

# A Future for Gulf Cities

A report for an international expert meeting co-hosted  
by the Al Habtoor Group, Dubai September 2012

Prof. Herbert Girardet

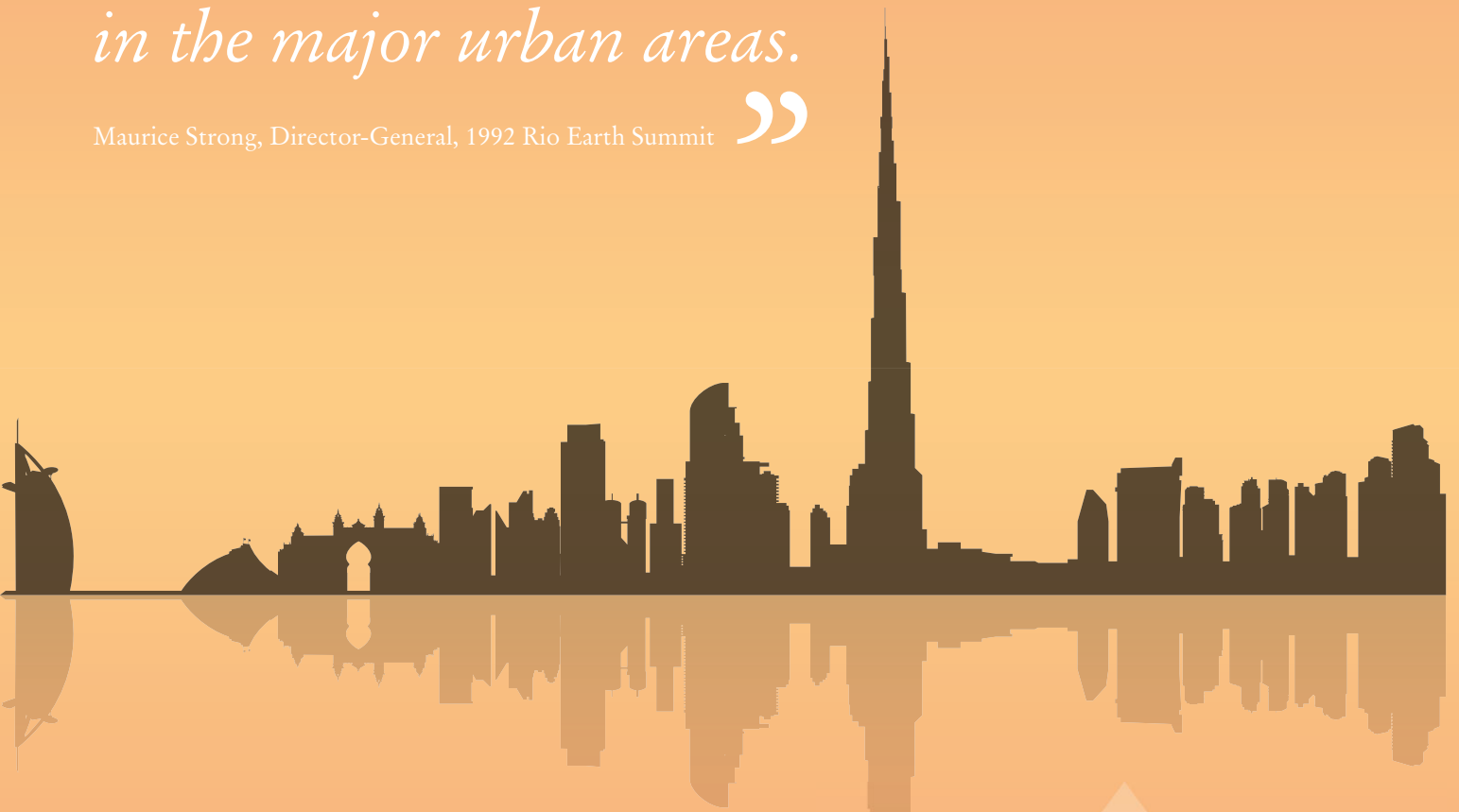


“

*The battle to ensure that our planet remains a hospitable and sustainable home for the human species will be won or lost in the major urban areas.*

Maurice Strong, Director-General, 1992 Rio Earth Summit

”



## Contents

<b>1. Doing what is necessary</b>	<b>4</b>
Foreword by Jakob von Uexküll, Founder of the World Future Council	
<b>2. Looking to the future</b>	<b>7</b>
Report by Prof. Herbert Girardet co-founder of the World Future Council	
a. Executive summary	7
b. An urban future ?	9
c. The purpose of urban planning in the Gulf	11
d. Regenerative Cities and the urban metabolism	11
e. Water and waste water	13
f. The threat of nutrient loss	13
g. Low-carbon urban design and electrical mobility	14
h. Renewable energy and the green economy	14
i. The Adelaide experience	16
j. The governance challenge	18



## Doing what is necessary



There is no better place to discuss the future for Gulf cities than in Dubai. This city shows us both what can be done and what must be done. Its growth from a small trading port on the edge of the desert to a global city in just a few decades shows the power of visionary leadership. This gives us hope that this city can, in the coming decades, mobilise the same vision and energy to regenerate itself into a pioneering post-modern city, using its resources and ingenuity to show how to win the coming battle for sustainability to which Maurice Strong refers.

Critics will dismiss this as absurd. They see Dubai as a prime example of an unsustainable urban development model. But Dubai still represents the dream of modernity of the majority of the world's population – as anyone who has travelled in rural Asia can confirm. Those who believe that Dubai cannot become part of a sustainable future remind me of the joke about the man asking for directions, only to be told, “Well, I would not start from here.”

Dubai is here! But far too many of those who understand the huge challenges we face prefer to dream of a global future of small-scale communities. No doubt these will multiply, but they will not attract the global majority.

As Prof. Girardet's paper shows, the challenges of “future-proofing” Dubai into a sustainable - or indeed, a regenerative - city are huge but not impossible. Imperial capitals like London or Vienna once needed empires to sustain them. But when their empires disappeared, they re-invented themselves. Dubai grew up on oil but now has many other sources of income.

The industrial revolution polluted cities but these eventually passed laws to clean their air and water. Technological innovations and entrepreneurial initiatives are vital but the key to unleashing them is leadership and legislation. That is why the World Future Council works to identify and help spread best policies, regulations and institutions. Laws do not move the heart, said Martin Luther King, but they restrain the heartless – and those imprisoned by short-term thinking and fearful of change.

Wealth and civilisations come and go. Over a thousand years ago the Abbasid Caliphate in Arabia, based in Baghdad, was many times wealthier than Europe. Today we face a more fundamental challenge. If we do not succeed in limiting and reversing climate change in the coming years (not decades!), we risk not only everything our civilisation has achieved and still hopes to achieve; we risk everything every civilisation has ever achieved. We risk making Planet Earth “uninhabitable like Venus” within this century, to quote one of the foremost experts in this field, Lord Giddens, author of “The Politics of Climate Change.” The Geography Schoolbook of my 16-year-old son predicts temperature increases of 5 degrees Celsius if we do not change course rapidly – enough to ensure unprecedented global disaster.

As you may know the UAE government had the courage and vision to sign the 2009 Copenhagen Climate Accord. The first paragraph states: “We agree that deep cuts in global emissions are required... so as to hold the increase in global temperatures below two degrees Celsius.” Some fear this amount is already too high to protect parts of Africa and many island states. But it is a huge commitment, considering that even Fatih Birol, Chief Economist of the International Energy Agency recently warned that the new climate data “provides further evidence that the door to a two-degree trajectory is about to close... The trend is perfectly in line with temperature increases of six degrees.”

Our current emissions and ecological footprint threaten the very lives and livelihoods of our grandchildren. There can be no “human right” to demand what our Earth cannot supply. No government can abolish natural laws, nor can they negotiate debt forgiveness or “rescue packages” with spreading deserts or melting glaciers!

This is better understood in Asia than in the “West”. Recently Chandran Nair, who advises the Chinese government, wrote in a leading UAE newspaper that “there is no human right to own a car”. I asked him what reaction he received to this statement in the USA. “They told me that I was a Taliban.”

But there can be no human development on an uninhabitable planet. We now need what has been called “ecocracy”, i.e. leadership which ensures that the public debate and expectations face a “reality check”. For true leadership first of all requires the truth: we have lived at the expense of nature and future generations and these bills are now coming due. We are not as rich as we thought, for much of our “wealth” represents claims on planetary resources which either do not exist or cannot be used without causing irreversible damage to the natural environment on which we all depend. The value of many current “investments” is based on expectations of future capital flows which the Earth can no longer deliver.

We therefore need legal frameworks which ensure that we maximise – and cap – the efficient use of resources. The belief that China and India can reach current US or European per capita resource use levels is, to quote Chandran Nair, a fantasy. We need financial incentives which promote a different human development model in taxing human labour less and scarce resources more. It is not military or financial risks but rather environmental collapse which is now by far the greatest security challenge facing us!

What does this mean for cities? First, as the great Egyptian architect Hassan Fathy reminded us, true modernisation builds on and adapts local and regional traditional knowledge. Also, as humans are fallible, it is better that the mistakes we make are small; we must ensure that cities maximise resilience by introducing policies which support the revival of “transition” neighbourhoods with the autonomy and power to compete in developing sustainable ways of life. Even New York is still in many ways a city of villages, as is Hong Kong. We also need to reduce the waste in time and pollution from vehicle congestion through integrated traffic systems and financial incentives.

The much-quoted economic bottom line is always the sum of what we include or omit from the top lines. Current calculations often omit future costs, which are now rushing backwards to hit us. “Modern” economists also like to discount the future as they assume we will be richer then and better able to pay for accumulated “externalised” costs. But this is a dangerous fallacy based on their ideological assumption that “wealth” of any meaningful kind can and will continue to grow on a depleted planet. If food production collapses due to climate chaos, increasing the production of computers and financial derivatives may continue for a while to generate GDP – until the workers collapse from hunger or leave their jobs to fight each other for ever scarcer resources.

Also, current energy cost-benefit analyses omit the huge daily costs of not maximising the use of renewable energy resources, but instead continuing to burn valuable fossil fuel raw materials with alternative uses, e.g. for petrochemicals. This massive daily destruction and waste of natural capital appears nowhere in their calculations and the WFC is the first organisation to calculate it.

It is well-known how dependent large modern cities are on vast and intricate systems of daily just-in-time deliveries. While I trust this report will help identify and develop policies to overcome and mitigate urban challenges in areas such as energy, transport and logistics, infrastructure and building, we will also need to focus on adaptive policies to reduce the vulnerability to sudden supply disruptions, massive environmental refugee flows, etc.

What plans exist? What can Dubai learn from other cities and what can we learn from Dubai and other Gulf cities in this field?

In conclusion, we need to remember that, when we decide how to regenerate our cities, and to create regenerative urban systems, we are deciding what kind of society we want to live in and be proud to hand over to our children. Do we continue building a world of growing distrust and conflict in constant fear of reaching irreversible tipping-points, or do we work together to develop, promote and implement coherent policy frameworks, locally, nationally and internationally, which can ensure that we build a future which will make our grandchildren look on us with pride? Do we want them to see us as selfish criminals who have caused irreversible damage to our shared home?

Faced with this challenge, it is not enough to say that we are doing our best. We have to do what is necessary!

*Jakob von Uexküll, Founder of the World Future Council*





# Looking to the Future

*Herbert Girardet, co-founder World Future Council*



## Executive summary

Urban growth has come to define the landscape of the Arabian Peninsula, with half a dozen major cities that have sprung up over the last fifty years. Yet a century ago, the region was sparsely populated and consisted of several sheikhdoms that controlled vast – mainly desert – land areas, including several oases. Most settlements were concentrated on the coast.

Doha, Kuwait, Manama, Muscat, Dubai and Abu Dhabi were small fishing and pearling settlements with well-established trade connections beyond the region. Camel caravans brought trade goods such as incense, gold and precious stones across the desert. Carpets and leather goods also contributed to trade. But economic development and population growth in the Gulf Peninsula were severely limited by the region's harsh environment, with lack of fresh water and land suitable for cultivation as the primary limiting factors.

Until the 1930s, the pearl industry was a major economic activity of the Gulf Region. But when Japan started to flood the world market with cultured pearls, the Gulf's pearl industry collapsed.<sup>1</sup> However, when oil was discovered below the desert sand everything started to change. In remote locations oil pump jacks started to dot the desert landscape, and new pipelines started to fuel the rapid growth of the Gulf's coastal cities and their economies.

The Arabian Peninsula, or Arabian Gulf Region, is the world's largest peninsula and covers 3,250,000 square kilometres. The huge oil and gas revenues are at the heart of the region's prosperity, and many people have become wealthy without too much effort or risk. Today its population, including residents and migrant workers, numbers around 80 million, and over 80 per cent live in large modern cities.

On the Arabian Peninsula per capita use of fossil fuels – and greenhouse gas emissions – are among the highest in the world. But there is growing concern about the finite nature of oil and gas supplies and the limited availability of water. Meanwhile the effects of rising temperatures due to climate change are increasingly being felt across the region. In the cities the large surface areas covered in concrete and tarmac are further contributing to a significant "heat island effect", demanding ever greater reliance on air conditioning.

It is becoming increasingly apparent that the ever rising expectations of the local population are set against the gradual depletion of non-renewable oil and gas supplies. Tied into global communication networks young people, in particular, are starting to demand appropriate measures to assure their future existence.<sup>2</sup>

Globally, it is becoming apparent that the design, construction and management of modern cities are overly dependent on fossil fuels.<sup>3</sup> There is a growing understanding of the need for new approaches to urban planning and development. This paper proposes smart, integrated solutions to maximise renewable energy, to make efficient use of energy and water, and to minimise waste and pollution whilst increasing the comfort, health and safety of the population. We suggest that the time has come to conceptualise not just *sustainable* but *regenerative* urban development.

Other regions with similar environmental and climatic conditions to those of the Arabian Peninsula provide some insightful lessons learnt. Adelaide, South Australia has to deal with water scarcity similar to that of the UAE. A package of new policies have resulted in the implementation of ground breaking new sustainability projects and measures in recent years that are of great relevance to the cities in the Gulf region.

<sup>1</sup> [http://en.wikipedia.org/wiki/Arab\\_states\\_of\\_the\\_Persian\\_Gulf](http://en.wikipedia.org/wiki/Arab_states_of_the_Persian_Gulf)

<sup>2</sup> Salih A. El-Arifi, The nature of Urbanisation in the Gulf Countries, *Geojournal* Vol 13, 13, 1986

<sup>3</sup> Speech by UN General Secretary Ban Ki-Moon, 15th January 2012

*Credit: Herbert Girardet/Rick Lawrence. The ecological footprints of modern cities stretch across the world. The challenge now is for cities to become much more nimble footed, with resource efficiency becoming the basis for sustainable local economies.*

#### A GIANT FOOTPRINT

The modern city squanders resources.

It demands huge inputs of energy.  
It gorges itself on meat, requiring huge areas to produce animals feeds.  
It uses timber and paper products with little concern about their forest origins.  
It emits vast amounts of CO<sub>2</sub>, without setting aside land areas to reabsorb it.

#### A NIMBLE FOOTPRINT

The future city uses resources efficiently.

Recycling and reuse is taken for granted.  
Energy comes from renewable sources.  
Its citizens limit their meat consumption, eating vegetable foods for much of their diet.  
Forest products are used frugally & efficiently.  
Tree planting schemes, sometimes in distant locations, absorb its limited CO<sub>2</sub> emissions.



When thinking of the future of cities globally as well as in the Gulf, new comprehensive, integrated approaches to urban governance are needed. These can be described as follows:

- Well-integrated urban planning and management;
- Land-use planning in favour of compact urban form;
- Efficient use of water and reuse of waste water;
- Routine composting and reuse of organic waste;
- Recycling and remanufacturing of all other waste;
- Maximum energy efficiency in buildings;
- Renewable energy production and smart grids;
- Transition to efficient electric transport systems.

It has to be stressed that the impact of policies corresponding with the above mentioned eight areas very much depends on the question of governance. This paper states that cross-departmental thinking and interface capacities between city authorities and the public are important for a successful implementation of policies. Furthermore, national policies and national institutions are the most important catalyst for transforming cities into regenerative systems.



Solar dishes with sterling engines are a technology of major potential for low-density locations, suitable for public spaces within suburbia. Credit: Tessera Solar.



## An urban future ?

The Gulf nations, plus Iran and Iraq, contain the world's largest oil deposits. They have about two-thirds of the world's crude oil and gas reserves and currently produce about a quarter of the world's oil.<sup>4</sup> The huge revenues from oil and gas production in the last 75 years have turned their urban centres into major financial powerhouses.

The Arabian Peninsula, or Gulf Region, is an improbable area for large-scale urban growth, with its need for huge water and food supplies. For time immemorial, water scarcity had severely limited both food production and population growth in the region. Less than one per cent of the land area – the narrow coastal plain and isolated oases – was traditionally used for the sedentary cultivation of grains, vegetables and fruit. On the other hand, nomadic husbandry of camels, goats and sheep was widely practised on the huge, arid zones of the Peninsula.

However, the sea around the Peninsula was and is an important renewable resource: it harbours a great variety of fish and some of the world's largest and most pristine coral reefs.<sup>5</sup> Many of the coastal towns of the Arabian Peninsula also have a long tradition as marine trading centres. But their transformation from small settlements into large, gleaming modern cities follows the discovery of oil in the 1930s. Most of the cities of the region have grown dramatically since and become major ports, oil storage and transport hubs.

The factors contributing to urban growth in the Gulf also need to be seen in a global context. Urbanisation is a seemingly unstoppable worldwide trend. A vast rural-urban migration is currently under way involving hundreds of millions of people. Today, for the first time in history, over half the world's people live in cities, and this figure is expected to rise to 60 per cent or more by 2030.<sup>6</sup> Human numbers grew over fourfold from 1.5 to 7 billion people from 1900 to 2010. But other figures are even more striking. The 20th century was the age of “great acceleration”: world economic output grew 40 times, fossil fuel use 16-fold, fish catches grew 35-fold and water use nine-fold.<sup>7</sup> How can this seemingly infinite growth, which is still accelerating in the 21st century, be accommodated on a finite planet?

Cities are the drivers and the primary manifestation of the great acceleration. They are centres of production and consumption, gobbling up resources and producing wastes. And yet, surprisingly, cities are often cited as *the solution* to the world's quest for sustainable development. How can this be? Can ways be found to create a sustainable or even regenerative relationship between cities and our living planet?

In the rich countries, the consumption patterns of urban and rural populations are very similar. But what about rapidly urbanising developing countries? Studies from China and India have shown that people moving from a village to a city will, typically, increase their resource consumption four-fold.<sup>8</sup> The reason is quite evident: Traditional rural living there relied largely on renewable local resources. Cities, on the other hand, offer much easier access to fossil fuels, enabling consumer lifestyles that are not available to villagers or nomadic herdsman. As hundreds of millions of Asians and Middle Easterners become city dwellers, the consequences for the region and the world as a whole are huge.

The situation in the Arabian Peninsula is particularly striking: the per capita consumption of resources in its new cities is many times greater than that in the past. Of course, Riyadh, Dubai, Doha, Manama or Jeddah were not conceptualised as sustainable cities but rather primarily as service centres for the oil and gas industries and as administrative, transit, trading and cultural centres. The quest for sustainable or regenerative development has only recently emerged as a significant challenge for these very affluent cities.

In the light of these specific developments in Asia and the Middle East, we certainly need to be cautious about claiming that an urban future can be a sustainable future for humanity. And this is just as true for Europe, America and Australia, where over three-quarters of the population already live in cities. We need to be very clear

<sup>4</sup> [http://en.wikipedia.org/wiki/Persian\\_Gulf](http://en.wikipedia.org/wiki/Persian_Gulf)

<sup>5</sup> [http://en.wikipedia.org/wiki/Arabian\\_Peninsula](http://en.wikipedia.org/wiki/Arabian_Peninsula)

<sup>6</sup> United Nations, World Urbanization Prospects, UN, New York 2004

<sup>7</sup> European Environment Commissioner Janez Potocnik:  
<http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/12/248&format=HTML&aged=0&language=EN&guiLanguage=en>

<sup>8</sup> Herbert Girardet, Cities, People Planet, Wiley, 2004

about the consequences of this particular development trajectory. The fact is that cities today are *entropy engines*: they use the bulk of the world's resources and discharge the bulk of the liquid, solid and gaseous wastes, including carbon dioxide, without much concern about the consequences. In the process they degrade energy and resources and thus foreclose options for future generations.

The ever growing ecological footprints of cities are a particular cause for concern. Today they cover much of the face of the earth, directly affecting all its terrestrial and marine ecosystems.<sup>9</sup> If all people on earth lived the lifestyles we lead in European cities, three planets would be needed. Since we only have one planet available to us we had better change the way we live. Can we design and run our cities in better ways? **Only by assuring that cities continuously regenerate the ecosystems and soils from which they draw their resources can we assure a long-term future for an urbanising world.**

## A journey through time

The Arabian Peninsula has an ancient history. Even before Roman times, both the camel caravan routes and the ports along the coast were part of a vast trade network covering most of the known world. Arabian merchants not only transported frankincense and myrrh along the Incense Route, but also spices, gold, ivory, pearls, precious stones and textiles. All of these arrived from Africa, India and the Far East at the ports on the peninsula.<sup>10</sup>

In the towns, architecture and urban design were carefully adapted to local conditions. Houses were arranged so as to best take advantage of prevailing breezes, and they never faced south. Narrow streets and lanes ensured shade, and the houses were comfortable to live in because thick external walls helped to keep the cool in and heat out. Cooling towers harnessed the harsh summer winds and helped to keep rooms at pleasant temperatures. Gypsum, an abundant local resource, was used to reflect the sun's rays outside and thus to help provide comfort inside homes.<sup>11</sup>

The appearance of today's Gulf cities is very different: narrow, shaded pedestrian streets have given way to wide, multi-lane urban motorways where the car is king. Glass, concrete and tarmac are the predominant construction materials. The urban landscape is defined by soaring glass towers, shopping malls, commercial centres and housing estates, as well as religious, educational, cultural and sports centres.

Urban expansion occurs both in desert locations as well as on land reclaimed from the sea. Vast stretches of the shallow Gulf waters that were once marshes have been covered with hotels, villas and office buildings. Huge real-estate companies have taken on the task of creating cities as "commercial projects" rather than as "places for living".

Separation of residential and commercial areas has made car travel an essential feature of daily life. Gulf cities like Riyadh, Jeddah, Dubai, Doha, Manama, Dammam, Abu Dhabi, Muscat and Kuwait City have become synonymous with urban sprawl. They are growing by up to five per cent a year, driven by the wealth created by an insatiable global demand for oil and gas.

To meet labour shortages, large numbers of temporary non-citizen migrants have been brought in from countries like India, Pakistan, the Philippines, Nepal, Somalia and Indonesia. Large numbers of Palestinians also work in the region. The percentage of non-national residents varies enormously: in Saudi Arabia they add up to 20 per cent, and in the United Arab Emirates to 89 per cent of the population.<sup>12</sup>

The shape of things to come may be seen in Dubai. With its reduced reliance on oil, it may be showing new directions to the other major cities of the Peninsula, but sustainability has barely begun to feature. Although Dubai's economy grew on the back of the oil industry, revenue from petroleum and natural gas now accounts for less than six per cent of the emirate's gross domestic product. The service sector, dominated by financial, IT, insurance and technical institutions, has come to define Dubai's economy. The city has also become an

<sup>9</sup> The Global Footprint Network, [www.footprintnetwork.org](http://www.footprintnetwork.org)

<sup>10</sup> [www.metmuseum.org/toah/hd/ince/hd\\_ince.htm](http://www.metmuseum.org/toah/hd/ince/hd_ince.htm)

<sup>11</sup> Leon Kaye, *Arabian Architecture: Green Building's Foundation in Doha and the Middle East*, Triple Pundit, 23rd February 2012

<sup>12</sup> [http://en.wikipedia.org/wiki/Arabian\\_Peninsula](http://en.wikipedia.org/wiki/Arabian_Peninsula)

important tourist destination and has built a major airport hub, and marine port: Jebel Ali port, constructed in the 1970s, is the world's largest man-made harbour.<sup>13</sup>

## Whatever next?

The purpose of urban planning in the Gulf seems to be to create cities that mimic well-established global centres such as New York, Hong Kong or Singapore, and with similar functions, but these models of urban design are increasingly regarded as unsuitable for the climatic conditions of the region. Wide, unshaded roads are contributing to local temperature increases that have to be countered by inordinate use of air conditioning, particularly in badly insulated glass towers. Climate change and the urban heat island effect combined are causing temperatures in the summer months to rise as high as 50°C.

The cities of the Gulf region were not built with the ambition of being sustainable cities. In fact, being located in a region with limited carrying capacity, they are probably some of the world's least sustainable places. According to 2008 World Bank figures, Qatar has by far the highest CO<sub>2</sub> emissions of any country, at a total of 49.1 metric tons per person per year. Kuwait, with 30.1 tons, is second highest, closely followed by the United Arab Emirates with 25.5 and Bahrain with 21.3 tons, Oman with 17.3 and Saudi Arabia with 16.6 tons.<sup>14</sup>

In its latest Living Planet Report the World Wildlife Fund has ranked Qatar as the country with the largest ecological footprint per capita. Kuwait and the United Arab Emirates also have an ecological footprint far exceeding that of other countries. If every human being on earth lived like the average Qatari, humanity would effectively need five planets.<sup>15</sup>

Not surprisingly, the region's rapid urban growth and its attendant environmental impacts have recently been the focus of much concern among urban planners and researchers. The key challenge is to reach a proper balance between urban growth and environmental protection. New approaches to urban growth management would seem to be crucial in cities in the Arabian Peninsula. The local political leadership is only just starting to grapple with these issues.

**It would seem that the primary challenge in the Gulf today is to find ways of retrofitting existing urban infrastructure: individual buildings, transport systems, and energy, water and waste management could be dramatically improved in line with global best practice. A significant possibility inherent in all this is to use urban retrofit as an opportunity to build a vibrant new, green economy for the region, particularly for the large population of young people who are eager to create viable livelihoods for themselves.**

## Regenerative Cities and the urban metabolism

As cities become the predominant human habitat, urban development needs to undergo a profound paradigm shift. This means first and foremost that ways must be found for cities to minimise their systemic dependence on fossil fuels and their inefficient, unsustainable use of resources. The ecological, economic and social *externalities* of our urban systems, in particular, need to be assessed and addressed in new ways. A rapid move towards making our cities much more energy efficient and powering them with renewable energy is crucially important, but we need to go beyond that: huge efforts must be made to enable cities to develop regenerative relationships with the world's ecosystems.

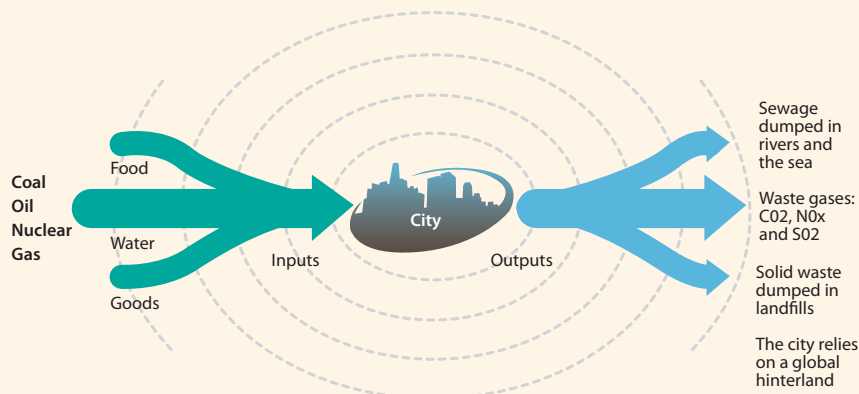
The primary metaphor of relevance here is the “**metabolism of cities**”. The metabolism of modern cities is essentially linear - resources flow through the urban system regardless of their origin or the final destination of wastes. This is very different from nature's circular metabolism, where the waste generated by one organism serves as a useful resource for others. In contrast, modern urban systems externalise their wastes in ways which damage the health and well-being of ecosystems locally, regionally, and globally. In a predominantly urban world, cities will need to adopt circular metabolic systems to assure their own viability as well as that of the rural environments and ecosystems on whose viability they ultimately depend.

<sup>13</sup> [http://en.wikipedia.org/wiki/Economy\\_of\\_Dubai](http://en.wikipedia.org/wiki/Economy_of_Dubai)

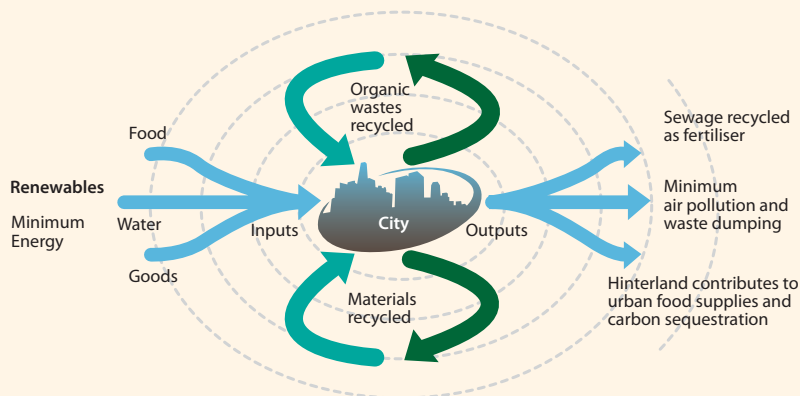
<sup>14</sup> <http://data.worldbank.org/indicator/EN.ATM.CO2E.PC>

<sup>15</sup> <http://alifarabia.com/.../qatar-kuwait-uaes-ecological-footprint>

**LINEAR METABOLISM: CITY USES VAST AMOUNTS OF RESOURCES AND DISCHARGES HUGE QUANTITIES OF POLLUTION AND WASTES.**



**CIRCULAR METABOLISM: CITY MAXIMISES RESOURCE EFFICIENCY AND RENEWABLE ENERGY, AND MINIMISES POLLUTION AND WASTES.**



A key component of the regenerative city is a 'circular metabolism' which assures the most efficient possible uses of resources.  
Credit: Herbert Girardet/Rick Lawrence.

We argue for the need to go beyond the well-established concept of sustainable development because, unfortunately, it has become quite meaningless in the last 20 years. Cities need to find ways not just to sustain the ecosystems on which they depend but to help *regenerate* them.

The transition from a fossil fuel dependent society to a low carbon eco-society needs to take place in all regions across the world, including the Gulf region. Whilst there are numerous entry points to pursuing this transition, we would submit that the outcome has to be none other than the *regenerative city*.<sup>16</sup> Such a city will need to minimise its ecological footprint and produce a substantial proportion of its resources, including renewable energy, from its own territory and its immediate hinterland.

For regenerative cities to become reality, urban development will need to undergo a profound paradigm change. The regenerative city assures highly efficient use of resources whilst continually regenerating the ecosystems on which its long term well-being

ultimately depends. In the face of planetary limits it would appear to be the only plausible option for an urbanising world. We urgently need to develop the policies and practical strategies to implement it.

The solutions we propose include:

- Well-integrated urban planning and management;
- Land-use planning in favour of compact urban form;
- Efficient use of water and reuse of waste water;
- Routine composting and reuse of organic waste;
- Recycling and remanufacturing of all other waste;
- Maximum energy efficiency in buildings;
- Renewable energy production and smart grids;
- Transition to efficient electric transport systems.

<sup>16</sup> Herbert Girardet, *Regenerative Cities*, World Future Council, 2010

## Water and waste water

The Gulf region has a major systemic problem: water, which underpins urban existence and urban food supplies, is very scarce indeed. The large new cities in the Gulf can only exist because this problem has been temporarily dealt with by modern, technical means. Most food is imported and two thirds of the water is supplied by oil powered desalination plants erected along the Gulf coast. Water use, at around 300 litres per person, is among the highest in the world. Of this, 70 litres are used to flush toilets, 150 litres for washing and cleaning, and up to 50 litres for landscaping and gardening.<sup>17 18</sup>

The international consultancy Booz and Company has reported that Saudi Arabia and the United Arab Emirates use more water per capita than the global average and that Gulf residents largely disregard the consequences of their water usage. Saudi Arabia was found to consume 91 per cent more than the global average of water consumption, while the UAE consumed 83 per cent more – about six times more than that used in the UK. The 22 Arab countries account for 6.3 per cent of the world's population, but only 1.4 per cent of its fresh water supplies. Desalinated water costs around \$1 per cubic meter to produce and consumes eight times more energy than groundwater projects. Desalination of seawater accounts for up to 20 per cent of the region's total energy consumption.<sup>19</sup>

The UAE, Qatar, Bahrain, Saudi Arabia, Kuwait and Iran have 120 desalination plants between them. They use huge amounts of fossil fuel energy, and flush nearly 24 tons of chlorine, 65 tons of chemicals used to descale pipes, and around 300 kg of copper into the Persian Gulf every day.<sup>20</sup>

Desalination is highly problematic in the long term, not only because fossil fuels are a finite resource but also because the brine is pumped back into the sea, contributing to the increasing salinisation of the Gulf and the Red Sea, affecting coral reefs and fish stocks.<sup>21</sup>

Salt levels in the Arabian Gulf are eight times higher in some places than they should be, as desalination plants return brine to the sea. The higher salinity of the seawater intake, in turn, becomes a further problem because it reduces the plant's efficiency and increases its energy demand.<sup>22</sup>

Interestingly, the rise and fall in sea water temperature is less of an issue. The organisms that populate the Gulf and the Red Sea coral reefs are uniquely capable of adapting to temperature changes. Hence they are less affected by coral bleaching caused by temperature increases elsewhere in the world's oceans. However, some of the reefs have been severely damaged by phosphate water pollution from sewage discharge, which has increased the growth of algae. Oil pollution from tankers and pipeline leakages has also been a problem.<sup>23</sup>

In the Gulf Region, and indeed elsewhere, few people are asking why drinking water is used for washing and flushing toilets. The issue is not only waste of fresh water but also waste of grey water. Very few cities have found an effective solution to treating and making good use of it. Yet grey water can easily be treated at the neighbourhood or building level for reuse twice: once for cleaning and sanitation, the second time for gardening or urban and peri-urban farming. The result could be a two-thirds reduction in the volume, and the cost and energy required for sewage treatment.

## Nutrient loss

The vision of the regenerative city, then, incorporates a full circle of waste water recycling and reuse. While considerable progress has been made in solid waste recycling and reuse, the loss of nutrients from sewage discharge is rarely addressed.

Nitrogen, potash and phosphate are essential nutrients for sustaining the fertility of the world's farmland. Limits of available nitrogen, in particular, constrain how much plants can grow and, in turn, how much carbon

<sup>17</sup> <http://grist.files.wordpress.com/2012/04/2012.jpg>

<sup>18</sup> [http://siteresources.worldbank.org/INTMENA/Resources/Water\\_Arab\\_World\\_full.pdf](http://siteresources.worldbank.org/INTMENA/Resources/Water_Arab_World_full.pdf)

<sup>19</sup> <http://english.alarabiya.net/articles/2012/01/23/190093.html>

<sup>20</sup> [www.sawi.org/sa/node.asp?node=774](http://www.sawi.org/sa/node.asp?node=774)

<sup>21</sup> <http://www.saudiaramco.com/content/dam/Publications/Environews/Environews%20Winter%202011/Desalination.pdf>

<sup>22</sup> [www.guardian.co.uk/Environment/Water](http://www.guardian.co.uk/Environment/Water) 20.2.2011

<sup>23</sup> [http://en.wikipedia.org/wiki/Arabian\\_Peninsula](http://en.wikipedia.org/wiki/Arabian_Peninsula)



dioxide they can absorb. In modern agriculture nitrogen is supplied in a highly unsustainable way via inorganic fertilisers that are mined or synthesized by the use of fossil fuels.

Yet we still ignore the fact that modern cities discard vast amounts of nitrogen, phosphates and potash via their sewage systems. The human metabolism only absorbs a fraction of these nutrients contained in the food we consume. For this reason, urea typically contains 70 percent of the nitrogen and more than half the phosphorus and potassium found in urban waste water, while making up less than one per cent of the overall volume.

Source separation and on-site treatment of urea can resolve several challenges. It can help close the cycle of nutrient flows required to feed the world's urban population and in the Gulf this could be used in peri-urban agriculture. Using these local resources as a nutrient base should be regarded as a key element of food security. It can also help reduce the costs and energy intensity of sewage treatment and the ecological consequences of disposal of nutrient rich effluent into marine ecosystems. In the cities of the Gulf these issues need to be addressed as a matter of great urgency.<sup>24</sup>

## Low-carbon urban design and electrical mobility

All urban transport in the Gulf currently requires fossil fuels and the region is a major market for luxury cars. Car-based transport in Gulf cities accounts for about a quarter of their total energy use and contributes about a third of urban greenhouse gas emissions, as well as other pollutants that affect the health of city people and the global climate.

In the long run, land use planning, favouring compact urban settlements where most products and services can be supplied by non-motorised mobility, will be critical to low-carbon urban development. But in the short and medium term, cities should make every effort to pursue alternative mobility options including public transit systems utilising regionally supplied renewable energy. A key aspect of realising low-carbon urban development resides with e-mobility, or electric vehicles.

Meanwhile architects have long demonstrated the potential for residential and office buildings of low-carbon design to provide comfortable living and working environments. A key reason why these innovations are not yet widely adopted is the need to insulate buildings in urban areas from noise pollution. This compels architects to seal their edifices and to rely on energy-intensive heating, ventilation and air conditioning.

The principle source of noise pollution in cities comes from vehicular traffic using the internal combustion engine. E-vehicles generate so little noise that they are now equipped in some countries with noise generators to signal their presence to pedestrians. A promising option for low-carbon urban design and planning will be to reserve access to urban neighbourhoods and districts by e-vehicles only, enabling designs to be implemented that would far exceed the current benchmarks for energy-efficient buildings.<sup>25</sup>



*Credit: Abengoa. Powerful, efficient and cost-effective Concentrating Solar Power (CSP) systems work by concentrating sunlight with mirrors to create heat which may be used to raise steam to drive turbines and generators. Heat may be stored in melted salts or other substances so that that electricity may be generated at night or on cloudy days.*

## Renewable energy (RE) and the green economy

Across the globe in the coming years, the energy infrastructure, networks, markets and systems of future cities will be much more integrated and interrelated than they are today. Renewable energy, energy storage for

<sup>24</sup> [www.unhabitat.org/downloads/docs/UW-RegenerativeCityCC.pdf](http://www.unhabitat.org/downloads/docs/UW-RegenerativeCityCC.pdf)

<sup>25</sup> [www.unhabitat.org/downloads/docs/UW-RegenerativeCityCC.pdf](http://www.unhabitat.org/downloads/docs/UW-RegenerativeCityCC.pdf)

intermittent RE, smart grids and distributed power generation will be combined with energy efficiency initiatives.

The Gulf is beginning to catch up with Europe and China in renewable energy development. A major challenge is to compete with the cheap electricity produced by local oil and gas fired power stations. Whilst solar power is currently more expensive today than conventional electricity, by 2020 it is expected to reach grid parity with electricity from conventional power stations. With determination, and with funding sources for RE readily available, the Gulf Region could easily overtake European countries.

In 2011 the Saudi government created an important new initiative called KCARE, the King Abdullah City for Atomic and Renewable Energy. The aim is to develop the knowhow to generate a third of the nation's electricity

by renewable energy technology by 2032 – 41,000 megawatts of installed solar capacity: 16 GW of solar PV and around 25 GW of concentrated solar power capacity.<sup>26</sup>

The kingdom is expected to announce the introduction of a feed-in tariff (FIT) similar to that introduced in countries like Germany. In many European countries FITs set a preferential price for RE that has helped companies in this sector to take off. In addition to using more solar energy, the kingdom will also add wind, geothermal, waste-to-power and nuclear plants to its power mix. The plan, worth billions of dollars, aims to catapult Saudi Arabia into the group of global leaders in RE development.<sup>27</sup> Although the expanded renewable energy capacity is critical in the peak summer months, particularly for supplying power to urban air conditioners, much would lie idle in winter. KCARE is conducting a feasibility study on exporting surplus power to Europe during the winter months.<sup>28</sup>

Can the fossil fuel powered cities of the Gulf be turned into *solar cities* instead?

Abu Dhabi was the first Gulf emirate to take significant steps in RE development. The Masdar Eco-City project, started with much publicity in 2008, is now well under way, though scaled down in ambition. Powered by the sun and cooled by wind, the car-free environment of Masdar is aiming to become the world's most sustainable low-carbon city. Inspired by architecture and urban planning traditionally practised in the Arab world, Masdar City incorporates similar concepts: narrow streets; shaded windows, exterior walls and walkways; thick-walled buildings; courtyards and wind towers; vegetation and a generally walkable city. The streets of the first section of Masdar have been found to be up to 15 degrees cooler than city streets in downtown Abu Dhabi.<sup>29</sup>

Masdar will employ a variety of renewable power resources. A ten megawatt solar power station has been completed. This will be followed by a much larger installation, totalling



#### Masdar City

What about creating new solar cities from scratch? Abu Dhabi has started to build what it says is the world's first purpose built new zero-carbon, zero-waste, car-free city which will be powered by the sun. Masdar City, which will extend to 6 million square metres, will cost \$22 billion, take eight years to build and be home to 50,000 people and 1,500 businesses. It uses traditional planning principals, together with new technologies, to achieve a carbon neutral community. The shaded walkways and narrow streets will create a pedestrian-friendly environment suitable for Abu Dhabi's extreme climate. Residents will move around on foot, by bike or on the city's tram system. The city forms part of an ambitious plan the government of Abu Dhabi to develop clean energy technologies, including Masdar PV, which is to become one of the largest solar technology companies in the world. Masdar City will consist mainly of low-rise low-energy buildings. They will be constructed to allow air flow in but to keep the sun's heat out. Wind towers will ventilate homes and offices using natural convection. Water will be provided through a solar-powered desalination plant. The city will need only a quarter of the power required for a similar sized community, while its water needs will be 60 percent lower. The land surrounding the city will contain photovoltaic arrays, wind farms and food growing areas. Masterplanned by Foster + Partners, the initiative has been driven by Dr. Sultan Ahmed Al Jaber, CEO of the Abu Dhabi Future Energy Company. Source: Foster and Partners.

<sup>26</sup> <http://www.businessweek.com/news/2012-05-10/saudi-arabia-plans-109-billion-boost-for-solar-power>

<sup>27</sup> <http://sustainableenergysystemz.com/saudi-arabia-target-41-gw-solar-power-by-2032/893/>

<sup>28</sup> [www.wind-works.org/FeedLaws/Saudi%20Arabia/SaudiArabiaList.html](http://www.wind-works.org/FeedLaws/Saudi%20Arabia/SaudiArabiaList.html)

<sup>29</sup> [www.fosterandpartners.com/Projects/1515/Default.aspx/](http://www.fosterandpartners.com/Projects/1515/Default.aspx/)



130 megawatts. Wind farms outside the city's perimeter will produce a further 20 megawatts, and geothermal energy may be used as well. In addition, Masdar plans to host the world's largest hydrogen power plant.

Water management in Masdar will be environmentally sound as well. A solar-powered desalination plant will provide the city's water needs, which are targeted to be 60 per cent lower than in other Gulf cities. 80 per cent of the water used will be recycled and waste water will be reused as many times as possible, with grey water intended for use in crop irrigation and for other purposes.

The city will also attempt to reduce waste to zero. Biological waste will primarily be used to create nutrient-rich soil and fertiliser, with waste incineration as an additional option. Industrial waste, such as plastics and metals, will be recycled or reused for other purposes.<sup>30</sup>

As well as building a city, Masdar is also an international holding company for RE investment. In addition, the Masdar Institute of Science and Technology, one of the world's first universities dedicated to providing real-world sustainability solutions, is located in the city. The Institute does advanced research and trains graduates to be ready for employment in renewable energy and eco-city enterprises.<sup>31</sup>

Masdar recognises that solar energy is not without its problems. One issue of concern is that the solar power station is often covered in thin layers of desert dust. In association with Siemens, Masdar has recently started a research project to develop non-stick coatings that will enable solar panels to better withstand sand and dust.<sup>32</sup>

Masdar is a significant learning laboratory focused on new approaches in urban planning and use of technologies. But critics say that it is an even more important task to retrofit existing Gulf cities, where tens of millions of people already live.

## The Adelaide experience

In the context of urban retrofit, the example of Adelaide, South Australia, with its lack of rainfall and high summer temperatures, is of particular relevance to Gulf cities. In the last nine years metropolitan or Greater Adelaide, a city region of some 1.2 million people, has undergone a major transformation towards becoming a regenerative city.

In 2003 I was invited by the premier of South Australia, Mike Rann, to be Adelaide's inaugural "Thinker in Residence", focusing on the "greening" of metropolitan Adelaide. The working premise I defined for my residency was quite simple: active moves towards environmental sustainability could be an excellent basis for creating new businesses and jobs by *internalizing* and reducing resource flows. If Adelaide took active measures to improve the efficiency of its use of resource it would also reduce its reliance on imported resources; consequently it could re-localise parts of its energy and food economy and bring a substantial proportion of it back home.



<sup>30</sup> [http://en.wikipedia.org/wiki/Masdar\\_City](http://en.wikipedia.org/wiki/Masdar_City)

<sup>31</sup> [www.masdar.ac.ae/](http://www.masdar.ac.ae/)

<sup>32</sup> <http://www.smartplanet.com/blog/intelligent-energy/sand-resistant-solar-panels-for-middle-east-from-siemens-masdar/12180>

During a nine-week period, my colleagues and I held innumerable seminars and events in which we invited a wide cross-section of business, administration and civil society groups to discuss ways in which metropolitan Adelaide could benefit from a major transformation. In every seminar we brought people together who had similar aims but who often had never met before. At the end of my residency I published a report called “Creating a Sustainable Adelaide” with 32 recommendations which were subsequently scrutinised and approved by a South Australian cabinet committee, and which then became the basis for many new policy initiatives.<sup>33</sup>

Greater Adelaide is a medium sized city region that has matured over a period of 160 years, growing by converting territories previously used by the aboriginal hunter-gatherer tribe, the Kaurna people, into farms and pastures. Today Adelaide still has a strong relationship to its rural regions, with a thriving horticultural, wine and mining economy. Manufacturing, services, culture and education also play an important economic role.

In Adelaide, a decade ago, concern about very limited water supplies and the threat of droughts had started to stimulate a wider discussion about the need for sustainable re-development. Since then, the tangible effects of climate change, and Greater Adelaide’s role in causing it, have been cited as an urgent reason for drawing up an overarching integrated urban systems design strategy, and a targeted program for implementing this.

The government of South Australia involved many different civil society groups and businesses in reshaping Adelaide in a comprehensive process of urban retrofit. In November 2011 I went back to Adelaide to find out what had happened there regarding my proposals in the last nine years. It soon became apparent many truly remarkable initiatives had been taken since 2003. I think Adelaide is well on its way not just to become a *sustainable city* but a *regenerative city*: it has been building a new green economy while also actively contributing to the well-being and restoration of ecosystems and soils in South Australia.

### Here is a list of changes that have occurred in Adelaide:

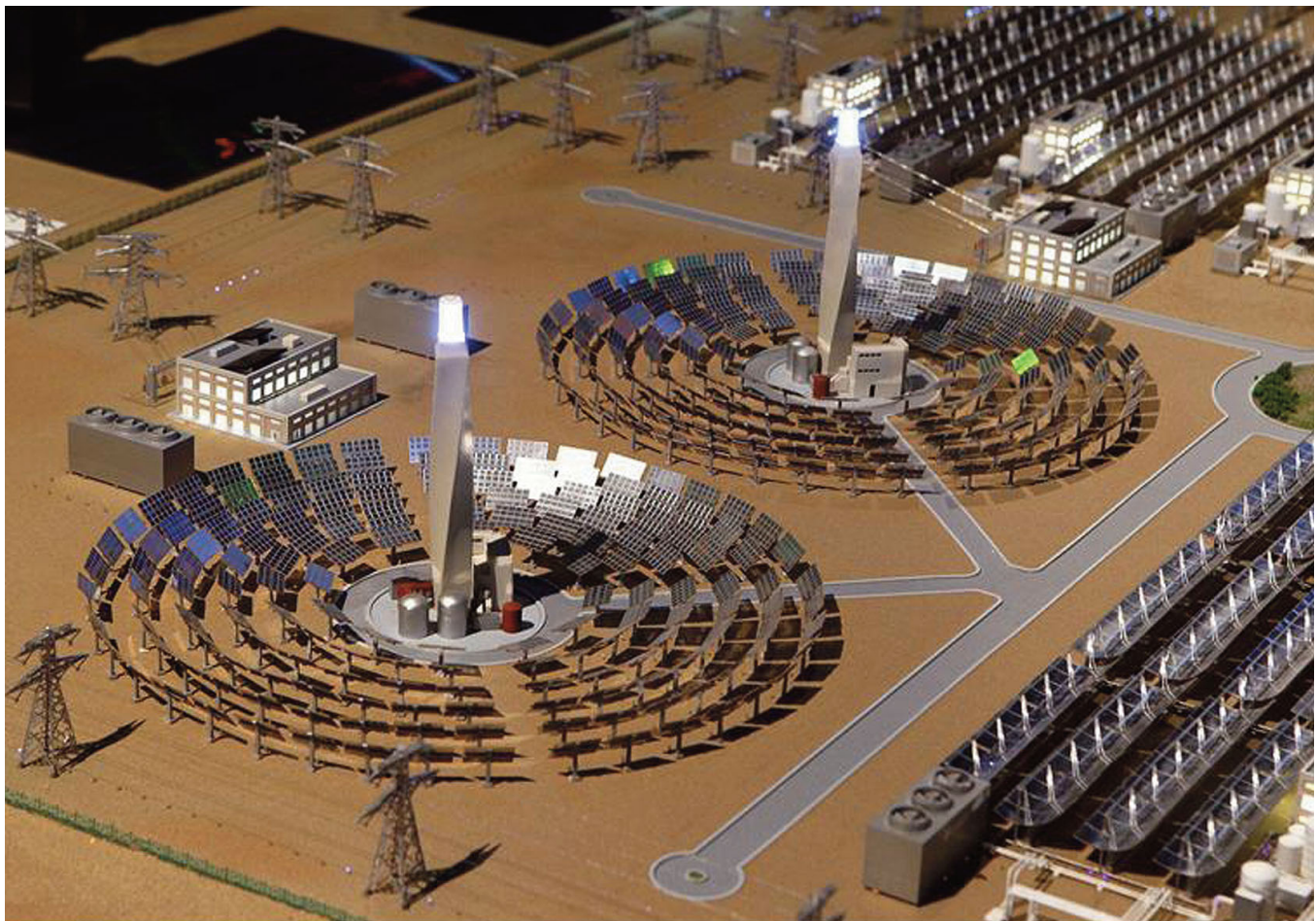
- Over 26% of electricity produced by wind turbines and solar PV panels
- PV roofs on 120,000 (of 600,000) houses, and on most public buildings
- The world’s first bus running on solar energy
- Solar hot water systems mandated for new buildings
- Large scale building tune-up programmes across the city region
- 60% carbon emissions reduction by municipal buildings
- Construction of Lochiel Park Solar Village with 106 eco-homes
- 15% reduction of CO2 emissions since 2000
- Water sensitive urban development
- 3 million trees planted on 2000 ha for CO2 absorption and biodiversity
- Creation of an ambitious zero-waste strategy
- 180,000 tonnes of compost a year made from urban organic waste
- 20,000 ha of land near Adelaide used for vegetable and fruit crops
- Reclaimed waste water and urban compost used to cultivate this land
- Thousands of new green jobs <sup>34</sup>

Greater Adelaide has already made an impressive start that is of relevance to cities all over the world: it has developed many of the attributes of a *regenerative city* – large scale waste recycling, waste water crop irrigation, organic waste composting, peri-urban agriculture, tree planting, biodiversity protection, energy efficiency initiatives and renewable energy development. An excellent start has been made, but there is no doubt that a lot more still needs to be done.

<sup>33</sup> [www.thinkers.sa.gov.au/lib/pdf/Girardet\\_Report.pdf](http://www.thinkers.sa.gov.au/lib/pdf/Girardet_Report.pdf)

<sup>34</sup> Herbert Girardet, *Regenerative Adelaide*, Solutions Journal, vol 3, issue 5, September 2012, [www.thesolutionsjournal.com/](http://www.thesolutionsjournal.com/)





Dubai's bold announcement of a 1GW solar park will see the first 10MW PV contract tendered in June 2012, with concentrated solar power tenders to follow. As Abu Dhabi's 100MW Shams 1 CSP plant approaches its completion date, Dubai is delving into solar power with a project ten times the capacity, incorporating both concentrated solar power and photovoltaics. The Mohammad Bin Rashid Al Maktoum solar park, named after the Dubai sovereign, aims to generate 1,000MW by 2030 at a total cost of Dh12 billion (€2.5bn; US\$3.3bn). The first portion, a 10MW solar photovoltaic (PV) project, is scheduled for commissioning by the fourth quarter of 2013, at a cost of Dh120million (€24.7mn; US\$32.6mn).

## The governance challenge

Creating environmentally regenerative cities in the Gulf or anywhere else is a challenge that few urban politicians and administrators have, so far, had to grapple with. What does it mean in governance terms to create *regenerative* cities? First and foremost it means that in a world plagued by short-termism, the need for holistic long-term perspectives needs to be taken much more seriously.

We need to deal with the fact that the rapidly urbanising world we currently inhabit represents a fundamental, systemic disconnect in the relationship between humans and nature. Creating a new integrated model of urban governance means, above all else, finding effective ways to address the wastefulness of urban resource use.

Assuring that our urban systems maintain and regenerate vital ecosystems they depend on long-term requires new governance interventions that go beyond current norms. Only by assuring that cities continuously contribute to the *regeneration* of the ecosystems and soils they depend on for their sustenance can a long-term future for an urbanising world be assured.

A critical point is that the parameters of urban governance need to extend beyond the physical limits of the city and to encompass decision making concerned with reducing urban ecological footprints. In the Gulf integrated urban water planning and management, which aims to achieve sustainable water supplies and effective reuse of waste water, is particularly critical. The reuse of waste water and the use of compost from organic waste in food production on the urban periphery are particularly important.

Integrated and multi-disciplinary urban planning is part of holistic governance. In our work in Adelaide integrated planning was implicitly part of the mission. In the cities of the Gulf it is more important than ever



to bring energy supply and management, transport policy, housing development, commerce, and food and water policy together in an integrated process, whilst also involving education and the media at the same time. Only by developing such a holistic perspective can urban governance become future-proof.

Integrated, restorative planning, governance and management of cities also present major new opportunities for reviving urban economies and creating new businesses and jobs. In Adelaide thousands of jobs were created by retrofitting buildings, creating wind farms, PV installations, solar hot water systems, and by urban agriculture developments. In addition to practical jobs, many new research jobs were also created.

History tells us that, by and large, cities tend to be rather resilient places that are able to reinvent themselves again and again as conditions change. But across the world there are also many examples of cities that have failed and ended up as heaps of rubble, due to the destruction of their sources of sustenance or as victims of overwhelming hostilities. Today, in a global age of the city, the unprecedented challenge is to formulate plausible, integrated governance concepts that acknowledge that cities are increasingly vulnerable to disruption of the natural systems on which their long-term well-being ultimately depends. In this context climate change is a particularly important point.

The ecological, economic and social *externalities* of our urban systems need to be assessed and addressed in new, imaginative ways. A rapid move towards making our cities much more energy efficient and powering them with renewable energy is often cited as a crucially important issue, but we need to go beyond that: huge efforts must be made to create governance concepts to enable cities to develop regenerative relationships with the world's ecosystems.

First we need to develop new integrated systems thinking, starting with a clear understanding of the workings of complex natural systems. Then, to ensure the long-term environmental viability of our urban systems, a new understanding of regenerative urban systems needs to be backed by new technologies and policies, new public attitudes and, above all else, new approaches to governance.

We need creativity and initiative at the local level, but we also need appropriate national policy frameworks to enable useful things to happen locally: without national policy initiatives the necessary changes will not happen fast enough, if at all. For example, feed-in tariffs (FITs) for renewable energy in Denmark, Germany and South Australia resulted from vigorous public demand for PV installations and wind farms. This was then turned into national policy and implemented in cities and in the urban hinterland. Can similar policies be applied in the Gulf region?

We need plausible concepts for cities to shine brightly not only as the new primary habitat of humanity but also as places where a viable future for life on earth is assured. The quest is now on for a new integrated model of urban governance that allows cities to be liveable and economically viable as well as environmentally regenerative. Nowhere is the challenge to achieve such outcomes more challenging – and potentially more rewarding – than in the Arabian Peninsula.

© Herbert Girardet and World Future Council

*Prof. Herbert Girardet is an international consultant, author and film maker focused on regenerative development. He is a co-founder and an honorary member of the World Future Council.*

With thanks for comments and suggestions to Stefan Schurig, Director Climate Energy, World Future Council.

“ We cherish our environment because it is an integral part of our country, our history and our heritage. On land and in the sea, our forefathers lived and survived in this environment. They were able to do so only because they recognised the need to conserve it, to take from it only what they needed to live, and to preserve it for succeeding generations.

*With God's will, we shall continue to work to protect our environment and our wildlife, as did our forefathers before us. It is a duty, and, if we fail, our children, rightly, will reproach us for squandering an essential part of their inheritance, and of our heritage. ”*

Sheik Zayed bin Sultan al Nayan, 1998

## World Future Council Foundation

### Head Office, Hamburg

Mexikoring 29, 22297 Hamburg  
Germany  
0049 (0)40 3070914-0  
info@worldfuturecouncil.org

### UK Office, London

100 Pall Mall  
London, SW1Y 5NQ, UK  
0044 (0)20 73213810  
info.uk@worldfuturecouncil.org

## World Future Council

The World Future Council brings the interests of future generations to the centre of policy making. Its 50 eminent members from around the globe have already successfully promoted change. The Council addresses challenges to our common future and provides decision-makers with effective policy solutions. In-depth research underpins advocacy work for international agreements, regional policy frameworks and national lawmaking and thus produces practical and tangible results.

In close cooperation with civil society actors, parliamentarians, governments, business and international organizations we identify good policies around the globe. The results of this research then feed into our advocacy work, supporting decision makers in implementing those policies.

The World Future Council is registered as a charitable foundation in Hamburg, Germany. Our work is not possible without continuous financial support from private and institutional donors. For more information see our website: [www.worldfuturecouncil.org](http://www.worldfuturecouncil.org)

## How to donate

### Bank transfer

Stiftung World Future Council  
Institution: GLS Bank  
Acc. No.: 200 900 4000  
Sort Code: 430 609 67  
IBAN: DE 7043 0609 6720 0900 4000  
BIC/SWIFT-Code: GENODEM1GLS

### Cheque

**Please make cheques payable to Stiftung World Future Council and send them to:**

Stiftung World Future Council  
Mexikoring 29, 22297 Hamburg, Germany