clearly an alternative picture to today’s capitalism, whose core activity is the profit-making business of large corporations. But today’s capitalism seems an impregnable citadel, how to avoid therefore that this vision seems only an utopian scheme?

An answer is provided by the process of “democratization of wealth” through employee share-ownership and participation. Indeed, several groundbreaking patterns of ownership and control are emerging in the capitalist world and worthy of note:

- Greider reports that “at the start of this new century, around 10 million Americans are worker-owners in some 11.000 employee-owned companies.” In the UK, share-ownership schemes now cover almost a quarter of all employees and some 15 or 20 percent of all UK companies.⁶⁷ In the U.S., the 2001 Tax Law increased the tax advantages of Employee Stock Ownership Plans (ESOPs), and they cover 8 million employees in 10.000 firms with an average employee-ownership of 15-20 percent;⁶⁸
- At the grandest level, state and national ownership funds – public trusts – could be established to benefit citizens and the environment. These funds would operate on fiduciary trust principles. Capital could be generated through the proceeds of natural resource sales or from the auction of carbon emissions rights. These ideas have been creatively developed by Peter Barnes in his new book, *Capitalism 3.0*;⁶⁹
- Cities and states are becoming owners and direct actors in the business arena – chartering municipal development corporations, providing health services and environmental management, and other revenue-generating activities;
- Charities and other non-profit organizations are also getting into business, blurring the distinction between the for-profit and the not-for-profit sector. Businesses and nonprofits are spawning a wide variety of corporate hybrids.

All these trends show a process of “democratization of wealth” which break with traditional capitalist patterns (see box below). They involve ownership by workers, public ownership, and public and private enterprises that do not seek traditional profits. Collectively, they signal the emergence of a new sector – a public or independent sector - that has the potential to be a countervailing center of power to today’s capitalism, and may play the leading role in the transition towards the new paradigm of social economy. The variety and scale of this growing sector leaves no doubt that profit-making business is not the only effective way people can work together to provide important services. It is a

⁶⁷ M. J. Conyon and R.B. Freeman, ‘*Shared Modes of Compensation and Firm Performance: UK evidence*’. NBER Working W8448. Cambridge MA: National Bureau of Economic Research, 2001.

⁶⁸ G. Gates, ‘*Holding your own: the case for employee capitalism*’, Demos Quarterly, 1996 8: 8-10. However, many share-ownership schemes amount to little more than incentive schemes, intended to make employees more compliant with management and sometime to provide a nest-egg for retirement. They are mostly far away from the truly employee-ownership and participation experiences described in the box.

⁶⁹ Peter Barnes, *Capitalism 3.0: A Guide to Reclaiming the Commons*, San Francisco: Berrett-Koehler, 2006

truism – but nevertheless an important one – to say that the key difference between the kinds of organizations belonging to this new sector – institutions like universities, hospitals, local governments, co-operative banks, co-op shops, charities, etc. – and profit-making corporations is simply whether or not their primary purpose is to make money or to provide a service while remaining economically viable.

Democratization of Wealth: employee ownership and participation

Recently, two American thinkers have turned attention to possible contours of a new economic system beyond capitalism. The latter is an economic system in which employers – the owner of capital – hire workers to produce goods and services for the owners' profit. A key change that both Greider and Alperovitz observe is the beginning of an erosion of this system through new forms of ownership and control. They believe that conscious promotion of these developments can hasten that erosion. One pattern is employee ownership – people owning their own work.

Robert Oakeshott, a British authority on employee-ownership, says that employee-ownership "entails a movement from business as a piece of property to business as a working community". Companies change from being property to being communities when employees own a majority of shares and so control the business. That is when management becomes responsible, not to outside shareholders with little interest in the company beyond return on capital, but to the body of employees. Then company meetings become occasions when management reports back to employees and has to do with questions and discussion among people who have an intimate knowledge of what has gone right and what has gone wrong in the preceding period, and what the remedies may be. The transformation after an employee buy-out from the usual top-down mentality can involve a long slow process of people's emancipation from the usual assumptions round class and ability which make those in more junior positions feel themselves to be inferior human beings. The potential for people to feel valued at work is usually undermined by the hierarchical stratification of people into various gradations of order-givers and order-takers, which ensure that employees act not as a community, but as property, brought together and used to earn a return on other's people capital. Employee-ownership has therefore the advantage of increasing equality by extending liberty and democracy. It is bottom-up rather than top-down. However, to make a reliable difference to company performance employee share-ownership has to be combined with more participative management methods. Moreover, the concept of a truly democratic employee ownership makes increasingly anachronistic the traditional concept of a company being owned by outside investors. Should employees not have a full control over their work and the distribution of its earnings? And should external shareholders really receive unearned income beyond agreed interest on capital? Participation, commitment, control and profit-sharing would be maximized if companies were 100 percent employee-owned. Companies could raise capital through loans or mortgages, retaining control themselves. As a way of creating a more egalitarian society, employee-ownership and control have many advantages. First, it enables a process of social emancipation as people become members of a team. Second, it puts the scale of earnings differentials ultimately under democratic control: if the body of employees want big income differentials they could choose to keep them. Third, it involves a very substantial redistribution of wealth from external shareholders to employees and a simultaneous redistribution of the income from that wealth. Fourth, it improves productivity and so has a competitive advantage. Fifth, it increases the likelihood that people will regain the experience of being part of a community. And sixth, it is likely to improve sociability in the wider society. The real reward, however, is not simply to have a few employee-owned companies in a society still dominated by a hierarchical ideology and status-seeking, but to have a society of people freer of those divisions. And that can only be achieved by a sustained campaign over several decades.

Richard Wilkinson and Kate Pickett, *'The Spirit Level: Why Equality is Better for Everyone'*, Penguin Book, 2010

5.5.3.4 Shifting from market-based to the new model of social production (peer production)

A fourth answer would be envisioning a shift from proprietary technology and market-based production towards the prevalence of the "free/open source" and non market-based production model, already introduced in section 5.5.2.4 above as a feature of the networked information economy.

Though less dramatic than in the digital economy, the trends towards rapidly diminishing variable costs enabling forms of “free provision” or “open access to” services and products may also apply to many other areas of technology, including the products of nanotechnology, biotechnology, electronically printed components and genetic engineering. These new technologies hold out possibilities of more efficient solar power, cheaper medicines, more economical new materials – to name a few.

A new wave of “open” technologies may be envisaged, with a wider range of production activities shifting to the model of peer production. This is a new modality of production enabled by the networked economy, radically decentralized, collaborative, nonproprietary, based on sharing resources and outputs among widely distributed, loosely connected individuals who cooperate with each other without relying on either market signals or managerial commands.

However, underpinning the change towards open forms of peer production there is a fundamental struggle between old and new institutions. From the point of view of many of the companies producing digital products or developing new potentially open technologies, the change does not appear as a new opportunity for enhancing human life and enjoyment, but as profound threat to profits. Indeed, instead of maximizing the benefits of the new technologies, currently we find ourselves with institutional structures which fight to restrict this new potential. The dramatic lowering of variable costs puts a rapidly widening gap between the **maximization of profit** and the **maximization of public benefit**. In this situation is important that governments use their powers to aid the development of new institutional structures, not to prop up and defend the restrictions of the old ones. People should be allowed free access. The need to provide unrestricted free access in order to maximize the public benefit was offered in the past as an economic explanation of why roads and bridges were in the public ownership – at least until governments began to try to recoup the costs of road building by charging tolls (an incursion back of market concepts in the public realm). The key point here is that once the capital costs have been incurred, the more people sharing the benefits the better. Where municipal investment provides local Internet access, there is no need to restrict access to it. When the Victorians established free public libraries they recognized the same logic: a book can be read repeatedly at no extra costs. We would need something alike: public bodies and non-profits, funded from public revenue, able to negotiate a price at which to buy access or copyrights for the nation. Perhaps we need international bodies able to negotiate free access to educational and business resources throughout the world.

It is clear that the shift to peer production discussed here is strongly related to either the shift to social entrepreneurship and innovation (see section 5.5.3.3) and the shift to expanding the commons’ sector (see section 5.5.2.3).

As it concerns the shift to social entrepreneurship dominance, it is clear that the tendency for technological change to reduce marginal costs is rapidly tipping the balance of advantage away from allowing profit-maximizing corporations to control the distribution of goods. Increasingly they can only rely on the remnants of monopolistic power provided by patents or copyright. In order to stimulate and consolidate this tendency, new ways are to be found of paying organizations and individuals for life-enhancing research, creativity and innovation which do not restrict access to the benefits. A possible way would be charities to fund the development of software for free worldwide use. We certainly need a complete revision of copyright and patent laws so that those who produce valuable goods and services can be paid in ways which do not restrict access to their products. Indeed, the key question for politicians and the public is whether it is possible to find ways of paying corporations for their research and development without trying to police a pricing system which restrict access to the benefits of what they have produced – benefits which may include life-saving drugs, agricultural

innovations which could feed the hungry, access to scientific and academic journals for universities in the developing world, etc. This logic moves us towards a society in which access to an ever-increasing range of goods is no longer tightly rationed by income, and our possessions cease to play such an important role in social differentiation.

As it concerns the shift to an expanded commons sector, peer production can be seen as a sub-set of commons-based production practices (see box).

Commons-based peer production

“Commons refers to a particular institutional form of structuring the rights to access, use and control resources. It is the opposite of property in the following sense: With property, law determines one particular person that has the authority to decide how the resource will be used. That person may sell it, or give it away, more or less as he or she pleases. “More or less” because property doesn’t mean anything goes. We cannot, for example, decide that we will give our property away to one branch of our family, as long as that branch has boys, and then if that branch has no boys, decree that the property will revert to some other branch of the family. That type of provision, once common in English property law, is now legally void for public policy reasons. There are many other things we cannot do with our property – like build on wetlands. However, the core characteristics of property as the institutional foundation of markets is that the allocation of power to decide how a resource will be used is systematically and drastically asymmetric. That asymmetry permits the existence of an owner who can decide what to do, and with whom.”

“The salient characteristics of commons, as opposed to property, is that no single person has exclusive control over the use and disposition of any particular resource in the commons. Instead, resources governed by commons may be used or disposed by anyone among some (more or less well defined) number of persons, under rules that may range from anything goes to quite crisply articulated formal rules that are effectively enforced.”

“Commons can be divided into different types based on two parameters. The first parameter is whether they are open to anyone or only to a defined group. The oceans, the air, and highway systems are clear examples of open commons. Various traditional pastures arrangements in Swiss villages or irrigation regions in Spain are now classic examples, described by Elinor Ostrom, of limited-access common resources – where access is limited only to members of the village or association that collectively “owns” some defined pasturelands or irrigation system. As Carol Rose noted, these are better thought of as limited common property regimes, rather than commons, because they behave as property vis-à-vis the entire world except members of the group who together hold them in common. The second parameter is whether a commons system is regulated or unregulated. Practically all well-studied, limited common property regimes are regulated by more or less elaborate rules – some formal, some social-conventional – governing the use of the resources. Open commons, on the other hand, vary widely. Some commons, called open access, are governed by no rule. Anyone can use resources with these types of commons at will and without payment. Air is such a resource, with respect to air intake (breathing, feeding a turbine). However, air is a regulated commons with regard to outtake. For individual human beings, breathing out is mildly regulated by social convention – you do not breathe too heavily on another human being’s face unless forced to. Air is a more extensively regulated commons for industrial exhalation – in the shape of pollution controls. The most successful and obvious regulated commons in contemporary landscapes are the sidewalks, streets, roads, and highways that cover our land and regulate the material foundation of our ability to move from one place to the other.”

“The term commons-based is intended to underscore that what is characteristic of the cooperative enterprises is that they are not built around the asymmetric exclusion typical of property. Rather, the inputs and outputs of the process are shared, freely or conditionally, in an institutional form that leaves them equally available for all to use as they choose at their individual discretion. Any production strategy that manages its inputs and outputs as commons locates that production modality outside the proprietary system, in a framework of social relations. The term peer production characterizes a subset of commons-based production practices. It refers to production systems that depend on individual action that is self-selected and decentralized, rather than hierarchically assigned. Not all commons-based production efforts qualify therefore as peer production: only those where the networked environment make possible to organize a new modality of production, radically decentralized, collaborative, nonproprietary, based on sharing resources and outputs among widely distributed, loosely connected individuals who cooperate with each other without relying on either market signals or managerial commands.”

Yochai Benkler, *‘The Wealth of Networks: How Social Production Transforms Markets and Freedom’*, Yale University Press, 2006.

5.5.4 The shift from globalization to localization

Another key feature of the beyond growth scenario is the shift from the economic globalization to the economic localization paradigm. **Economic localization** is indeed the antithesis to economic globalization.⁷⁰

The latter is an economic system that is driven by corporate interest and is based on ever-increasing free trade and international competitiveness, and its emphasis on beggar-your-neighborhood reduction of controls on trade and investment. The former is instead an alternative which involves a better-your-neighborhood supportive internationalism where the flow of ideas, technologies, information, culture, money and goods has, as its end goal, the rebuilding of truly sustainable national and local economies worldwide. Its emphasis is not on competition for the cheapest, but on cooperation for the best.

Several leading anti-globalization theorists and campaigners have recently promoted economic localization, but one of the clearest statements of its basic principles pre-dates the current debate by several decades. In a famous lecture in 1933 entitled National Self-Sufficiency, John Maynard Keynes said: “I sympathize, therefore, with those who would minimize, rather than those who would maximize, economic entanglement between nations. Ideas, knowledge, art, hospitality, travel – these are the things that should of their nature be international. But let goods be homespun whenever it is reasonable and conveniently possible, and above all, let finance be primarily national.”

Economic localization actively discriminates in favor of more local production and investment whenever it is, as Keynes said, “reasonable and conveniently possible”. However, local does not always mean national, as Keynes supposed. The New Economics Foundation defines local as “... a relative term. It means different things to different people and depends on context. For example, your local TV station is likely to be further away than your local corner shop. For some of us local refers to our street. For others it means our village, town, city or region. However we think it, local usually connects to a group of people and the things they depend on – whether shops, health services, schools or parks. Think of local as that surrounding environment and network facilities that is vital to our quality of life and well being.”⁷¹

Economic localization has the developmental advantage of enabling the poorer countries to protect their infant industries and food production systems from ruthless and often devastating competition from cheap imports, thus allowing them to develop diverse and resilient local economies that respond to local needs. It has the environmental advantage of no longer requiring the transportation of so many goods over unnecessary distances. And it has the democratic advantage of promoting an increase in national and local control of the economy and allowing people to decide for themselves the direction in which they wish their economy to develop, and the potential – at least – for the benefits of that economy to be shared out more fairly. Some of these advantages can be already seen in the existing examples of business localization (see box).

⁷⁰ This section is based on excerpts from M. Woodin and C. Lucas, ‘Green Alternatives to Globalisation: A Manifesto’, Chapter 5, 2004.

⁷¹ Cfr. www.neweconomics.org

Relocalizing Business

“ To see what a culture for sustainability might really look like, pay a visit to Bellingham, Washington, recently named by the Natural Resource Defense Council as the 1st Smarter small city in the United States. This coastal town two hours north of Seattle has pioneered an economic development strategy that is radically different from the traditional preoccupation with attracting and retaining global business. Thanks to the leadership of a nonprofit called Sustainable Connections, Bellingham has focused on nurturing its local businesses and organizing them into a powerful collaborative network to rebuild the community economy from the ground up.”

“Bellingham is among the growing number of communities worldwide that see their future sustainability and prosperity grounded in local businesses. Internationally, more than a thousand communities are beginning to undertake similar work through organizations like Transition Towns and Post-Carbon Futures. As these organizations see it, local business has two meanings. One is ownership. In a locally owned business, more than half the owners live where the firm operates. By this definition, local ownership actually characterizes the vast majority of sole proprietorships, partnerships, nonprofits, cooperatives, and public-private partnerships operating in the world. Even most privately held corporations are local. Really, the only kind of business clearly not local is a publicly traded company. The other meaning of local is the proximity of its stakeholders, like suppliers and consumers. Because locally owned businesses tend to give priority to using local land, labor, and capital and producing goods and services in local markets, these two concepts are inherently intertwined.”

“In an era of globalization, it is easy to forget that local businesses actually have been the economic norm for most human history and, contrary to public perceptions, continue to account for most of the world’s economy today. One distinguishing feature of very poor countries is that a large percentage of the population is engaged in subsistence agriculture – that is, local farming. As countries develop, farm families migrate to the cities for industrial jobs. But vast numbers remain jobless or unemployed and effectively wind up as micro-entrepreneurs in the informal sector.”

Michael H. Shuman, ‘*Relocalizing Business*’, in Worldwatch Institute, State of the World, 2010.

Economic localization, however, is an ambitious agenda that, just like economic globalization, will take time and political will at every level from the local to the international to implement.

Over time, the beyond growth scenario will have to show therefore a gradual transition away from dependence on international export markets, with countries racing each other round a downward spiral of social and environmental standards, and towards the national provision of as many goods and services as is feasible and appropriate. Long distance trade would then be reduced to its original purpose: supplying what cannot easily come from within one country or geographical grouping of countries.

As it concerns the political will, just like economic globalization, economic localization will only come about through the determined implementation of a set of interrelated and self-reinforcing policies, illustrated in the following sections, which include:

- Localizing money and finance.
- Controlling the Transnational Corporations (TNCs).
- Taxes for localization.
- Rewriting the World Trade rules.

5.5.4.1 *Localizing finance and money*

Rapid liberalization of investment is key to economic globalization, but it has created a global casino economy that deals a double blow to local economies. On the one hand, local economies have to distort themselves to conform to the demands of global finance. On the other, their stability is undermined by moment-to-moment fluctuations in the international financial markets that have no basis in real economic activity. Localization demands instead that investment seek the development of

stable local economies, based on sustainable patterns of production and consumption – not the quickest short-term return. This requires controls on capital flows and tax evasion, including off-shore banking centers, and measures to limit the destabilizing effect of short-term speculative currency transactions. The World Trade Organization is seeking to liberalize investment, so that governments have even fewer rights to attach conditions to inward investment.

By contrast, economic localization calls for building international agreement to an alternative localist code of investment and procurement. This would allow governments to prefer local investors and discriminate between inward investors on the basis of social and environmental criteria. Governments should be able to insist on measures that maximize the benefits of inward investment, such as prohibiting the excessive repatriation of profit and specifying the minimum proportion of labor and content that should be sourced locally.

A Tobin-like tax on speculative currency transactions would help dampen the impact of the foreign exchange markets.⁷² Levied at just 0,05 percent, it would raise globally between US\$ 50-100 billion a year, more than the global aid budget at the turn of the 21st century. These revenues could be placed in a multilateral fund administered by the UN to promote sustainable development in the poorest countries. Controls on international currency trading and investment flows should be complemented at local level by policies that support smaller, locally based banks and loan schemes, credit unions, local bond issues, and local exchange and trading schemes. Known collectively as Community Development Finance Institutions (CDFIs), these measures help to retain wealth and exchange within a community. They provide insulation from the turbulence of global financial markets and a secure source of finance, often at favorable terms, which can help generate local employment and training opportunities or be used to finance community infrastructure.

Recently, the New Economics Foundation has proposed that the principles of the CDFI sector be extended to provide an alternative to the stock market as a vehicle for the investment of pension contributions. Mutually managed “people” pension funds would be established to collect employers’ and employees’ contributions and use them to develop local public infrastructure, such as schools, hospitals and public transport systems. Once completed, the new facilities would be leased to the government for a long fixed term at an agreed rent, providing the necessary income to the fund and a sound alternative to the private finance initiative.⁷³

Besides localizing finance, the beyond growth scenario envisage an increasing diffusion of local currencies and exchange schemes, running in parallel with national and international currencies (see box).

⁷² The Nobel Prize winning economist, James Tobin, first proposed the idea of a tax on foreign exchange transactions in 1978. He suggested that all major countries should levy the tax at a rate (less than 0,5 percent) that is low enough not to hamper long-term investment, but high enough to dampen the impact of large scale, speculative currency movements aimed at exploiting minute differentials in currency fluctuations. However, a 0,05 percent rate would do little to halt the stampede of transactions seen during currency crises. To overcome this problem a German economist, Paul Bernd Spahn, suggested a variation of the Tobin tax whereby a very low default rate is set, but a much higher surcharge is imposed for transactions involving a particular currency if that currency’s value changes suddenly by a large amount. The surcharge rate would be set sufficiently high to remove the profitability of speculative attacks on the currency, and would operate in a similar way to the New York Stock Exchange’s circuit-breaker mechanism.

⁷³ R. Murphy, C. Hines, A. Simpson, *‘People’s Pensions: New Thinking for the 21st Century’*, London: New Economics Foundation, 2003

Localizing Money

"A currency should be regarded as no more than a mechanisms to facilitate exchange. The monetary levers that surround a currency, such as interest and exchange rates, are simply the channels of regulatory feedback to the economy within the currency area. ... Localization aims to give each local economy its own feedback system tailor-made to the local level of economic activity. That way, each local economy cab be regulated in accordance with its own activities and goals. This sounds straightforward in principle, but in practice it raises once again the question of what is local. The answer to that question varies from one place to another... it depends on finding a point of equilibrium where the inconvenience and instability caused by the need to trade across currency boundaries will outweigh the advantages of highly specific regulatory feedback. Just where the point of equilibrium lies will depend on the relative importance of exchange within a currency area compared with its trade with other currency areas. Thus, under localization, the point of equilibrium will shift towards the local and optimal currency areas will tend to shrink." (...) "However, different sectors of an economy will always tend to reach different views as to where the point of equilibrium should lie. Imagine a typically industrial estate on the edge of a fictional town in a run-down region of an otherwise reasonably prosperous and averagely sized currency area. The town could be in Canada or the UK, for example, but it is starved of currency because the interest rates are too high to suit the local economic climate. Occupying one of the units is a high-tech manufacturer of specialist equipment. The company sources components from around the world and has to export to many different countries to generate sufficient sales volumes. Business is good, particularly in Asia and the company has been pricing its products in euros and US dollars for three years. Next door is a small dairy that buys its milk from a local farmers' co-op and sells its products in local shops and farmers' markets. The local recession has hit the dairy's business. If asked for their views on the optimal sizes for the local currency area, the economically literate bosses of the dairy and the manufacturing company would give very different answers. The dairy would do much better under a more localized currency with lower interest rates, the manufacturers would be more concerned about the ease of exchange and would probably favor joining the much bigger currency area next door. There is no single answer to suit them both. ...The situation that would suit them best is the one where they could trade in any of different parallel currencies operating in their area to suit their needs." (...) "What is generally lacking is the opportunity for local regions to create their own means of exchange to operate alongside the national and international currencies and stimulate the local economy. There are some exceptions to this general rule. Local exchange trading schemes (LETS) provide a very small-scale and informal example. The Swiss Wir system operates along similar lines to LETS schemes to provide low-cost finance to local business. It started in 1934 and by 1993 had 65.000 corporate members and a turnover valued at £12 billion. Regional currencies have occasionally emerged, usually in the form of notes issued by regional governments needing to inject liquidity into their local economy. Regional currencies became an important part of Argentina's efforts to recover from its economic crisis of 2001. Local exchange schemes usually encounter official hostility. Central banks are not keen on competition and the schemes are frequently suspected as a means of tax evasion, despite the fact that one-third of global tax revenues are estimated to be lost, not through LETS schemes, but to off-shore tax havens. If a local currency is based on a unit of exchange that is of practical value to the tax-raising authority, there is no reason why it should not accept taxes in that currency." "Local currencies and exchange schemes, running in parallel with national and international currencies, could have a vital role to play in boosting the resilience of local economies. They would allow local communities to assign value according to local conditions, retain wealth within the local area, supply low-cost finance to local business and provide an alternative source of liquidity when it is denied by the one-size-fits-all prescriptions of the wider economy."

Michael Woodin and Caroline Lucas, *'Green Alternatives to Globalization: A Manifesto'*, Pluto Press, 2004.

5.5.4.2 Controlling the Transnational Corporations (TNCs)

TNCs enjoy economic power that is out of all proportion to their importance as employers. At the turn of the 21st century, just 500 corporations controls 70 percent of world trade and the value of the combined sales of the world's 200 largest TNCs exceeds the combined global economy except the biggest nine countries. Yet these 200 companies employ just 0,75 percent of the global workforce, and many of them are busy downsizing by shedding jobs.⁷⁴ Nevertheless, because of the number of jobs involved in each plant, the threat of relocation holds powerful leverage over governments. The urgent need for a tighter regulatory framework for TNCs is also illustrated by the effect they have on the environment. TNCs produce more than half of the global emissions from the industrial sectors that have the greatest impact on global warming. TNCs dominate the extraction and trading of natural resources that threaten global forest, water and marine resources together with the people who depend on them, e.g. just six TNCs produce 63 percent of mined aluminum and 20 companies account for the production of 90 percent of all pesticides. TNCs manufacture the majority of the most persistent and polluting chemicals – the chlorine-based PCBs, dioxins and DDT.⁷⁵

Economic localization would give governments the leverage to hold TNCs to account by encouraging countries or regional groupings of countries to adopt “site here sell here” policies for manufacturing and services, which would make access to a given market dependent on a company being based in that country or grouping of countries. Under this policy, an inventory of imports would be drawn up with a view to identifying those goods and services that should be produced within the domestic market area. Over a transitional period, incentives would be offered to producers to set up within the domestic market. The aim would be that, by the end of the transitional period, local producers would dominate the domestic market for the selected goods.

In so doing, the policy applies the principle of **trade subsidiarity**, which states that distance between production and consumption should be as short as reasonably possible. Thus, in accordance with this principle, market areas for goods and services that are relatively easy to produce, such as staple food crops, should be the most localized. Goods that depend on highly capital-intensive production, such as cars and computer chips, could be in principle also be manufactured on a very localized basis, but in practice this would be highly inefficient and their “domestic” market area would therefore need to be larger, perhaps even the size of the EU. Market areas for these products would initially need to be larger still in regions where market volumes are relatively low, for example, computers in Africa. Nevertheless, production standards should ensure that the repair and recycling and, in some cases, elements of the assembly of these products can take place on a more localized basis. Finally, there are some products that simply cannot be produced in certain localities, such as tropical food crops. For obvious reasons, these should be excluded from the import substitution programme and traded accordingly to fair trade principles.

5.5.4.3 Taxes for localization

By reducing the power of the TNCs and making investors, producers and consumers much more directly accountable to each other, the policies already outlined will help to create sustainable local economies. However, this shift can be given extra impetus by an overhaul of taxation that internalizes

⁷⁴ A. Anderson and J. Cavanagh, *The rise of global corporate power*, Third World Resurgence, 97, 1998

⁷⁵ M. Khor, *Globalisation and the Crisis of Sustainable Development*, Penang, Malaysia: Third World Network, 2001

the hidden costs of the current production and distribution systems. Energy derived from fossil fuels should be taxed in proportion to the carbon content of the fuel used and aviation fuel's exemption from excise duty should be ended. The use of other polluting resources should also be taxed and "eco-taxes" should replace value-added taxes (VAT) or sales taxes.

The level of eco-tax levied on any product should reflect the health and environmental impacts of its full life cycle. These taxes could be introduced at relatively low rates, but be increased steadily according to a pre-arranged timetable, as suggested since the 1990s with the Ecological Tax Reform proposal.⁷⁶ This would provide powerful incentives for technological improvements in energy and resource efficiency. Crucially, it would also reflect the environmental impacts of transport more directly in its costs, which would help to localize patterns of production and consumption and cut down on the unnecessary transportation of goods that could be produced nearer to the point of consumption.

Ecological taxes have the potential to raise a great deal of revenue, but their aim is to curb pollution so the revenue they generate should decline over time. This means they will be an ideal way of funding any transitional costs involved in introducing the economic localization framework at global level. However, research has also predicted that they would yield lasting economic benefits beyond their obvious environmental effects, particularly if their introduction is matched by a reduction of taxes on employment. Finally, a well-known pitfall of eco-taxes is that, being indirect taxes, they have a relatively impact on poorer people. There are several ways of avoiding this problem. Households could be granted a basic allowance of domestic energy tax-free, for example, or a means-tested benefit could be introduced, funded from ecological tax revenues, to offset the regressive effect of Ecological Tax Reform. The problem will be reduced, and eventually disappear, as more sustainable, and therefore lightly taxed, alternatives to fossil fuel energy become readily available.

5.5.4.4 *Rewriting the World Trade rules*

Under the localization paradigm, international trade will continue, but only when it provides the most efficient distribution of goods after all external costs have been internalized and does not undermine the diversity and resilience of the traders' local economies. Similarly, Foreign Direct Investment (FDI) will in some cases have a role to play in the transition towards sustainable and self-reliant local economies.

In other words, it is clear that goods and money still move around the world. Therefore, the need for the agreement and enforcement of international rules to govern these movements will be as great as ever, but the current rules must be rewritten so that their end goal is to rebuild a diverse and sustainable national and regional economies everywhere. Existing WTO rules must be radically overhauled so that they incorporate the goal of economic localization and permit the introduction of the policies outlined above to support localization. A leading localization campaigner, Colin Hines, has suggested one set of reforms to the key provisions of the 1994 version of GATT and other trade agreements that together make up the rules of the WTO. Taken together, these reforms would create a **General Agreement of Sustainable Trade (GAST)**.⁷⁷ A key element of the GAST is that trade will be regulated by fair trade rules similar to those that are currently adopted voluntarily within the fair trade

⁷⁶ Ernst von Weizsacker, Amory B. Lovins, L. Hunter Lovins, *Factor Four: Doubling Wealth, Halving Resource Use – The New Report to the Club of Rome*, Earthscan, 1997

⁷⁷ C. Hines, *Localization*, 2001; the amended GAST rules are summarized in M. Woodin and C. Lucas, *Green Alternatives to Globalisation: A Manifesto*, Pluto Press, 2004.

movement to guarantee decent wages, working conditions, environmental standards and fair prices for producers and consumers. One way of enforcing such rules would be for a new successor to the current WTO to withdraw the international trading license of any company that is found to have breached the rules.

However, there are three problematic aspects of economic localization that need to be carefully considered when rewriting the global trade rules:

- *The need of some form of “Green Marshall Plan”*: The first aspect is related to the belief, hold by many trade theorists, that international trade is the best, or in the extreme, the only means of redistributing wealth between nations. These trade theorists thus regard elements of localization as unjust, inasmuch as they would reduce the opportunities for poor countries to export to rich countries: rich areas that undertook localization would remain rich, while poor areas would remain poor. To prevent this injustice arising, localization must demonstrate that trade is not the only means of transferring resources from rich to poor countries. In other words, the developed world must radically reorient its approach to development aid and debt so that sufficient resources are transferred to the South to give it the opportunity to create the resilient, self-reliant local economies that will lift its people out of poverty. The shift towards economic localization and the adoption of a new General Agreement on Sustainable Trade must be coupled therefore with some form of “Green Marshall Plan” whereby the Northern countries would allow the cancellation of conventional “third world” debt. Not only this free debtor countries to devote more resources to essential public services, but crucially, it would also reduce their need for foreign exchange earnings and allow them to diversify their economies away from over-reliance on export markets. Debt cancellation would merely stop the ongoing extraction of wealth from the South to repay the loans; a second element of the Green Marshall Plan would involve a dramatic increase in development aid as a transitional measure to help poor countries develop the diverse local economies that will be their engines of future sustainable development.⁷⁸
- *The need to prevent unfair imports from economies that impose lower levels of ecological taxes*: Imports from economies that impose lower levels of ecological taxes will unfairly undercut the price of domestically produced goods. The new international trade rules should be amended therefore to allow countries, or regional groupings of states, to impose import tariffs to prevent this, providing they accept the terms of the Green Marshall Plan mentioned above. Within this framework, the tariffs and quotas needed to regulate trade would not be perceived as a narrow, protectionists measures. Rather they would be seen as elements of an internationalist project designed to help parts of the world achieve greater food security and self-reliance and to replace market-dependence with resilient and socially responsive local economies. As a result, countries with commitments to reduce emissions are allowed to implement border-tax adjustments to tax carbon and energy-intensive products from countries not subject to those commitments, so as not to suffer a comparative disadvantage.
- *The need of fostering local competition and innovation*: Last, but not the least, there is the problem that in the relatively protected environment that localization will create, it would be easier for producers, left unchecked, to establish monopolies, cartels or corrupt, patronage-based networks of production and distribution. This could reduce the choice and quality of products available, inflate prices and lead to wasteful production methods. To avoid this,

⁷⁸ Nevertheless, safeguards must be provided against the dangers of patronage and dependency. Under the terms of an UN Green Marshall Plan, payments would be made according to an agreed and time-limited timetable and would be targeted on project that would help to reduce the need for aid in the future by eradicating poverty and establishing greater local self-reliance. Projects should be planned and led by local the local community and should aim in particular to boost local food and energy security and make basic health care, education and family planning universally available.

localizing economies will need to introduce local competition policies and offer incentives to new market entrants. International treaties to ease the transfer of technology and information would also ensure that the reduction in international competition induced by localization will not eventually result in a loss of innovation. Indeed, localization will reduce the profit companies can expect from the global exploitation of their intellectual property, and as a consequence their private R&D efforts. However, this can be compensated by placing the onus for research funding more firmly on governments, resulting in research that is driven more by public interest than potential profit, and greater public ownership of the outcomes.

5.5.5 The shift towards a new local and global democracy

A key feature for the transition to a beyond growth society is to establish a new and more effective framework of global politics, a global political space in which local democracy and sustainable alternatives can flourish. Government is the principal means available to citizens to collectively exercise their stewardship responsibility to leave the world a better place. Inevitably, then, the drive for transformative change leads to the political arena, where a vital democracy, steered by an informed and engaged citizenry, is needed.

Currently the situation, even in the most long-standing democracies of U.S. and the European Union is far from providing this. It is unimaginable that the current politics as we know it in these areas of the world will deliver the transformative changes needed for them and the rest of the world. There are many reasons why government in Washington, Brussels and many other capital cities of Europe is more problem than solution. It is hooked on GDP growth – for its revenues, for its constituencies, and for its influence abroad. It has been captured by the very corporations and concentrations of wealth it should be seeking to regulate and revamp, a pattern of “lobbycracy” that has now reached alarming proportions. And it is hobbled by an array of dysfunctional institutional arrangements, beginnings with the way presidents and parliaments are elected (see box).

Why current politics cannot deliver the transition to a post-growth society?

“William Greider, in his book *The Soul of Capitalism*, expresses a proper skepticism that today’s politics can address the underlying problems of capitalism. He writes, “If an activist president set out with good intentions to rewire the engine of capitalism – to alter its operating values or reorganize the terms for employment and investment or tamper with other important features – the initiative would very likely be chewed to pieces by the politics. Given the standard legislative habits of modern government, not to mention its close attachments to the powerful interests defending the status quo, the results would be marginal adjustments at best and might even make things worse.”

Peter Barnes explains the problem starkly in *Capitalism 3.0*: “The reason capitalism distorts democracy is simple. Democracy is an open system, and economic power can easily infect it. By contrast, capitalism is a gated system; its bastions aren’t easily accessed by the masses. Capital’s primacy thus isn’t an accident, not the fault of George W. Bush. It’s what happens when capitalism inhabits democracy”. Barnes notes that regulatory agencies have been co-opted by the industries they were intended to regulate. “And it’s not just regulatory agencies that have been captured. Congress itself, which oversees the agencies and writes their controlling laws, has been infected. According to the Center of Public Integrity, the “influence industry” in Washington now spends \$6 billion a year and employs more than thirty-five thousands lobbyists ... In a capitalist democracy, the state is a dispenser of many valuable prizes. The rewards include property rights, friendly regulators, subsidies, tax breaks, and free or cheap use of the commons. The notion that the state promotes “the common good” is sadly naïve ... We face a disheartening quandary here. Profit-maximizing corporations dominate our economy ... The only obvious counterweight is government, yet government is dominated by these same corporations.”

Another longtime analyst of our politics, Gar Alperovitz, explains how the corporate sector wields the influence it does. In *America beyond capitalism*, he writes that “the large corporation regularly: 1) influence legislation and agenda setting through lobbying; 2) influence regulatory behavior through direct and indirect pressure; 3) influence elections via large-scale campaign contributions; 4) influence public attitudes through massive media campaigns; 5) influence local government choices through all of the above – and adds the implicit or explicit threat of withdrawing its plants, equipment, and jobs from specific locations.”

James Gustave Speth, *The Bridge at the Edge of the World: Capitalism, the Environment and Crossing from Crisis to Sustainability*, Yale University Press, New Haven and London, 2008.

The first step to move beyond this poor state of affairs is to start envisioning the type of democracy that is needed. One root to feed the vision of a new democracy can be found in the debate about rethinking **local democracy**, animated by many environmental grassroots movements who, placing especially high value on sustaining the environment, have stressed the revitalization of life and democracy at the local, community, or bioregional levels.⁷⁹ This preference for the local is also clear in the program of the antiglobalists. In *The Land That Could Be*, William Shutkin⁸⁰ discusses **civic environmentalism**, where members of particular geographic or political communities work together to build a future that is environmentally healthy and economically vibrant at the local and regional levels. Civic environmentalism entails a set of core concepts that embraces civic action and community planning on the part of a diverse group of stakeholders aimed at promoting both environmental protection and democratic renewal: participatory processes, community and regional planning, environmental education, industrial ecology, environmental justice, and place. A sense of place and geographic continuity are important in all these visions. In short, many of those who have given the future of democracy the deepest thought have concluded that empowerment of citizens to decide matters of common concern and to legislate the results themselves is essential not just to better decisions but also to better citizens. A first step towards a new paradigm of politics is therefore to strengthen deliberative democracy and self-government everywhere (see box).

Envisioning Deliberative Democracy and Self-government

“It is at the community and regional levels that it is easiest to envision what many see as the best model for democracy’s future – **deliberative or discursive democracy**, what Benjamin Barber calls strong democracy. This is direct democracy – citizens debating the options, learning together, overcoming their differences, and coming to decision. It is far away from today’s interest-group, representational democracy.”

In *Deliberative Environmental Politics*, Walter Barber and Robert Bartlett describe its growing support: “The deliberative democracy movement has been spawned by a growing realization that contemporary liberalism has lost its democratic character just as it has sacrificed its ecological sustainability. Modern democracies, confronted with cultural pluralism, social complexity, vast inequities of wealth and influence, and ideological biases that discourage fundamental change, have allowed their political institutions to degenerate into arenas for strategic gamesmanship in which there is no possibility for genuine deliberation. Neither true democracy nor environmental protection is possible where citizens become mere competitors with no commitments beyond their narrow self-interests ... Deliberative democrats presume that the essence of democracy is deliberation rather than voting, interest aggregation, or rights. Deliberative democracy has a distinguishing core set of propositions, namely: political equality of participants; interpersonal reasoning as the guiding political procedure; and the public giving, weighing, acceptance, or rejection of reasons.” Efforts are now under way to identify ways to move deliberative democracy from theory to practice on a larger scale. These include identification of institutional arrangements that will require the direct participation of citizens and the types of dialogue mechanisms that can be used in the process. An important critique of deliberative approaches has come from those who stress that inherent power imbalances can skew its outcomes and who see a continuing need for activists’ methods (demonstrations, boycotts, sit-ins, etc.). Both approaches are seen as having important roles.”

“In his *Strong Democracy: Participatory Politics for a New Age*, Barber argues that participatory democracy does not require either the “antiquated republicanism” or the Greek polis or “face-to-face parochialism” of the town meeting. But it does require “self-government by citizens rather than representative government in the name of citizens. Active citizens govern themselves directly here, not necessarily at every level and in every instance, but frequently enough and in particular when basic policies are being decided and when significant power is being deployed. **Self-government** is carried on through institutions designed to facilitate ongoing civic participation in agenda setting, deliberation, legislation and policy implementation (in the form of “common work”). Strong democracy does not place endless faith in the capacity of individuals to govern themselves, but it affirms with Machiavelli that the multitude will on the whole be as wise as or even wiser than princes and with Theodore Roosevelt that “the majority of the plain people will day in and day out make fewer mistakes in governing themselves than any smaller body of men will make in trying to govern them.”

To implement these goals and make “every citizen his own politician,” Barber lays out a series of innovative arrangements to institutionalize strong democracy in today’s context, arrangements designed to “involve individuals at both the neighborhood and the national level in common talk, common decision-making and political judgment, and common action.” At the top of his list is a uniform national system of local participation: “The first and most important reform in a strong democratic platform must be the introduction of a national system of *neighborhood assemblies* in every rural, suburban, and urban district in America. Political consciousness begins in the neighborhood”

James Gustave Speth, *The Bridge at the Edge of the World: Capitalism, the Environment and Crossing from Crisis to Sustainability*, Yale University Press, New Haven and London, 2008.

⁷⁹ See Kirkpatrick Sale, *Dwellers in the Land: A Bioregional Vision*, Athens: University of Georgia Press, 2000.

⁸⁰ William A. Shutkin, *The Land That Could Be: Environmentalism and Democracy in the Twenty-First Century*, Cambridge, Mass.: MIT Press, 2000.

Another root for envisioning the future of democracy can be found in the current debate about rethinking equal citizenship and social justice. Given the importance of keeping inequality down, ways are devised in this debate for ensuring that greater equality is more deeply rooted in the fabric of modern societies, including in particular achieving more **social justice** through the spreading of a model of “**rawlsian society**”, as it is called from the leading work of John Rawls on the theory of justice (see box).

Pursuing Social Justice in a “rawlsian society”

The most prominent thinker that has developed the concept of social justice in his work is **John Rawls**, whose most important ideas are presented in his 1971 book *A Theory of Justice*. The main focus of Rawls investigation have been the “social institutions”, meaning with this term the practices and rules that structure relationships and interactions between agents. Any given society can be structured and regulated in many different ways, featuring diverse ways of organizing economic cooperation and control of resources and of the means of production. There are many different options for devising its governmental agencies and for formulating its laws governing property, taxation, labour, inheritance, and so on. Some of these institutional designs would tend to generate more poverty than others. Moral attention and polity is focused here on the design and reform of society’s institutional order – not on the particular acts and omissions of its participants. The Rawls approach suggests therefore an additional responsibility we have as citizens, through our participation in the imposition of our society’s institutional order. This is a special political responsibility, typically borne by adult citizens. These citizens are then collectively responsible for excess unemployment and poverty that could be avoided through a better design of the institutional order. Achieving institutional reform through collaborative efforts its difficult. It requires political cooperation. And it requires research into how the distribution of morally significant goods (income, employment, education, etc.) depends on the design of the institutional order and what these distributions would tend to be like under practicable alternative designs.

Socially just societies should respect two public criteria or “**principles of justice**”. The *first principle of justice* applies specifically to the political order of a society, and aims to secure certain basic rights and liberties to its members. Rawls explicates the basic liberties, in the first instance, by a list organized under four headings: political liberties; liberty of conscience and freedom of association; freedom and integrity of the person; rights covered by the rule of law. Provided that the first principle guarantees a society’s political and legal order, its social and economic institutions are to be governed by Rawls’s *second principle of justice*, which says, in its most recent formulation: “Social and economic inequalities are to satisfy two conditions: first, they are to be attached to positions and offices open to all under conditions of fair equality of opportunity (opportunity principle); and second, they are to be to the greatest benefit of the least advantaged members of society”.

In the economic field, a shift to a “**rawlsian society**” would mean indeed shifting away from profit maximisation principles - which currently govern the global market-oriented society and corporations – towards the maximin criteria underpinning the difference principle, i.e. to a distribution of social and economic inequalities (e.g. of income) which is to be to the greatest benefit of the least advantaged members of society. Perhaps the most important aspect of the theory is that these criteria of justice are assumed to be identified and applied as a result of building an overlapping consensus among citizens and actors of the civil society – who see therefore themselves empowered and engaged in reaching a consensus with other participants on how to rule their societal institutions.

However, the Rawls’s theory it has been criticized, in particular by the Nobel Prize Amartya Sen, for its focus on income, wealth and other primary goods, disregarding the assessment of capabilities. In the capability-based assessment of justice, individual claims are not to be assessed in terms of the resources or primary goods the persons respectively hold, but by the freedoms they actually enjoy to choose the lives that they have reason to value. To illustrate this point, a person who has a disability can have more primary goods (in the form of income, wealth, liberties, and so on) but less capability, due to the handicap. Finally, it is important to note that six restrictions apply to the Rawls’s theory of justice: 1) it addresses only one kind of social systems, i.e. a society defined as a large group of people living together in an organized way, in a fixed geographical area, over generations. As part of this first restriction, Rawls also stipulates that a society is isolated and self-contained, and he aims to develop a conception of justice applicable to relatively homogeneous national societies; 2) all members of the society are capable of taking part in education, work, and politics over a complete life. People not compliant with the citizenship conditions (e.g. foreigners or irregular immigrants) are left aside, as well as people affected by severe mental or physical disabilities; 3) Rawls assumes conditions of relative scarcity, where available resources are sufficient so that social cooperation enables the comfortable survival of all members of society but not so abundant that each can have all his heart might desire; 4) Rawls is engaging in ideal theory, i.e. he is asking how well each candidate public criterion of justice would guide and organize human beings as they would come to be if they grew up in a society governed by this criterion. The sought public criterion is not meant to be used for guiding the reform of an unjust basic structure design, but only as an ideal yardstick – i.e. no room is given to consider how this envisioned criterion is reachable from where our society is now; 6) Rawls is seeking a conception of social justice that can achieve stability, that is, can endure by engendering a firm moral allegiance to itself and to the social order it sustains on the part of all (or nearly all) citizens. This claim for a condition of pluralism and tolerance: a conception of justice can achieve stability only if it can be the object of an overlapping consensus, that is, only if it can be morally endorsed by citizens who are also committed to diverse and partially conflicting moral, religious and philosophical worldviews.

Thomas Pogge, *John Rawls: His Life and Theory of Justice*, Oxford University Press, 2007.

In describing his model, Rawls concentrates on a **property-owning democracy** and how it differs from a capitalist welfare state. Both types of regime provide for private ownership in the means of production. In a capitalist welfare state, however, economic power – and therefore also political power – is highly concentrated, so that a small elite dominates the political process. A property-owning democracy sustains instead a much broader distribution of wealth, in particular by means of a high and progressive inheritance tax and a partial replacing of income taxes with expenditure taxes (engendering a tendency for wealth to concentrate in households with high saving rates). Another important difference consists in the fact that a capitalist welfare state tends to engender a permanent underclass of welfare recipients who, even if they receive adequate benefits, are excluded from any role in their society's social and economic life. A property-owning democracy would avoid this problem. Rather than alleviate the most severe poverty – after the fact, as it were – through public assistance, its design preempts the very emergence of an underclass in need of public subsidies. The aim is to enable all citizens to meet their own socioeconomic needs out of their own earned income. Here educational institutions play a crucial role. All citizens are to be educated in such a way that they can participate, fully and as equals, in the economic and social life of their society and are motivated to do so by their secure sense of being, and being seen and treated as, equal citizens. In such a society, there would be much less need for welfare payments, though they could hardly be wholly eliminated.

In this model of society, steps could be envisioned to give individuals and local communities more direct power in the running of their local economies. One such step is to introduce a **citizen's income** and to couple it with the engagement in some forms of civic duties – e.g. participatory processes that aim to support decision making building the needed consensus around key social choices at local, national or even international level. The citizen's – or basic – income is a non-means-tested payment to every citizen, working or not, set at a level to cover basic needs without removing all motivation to take paid employment which, in its full form, would replace state pensions, tax-free allowances and all benefits. Citizen's income aims to abolish the poverty trap and to free people to choose the type of work and hours they want as their circumstances change; it thus stands to increase the power of individuals in the labor market, but also to help build cohesive and resilient communities by providing a basic wage for carers and community volunteers, who currently go unpaid.

However, strengthening local democracy and empowering citizens is necessary, but not sufficient. **Global democracy** must be also addressed. For instance, the “cosmopolitan project” as described by David Held and his colleagues in *Global Transformations* seeks to bring political accountability and democratic control to a range of international issues. To that end, they see the need for a “cosmopolitan citizen” who enjoys multiple citizenships – national, regional, and global. They believe that “democracy needs to be rethought as a “double-sided process.” By a double-sided process – or process of double democratization – is meant not just the deepening of democracy within a national community ... but also the extension of democratic forms and processes across territorial borders. Democracy for the new millennium must allow cosmopolitan citizens ... to render accountable the social, economic and political processes and flows that cut across and transform their traditional community boundaries.”⁸¹

There are thus advocates for localization of politics and advocates for political globalization. Seemingly at odds, the two positions are actually complementary. “**Glocalization**” is emerging, with action shifting away from the nation level, towards local and global levels. The nation-state, it has been said, is too little for the big things and too big for the little things. In many places, and especially in Europe, one can see indeed a growing psychological disinvestment in the nation-state and the strengthening of both local and transnational citizenship.

⁸¹ David Held et al., *Global Transformations: Politics, Economics, and Culture*, Stanford, Calif.: Stanford University Press, 1999

The key question now is how can the global and the local be integrated into one political framework?

In principle, the answer may be provided by new global democratic institutions, such as the world parliament envisioned by George Monbiot. However, the issue is clearly complex and it is not easy to find the right equilibrium between global and local initiative (see box).

Global vs Local Democracy

"At one end of the spectrum reformist critics of globalization argue that since economic globalization is inevitable, we should direct our efforts not at reversing it, but at ensuring that democratic globalization keeps pace with it; reform will only be possible once the global institutions that regulate the global economy are fully democratic. All effort should therefore be directed towards that end. The argument at the other end of the spectrum is that nothing short of complete autarky, a retreat into total and isolated local self-sufficiency, will serve as an adequate defense against the democratic deficit that exists at the international level."

In his recent book, *The Age of Consent*, George Monbiot assesses the merits of two approaches that lie close to the ends of the spectrum in the following terms: "In the absence of an effective global politics ... local solutions will always be undermined by communities of interest which do not share our vision. We might, for example, manage to persuade the people of the street in which we live to give up their cars in the hope of preventing climate change, but unless everyone, in all communities, either shares our politics or is bound by the same rules, we simply open new road space into which neighbouring communities can expand". This line of reasoning draws Monbiot to the political globalization end of the spectrum and the conclusion that, "by first rebuilding the global politics, we establish the political space in which our local alternatives can flourish". Accordingly, he proposes to remedy the democratic deficit that lies at the heart of the global institutions largely by relying on the "moral authority" of a new, democratically elected, **world parliament** to call them to account."

"Action at the local level will of course be reinforced if it is supported by global agreements. Nevertheless, to the return to the enlightened car-free residents, given sufficient democratic empowerment at the local level their street need not simply become new road space for the neighbouring communities to occupy. The residents could, for example, persuade their local council to close their street to through-traffic and turn it into a home-zone, creating space for children to play and trees to grow. Of course, one car-free street will not prevent climate change, but the children who live in it will have more fun and less asthma, the residents will gain a pleasant shared space in which to get to know each other and their local shops and bus services will benefit. Crucially, it will set an inspiring example for others to follow – one that might even spread sufficiently for the rate of growth of transport-related greenhouse gas emissions to be slowed in advance of the global treaty that finally combats climate change. It would be unduly restrictive to prevent the residents from reclaiming their street until after that treaty has been ratified."

"Such is the diversity of human society and the global environment on which it depends that truly representative democracy, let alone the participative variety, can only work very imperfectly at a global level. It is therefore no accident, for example, that the one-size-fits-all rules of the IMF and WTO ride roughshod over the world's intricate pattern of cultural and economic variations, just as thoroughly as the economic activities they propagate trample its fragile ecosystems. George Monbiot's proposal for a global parliament illustrates the difficulties of operating democratically at a global level. Rightly, he suggests that people, rather than states should be represented in the parliament, which should not become too large to operate efficiently. The world is therefore to be divided into 600 constituencies, each containing 10 million voters who elect a single member of the parliament. Two problems immediately become apparent. First, one person cannot accurately represent the diversity of opinions and interests of 10 million people and, second, the 600 members of the parliament would be easy targets for corporate lobbyists. These problems do not rule out the proposal, but they certainly caution against expecting too much of it."

"Localization therefore draws some inspiration from both ends of the spectrum. Autarky is rarely advanced with any seriousness; it ceased to be a realistic option many centuries ago. But achieving greater self-determination by relying less on markets over which one has little control is a central goal of economic localization. Equally, localization contends that democratizing the global institutions is indeed urgent and necessary, but there is much that could be done more locally to right the wrongs of economic globalization in advance of the dawning of the age of perfect global democracy.... Advocates of economic localization do not advocate withdrawal from the international stage, but they do recognize that, no matter how much it is improved, global society will never reflect the full diversity of its component parts as successfully as national or local society. Global democracy should therefore only be relied upon to solve those problems that cannot be better resolved more locally, such as the equitable allocation of the right to emit greenhouse gases. Except in a small minority of cases, the fair distribution of goods is not one such problem. There are only few goods, such as climate-specific agricultural products and rare mineral resources, that can only be sourced from a few geographically specific regions. Thus, a major advantage of economic localization is that it will shift the balance of economic control towards a level where democratic institutions enjoy greater prospects of imposing socially and environmentally sensitive regulations on the market. However, for the shift towards more diverse local economies to be effective and equitable, local democratic involvement must be increased to keep pace with the reinvigorated power of the local economy. Localization must avoid replicating the democratic deficit that lies at the hearth of globalization. There is no precise prescription for increasing democratic involvement. Each community and society has a different starting point and this will determine what needs to be done."

Michael Woodin and Caroline Lucas, *'Green Alternatives to Globalization: A Manifesto'*, Pluto Press, 2004.

In any event, the best perspective and wisdom is perhaps given in the “report from the future” prepared by Paul Raskin and his colleagues in the Great Transition Initiative. In his epistle from the last part of this century, his history of the future, Raskin begins by noting that “identity and citizenship has reached the level of the planet. Now, globalism is as deep-rooted as nationalism once was, perhaps more so.” Raskin continues, explaining how global and local perspectives were combined: “The Great Transition political philosophy rests on what has come to be called the principle of constrained pluralism. It includes three complementary ideas: irreducibility, subsidiarity, and heterogeneity. The *irreducibility principle* states that the adjudication of certain issues is necessarily and properly retained at the global level of governance. Global society has the responsibility for ensuring universal rights, the integrity of the biosphere, the fair use of common planetary resources, and for the conduct of cultural and economic endeavors that cannot be effectively delegated to regions. The *subsidiarity principle* dictates that the scope of irreducible global authority be sharply limited. To promote effectiveness, transparency and public participation, decision-making should be guided to the most local feasible level of government. The *heterogeneity principle* validates the rights of regions to pursue diverse forms of development and democratic decision-making constrained only by their obligations to conform to global responsibilities and principles. ... These principles are enshrined in the **world constitution** and it would be difficult to find anyone who finds them objectionable.”⁸²

A key feature of the new global politics would be therefore the adoption of a world constitution addressing a full collection of universal human and nature rights. Universal human rights started to be endorsed at the global level since the year 1948, with the UN Declaration of Human Rights. Fundamental rights including basic civic and policy liberties should be generalized, in the beyond growth society, to the whole world population, and extended to include also a number of social rights to nutrition, water access, health, education, a decent job and welfare provisions for all the citizens of the world.

However, the extension of the global constitutional chart should be enlarged to include not only human but also the newly perceived “nature’s rights”. This represents a key aspect of the whole paradigm shift underlying the transition to the beyond growth society.

Currently we live in a world where almost all legal systems define nature as property and “natural resources” as available for state-sanctioned exploitation, with the highest goal of government being the pursuit of an ever-growing GDP. The law defines everywhere land, water, other species, and even genetic material and information as “property”, which entrenches an exploitative relationship between the owner (a legal subjects with rights) and the property (legally speaking, a “thing” incapable of holding rights). Most legal systems also grant human beings legal rights to exploit all aspects of the Earth community (through mining, fishing, and logging concessions, for example), with predictably dire consequences for the integrity and functioning of indigenous communities. Almost all of the “environmental crises” that threaten contemporary industrialized civilization can be seen as a consequence of this legal attitude, and of the ecologically unsustainable and harmful human practices it brings in. Since these practices reduce the prospects of our descendants surviving and thriving, from an evolutionary perspective – as well as from ethical, spiritual, and pragmatic perspectives – they are contrary to the interest of species. Legal systems are failing to protect the Earth community in part because they reflect an underlying belief that humans are separate from and superior to all other members of the community, and that the primary role of Earth is to serve as natural resources for humans to consume.

⁸² Paul D. Raskin, *The Great Transition Today: A Report from the Future*, Boston: Tellus Institute, 2006.

However, as it appears increasingly clear that in the long term humans cannot thrive in a degraded environment anymore than fish can survive in polluted water, a new pattern of initiatives is now emerging across the world to bring about a fundamental change in human legal systems. These all share the belief that a primary cause of environmental destruction is the fact that current legal systems are designed to perpetuate human domination on nature instead of fostering mutually beneficial relationships between humans and other members of the Earth community. These initiatives all advocate an approach known as **Earth jurisprudence** (see box).

Principles of Earth Jurisprudence

- The universe is the primary law giver, not human legal systems.
- The Earth community and all the beings that constitute it have fundamental “rights”, including the right to exist, to have a habitat or a place to be, and to participate in the evolution of the community.
- The rights of each being are limited by the rights of other beings to the extent necessary to maintain the integrity, balance, and health of the communities within which it exists.
- Human acts or laws that infringe these fundamental rights violate the fundamental relationships and principles that constitute the Earth community and are consequently illegitimate and “unlawful”.
- Humans must adapt their legal, political, economic, and social systems to be consistent with the fundamental laws or principles of that govern how the universe functions and to guide humans to live in accordance with these, which means that human governance systems at all times must take account of the interests of the whole Earth community and must:
 - determine the lawfulness of human conduct by whether or not it strengthen or weakens the relationships that constitute the Earth community;
 - maintain a dynamic balance between the rights of humans and those of other members of the Earth community on the basis of what is best for Earth as a whole;
 - promote restorative justice (which focuses on restoring damaged relationships) rather than punishment (retribution); and
 - recognizes all the members of the Earth community as subjects before the law, with the right to the protection of the law and to an effective remedy for human acts that violate their fundamental rights.

Cormac Cullinan, ‘*Earth Jurisprudence: From Colonization to Participation*’, in Worldwatch Institute, State of the World, 2010.

Accordingly to this philosophy, human societies will only be viable and flourish if they regulate themselves as part of the wider Earth community and do so in a way that is consistent with the fundamental laws or principles that govern how the universe functions. In the beyond growth scenario we assume that the Earth jurisprudence principles are written down in a world constitution adopted by the great majority of nation states. The precise nature and way in which the Earth jurisprudence principles are expressed in each nation or region would vary according to the particular context, but all would be consistent with the fundamental principles on which the Earth community is ordered. The new dominant view is that the long-term viability of human societies cannot be attained at the expense of the Earth community, and this is supported both by the teachings of many ancient traditions and religions and by the findings of physics and ecology – all of which point to the interconnectedness of everything and the futility of attempting to understand any part of a system without reference to its context.

A practical way to foster the transition and achieve a new world where Earth jurisprudence is fully endorsed and enforced at global and local level was to strengthen environmental politics everywhere. This entailed three major moves to scale up the impact of environmentalism: First, enlarge its agenda to include the full range of relevant issues, including humans’ and nature’s rights as a central concern; second, “get it political”, building a mighty force in electoral politics everywhere this was possible, starting from the biggest democracies in the world (US and EU); third, build an international movement of citizens and scientists, one capable of dramatically advancing the political and personal

actions needed for the transition to sustainability. Early signals of these moves are already with us (see box).

A new Constitution in Ecuador

“If we have our land and clean air and water, our communities can have *sumac kawsay* – the good life,” the indigenous leader said with calm conviction. “I don’t know why you are calling this a new development model – we have always lived in this way. The duty of the state is to ensure that these fundamental rights are protected in order to safeguard the well-being of our people.”

The leader was speaking to legislators, politicians, lawyers, and activists gathered in Quito in November 2008 to discuss how best to implement the provisions in Ecuador’s new constitution that recognizes that nature has rights that must be enforced by law. The constitution sets the achievement of well-being in harmony with nature (*el buen vivir* or *sumac kawsay*) as a fundamental societal goal. Inclusion of these provisions was achieved in a remarkably short time by the collective efforts of indigenous people’s representatives and environmental nongovernmental organizations (NGOs) supported by lawyers from the Community Environmental Legal Defense Fund (CELDF) of United States.”

“The rapidly intensifying challenge of climate change has exposed how ineffective international and national governance regimes are in dealing with the side effects of consumerism and the excessive use of fossil fuels. But there are still major differences regarding how best to respond. Most governments today favor a combination of new technology and better application of existing regulatory systems. Ecuador is exceptional in opting to make a fundamental change to the architecture of its governance system by recognizing the rights of nature and redefining its concept of development. There, the existence of a large number of people who had not wholly adopted western consumerist values appears to have been a crucial factor in securing the recognition of the rights of nature in the constitution. And in a speech to the U.N. General Assembly in April 2009, President Evo Morales of Bolivia called for a *Universal Declaration of the Rights of Mother Earth*, indicating the potential for these ideas to spread rapidly.

Cormac Cullinan, ‘*Earth Jurisprudence: From Colonization to Participation*’, in Worldwatch Institute, State of the World 2010.

5.5.6 The new global picture in the beyond growth scenario

Combining all the sectoral transformations described in the previous sections a new global picture of the world emerges. In a nutshell, the world, in this scenario, escapes the current recession implementing a Marshall Plan for global environment, including huge public works and housing regeneration to improve energy efficiency and the quality of life in the North, as well as a great expansion of investment directed to enhance the affluence and well being of populations in the South. The present focus on (and measurement of) growth evolves with the adoption of a more comprehensive measurement of progress in the economic, environmental and social dimensions. Important education programs are launched, particularly in Africa in order to stimulate local development and to limit emigration. The Marshall Plan contributes to curb the increase in temperature, and the world population is expected to stabilize around 8 billion by 2050.

This is the result of coherently pursuing, at the global scale, a “climate Keynesianism” strategy, i.e. a variant of the climate capitalist scenario that we assume may enable the transition to a low carbon economy (see chapter 5.3). The climate Keynesianism strategy emerges on the global arena as the ability of carbon markets – the engine of the climate capitalism scenario – to exercise an invisible hand that drives carbon emissions becomes increasingly dubious, and more and more political forces come together to strengthen their governance. Carbon markets are not abandoned, merely better governed to direct them more closely towards the goal of decarbonisation and to ensure the “environmental integrity” of offsets both in an increasingly expanded Clean Development Mechanism (CDM) and in voluntary markets. In the voluntary carbon markets, certification systems are strengthened, it becomes impossible to have offset projects without certification and there is pressure to adopt ever more stringent standards in the projects. Offset projects in the voluntary markets thus become progressively more useful in pursuing both decarbonisation – eschewing large-scale “low-hanging fruit” projects in favor of ones that are more transformational – and serve broader sustainable development goals. Forestry projects, for example, become restricted to small-scale community forestry projects, avoiding large scale plantations.

A greatly expanded CDM is organized in the context of the negotiations about the international regime beyond 2012, to generate investments in broad programs across whole economic sectors rather than just individual projects. All this ends up in the creation of the **Earth Atmospheric Trust** proposed since the early 2000s.⁸³ This system comprises a global emission trading system for all greenhouse gas emissions, with the auctioning of all emissions permits before allowing trading among permit holders (to send the right price signals to emitters) and a reduction of a cap over time to stabilize atmospheric greenhouse gas concentrations at a level equivalent to 350 parts per million of carbon dioxide. The revenues resulting from these efforts are deposited into the Earth Atmospheric Trust, administered transparently by trustees who serve long terms and have a clear mandate to protect Earth’s climate system and atmosphere for the benefit of current and future generations. A designated fraction of the revenues derived from auctioning the permits is used to reduce global poverty, for instance returning it to people throughout the world in the form of a per capita payment. The remainder of the revenues are used to enhance and restore the atmosphere, invest in social and technological innovations, assist developing countries, and administer the Trust. The expanded CDM eventually evolves into a new “**Climate Marshall Plan**”, with the carbon credits gained through investments in the Plan which are used to offset carbon debits in the Trust. The Climate Marshall Plan becomes, in effect, a grand bargain between North and South, facilitating a great expansion in investment to the South, more evenly distributed among Southern countries thanks to a quota system embedded in the CDM which ensures

⁸³ Cfr. Peter Barnes, *Who Owns the Sky? Our Common Assets and the Future of Capitalism*, Washington DC, Island Press, 2003

a fairer share of carbon finance for sub-Saharan Africa. In addition, an agreement on new and increased levels of additional aid for mitigation – a fixed per cent (up to 1 per cent) of Northern countries' GNP as proposed by China and the G77 since the beginning of the 21st century – is achieved, feeding the Plan with the needed critical mass of funding

In this context, one key feature that will help to achieve global financial stability in the beyond growth scenario could be the introduction of a new neutral global currency that will implement the Keynes's original vision of an international clearing union, that prioritizes balanced trade accounts and uses a global currency that is not controlled by any nation. One radical idea for a new neutral global currency is the Emissions-backed Currency Unit (Ebcu), proposed as a development of the Contraction and Convergence method of cutting greenhouse gas emissions.⁸⁴

Other key features complete the picture of the beyond growth society. In a nutshell, there is a reduction of the world trade (North-South), compensated by a growth of regional trade (South-South) and local trade. Local employment increases, especially in the renewable energy and energy saving sectors, environmental services and social activities. Solar energy and energy saving are the new pillars of the energy transition. The urbanization process is steered by urban planning measures enforced everywhere, which contribute to limit urban sprawl and foster the development of polycentric networks of compact and resilient cities. Organic farming is now growing and may represent, in this scenario, an important share of the agricultural land surface, especially near or even within the cities, where some land is recovered for private and common food gardens.

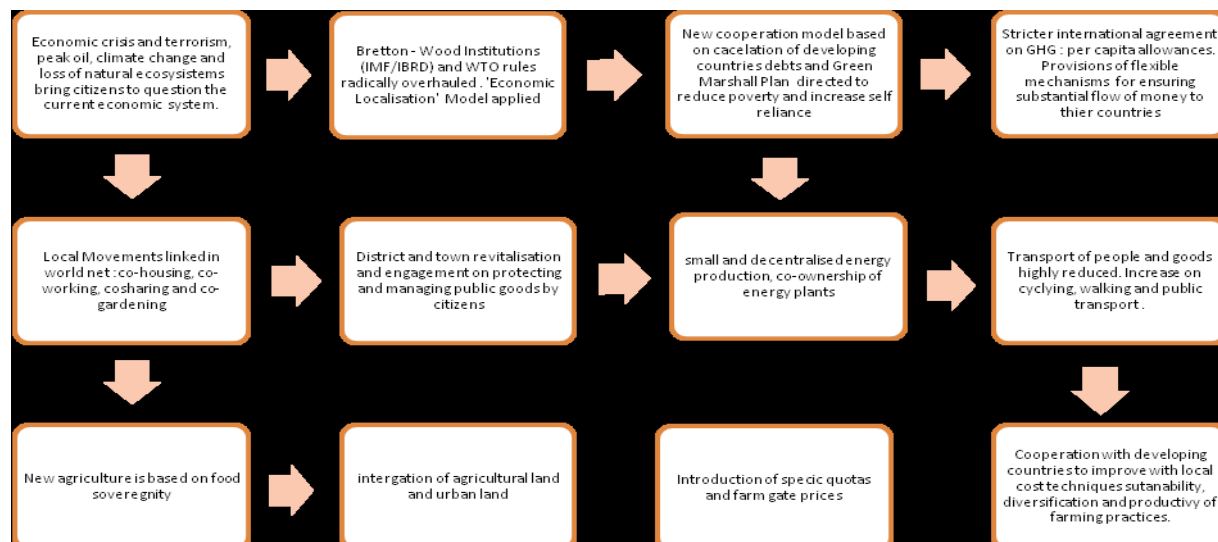
In the social field, the full transition from the industrial to a new "cognitive" civilization, which started at the end of 20th century, is completed. A new type of Internet is settled: open access for an open society. In this new civilization, the dominant activity is no more market production, but new forms of social production. The main focus of social production activities are nature care, community care and information handling.

The communication network crosses the former institutional frontiers and renders progressively obsolete the former divides, including the nation state one. In the cognitive civilization, the education system becomes international and completely reshaped by the Internet access, not only to information, but also to training processes and validation tests. Research will attract talented young people. What is nowadays considered as being a high level knowledge will become currently accessible by anyone, and what are considered as second level skills, like the handicraft skills, becoming rare, will be appreciated because of their scarcity. As for education, self-care should also increase, as a consequence of the accessibility of information through Internet.

A scheme of the assumptions of drivers' interactions underpinning the scenario is presented below:

⁸⁴ Under this method, each country would receive an annual allocation of emission permits on a per capita basis. Over an agreed period of time, the total annual allocation would be reduced until it no longer exceeds the planet's ability safely to absorb the emissions it permits. Countries would be able to trade in emissions permits using Ebcus, which would also be allocated on a per capita basis. Until they become more energy efficient, rich countries that emit more than their fair share of greenhouse gas emissions would need to buy emission permits from poorer countries. Poor countries would have an incentive to invest the Ebcus they receive in the development of energy-efficient economies so that they retained a surplus of tradable permits. Ebcus could also be used as a global reserve currency, as the dollar now.

Table 17 The scheme of drivers interaction in the 'Beyond Growth Scenario'



5.5.6.1 A new globally interdependent world order



The “beyond growth scenario” was associated in the DELPHI survey to an “orange”, evoking a world that tends to progressively harmonize different regions, becoming more equilibrated in the long term. The world will shift in this picture from being dominated by a leading player “on top” – as it is for the dominant (but challenged) U.S. global power today – to new **“a-polar” world**. Indeed, the relative diminishment of U.S. economic power has been under way since the end of World War II – when the U.S. power was at its climax – and it is an entirely expected trend, not a cause of concern. What is more important is the rapidity of this decline and its eventual extent, and

the concurrently unfolding fortunes of other principal contenders for the place on top. At this last regard, Russia and Japan will remain major economic powers for decades to come, but their chances of claiming the dominant spot are highly unlikely because both of them are rapidly ageing and significantly depopulating. Neither Russia’s vast resources not Japan’s productive proficiency will be enough to make them contenders for global primacy. China is perhaps the foremost contender for the “on top” position. However, there are a multitude of long-term complications and serious checks that will contribute to delimit the current China’s ascent: an extraordinarily aberrant gender ratio, serious environmental ills, the increasing inequality of economic rewards, and its weak soft-power appeal. India’s quest, largely a race to catch-up with China, also faces many natural, social and economic limits. One may consider the role of the resurgent Islam, but the very heterogeneity of that faith and the major social, cultural, and economic divides among its adherents preclude the emergence of a unified Muslim power.

Finally, the prospects for the EU taking a global primacy role are almost inexistent. By 2050, Europe’s share of global economic product may be lower than it was before the onset of industrialization, hardly a trend leading toward global economic dominance. Another inescapable factor that will

determine the future of Europe's most affluent western and central parts and poorer eastern regions – limiting their ambitions of global primacy – is the shrinking and aging population. And no matter how far the EU expands, an entity so preoccupied with its own makeup, so unclear about its eventual mission, and so imperiled in terms of its population foundations cannot be a credible candidate for global leadership. In this situation, the demise of U.S. global dominance will not bring any multilateral balance of power.

The conclusion that would be perhaps the most easiest to defend is a pessimistic one: conditions in the absence of a global leader in a world swept by the forces of globalization would resemble those following the retreat of Roman power that underpinned centuries of coherent although not appealing middle-age civilization, featured by chaotic, long-lasting fragmentation, inimical to economic progress, which would greatly exacerbate many of today's worrisome social and environmental trends. Escaping from these doomed prospects, the beyond growth scenario envisions instead a shift away from globalization to **global interdependence**. This term describes much more accurately the realities of modern economies in the beyond growth world: once they left behind the limited autarkies of the preindustrial era, states have come to rely everywhere on more distant and more diverse sources of energy, raw materials, food and manufactured products and on increasingly universal systems of communication and information processing.

The key insight here is that global interdependence is already now an inescapable imperative for all modernizing countries, and as this process advances, it will become impossible for any nation – no matter how technically adept or how military strong – to claim a commanding place on top. The whole world can achieve in this way a new “a-polar” pattern of global stability in a way similar to what complex natural ecosystems do (see box below).

Global Interdependence and the ecosystems' analogy

“Analogies with ecosystems are always useful when thinking about economic organization and modern states. The most complex ecosystems abound with many fierce forms of specialization, competition and aggression, but they are fundamentally founded on enormous webs of symbiosis and cooperation. They have top (carnivorous) predators, many omnivores, and a very large number of herbivores, but there is no dominant species able to claim an excessively large share of resources, and all macro-organisms depend critically on environmental services provided by micro-organisms, mostly bacteria and fungi. An outstanding example of this is the fact that African termites may consume annually as much biomass per unit of savanna as do elephants.

Today's global economy still has its dominant top carnivore. In 2005 the United States, with less than 5% of the world's population, accounted for 20% of the world's economic output and claimed about 23% of the world's commercial primary energy. But its influence has been declining, and its relative importance will further diminish by 2050. As its complexities and interdependencies increase, the modern world thus begins to resemble a coral reef rather than a tundra, and there is actually no alternative to this shift, short of the system's collapse and a return to pre-modern existence with all that it implies for the quality of life.

There is enough evidence to conclude that in natural ecosystems greater complexity promotes system stability. Analogously, greater interdependence of national economies is (in the long run) a stabilizing factor.”

Vaclav Smil, *'Global Catastrophes and Trends: The Next Fifty Years'*, The MIT Press, Cambridge, Mass. and London, 2008.

Besides interdependence, however, a true global stability also requires that the benefits of globalization be reasonably well distributed, both internationally and within individual countries. Internationally, since 1945 inequality of per capita GDPs has been declining among the Western nations, but North America and Western Europe, the principal architects and beneficiaries of globalization, have been pulling ahead of the rest of the world. The U.S. GDP per capita was 3.5 times the global mean in 1913, 4,5 times in 1950, and nearly 5 times in 2000. Even China's spectacular post-1980 growth did not narrow the income gap with the Western world very much.

The obverse of this trend has been the growing number of downwardly mobile countries. In 1960 there were 25 countries whose GDP per capita was less than one-third of the poorest Western nation; in 2000 there were nearly 80. Also within individual countries there is evidence of growing inequality. Income inequality has been on the rise not only in the United States, where riches have always been rather unequally distributed, but also in Japan, for decades a paragon of well-distributed riches, in China, where globalization of the country's economy lifted all boats but at the same time made them more unequal than anywhere else in East Asia, and in Russia.

Finally, beyond achieving global stability thanks to increased global interdependence and a greater global equality, the new emphasis on economic localization in the beyond growth scenario will contribute to create a new context within which mutually beneficially multilateralism can succeed, because economic self-interest is contained and no longer stands in its way. Indeed, economic globalization – with its overriding imperative of international competitiveness – currently encourages the powerful nations to regard international cooperation as a zero-sum game in which any obligation it might entail is seen not as a contribution towards a shared goal, but as a threat to their immediate economic self-interest. Economic localization will deliver instead a regulatory framework where countries of different regional blocks – such as the EU or ASEAN in South East Asia or Mercosur in South America – will gain the option to promote highest standards of social, environmental and economic well-being at home and abroad, without automatically trampling on the rights of others to achieve the same objectives or, equally automatically, suffering from a loss of international competitiveness.

In the scenario of transition to a “beyond growth society” the global GDP growth register a relative decline, as more people work less hours and the production has a slight decline.

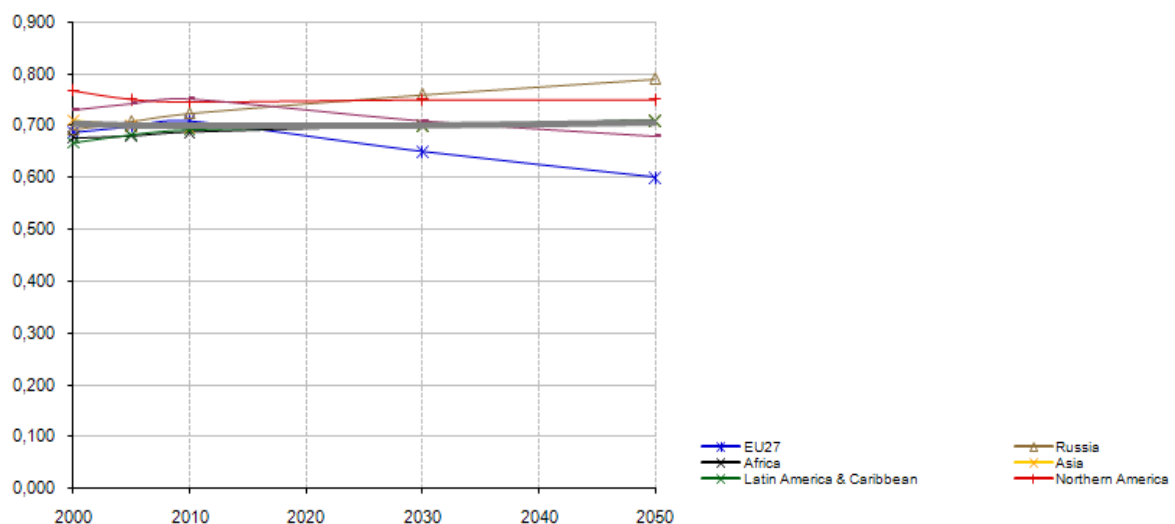


Figure 7 Beyond Growth - Employment rate (% working over 15-64)

However, progress is measured with others indicators more apt to catch the evolution of human well being as well as environmental performances. In this scenario, citizens work less, but are more satisfied of their work conditions; societies are less rich but the wealth is distributed more fairly. Less products are available but they are healthier and diversified. Access to ecosystem services, water first, are available for all and cultural diversity is supported with the provision of public space and a wide range of common goods. Health risks are decreasing thanks to the improved air quality and the diffusion of more healthy life-style and diets.

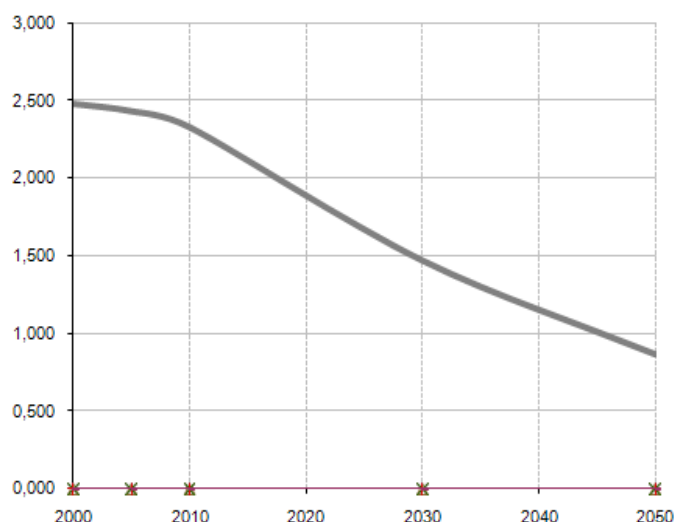


Figure 8 Beyond Growth - Economic inequality (GDP Cap _ stand _ Dev/World GPD Cap)

The following tables show the key scenario's features at a glance, by giving⁸⁵:

- The values of key variables in 2010, the projection of current trends at the 2050 horizon (trendline), and the values considered for the “beyond-growth” scenario in the WP1 meta-model analysis (Table 18)
- The assumptions of drivers evolution considered in the Delphy Survey (Table 19).

Table 18 The Vital signs in the ‘Beyond Growth Scenario’

VITAL SIGNS		2010	Trendline (2050)	New welfare
Population <i>(million inhabitants)</i>		6910	9214	8360
Settlements: Urban society <i>(% of people living in cities)</i>		50%	69%	62%
Rural land overexploitation	<i>Arable (% over total land)</i>	12%	12%	11%
	<i>Meadows (% over total land)</i>	26%	26%	25%
	<i>Forests (% over total land)</i>	31%	30%	33%
	<i>Biofuels (% over total land)</i>	0%	4%	4%
	<i>Other (% over total land)</i>	31%	28%	27%
Technology <i>(% of R&D investment over GDP)</i>		1,9%	2,0%	2,3%
GDP <i>(2010 = 100)</i>		100	311	296
Wealth disparities <i>(GDP/capita dispersion relative to mean)</i>		2,3	1,7	0,9
Energy consumption <i>(MTOE, 2010 = 100)</i>		100	238	112
Transport		100	With economy	Heavily under economy
Climate change <i>(Mtones CO2, 2010=100)</i>		100	213	111
Biodiversity <i>(% yearly change in the number of species)</i>		-0,07%	-0,08%	0,03%
Governance <i>(forms of government)</i>		93 democracies, 50 anocracies, 20 autocracies	130 democracies	110 peaceful anarchies

⁸⁵ Main References for this Scenario: New Economic Foundation ‘Great Transition’, 2009; New Economic Foundation ‘Clone Towns Britain’, 2004; M- Woodin, C. Lucas ‘Green Alternative to Globalisation – A Manifesto’, 2004 The Transition Network: <http://www.transitionnetwork.org/>; R. Hopkins ‘The Transition Handbook’, 2008, S. Chamberlin, ‘The Transition Timeline’ 2008

Table 19 The scheme of drivers evolution in the ‘New Welfare Scenario’

	Trend 2010-2050	Scenario snapshot 2050	Rate of change
Population	↔	8000 millions in 2050	Population yearly growth rates from 1'3% in 2010 to 0'5% in 2030 and 0'2% in 2050
Settlements: Urban society	↓	From 50% urban population in 2010 to 45% in 2050.	3 million urban residents more per year between 2010 and 2050.
Rural land overexploitation	↓	Land for bioenergy production 500 mil.ha in 2050 (4% global land)	1% decrease in agricultural land, 1% decrease in meadows and 2% increase in forests.
Technology	↑	- Telemedicine - Ubiquitous computing - Countryside sensors - Precision bio farmin	2% GDP devoted to R&D investment in growing within limits nations
GDP	↔	- Global GDP about 30% higher in 2050 than in 2010.	0'5% GDP yearly growth rate for developed regions, 1% for developing.
Energy consumption	↓↓	Energy yearly consumption in 2050 is one third of 2010's.	Energy intensity yearly decrease (Δ energy/GDP) from -0'8% in 2010 to -2% in 2030 and to -5% in 2050
Transport	↔	Transport drops sharply due to locally based societies and drop in GDP	Decoupling of transport and economy
Climate change	↓↓↓	World GHG emissions in 2050 are 85% lower than in 2010	Emission factors yearly decrease (Δ emission/energy) from -0'3% yearly to -1% in 2030 and -3% in 2050.
Biodiversity	↑↑	Reintroduction of extinguished species. Social awareness helps preserve environmental values.	15.000 species are recovered per year
Governance	↑↑	Networked society, bottomup governance based on human capital rather than institutions.	10 new peaceful anarchies per year between 2010 and 2050

5.5.6 Changes in urban land use and transport: compact and resilient towns

Urban change in the “beyond growth scenario” reflects the radical shift towards a more sustainable lifestyle that has spread throughout the societies. The solutions and the innovations adopted in the urban contexts are highly differentiated depending on the cultures, environment and resources available in each community. A common trend underpinning urban change across the world is the flourishing of grass-root movements dedicating attention and passion to the renewal of their own district, in order to make the city more livable, sustainable and resilient. These movements were spurred off at the turn of the 21st century by economic and political crises and - as a consequence of some disillusion about the effectiveness of international institutions and national authorities - the growing willingness of people to engage themselves in sustainability programs and initiatives at local level.

Early in the 21st century, new pioneers cities like Masdar in Abu Dhabi and redeveloped districts like Treasure Island in the United States, Vauban and Hanover in Germany, and BedZED and the new Olympic Village in London, were dramatically reducing their ecological footprints. Besides these pioneering realities, cities across the world were becoming more sustainable through resilient buildings, alternative transport systems, distributed and renewable energy systems, water-sensitive design, and zero-waste systems – with all the cleverness of a new industrial “blue” revolution (see section 5.5.2.2). Urban change and city innovations are not imposed on people who do not know how to use the new buildings and appliances, or why they should use less power or water or fuel. On the

contrary, education and engagement of people towards sustainable lifestyles is achieved with the spreading of “living-smart” campaigns (see box).

TravelSmart and LivingSmart campaigns

“German sociologist Werner Brog has developed an approach to travel demand management that is based on the belief that cultural change towards less car dependence can happen in any part of any city as long as it is community-based and household-oriented. After some trials in Europe, Brog’s approach was adopted in large-scale projects in Perth, Western Australia. It has since spread across most Australian cities and to other European cities, especially in the UK, and has now been piloted in six American cities.

Known as **TravelSmart**, the approach targets individual households directly (rather than through mass media) in a letter from the Mayor or State Minister (funds for the program are usually a partnership of the two), asking them to participate in the program. Follow-up phone calls elicit the residents’ interest in receiving information and, for the few who need extra support, a potential visit from a TravelSmart officer. People select information material to suit their individual needs and these are delivered by staff using bikes and trailers. The information is packaged in specially designed TravelSmart bags and includes walking and transit information, as well as pamphlets on why it is good for their health and the planet for people to get out of their cars more often. ... People involved in TravelSmart become real advocates of sustainable transport – telling their friends how much better they feel after bicycling, walking or taking the bus or train instead of driving. They show friends how much money it saves as well as making them feel they are doing their bit for climate change and oil vulnerability.”

“In communities where TravelSmart has been conducted, people have reduced the kilometers travelled by vehicle by around 12-14 percent – a result that seems to last for at least five years after the program ends. Where transit is not good and destinations are more spread out, the program may only reduce car use 8 percent, but where these are good it can rise to 15 percent.”

“The same approach to cultural change that TravelSmart uses can be applied to other aspects of sustainability at the household level – reducing energy, water, and waste. ... As with TravelSmart, the possibility of using educational programs to underpin these policy areas is critical to achieving the necessary planetary cultural change. In many cities, approaches to community-based planetary education are emerging as the politics of climate change becomes a major force. Perth has built on its TravelSmart program to create a successful household education approach, known as **LivingSmart**, that brings sound and locally relevant material into people’s homes. The eco-coaches who have worked with the first 15,000 households in a trial run have found enormous enthusiasm from people who have been looking for this targeted assistance. Using unsolicited phone calls to residents, the program is finding that 74 percent of households are interested in making changes to improve energy, water, waste, and travel sustainability. Half of the households contacted are signing up for ongoing coaching for special meters, advice on gardens, workshops, and home audits.”

Peter Newman, *Building the Cities of the Future*, in Worldwatch Institute, State of the World, 2010.

Several key government policies are combined within cities, and benchmarked across cities, in different regions of the world, to move cities towards sustainability everywhere by means of:

- Infrastructure to enable energy, water, transport, and waste to be managed with minimal ecological impact.
- A design to ensure that the infrastructure is efficiently available to all.
- Innovation through R&D and demonstrations to continually ensure that the latest eco-technology becomes mainstream.
- Tax incentives to direct investment into these technologies and provide people with the motivation to change their behavior.
- Regulations to set the standards high enough for sustainability technologies to cover their externalities.
- Education to ensure households and communities are aware of and want to make the changes needed.

At different scales – national, regional and local – governments realize that without infrastructure investments in urban areas and more aggressive policies, higher carbon prices (due to the increasing scarcity of fossil fuels and/or carbon taxation) are not be sufficient to get enough people out of their

cars and onto bikes or into trains and buses, nor to stimulate the retrofitting of large amounts of housing stocks and realize the potential for savings in households. They, therefore, reorganize urban planning processes to systematically favor sustainable transport modes, sustainable housing, energy saving and renewable energy. These policies contribute to create jobs, increase skill levels, as well as address other problems like fuel poverty and urban congestion.

In OECD countries, by mid 2020, co-housing is increasingly used among citizens to reduce housing costs. As energy prices increase, more and more singular and co-housing settlements also apply measures, first, to reduce the energy consumption and, then, to produce their own energy through renewable energy sources. The needs to self-organize strengthen the relations among neighborhoods and it contributes to create communities of people engaged in improving the quality of life of their district: from renewable energies the interest is moved to providing more healthy and creative urban environment through the provision and use of proximity services, e.g. public gardens, libraries, kindergartens, etc.. Even if solutions are applied at local level, creativity and inventions circulate freely and replicate rapidly across different cities. Stimulated by the economic situation and by the rising ecological consciousness, also co-working, co-gardening and transport co-sharing becomes widespread.

**Seed of Change
Transition Network**

Totnes has joined the 'Transition Town Initiative' in 2006 and has published a Energy Descent Action Plan (EDAP) in 2008. The Transition Initiative has the main objectives of supporting practical actions to reduce citizens carbon emissions and of building town's resilience in term of food, energy, employment and economics. The Transition Network now includes initiatives in 170 towns, situated mostly in the UK, and it represents an example of bottom-up approach regarding the promotion of sustainability measures in transport, housing and food production. The movement is deeply rooted in local culture and needs, and it has been able to elaborate a global vision and to communicate and networking with different realities

Info: <http://www.transitionnetwork.org/>

City life changes gradually, in a participated manner and with a long lasting evolution, as more and more citizens decide to adopt more sustainable lifestyle. In some cases, the City administration supports citizens' queries, promoting a different approach for the renewal and construction of the city's district. The new process, largely inspired by the one used in the Freiburg district of Vauban, is based on a 'learning by doing' modality, whereby the administration set basic ecological standards and then allocates the plots to private builders and co-housing groups. The citizens and developers' groups are requested to work together in order to achieve the most environmental and cost effective solutions. This highly participatory process helps to create a strong community, characterized by shared ecological and social values.

The new buildings are, in the vast majority of cases, low energy standard or passive houses. Solar panels and photovoltaic cells are also frequently used, combined with a co-generation plant. New materials for construction and insulation are being explored. Whereas possible, green roofs are introduced in buildings, to reduce the 'urban heat island' effect, and hydroponics facades gardens are also used to help supplying the city with locally produced fresh fruits and vegetables. Great savings are assured as well by citizens' behavioral changes aimed at a smarter use of daylight, and the frequent use of a 'smart metering' to effectively manage the building energy needs. In this scenario, urban agriculture provides a significant share of city's food needs, and the own production is incentivized through the provision of roof gardens, allotments, community gardens, backyards, and through eco-villages specifically designed to fit in urban areas.

This scenario implies a radical change of the urban ecological footprint, as the urban areas rely less on long distance supplies and more on the adjacent ecosystem services. The cities indeed increasingly include in their urban boundaries a 'green infrastructure', i.e. green and ecological features and

systems, from wetlands to urban forests, that provide a host of benefits to urban residents - clean water, storm water collection and management, climate moderation and cleansing of urban air. Green infrastructure - in the wider sense of 'photosynthetic infrastructure' - provides the source of renewable energy or local food and timber. The link between the city and the rural hinterland is based therefore on a closer relationship⁸⁶.

Besides the sustainable renewal of city districts, another relevant change is the repopulation of a growing number of small compact towns, which experience a regeneration and attract an increasingly large community of people interested by the lower land prices and by the more healthy quality of life. In this scenario, indeed, they become a pervasive feature of the urban landscape, especially in Europe, where several regions – including some coastal regions – host a number of compact small to medium cities which contains a full range of production and consumption opportunities for a population that lives and works – or due to aging is increasingly retired – within the city boundaries. These cities are small and dense, relative far from other core cities and not connected by fast transport services to them (they are outside the commuting range). They host a variety of economic and social activities which make the city life vibrant and self-reliant. Workplaces and consumption opportunities are located in these towns near to housing and this – together with the relative high density – facilitates walking, cycling and light public transport services. The trend towards living in small compact cities was fostered by “slow town” movements since the early 2000s (see box).

The “CittàSlow” Movement

The ‘CittàSlow’ Movement, created in 1999, links towns with less of 50.000 habitants. The principles of the this movement include:

- Environmental policy aimed at maintaining and developing the characteristics of the area and urban fabric, appreciating in first place the techniques of recovery and recycle.
- Infrastructure policy which aims first to regenerate and valorise the existing infrastructure before (or instead of) consuming new land for new infrastructure.
- Use of technologies aimed at improving quality of the environment and urban fabric.
- Production and use of food products obtained through natural techniques and compatible with the environment, excluding transgenic products, and whereby deemed necessary, the set up of facilities to safeguard and promote typical local productions.
- Promotion of local products and activities rooted in the culture and traditions of the place.
- Promotion of hospitality, as a real moment of connection with the community and its features, removing physical and cultural obstacles that may prejudice the full and widespread use of city resources by visitors.
- Raising the awareness of living in a “slow town” amongst the citizens, and not just among the operators, with special attention paid to young generations, through systematic introduction of taste education in the school programs.

These principles are deployed in 50 actions/measures, which ranges from the adoption of municipal plan for saving energy, with reference particularly to the use of alternative sources of energy (renewable sources, green hydrogen, mini hydroelectric power plant) and producing heat from waste and biomasses, to the provision of bicycle tracks connecting schools and public buildings and the promotion of teleworking. However, the concept of “Cittaslow” goes beyond a mere set of 50 measures. It is a way of thinking. It is about caring for your town and the people who live and work in it or visit it. It is about celebrating and promoting diversity and avoiding the cultural uniformity that afflicts too many towns in the modern world. It is about finding a place in a changing world where values are often uncertain and the needs and aspirations of local communities can often be overlooked.

Source: <http://www.cittaslow.org.uk/index.php?Pid1=1&PLv=1>

The trend towards increasingly living in small to medium compact town is also coherent with the new economic localization paradigm around which the beyond growth scenario is framed. Citizens start to

⁸⁶ Peter Newman, *Resilient Cities – Responding to Peak Oil and Climate Change* Island Press, Washington DC; Beatley, 2009.

reclaim a ‘main street’⁸⁷ able to represent the city characters and diversity, and to offer a place for people to meet more than to consume. Chain stores, highly predominant in the main street up to 2020 and that make the city landscape highly homogeneous in developed countries, are replaced again with local shops, services and cultural places.

This trend contributes to increase the number of short trips, done by walk or with sustainable transport modes such as cycling, light electric or hybrid public bus. For longer distance trips, car sharing is widely diffused, thanks to networks of car sharing services that allow to share cars for both urban and interurban trips (the latter in connection with interurban rail transport, whereby the rail operators provide cars to be shared at destination). Generally, however, long distance mobility of people and goods is reduced. For the latter, this is the result of economic localization and its influence on the international trade patterns (see section 5.5.4). For people, long distance travel need is reduced instead depending on two main factors: firstly, the trips may be avoided through the opportunities offered by new technologies (tele-working, interactive video conference); secondly, a social feeling is rising amongst the majority of citizens that consider unacceptable to conduct long travels for a few days visit.

5.5.7 Changes in energy and climate: small scale de-carbonised energy supply scenario

In the “beyond growth” scenario, the energy consumption is more than halved as compared to the “growth without limits” scenario. The reduction reflects a slowdown in population growth and in the development of global trade and economic activities.

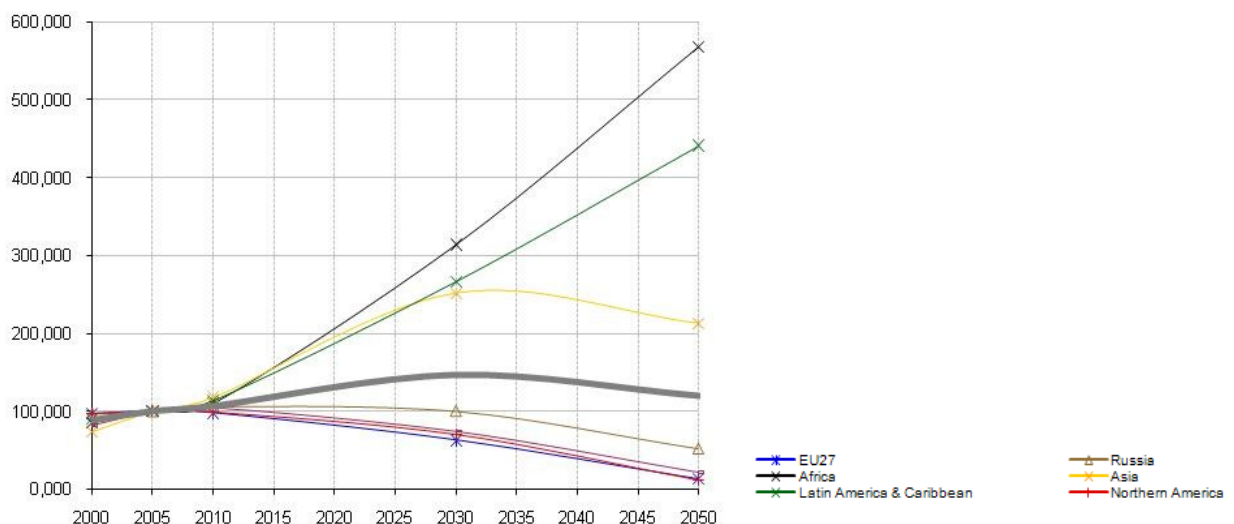


Figure 9 Beyond Growth - Primary Energy Consumption (2005=100)

Besides the reduction of global primary energy consumption, another key feature of the beyond growth scenario is the world energy mix, presented in the table below. As compared to the low carbon scenario, the increase by 2050 in the share of renewable energy is less pronounced, and the

⁸⁷ See the new Economic Foundation surveys on ‘Clone Town Britain’ <http://www.neweconomics.org/category/tags/clone-town?filters=type:publication>

concomitant reduction of fossil fuels is less dramatic. This is due to the fact that renewable energy is produced mostly by means of small-scale plants, operating alone or more often connected to increasingly diffused smart grids, whereas the share of (clean) carbon is higher, and it compensates for a substantial reduction of the nuclear energy share (which was higher in the low carbon scenario). The share of oil decreases, but less than in the low carbon scenario, whereas natural gas increases more than in the low carbon scenario:

Table 20 Beyond Growth – Energy Mix

World Energy Mix	Trend line			New welfare	
	2010	2030	2050	2030	2050
% of fossil	85,3%	72,0%	60,9%	70,6%	56,2%
% of oil	34,4%	24,6%	17,7%	21,2%	11,9%
% of coal	27,7%	29,2%	28,3%	29,4%	25,3%
% of natural gas	23,3%	18,1%	15,0%	20,0%	19,0%
% of nuclear	5,7%	7,1%	9,0%	4,8%	3,9%
% of renewables & biomass	9,0%	20,9%	30,0%	24,7%	39,9%

The energy intensity gains improve significantly in all world regions, even more than in the low carbon scenario:

Table 21 Beyond Growth – Energy Intensity

Energy Intensity (Mton/M\$) in constant 2005\$	Trend line			New welfare	
	2010	2030	2050	2030	2050
EU27	0,13	0,11	0,09	0,08	0,01
Russia	0,55	0,45	0,35	0,35	0,15
Africa	0,30	0,28	0,25	0,22	0,15
Asia	0,27	0,24	0,21	0,22	0,09
Latin America & Caribbean	0,28	0,23	0,20	0,23	0,17
Northern America	0,18	0,14	0,11	0,11	0,02
Oceania	0,52	0,35	0,20	0,31	0,08
World	0,22	0,19	0,17	0,17	0,08

In this scenario, all the energy intensive-sectors (transport, building, industry, agriculture) adopt policy measures and technologies able to both reduce and improve the energy use. The technology drivers are similar but their influence is assumed to be less pronounced than in the low carbon scenario. It is increasingly common to control carbon footprints and communities engage themselves in finding new ways to reduce their impacts. Creative and innovative solutions are formulated, discussed and adapted to different local situation by the networking communities.

In OECD countries, especially EU and U.S., the consumption of energy decreases steadily from the 2010 onwards. As mentioned in the previous section, urban districts are renovated and increasingly adopt energy efficiency measures, accompanied by a progressive change of users' behavior that contribute to reduce energy demand. In the housing sector, retrofitting of old buildings and construction of new ones is mostly aimed to recover the historic centre of small towns, through the use of local traditional materials and techniques. New technologies are inserted only in those cases in which their added value is proven. In the transport sector, the trend is to avoid as far as possible superfluous trips, and to shift as much as possible to collective transport systems. More than on technological innovation and

efficiency, these changes rely mostly on behavioral change, as this is crucial to avoid a rebound effect – the so-called Jevons paradox that shows how increasing efficiency, if not coupled with behavioral change, means increasing consumption.

In Asia, the energy consumption grows along with the urbanization process – most notably in China - up to 2030, when it starts to decline. This decline is due to a wide range of causes: the deceleration of the urbanization process, the reduction of the international trade, the wave of interests toward protecting natural resources and a new international agreement for the inclusion of externalities into production and global trade prices. In Africa and South America, the relative growth of the energy consumption is facilitated by effective North – South technology transfers and capacity building exchanges, which contribute to provide access to electricity and essential services in rural and sub-urban areas. Energy is key to upgrade slums conditions, ensuring access to water, sanitary, and educational services, as well as to promote the development of local agriculture and industries.

This scenario assumes indeed a successful international cooperation, based on a bottom up approach and whose focus is moved from boosting global trade to ensure environmental protection, fair trade and knowledge exchange, and poverty eradication. The ‘negawatt’ principle is increasingly used by people, and a number of local and regional authorities have agreed to introduce a system of carbon rationing, inspired by the model of Tradable Energy Quota (TEQs). The mechanism allows each citizens and business a carbon allowance which is gradually reduced each year. The allowances are managed with a swipe card, used to purchase energy or fuel. The different emissions trading systems adopted are then included in an international framework, which substitutes the Kyoto Protocols, implementing a “Contraction and Convergence” pathway of global emissions reduction (see section 5.5.6).

By mid 2020, meanwhile international and national governments partially delayed the reform of energy markets and the upgrade of the long distance electricity grids, a wide range of activities are started up by local communities to react to oil’s price increase and the growing ecological concerns. The solutions exploited are highly diversified but all aim to strengthening the community resilience to energy shocks. Local production activities are increasingly based on sustainable use of the natural resources available on the territory (wind, sun, biomass, geothermal), and are mostly exploiting small scale applications.

In the OECD countries, a greater attention to territorial identities and local resources facilitates the installation and operation of plants co-owned by cooperative of stakeholders, which act in partnership with municipal utilities. Pioneering local systems of production followed the first examples found in some countries in northern and southern Europe, for instance, in Denmark, the off shore wind farm Middelgrunden, in UK, the Baywind wind farm and in Spain, the wind-hydro plant in El Hierro⁸⁸. These developments contribute to increase the awareness of and involvement in renewable energy developments, to maximize financial returns from local resources and to promote local employment.

SEED OF CHANGE

El Hierro 100% Renewable Energies

The project at El Hierro aims at creating a 100% sustainable energy sources island. Using wind turbines, a hydro power plant as well as PV installations and solar thermal collectors, with possible extensions towards biomass. A Wind-Hydro Plant should be able to cover nearly 80% of the Island’s electricity demand. The system is linked to a water desalination plant to fill reservoirs and produce water for irrigation and domestic use. Seminars and campaigns have been run to increase citizens’ acceptance of the project and it was decided to directly involve the citizens as co-owners of the wind-hydro plant.

<http://www.reshare.nu/en/reshare/reshare-database/show/41/el-hierro-100-res-island>

⁸⁸ http://www.energy4all.co.uk/energy_aboutus.asp; <http://www.reshare.nu/en/reshare/home>.

In fast growing economies, as China and India, the reliance on available natural resources (coal and renewable) is stimulated by the security of supply policy. Thanks to the international technology transfer, coal is used in an increasingly efficient way: the newly built plants are 'supercritical' and coal is mostly processed using clean coal technologies.

SEED OF CHANGE
Barefoot College

The Barefoot College has been pioneering solar electrification in rural, remote, non-electrified villages, since 1989. The College has demystified solar technology and is decentralizing its application by making it available to poor and neglected communities. By 'demystification' of solar technology and 'decentralisation' of its application, we mean placing the fabrication, installation, usage, repair and maintenance of sophisticated solar lighting units in the hands of rural, illiterate and semi-literate men and women. In a span of 25 years, the College has helped to generate solar energy worth a capacity of 819.88KWP (Kilowatt Peak), through electrification in rural villages across 16 states of India and 17 countries in Asia, Africa and South America. The College aims to provide sustainable sources of alternative energy at the grassroots level for cooking (parabolic solar cookers), lighting (solar lighting), heating (solar water heaters) and power (biomass gasifiers and micro-hydel).

From: <http://www.barefootcollege.org/>

In Africa and South America, renewable energy contributes to eradicating poverty by providing access to energy for many rural off grid villages. The diffusion is stimulated by local initiatives which reveals to be far more efficient than some international aid projects. Following the micro-credit practice of the Grameen Bank in Bangladesh, revolutionary schemes are being funded in several developing countries, and they help to fill the energy and other gaps with a development in line with traditional knowledge and the respect of natural resources.

In the beyond growth scenario, natural gas continues to play a role – being a relatively clean and highly flexible fossil

fuel source – during the transition towards a world more heavily relying on renewable energy. More and more of it is used in highly efficient combined-cycle power plants and in tri-generation applications. Beside costs increase, the nuclear energy development is undermined by the safety, acceptability and security problems. Thus, most of the existing reactors are closed at the end of their average operational period, and only two third of the reactors listed as under construction in 2007 are finally put in operation.

The use of oil in the transport sector declines inasmuch the progresses on the biofuels advance. Bio-fuels, which become tax free in EU and many OECD countries, are increasingly used. To the first generation of bio-fuels from natural plant oils follows a second generation made of more efficient and environmental friendly fuels such as bio-hydrogen and bio-methanol, partially solving the querelle of land for food versus land for energy. Bio-methane becomes the main fuel for public fleets, thanks to the improvements of waste management and treatment. Research focuses on the production of cellulosic ethanol and hydrogen fuel cells. In 2040, it is commercialized as the third generation of biofuels produced by algae, in a sustainable way.

The "beyond growth" scenario presents better prospects for electro-mobility than the low carbon scenario. Indeed, the increasing reliance, in this scenario, on short distance trips within small to medium compact cities, as well as on car sharing schemes extended to entire networks of cities, makes to own or, even more, to share electric cars more common for inner city travel, and the market niche for electric city cars is more substantial than in the low carbon scenario (see box on electric cars in section 5.3.2).

The greenhouses gas emission shows a steady decline, more sharp respect to the low carbon scenario, due to the global reduction of energy consumption and the growing share of renewable sources in the world energy mix.

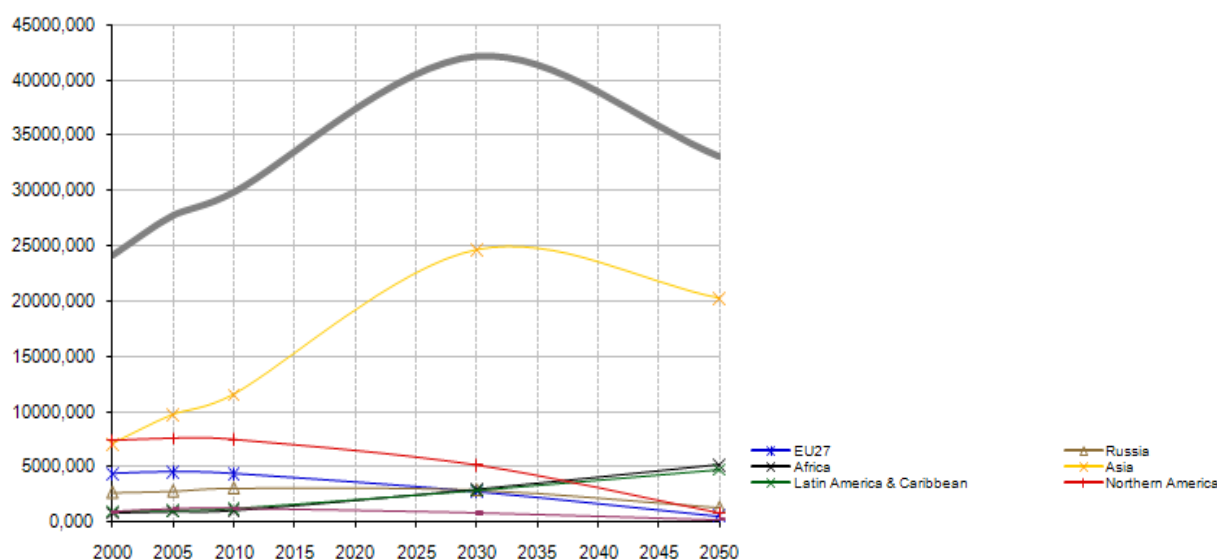


Figure 10 Beyond Growth - CO2 Emissions (Millions tones)

5.5.8 Changes in rural land use and agriculture: local food as a global solution

A key feature of the scenario of transition towards a “beyond growth” society is the shift to **local food production as a global solution** to provide food security. A collective mind-shift is needed for local food production to prevail as a global solution, and significant political will is required to overcome the momentum that is propelling currently the world in the opposite direction of increasing food trade globalization. International agreements will have to be changed, in particular the rules of the WTO, which do not allow countries to make choices between imports on the basis of the way they have been produced or erect barriers to protect local food security. The rationale and a proposal for doing these changes are presented, for instance, by Michael Woodin and Caroline Lucas in their book *Green Alternatives to Globalization: A Manifesto*.⁸⁹

First comes the clear perception that economic globalization and the increased international food trade is not *per se* the answer to food poverty (see box below).

⁸⁹ the remainder of this section is mostly based on excerpts from this book.

The Great Food Swap

“The twin forces of the WTO’s Agreement on Agriculture (AOA) and the structural adjustment policies of the International Monetary Fund are forcing developing countries, often against their better judgment, to gear production to the export market. ... Countries are now being forced to compete to produce each other’s food as cheaply as possible and at the expense of domestic production. Local food security is being swapped for mandatory trade rules that are biased towards agribusiness, industrial production and long-distance transport. Recently, the UK food and farming minister, Larry Whitty, provided a blunt summary of this policy, when he said, “a self-sufficient target is not what drives policy. Being competitive drives policy”.

Unsurprisingly, this policy shift has produced a dramatic increase in the international food trade. Over the last thirty years for example, exports of a variety of food products from EU members states increased by between 164 percent and 1340 percent. However, it is not as if the EU has achieved self-sufficiency and its exporting its surplus – it remains one of the world’s largest food importers. Over exactly the same period, food imports into the EU increased, in some cases by as much as 289 percent. This pattern is repeated at the global level. Between 1968 and 1998, world food production is increased by 84 percent, yet over the same period international trade in food products almost trebled, with trade flows doubling for almost every food category.”

“Of course, conventional economists would welcome this as evidence of increasing specialization in food production, such that countries are concentrating on producing those products for which they have a comparative advantage and are importing foods that are produced more efficiently elsewhere. However, closer inspection of the figures reveals that a large part of the growth in international trade in food is accounted for by simultaneous imports and exports of the same products between exactly the same countries. ... Increasingly, agriculture is held in thrall to the overwhelming and hugely mistaken imperative of international competitiveness. Producers are being locked into an absurd and wasteful global food swap, and everyone, save a few agribusiness giants, is paying the price.”

Woodin M., Lucas C., *Green Alternative to Globalisation – A Manifesto*, Pluto Press, 2004.

Producers and consumers alike across the world are increasingly coming to realize that the erosion of localized patterns of production and consumption due to the intensification of global agribusiness and export-oriented agriculture has a serious impact on the environment and the health of rural economies. A global food movement has already sprung up, both in the North and in the South, to demand a radical change. Groups like La Via Campesina, a global alliance of small and family farmers, peasants, the landless and indigenous people are championing the concept of **“food sovereignty”**, that is the ability to prioritize local food security above the production of exports and dependence on imports, and free from the control of agribusiness TNCs. Based on this approach, local food security must replace international competitiveness as the central goal of global and local agricultural policies, and the shift to a localization regime is what is assumed to happen in the “beyond growth” scenario. In this new regime, national and regional (e.g. EU) subsidies shift away from supporting intensive production, which results in export dumping, towards paying for a transition to more extensive and organic farming, with higher standards of animal welfare, reduced pesticides use and less dependence on expensive and dangerous technologies such as GM production.

A radical proposal would be to introduce, in the new regime, foodshed-specific quotas and guaranteed farm-gate prices. The US rural sociologist Jack Kloppenberg coined the term **“foodsheds”** as a useful way to summarize this approach. Foodsheds are *“self-reliant, locally or regionally based food systems comprised of diversified farms using sustainable practices to supply fresher, more nutritious foodstuffs to small-scale processors and consumers to whom producers are linked by the bonds of community as well as economy.”*⁹⁰ Foodsheds are a reality in many parts of the world, particularly in developing countries, but where supermarkets are dominant only very faint traces of

⁹⁰ Kloppenberg, J. Hendrickson, J. And Stevenson G.W. ‘Coming in to the foodsched’ Agriculture and Human Values, 1996.

them remain. Encouragingly, however, a spontaneous resurgence of foodsheds and farmers' markets is taking place in several EU countries.⁹¹

Under the new localization regime, the level of production of any food product within each foodshed can be geared to meet a target that is set to satisfy local need, with allowance made for export in the case of special, tropical or exotic crops. Working from the target, individual farms within the foodshed can be allocated a quota contingent on their meeting specific local and national objectives, such as animal welfare, hygiene and nutritional standards, and environmental, biodiversity and rural development goals. Quotas would remove the incentive for intensification and the overall target levels for production would prevent the generation of surpluses.

However, to ensure that farming incomes would be adequate, fair minimum farm-gate prices would need to be guaranteed for all within-quota produce. Minimum prices would be based on the average return needed to provide a reasonable income after production costs. Additional grants could be made available to fund the development of cooperatives for marketing local and regional produce, the transition to organic production and the achievement of higher animal welfare and environmental standards.

Existing subsidy budgets would fund much, if not all, of any shortfall between market prices and guaranteed farm-gate prices, and paying farmers to produce only for market needs would eliminate the huge costs of storing excess production and the need for the export grants that are currently used – mostly in the U.S. and EU schemes – to dump surpluses on world markets. In this way, farmers' markets would spread over the rural and urban landscape, benefiting farmers, who get a fair price for their products, as well as consumers, who get choice, quality and good prices. Farmers' markets are good for the environment too, because they involve less transport and packaging, as the produce is more likely to be organic or less intensively produced; they are good for the rural economy, since they keep money circulating locally, and they foster stronger community relations.

There are of course some objections to this regime of local production that are worth of consideration:

- First, cheap imports could easily undermine a quota system or any other program that is designed to engender local food security. Import tariffs and quotas are therefore essential to protect domestic markets and allow a transition to production for self-reliance. Clearly, the current rules of the WTO and other regional treaties that make it impossible to limit trade in order to protect food security must be changed, eventually excluding trade in food from the agreements altogether;
- Second, one consequence of sourcing more food domestically rather than importing cheaper produce, internalizing external costs of agriculture, and paying fairer prices for imported exotic crops, is that the cost of food might rise. Several steps would need to be taken under localization to ensure that this does not increase food poverty and that poorer consumers in particular are protected from any price increase. Extra costs for the consumers would be avoided by measures designed to curb the power of the supermarkets and processors, and force them to pay higher farm-gate prices at the expense of their profit levels. Even if supermarkets are forced to lower prices by cutting their profits, there might still be a danger of increases in food prices. Social welfare mechanisms such as the minimum wage, citizens'

⁹¹ For example, the UK is experiencing an enormous growth in farmers' markets. In just five years from 1997 to 2002, the number of farmers' markets has multiplied from the first fledging market in Bath to 450 regular markets. An estimated 7.500 individual markets take place each year (cfr. National Farmers' Union, 2002, *Farmers' Markets: A Business Survey*, London: NFU Public Affairs).

income or benefits should be adjusted to compensate for any increase in the cost of a basket of basic food products, to ensure that this does not harm the poor;

- Third, a rather predictable objection to the proposal to allow import controls is that they would be unfair to poor producers in the South whose livelihoods depend upon access to Northern markets. This would be a fair criticism if the only element of the localization proposal is the erection of import barriers in the North. However, the proposal would also include measures that would end the dumping of the North's subsidized exports in the South, and uphold the right of developing countries to impose barriers against imports that would otherwise undermine their own food security – the so-called “Development Box” that a number of NGOs have suggested introducing into the WTO Agreement on Agriculture, to allow developing-country governments to protect their poorest farmers and support national food security;
- Fourth, another objection, readily advanced by the agribusiness TNCs that have strong interests on the subject, is that even if not producing for export, Southern farmers can best alleviate hunger by adopting GM and other intensive technologies which are typically fostered by the globalization regime. However, there is substantial evidence that small farmers can dramatically increase the yields per acre, not through intensive monoculture, but by using simple, low-cost techniques with local inputs (see box).

Local farming vs. GM production

“A Recent study led by Jules Pretty at Essex University has shown that small farmers can dramatically increase production, not through intensive monoculture, but using simple, low cost techniques with local inputs. The research studied the effect of ‘sustainable agriculture’ projects involving 4,42 million small farmers in developing countries farming 3,58 million hectares of land. Projects were categorized as sustainable if the farming practices they used aimed to reduce water use, regenerate soils by using manure, prevent erosion through shallow ploughing and minimize use of agrochemicals. The study found that average food production in these projects increased by about 73% per household. For those that were growing important staple crops such as potatoes and cassava, the increase was about 150 %, far greater than anything promised by GM technology”.

“GM (genetically modified) crops have their genetic make-up modified by adding genes of other species, in order to make them resistant to insects or disease, or tolerant to pesticides, among other things. Genetic engineering is imprecise and unpredictable. By inserting foreign genes into the DNA of a host, new life forms are created that have never occurred in nature. The long-term impacts of this are unknown. The advocates of GM technology, desperate to find new arguments to persuade a skeptical public of the benefits of GM foods, are increasingly presenting GMs crops as a panacea for world hunger. Yet the reality is that the root cause of hunger is not absence of food per se, but lack of access to food – often for complex political, social and economic reasons. Famines frequently occur, after all, in countries that have food surplus.”

Woodin M., Lucas C., ‘Green Alternative to Globalisation – A Manifesto’, Pluto Press, 2004.

Achieving local food security would not put an end to all international trade in agricultural products. Rather, countries would attempt to become self-sufficient in the foodstuffs best suited to their own climate, soil and farming methods, whilst relying on residual long-distance trade to supply products that cannot be produced in every region. In this way achieving local food security would limit the needless transport of food by trying to meet as many of our basic needs as possible from closer to home. It would bring diversity back to the land, enabling us to provide for ourselves in a sustainable and equitable way. It would rebuild communities and their connection to land. And, it would not mean having to do without coffee, oranges and bananas in temperate climates.

However, if the remaining international food trade is not to undermine the goal of food security in the exporting regions, it must be conducted equitably and in a way that minimizes its ecological impact.

Some commentators have summarized this as the “**Fair Trade Miles**” approach, which combines the requirements of fair trade with food miles.⁹²

In the scenario of transition to a beyond growth society, population is increasingly eager to live outside of the mega-cities, preferably in smaller towns, in OECD and developing countries alike. The 20th century global consumerist society is progressively abandoned. This leads to the creation of new opportunities for jobs and satisfactory livelihoods in rural areas, thus reducing markedly the flow of rural populations to new urban areas. The increasing focus on local and regional cultural values has strengthened people’s pride in their regions, and they started to consider “their” ecosystems as an integral part of their culture and local identity.

The trend started in OECD countries as more people wished to live – on a yearly or seasonal base - in rural places, eco-villages, small and medium towns, have more free time to spend and choose typical, fresh products bought directly from the farmers that ensure products’ traceability. The latter change of preferences is triggered by health, quality and environmental concerns. In addition, the price of these products are increasingly competitive because eco-taxation is introduced to ensure that the cost of food reflects the true costs of agriculture in terms of environmental damage, input-intensive production methods and long distance trade. Meanwhile, taxes on pesticides and fertilizer encourage farmers to switch toward a less energy and chemical intensive farming. The next steps see then the implementation of foodshed schemes, with specific quotas and guaranteed farm-gate prices, across the different regions of the world. All these steps are directed to promote nutritional standards, environmental biodiversity and rural goals and, conversely, avoid intensification, overproduction and export dumping.

A similar path is followed by developing countries where the import controls are introduced to protect domestic agriculture, rural incomes and reduce the dependence on export markets. The dominant local production model of food security is based on ecological production and consumption, with an increased use of simple and low cost techniques with local inputs. New form of collaboration and exchange of practices are being developed, following pioneering initiatives such as, for instance, “A thousand of Gardens in Africa” promoted at the turn of the 21st century by the network Slow Food and developed in Kenya, Uganda, Ivory Coast, Mali, Morocco, Ethiopia, Senegal and Tanzania. The project aimed to sustain food sovereignty and to help farmers recreating their traditions and recover local crop varieties that are more resistant and have less need for inputs from abroad. The gardens were adopted as laboratories to facilitate the collaboration among different generations and promote educational activities.

These changes are neither sudden or imposed top down by a coalition of countries on the others. They are instead the result of a long process stimulated and promoted by movements, organizations of farmers, and consumers, reacting to the continuous food and ecological crisis caused by the ‘free trade approach’ with proposals for a radically different approach.

⁹² Under this approach, export crops would be produced predominately by small farmers using sustainable farming methods and sourced as close to the market as possible in order to minimize transport. As an extension of the domestic quota and fair farm-gate regimes, Fair Trade Miles would require importing countries to guarantee to buy a certain quantity of goods within a guaranteed range of prices. As far as is feasible, this would deliver exporting nations a secure level of earnings (cfr. C. Hines and V. Shiva, *A Better Agriculture is Possible: Local Food, Global Solution*, San Francisco, CA: International Forum on Globalization, 2002)

Table 22 Beyond Growth Scenario - Land Use Agricultural land (% over total)

Landuses. Agricultural land (% over total)	Trend line			New welfare	
	2010	2030	2050	2030	2050
EU27	29%	30,33%	29,94%	28,62%	26,27%
Russia	8%	7,96%	7,86%	7,51%	6,90%
Africa	8%	8,94%	8,82%	8,43%	7,74%
Asia	17%	18,48%	18,24%	17,43%	16,00%
Latin America & Caribbean	8%	8,87%	8,75%	8,37%	7,68%
Northern America	12%	12,76%	12,60%	12,04%	11,05%
Oceania	5%	5,79%	5,71%	5,46%	5,01%
World	12%	12,40%	12,24%	11,70%	11%

Locally successful experiments in innovative agricultural systems (translated into an increasing rate of improvement of crop yields) mitigate a further expansion of agricultural land in most of the world regions after 2040. This is a particularly important trend for Africa, as the “beyond growth” scenario shows the lowest deforestation rates for this region compared to the other scenarios.

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Futurist Update, a monthly electronic newsletter with topical items of interest to the futures community.

Outlook, an annual report offering members selected forecasts that can help them anticipate events of the future.

Learning Tomorrow, a quarterly electronic newsletter with articles of on a wide range of education or training subjects written by WFS members and education professionals around the world.

Future Times, a quarterly Web journal about the World Future Society and its activities plus a column on new technologies written by WFS President Timothy C. Mack.

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