forum for the future
action for a sustainable world

FIA Foundation
for the Automobile and Society

vodafone

EMBARQ®
The WRI Center for Sustainable Transport

megacities on the move

your guide to the future of
sustainable urban mobility in 2040

Forum for the Future is the UK's leading sustainable development NGO. We work internationally with government, business and public service providers, helping them to develop strategies to achieve success through sustainability, to deliver products and services which enhance people's lives and are better for the environment, and to lead the way to a better world.

www.forumforthefuture.org

EMBARQ
The EMBARQ global network catalyses environmentally and financially sustainable transport solutions to improve quality of life in cities. Since 2002, the network has grown to include five Centres for Sustainable Transport, located in Mexico, Brazil, India, Turkey and the Andean Region, that work together with local transport authorities to reduce pollution, improve public health, and create safe, accessible and attractive urban public spaces. www.embarq.org
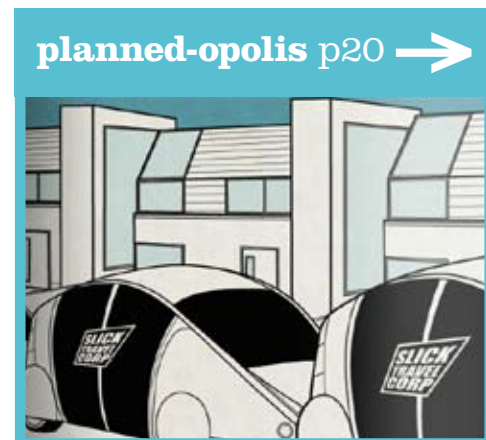
Download

All the *Megacities on the Move* resources at:
www.forumforthefuture.org/projects/megacities-on-the-move

For more information on *Megacities on the Move* or to organise a workshop please email Ivana Gazibara at: megacitiesonthemove@forumforthefuture.org, or call +44 (0)20 7324 3673.

contents

scenarios:

1. overview

megacities on the move

foreword – the future of the world is urban

How will people travel in the cities of the future? How will billions of city-dwellers access what they need without putting intolerable strains on the planet? How can we plan now for more sustainable ways of life in a radically different world?

Tokyo skyline

Megacities on the Move, a collaboration between Forum for the Future, the FIA Foundation, Vodafone and EMBARQ, can help you find answers to these questions. It is a toolkit designed to help governments, companies and civil society organisations understand the challenges of the future and start planning for sustainable city living.

Humankind recently reached a historic tipping point: for the first time more people live in cities than outside them. This trend is set to intensify. By 2040 two in three people on the planet will be city-dwellers.[1] There will be many more of us, as world population grows by two billion, and far more megacities, primarily in Asia, Africa and Latin America.

The social, environmental and economic implications of this will be enormous. All over the globe, cities need to start planning now to radically re-engineer their infrastructures to cope with much larger populations than they currently support.

But cities do not exist in isolation. They will need to succeed in a world where key resources are in short supply: from oil scarcity and rising energy prices to competition between biofuels and food production, there are major challenges ahead that face us all. There will be critical questions about how we manage these resources, who controls them, and who can afford them.

Overlaying – and intensifying – all of these pressures is climate change. Cities will have to deal with both the policy responses, such as more expensive carbon, and the physical impacts of changing weather patterns. Throughout human history we have built our major settlements on rivers, estuaries and coasts. Sea level rise and more frequent and intense storms and floods are just some of the impacts cities will have to contend with.

It is clear that people must find sustainable ways to live and travel in cities. We won't survive without new thinking and more creative approaches. We will need completely new ways to produce and deliver goods and services, consume and move about. Cities are in many ways places of opportunity – hot-houses for economic, social and cultural innovation – so they are likely to be the places where we find new solutions to mobility.

---

[1] United Nations Department of Economic and Social Affairs, World Urbanization Prospects: The 2009 Revision, http://esa.un.org/unpd/wup/index. htm (accessed on 24 September, 2010).

What is 'mobility'?

In this toolkit, 'mobility' means more than just transport. Our definition of mobility is a means of access – to goods, services, people and information. This includes physical movement, but also other solutions such as ICT-based platforms, more effective public service delivery provision, and urban design that improves accessibility. To plan for people's needs in the megacities of the future, we need to look at all of these aspects together.

What are 'megacities'?

Megacities are urban areas with a population in excess of 10 million people. For more information, see: http://en.wikipedia.org/wiki/Megacity

Megacities on the Move offers six sustainable mobility solutions that we can all begin acting on today, from integrated planning, to looking beyond the car, to improved use of technology. But more than anything, we want you to take this toolkit and apply it to your own context. Through research, interviews, and workshops in Istanbul and Mumbai, we have collected the most exciting thinking about sustainable mobility. We have used this to create four scenarios that paint challenging but realistic pictures of what the future could hold. They enable you to explore your future, whoever you are, wherever you are – and shape your own response.

The future of the world is urban. Because of the rapid modernisation of countries such as Brazil, China, India and Turkey, we are seeing the largest rural-urban migration in history. How that urban development happens will lock-in behaviour for decades to come, so it needs to be sustainable. It is no exaggeration to say that the global race for sustainability will be won or lost in our cities.

" The goal is not transport, but accessibility – more productivity, more mobility, more beauty in one day."
> **Sue Zielinski**, MD, Sustainable Mobility & Accessibility Research & Transformation, University of Michigan

Peter Madden,
CEO, Forum for the Future

Clayton Lane,
Acting Director, EMBARQ

Sibel Bulay,
Director, EMBARQ Turkey

Madhav Pai,
Director, EMBARQ India

Sheila Watson,
Director of Environment, The FIA Foundation

Nicola Woodhead,
Group Environment Manager, Vodafone

ULTra PRT, © www.ultraprt.com

Megacities on the Move

Read on to find out more about the challenges and solutions of the future. Download all the *Megacities on the Move* resources at: www.forumforthefuture.org/projects/megacities-on-the-move

how can you use this toolkit?

Megacities on the Move is designed to be a practical toolkit which can help public bodies, companies and civil society organisations develop strategies which will enable people to live and travel more sustainably in the major cities of the 21st century. It aims to help you understand the key long-term issues better, apply them to your own thinking, and inspire innovative solutions. The toolkit contains four sections and a set of scenario animations.
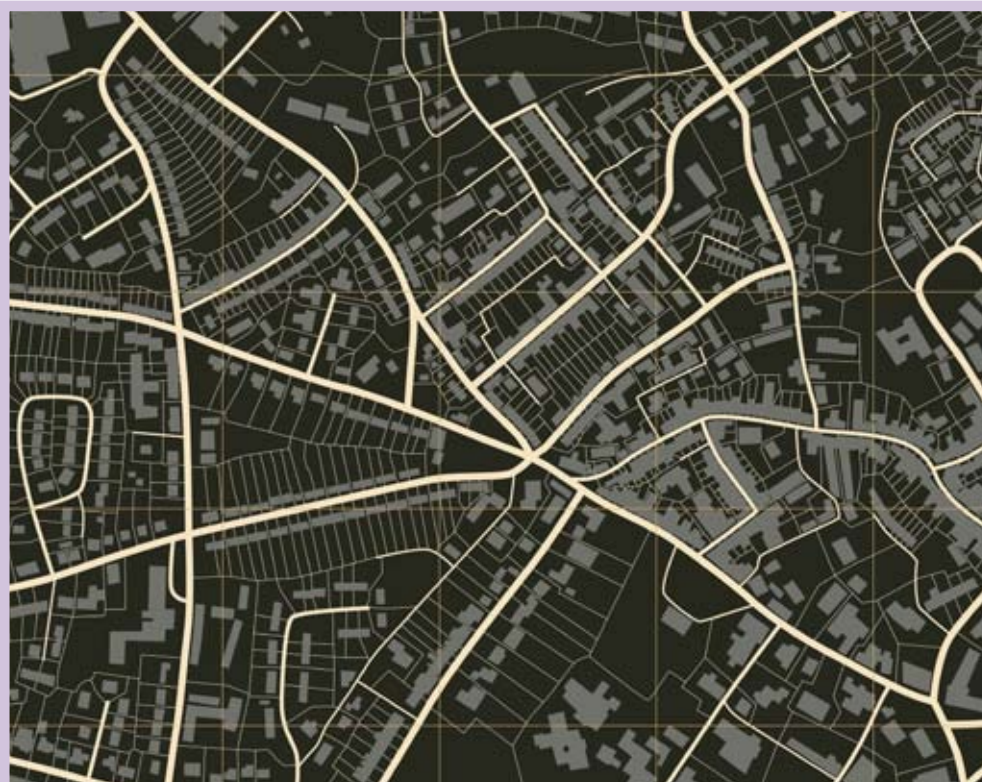
1. Overview

You can use this section to introduce your colleagues, business partners and clients to the issues.

2. What's your destination? Four scenarios for urban mobility in 2040

Want to explore what the future may hold and test your strategy? Our scenarios – Planned-opolis, Sprawl-ville, Renew-abad, and Communi-city - are four possible visions of urban mobility in the world of 2040. They can be a very effective tool for understanding how complex factors may play out and shape very different futures, challenging and inspiring organisations to plan for more effective solutions. They are designed to strengthen strategy and policy, advocate long-term thinking and build collaborative visions for a sustainable future.

3. What can you do? Six solutions for sustainable urban mobility

If you are motivated to bring innovation into your strategic planning, these are actions you can take now to help create the sustainable urban mobility systems of the future. This section includes practical examples of how these solutions are already being put into practice around the world; from integrated cities to intelligent traffic systems, automotive technology, car-free days and virtual meetings.

4. Plan the future now: How to run a workshop using the scenarios

One of the best ways to get engaged in the challenges you face is to organise a workshop. This section gives specific guidance on how to plan a workshop on the future of urban mobility, using the four scenarios as a starting point to explore issues relevant to you and develop a strategy and action plan. In May and June 2010 Forum for the Future ran similar workshops in Mumbai and Istanbul – you can see the highlights from this process which may give you ideas for your own workshop.

Scenario animations: Bringing the future to life

We have brought the scenarios to life in four short, vivid and compelling animations examining mobility challenges and solutions as we follow a day in the life of an ordinary woman in each of the four worlds. Animations give a snapshot of each scenario and can be a very effective way of engaging your audience in the subject.

what's ahead? factors shaping the future of urban mobility

What does the future hold for large cities of the 21st century? We can be more or less certain about how certain factors will play out. What we *are* certain of is that the responses to these factors will be critical in determining the nature of mobility in our cities.

São Paulo

what can we be more certain about?

Climate change

The scientific consensus is that climate change is a reality and that it is extremely likely to be the result of human activity. We are already seeing the effects: we continue to break temperature records; extreme weather events are increasingly common; and the melting of Arctic ice may now be irreversible. Even if we manage to take early global action to decarbonise our economies, the pollution we emit now will stay in the atmosphere – unless deliberately removed by human action – for decades.[2]

Climate change will affect key aspects of our lives and will have profound impacts on our cities in particular. Heatwaves or flash flooding, for example, will impact the comfort, cost and reliability of daily urban life. But climate change will also affect the vast areas, both near and far, that cities rely on for supplies such as water, food or energy. Ultimately, climate change could affect cities' basic ability to function.

" *Climate change will change the game, bringing forward 'the first predictable industrial revolution'.*"
> **Paul Dickinson**, Executive Chairman, Carbon Disclosure Project

Demographic trends

We can be reasonably certain about population increases over the next 30 years: from 6.8 billion people in 2010 to approximately 8.8 billion in 2040.[3] This growth won't be evenly distributed: most of it will occur in the cities of Africa, China, India and Latin America. China will also be dealing with an ageing population, as will

most of Europe and North America. These changes will put increasing pressure on mobility in cities, and make it more difficult to ensure a growing and ageing urban population can access affordable mobility solutions – such as public transport and other essential services.

" *In an optimistic scenario, cities will have planned to create an urban environment for people. They will make their planning and infrastructure investments based on accessibility for people.*"
> **Nancy Kete**, former Director, EMBARQ

Resource constraints

This growing global population also has an increasing taste for resource-intensive goods such as meat and cars. The result is exploding global demand for water and land for crops, livestock, domestic use and biofuels; fossil fuels to power transport or production; and minerals, metals and forests for manufacturing.

All of these resources are already heavily exploited, and many face the possibility of severe depletion or even exhaustion in the first half of the century. Scarcity will lead to competition and high, volatile resource prices – it seems likely that the age of cheap oil and cheap energy is over, for example. This will have a knock-on effect on the cost and availability of transport and other goods and services essential to everyday needs in cities. Urban societies can respond in different ways: through technological innovation, behaviour change, economic development, migration patterns and more.

---

[2] Intergovernmental Panel on Climate Change, http://www.ipcc.ch/, The Royal Society, http://royalsociety.org/climate-change/.

[3] UN Department of Social and Economic Affairs, World Population Prospects, 2008 revision: http://esa.un.org/unpd/wpp2008/index.htm (accessed on 24 September 2010).

what are we less certain about?

Energy supply and demand

It is highly uncertain how societies will respond to the exploding demand yet stagnating supply of energy, especially oil. But it is clear the energy mix that's in place in 2040 will determine what types of mobility systems we have in our cities. For example, if there is a large-scale shift to renewable energy, this could favour electric, solar or hydrogen-powered vehicles. Or if energy is expensive and inaccessible to most, this could favour mass transit over personal motorised transport. People's lifestyle choices, such as opting for virtual services instead of travel, could directly affect energy demand levels in cities too.

" *By 2040, the grid will be different: we will be burning electrons rather than hydrocarbons. Those electrons will be greener, so there will be a lot more renewable energy generation.*"
> **Gordon Feller**, Director of Urban Innovations at Cisco Systems

Resource use

Mobility is essentially about the ability to access goods, services, people and information. Therefore the future response to resource scarcity will have a huge impact on urban mobility and quality of life. If there is strategic investment in energy, food and water supply infrastructure, for example, cities will be better able to ensure their citizens can access essential goods and services. If there are inadequate responses to resource scarcity, life in megacities of the future will be tough, with rapid population growth but too few resources to meet people's demands.

Global economy

Economic growth creates a spiral of greater demand for mobility, and greater demand for goods and services. Providing more goods and services requires more transport, support and staff; increased wealth allows people to travel more and encourages more expensive modes of transport such as the car; and growth in property prices leads to longer commutes.

We have come to take growth for granted, but could resource limitations or climate change bring the seemingly endless expansion cycle to an end? Or, might lifestyle changes alter how we think about growth and wellbeing, affecting everything from consumption patterns to modal choices?

" *In places like Istanbul and Mumbai, with large populations with rapid economic growth, it is absolutely key that they focus on restraining growth in vehicle use. It's arguably the hardest and the most important challenge confronting these cities.*"
> **Dan Sperling**, author of *"Two Billion Cars: Driving Towards Sustainability"*

Climate change responses

The response to climate change is likely to deeply affect how cities of the future look, feel and operate. The *Megacities on the Move* scenarios all show a different balance of measures to adapt to climate change and reduce further emissions. For example, in the carefully planned and centralised world of Planned-opolis, streets are lined with carbon scrubbers that suck carbon dioxide out of the atmosphere, and neighbourhoods are designed from scratch to maximise natural cooling. In contrast, the cities of Sprawl-ville are designed by the rich for the rich, who effectively live in a city within the city, protected from the floods and heat to which the poor are exposed.

Governance

There are big gaps in global governance systems on major issues including energy, food, water and climate change. If these are not improved, or if governance deteriorates, our countries and cities will be more vulnerable to external shocks. City-level governance is also critical, particularly when it comes to mobility – for example, to develop well-designed public transport systems, maintain order and support the integration of various mobility networks.

It is highly uncertain how the quality, effectiveness and structure of governance systems will unfold. Different approaches to governance could profoundly affect mobility in cities – from tightly controlled and networked mobility systems on one end of the spectrum, to a chaotic proliferation of mobility solutions in a world with poor governance on the other.

" *Governments make a lot of money on fuel duty, and this would be displaced by electrons if electric vehicles were mainstreamed – so there will have to be a profound shift in terms of how governments generate income, and structure tax and incentives.*"
> **Tom Briggs**, Vice President, Policy and Communications, BP Alternative Energy

Social structures

Traditionally, most societies have favoured the family as the core unit, often with strong communities surrounding the family. These communities were typically more self-sufficient and had lower levels of mobility. Today, many cities are becoming more atomised spaces, with a huge influx of diverse groups and more emphasis on individuals. This could spell the decline of traditional community structures and an emergence of new types of community for the 'urban age' – more networked, flexible, and mobile, but also more temporary. Equally, there is a possibility that we might see a reassertion of traditional community and family structures in the cities of the future, whether as a backlash against too much individualism and social fragmentation, or as a result of resource and climate constraints.

Values

The 20th century was the age of the car. It became a status symbol for those who had it, and an aspiration for those who could not afford it. In the age of rising middle classes in emerging economies, demand for the car may explode – as we are already seeing in markets such as China. Managed badly, this could have detrimental impacts on the quality of life in cities – from air pollution, to congestion and road safety, to exacerbation of climate impacts.

However, future generations may have a different set of mobility preferences. Today's children will have grown up with immersive networking technology, and are likely to be much more comfortable spending time in virtual spaces. There are already signs in some cities that the popularity of the car as a status symbol is declining, especially as congestion problems get worse and alternative status symbols (such as smart technology devices) emerge.

" The UK government banned smoking in public places and nobody batted an eyelid. A generation ago, this would have been unthinkable. At the moment, mobility is different. There is no sense that mobility causes harm. Indeed it is seen as a good thing if you can afford it. Maybe attitudes to travel will change like they did to smoking."
> Ben Plowden, Director of Integrated Programme Delivery, Transport for London

Business

Future trends such as climate change impacts, resource constraints, technological innovation, or cost pressures on public services, will present a number of risks and opportunities to businesses operating in cities. The typical urban mobility model is state-funded public transport systems, competing and combining with privately owned cars and taxis running on public roads.

This could change in a number of different ways. There will almost certainly be opportunities to provide digital alternatives to physical mobility – from employment, to retail, to leisure. New business models could emerge in personal mobility as well, such as today's urban car clubs. Office spaces and the way we work could change, and private sector provision could extend further into areas traditionally addressed by governments – from public transport to wider infrastructure.

Cyclist in Mumbai

Technological development

Technological change has reached an unprecedented speed, and this is likely to continue into the future – though innovation could also be stifled as a result of various economic or political factors, as in our Sprawl-ville scenario. Many place faith in technology, and indeed new vehicle systems do have the potential to reduce energy and carbon impacts dramatically, especially from cars. However, it is much harder to predict what technological developments we will have in 2040, and even how influential these will be compared to other factors, from policy to behaviour change.

Certainly, ICT-based innovation will be a prominent feature of our lives, particularly in increasingly networked cities, where the ability to be permanently connected could bring better access to goods, services and other people with less need for physical transport. Transport technology innovations might include further changes in vehicle design, propulsion systems and energy sources to address congestion, carbon emissions and safety. The most anticipated trend is for new electric vehicles, including low carbon power-trains similar to electric cars. Other possibilities include buses or cars driven by locally produced hydrogen or biofuels.

" The convergence between cities and other areas will grow as we start to spend time in 'virtual cities'."
> Guy Summers, R&D Collaboration Manager, Vodafone

Urban form

Currently we are on a pathway to ever-increasing urban sprawl, and in some cases megacities merging with neighbouring cities and towns. These mega-regions, formed by megacities that stretch hundreds of kilometres – sometimes across state borders – form vast belts of high population density and economic power and create huge challenges for governance and mobility.

However, this trend is not inevitable and it is possible to reverse it. For example, many urban planners and transport officials today advocate replacing low density car-centric cities and zoned land use with denser, integrated urban villages based around mixed land use, public transport and walkability. Our scenarios reflect these different possibilities.

" In the past 100 years, the automobile has shaped the city rather than cities shaping the automobile. In the future the opposite will be the case: cities will start to shape mobility."
> Chris Borroni-Bird, Director of Advanced Technology Vehicle Concepts, GM

Return to contents
1. overview > what's ahead?
page 10

what can you do?
six solutions for sustainable urban mobility

Looking 30 years into the future, the challenges – and the solutions – can seem a long way off. But everyone involved in urban mobility can take action today, whether you are a government, city authority, urban planner, transport provider, in business or the public sector.

High speed train

1. Integrate, integrate, integrate

Transport, urban planning, business, public services, energy and food supply can no longer be considered in isolation. Together, we need to create integrated mobility systems that will provide people with choice, flexibility and seamless connectivity whether they are travelling from one place to another or accessing the things they need virtually.

2. Make the poor a priority

Mobility systems must work for rich and poor alike, to ensure everyone has access to goods, services and job opportunities. Cities already have many people on lower incomes and this trend will only increase. Tailored mobility solutions must be designed to meet their needs.

3. Go beyond the car

Current growth rates in car ownership are simply unsustainable: there are already one billion cars in the world, projected to grow to two billion within a few decades.[4] We need alternative ways of getting around, and we need to design for people, not cars. We will need urban neighbourhoods with the infrastructure to serve local communities and dense developments that prevent further sprawl, are easy to walk around, and provide access to key goods and services.

4. Switch on to IT networks

There is enormous potential for information technology to reduce the need for physical movement by enabling urban dwellers to access more and more services online. Using IT networks to connect and coordinate cars and public transport can also help reduce traffic congestion and accident risks.
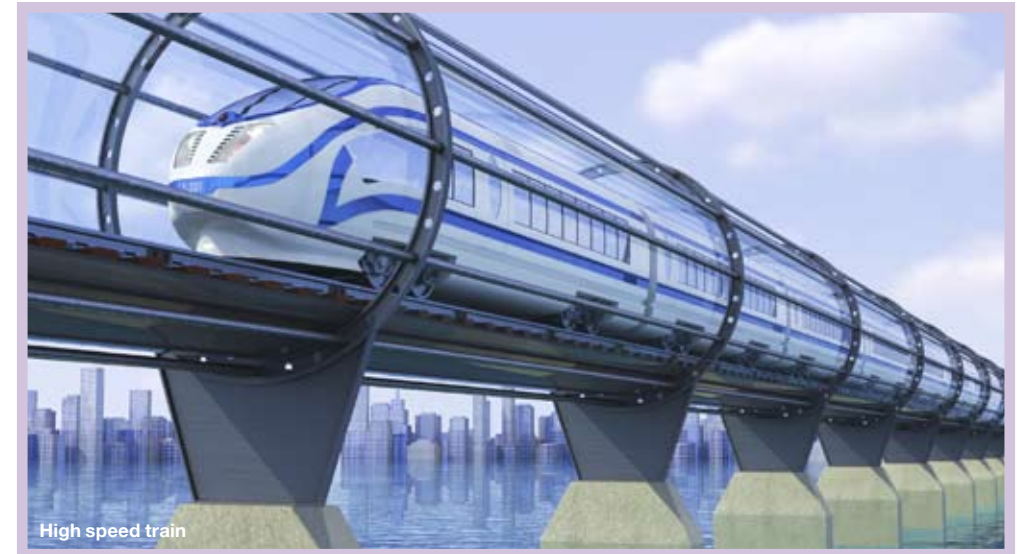
5. 'Refuel' our vehicles

As oil becomes more scarce, expensive and a security risk, we will need to implement greater energy efficiency measures, as well as shift to powering our vehicles with renewable, low-carbon fuel sources. We will need significant investment in battery and fuel technology to seize this opportunity and take alternative energy-powered vehicles to scale over the next few decades. Most vehicle technology experts agree that advanced technologies also have enormous potential to improve fuel efficiency.

6. Change people's behaviour

Many of our future challenges are shaped by people's values, behaviour and preferences. We need to think about ways to influence mass behaviour and social norms in positive ways to promote low-carbon, healthier urban lifestyles. Future leading cities will plan today to influence lifestyles rather than simply relying on additional road infrastructure and modes of transport.

Want to see how this is happening in the real world?

Please see section 3 for more details and practical examples of how these six solutions are already being designed, put into practice, or scaled up around the world: from integrated cities to intelligent traffic systems, biofuels to battery technology, car-free days to travel-free virtual meetings. Download it from: www.forumforthefuture.org/projects/ megacities-on-the-move

[4]   Daniel Sperling and Deborah Gordon, *Two Billion Cars, Oxford University Press*, New York, 2009.

planned-opolis

In a world of fossil fuels and expensive energy, the only solution is tightly planned and controlled urban transport.
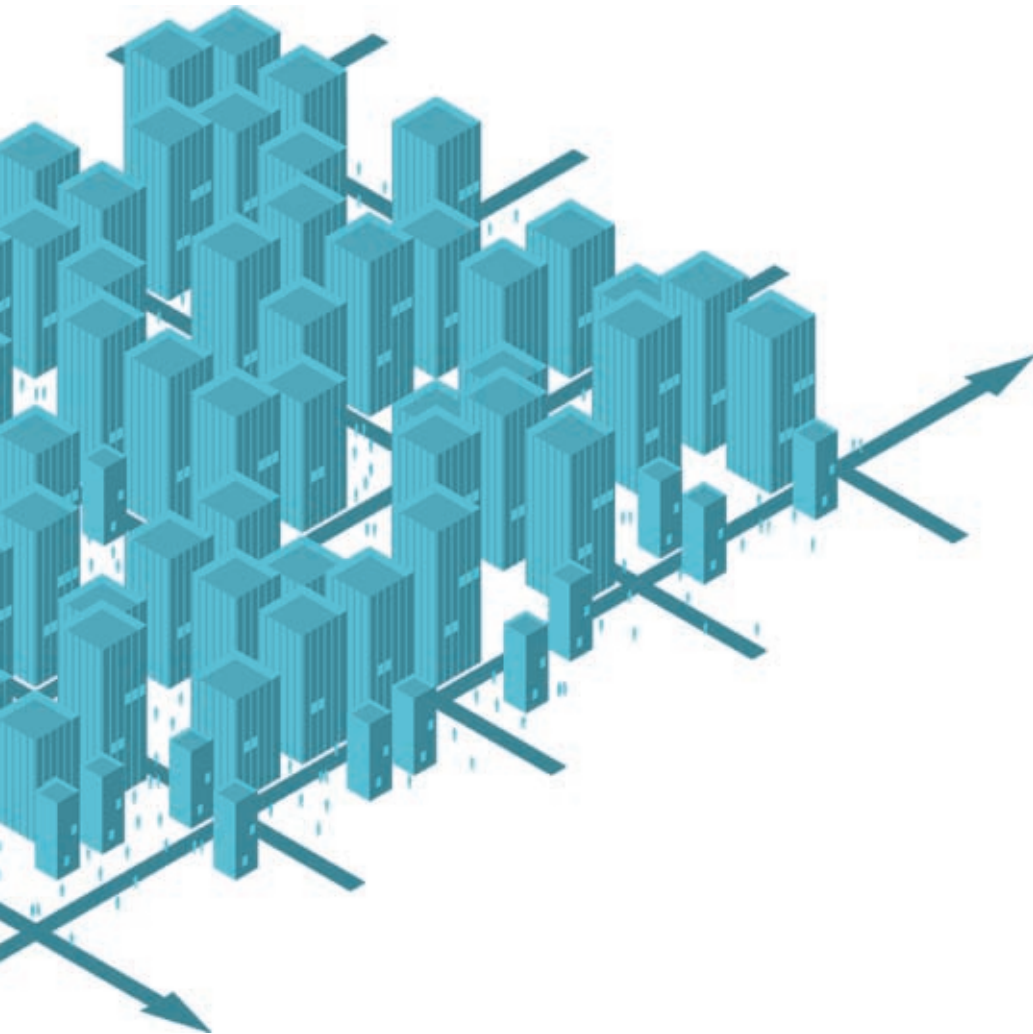
urban form

Because energy is very expensive, cities are highly managed, with limited personal mobility and efficient public transport networks. In some cases, cities are downsized or even designed and built from scratch. Floating cities are also taking off in coastal areas as a key climate adaptation strategy.

mobility

Mobility choices are constrained. People have allowed ICT and the advent of 'virtual city spaces' to replace a large portion of physical travel. Many cities ban cars in central areas to meet carbon targets. Personal vehicles are available only to the wealthy, so the average citizen moves around the city using tightly controlled and networked public transport systems, and by walking or cycling through strictly non-motorised zones.

highlights

Feeling hot? > People keep cool under the ten million trees the city has planted.

What's on the menu? > The Global Food Council can tell you – it decides what food is grown in which region.

Need to get away? > Millions of people now live in floating cities and millions more escape daily to virtual cities like 'London 2.0'.

Energy > Centralised grids rely on gas-fired power stations and carbon capture and storage.

Resources > Strict planning and rationing ensure resources are used as efficiently as possible.

Economy > A strong, regulated economy invests in technology and infrastructure.

Climate change > Cities are replanned as extreme measures are taken to decarbonise the world.

Governance > One-size-fits-all governance is effective, but reduces freedom.

Social structures > Society is fairer but less individualistic.

Values > It is a hard-working but high-trust world.

Business > Big business is everywhere, and even governs some cities.

Technology > We live in a hi-tech world of integrated systems and virtualisation.

scenario summary:

sprawl-ville

The city is dominated by fossil fuel-powered cars. The elite still gets around, but most urban dwellers face poor transport infrastructure.

urban form

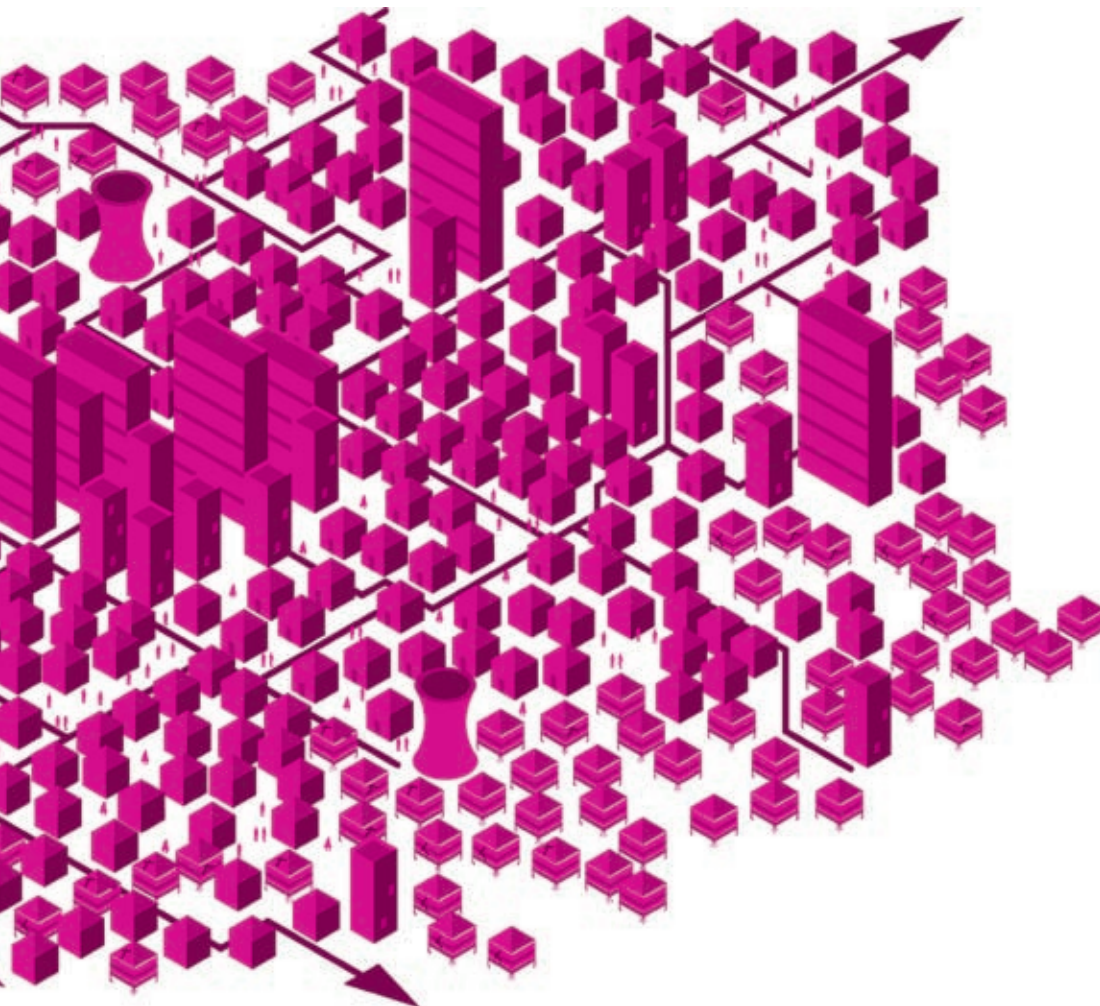The city is a great fragmented sprawl. There are huge, low-density suburbs, freeways to connect them, and commuter jams. In the periphery of the city there are numerous 'failed' developments, built too far from public transport and therefore unaffordable to urban commuters now that oil prices are high. They either become ghetto areas for poorer people or are reborn as local communities trying to provide their own services.

mobility

In urban areas, the car-dominant model persists, although the average personal vehicle is now an ultra-efficient hybrid or diesel car. As the poor are increasingly unable to afford the daily car commute, urban ghetto areas spread in the city core and informal paratransit [5] services spring up to serve community needs. People begin to alter their commute to address daily needs: nomad businessmen sit in traffic in armoured vehicles, working while moving slowly from meeting to meeting; many of the cars bought by the emerging global middle classes become driveway trophies rather than a practical means of transport, as people return to buses and bicycles.

highlights

Where's my car? > Everywhere! Cars are still in favour and still the ultimate status symbol.

Don't like the jam? > It's a 24-hour city – of never-ending congestion.

Fill up the tank? > Businessmen get around in tank-like armoured cars to protect themselves.

Energy > Oil production peaked around 2030 but transport still uses fossil fuel – particularly gas – and focuses on efficiency.

Resources > Resource scarcity has lowered the quality of life for the urban masses in this elite-controlled world.

Economy > The global economy is stagnant, susceptible to protectionism and shrinking supply chains.

Climate change > Short-term thinking rules as people focus on adapting and protecting their property.

Governance > Cities are governed by and for the elites – they maintain just enough of the basic infrastructure to minimise public disorder.

Social structures > It's a less equal world where the informal economy prospers.

Values > Tension is growing as people lose faith in consumerism and the world is increasingly polarised into religious and ethnic extremes.

Business > Business is powerful – with an expanded role in society as a result of less public service provision – but it is less accountable.

Technology > There are efficiency gains but few major breakthroughs.

---

[5] An alternative mode of flexible passenger transportation that does not follow fixed routes or schedules. Typically mini-buses are used to provide paratransit service, but share taxis and jitneys are also important providers. For more information, see the Wikipedia entry on paratransit: http://en.wikipedia.org/wiki/Paratransit

renew-abad

The world has turned to alternative energy, and high-tech, clean, well-planned transport helps everyone get around.
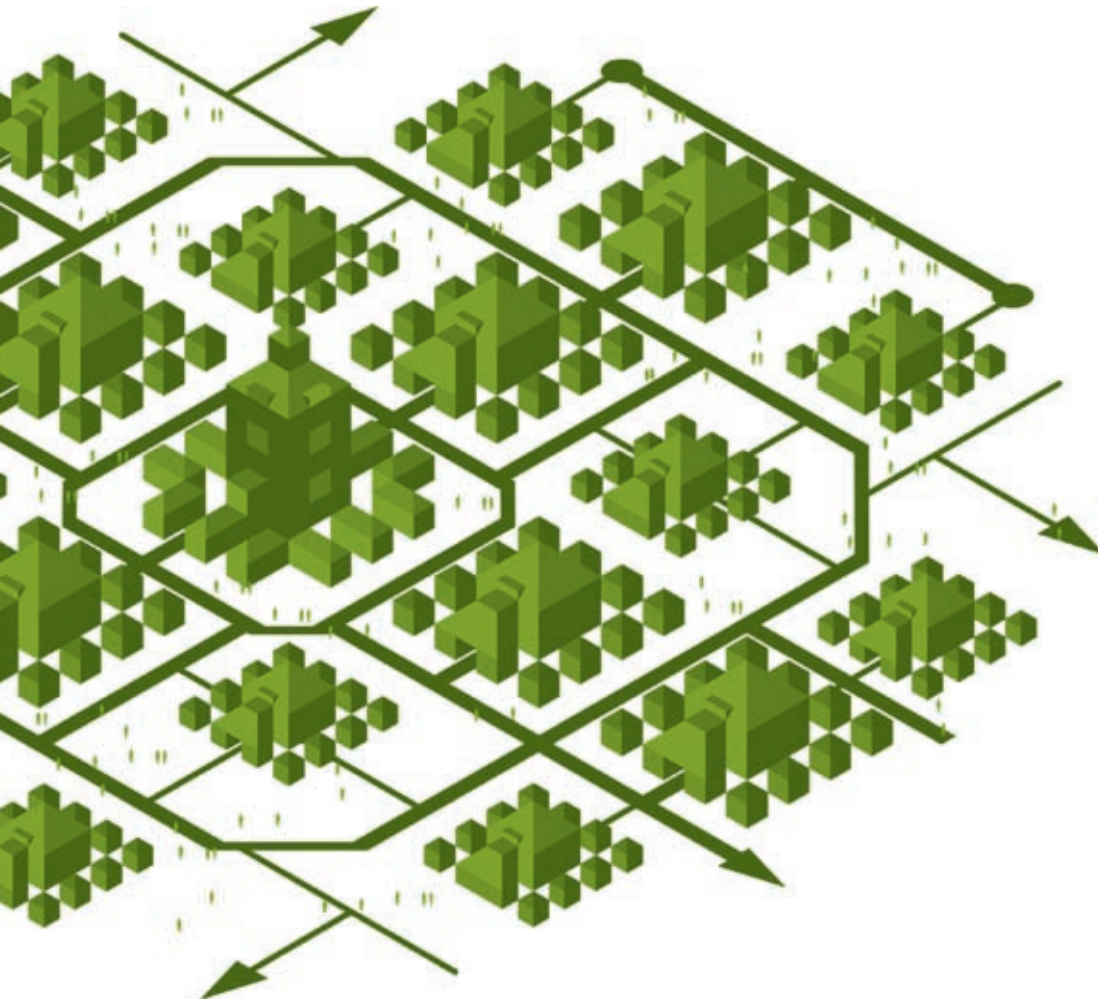
urban form

The age of urban sprawl is over: cities are becoming more densely populated as they set boundaries for growth. City states have re-emerged as powerful forces to be reckoned with. Neighbourhoods are organised around hubs providing integrated services from in-house energy generation to vehicle charging points to community centres and flexible offices.

mobility

On city streets, many more personal vehicles are electric or hybrid, and electric rail and buses are the top choice for public transport. Energy continues to be relatively expensive, so people often switch between personal vehicles, public transport, walking and cycling. The infrastructure has been massively upgraded in many cities to encourage this. Sophisticated augmented reality services reduce the need for physical travel, and almost every aspect of transport is guided by technology.

highlights

Waiting for the train? > There are ultra-high-speed rail links connecting every suburb.

Drive off into the sunset? > Solar scooters are one of the popular ways to get around.

Who's in charge? > The city council controls our lives to keep us safe and comfortable – and we like it.

Energy > It's a brave new world where we have rapidly embraced renewable energy.

Resources > There's a shortage of food and land, and resource use is strictly regulated.

Economy > Economic power has shifted south to China, India and their allies.

Climate change > An early global deal on climate change means that the most dangerous impacts were averted.

Governance > Strict governance holds sway in nation-states and city-states alike.

Social structures > The rich-poor gap has narrowed within societies, though many regions have been left behind in the low carbon race.

Values > People value simplicity and authenticity.

Business > Business provides low-impact services in collaboration with governments.

Technology > Innovation is driven and regulated by the public sector. There have been important breakthroughs, including in electric vehicle battery technology.

communi-city

The world has turned to alternative energy, and transport is highly personalised with a huge variety of transport modes competing for road space.
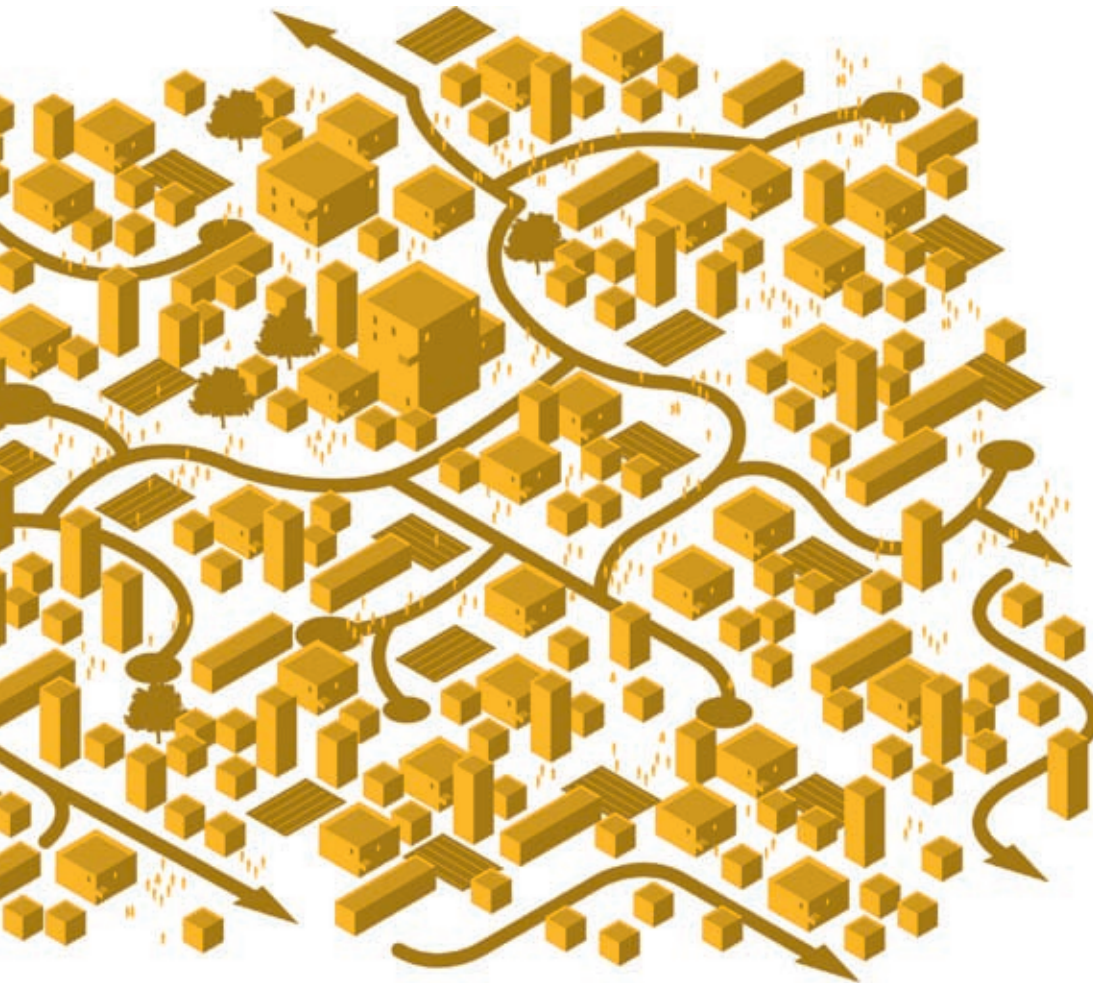
urban form

Power has devolved to individuals and communities; cities have become more informal and sometimes chaotic centres of creativity. For example, community-organised vertical and small-scale horticulture has flourished, with balconies, roofs and the sides of buildings given over to growing food.

mobility

Personal and individualised mobility is important. Modes of transport proliferate and people move about in a range of small electric vehicles – souped-up bikes, covered scooters, pod-cars and so on. Customisation is rife. Some people even build their vehicles locally from kits, using open-source designs, local materials and home-brewed biofuels. The roads look chaotic with so many vehicle types and so much personalised transport – but somehow it all works, through smart use of information technology to avoid collisions and optimise routes.

highlights

Plant-powered public transport? > 'Biobuses' are one of the most popular cheap ways to get around the city.

DIY everything? > 3D printers allow anyone to be a homegrown manufacturer – from furniture to fashion.

Where did our centre go? > There is no city centre any more, everyone has their own very different neighbourhood.

Energy > Local renewable energy generation and decentralised grids have superseded coal, gas and oil.

Resources > Cities have transformed to produce more of their own food and deal locally with waste and water.

Economy > Grassroots business and new technology compensate for protectionist trade and slow global growth.

Climate change > People and communities adapt to climate change and reduce carbon, despite weak global policy.

Governance > Central coordination is weak and more power resides at the community level using computer-based collaborative tools.

Social structures > It's a more unequal world, but full of opportunities if you're able to grab them.

Values > People are less consumerist and less status-driven; they look more to religion and community.

Business > Business is more local and decentralised, and many global brands are now extinct.

Technology > Rapid breakthroughs make technology an exciting area of change, and many people are involved through grassroots innovation and research.

perspectives from our partners

Imagination in energy

"It is our conviction that mobility is central to the delivery of wider human benefits of economic development, social interaction and freedom to explore our surroundings. However, we believe also that these positive benefits are entirely dependent on the extent to which mobility is both safe and sustainable. The FIA Foundation's work – from promoting fuel efficiency in the world's cars to working for the greatest possible safety on our roads – aims to ensure that it is.

The specific challenges in addressing an increasingly urban and intensively populated planet are complex. However, they centre around our ability to be efficient in our use of energy and imaginative in how we source it. Of equal importance will be our capacity to work together across the globe to find common and coordinated solutions. Our global response has not been impressive so far. To the extent that this is due to a lack of information and shared understanding, our hope is that this study will cast some useful light into that darkness."

Sheila Watson
Director of Environment, FIA Foundation

Transformation through technology

"Given the rate of change, our world will be a very different place by 2040. Engineering and technological innovations will transform urban living – in particular the way we communicate and share information, as the convergence of internet and mobile technology becomes a reality. Expect mobile networks to extend beyond human communication; everything that could benefit from a wireless network is likely to have one; and connectivity will combine with energy, water management, transport and health as more services are delivered online.

Vodafone has participated in Megacities on the Move because we believe we have a role to play in shaping solutions for the future. This project builds upon the issues identified in our Future Agenda project (www.futureagenda.org) and supports the work we have already done in other areas where we believe our products and services can help others make a difference, for example Carbon Connections (www.vodafone.com/carbonconnections).

Although cities themselves have a remarkable ability to innovate, it is difficult for urban planners to keep up with the pace of change. This project is a valuable resource for city authorities, businesses and policy makers, to allow them to think beyond traditional solutions and consider different approaches."

Nicola Woodhead
Group Environment Manager, Vodafone

A vision for Istanbul, Mumbai – and megacities around the world

"Both Mumbai and Istanbul have grown phenomenally in the past two decades, both geographically and in population. With this growth as a given, the scenarios for both cities presented an elaborate imagination of our world 30 years from now, charted on the two crucial elements of our future in this world: fuel dominance and governance structure.

The future scenarios approach provides a unique opportunity to plan for the long-term and bring it into the present. EMBARQ partnered with Forum for the Future on workshops in Istanbul and Mumbai (read more about these in section 4 – Plan the future now).

We believe it is urgent to abandon many of the current planning practices and move to less energy intensive options in preparation for 2040. Our hope is that the scenarios exercise will catalyse not only a discussion of transport and urban development in Istanbul and Mumbai, but also contribute to the discussion of energy policies nationally and around the world."

Sibel Bulay
Director, EMBARQ Turkey

Madhav Pai
Director, EMBARQ India

Clayton Lane
Acting Director, EMBARQ

Want to plan your own workshop?

Get a how-to guide for organising a sustainable urban mobility workshop and find out more about Istanbul and Mumbai in section 4: Plan your future now. Download it from: www.forumforthefuture.org/projects/megacities-on-the-move

forum for the future
action for a sustainable world

FIA Foundation
for the Automobile and Society

vodafone

EMBARQ®
The WRI Center for Sustainable Transport

2. what's your destination?

megacities on the move

four scenarios for urban mobility in 2040

The future is likely to be dramatically different from today. To get the future we want, we need to be better at understanding what it might look like, what will shape it, and what is already happening today that could affect it.

what are scenarios?

Scenarios are explorations of alternative futures. They are a tool to challenge, inspire and support individuals and organisations to plan ahead. Scenarios are designed to strengthen strategy and policy, advocate long-term thinking and build a collaborative vision for a sustainable future.

Scenarios are not predictions. We do not think that any one scenario is more likely than the other, nor is our intention to prescribe one scenario as 'best case' or 'worst case'. All scenarios should present elements of a possible future, and present a realistic combination of positive and negative developments.

The *Megacities on the Move* scenarios are intended to present plausible future developments, describing the challenges and opportunities of personal mobility in large cities in 2040. Each scenario covers a range of issues and addresses a number of critical questions, including:

- How might our mobility needs and aspirations change?
- How might sustainability challenges such as resource constraints, climate change impacts and social (in)equality impact personal mobility in cities?
- What might be the modal mix of transport solutions?
- Which of our mobility needs might be met in ways other than transport (e.g. through virtual services or urban planning solutions)?

how were the scenarios created?

In order to create the scenarios, we went through a number of key phases:

Why 2040?

We chose to examine the future of mobility in 2040 because urban infrastructure has a long life, so setting a 30 year timeline provides enough time to plan for and deliver a new generation of sustainable mobility solutions.

Horizon-scanning research

As part of this phase we undertook desk research as well as structured interviews with more than 40 experts involved in different aspects of urban mobility from around the world – including stakeholders in the two cities we had chosen to test the scenarios, Istanbul and Mumbai. Our aim was to identify current forces and uncertainties around urban mobility, as well as get interviewees' perspectives on key factors and trends shaping the future of mobility.

Scenario planning

Based on the key factors and trends we then developed scenarios showing different possible outcomes for mobility in cities in the year 2040. Using these scenarios, we also created outlines of city-specific scenarios for Istanbul and Mumbai, suggesting what might happen locally in each city within the context of the global-level scenarios.

City workshops

We conducted 2-day workshops in Istanbul and Mumbai to validate the scenarios, identify relevant challenges and opportunities for the local context, as well as short, medium and long-term solutions that could be implemented. In particular we asked people to critique the scenarios, and tell us what they thought were the most plausible outcomes and trends.

Partner workshops

We also conducted workshops for the project partners in an effort to explore the implications of the scenarios for their organisations, and identify options for future strategy responses.

key variables:
energy sources and global governance

Amongst the uncertainties, we identified two as the most critical in influencing future mobility solutions: **energy supply and demand, and governance systems**. Our research indicated that these are the most uncertain trends and have the greatest potential impact on the future of urban mobility. We identified two very different outcomes for each, and used this to construct the 'axes': the overall framework for the scenarios that defines the key differences between the scenarios.

Axis 1: what kind of energy mix will be dominant?

Fossil fuels dominant: The world is still running on fossil fuels. Although there are significant constraints in supply, a mix of mitigating factors – including efficiency gains, clean-up mechanisms, and supply augmentation through different sources such as shale gas or tar sands – help maintain fossil fuel dominance.

Alternative energy dominant: Alternative energy sources have been scaled up and are much more affordable. Conventional oil supply has peaked. Simultaneously, a mix of cost and technology breakthroughs in alternative energy generation spurs innovation that changes the energy mix.

Axis 2: what kind of global governance framework will we have?

Top down: Global governance frameworks are strong and well coordinated. A convergence of opinion on key issues such as climate change has led to the develop-ment of stronger institutions and binding frameworks, and a more collaborative world order.

Bottom up: Decentralised governance solutions are preferred to global-level action. Trade relations are more regionalised, and innovation happens in local power hubs. The world is focused on self-sufficiency, resilience and localised solutions.

Fossil fuels dominant

planned-opolis

sprawl-ville

Top down

Bottom up

renew-abad

communi-city

Alternative energy dominant
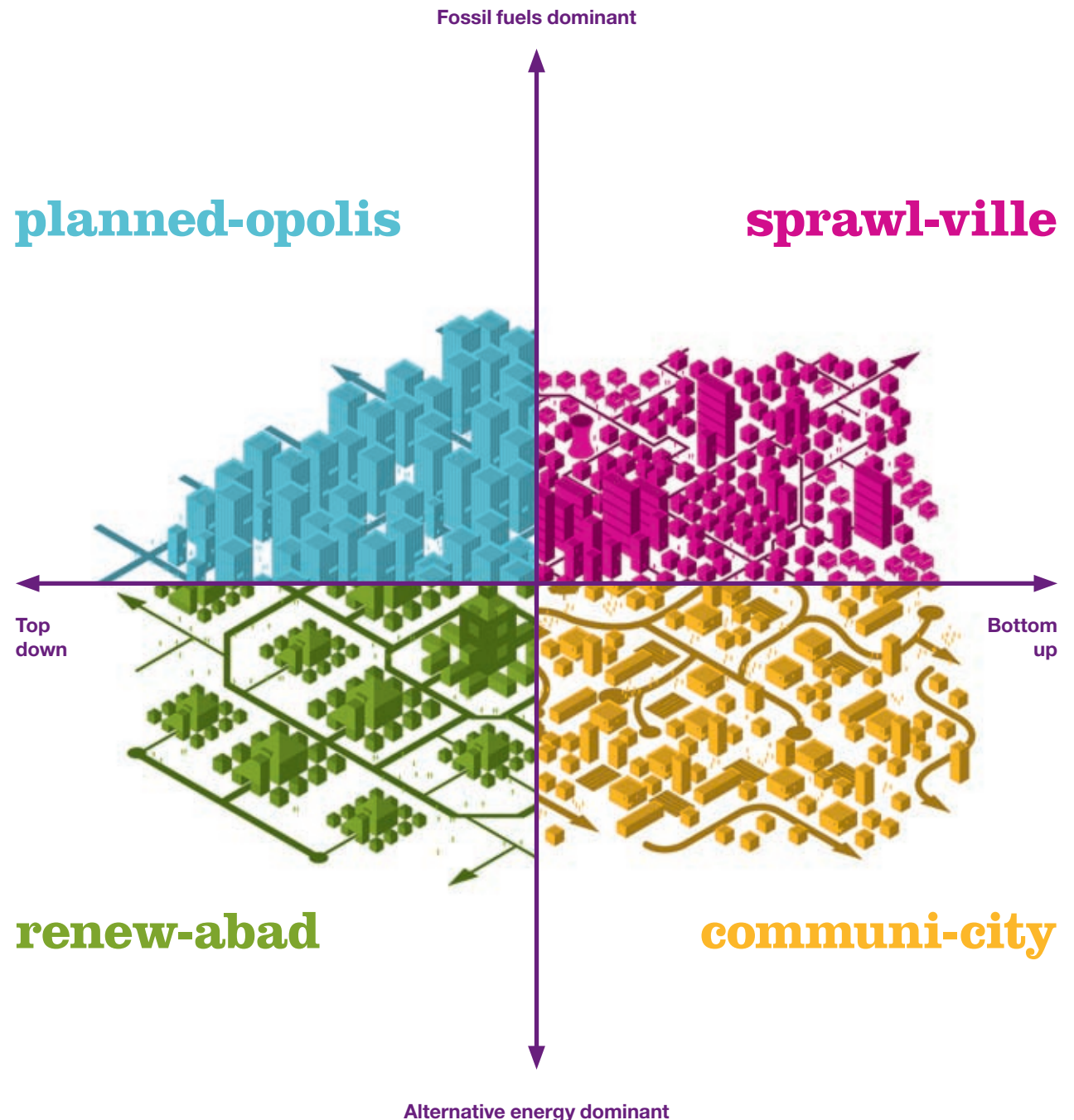
scenario 1
planned-opolis

In a world of fossil fuels and expensive energy, the only solution is tightly planned and controlled urban transport.

timeline
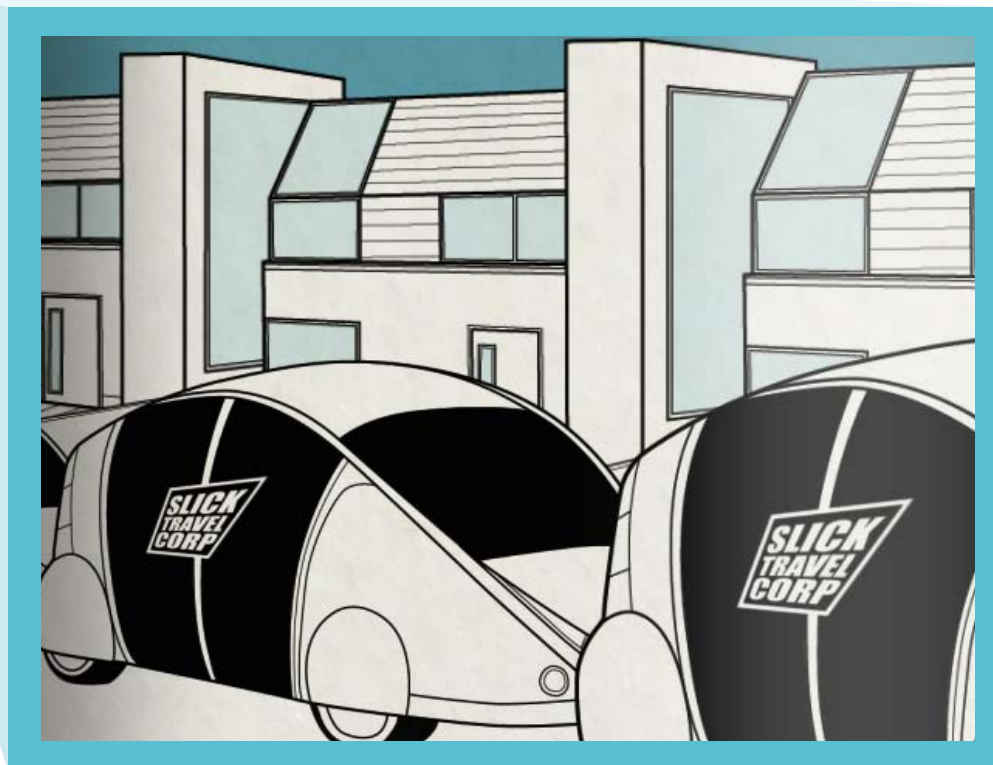
2018
Most new coal and gas power stations have CCS, with funds supporting this technology in developing countries.

2023
A high profile nuclear storage shelter leak due to a rushed project further delays nuclear large scale generation.

2027
Plans for new floating cities approved in Bangladesh and the Netherlands.

2015
A global climate deal is reached. A framework of global cuts for 50% (to 1990 levels) by 2050 is agreed, with interim targets.

2020
Globetech, a major multinational company, bans flying for business meetings and sees share prices rise sharply in the following years.

2025
City Corp takes over the management of Laos after a governance failure.

2035
Global Food Council gets new powers to control farming.

factors shaping mobility

Energy supply

Centralised grids rely on gas-fired power stations and carbon capture and storage.

A high carbon price makes energy very expensive, but a lack of viable alternatives means fossil fuels – in particular shale gas and methane hydrates – still dominate. Investment has been focused on reducing energy demand and increasing efficiency. Nuclear energy has not scaled as expected, held back by technical delays, escalating costs and a shortage of skills. Very efficient carbon capture and storage (CCS) technology is necessary to keep carbon emissions down.

Resource use

Strict planning and rationing ensure resources are used as efficiently as possible.

There is strong reliance on technological solutions and centralised planning to overcome resource shortages. Water is commonly rationed. To maximise efficiency the 'Global Food Council' dictates what crops can be grown where in the world. Consumption of energy-intensive meat is restricted. Tight monitoring of raw materials such as metals, wood or paper, ensures that resources are reused and recycled. Biotechnology and nanotechnology have helped engineers and scientists develop new materials with exceptional physical properties.

The economy

A strong, regulated economy invests in technology and infrastructure.

The economy in 2040 is quite strong, and global trade continues to grow, although it is tightly regulated and sky-high oil prices restrict the sort of goods that can be traded. Import tariffs and subsidies have been reduced. The US, China and Russia dominate – the latter due to its land, oil, coal and forest resources. Spending on technology and R&D, especially on energy efficiency measures, is very high. Growth has allowed significant investment in new infrastructure, including large urban projects.

Climate change responses

Cities are replanned as extreme measures are taken to decarbonise the world.

The world relies on geo-engineering. 'Carbon scrubbers' that take CO_2 directly out of the air are a common sight on city streets. Many cities with high food risk have been deliberately downsized and populations moved to new cities designed from scratch. Floating city technologies pioneered by the Dutch have spread to other rich city areas such as Hong Kong. Cities are re-engineered for natural cooling – tree-planting, green roofs and natural ventilation are common.

Governance

One-size-fits-all governance is effective but reduces freedoms.

Global governance is well-coordinated and effective. There are agreements on climate change, displaced people and global agriculture. Global agreements are quickly implemented at a national level. Technology plays a significant role in supporting governance. Cities are often run by specialist, city-governing companies. These companies bid for very lucrative long-term contracts and may run dozens of major cities worldwide. This means that effective policies developed in one city can quickly spread around the world, but it also means that very different cities tend to be run in the same way, despite local differences. This leads to complaints about loss of national sovereignty and individual freedoms.

Old Car Park Farm →

continued...

Social trends

A fairer but less individualistic society.

Inequality between countries has decreased as the global economy has rebalanced. Inequality within countries has also decreased, though in most societies there is still a persistent underclass and elite. Individual freedoms have been eroded. Societies tend to be less diverse than in the past. Civil society is less vibrant and there is less protest and political violence.

Human values

A hard-working but high-trust world.

People rely on new technology to solve problems. They are also, in general, very accepting of government or business intervention in their lives, and look to large institutions to provide security and stability in an unpredictable world. There is a strong feeling of international solidarity.

The car is no longer seen as a status symbol by many. Right across the world, people are very willing to participate in coordinated mass transit systems. The 9-to-5 no longer exists since we are always 'logged on', although we also work more. In some megacities, alienation and depression is a big issue due to much 'virtualisation', work fatigue, and the fragmentation of traditional social units. Special interest groups are popular among older people, calling for a renaissance of low-tech, face-to-face connectivity in cities.

The business landscape

Big business is everywhere, and even governs some cities.

Big business is thriving in the globalised economy, operating global brands, with localised distribution and supply chains due to the high price of oil. Business plays a major role in government and in people's lives. For example, City Corp is a global firm that specialises in governing cities (transport, energy, healthcare and so on) as efficiently as possible. It uses computer models to design integrated systems that can be adjusted and applied to any large city in the world. More and more services are delivered virtually.

The role of technology

A hi-tech world of integrated systems and virtualisation.

Technology penetrates every aspect of life. The natural environment is continuously monitored. Many people, especially the young, live much of their lives through avatars – online personas – working and forming relationships, learning, seeking advice and spending leisure time. This means there is less need to travel. Smart technology is everywhere and helps to integrate diverse systems, such as energy, food and waste. Most vehicles communicate with each other, can drive themselves, and use augmented reality technology.

urban form

Huge urban regions are transformed by system-planning, virtualisation and a generational divide.

Megacity regions in some parts of the world house more than a hundred million people. Cities are tightly regulated and carefully planned. Many new cities have been created and slum-dwellers forcibly resettled. New suburbs have often been designed around the electric bike, not the car, with narrow streets that blend walking space with bike space. Cities are more formalised places than they used to be. Informal activity, such as unplanned building or unlicensed markets, is not tolerated.

City form is heavily influenced by virtualisation, with a greater blending of social classes and more people living urban lifestyles far away from the city. People can live in one city but be 'resident' in another location of their choice, some of which only exist in the virtual world, such as 'London 2'. Cities are governed increasingly as complex systems (integrating energy, transport, water, waste and so on), to maximise efficient use of resources. Activity – movement of traffic and people in particular – is continually tracked.

There is a significant generational gap between younger and older people, as the young adapt more quickly to living their lives in virtual spaces. The over-60s dominate the physical city, while younger people dominate the virtual city. This means that the whole urban physical environment, including

mobility

Demand for mobility is down, car ownership has reduced and transport systems are highly integrated.

Transport in most cities is highly regulated. Some cities have become completely car-free, others only allow electric cars and the majority have strict standards on fuel economy for any internal combustion engine or hybrid vehicles. Car parks have disappeared from many urban areas, replaced by houses or urban farms. Commuters apply for a 15-minute travel slot if they need to travel to work.

People are told when to travel and by what mode. Small vehicles are likely to be electric, using energy from centralised grids, while larger vehicles such as coaches and trucks are more likely to use liquid fuel. Car ownership is low, though the rich are still driving cars and paying the high price. Transport systems have evolved to be highly integrated across the different modes, including walking and cycling, inter-city travel and consequently also transport systems in nearby cities. Any delays or breakdowns can disrupt transport over huge areas. People have 'calorie cards' that can be topped up and spent on anything, including different modes of transport, with a high-energy mode using more calories than a low-energy mode.

Smart cars ensure that driving behaviour is smooth and safe and keeps traffic moving as much as possible. In the most advanced cities, mass transit and individual transit become blurred: an individual can drive a car to a mass transit route and join a computer-controlled convoy, effectively becoming a part of the mass transit and surrendering control of the vehicle, then leave the convoy again when convenient.

Transport is treated by city governments as one part of a functioning urban system that includes energy systems, water, waste, food, distribution and so on. City governments look for solutions that can integrate the different subsystems most efficiently, for example combining public transport with freight transport or energy storage.

The high prices of oil and carbon mean that all transport modes are expensive, except for walking and cycling. Along with the tight regulation of transport and advances in ICT this means that many people, particularly younger people, live their lives online – working, shopping, consuming and socialising. As a result, personal mobility is reduced but freight mobility (delivering products that were ordered online) has increased.

ARMOVAN
300

300 - YOUR HOME ON WHEELS

scenario 2
sprawl-ville

The city is dominated by fossil fuel-powered cars. The elite still gets around, but most urban dwellers face poor transport infrastructure.

2017
Oil prices spike to US $200.

2027
Wealth gap reaches historic high.

2035
Beijing and Singapore ban non-electric cars in city centres.

timeline

2015
Global climate change deal fails.

2020
Three month traffic jam in India ends in tradegy.

2031
Global oil supplies peak.

2036–38
Global food production falls under the combined pressures of a biofuels rush. A 2 year global level famine occurs.

factors shaping mobility

Energy supply

Oil production peaked around 2030 but transport still uses fossil fuel – particularly gas – and focuses on efficiency.

Electricity grids rely on fossil fuels – primarily coal and natural gas – for over half of their energy, with nuclear and renewable energy providing the rest. With demand down due to energy efficiency and a shrinking economy, supply is generally more reliable than it has been in recent decades. Rapid advances in engine efficiency (forced by regulation in developed countries) mean that most vehicles still use oil-based fuels, despite the fact that in 2040 there are so many more cars in the world than in 2010. Fuel comes from unconventional sources such as tar sands and gas-to-liquids, but an increasing proportion comes from biofuels. Vehicle use is expensive and excludes poorer people from using their cars regularly. Growth in electric vehicles has been limited due to high costs of developing the necessary new infrastructure.

Resource use

Resource shortages – and the ensuing scramble – have a direct impact on human development.

The market is only now starting to realise that oil supply has peaked. Biofuel crops are big business, resulting in uncontrolled encroachment on both forest and croplands. As well as causing high food prices, this has led to serious deforestation, in turn affecting ecosystems and livelihoods of poor people. Add in the fact that water is in short supply, and it is not surprising that there has been a significant increase in deaths from famine in the last few decades. Home-grown food is booming across the world, in cities as well as rural areas and transport of water by road and rail across vast distances to megacities (for example from Cambodia to south China) is commonplace.

The economy

Global stagnation, protectionism and shrinking supply chains.

After a period of moderate growth up to the early 2030s, the global economy, dominated by China and the US, is now flat at best, with some major economies including China teetering on the edge of recession. The main cause of this is the decline in oil supplies and price shocks, but other resource constraints have taken their toll. The economy is rapidly becoming more protectionist, with bilateral agreements and export bans proliferating. The transport supply chain is still global but reduced, with air travel shrunk by high fuel prices, and increased shipping costs driving shorter supply chains.

Climate change responses

A focus on adaptation and protecting assets in the short term.

Climate impacts are occurring roughly in line with predictions, but the elites (nations or groups) prefer to protect themselves rather than taking global action. Adaptation measures tend to be local and reactive, for example building new sea walls after flooding or abandoning dust-bowl agricultural regions. Land and assets are exploited for short-term profits and then abandoned when exhausted. This tendency is amplified by the ability of the rich to shield themselves from climate change impacts inside air-conditioned domes, malls and vehicles. Corporate action is significant, trying to protect supply chains and markets. A new sector of the economy has emerged whose business is global climate change response strategy.

Governance

A global shift towards more authoritarian power.

Short-termism is the rule. There is little international collaboration on energy or climate concerns. Emissions reduction targets exist in developed countries but are increasingly circumvented. Nation-states are becoming more authoritarian in the face of fuel and food shocks, spawning a number of violent changes of government. The European Union is intact but has not expanded further. Cities are governed by and for elites, but this includes avoiding unrest and keeping the wheels of business turning, so basic transport infrastructure is maintained. Corruption has increased, with the potential for profiteering from energy and food issues.

continued…

Social structures

A less equal world, where the informal economy prospers.

This is an oligarch's and black marketeer's world. Global middle class prosperity in the 2020s proved a false dawn and inequality is up. Democratic institutions are on the back foot and power goes to those who grab resources and political influence. Oil companies retain their influence, much as bankers did after the financial crisis of the 2010s, with the industry dominating important cities such as Washington DC. The informal economy flourishes in the face of high unemployment, taxes and import costs, with local and home-grown produce and even organic waste (as a biofuels feedstock) traded both on the streets and the internet.

Human values

Polarisation of ideology and a loss of faith in consumerism.

The economic difficulties of the past decade have contributed to two notable trends. First is the polarisation of political attitudes, with some sectors of society calling for predatory energy policies or draconian austerity measures to allow a return to business as usual, while others seize on the new crisis as a chance to reform capitalism and reverse globalisation. The polarisation is particularly critical in the USA, where some states threaten secession. Revolutionary Marxism has returned as a major political force. The second trend is a resurgence in ethnic tension and a return to religion and traditional values as people lose faith in consumerism.

The business landscape

Business is powerful – with an expanded role in society as a result of less public service provision – but it is also less accountable.

Business plays a central role in this world, stepping in when government or communities fail, or even usurping power. Most of the largest and most powerful businesses in the world are privately owned. This makes them less accountable, which they often counter with major philanthropy and civic investment programmes. There are huge opportunities for entrepreneurs. Expanding areas of business include: coal, coal-to-liquids and gas-to-liquids, biofuels, urban gardening, warehousing (as just-in-time is rolled back), domestic service, grid renewables, nuclear, military, security, and the scrapping or modifying of vehicles. On the other hand, airlines, international tourism, hotels, cars and luxury goods (except for top-end billionaire yachts, which remain popular with the "biofuel barons") are all in decline.

The role of technology

Efficiency gains but few major breakthroughs.

Technological developments have focused on efficiency gains. This is most notable with the internal combustion engine, but can also be seen with solar energy and a host of others. For a long time there have been no major breakthrough technologies that have changed the world in the way the internet did. Technology development tends to be driven most by corporate R&D and the public, especially those with few resources, struggle to access much of it.

urban form

Low density sprawl and fragmented suburbs are the norm.

The car-dominant urban model persists, resulting in the growth of huge, low-density suburbs, freeways to connect them and commuter jams. In the periphery of the city there are numerous 'failed' developments, built too far from public transport and therefore unaffordable to urban commuters now that oil prices are high. Since 2030, the value of many of these new developments has crashed, with too many residents unemployed or unable to afford the car commute to their jobs. They either become ghetto areas for poorer people, and informal paratransit services spring up to service long commutes for those who were still employed, or are reborn as local communities try to provide their own services. Many large cities have gone back to being fractured towns with either derelict or farm areas in between. For example, Detroit no longer exists, replaced by five smaller cities. There is a lot of decaying, underused car infrastructure being scavenged and repurposed. Successful 'post-oil' cities such as Amsterdam and Singapore are doing very well.

mobility

Cities are locked into car-use though congestion is rife, leading to a spate of innovative solutions.

Car ownership has grown hugely, especially in middle-income countries such as India and China. Local politicians have responded to the rise of new middle class car owners with road-building trophy projects. However, the latent demand before 2030 was such that new roads became congested immediately, and many of the new vehicles are only used sporadically. Vehicles are designed for occasional use, and build in alternative functions while they are stationary, such as storage or energy generation. Some are designed to attach to buildings and act as extra living or storage space.

Rush hours spread as people move their commute to escape the congestion. A new phenomenon is the nomad businessman, who may spend much of the day working online in a secure vehicle while his driver takes him slowly through the jams to meetings. Vehicles providing many of the services an office might provide, such as IT help, refreshments, toilets and meeting facilities, can be found using location software. Some vehicles are fitted with solar roofs to drive systems when stationary, though the impact of smog on the performance of these products can be severe.

Car parks have proliferated. Delhi boasts the highest sky-park in the world, at 45 storeys, serviced by car-lifts. Other responses to congestion, from helicopters to straddling buses to underground freight solutions, are common.

SPRAWL-VILLE

The developed world has been at car saturation since the early 2010s. Travel has increased modestly but only where there is room, which means via cycling, walking and public transport expansion, all of which saw significantly increased investment in the 2010–30 period. Traffic growth has been constrained as area-congestion and other road charging schemes have spread, as have car clubs and bike hire. Electric vehicles are a common sight in city centres but have not hit the mainstream. Some cities, for example Shanghai, Beijing and Singapore, have mandated them in the city centres, mainly to control air quality.

With power often concentrated with elites, schemes to free up the roads – and even elevated walkways – for the wealthy are widespread, particularly congestion charging and toll roads. Many cities have built private member-only roads. In an economically constrained world, new infrastructure projects are rare, and those that do exist find new ways of full price recovery.

2015
Binding global climate change pact signed. Strict carbon quotas and US $1 trillion mitigation fund.

2022
Car use and GDP growth are officially decoupled.

2032
US $1 billion Beijing Energy Innovation Contest leads to hydrogen cells breakthrough.

2013
A second global recessionary cycle occurs, becuase of a resources crunch, and hardhitting natural disasters impacting key economic hubs.

2018
'C8' powerful world cities hold first summit and agree to form cyber armies.

2025
The EU bans fossil fuel powered automobiles, with a 5 year phase out plan.

2037
China, Mexico and Turkey form resource coalition to secure global lithium supplies.

scenario 3
renew-abad

The world has turned to alternative energy and high-tech, clean, well-planned transport helps everyone get around.

factors shaping mobility

Energy supply

A rapid transition to renewable energy brings the world to the edge of a new energy paradigm.

A high carbon price has pushed fossil fuel prices up and stimulates investment in renewables, including concentrated solar power, wind and wave. Because of the sharp transition to low carbon solutions, energy is still relatively expensive. Innovations in advanced thin film solar cells make decentralised generation easier, and some countries set micro-generation targets for households in an effort to reduce costs.

Nuclear energy and biofuels are uncompetitive. The next wave of energy innovation is happening with ubiquitous generation through vibration-based technology and mainstreaming of hydrogen fuel cell technology. Thanks to breakthroughs in solar-powered electrolysis, several regions in North Africa and Asia have transitioned entirely to a hydrogen economy.

Personal mobility continues to be accessible, but several countries have recently had electricity outages as a result of electric cars overloading the grid.

Resource use

Resource use is strictly regulated in a world short of food and land.

The shift to alternative energy in the 2030s caused resource grabs and land-use shifts, affecting food production as a result. Food is particularly scarce in Central Asia and Sub-Saharan Africa. Agrichemical companies are tightly regulated in these regions and focus on biotech innovation to build yield and climate resilience.

Many governments impose biodiversity restrictions such as natural resource quotas, offset obligations, and restrictions on the use of virgin resources. In some countries, for example, the lack of bees now means that vehicles driving between cities are fitted with technology to artificially pollinate the fields surrounding highways. Micro-food production in urban areas is flourishing as people utilise locally abundant food sources to address resource needs.

The economy

Economic power has shifted.

The cost of decarbonisation has caused global disruption, and disposable incomes are lower than in 2010. The global balance of power has shifted radically. China's early push on clean-tech brought huge growth dividends. India is also strong, particularly in terms of the hydrogen economy and IT. Brazil and Mexico compete over the leadership of a powerful Latin American bloc. US and Russian influence is waning. Some European states with shrinking populations have developed steady-state economies.

Nimble emerging players in Asia, Latin America and Africa leapfrog to low-carbon solutions. This includes hydrogen generation, which gives these economies an edge when it comes to emerging mobility technology, and is beginning to disadvantage those who made early investments in electrification.

Climate change responses

An early global deal on climate change means crisis can be averted.

Climate action emphasises mitigation – the community of states believes that the worst climate impacts can still be averted. The price of carbon is very high, and there are personal carbon quotas in place in many countries.

A climate change adaptation fund for low-income countries has existed for decades. Some countries used it to pursue aggressive low-carbon growth instead, sparking tension and resentment from the West. But others are forced to be more reactive, including parts of South and Central Asia as well as Sub-Saharan Africa, where low lying cities and drought prone regions have to invest massively in sea barriers, resilient crops and cooling urban green top.

continued…
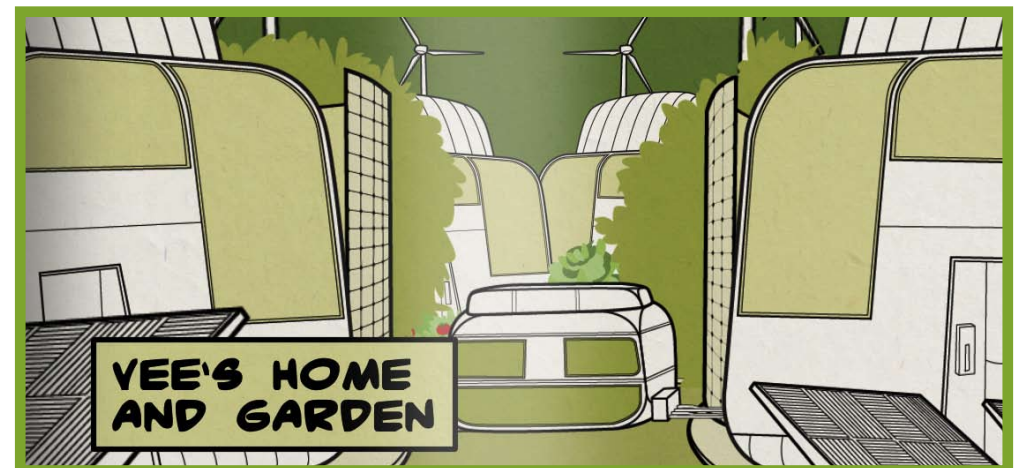
Governance

Strict governance holds sway in nation-states and city-states alike.

Governance systems are unified and strong. Benign autocracies in a number of emerging markets have often been more successful than traditional Western democracies. The global balance of power is concentrated between China and a handful of key allies, including Mexico, Turkey and some city states.

Governments impose stricter rules, and use increasingly sophisticated technology for monitoring and enforcement. They often mandate where you live within the city, how you travel, and how much energy you use. Chips embedded in everyday objects ensure compliance. Crime rates have dropped and traffic regulation has improved, but civil society organisations argue that the democratic process is dead.

City-states again hold sway over wider territories, as they did in medieval and early modern Europe. The 'C8' powerful conurbations – Cairo, Lagos, Los Angeles, Mumbai, Sao Paulo, Seoul, Shanghai and Tokyo – hold an annual summit, and have developed their own defence forces.

Social structures

The rich-poor gap has narrowed but a generational gap has opened up.

This is a world of greater social order and more equity within societies. Governments redistribute wealth. People seek to re-identify with their local communities, despite strong global governance and ubiquitous web connectivity. Pockets of poverty and simmering resentment are growing in regions left behind in the low-carbon race. The ageing populations of China and Latin America cause intergenerational strife.

Human values

People value simplicity and authenticity.

Lifestyles have become more sustainable and people define themselves through low-carbon, green identities. Consumption is oriented towards 'experience' services, slower living and simplicity, which is just as well because there is less disposable income to spend on acquiring goods.

'Quality of life' means superior connectivity via integrated smart personal devices, access to nature, and access to efficient, low-carbon lifestyle enablers, such as integrated work-travel-entertainment services.

The desire to drive has diminished and previous generations' obsession with the motor car seems strange and old-fashioned.

The business landscape

Business provides low-impact services in collaboration with governments.

The low carbon economy has created losers such as big oil companies – and winners, such as renewable energy firms. Businesses operating in cities are forced by law to invest in infrastructure and services. Those able to partner with governments in delivering low-carbon, resource efficient infrastructure are best placed.

New industry clusters have emerged to cater to the sustainable consumer's increasing demand for integrated, low-carbon access to goods, services and information. Former food retailers have partnered with construction companies and designers to provide integrated domestic asset management, delivering living spaces bundled with nutrition and water systems. Transport providers vie to offer the best 'experience' service, such as providing the best food on the daily train or bus commute, the best ICT solutions for virtual working, and superior onboard entertainment.

The role of technology

Innovation is driven and regulated by the public sector, with an important breakthrough in battery technology.

Technological progress has been rapid and dominated by the public sector. Networking technology has been a great enabler of development, but has also allowed governments to monitor citizens' movements and behaviour patterns more closely.

Technology investment is channelled towards achieving national goals and improving civic life. Countries invest in smart-grid systems that optimise energy use. There have been breakthroughs in battery technology allowing electric vehicles to scale up, with Asia as the key centre of innovation. Mobility efficiency is a priority, and all modes of transport are equipped with data storing and sharing capabilities.

urban form

Cities are consolidating and moving towards polycentric models.

The age of urban sprawl is over. Cities are redensifying and setting growth boundaries in an effort to create more efficient, polycentric forms. Former suburbs have emerged as new cities, smaller in size but well-connected to megacities through ultra high-speed rail links. Megacities continue to be important engines of growth and in the new city states this is matched by political power.

Neighbourhood-centric planning is the norm and people tend to live, play and work in the same locality. Neighbourhoods are organised around key mobility and energy nodes. These provide integrated services, from in-house energy generation to vehicle charging points, to community centres and smart working hubs.

There are strict targets around waste disposal and energy generation in buildings – all monitored by smart meters. In shrinking, post-industrial cities, unused inner-city land is converted into intensive farmland. Inner-city slums have become 'urbanised' with affordable eco-housing and greater access to transport and other infrastructure.

In megacities where overcrowding has become an issue, governments are incentivising large-scale population shifts to second- and third-tier cities, which are experiencing rapid social and economic growth.

mobility

A shift to mass transit reduces congestion while alternative fuels reduce the impact of travel.

There has been a sharp change in the transport fuel mix: electric, hybrid and – increasingly – hydrogen motors dominate. Filling stations have been converted into 'energy stations', integrated service stops that offer a multiplicity of fuels.

Personal vehicles are attainable, but no longer as desirable. Car ownership is stigmatised in many places – much like smoking was in the 2000s. Personal vehicles are ultra-small, stackable electric pods and solar scooters that can be programmed to drive themselves via an onboard journey planner, leaving the driver to have a meal or chat with friends. They are frequently interchanged with public transport modes as well as cycling and walking, because urban centres are often non-motorised.

People feel civic pride in using effective public transport systems. In order to maintain a degree of personal space, personal rapid transit (PRT) is a popular mode of choice: people can work or surf the net while travelling in individual rail pods. The less privileged pile on hydrogen-powered buses, although with a powerful range, dedicated corridors, and sophisticated ICT services, these are a far cry from the buses their parents used.

Almost every aspect of transport is guided by e-technology (e.g. sensing technologies and interactive services deployed to enable information access, manage demand, etc.). Daily commutes are optimised by always knowing what – and who – is around, through
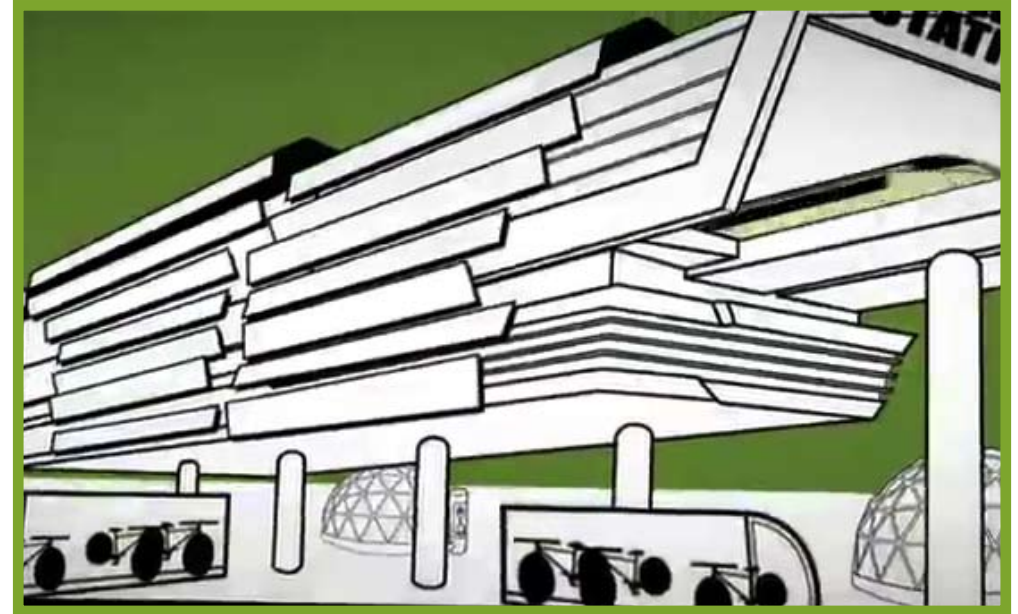
location-based applications that convey tailored information to users.

All this, combined with the proliferation of local food production and sophisticated underground freight pipelines, means congestion is an issue of the past in most cities. The daily commute is tightly controlled by government. There are often set times when you can commute to work and back; and some cities even mandate a residence radius within a certain distance from work, impose commuter taxes, or subsidise low carbon mobility patterns (e.g. online shopping, cycling, non-motorised delivery services).

Key urban zones are now connected by ultra high-speed trains, so mobility between regions remains high despite the fact that flying is no longer available to the masses. Chinese railway systems encircle the globe, taking people vast distances on 300mph trains.

2020
The UN is disbanded, and the G20 is put on hold as people vote for the next president via facebook.

2025
An escape of bio engineered algae carpets the mediterranean, devastating marine life and tourism.

2031
The first hands free neuro-sensing scooters go on sale.

2015
Global climate change deal fails.

2022
South Korea ranks highest in terms of GDP per capita.

2027
Bangladesh and Netherlands hit by worst ever floods. New international alliance of 'L20' low-lying countries to deal with threats.

2035
Alternatives now mainstream: renewables outproduce fossil fuels.

scenario 4
communi-city

The world has turned to alternative energy, and transport is highly personalised, with a huge variety of transport modes competing for road space.

factors shaping mobility

Energy supply

Local renewable energy generation and decentralised grids have superceded coal, gas and oil.

Fossil fuel use is a thing of the past. Oil supplies have peaked and coal sits in the ground un-mined because the alternatives are so much cheaper and work better. The full spectrum of renewables is being deployed at a local scale: solar, wind, wave and biomass, depending on local circumstances. Small-scale, local, decentralised grids proliferate and many businesses and individuals around the world have gone completely off-grid. Micro-nuclear has proliferated too, with thousands of small reactors dotted across the world. These have passive cooling systems, which continue to work even if power goes down, and operate for up to 30 years without refuelling. Nuclear proliferation has now eclipsed climate change as the number one security worry.

Resource use

Cities have transformed to produce more of their own food and deal locally with waste and water.

Food is expensive and demand for land is high. Large, privately owned and poorly regulated plankton and algae farms dot coastlines in populated zones, all bioengineered. Community-organised vertical and small-scale horticulture has flourished in cities, with balconies, roofs and the sides of buildings given over to growing food. Cities look and feel very different as a result, though they are still reliant on their hinterland and imports to feed themselves. Urban aquaculture, using various bio-engineered species, helps dispose of waste and provide food. Cheap energy means cities can afford desalination. Technologies for water capture and saving are booming. Most houses and apartment blocks have their own harvesting, recycling and purification plants.

The economy

Grassroots business and new technology compensate for protectionist trade and slow global growth.

The world is a more fragmented place. The lack of a global framework for climate change has led to protectionism, smaller markets and lower overall growth. On the other hand, energy is more accessible, cheaper and cleaner. Rapid, bottom-up technology development has boosted productivity. Winner countries are those with large internal markets to drive growth, big cities and a highly educated knowledge-based workforce. Brain enhancement breakthroughs in Korea have pushed that country to the top of the economic league, but others are now copying and catching up.

Climate change responses

People and communities adapt to climate change and reduce carbon despite weak global policy.

There is no global climate change deal but, spurred on by climate disasters, individual governments and companies proactively put money into technological development without waiting for a cap-and-trade system. As a result, low carbon solutions have come on stream quickly and overall emissions are quite low. In this do-it-yourself world, people are adapting to climate change themselves, leading to some interesting new ideas. Floating farms and flood-resistant construction are now routine technologies for resisting climate shocks. The rich world is better able to afford these technologies for low-carbon adaptation. When poor countries experience natural disasters, there is no global relief effort. This has lead to an increase in violent outbursts against what is perceived to be the rich world's 'climate debt' and monopoly on life-saving technology.

continued...

Governance

Central coordination is weak and more power resides at the community level using computer-based collaborative tools.

Multilateralism has disintegrated, because Global agreements and governance grew increasingly complex, expensive and unworkable. Politicians failed to realise that international machinery could only go so far without cultural integration. Eventually, much of it fell apart to be replaced by a network of bilateral, regional and peer-to-peer alliances. Some nations remain strong, but many have weakened or fragmented, replaced by regional and local governance. People are less willing to be told what to do. Online crowd-sourcing is common in city development and in deciding what public services should be provided. Many cities adopt a collaborative model of governance with local participatory budgets. This has worked very well in many areas, but in others it has been hijacked and corrupted.

Social structures

A more unequal world, but full of opportunity.

Inequality within and between societies is on the rise, and the process of reverse globalisation has led to distinct winners and losers. There are few mechanisms for wealth redistribution, though social mobility is high and entrepreneurialism is strong. If you've got a good idea you can build a successful business locally, but it is difficult to take it to scale.

Human values

People are less consumerist and status-driven and look more to religion and community.

Religious and cultural norms have become more entrenched in many places. Elsewhere, people value the local and blend the traditional with ultra-modern. In the US, for example, anti-consumerist evangelical Christianity holds sway. With Islam on the rise in Africa and Asia, as well as vocal nationalism in countries like China, many consumers have turned to local trends inspired by religious and cultural ideals, and reject 'Western' style. It is a more individualist world, with people wanting to do things on their terms. Sometimes that means collaborating with others through communities and sometimes it means going it alone.

The business landscape

Business is more decentralised and global businesses are less common.

The model for the economy and commerce is the internet: distributed, and bottom up; with not too much power held in one place. The physical economy – primary, secondary and tertiary – is very localised. Manufacturing too is very local, often using nanotech, and made viable by very cheap renewable energy. Goods and services have become more regionalised and culturally specific. Products are made for local markets and, because of a lack of international standards are difficult to trade internationally. One area where the world is still relatively globalised is in information technology. It is a networked world, with lots of virtualisation. However, even here a series of catastrophic viruses have focused people on IT security rather than speed of interaction, and increasing distrust between nations means that some thirty governments have blocked access to the global internet.

The role of technology

Rapid breakthroughs make technology an exciting area of change, and many people are involved through grassroots innovation and research.

Innovation has flourished all over the globe. Bottom-up, multiple approaches have led to rapid breakthroughs, and not just in low-carbon technology. Bio and nano technologies have also developed rapidly. Some of the biggest breakthroughs are happening where technologies – such as bionics and ICT or bio and nanotech – converge. Neuro-sensing control via brain activity is being widely used in information technology and more recently in transport. This R&D is no longer the preserve of major companies and governments: open source ICT and local manufacturing technologies mean that backstreet labs are a major source of innovation.

urban form

The city has become less formalised and more diverse and dynamic, with individuals and communities taking control over planning.

Cities have greater significance and economic clout than ever before. Non-urban regions have to be either part of their hinterlands and spheres of influence or they suffer. The informal settlements that encircle major cities have had a big influence on how they function. They have been the source of much innovation and creative energy. Cheap ICT, open source programmes and do-it-yourself manufacturing such as 3-D printing have allowed 'garage innovators' to flourish. And so the trend of informal settlements gradually gentrifying and coming to resemble the formal city has gone into reverse. The whole city has become more informal, with crop-growing, temporary and creative use of space, self-planned settlements and open-source enabled mobility systems, and multiple road users in multiple vehicle types, all to be found right across the urban area.

The sheer wealth of detailed information from networked tracking and monitoring devices has caused a re-evaluation of some basic design assumptions. For example, some 'safety features' on streets have been replaced by 'hazards' to increase safety by forcing people to pay attention.

Much of urban design has shifted to a collaborative model with local participatory budgets. Where this works, everything is very tailored to the desires of the participants, for example with car-free family areas, or Segway lanes for the elderly.

mobility

Diverse modes of personalised transport compete for space, coordinating via automated technology.

Personal – and personalised – mobility is important. Modes of transport proliferate, from high-tech power-assisted bicycles to personal rapid transit pods to the very popular solar-scooter (an electric moped with a wrap-around roof that both generates electricity and shades the rider). Impact prevention software and neuro-sensing technologies keep the whole system moving and avoid too many collisions. Customisation is ubiquitous. Some people build their own vehicles and customise them using locally designed and produced kits, open-source designs and scrap materials. In some cases this can lead to pollution problems and some vehicles look very unsafe.

Public transport systems persist but in general have suffered through lack of investment. Some have fallen into disrepair, even in wealthy cities. Those that remain are often overcrowded and unreliable.

The wealthy have taken to the skies in fan-driven personal flight vehicles such as the Heli-Hopper, Fly-lite and Jetson. One technology that is popping up everywhere is the biofuel-powered mini bus, which is hugely adaptable in different urban environments, and can be powered by food waste as well as locally-grown crops.

With production having peaked, and demand falling away rapidly, oil has been supplanted by third-generation, nano and biotech enhanced biofuels, as well as cheap electricity. 'Home-brew' biofuel kits, for

COMMUNI-CITY

households and communities, are the new bestseller and are widely used to fuel family or community-owned vehicles.

With transport infrastructure at capacity, many people choose to work, learn and play in their local communities or use tele-presencing to access work, services and leisure. The poorer sections of urban society get around much as they have for decades – on foot and by bike, though many now build their own vehicles.

3. what can you do?

megacities on the move

solutions for sustainable urban mobility

The future may seem difficult to predict, but there are key ways in which you can begin to respond to ensure you are taking the path you want. There are already many urban mobility innovations, as the examples below demonstrate. These innovations might not be mainstream at the moment, but they are all real world examples – some are concepts, others are at pilot stage, and yet others fully implemented. We believe they illustrate the ways in which city governments, urban planners, transport providers and all other key actors will have to respond in order to transition to sustainable mobility systems.

We encourage you to think about the way that your region, city or organisation can translate these six key responses into your own work, and we hope that the real-life examples will inspire you.

Fukuoka Prefectural International Hall, © Emilio Ambasz & Associates

1. integrate, integrate, integrate

Transport, urban planning, business, public services, energy and food supply can no longer be considered in isolation. We need to create truly integrated systems where people have choice, flexibility and seamless connectivity. When people travel, they should be able to connect much more smoothly and quickly between different modes of transport. Increasingly, there will also be a need to supplement this physical connectivity with online connectivity: the ability to check information before, and during, travel will allow people to optimise their journeys, and perhaps even substitute a degree of physical movement with virtual access to lifestyle needs.

1.1 MIT CityCar System

A stackable, electric two-seater car designed to be used as part of a mobility on-demand system – similar to a bike-hire scheme such as Vélib, where stacks of vehicles are available for instant short-term hire at key transport hubs such as train stations and multiple other points around the city. Three or four CityCars can fit in a standard parking space. Future iterations could be integrated with the urban energy supply system – stacks of parked cars act as batteries that could 'smooth' electricity demand in a city with lots of microgeneration such as solar roofs or small-scale wind turbines.
http://cities.media.mit.edu/ (Go to Mobility section, then select CityCar).

MIT CityCar System, © William Lark, Jr. – Smart Cities, MIT

>>

Straddling Bus, © Press Association

London Garden, © www.martenwallgren.com

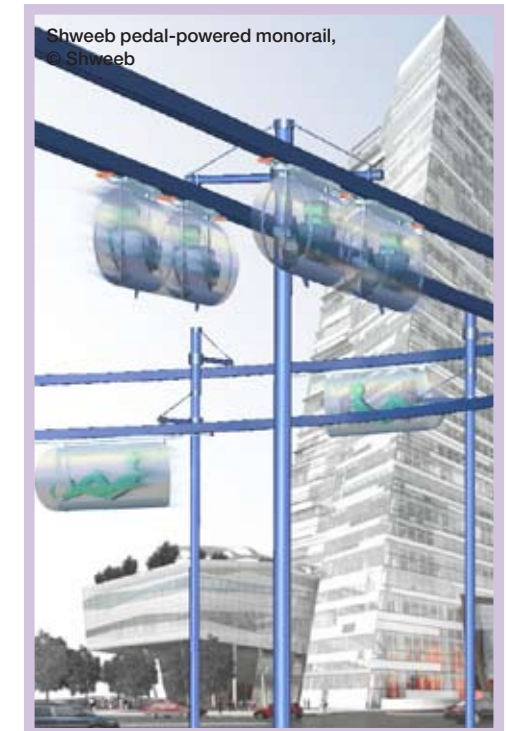Shweeb pedal-powered monorail, © Shweeb

1.2 Straddling Bus

An electric Bus Rapid Transit (BRT) system without the need for additional road space. The bus has two levels, the lower of which is open and straddles the road, acting like a tunnel that cars can drive through. Passengers board the upper deck to a maximum capacity of 300. The bus can either run on rails either side of the car lane, or it can follow white lines using an auto-pilot system. The bus is powered by relay charging and also charges at its stops. The first system is due to be built in Beijing in 2011. http://www.chinahush.com/2010/07/31/straddling-bus-a-cheaper-greener-and-faster-alternative-to-commute/
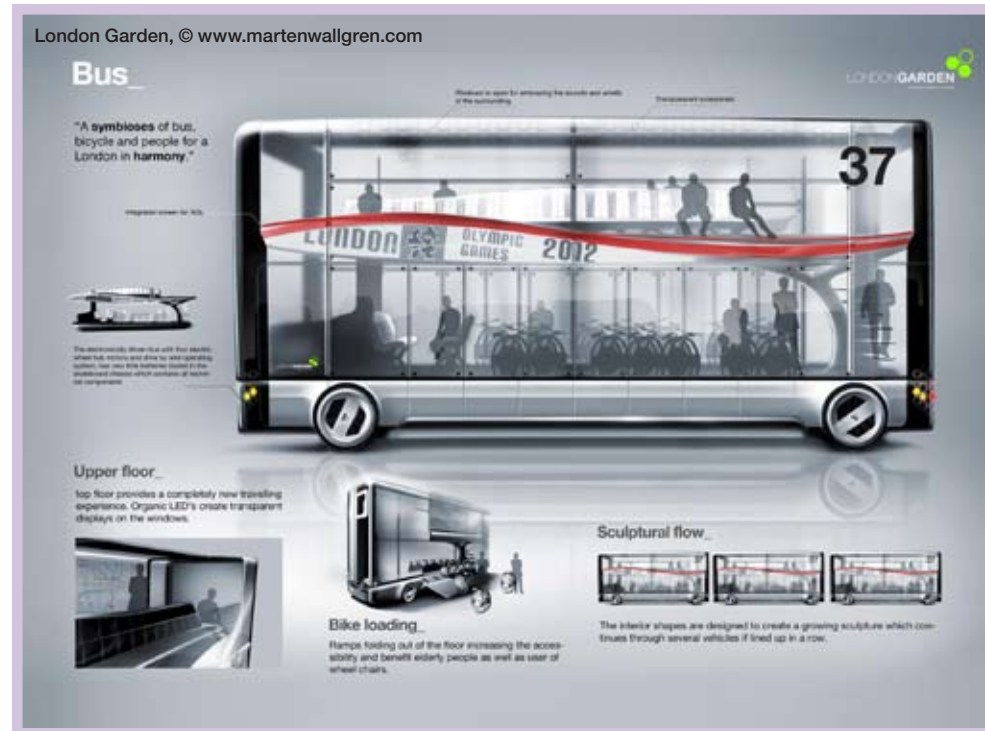
1.3 London Garden

An award-winning concept for car-free mobility in central London that integrates bicycle, scooter and bus modes. A specially designed semi-electric bicycle is available for hire and can be ridden as either a bicycle or an electric scooter. When ridden in bicycle mode it generates and stores energy for the scooter mode. It can also be folded up and used as a bus seat – in this case the energy you generated and stored in your bike is credited to you and used as a currency to subsidise the cost of your journey. When not in use the bikes are stored on overhead racks at bus stops where they generate further energy via solar cells in their solid, hub less wheels. http://martenwallgren.blogspot.com/2009/06/winner-seymourpowell-award-for.html

1.4 Shweeb pedal-powered monorail

Shweeb uses pedal-powered, highly aerodynamic capsules that reduce drag and require less energy to propel at 20km/h than you need to walk at 5km/h. The capsules travel along guiderails 6m above the ground that can be suspended above existing roads and walkways. A successful system would potentially have positive effects on a city's health system by increasing general activity levels. There is also scope for some energy generation. Shweeb has just received US $1million in funding from Google's Project 10[100] to build its first transit system for public use. http://shweeb.com/

2. make the poor a priority

Mobility systems must work for rich and poor alike, to ensure no-one is shut off from goods, services and employment opportunities. There are currently 4 billion people around the globe on low incomes.[6] Cities in particular have many low-income communities – this trend will increase as much of the world's future population growth will be occurring in Asian and African cities.

Everyone in the mobility sector will have to design tailored mobility solutions that meet these people's needs.

Chop 'N Drop bike, © Worldbike

Urban cable car

Ripple Effect, Naandi Container, © courtesy of IDEO

2.1 Chop'N Drop Worldbike

Worldbike is an international network of professionals in the bicycle industry, who work on creating affordable bike transportation and income-generating opportunities for the poor. The Chop'N Drop bike is an open-source design, which is shipped to small-scale manufacturing facilities or skilled individuals in the developing world, who then construct the bike locally. http://worldbike.org/

2.2 Medellin Metrocable

Metrocable is an urban electric cable car system in Medellin, Colombia, that was installed as a complementary transit system to the Metro. It links poor hillside barrios directly to the city and the metro system, vastly improving access as conventional public transport could not negotiate the steep hillsides. It has eased the commutes of most of the inhabitants of the barrios and has also revitalised some of the areas that it passes through. http://www.medellininfo.com/metro/metrocable.html and http://thecityfix.com/up-up-and-away-in-a-cable-car/

2.3 Naandi Container

The design firm IDEO collaborated with Acumen Fund, a non-profit global venture fund, and the Naandi Foundation to design the Naandi container. The 20-liter water vessel has smooth contours and handles to be carried on the hip and includes an optional wheel kit that allows it to be pulled on the ground. With the flat side of the vessel down and the opening facing up users can easily fill it with water. This design is more accessible for women, and encourages easy water handling and transport. http://www.rippleeffectglobal.com/naandi-container/

[6] WRI, The Next Four Billion: "Low-income" is defined as earning less than $3,000 in local purchasing power.

3. go beyond the car

The current growth rates of personal vehicle ownership are simply unsustainable in the future: there are already 1 billion cars in the world, a figure which is expected to grow to 2 billion within a few decades.[7] To avoid cities becoming further congested and car-dependent, it is critical that we design now for people, not cars.

Architects and urban planners need to create mixed-use urban neighbourhoods with the infrastructure to serve local communities, dense developments in cities that prevent further sprawl, and a high degree of accessibility and walkability. These changes to the urban form would almost certainly alter the daily commute for many residents, encouraging less reliance on cars. Cities should further encourage a shift away from cars by promoting alternative modes of transport and creating alternatives to car ownership like flexible car renting.

3.1 Vancouver's downtown travel plan: integrated travel planning and walkability

This is an example of a broad approach to accessibility and mobility, recognising that most journeys involve multiple modes of transport. The system was treated as a whole and multiple design improvements included simple but systemically effective actions such as: the widening of pedestrian crossings, new cycle lanes on major roads and the provision of cycle racks on buses, as well as the implementation of technological improvements such as the Sky Train (an automated light mass rapid transit system). http://www.driversofchange.com/slimcity/urban-mobility/integrated-planning.php

Vancouver

7   Daniel Sperling and Deborah Gordon, *Two Billion Cars*, Oxford University Press, New York, 2009.

>>

Masdar City, © Masdar City, Abu Dhabi, United Arab Emirates

Sobi, © Socal Bicycles

3.2 The city as an organism

A recent concept popularised by William McDonough that is starting to influence urban design, particularly in new cities such as **Masdar**. According to this concept, cities have metabolisms analogous to those of complex organisms in terms of nutrient and waste flows, and they should therefore mimic the dynamics of ecosystems if they are to be truly sustainable. Key principles include: total reuse of waste via upcycling, recycling, composting and energy generation; maximisation of solar and wind energy collection via passive design and microgeneration; multiplicity of landscape types which increase resilience and liveability, such as mixed use developments, walkable neighbourhoods, green roofs, inner city parks and farms for biodiversity. http://www.mcdonough.com/writings/living_city.htm

3.3 So Bi – Social Bicycle

This is an example of a system using geolocation and wireless networks for seamless travel and access rather than ownership. It uses ICT to enable a flexible, lower cost and distributed version of a bike-share scheme: "SoBi will be the first public bike share system with the authorisation, tracking, and security systems attached to the bicycle itself. SoBi uses GPS, mobile communications, and a secure lock that can attach to almost any bicycle and lock to any regular bike rack. The system does not require separate infrastructure and can be deployed at approximately one-third the cost of existing systems. Administrators will be given powerful tools to manage demand and map patterns of use. Users will enjoy door-to-door transportation and an interactive cycling experience that can track miles travelled, calories burned, CO2 emissions offset, and connections to other Social Cyclists." http://socialbicycles.com/

4. switch on to IT networks

There are two key ways that IT networks need to be used to improve mobility systems: by substituting physical movement with ICT-based solutions, and by better connecting and integrating transport systems. People are becoming increasingly comfortable accessing services, information and social networks online.
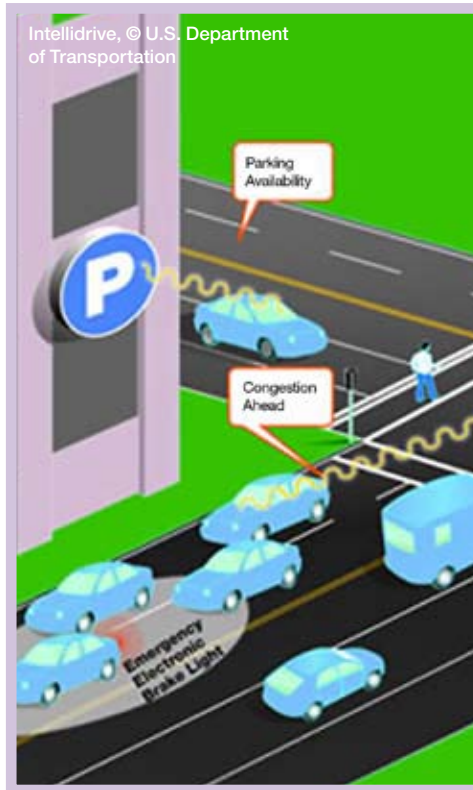
Mobility providers will need to introduce IT connectivity throughout urban mobility systems and develop sophisticated, user-centred online platforms so urban dwellers can access everything they need to maintain and improve their daily quality of life.

In addition, transport systems will need to use technology to lessen traffic congestion and accident risks, for example interstate highways that feature lanes for cars and trucks controlled by computers. Cars will change too: leading companies are incorporating ICT into vehicles, and over the next thirty years this trend is likely to become much more mainstream.

4.1 Nissan Eporo Robot Car

Nissan has designed a collision-free, zero carbon robot concept car. The design is biomimetic – the Eporo travels in a group of like-vehicles, mimicking the behavioural patterns of a school of fish in avoiding obstacles without colliding with each other. The technologies developed for Eporo are not just useful for collision avoidance but also aim to improve the migration efficiency of a group of vehicles and contribute to an environmentally friendly and traffic jam-free driving environment. http://www.nissan-global.com/EN/NEWS/2009/_STORY/091001-01-e.html and http://www.greencarcongress.com/2009/10/nissan-to-show-eporo-robot-cars-collisionfree-driving-by-mimicking-fish-behavior.html

Nissan Eporo, © Nissan

>>

Intellidrive, © U.S. Department of Transportation

Media Pole on the U-street in Gangnam, Seoul. Source: Inews24 (South Korea)

DVE Immersion Room – 3D Room, © www.dvetelepresence.com

4.2 Intellidrive

Intellidrive is a US initiative to develop transport connectivity. It aims to enable networked wireless real-time commun-ications between vehicles, infrastructure, and drivers' and passengers' personal devices. At the individual level this improves safety via crash prevention and provides rich real-time information about routes, traffic and optimum drive speeds. At the system level, real-time information from thousands of vehicles will enable transportation managers to optimise the system for efficiency by adjusting signalling, lane availability, etc. http://www.intellidriveusa.org/

4.3 U-City Seoul

Seoul's city-management is piloting a project called Ubiquitous Seoul, or U-City Seoul which offers real-time, location based services from multiple sensors around the city. Residents can use smart-phones to check air quality, get traffic information or reserve sports pitches at local parks. People with asthma can get pollution alerts. For mobility, there is a personal travel assistant app available that gives real-time transport information (such as when the next bus/train will arrive), and also provides a travel planner, carbon calculator, and real-time router to enable "seamless travel". http://www.time.com/time/nation/article/0,8599,1916302-1,00.html

4.4 Telepresence

High-end telepresence systems such as the **DVE Immersion Room** are now good enough for people to feel like they are in the same room, thanks to 3D high-definition live video. 3D presentations can simultaneously be given, blurring the boundaries further between the real and the virtual. http://www.dvetelepresence.com/

5. 'refuel' our vehicles

We need to shift the way we power our vehicles from petrol to renewable, low-carbon fuel sources. Oil is one of the most threatened, and increasingly difficult to access, resources in the world.

Even though we cannot say with certainty that we will run out in the next thirty years, extracting and delivering the remaining oil to market is becoming increasingly difficult.[8] Moreover, shortages and disruptions could occur for a number of other reasons, from policy to terrorism, warfare and natural disasters.

The uncertainty over future energy supplies is, of course, compounded by rising awareness of climate change and the increasing possibility or regulation that will shift the way we power the global economy. As oil becomes more scarce, expensive and a security risk, we need implement greater energy efficiency measures, and shift the way we power our vehicles from petrol to renewable, low carbon fuel sources.

Most vehicle technology experts agree that the potential to improve fuel efficiency with advanced technologies is enormous. At the same time, the market for low-carbon energy could treble to US$2.2 trillion by 2020.[9] We need significant investment in battery and fuel technology to take alternative energy-powered vehicles to scale over the next few decades.

---

[8] Richard Heinberg, *The Party's Over, Peak Everything*.
[9] James Murray, HSBC predicts low-carbon energy market will treble to $2.2. tn by 2020, GreenBiz.com, 6 Sept 2010, http://www.businessgreen. com/business-green/news/2269279/hsbc-predicts-low-carbon-energy.

Better Place, © www.betterplace.com

5.1 Better Place – battery subscription

Better Place has been set up to counter the two main obstacles to mass adoption of electric vehicles (i.e. cars that solely use batteries, as opposed to hybrids). Better Place stations allow you to switch a used battery in your car for a fully charged one in a few minutes, avoiding the need for hours of recharging during a long journey. Better Place also allows you to subscribe to a battery service. This means that drivers don't have to pay to own the battery – which is usually the most expensive component of a fully electric vehicle. Better Place is due to launch commercially in 2011 in Denmark and Israel, in partnership with Renault which has designed a switchable-battery electric vehicle. http://www.betterplace.com/

>>

RoboScooter, © Michael Chia-Liang Lin, MIT Media Lab, Smart Cities group

Wood Chips storage lot – Used for Biofuel

5.2 MIT Roboscooter concept

This is a folding electric scooter designed for cities where scooters are a popular form of transport (such as many developing world cities). "RoboScooters serve as approximate functional equivalents of 50cc gasoline-powered scooters. They are, however, clean, silent, and occupy less parking space. They are also much simpler – consisting of about 150 parts, compared to the 1,000 to 1,500 of an equivalent gasoline-powered scooter – which simplifies supply chains and assembly processes, reduces vehicle costs, and simplifies maintenance."
http://cities.media.mit.edu/ (Go to Mobility section, then select Roboscooter).

5.3 Biofuels from waste

First-generation biofuels from food crops are unsustainable and are unlikely to have a significant long-term future. However, second-generation biofuels from waste are in development, such as cellulosic ethanol. This can be distilled from plant waste headed for landfill such as corn stalks, timber chippings, even low-grade paper. It is estimated that cellulosic ethanol from these sources could provide a third of the USA's transport fuel requirements; there is also potential for effective deployment in the developing world, where most plant waste is currently burned.
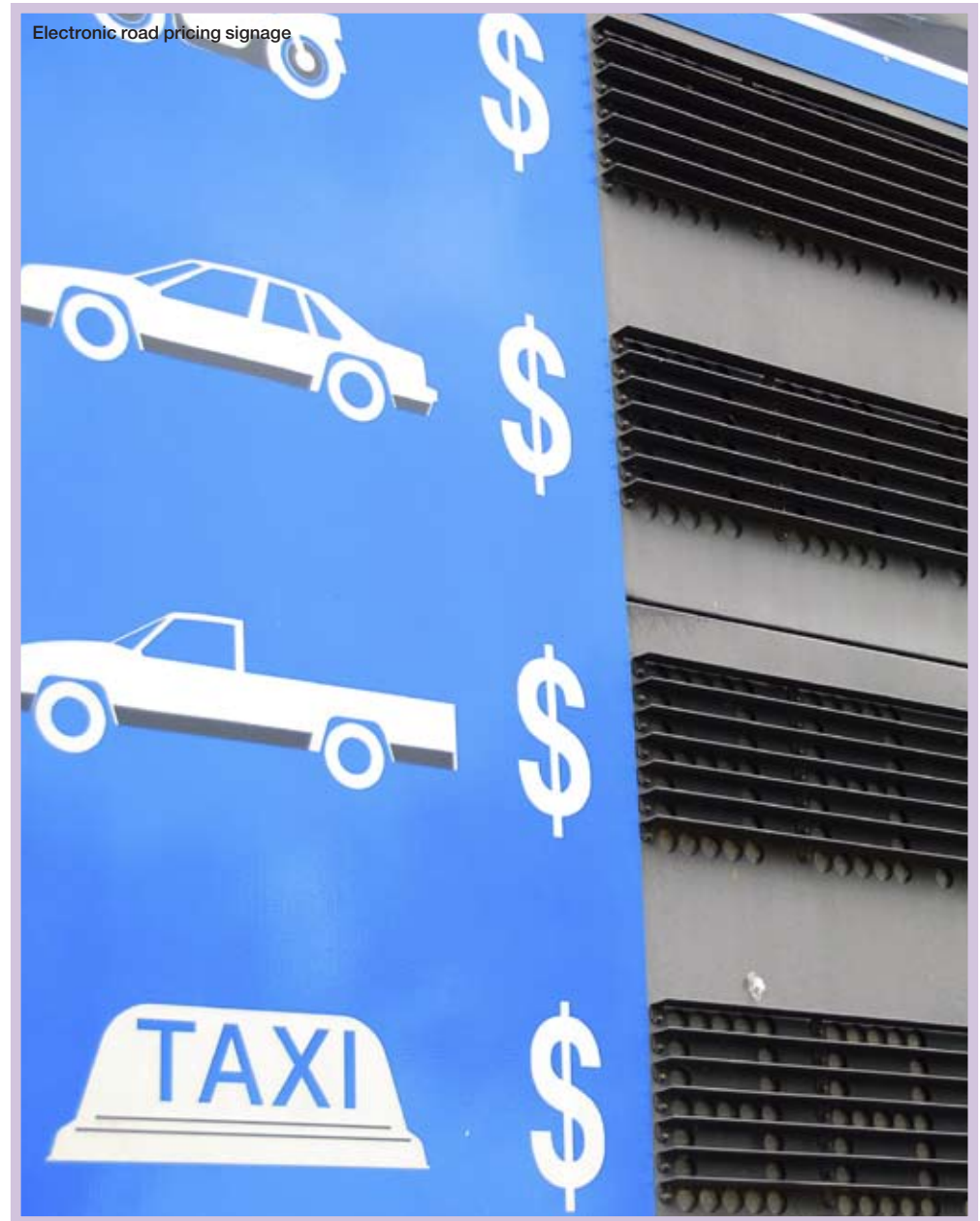http://www.scientificamerican.com/article.cfm?id=trash-based-biofuels

6. change people's behaviour

Although planning and technology can do a lot to improve mobility, many of our future challenges are shaped by people's values, behaviour and preferences. As well as switching from cars to more low-carbon vehicles, cities need to think about ways in which mass behaviour and social norms can be influenced to get people to think beyond their current patterns of travel and ways of living.

In fact, because of increasing urbanisation, cities need to be the key players in promoting low-carbon, healthier lifestyles. The most effective governments and businesses will engage in early planning to influence lifestyles rather than simply relying on additional road infrastructure and modes of transport.

Electronic road pricing signage

6.1 Singapore congestion pricing

Singapore was an early and successful pioneer of user charges to prevent urban congestion. It began with a simple fee system in 1975 that was upgraded in 1998 to a high tech system that charges motorists at variable rates depending on the time at which they drive within the city. Strong investment in public transport provides an alternative means for residents to move about. The Singapore congestion pricing system has inspired similar systems in London, Oslo, Stockholm and Milan. http://worldstreets.wordpress.com/2010/05/31/density-without-tears-singapores-transportation-secrets/

>>

Cyclists in Seoul

Whipcar website, © Whipcar Ltd

6.2 No-driving days in Seoul

No-driving days are used in many cities around the world to check congestion. The system in Seoul is particularly notable as it is voluntary and popular: residents are incentivised to sign up to it by benefits such as insurance discounts, reduced–price parking and tax-breaks. Participants agree not to drive on one business day per week, and compliance is monitored via RFID tags attached to windscreens. The city benefits from having approximately 10,000 fewer vehicles on the road every day. http://www.time.com/time/nation/article/0,8599,1916302-1,00.html

6.3 Whip car – peer-to-peer car rental

Whip car is the world's first peer-to-peer car rental service. Car owners can rent out their own cars when they aren't using them. Users can search for and hire cars in their neighbourhoods. This is a distributed and flexible system that uses existing cars, mediated by a trusted website with a ratings system, and requires no additional physical infrastructure. http://www.whipcar.com/

4. plan the future now

megacities on the move

how to run a workshop using the scenarios

Futures workshops are a powerful way for organisations to develop a common understanding of the challenges and opportunities that lie ahead and to develop effective plans. Our scenarios are designed to help governments, city authorities, businesses – anyone involved in urban mobility services – to explore how major trends may play out in different ways and to assess what this would mean for their goals.

Workshops get people to talk and listen, to find common, motivating ground, and to develop more sustainable, long-term solutions. They are an excellent way to test strategy and make it more resilient by integrating sustainability considerations. And they can be a strong tool for sustainable innovation, helping to develop new business models, products or services.

We are also very keen to hear of your experiences using the scenarios – please contact us to tell us how you use them and what results.

Below is an outline for how to plan a workshop using the four scenarios

Please note that this is a generic outline of how to run the workshop and you should customise it to suit your particular needs and objectives.

Not sure how to run this workshop or need some assistance?

Please contact Forum for the Future at MegacitiesontheMove@forumforthefuture.org – we can help facilitate workshops and provide strategic advice on sustainable urban mobility. We are also very keen to hear of your experiences using the scenarios – please contact us to tell us how you use them and what results.

General workshop hints and tips

A few words of advice that we recommend as part of any type of futures workshop process:

- Establish a set of ground rules at the outset of the workshop e.g. everyone to participate and engage, no mobiles, etc.
- Ensure participants understand that futures workshops are a journey. They should expect to feel challenged and be willing to suspend disbelief.
- Have participants introduce themselves at the outset of the workshop. Make introductions more interactive and engaging by asking each participant to answer a question (e.g. what is your main aspiration for your city over the next 30 years?) in addition to introducing themselves.
- Make sure you are recording key parts of the workshop discussion on flipcharts or with an audio/video recording.
- Have readymade hand-outs for key exercises to facilitate a more structured process of recording key take-aways.
- Consider using materials that will assist people with creative exercises such as coloured paper, magazines for cutting images out, different coloured markers, post-its for annotation, etc.

sample agenda day one:
engaging with the scenarios

Plenary

- Introduction and framing.
- Plenary brainstorm exercise.

Introduction to scenarios

- Presentation of the scenarios.
- Plenary discussion to get initial reactions.

Scenario immersion exercise

- In groups, participants engage with the scenarios using a critical question and/or creative exercises.
- Scenario immersion exercises.

Sharing feedback

- Presentations of each group's findings/conclusions and plenary discussion.

Wrap up

- Review what has been achieved in the first day.
- Discuss plan for day two.
- In groups, participants engage with the scenarios using a critical question and/or creative exercises.

day one: example exercises

plenary brainstorm

Sample exercise: "What changes?"
(20 minutes)

This exercise helps demonstrate how much can change in a 30-year time period: that 2040 could be radically different from today, that the future is uncertain and that we should plan for a range of possibilities.

- Going around the room, get each participant to respond to the following questions:
  - > What's changed in your city/in the world/in your organisation/etc. in the past 30 years?
  - > Which of these developments were expected? Which less so?
- Prompt people to respond to the question thinking about: How they socialise? How they work? How they communicate? How they move around?
- Have on hand examples of changes that have happened over the past 30 years to spark conversation in case people are having trouble getting the brainstorm going.

scenario immersion

Sample exercise 1
(35 minutes)

The aim of this type of immersion exercise is for people to accept their scenario as a possible future, and to get to know it well enough to respond to it creatively.

- Explain that you want participants to talk about one scenario in a small group.
- Break up into four smaller groups, and assign one scenario to each group; ensure that each group has a good representation of people from different backgrounds, if possible.
- Facilitators should be on hand to answer questions in groups, explain process, etc.
- Provide individual handouts of detailed scenarios for each group to read, as well as a pro-forma for groups to structure discussion around and record key comments on.
- Ask people:
  - > What they think about their scenario?
  - > How easy/hard is the scenario to engage with?
  - > In this scenario, what sectors of the population would be winners and which would be losers?
  - > How successful would your organisation/city/country be in this scenario?
  - > What sort of world is this for sustainability?

Sample exercise 2: "city sketch"
(50 minutes)

The aim of this immersion exercise is to get people closer to thinking about specific mobility risks and opportunities by visualising their 'world' in the form of a city street sketch.

- Groups to sketch out what a typical city scene would look like in their scenario in 2040.
- Include as much detail as possible, annotating when necessary.
- Try to allocate tasks to everyone in the group.
- Think about a typical city street scene in your scenario in 2040…
  - > How do people move around on the street, and why?
  - > What kinds of shops are there, offices?
  - > How are buildings used?
  - > What does the 'street furniture' look like (benches, trees, bus stops)?

In Mumbai and Istanbul, participants were asked to develop scenarios for their respective cities as part of the immersion process. Take a look at the Istanbul and Mumbai scenario examples for more detail.

sample agenda day two:
responding to the scenarios

morning

Introduction

- Review day one achievements.
- Go through agenda for day two.

Identifying challenges and opportunities

- Discuss and agree the most significant mobility challenges for your organisation/city/country.
- Discuss the best ways of providing people with access to essential goods, services and information in your scenario.

then either

afternoon

Option 1 – strategic action planning

- Prioritising solutions:
  - > Groups share their primary challenges and solutions in plenary.
  - > Groups select the most attractive/critical solutions.
- Developing strategic action plan:
  - > Group discussion around key solutions, and what would need to be done to implement them fully.
- Present action plans:
  - > Groups present strategic action plans.
  - > Plenary discussion to scrutinise whether the action plan would work in all scenarios.

afternoon

Option 2 – product/service/business model innovation

- Business model generation
  - > Groups to brainstorm potential new product/service/business models for their scenario.
  - > Groups to capture key elements of the value chain, and share in plenary.
- Test the innovations
  - > In groups, test each of the product/service/business models by analysing whether they would work in all the scenarios
  - > Identify the most 'future proof' innovation/elements of innovations.
  - > Discuss next steps in implementation.

end of day

Review workshop and wrap up

- Time for individuals to reflect on the process, and actions to take away into their respective organisations.
- Opportunity for people to share their reflections.
- Wrap up, next steps.

day two: example exercises

morning

Identifying challenges and opportunities (85 minutes)

This session is about explicitly identifying the risks and opportunities that have emerged out of group discussion during immersion sessions. Most of this will have come up already, so it is a matter of getting it down on paper, plus teasing out more thinking.

- Urge people to think about mobility as a means of access – to social capital, to financial capital, information, etc. – not just as transport.
- Ask them to write down each challenge and opportunity on a post-it.
- Thinking about the challenges and opportunities encapsulated in your city sketch, discuss the best ways in this city of the future of providing access:
  > to employment opportunities.
  > to goods and services.
  > to friends and family.
  > for the urban poor.
  > within environmental limits.
- Use the follow on session to share each group's risks and opportunities in plenary, cluster according to themes.
- Prioritise three key opportunities based on their applicability to each scenario.

afternoon: option 1

Action planning (50 minutes)

The final group work session in this type of workshop process involves getting participants to the point where they have identified a small number of sustainable mobility solutions that would be robust in each of the four scenarios. In the action planning session, they will begin to identify the high-level actions that will be needed to implement these solutions.

- Begin with a plenary discussion: for the opportunities we came up with, what solutions could help us capitalise on them?
- Get people to identify 3–5 potential solutions.
- Form working groups, one per proposed solution.
- For the solutions that have been prioritised:
  > What are the short term, medium term and long term actions to implement the idea?
  > What organisation needs to do what?
  > What further information is required?
  > Other action planning e.g. different actors, gateways, barriers etc?

afternoon: option 2

Business model generation (1 hour)

Groups stay with their specific scenario. Put aside the current business strategy for a moment and ask yourselves:
- If you were an entrepreneur in this scenario and you wanted to set up a new fashion company (with global ambitions), what sort of company would this be?
- Please describe this new company's business model (product, service, markets, supply chains etc).
- What would this company's key assets be, what differentiated it and made it a commercial success?

Testing the innovations (1 hour)

In plenary, discuss the following:
- Is there anything in common between the different business model innovations?
- Is there one that could be successful in all four scenarios?
- Alternatively, are there elements of each – e.g. specific products/services – that could form part of a successful innovation process in each scenario?
- What are the key next steps in shifting to the most interesting/viable business model ideas?

case studies from Istanbul and Mumbai

In order to test the mobility scenarios and explore their application to different urban settings, we ran workshops in two different cities: Mumbai and Istanbul.

These are two key global 'megacities', but they are also rapidly growing, rapidly changing urban areas. They are already experiencing all the positive and negative effects of these changes, including severe mobility challenges.

Mumbai

Istanbul
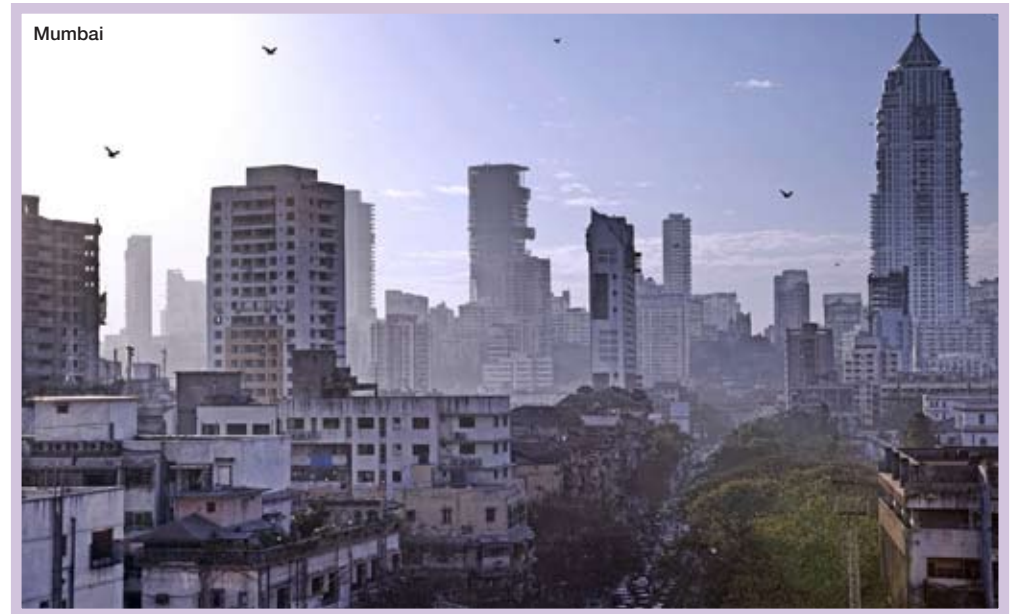
The aim of the workshops was to:

- Explore specific future challenges and opportunities around mobility in the city.
- Generate innovative sustainable mobility ideas and solutions and explore means of implementing them.
- Build collaborative networks between experts working on mobility-related issues in the city.
- Inspire enthusiasm and a desire for sustainable change.
- Inspire a shift in existing strategy and contribute to promoting systemic sustainable mobility solutions.

In advance, we developed outlines of what might be happening in Mumbai and in Istanbul if each scenario became reality. We asked the participants to engage with these in the workshop and develop visions of the future – based on their expert knowledge about their cities and the specific mobility challenges they might face.

In order to get as holistic a perspective as possible, the workshop audience was a varied mix of stakeholders engaged in different aspects of mobility: including transport planners, architects, companies providing mobility solutions and campaigning organisations.

There were very different results for each city. The Mumbai workshop led to an overall action plan focussed on transport and urban planning, whereas in Istanbul the participants decided they needed a more general campaign to promote sustainability in the city.

case study: Istanbul

"The *Megacities on the Move* scenarios ignited a powerful understanding of the need to change. Continuing with business as usual made Istanbul in 2040 a dismal place with severe limitations on energy use.

But there are interesting, more positive visions. Could Turkey become a big player in the energy markets by investment in alternatives? How could this also create an awareness of sustainable living among the citizens of Istanbul? We could build a very liveable city with a great sense of community."

> Sibel Bulay, Director, EMBARQ Turkey

aspirations for Istanbul

In the workshop, the participants expressed the following aspirations for Istanbul in 2040:

"One of the top five cities in the world"
- A greener city, with lower emissions and healthier air.
- A peaceful city.
- A stable population.
- Sustainable lifestyles.
- Strong safety nets for the poor.
- Infrastructure that keeps up with population and demand.
- Eco footprint going down, and bio capacity going up (i.e. the city produces more and consumes less).

"Mobility for people, not vehicles"
- Collaborative, human-centred urban planning.
- Planning takes into account factors such as accessibility and resource availability.
- More use of ICT solutions to reduce physical movement.
- A world-leading, multi-modal public transport system.
- Shift away from fossil fuels.
- Car-free city centre.
- More pedestrian- and cyclist-friendly solutions.
- Better navigation systems to improve road safety.

" *People will aspire to a more relaxed, less stressful way of life – a slower lifestyle. Less time at work and more time to spend with family or on leisure pursuits. Less time wasted commuting.*"
> **Haluk Gercek**, Head of Transportation Research Center, Istanbul Technical University (ITÜ)

Istanbul workshop – highlights from the scenarios

Planned-opolis

- Turkey's economy is strong as a result of its wealth in natural resources and strategic alliances with the Central Asian Bloc. It is the **key energy corridor between East and West**. Istanbul's **population growth has been restricted** by availability of water and land. There has been planned resettling as a result, with the formation of new satellite cities. Informal settlements have been cleared and replaced by efficient tower blocks.
- Istanbul is experiencing **severe water shortages** and there is a strong focus on technologies that radically improve the efficiency of resource use and agriculture.
- A lot of money has also been spent on making Istanbul's **infrastructure more resistant to flooding and earthquakes**. Parts of the city have been cleared of settlements to provide water channels and flood plains.
- There is inequality in the city, but everyone has benefitted from growth and new investment. Business is more formalised, and closely involved in the running of the city. The 'grey market' has contracted.

- Turkey has a commitment to a 40% absolute cut in carbon emissions by 2050, placing **great pressure on emissions from transport in Istanbul**. People have personal Energy Calorie Cards that regulate mobility and use of fossil fuel.
- **Polluters are heavily fined**. Traffic is automatically controlled by a smart system, reducing congestion and regulating flow. Companies have specific travel slots for their employees.
- **Car use is restricted**, forcing people onto public transport networks. The third bridge is now reserved for public transport only, for example. There is also much more sea-based public transport, including wind and solar powered ferries.
- There has been a **massive uptake of virtual working** as well as cycling, because this helps add credit to your calorie balance. All of this is facilitated by smartphones, which have become a one-stop-shop for information, payment, and regulation enforcement.

Sprawl-ville

- Turkey remains a **major oil and gas transport hub, but with volatile flows** and falling production levels.
- **Energy security** is a concern and pipelines are now guarded by the military. Turkey is finally, if belatedly, scaling up its wind power capabilities.
- Istanbul has been weakened by lack of secure energy supply, there are periodic supply disruptions and **unrest on the streets** as a result.
- Power is in the hands of the few and decisions are made by elites and in the interests of elites. For example, many buildings and developments owned by **the wealthy truck in daily water supplies** while the poor are left to fend for themselves.
- The population of Istanbul grew rapidly up to around 2030 but then peaked and began to decline as **migrants returned to their rural roots**, disenchanted by overcrowding, resource scarcity and rising unemployment. The formal economy is dominated by big business and owes its power and success as much to political influence as to legitimate profit.

- **Infrastructure favoured by the elites and powerful companies is cordoned off**, while other has become semi-derelict, unofficially colonised by migrants and with major security problems. Many **low-income workers are forced to relocate** close to work sites in order to manage the commute. **Roads are segregated**, so that the rich get access to high speed lanes, breeding resentment. Those who cannot afford this privilege are stuck in more congested traffic on ground level – with a mix of cars, buses, two-wheelers and pedestrians.

Renew-abad

- Turkey has become a **strong player in wind and solar** as well as a major energy supplier for the EU, which it is now a part of.
- Strong city governance has ensured **Istanbul has become a low-carbon city** by 2040. However, it is experiencing significant climate impacts, including extreme heat, increased seismic activity and rising sea levels.
- Comprehensive **flood protection and infrastructure retrofitting** is taking place, at great expense. Green cover is increased, both at street level and across all city rooftops. People continue to have increasing lifestyle aspirations – including personal vehicle and home ownership, more space and more leisure time – which is causing **social tension between the haves and have-nots**.
- Istanbul has grown significantly over the past three decades into a **vast, crowded city-region**, spreading farther and farther as the rich migrate out in pursuit of more space and greenery. Turkey is one of the world's **biggest markets for electric cars** (mainly imported from China), and motorisation levels have caught up with Europe.

- **Emissions are no longer a problem, but congestion is**. Zoning is strict, with more and more localisation of housing and services within self-sufficient areas, e.g. community farming towers, local multi-faith complexes.
- **Services between neighbourhoods are increasingly linked virtually**, from virtual museums to hospital check-ups. The city government has mandated increased home-working to limit daily commuting.
- The city is **revitalising public transport, including the water ferry system** – using high-speed catamarans and adding more routes. This is emerging as one of the most popular modes of public transport
- **The third bridge has been pedestrianised**, and is being utilised by small entrepreneurs as retail space.

Communi-city

- Istanbul is a **powerful and wealthy city**, influencing both the east and the west. As a regional hub, it attracts international migrants and is becoming more diverse, despite continuing migration from Turkey's east.
- Most planning and regulation is **local and community-based** – except for matters of National Security relevance, typically related to climate adaptation, resource use and basic infrastructure.
- **Energy supply is very diverse**. Small scale urban solar generation is big, for example, but needs to be supplemented by large-scale wind and Concentrated Solar Power from other parts of the country. There are many home-brewed biofuels.
- **Climate change has destabilised less affluent areas of Turkey** and this has increased the number of migrants arriving in Istanbul. There is huge pressure on key resources from a growing population.
- To cope with the heat, **large-scale greening** of the city has taken place. For example, buildings must be painted white by law.
- Society is more materialistic than before. **People are very self-reliant and entrepreneurial**.

- **The whole city has become more informal:** there is more individual crop growing and creative use of common space, and more chaos on the roads.
- The city's three **bridges use shock-absorbing energy collectors** which restaurant owners and retailers on the banks are using to power their businesses.
- Turkey has become a **centre for low-carbon vehicle technology**, in order to satisfy high levels of local demand within fossil fuel constraints. Public transport is used, but mainly with incomes below $3,000 in local purchasing power in the city. Istanbulus otherwise prefer to have their own, customised personal mobility solutions, from solar scooters to self-driving luxury electropods.
- People are very comfortable **moving between real and virtual spaces**. They socialise less in person, and some increasingly shield themselves from reality through virtual lives, retreating from reality.

Istanbul workshop – planning ahead

Key opportunities

The participants in Istanbul identified a number of opportunities relevant to all the scenarios and vital for the promotion of sustainable mobility in the city.

However, awareness raising was seen to have a number of cross-cutting benefits, including:
- Building a critical mass of support for more sustainable living in Istanbul.
- Creating an environment for success, encouraging government or business action.
- Offering a systemic approach to urban lifestyles, rather than focusing specifically on transport.

Next steps

The participants felt that at this stage the most important opportunity was to "raise awareness of climate change and the need for sustainable mobility, so that people are more willing to change their behaviour." They identified a plan for coordinating an awareness-raising campaign:

Strategic framework
- Common awareness platform.
- Multi-stakeholder partnership: government, investors, civil society, business, etc.
- Emphasise social and economic opportunities of sustainability for each stakeholder group.
- Create sustainable lifestyle pilots: e.g. use the Princes Islands as a demonstration for sustainable mobility.
- Lifelong learning sustainability. programme integrated into school curricula, television programming.
- Training for politicians.
- Creation of beneficial subsidies.
- Guidance and capacity-building for NGOs.
- Monitoring group to oversee progress.

Key phases

- Educate next generation and apply pressure on the system (a series of politically binding agreements on sustainability in the city).
- People demand better, more sustainable mobility solutions.
- Politicians will have to act accordingly, creating a virtuous circle.
- Regulation.

" People are not really aware of the danger. We have to educate even the policy makers, as well as the people on the streets."
> Orhan Demir, Urban Planner, PlanOfis

case study: Mumbai

"In Mumbai the suburban rail system is already 150% over capacity. We can see the challenges looming ahead as the city's population is predicted to grow from 22 million residents in 2001 to 38 million residents by 2040.[10]

The scenarios prompted imaginative visions in response to this – from a metro line towering at 150 feet over several tiers of elevated roads, to creative multi-use of building space and more localised planning solutions. Many of the scenario responses highlighted the need for immediate action to shift to less energy intensive transport modes."

> Madhav Pai, Director, EMBARQ India

aspirations for Mumbai

In the workshop, the participants expressed the following aspirations for Mumbai in 2040:

"A localised, liveable city"
- Vibrant local communities.
- A pleasant, stress free daily experience, with lots of open spaces.
- Better air quality.
- Better living conditions and more accessibility.
- Less need to travel for the basics.
- More space for pedestrians and cyclists in the city.
- Improved transport capacity.

"A city that's run for everyone"
- Better accessibility, particularly for the poor.
- Better community engagement.
- Enforced rights and regulations.
- Improved governance around land use and transport planning, with a focus on holistic planning approaches that address interconnected issues such as transport and environment.

" *There is a lot that needs to be done to make planning more democratic. There is not much public discussion on what people require or want. Only the powerful builders decide what happens to the city."*
> **Aneerudha Paul**, Director, Kamla Raheja Vidyanidhi Institute of Architecture and Environmental Studies

[10] Mumbai Metropolitan Regional Development Agency (MMRDA), Comprehensive Transport Study (CTS) for Mumbai Metropolitan Region (MMR): http://www.mmrdamumbai.org/compreh_transport_study.htm (accessed on 24 September, 2010).

Mumbai workshop – highlights from the scenarios

Planned-opolis

- Mumbai is still an important urban area in India, but the economy has not grown as anticipated and there are **many more rival cities**.
- **The management of the city is highly automated** to minimise climate impact and maximise efficiency. All buildings have compulsory rainwater harvesting requirements, for example, and electricity disruptions due to flooding mean periods of enforced rationing.
- With tight controls on resources, it is **difficult to live off the informal economy** in the city. Mumbai's **population has peaked at 20 million**. Many slums have been cleared, especially when damaged by floods, and **slum dwellers have been given aid packages to relocate** to less vulnerable, or even newly build towns.
- In Mumbai there has been an increase in the number of **floating settlements for the rich** that offer a higher level of security.

- People tend to support change and intervention, however there is a vocal minority that feels that Mumbai's **plural, democratic identity is being eroded**. India is still a **powerful global player in technology** research and development, with many technologies having originated in Mumbai.
- India's Carbon Plan has driven a shift to **widespread electrification and energy efficiency** measures.
- Some historic parts of the city remain, but much of Mumbai now looks very similar to other megacities in the world. Businesses have to provide transport for their employees, using ultra-efficient buses, creating public private partnerships on rail networks, or enabling their employees to work in hubs close to home.
- Carbon constraints and the high oil price mean that mean that car ownership has not grown as much as expected, but people are content to rely on a high degree of virtual mobility.

Sprawl-ville

- Like many countries, India is forced to **scramble for oil supplies** on the world market.
- The city's **population is lower than estimates predicted**, as a result of renewed economic hardship and fuel poverty, which has forced some migrants back to rural areas.
- There are numerous **'failed' developments on the outskirts of the city**, built too far from public transport and therefore unaffordable to urban commuters now that oil prices are high.
- **Climate induced flooding events** and heat waves in the city have increased, but little official action is taken.
- The rich rely on **expanded police forces and sophisticated IT** to govern, and benefit from **roads or lanes reserved for paying customers** and many live in floating developments connected by speedboats.

- There is an **increase in street protests** by the masses of low-income rural migrants and newly disempowered middle classes who face rising food and fuel prices, wage cuts and job insecurity.
- **Rail and the metro remain the main choice for mass transit**, but maintenance cutbacks are resulting in rising problems with unreliability and a number of accidents. **The bicycle has also returned** in large numbers.
- Mumbai is more resilient than many cities because of its **strong IT sector** that relies less on oil for production and transport.

Renew-abad

- India is one of the **global leaders in solar and hydrogen innovation** and Mumbai has a goal to become **the first carbon-free city in the world**.
- Growing energy demand is met through decentralised generation, mandated by policy: household-level anaerobic digestion and micro-solar generation have gone to scale.
- A **mega-project for desalination of sea water** is being implemented. On the city streets, *Aquawallas* distribute harvested and filtered water packs to daily commuters.
- A recent wave of **plant skyscrapers** increase green space and food availability, reduce the urban heat effect, and help absorb runoff from rainwater. **Mumbai's biggest challenge is its continued high population**, which has surpassed 22 million, as the city's dynamic economy makes it attractive to immigrants.

- **Urban agriculture** is heavily subsidised by the government to ensure adequate levels of nutrition for the poor.
- **Slums have been rehabilitated as urban eco-villages**, with thriving cottage industries. There has been a renaissance of small, local retail formats in pedestrianised zones.
- **Mumbai's streets continue to be overcrowded** after a huge uptake of locally produced personal electric pod vehicles – both in terms of personal ownership and on-demand rental services.

Communi-city

- As a global knowledge economy hub, **Mumbai has fared better than many other Asian cities** in this more protectionist world.
- **Micro-entrepreneurship and DIY flourishes**, and has proved to be a driver of strong growth for Mumbai in an age of fragmented globalisation. For example, the city has been a leader in the scaling up of solar scooter technology.
- **The city continues to be an unequal place**, but there is greater social mobility than before. People are very self-reliant, and innovate rapidly in order to maintain their livelihoods and generate new opportunities.
- The city is locally organised. Many **local neighbourhoods have their own climate change adaptation strategies** – constructing floating farms, restoration and expansion of mangroves, and creating flood-resistant construction.

- **Widespread urban agriculture and aquaculture** – bolstered by neutraceuticals, genetic modification and other agricultural technologies – allows food supply to keep up with demand, but only very narrowly.
- **Micro nuclear** is the dominant energy generation technology in Mumbai's neighbourhoods, though the wider Mumbai city region is also a leader in small-scale biomass conversion.
- The less well-off build their vehicles personally and customise them using locally designed and produced kits, open source designs and old cars. **TATA has just released its millionth Nano-er** self-assembly kit.
- **The rich have gone increasingly virtual**, preferring to avoid the tedious daily commute altogether.

Mumbai workshop – planning ahead

Key opportunities and next steps

The participants identified a number of key solutions and developed a high-level action plan.

1. Localised urban planning

a) Launch a project to demonstrate the benefits of localised/mixed use planning, looking at existing examples, analysing success factors, and implementing a pilot with a new development in the city.

b) Identify and advocate new ways to do work in local neighbourhoods (e.g. building small, localised working hubs, mainstreaming remote working – currently not common practice).

c) Advocate the need for a cultural shift to more flexible working practices (e.g. corporate policies on flexi-working, campaigns that highlight benefits of remote working, etc.).

2. Integrated transport solutions

a) A phased Bus Rapid Transit (BRT)[11] implementation, which also systematically segregates pedestrians, other non-motorised vehicles, and motorised vehicles.

b) Transport hubs where the different nodes (including the metro, which will have been built by then) can meet.

---

[11] A public transportation system which uses buses to provide faster, more efficient service, usually by making improvements in infrastructure, vehicles, or scheduling such as having a dedicated lane for buses for example. For more information on BRT, see the Wikipedia entry: http://en.wikipedia.org/wiki/Bus_rapid_transit.

3. Innovation in energy and transport technologies

a) Create a solid platform for future technologies – electric cars, hybrids, hydrogen fuel cell (e.g. address battery challenges).

b) Implement a vehicle-sharing system.

c) Identify solutions with highest potential for uptake.

d) Identify potential barriers (e.g. IT platform availability).

e) Create partnerships to scale it up (VCs, corporations, NGOs, IT providers, etc.).

f) Consumer advocacy campaign.

g) Create demand management system.

h) Implement technology platform.

" *The importance of early action is huge. We need to understand the problem, but also the advantages we have right now. Public transport and non-motorised travel are still very high in Mumbai. If we do not intervene now… THEN it's going to be a big problem!*"
> **Anumita Roychowdhury**, Associate Director, Centre for Science and Environment

appendix: thank yous

Special thanks to the following people for their contributions to the project – through interviews, workshops and peer reviews:

Neera Adarkar, Architect, Rachana Sansad Academy of Architecture

Uma Adusumili, Chief Planner, Mumbai Metropolitan Regional Development Agency

Rishi Aggarwal, Research Fellow, Observer Research Foundation

Dr. Jillian Anable, Co-transport Topic Leader, UK Energy Research Centre

Greg Archer, Director, Low Carbon Vehicle Partnership

Ceren Ayas, Freshwater Programme Officer, WWF Turkey

Ela Babalik, Professor, Faculty of Architecture, Middle East Technical University in Ankara

Sudhir Badami, Independent transport & urban analyst

David Begg, Publisher, Transport Times

Chris Borroni-Bird, Director of Advanced Technology Vehicle Concepts, General Motors

Thomas C. Briggs, Vice President, Policy, BP Alternative Energy, and Head of Transport Energy Policy, BP

Isa Cerrah, Istanbul Metropolitan Municipality, Transport Coordination Directorate

Dilek Çol, Urban Planner, Istanbul Metropolitan Municipality, Transport Planning Directorate

Naveen Chopra, Director – Enterprise & Carrier Business, Vodafone Essar Limited

Susan Claris, Associate Director, Arup

Madhvendra Das, Head, Public Relations, Vodafone Essar

Ashok Datar, Head, Mumbai Environmental Social Network

Orhan Demir, Urban Planner, Plan Ofis Ltd

Paul Dickinson, Executive Chairman, Carbon Disclosure Project

Selim Dundar, Bahcesehir University

Pinar Erbayik, Club Correspondent, Turkey's Touring and Automobile Association

Necip Ertas, Transportation Director, Istanbul Metropolitan Municipality

Govindraj Ethiraj, former Editor-in-Chief, Bloomberg UTV

Gordon Feller, Director of Urban Innovations, Cisco Systems

Dr. Haluk Gerçek, Professor, Istanbul Technical University

Swati Ghangurde, Head, Business Relations, British Council

Craig Goodfellow, Project Director for Fuels and Lubricants, Ricardo Consulting Engineers

Dave Greenwood, Project Director, Technology, Ricardo Consulting Engineers

Engin Güvenç, Executive Director, Turkish Business Council for Sustainable Development

Dr. Murat Güvenç, Professor, Bilgi University

Salvador Herrera, CEO, Centro de Transporte Sustentable de México

Mustafa Ilicali, Transportation Advisor, Istanbul Metropolitan Municipality

Mine Izmirli, Environmental Advocacy Coordinator, TEMA

Ajit K Jindal, Head Engineer, Tata Motors

Stephen Joseph, Director, Transport 2000

Hadi Karadeniz, Deputy Director, Istanbul Metropolitan Municipality, Transport Planning Directorate

Aslıhan Karayama, Health & Safety, Vodafone

Dilem Kaya, Product Development Engineer, Ford Otosan

Emre Kaynak, TNT Express Turkey

appendix: thank yous (cont...)

Sonali Kelkar, Mumbai Environmental Social Network

Hadas Keren, Architect, Penoyre & Prasad

Dr. Tansel Korkmaz, Professor, Istanbul Bilgi University

Shanti Krishnan, Deputy Secretary, Western India Automobile Association

Mehmet Kutukcuoglu, Architect, Teget Architecture

Binoy Mascarenhas, Urban Planner, EMBARQ (CST India)

David Mayes, Director for Strategic Planning and Sustainability, Melbourne Council

Erhan Öncü, Transport Planner, Transportation Research and Planning Ltd

Dr. Pınar Özuyar, Manager, Center for Energy, Environment and Economy, Özyeğin University

Tim Papandreou, Assistant Deputy Director, San Francisco Municipal Transportation Agency

Shirish Patel, Head, Shirish Patel & Associates Consultants Private Limited

Aneerudha Paul, Director, Kamla Raheja Vidyanidhi Institute of Architecture and Environmental Studies

Ben Plowden, Director of Integrated Programme Delivery, Transport for London

VG Prasad, Head – Fully Built Vehicles, Tata Motors

Manjula Rao, Head Programmes (West India), British Council

Philip Rode, Executive Director, Urban Age Programme, London School of Economics and Political Science

Anumita Roychowdhury, Associate Director, Centre for Science and Environment, New Delhi

PC Seghal, Managing Director, Mumbai Railways Vikas Corporation

Prasad Shetty, Architect, Collective Research Initiatives Trust

Dan Sperling, Author of '*Two Billion Cars: Driving Towards Sustainability*'; Director, Institute of Transportation Studies, UC Davis University of California

Murat Suyabatmaz, Founder, Turkish Bicycle Association

Guy Summers, R&D Collaboration Manager, Vodafone

Mehmet Toker, R&D Director, Ford Motor Company

Ernest Tollerson, Director, Policy and Media Relations, Metropolitan Transportation Authority

Dr. Gereon Uerz, Project Director – Future Affairs, Group Research, Volkswagen

Kevser Ustundag, Professor, Architectural Faculty, Mimar Sinan Fine Art University

Ömer Yıldız, CEO, Istanbul Metropolitan Municipality

Sue Zielinski, MD, Sustainable Mobility & Accessibility Research & Transformation, University of Michigan

Alper Zümrüt, External Affairs Coordinator, Turkish Petrol Industry Association