

# Neo-Growth in Future Post-Carbon Cities

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## Abstract

*Ancient Greece had city-states – in 100 years we will have city-worlds. The global challenge of urbanisation has been exacerbated due to megatrends such as climate change, demographic change (i.e. ageing of the population in industrialised countries, and increasing populations in developing countries and new economies) globalisation and financial crises. The rise of megacities will speed up urbanisation. The concepts and structures of new cities and the urban sprawl of existing cities has been directly linked to energy, water, food, health and security issues. The consumption of fossil fuels in construction, housing, transport and industry should be minimised and replaced with renewable forms of energy. Future cities will also create a built environment that is based on a different logic than today. Humans started to construct cities thousands of years ago, as shelter for survival and as centres of housing, trading and recreation. In the future, cities will themselves be like organisms; sensitive and responsive to interaction, self-constructing “cyburgs”. They are foreseen to emerge as self-sufficient isles for energy, food, and comfort in the urban archipelago.*

**Keywords:** future of cities, post-carbon cities, limits to growth, neo-growth, new narrative, resilient suburbs

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## Introduction

Technology is a key driver for the future of post-carbon cities at three levels: 1) energy technology can be focused on renewable sources, 2) ICT can be used as ambient intelligence to monitor, control, enable and promote sustainable, comfortable and safe daily urban life, and 3) social media can empower citizens themselves to plan and redesign the existing urban fabric. Moreover, the social construction of cities as meaningful venues will rise parallel with technological developments. This implies the notion of a socio-cultural New Narrative around

which the identity and function of cities of the future can be embedded. This new notion must build on humans' deeper relationship to the city through the fulfillment of immaterial needs and the creation of rich cultural meaning.

When cities become overcrowded, urban exodus creates suburbs. A critical challenge is to prevent urban problems expanding, and instead to create suburbs as a resilient rescue to urban pressures. Resilience is the capacity of the suburbs to adapt to future changes and to nourish the livability of these areas. Cities often grow beyond their boundaries. This is only natural – growth is a phenomenon typical of Nature. However, how growth takes place is important. Future Post-Carbon Cities will follow the principles of Neo-Growth. People have developed economics. Since the current paradigm of economics is no longer viable (as recent financial crises have shown us), a new model is needed. People can make a new model only if they adopt a new mindset. Growth shouldn't be focused on products and services that are energy-intensive and generate waste and pollution. Limitless material growth is no longer possible or acceptable on a finite planet. There should be limits to material growth. Accordingly, growth should be based on the production of innovative and often non-material products and services that add to human well-being and the human search for meaning.

Existing cities increasingly face three kinds of problems: 1) ecological (fossil energy use, water scarcity, emissions, pollution) 2) economic (cost of public services, the pressure of supporting an aging population, citizens' income gaps, unemployment) and 3) social (unrest, health problems, unhappiness due to lack of employment, lack of attractive and safe environments, or of social networks). Key issues for existing and new cities as well are: energy, clean water, food, transport, social cohesion.

This paper probes the future of cities using the framework of a hypothetically forthcoming Post-Carbon World and Neo-Growth Economy. Such a world and economy are proposed here in the form of preferred futures (not as automatically developing futures). As is befitting the futures approach, the paper deals with the topic from several aspects that are characteristic of futures studies in general: the long-term perspective, the critical and re-thinking conceptual dimensions, the multidisciplinary global and holistic dimension, the systemic and organic dimensions, the converged technological and human-oriented dimensions, as well as the innovative suburban and neo-growth dimensions (Table 1). First, the paper tackles the conceptual dimension. Then it goes on to discuss the global and holistic dimension as expressed through megatrends and especially through hyper-urbanisation. The third dimension to the future of cities is addressed as a systemic and organic view of cities. The fourth is the technological and people powering dimension of cities as self-constructing and regenerating "cyburgs". Finally, the transformation into resilient post-carbon cities in the Neo-Growth economy is anticipated as a new narrative worth pursuing.

Table 1. *Characteristics of Futures Studies in general and their relevance for/counterparts to urban futures.*

<b>FUTURES STUDIES</b>	<b>URBAN FUTURES</b>
Long timeframe	Long term sustainability of cities
Complexity, systems thinking, and holistic thinking – connectivity	City as a system City as a whole
Multidisciplinarity and multisectorality (breaking boundaries between different fields of study, industries, and actors)	City as crossroads of several activities, fields and actors
Critical thinking and constant questioning of the futures	Revisiting core assumptions about the ‘city’
Proactivity (affecting and creating the future)	Goals for the good life in cities/multi-stakeholders
Participatory approaches	Citizen movements, grassroots action
Alternative thinking and scenario thinking	New narratives for urban development
Identifying discontinuities, disruptions, tipping points	City full of surprises, serendipity
Taking radical, unorthodox and unconventional views seriously	Open innovation for urban planning and crowdsourcing

## What Makes a City? Rethinking the Concept of Cities

### Conceptual Dimension

**Core question:** What variables and what invariables has the concept of the city contained throughout millennia?

**Imperative:** Rethink the city – rethink city planning (planning for who, and planning by whom)

When embarking on our exploratory journey through the future of cities, it is worth pausing first and thinking about the conceptual dimension: what is a city? What makes a city? In futures research critical thinking and constant questioning is the normal mode of study. Rethinking and out-of-the-box viewpoints are not neglected, but instead encouraged. For example, in the Delphi method the conventional procedure in earlier decades was to reach some kind of consensus after two or more rounds of expert surveys. Currently, more emphasis is laid on the outliers and on the variety of argumentation (Linstone, 2011).

In human history the urban age is relatively much more recent than our historical footprint as hunter-gatherers, nomads, and as farmers (Pinker, 2011). However, traces of several millennia of urban civilization are found in various locations around the globe (Sumer, Babylonia, Mesopotamia, Turkey, Mayan civilization, Classical Antiquity, etc). Originally cities were relatively large and permanent settlements with their own administration and with reduced transport costs for goods, people and ideas. Cities typically consisted of the built environment (buildings), natural environment (greenery), and social fabric (citizens). They have a complex infrastructure: sophisticated systems for land use, housing, production plants, transportation, and sanitation as well as various utilities.

According to the definition of cities in Wikipedia<sup>1</sup> the concentration of development facilitates interaction between people and businesses, in which process

both parties benefit. A big city or metropolis generally has adjacent suburbs and exurbs. Such cities are usually associated with metropolitan areas and urban areas, creating numerous business commuters that travel to urban centers for employment and back home from work into dormant suburbs. Once a city expands far enough to reach another city, this region can be called a conurbation or megalopolis. Urban sprawl defines cities as urban fabric unfolds to its surroundings.

Cities are settlements of relatively dense populations. Peter Hall (1998, 3) sees cities primarily as places of creativity – thus having sparked settlements. He classifies every great burst of creativity in human history as an urban phenomenon. In ancient Greece we had city-states-in 100 years we will have city-worlds if the megatrend of urbanisation continues (see the next paragraphs which discuss hyper-urbanisation). Future cities will also form a built environment that is based on a different logic than today. Humans started to construct cities thousands of years ago, as shelter and as places for housing, trading and recreation. In the future, cities will continue hosting those tasks but increasingly they themselves will be like green organisms, sensitive and responsive to interaction, self-constructing “cyborgs”. They must become self-sufficient isles for energy, food, and comfort in the urban archipelago. People are pivotal in creating this shift.

Cities are triple hybrids of i) people, ii) places, and iii) power (physical, political, economic, technological, psychological). The new logic of empowered citizens sees people as the social fabric for cities, seeking the construction of identities, while also seeking for means for continuous renewal and resilience. Moreover, rethinking the social construction of cities as meaningful venues should be just as important as rethinking cities as locales of technological transformation. This implies the notion of a socio-cultural New Narrative around which the identity and function of post-oil cities of the future can be embedded. This new notion must build on humans’ deeper relationship to the city through fulfilling non-material needs and the creation of rich cultural meaning.

## **Hyper-Urbanisation and Climate Change as Megatrends Driving the Need for Post-Carbon Cities**

### **Global and Holistic Dimension**

**Core question:** Will the whole world become a world city?

**Imperative:** Long-termism and globalisation, shift to sustainable urban form

Urbanisation refers to the physical growth of urban areas as a result of rural migration from the countryside into cities, as well as suburban concentration, and urban sprawl in general. Urbanisation describes both state and process i.e. proportion of population living in cities, and dynamic rate of migration into cities. From a global perspective, urbanisation is pushing towards hyper-urbanisation. More than half of the world population now lives in cities. Historically, urbanisation has been generated by modernisation and industrialisation processes. Urbanisation can also be seen to represent the industrial phase in the evolution chain and transition of societies – starting from hunter-gatherer to agricultural to industrial, continuing to strengthen in the present information society.

Megacities will speed up the urbanisation process. A megacity is typically

defined as a metropolitan area with a total population in excess of 10 million people. Some definitions also set a minimum level for population density – at least 2,000 persons/square km. A megacity can be a single metropolitan area or two or more metropolitan areas that converge.<sup>2</sup> We are already living in the century of megacities. As of 2011, there are 21 megacities in existence, (the official figure). Some lists contain 27 megacities – with conurbations such as Mumbai, Tokyo, Seoul, New York City, and Mexico City having populations exceeding 20 million inhabitants each (Smith, 2011). In 1950 there were only two megacities (New York and Tokyo). In 2025 there will be 27 (Smith, 2011, 34). Our global urban culture is also shifting east. Smith points out that out of the eight new megacities anticipated over the next fifteen years, five are in Asia, two in Africa, and only one in Europe (see Figure 1). The urban story is much more than just megacities: people migrate to towns of all sizes. If the present population growth trajectory continues, by 2050 for every one hundred of our future children and grandchildren born, 57 will open their eyes in Asia and 22 in Africa, mostly in cities (Smith, 2011, 35).

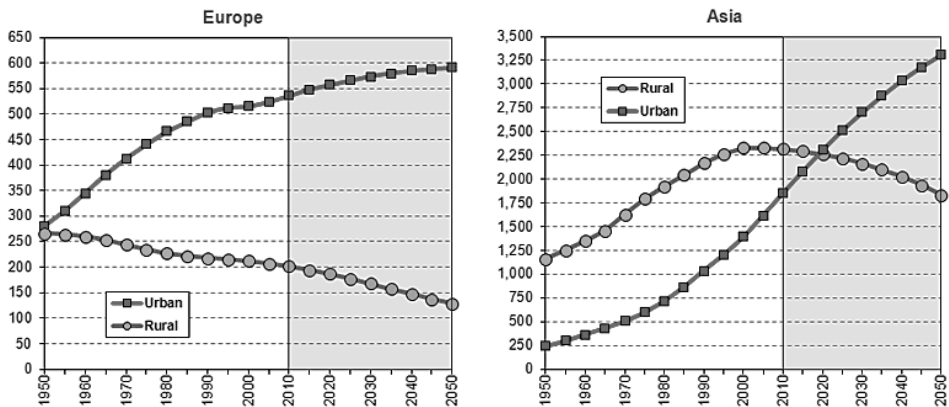


Figure 1. Urbanisation is a growing megatrend on all continents – as examples from Europe and Asia demonstrate. (United Nations, 2012).

Urbanisation which features an increasing number of megacities can be characterised as hyper-urbanisation. Urbanisation is a megatrend, a very strong global trend.<sup>3</sup> The global megatrend of urbanisation is acerbed due to various other megatrends such as climate change, demographic change (i.e. aging of the population in industrialised countries, and increasing population in developing countries and new economies), and the financial crisis. Urbanisation is also interlinked with other global challenges as presented in the Millennium Project 15 Global Challenges for Humanity framework.<sup>4</sup> By updating this framework annually, the Millennium Projects emphasize the holistic nature of interrelated global challenges. The future of cities could be analysed by using this specific framework, highlighting implications from one issue to another.<sup>5</sup> The Challenges are interdependent: an improvement in one makes it easier to address others; deterioration in one makes it harder to address others. Arguing whether one is more important than another is like arguing that the human nervous system is more important than the respiratory system. These Challenges are transnational in nature and transinstitutional in solution. They cannot be addressed by any government or institution acting alone. They require collaborative action among governments, international organisations, corporations,

universities, NGOs, and creative individuals. Although listed in sequence, Challenge 1 on sustainable development and climate change is no more or less important than Challenge 15 on global ethics (Glenn, Gordon & Florescu, 2012).

The concepts and structures of new cities and the urban sprawl of existing cities are directly linked with energy, water, food, health and security issues. Resource scarcity will be a critical issue to an increasing degree worldwide, and could generate conflicts among nations, regions and continents. Jorgen Randers (2012) in his newest Report to the Club of Rome “2052 – A Global Forecast for the next forty years” raises the possibility that humankind might not survive on the planet if it continues on its path of over-consumption and short-termism. The sheer size of the population sets limits to existing cities. This is because 1) the larger the population is, the bigger the ecological footprint the residents leave (use of land, energy, natural resources etc.); and 2) the greater the amount of pollution, the greater are the risks concerning safety, health, wellbeing and easy/smooth functioning of the city.<sup>6</sup>

The consumption of fossil fuels in construction, housing, transport and industry should be minimised and shifted to renewable forms of energy. In the latter rests solutions, even megasolutions to the megachallenges and megaproblems being posed to the future of cities by megacities and megatrends. The new world order – geo-political and economic power balance – will build on systemic changes. The megaperspective (megatrends + megacities) requires not only a global view, but also a holistic view. The urban built environment should be analysed and anticipated in relation to other environments in the world. The Millennium Project uses a framework of 15 interconnected Global Challenges to create a holistic approach (Figure 2). The future of cities and built environments should also be analysed and anticipated in the holistic framework concerning futures of other issues (megatrends other than urbanisation) as well.

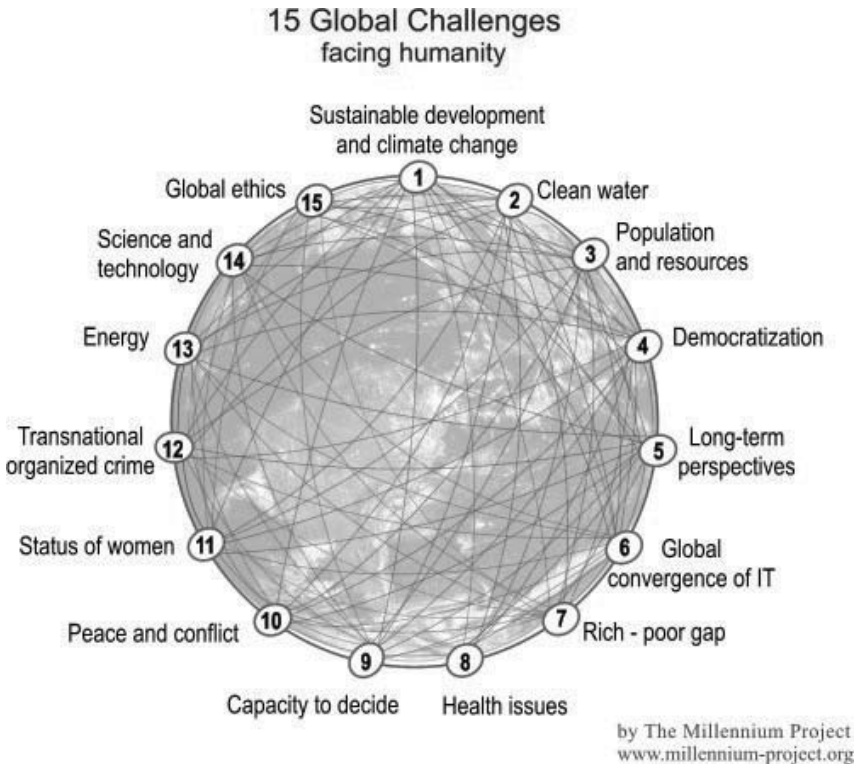


Figure 2. The Millennium project presents a holistic framework of 15 Global Challenges (Glenn et al 2012).

The growing BRICS economies<sup>7</sup> will hugely contribute to the growing urbanisation. China alone will construct 400 big cities during the next 15 years. The “Pearl River Delta into One” plan will merge the already giant cities of Guangzhou and Shenzhen together. Moreover, several other cities will be incorporated into the mix. This hyper-megacity carpet will have a population of over 42 million people, equaling the size of the Netherlands. The existing cities have already sprawled out into each other organically-it is hard to tell where one ends and another begins. By 2025 China is anticipated to contain over 220 cities with populations of over one million, as well as eight mega-cities, each with over 10 million people.

China will excel not only in the growing number of new cities, but in the growing height of construction projects. Their aim is to erect the highest building in the world (838 m). Currently, the highest building is Burj Khalif located in Dubai, topping 823 m. The Chinese plan to build the world’s tallest building as an entire city-therefore the building is called Sky City. According to the plans Sky City will be a vertical city providing work, accommodation and services for 30,000 people. The building is expected to consume a fifth of the energy required by a conventional one.<sup>8</sup> The reduced need for commuting also cuts emissions. This aim is based on the logic of incorporating apartments, offices, schools, kindergartens, clinics, shops, sports facilities, arts and culture, as well as gardens into the building. (Sky City, 2012). Human efforts to construct ever higher skyscrapers fits into the ecological argument for for dense urban form, while it also raises questions about the livability of cities.<sup>9</sup>

## Future Cities as Eco-Systems – Green Resilient Organisms

### Systemic & Organic Dimension

**Core question:** What might happen if everyday buildings were designed with the seeds of regeneration?

**Imperative:** Shift to systemic view, to organic view, to renewables, decentralisation, self-sufficiency

Based on the global issues presented above regarding the particular challenges related to growing urbanisation, the future of cities should be viewed through the spectacles of a systemic outlook. Cities are then conceived as eco-systems. This is related to the holistic approach as well. The city as an urban eco-system also evokes the idea of cities as organisms – ideally as green resilient organisms. The systemic dimension is thus blended with the organic dimension in our analysis.

In many aspects a city is like an ecosystem that has its own structure, dynamic and metabolism. Just as a forests' air and soil are shaped by its plants and animals, so are changes in the urban environment rooted in the patterns of urban activities. Urban density, mobility and lifestyles directly affect demands for space and the flow of various resources. (Firth, 2012). Cities as urban ecosystems include both nature and humans, in a largely human-built environmental context. It has to be born in mind that urban ecosystems have emergent properties that cannot easily be seen by simply looking at the different functional parts of a city: the whole is more than the sum of the parts (*ibid.*). An ecosystem can be defined as a community of living organisms interacting with their non-living environment.<sup>10</sup> Firth draws our attention to a common misconception related to this topic: that cities are separate from nature and do not need to be considered in the study of ecosystems. Nature vs. humans dualism must be avoided. Another common assumption is that by studying the different parts of a city (transportation, infrastructure, parks, water system, economic base, etc.), one can understand how the city functions (this is rarely the case). Urban ecosystems occupy only about 2% of the land surface area of the planet, but provide a home for half of the world's population – i.e. for more than 3 billion people. The proportion of people living in cities is even higher in the developed regions of the world.

Cities as organic and holistic entities play a key role in the idea of the new narrative (or Big Shift) around which the identity and function of cities of the future can be reconceptualised. Humankind is currently undergoing a shift in the idea of the city from mechanistic to organic and ecoholistic. This transition involves more than just a change in technology. It essentially recognizes that we cannot survive apart from nature.

Cities as eco-systems can be placed in the urban planning context of the Eco-Regional Model. This means developing a city within a larger context (in a geographical, economic, ecological and cultural sense). It also refers to developing a city with a view to, and through interaction with, the surrounding smaller towns (and the surrounding countryside as well). The Eco-Regional Model is a new holistic mindset and agenda for action where ecology, culture and wellbeing play a central role in urban development (Heinonen, Halonen & Daldoss, 2006). This eco-holistic model as synthesis builds on previous notions and movements such as garden city



developments, discussed later in this article

### **Urban Metabolism-What a city consumes and produces**

The concentration of people and activities in a limited space places high demands on local natural habitats. No city sustains itself within its own boundaries. Energy, water and other resources are brought into the urban system, where they are processed or consumed. Then residuals of these processes are disposed of, often outside the city borders (Firth, 2012). This produces an accumulation of waste in land, the atmosphere and waterways. The urban metabolism is important – in a cradle-to-cradle model, developed by William Mc Donough with his German colleague Michael Braungart (2002), all waste will ideally be used as raw material for other processes, and all energy is to be generated in situ (= active energy buildings). The cradle-to-cradle model is important, because most of the materials and energy used by a city come from outside the city boundaries.<sup>11</sup> We should understand that the pathway of these materials through the city tends to be linear (as opposed to the cyclic processes of natural ecosystems), and that flowpaths into the city are longer than flowpaths out.

We have learned how the exploitation of forests, irrigation waters, and other resources led to catastrophe for quite a few early prominent cities. The size and number of modern urban ecosystems is unprecedented and fossil fuel use is a key factor in this. Material and energy flowpaths into and out of cities are crucial and it is worthwhile to consider how and where these flowpaths are linear vs. cyclic. There are of course some very positive environmental features of urban ecosystems. While cities have a few unattractive features, e.g. noise and pollution, the density of human life enables energy efficiency, mass transit, recycling, and other benefits which are difficult or impossible in rural areas. Thus, the impact of any given individual urban dweller on the environment may be less than that of a suburban or rural individual, while quality of life may by some measures be higher. (Firth, 2012; Randers, 2012). The ecological footprint of a rural dweller is typically enlarged through personal car use.

Though only a little more than half of the global population currently lives in cities, 75 percent of the resources used by humans on the planet are used by people in urban ecosystems. In a typical city, much more material comes in than goes out each year. This means that cities actually continuously accumulate mass. Many natural ecosystems accumulate mass as well. For instance, a forest may accumulate dead wood and leaves, as well as the mass of the growing trees themselves. Periodically, many forests experience fires that burn off the dead material and sometimes even the living trees. Modern cities do not experience this kind of catastrophic removal of materials on a regular basis. This is where they clearly differ from non-urban ecosystems (Firth, 2012).

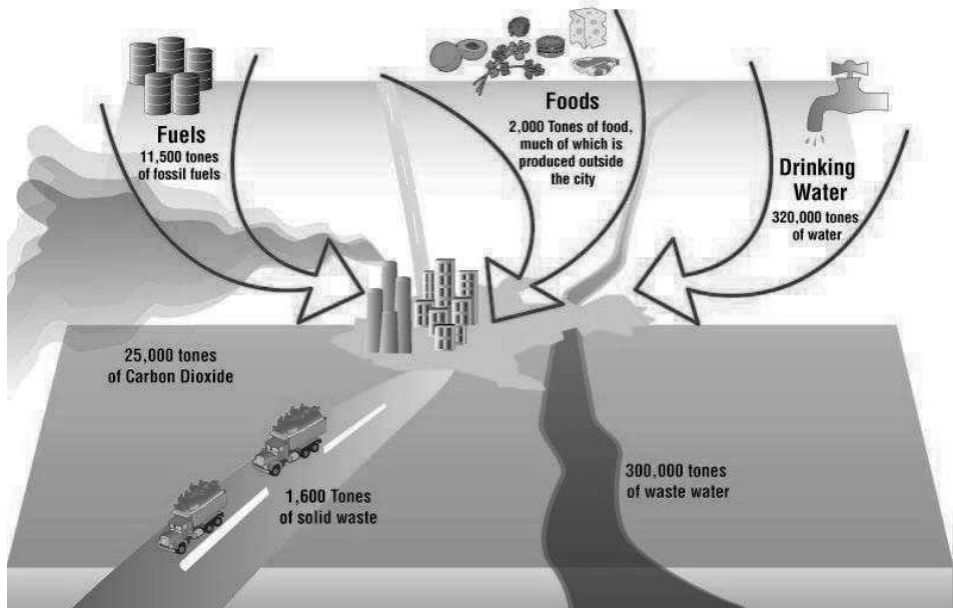


Figure 3. City as a system of continuous material flows in and out of it (Tveitdal, 2004).

In an analogy of cities and eco-systems, building a city should follow the principles that prevail in eco-systems. For example, Richard Register (2006, 182) recommends rebuilding cities in balance with nature, obeying the following Eco-city Principles:

- Build the city like the living system it is.
- Make the city's function fit with the patterns of evolution
- Follow the builder's sequence – start with the foundation
- Reverse the transportation hierarchy
- Build soils and enhance biodiversity

The idea of the French Physiocrats from the 18<sup>th</sup> century merits revisiting. Physiocracy (from the Greek words for “government of nature”) is an economic theory developed by a group of economists who believed that the wealth of nations was derived solely from the value of “land agriculture” or “land development.”<sup>12</sup> The most significant contribution of the Physiocrats was their emphasis on productive work as the source of national wealth. Earlier schools, e.g. mercantilism, often focused on the ruler's wealth, accumulation of gold, or the balance of trade instead. While the Physiocrats were formulating their ideas, economies were almost exclusively agrarian – accordingly, the theory considered only agricultural labor to be valuable. Physiocrats viewed the production of goods and services as consumption of the agricultural surplus, since the main source of power was from human or animal muscle and all energy was derived from the surplus from agricultural production.

The perceptiveness of the Physiocrats' recognition of the key significance of land was reinforced in the following half-century, when fossil fuels had been harnessed through the use of steam power. Productivity increased manifold. Railways, as well as steam-powered water supply and sanitation systems, made possible cities

of several millions, with land values many times greater than agricultural land. Thus, whilst modern economists also recognise manufacturing as productive and wealth-creating, the underlying principles laid down by the Physiocrats remain valid. Physiocracy also has an important contemporary relevance in that all life remains dependent on the productivity of the raw soil and the ability of the natural environment to renew itself. According to Dennis Meadows (2012) resilience may become a more attainable goal than sustainability. He defines resilience as the capacity to absorb shock then quickly regain the ability to perform essential functions. Jim Dator (2012) points out the emerging resource scarcity, especially in Collapse Scenarios and foresees the value of land to rise in the future context of an unsustainable world. He even urges people to re-learn skills such as farming, fishing and hunting as future skills needed for survival. This exhortation is also strong in many sustainability schools from previous decades such as permaculture, urban agriculture and most recently Transition Town movements. Permaculture has been defined as the conscious design and maintenance of agriculturally productive ecosystems which have the diversity, stability, and resilience of natural ecosystems (Mollison 1988).<sup>13</sup> In the early 2000s the Transition Town movement was created. This movement (to a large degree) to a large degree follows Permaculture thinking. It is a grassroots network of communities making efforts to build resilience in response to peak oil, climate degradation and economic instability. The main aim is to raise awareness around sustainable living practices, and to build local ecological resilience in the near future. Communities seek out methods for decreasing energy usage as well as reducing their reliance on long supply chains that are totally dependent on fossil fuels for essential items.<sup>14</sup>

### **Nature in cities**

Even apart from the survival context, nature has a significant role in the value systems of all cultures. The relationship of built environment and nature is delicate and challenging. Well-designed cities can, however, be seen as stages for an aesthetically satisfying and sustainable everyday life – the aesthetics of the built environment can merge with the richness of the natural environment.

In the design and planning of livable environments, the goal for an eco-aesthetic “green city” is an important one. Humans’ impacts on nature and nature’s effects on humans are both significant. In this regard education, age, gender, cultural background, and income level are irrelevant – everyone living in an urban society needs to be in touch with the nature within that city. Urban and environmental planners have integrated elements of natural environments and open green areas within their designs to alleviate urban stress. Vegetation, especially forests, in the landscape of the living environment should not be thought of as only a cosmetic decorations for urban life. These should be part of basic infrastructure, enhancing the city aesthetically as well as ecologically. These also have a direct connection with the area’s health and standard of living, and how the local community values the neighborhood. According to a study, the trees near a home can decrease the stress levels of the inhabitants (Low, Greeson, Green & Radovic, 2005). Also the trees visible from an apartment increase contentment with one’s living area.

Cities and communities can also be viewed using a forest metaphor, which defines a city or a community as a forest-like ecosystem. The areas built according to the forest metaphor take into account (and help develop) the organic qualities

of the city in many ways. In the creation of an eco-aesthetic, and a greener city, all the aspects of the built environment can be made “green”: gardens can be planted on roof tops, walls can be covered with plants (vertical farming), sterile and grey areas can be invigorated through the creation of shared gardens and farming patches. Garden roof tops decrease the energy consumption of a building, and neighbors get to enjoy beautiful views and rising property values. Nature itself is thankful: roof top gardens form relatively rich ecosystems, in which birds, spiders, grasshoppers and other insects thrive (Beatley, 2004.) In addition to this, with the addition of glazed balconies inhabitants can lengthen the time they spend on their balconies and enjoy the surrounding landscape.

### **Green Infrastructure – what does it mean as an enhanced concept?**

A characteristic of the present use of land is the growth and expansion of cities (harnessing land for construction) and the corresponding decrease in green areas. A part of this development is explained by population growth, but not entirely, as for instance in the US the harnessing of unused land increases faster than the growth in population. This kind of development affects nature as well as humans. Bio-diversity deteriorates as the continuous claiming of lands shatters nature into separated islets. This hampers, for example, the movement and reproduction of animals. Humans also need open spaces which offer opportunities for outdoor activities, recreation and relaxation.

Efforts have been made to conserve natural areas through different conservation programs. Such programs are useful but have some deficiencies: they tend to concentrate only on a few restricted areas, they are executed separately from land use planning, and their funding is often eroded during recession. Natural areas have also been traditionally regarded as amenities, not necessities. Thus the attitude towards them has differed from other public infrastructure, such as traffic routes and schools (Benedict & MacMahon, 2006.)

To solve the problem, a more holistic approach is needed. City growth cannot be stopped, but the utilisation of new areas can be introduced in a more planned and thoughtful way, taking into account the multi-faceted value of the area. Green infrastructure offers such an approach. Its purpose is to assist conservation proceedings, which are carried out in cooperation with the planning and development of land use. In the decision making processes considering land use, the needs of humans as well as nature must thus be taken into account. The goal is to establish a broad and uniform network which maintains a functioning ecosystem and offers different kinds of recreational, social and economic gains for citizens.

Green infrastructure can be defined as a noun or as an adjective (Benedict & MacMahon, 2006; Heinonen et al., 2006). The noun defines green infrastructure as a concept, and the adjective as a process. When green infrastructure is used as a noun, it refers to the network formed by nature and other open areas which conserves ecosystems, maintains fresh air and pure water, and produces many other utilities for humans and nature. These kinds of areas include protected natural areas (e.g. swamps), conservation areas (e.g. national parks and wilderness), forestry/agricultural areas with conservation value, and other open areas (e.g. parks). The network of green infrastructure connects ecosystems and landscapes as a system with centres, links and objects.<sup>15</sup>

When green infrastructure is used as an adjective, it depicts a process which

encourages land use planning which takes into account both the needs of humans and the needs of nature. This approach offers a mechanism which can be used to recognise and prioritise conservable land areas. Green infrastructure offers a context, which can steer the decisions related to future land use and conservation in such a way that these different factors can be combined as well as possible (Benedict & MacMahon, 2006).

### Living architecture

An experiment in new kinds of eco housing is related to the planning of eco-aesthetic living areas as part of enhanced green infrastructure. At MIT a vision of accommodation as a living ecosystem is being developed by a Human Ecology Design team. The concept of the Fab Tree Hab House proposes a method to grow homes from native trees (Figure 4). Housing is not seen solely as a product of eco-planning; living organisms are used directly as the structures and components of the building. This human ecology design approach is based on a new kind of symbiosis between the house and its surrounding ecosystem.



*Figure 4.* MIT Fab Tree Hab House has a living tree as the supporting structure – building itself as a living organism (Mawani, 2011. Courtesy by Joachim Mitchell).

If human ecology design gets more ground in architecture, the future urban areas of tomorrow will look more like ever-changing and vibrant gardens than machines, i.e. a static set of buildings and blocks. British designer and architect Rachel Armstrong (2012) argues that in order to achieve sustainable development of the built environment – and help countries like Japan recover from natural disasters – we need to rethink how we approach architecture. By genetically modifying biological systems and studying such things as protocells – nongenetic self-organising molecules that exhibit movement and sensitivity to their surroundings – we can create more responsive and dynamic structures. The result is a new kind of architectural practice where cities behave more like an evolving ecosystem than lifeless machines.

According to Armstrong (2012) living architecture is a way of using ecological solutions for urban problems. Living architecture works by applying new materials and engineered systems that harness some of the unique properties of ‘life.’ Living

technology is more robust and environmentally responsive than traditional materials, and can manage unpredictability in a way that current technologies cannot. Buildings will perform functions that we currently attribute to the plant world, such as carbon capture. They will also contribute to the health of residents by removing pollution or providing food and energy. Living architecture is not a panacea for urban problems, but rather offers an alternative approach to creating buildings that may help alleviate these problems. Our cities, as they currently exist, are seen as inert barriers to the natural world. These barriers are inevitably breached in the event of a natural disaster. All in all, architecture could benefit greatly from biomimicry, i.e. technology trend where nature's processes, solutions and systems are simulated in construction.

## Cities as Self-Constructing and Regenerating “Cyburgs”

### Technological and People Empowerment Dimension

**Core question:** What kind of governance will the cities need as self-organising spaces?

**Imperative:** Shift to prosumeristic co-creation of urban futures

To be sustainable, future cities will need to form a built environment that is based on a different logic from today. Humans started to construct cities thousands of years ago, as shelter and as places for housing, trading and recreation. In the future, sustainable cities will be like green organisms as described above, and they will become more and more sensitive and responsive to interaction, portraying themselves as self-constructing “cyburgs”. They are self-sufficient isles for energy, food, and comfort in the urban archipelago by the necessity of pressing global challenges on one hand and by the empowered will to become self-sufficient on the other hand. The concept of the cyburgs introduced in this article is based on the following logic. The prefix “cy” of the “Cyburg” means that life in cities is governed by technology enabling people's choices (cybernetic view). Cities will become even more important than nation-states and define people's lives. “Burg” is the word for castle in various Germanic languages. My home is my castle – the home of citizens is the city.

The next section describes how technology will be a key driver for future post-carbon cities at three levels: 1) energy technology that is focused on renewable sources; 2) ICT that is used as ambient intelligence to monitor, control, and enable sustainable, comfortable and safe daily urban life; and 3) social media that empowers citizens themselves to plan and redesign the existing urban fabric. This approach to the built environment will use Disciplined Technology as its Enabler. Enabling technologies will drive a socio-cultural metamorphosis that is nourished by renewables, society, and prosumerism (= producer + consumer, consumers increasingly adopting the role of producers). Possible avenues of how such transformation for post-carbon cities might take place are discussed.

### Renewables

A “Big Shift” is needed, according to Georgescu (2012). This planet is the only one we have. Energy is the fuel for life. Energy technology must be focused on

renewable sources, in order to cut the GHG emissions and combat climate change. Cities are great consumers of energy – the built environment covers 40% of the total use of energy (for heating, cooling, lighting etc.). Instead of aiming for passive energy houses, the goal could be raised higher to zero-energy houses or “active” houses that generate all the energy they need, and even create a surplus. Naturally, the ideal case would be to have this model applied in all cities and using exclusively renewable resources.

Even oil-producing countries are anticipating a future energy world where renewables play a central role, as a rational alternative to the present predicament of the fossil fuel-based world. For example, Abu Dhabi has an ambitious plan for a city that will rely entirely on solar and other renewable energy sources (wind, geothermal, hydrogen). This Masdar City will also have a sustainable, zero-carbon, zero-waste ecology.<sup>16</sup> The city is planned to cover six square kilometres and will be home to 45,000 to 50,000 people and 1,500 businesses, primarily commercial and manufacturing facilities specialising in environmentally friendly products. More than 60,000 workers are expected to commute to the city daily. Masdar City is an example of efforts to design and construct whole cities based on post-oil infrastructure and activities. However, its impact will not be significant unless the ecological footprint of oil-producing countries as a whole are decreased. Moreover, commuting adds to environmental impacts unless it is done via mass transit, preferably by rail transportation.<sup>17</sup>



Figure 5. Masdar City (Photograph: Ali Haider/EPA/Corbis. Architecturecourses.org).

### SMART – ICT – UBI – DIGI

The rapid development of technology is one of the biggest driving forces in almost all areas of life. The phenomenon of technological convergence may turn out to be an even stronger driver. ICT will be used to an increasing degree, combined with biotechnology, gene technology, nanotechnology and cognitive sciences. Ubiquitous technology convergences mean that ICT may be used as an ambient intelligence to monitor, control, and enable sustainable, comfortable, healthy and safe daily urban life.<sup>18</sup>

The concept of the Smart City has been used and linked to urban words and phrases such as security/safe, green, efficient, sustainable, energy etc. Several fields of activity are described in the literature in relation to the term “Smart City”: industry, education, participation, technical infrastructure, and various ‘soft factors’ (Giffinger et al., 2007). Smart Cities can be identified along six main dimensions: a smart economy, smart mobility, a smart environment, smart people, smart living, and smart governance (Ibid.). The concept of the Smart City as the next stage in

the process of urbanisation has become quite popular in the policy arena in recent years. It draws a distinction from the terms digital city or intelligent city, which are considered heavily technology-orientated. The main focus of smart city is also on the role of ICT infrastructure, but much research has also been carried out on the role of human capital/education, social and relational capital and environmental interest as important drivers of urban growth.<sup>19</sup>

The term Smart City has also been used to discuss the use of modern technology in everyday urban life. This includes modern transport technologies. Logistics as well as new transport systems as “smart” systems are intended to improve urban traffic and inhabitants mobility. Wireless sensor networks help to create Smart Cities. A distributed network of intelligent sensor nodes can measure many parameters for more efficient management of the city. Data is delivered wirelessly and in real-time to citizens or appropriate authorities. For example, citizens can monitor the pollution concentration or the degree of traffic congestion in each street or section of the city. Rubbish bins can send an alarm when they are close to being full. Amsterdam, Dubai, Cairo, Edinburg, Malaga, and Yokohama have smart city schemes. Typical smart city programs go from visualisation of traffic data to smart grids and to smart water and e-government solutions. Webb, Buscher, Doody, Cosgrave, Giles, Hawes-Hewitt, Walt & Mulligan (2011) point out that in the age of the internet and the smartphone, together with an explosion in the use of new tools such as inexpensive sensors and mobile devices, cities now have totally new options for integrating technologies into existing infrastructure and services. There of course remains an important question: how much will infrastructure control in a smart city affect privacy and power issues for citizens?

The European Union (EU), in particular, has devoted constant efforts to devising a strategy for achieving smart urban growth in its metropolitan city-regions. This might be achieved by pushing cities towards Eco-Intelligent Development, that is the combination of the tools and potential of the Information Society (Digital Society/Ubiquitous Society) and the goals of Sustainable Development (e.g. promote teleworking, telemedicine, videoconferencing, intelligent transport etc.). In addition, the Internet of Things and the utilisation of Big Data might play an interesting role in such efforts towards Eco-Intelligent Cities.

The above developments and aspirations of embedding and nourishing nature in cities should not, however, be seen as an artificial technofix future where new technology—smart, ubiquitous and digital—is only supplemented by nature and living green. The ultimate goal in these efforts to create cities as self-constructing and regenerating “cyburgs” is meaningful urban redesign. For the new narrative of cities we need a synthesis of technical and cultural intelligence—radical redesign to something that is more sustainable both materially and culturally.

### **From information society towards meanings society**

A shift from one societal phase to the next (e.g. from the agricultural society to the industrial society, or to the information society and its more developed form: the knowledge society) begins with 1) new, emerging technologies that 2) answer the needs which are characteristic of a new era. Now, at the beginning of the second decade of the millennium, the technological environment has been shaped especially by the internet, convergence, mobile computing, cloud computing, social media, and application services. These are used to satisfy the urge for a meaningful life. The Net



is becoming ubiquitous in many and profound ways. We will see the dispersion of values and norms of web 2.0 to the entire society – and particularly to the workplace. Social media solutions will be used within the organisation and also as a way to communicate and interact with customers. Web 2.0 natives will take participation, bottom-up approaches, collaboration, and sharing for granted. They are intrinsically motivated rather than extrinsically motivated.

Due to these changes we might be shifting away from the information and knowledge society towards a “post-informational” meanings society characterised by digitalisation and less tangible, experience and transformation services (see e.g. Pine & Gilmore, 1999; Pine & Korn, 2011; Tuomi, 2006; Jensen, 1999). The experience economy and society are not of course new phenomena. In essence, whenever we design, sell, buy, and consume products and services, we design, sell, buy, and consume experiences. However, the recent developments and applications of the internet might be elevating the trend eventually to a megatrend.

In a society driven by cultural meaning, people’s needs and demands will be increasingly oriented towards genuine feelings, personal experiences, and the purpose and meaning of life. Consequently, an increasing proportion of (immaterial) production will be aimed at satisfying these demands. Small enterprises with close relations to their customers, and with a radically new corporate culture, are necessary to answer these needs.

The information society was (and still is) organised as networks that strive for maximum efficiency. The meanings society is organised as a “cloud”, a kind of a hyper-dispersed network. Hierarchies with very flat and bottom-up approaches are valued. The ethos of the meanings society emphasises creativity, sharing, romanticism, non-conformity, individualism, and self-fulfillment. Prosumerism is becoming the standard for production. Not only are consumers becoming producer-like, but producers are becoming consumer-like. They must, if they are to offer meaningful products.

The information society is a kind of upgraded version of industrial society. It is based on the production and processing of information. Information production and processing are especially used to make organisations and material production more efficient, flexible, and competitive. Therefore, the organisational form of the information society is the network. Networks flatten the hierarchies of bureaucracy and make employees more autonomous, thus enhancing flexibility. Creativity is emphasised, but innovations are mainly material or else are used to make processes more efficient. The ethos of the information society is a mix of straightforward rationality and creativity, objectivism and subjectivism, individualism and collectivism, asceticism and hedonism. The information society can be seen as a transition phase between a material industrial society and an immaterial meanings society. As Pentti Malaska (2010) has noted, in the initial phase of industrial society, new technologies were used to make the processes and production of agricultural society more efficient. It took awhile before industrial society matured and was able to stand on its own. The same applies to an information society. For quite a long time the information technologies have been used to make industrial processes and production more efficient and flexible. But now something new is starting to emerge as information and communication technologies are increasingly used to refine information and data into meaning.

## DIY city – people empowerment

Social media empowers citizens themselves to plan and redesign the existing urban fabric. Some urban planning authors such as Jane Jacobs (1961) argue strongly that urban places are built up over time by an infinity of small acts. Spontaneous order of creating city space is rising from below. Citizens are also encouraged to create urban space by getting out there on locations and finding ways to collect and visualise urban data. Citizen movements use a lot of tagging infrastructure (for example) when inviting people to get to know the neighbourhoods (pedestrian and cyclist paths etc.).



Figure 6. Citizens feeling the sense of places and DIY urban spaces (photos by Sirkka Heinonen during Helsinki Design Week in 2012 with the theme “co-creation”).

Creatively sustainable cities will emerge if the collective creativity of all stakeholders is used – that of planners, authorities, companies, artists, scientists, and citizens – to increase the sustainability of cities. Crowdsourcing is one way for finding and experimenting with creative and innovative ideas to make cities more sustainable. An example of one creative idea is “talking garbage bins” in parks, where you hear poems, aphorisms and songs when picking up some random rubbish from the street and putting it into the bin.

Globalisation has triggered decentralisation and re-localisation as a counter-reaction to globalisation. People get power from a sense of belonging – from connection to places where they can also have an impact on urban scenery and activities. This article claims that the trend of DIY can be interpreted to refer to a “do-the city-yourself” logic, as well as to a “do-the futures-yourself” objective that is explicit in futures studies. Amara (1981, 25) already set this proactive tone by pointing out that “future outcomes can be influenced by individual choices”.

## Transformation into Resilient Post-Carbon Cities in Neo-Growth Economy

### Transformational Dimension

**Core question:** How can cities provide inspiration and building blocks for the new narrative of transformation?

**Imperative:** New narrative for urban wellbeing in neo-growth economy

Futures studies are about proactivity and the determination to affect and create futures. When combined with the aim of participatory approaches that are typical in futures research and foresight exercises, a new logic emerges. It is based on questioning the current practices, on bearing in mind the compelling global challenges, as well as on working towards a common goal in collaborative settings (see Table 1).

The next session discusses such a goal and prerequisites for attaining it with relation to the future of cities. Are we at the tipping point leaning heavily towards post-carbon cities and at the same time seeking a new economy? In 2050 cities will need to meet the needs of future citizens with 1/10th of the carbon we generate today (Webb et al., 2011). With hyper-urbanisation proceeding and numerous new cities currently under construction, it will be of crucial importance to develop them with a much lower reliance on fossil fuel. Therefore, Post-Carbon Life, as a topic that is taken seriously is already on the agenda of some nations (e.g. Japan, Korea, Finland).<sup>20</sup>

Questions are beginning to arise over whether high-density megacities are the right solution, given the significant emissions that result from moving people, goods, food and water across such large settlements (Head & Singleton, 2011). Instead, the development of a network of decentralised mixed-use settlements, or “clusters” connected by high speed public transport and broadband communications, may be a more sustainable solution. With access to areas of intensive agriculture and natural systems, this decentralised model allows for the recycling of nutrients and water, as well as greater use of local materials. Certain clusters or decentralised urban nodes may eventually evolve into centres which offer specialised commercial and social facilities, for example high-tech healthcare and education. Information and communication technologies would minimise in decentralised nodes the need to travel, thus reducing carbon emissions. (Head & Singleton, 2011).

### **Suburbs and garden cities as nodes in the decentralised urban fabric**

Consequently, the question of suburbs might provide an answer here. Suburbs are often loaded with a variety of problematic issues such as failing economy, lacking services, or unaesthetic milieus. However, the suburbs could indeed create resilient rescue to urban pressures. The old concept of Ebenezer Howard’s (1902) Garden City could also be revived for this end. Suburbs and garden cities could accommodate urban spill as resilient havens, meeting both the challenges from the environmental point of view, as well as from the human capital aspect.

For example, in the Helsinki Metropolitan Region, the existing Finnish suburbs constitute a major part of the built environment. The research project Resilient Suburb<sup>21</sup> tackles the question of how to increase the life span of residential areas and their “spatial capital” by adding to the versatility of these areas. The aim is to explore how infill building, development and new building actions can strengthen the capacity of suburbs to adapt to future changes and increase the utility value of these areas. Holmgren (2009) also draws attention to suburbs and local mixed-use neighbourhoods in energy descent futures, e.g. where the role of permaculture becomes accentuated.

The starting point is the resilience of housing stock and user applicability. The aim is also to increase the involvement of third sector actors – thus emphasising do-

it-yourself (DIY) and bottom-up approaches. The project scrutinises specific suburbs from the viewpoints of local actors and their use of urban space, the life span of housing areas, and flexible availability of spaces. The results can be put to use in planning residential areas, in developing new housing concepts and in developing new service models. The versatility of residential areas and spaces as well as the active roles of users will create new possibilities both for firms and municipalities. This project has conducted several Futures Cliniques<sup>22</sup> where suburban futures are being explored for making a city a creative place where the citizens are generators of ideas, services, new practices and solutions. The results list as important urban futures factors the following: 1) the environment and the living of meaningful experiences; 2) local democracy and grass-roots, bottom-up approaches, and 3) new uses of suburbs and hybrid spaces combining different functions.<sup>23</sup>

### **The principles of Neo-Growth in the preferred future of Post-Carbon cities**

The new paradigm of urban design and urbanisation requires a new economic model where resilience, the efficient use of energy and other resources, as well as post-carbon practices are core. On one hand, in developing countries the emphasis will be on building new cities based on renewables and post-carbon modelling. On the other hand, in industrialised countries the focus must be put on retrofitting already existing cities along post-carbon trajectories.

Future Post-Carbon Cities could follow the principles of Neo-Growth. People have developed economics. Since the current paradigm of economics is no longer viable (as the financial crises have shown us), a new model is needed. Moreover, the present economic model is no longer viable, since it is based on continuous growth and we cannot have continued material growth on a finite planet.<sup>24</sup>

People can make a new model only if they adopt a new mindset. In the Neo-Growth model growth is no longer focused on products and services that are energy-intensive and generate waste and pollution. Growth will be based on the production of innovative and often immaterial products and services that add to human well-being and people's search for meaning. Neo-Growth feeds "spatial capital" with a big "digital handprint"<sup>25</sup>, while minimising ecological footprint.

Neo-Growth is a new concept sketched tentatively by Professor Pentti Malaska (2010). He defined Neo-Growth as economic growth without increasing environmental stress and without decreasing welfare in society. Neo-growth can be perceived as a kind of a positive version of de-growth<sup>26</sup>, as it retains the positive meanings and connotations of growth, but fundamentally defines growth anew. A neo-growth society bases its growth on sustainable technologies and processes, but also builds on new sources of growth, such as immaterial products and prosumerism<sup>27</sup> (producer + consumer).

If this vision gets systematic support, Neo-Growth will transfer the old carbon society structures and processes into the post-carbon paradigm. In this transformation new jobs and opportunities will arise when solutions are being sought and provided to create resilient post-carbon cities. For example, intensive food production and vertical farming is being planned for cities. This requires new competencies and skills. An old site for oil refineries can be turned into a residential area. This requires, for example, a lot of soil cleaning. Kruunuvuorenranta is a residential neighbourhood in Eastern Helsinki that is being built for 10 000 citizens, located on a coastline with a beautiful sea scenery. One of the oil tanks was

preserved as a historical landmark and piece of environmental art and a meeting place. What was needed, was political will based on a vision of a post-carbon city.

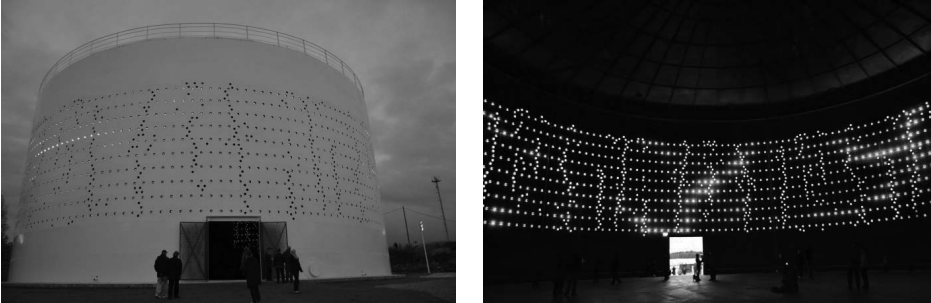


Figure 7. Post-carbon cities abandon or convert the previous oil production infrastructures (photos by Sirkka Heinonen).

### Post-Carbon cities in Neo-Growth economy as a New Narrative

The World in multi-crisis needs a new story. According to the cultural historian and ecotheologian Thomas Berry (1978, 1) "It's all a question of story. We are in trouble just now because we do not have a good story. We are in between stories." This advocate of deep ecology further claimed: "The old story, the account of how the world came to be and how we fit into it, is no longer effective. Yet we have not learned the new story." (Ibid.)

According to our hypothesis in the research project "Resilient Suburb", the new urban narrative is based on the emergence of a meanings driven society where people seek for meanings in everyday activities – housing, work, leisure, hobbies, transport, socialising, sharing, and relationship to nature. The new narrative also places humans inside nature, even within cities, instead of humans manifesting themselves as exploitative outsiders or observers. It is equally important to scrutinise our relation to technology – here attention should be paid whether the interaction between humans and technology in cities promotes both the quality of the environment and the wellbeing of humans (Heinonen, 2000).

In the creation of new kind of well-being, the living environment, its uses, spaces and social relations are pivotal. We need open urban spaces which are based on the activity of citizens, offer space and opportunities for creative ideas and activity, and open up possibilities for new kinds of (prosumeristic) production. Wellbeing springs more and more from self-expression, identity building, and grass-roots activity. These private elements are increasingly utilised in the sphere of work and economy. Crowdsourcing or the movement emphasising the wisdom of crowds (Surowiecki, 2004) will become normal in addressing future challenges in the development of urban areas, and in seeking for solutions and alternative trajectories. Elitist or authoritarian decision-making will yield to grassroot participation and collaborative ideation in creating livable environments. Surowiecki (2004, 11) even claims that when it comes to decision-making, average can be excellent (instead of mediocre) and that it seems as if we have been programmed to be collectively smart.

A new narrative and paradigm is likely to emerge for the new millennium. The key research question is: What kind of a new paradigm would ensure human survival and a more balanced distribution of welfare among humans and cultures. Our hypothesis<sup>28</sup> is that the relationship and interaction between humans, nature and

technology is crucial in producing a new paradigm of economics and technology. It will also play a necessary role in shaping global consciousness of the preferred image of humankind, adopted by many different cultures. We want to examine how the role of nature has shifted from that of a reservoir of natural resources to be exploited in the industrial age to that of a collective partner to humans in the new narrative where meanings matter.

### **Eco-Aesthetics in Meanings Society-on the role and meaning of aesthetics**

Architecture should be evaluated according to how people feel when they are using a certain space. This criterion takes into account architecture's functional as well as aesthetic aspects. The functional aspect is quite clear: people do not experience a place as cozy when a bright light shines straight into their eyes or when the temperature is too hot or cold in relation to the practical purpose of the space (Corbett & Corbett, 2005).

People support the use of land for aesthetic and leisure purposes at least as keenly as for conservation. Aesthetic landscapes catch the eye; people are intrigued by nature. As the relationship deepens, preoccupation transforms into devotion. The aesthetic appreciation of nature can thus lead to its ecological, evolutionary and anthropogenic valuation, which in turn can motivate an ecologically sustainable and ethical use of land (Hull, 2006). How can urban space embed and imbue such aesthetic experiences? The planner should be able to arrange the space in such a way that dwelling in it or viewing it arouses desired emotions, meanings and moods, the way a poet must be able to arrange his or her words so that a desired feeling or understanding is awakened in the hearer's or reader's mind. Corbett & Corbett (2005) depict how the task of a planner differs from that of the poet only in that those elements which the planner works with must also fulfill physical and concrete functions – contrary to poet's words on a paper. Design plans must integrate space and emotions with resilience and functionality. Thus urban space will contribute to citizens' construction of meanings.

To conclude, elements to be included in the new narrative for meaningful lives in post-carbon cities are manifold, but the key idea is to address both technical and non-technical issues and solutions. The socio-cultural implications of developing and applying technology are at the core of technology assessment, but they should also be proactively pivotal in technology foresight when exploring the full potential of, for example, digitalisation. Globally, when a large percentage of the population is still without ICT connectivity, social challenges and risks of disparity are great. Moreover, the question remains how to tackle the adaptive change. How are people going to be able to adapt to the massive technological and societal challenges proposed above as drivers for disruptive developments and eventual transition into a post-carbon, people empowered prosumeristic paradigm? A necessary prerequisite for this kind of adaptation is the will of economic and political powers to acknowledge the need for change and quickly take actions accordingly. This stand is by no means automatic. Instead it requires visionary and responsible decision-making by all stakeholders. Otherwise the transition will proceed through to chaos and conflicts.

The new narrative emerges from a deeper relationship to cities which satisfy sustainably both material basic needs and non-material needs, and also create rich cultural meaning. The new narrative for post-oil cities establishes –as a coherent agenda –self-sufficiency, smart resilience, low-carbon goals, renewable energy, easy mass transit and routing for pedestrians and cyclists, green infrastructure expansion (e.g. nature urbanism and vertical farming), diversification in buildings, social welfare, citizen empowerment, creative prosumerism, and slow regenerating lifestyle. These are all at the same time necessary ingredients for the urban philosophy of “good cities”.

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## Notes

- 1 Retrieved December 10, 2012, from <http://en.wikipedia.org/wiki/City>.
- 2 The terms conurbation, metropolis and metropex are also applied to the concept of megacity. The terms “megapolis” and megalopolis are sometimes used synonymously with megacity, though those terms denote a semi-continuous chain of large metropolitan cities. Retrieved December 10, 2012, from <http://en.wikipedia.org/wiki/Megacity>.
- 3 Businessman and author John Naisbitt popularised the term in his bestseller book *Megatrends* (1982), referring to societal and economic drivers of change such as globalisation, the rise of the information society, and the move from hierarchical organisations to networks.
- 4 <http://www.millennium-project.org/millennium/challeng.html>.
- 5 The MP 15 Global Challenges is cited to be the best introduction to the key issues of the early 21st century (Michael Marien, former editor of *Future Survey*, <http://www.millennium-project.org/millennium/challenges.html>).
- 6 However, Randers (2012, 170) points out that per capita greenhouse gas emissions are lower for megacity dwellers than for people living in the periphery, because of the reduced need for travel. He also finds it cheaper per person to defend one megacity against extreme weather conditions than to protect many individual settlements spread throughout the countryside.
- 7 BRICS = Brazil, Russia, India, China and South Africa.
- 8 More information available at [cnngo.com](http://cnngo.com).
- 9 The urge for similar megaconstruction is expressed by a counter perspective: building plans for “earth scrapers”. Mexico City has proposed to build an inverted 65 storey pyramid, reaching as deep as 300 metres below the city’s main plaza (Cressey, 2013)
- 10 The dichotomy of living vs. non-living is characteristic of western duality, with notable exceptions such as Stoic philosophy (Heinonen 2000). Ecosystems thinking breaks out of this approach and emphasises the balanced whole.
- 11 Cradle-to-cradle model is a contrast to the old cradle-to-grave model, dating from the Industrial Revolution and its manufacturing mode where 90% of the materials (many of them toxic) are cast off in the process.
- 12 Their theories originated in France and were most popular during the second half of the 18th century. Physiocracy is perhaps the first well-developed theory of economics.
- 13 The design principles of permaculture derive from the science of systems ecology and

- study of pre-industrial examples of sustainable land use. The key concept of permaculture is maximising beneficial connections between components and synergy within designs. One of the main principles of permaculture is “Produce no waste”. In this sense it is very close to the cradle-to-cradle approach. See . Mollison 1988.
- 14 Retrieved May 5, 2013, from [http://en.wikipedia.org/wiki/Transition\\_Towns](http://en.wikipedia.org/wiki/Transition_Towns).
  - 15 Centres of different sizes and shaped areas offer space for plants, animal populations, humans and different ecological processes. Links are connections binding the different parts of the system together. They are significant in maintaining important ecological processes and bio-diversity. The objects of green infrastructure are smaller than centres, but they also support important ecological and social values. (Benedict & MacMahon, 2006).
  - 16 The city as a whole was originally intended to be completed by 2016 but that date has now been postponed to 2025.
  - 17 This may at the moment be only a weak signal of emerging interest in post-oil society among oil-producing countries. However, a growing number several efforts can be seen. For example, Azerbaijan explored post-oil perspectives in a Futures Forum organized in June 2013 by the Node of the Millennium Project.
  - 18 Digitalisation or the use of ICT is by no means sustainable as such. First, technology itself needs to be more developed towards sustainability, and second, more applications of ICT need to be focused on promoting sustainability.
  - 19 These terms smart city, intelligent city, and digital city are sometimes used vaguely or carelessly as synonyms.
  - 20 The Low Carbon Asia Research project published a “Ten Actions Towards A Low Carbon Asia” report in 2012. Available at: [http://2050.nies.go.jp/file/ten\\_actions.pdf](http://2050.nies.go.jp/file/ten_actions.pdf), accessed 10<sup>th</sup> April 2013. The Finnish Government prepared its foresight report to Parliament on Long-term Climate and Energy Policy: Leading the way towards a low-carbon Finland. Published in 2009, available at: <http://vnk.fi/julkaisut/listaus/julkaisu/fi.jsp?oid=273275>, accessed 10<sup>th</sup> October, 2012.
  - 21 More information on the research project “Resilient Suburbs – Building sustainable homes and neighbourhoods for the future” available at: <http://eloisa.urba.fi/english>.
  - 22 The concept and implementation of Futures Cliniques is presented in Heinonen & Ruotsalainen, 2013.
  - 23 The results are published in a report in Finnish with an English abstract: Heinonen, Sirkka & Ruotsalainen, Juho (2012) People’s City 2030. “Opportunity”. The second Futures Clinique of the project Resilient Suburbs, 16.4.2012. FFRC eBooks 7/2012. Finland Futures Research Centre, University of Turku. 51. p. ISBN 978-952-249-144-2. Available at: [http://www.utu.fi/fi/yksikot/ffrc/julkaisut/e-tutu/Documents/eTutu\\_2012-7.pdf](http://www.utu.fi/fi/yksikot/ffrc/julkaisut/e-tutu/Documents/eTutu_2012-7.pdf)
  - 24 The Club of Rome report “Limits to Growth” by Meadows et al. in 1972 brought this notion into public debate but the message was largely neglected. Randers (2012) advocates the urgency of limits to growth thinking in his newest report.
  - 25 The concept of “digital handprint” refers to the potential of digitalisation to help reduce ecological footprint. The metaphor of handprint means that you take action and use energy-efficient or otherwise environmentally benign digital applications in society.
  - 26 Degrowth is a political and socio-economic movement based on ecological economics, anti-consumerist and anti-capitalist ideas. Degrowth movement advocates for the downscaling of production and consumption, arguing that overconsumption lies at the root of environmental issues and social inequalities. (Wikipedia). Retrieved April 10, 2013, from <http://en.wikipedia.org/wiki/De-growth>. A related concept is zero growth which emphasises a state of equilibrium in all economic activities and policies. This theory maintains steady state economics and claims that the continuous growth model is inherently unstable resulting in a “boom/bust” cycle. Zero growth theory sees that continuous growth in the context of finite resources is unlikely to support current levels of prosperity indefinitely. (Wikipedia). Retrieved April 10, 2013, from [http://en.wikipedia.org/wiki/Zero\\_growth](http://en.wikipedia.org/wiki/Zero_growth). All these three



concepts: neo-growth, degrowth and zero growth aim at deconstructing the ancient, but still vigorous myth of progress and the goal of continuous growth.

- 27 Unfortunately Pentti Malaska did not have a chance to finalise his work on the neo-growth concept, which now remains as an important challenge for his futurist colleagues to elaborate on.
- 28 "Our" and "we" refers to the Research Group of Media and Communications (FMC) at Finland Futures Research Centre (FFRC), University of Turku (<https://sites.google.com/site/futuremediac/home>).

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