

# ENVIROCITIES

eMagazine



A Magazine for the Environmental Center for Arab Towns

## Sustainable Investments For Greener Future



partners



# Our Message



## **H.E. Eng. Hussain Nassir Lootah**

**Director General of Dubai Municipality  
Chairman of the Board of Trustees of the  
Environmental Center for Arab Towns**

Protection of the environment issue from pollution and risks become of the most critical issues facing humanity, and when we look to the future, it is a very complex and sensitive in nature, as well it relates to our daily living and their direct impact on many of our lives. Therefore, the issue of environmental protection is a crucial public issue and should not leave to the Governments alone or for professionals only for consideration and addressed, everyone in the community is responsible and involved in preventing environmental harm, from his position or location as he could. We believe that the implementation of projects and eco-friendly initiatives in the frame and connected with urban development plans and strategic plans in city councils, is the key to the emergence of green cities. In our effort to practice the same and keeping with the times, the EnviroCities magazine is dedicated to be an online magazine only to raise environmental awareness and to enable maximum outreach in shortest time. Dubai Municipality believes in the importance of Environmental awareness and wants to define its role in environmental protection and conservation to achieve sustainability and real development as we are working, which makes Dubai an excellent city that provides the essence of success and comfort of living.

# Contents



Circular Economy and Material Flow Management: Two principles to enhance sustainable investments

4 - 7



Foreign green investments: definitions, forms, and risk mitigation

27 - 29



Dubai Sustainable City: Shaping Future Cities

8 - 11



Sustainable Investment for Greener Future  
Investments into energy efficiency are now a reality in the Middle East

30 - 33



Dubai Wastewater Treatment and Reuse  
Comprehensive Sustainable, Social and Economic benefits

12 - 17



UN Environment Promotes Sustainable Consumption and Production

34 - 36



Green Economy: A Paradigm Shift for sustainable Development

18 - 21



Untapped alternatives for a sustainable future

37 - 43



Dubai Government Role in Pioneering a Sustainable Energy Model  
Insightful Vision towards Sustainable Development and Security of Supply

22 - 26



Introduction of Seawater Desalination Plant

44 - 49

## Circular Economy and Material Flow Management: Two principles to enhance sustainable investments”

*Dr. Michael Knaus,  
Institute for applied  
Material Flow  
Management*



*Prof. Dr. Peter Heck,  
CEO of Institute for  
applied Material Flow  
Management*



### 1. Introduction to Circular Economy and Material Flow Management

Linear economy model rest on the foundation of easy accession to large volumes of natural resources and energy. Thus, it is characterized by high material and energy intensities, its reliance on economies of scale and intricate global logistics and supply chains. Typically, the bulk of the goods of consumer oriented linear economies become waste in a very short time. And that is only a fraction of the total emissions/waste generated throughout the process of creating the goods. Consequently, linear economies not only help rapidly deplete the natural resource base, but also accelerate the degradation of natural ecosystems such as water, air and land through its polluting emissions. And last but not least, linear economy systems are not designed to maximise the regional added value if all true and hidden costs are taken into account. A sustainable regional/national economy with a future oriented growth and investment strategy cannot be sustained indefinitely based on linear economies. Hence, the million-dollar question is: is there an alternative?

The answer could be found at the heart of biological systems, based on which the early economic models were founded on millennia before industrialization and globalization. The simple premise of the resource use of biological systems is that ‘whatever extracted from nature returns to nature to be recirculated indefinitely’. This principle saw the birthing of a phenomenon termed ‘Circular Economy (CE)’ in which, the localization and circularization of material and energy flows and maintaining modest productivity levels of economies helped maintain the natural resource utilization at a steady state.

This CE model is broadly characterised by a holistic and systemic thinking in material and energy flows striving to maximise the economic value of our actions while minimising negative impacts by closing material loops, activating renewable regional growth and energy potentials and ensuring participation of society.

Hence, CE model synergizes with the concepts of industrial symbiosis, cleaner production, eco-design, and sustainable consumption and production<sup>1,2</sup>. IfaS’ approach to CE is broadly based on the principles of Material Flow Management (MFM), which is since 1994 official German environmental policy and defined as goal oriented, responsible, holistic and efficient optimization of material systems. It aids in resource-efficient, responsible handling of material and energy flows of a system, which essentially forms the foundation of CE.

<sup>1</sup>[www.ellenmacarthurfoundation.org](http://www.ellenmacarthurfoundation.org)

<sup>2</sup>Tan, Z (2008) Circular Economy & Renewable Resources in China [www.eesc.europa.eu/resources](http://www.eesc.europa.eu/resources)

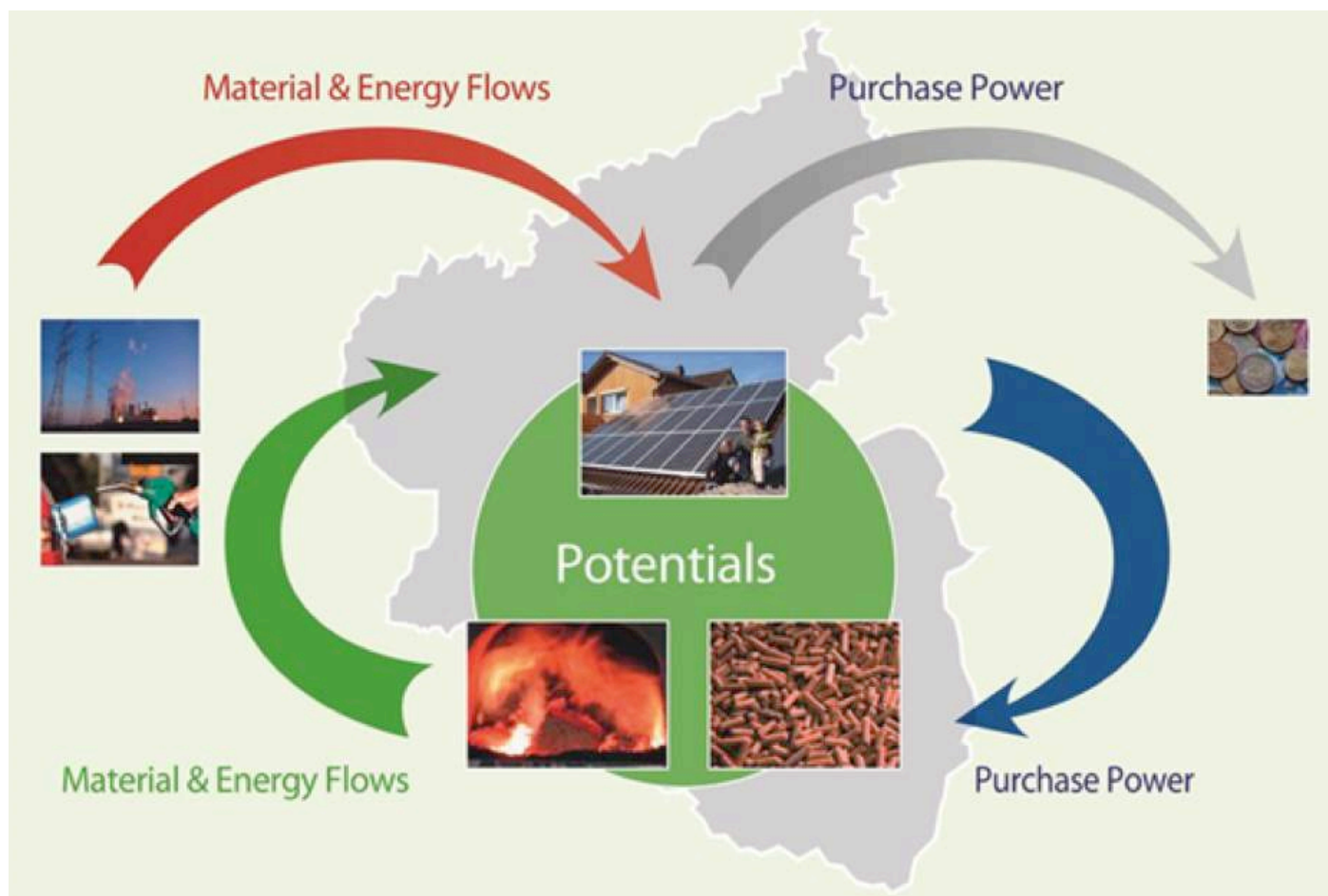
Regional MFM is a tool kit for the implementation of sustainable development e.g. the Circular Economy or Zero Emission (ZE) strategies on a regional scale including the important sectors such as industry, public, private household, agriculture, forestry and regional resource infrastructure (energy, waste, water).

In general, many regions and industries depend on imports of resources and goods; especially fossil energy carriers which then become the basis of many products. Therefore often only small added value can be generated within the region. Because of the payment for this consumption of goods and energy, most of the capital flows out of the region. On the basis of the energy flows, the following figure exemplifies the energetic and financial flows through the described system.



**Figure 1: Linear System without MFM approach (Source: IfaS)**

The detailed observation of the present state as well as the use of regional potentials is integral to meet the requirements of a Zero-Emission concept. The following figure demonstrates the situation within a region after the implementation of a Circular Economy and Zero-Emission based concept and the activation of regional added value throughout applied regional material flow management.



**Figure 2: Circular Economy with MFM approach (Source IfaS)**

Regional value creation is what drives the economy – and it is one of the pillars of the MFM approach. In a regional context, generated added value does not necessarily have to be in a monetary form only. It can include aspects such as protection and sustainable development of our cultural landscape, innovation, and image. And it means protection and enhancement of the quality of life as basic change of conditions (for example, under demographic change). When a region's material and energy streams are closed, the region's related financial streams remain within the region. The innovative technologies needed for using regional potential call for additional workforce capacities – often, highly qualified persons – and thus tie up capital. But with efficient management of regional material streams, products and services can usually be offered more reasonably, with no job losses and with higher capital in-flows. Savings resulting from reduced energy consumption, for example, directly benefit regional economic cycles.

MFM is thus much more than just a new approach in environmental and climate protection. MFM, and the related idea of a complete close-cycle economy, provide the basis for sustainable regional economic and industrial policies, and for promotion of innovation-related modernisation.

## 2. Examples of MFM Opportunities

Circular economy systems based on MFM principles offer manifold business opportunities, which can be turned with the right technology and management approach (accompanied by appropriate legal frameworks) into green investments with equity dividends for the investor and regional added value for the public.

Such business opportunities with societal co-benefits exist in nearly all sectors. A classical example is conventional waste management with non-separated waste collection and disposal at sanitary landfill sites. A solution, which seems to be environmentally sound at the first glance offers tremendous improvement and business potentials. Not only the recovery of secondary raw materials based on state of art recycling technologies but in particular the appropriate treatment of organic residues could transform a linear system into a closed loop economy. The treatment of organic residues in anaerobic digestion units produces biogas which could easily being upgraded into natural gas quality. The remaining substrate could be further process towards high quality organic fertilizer substituting mineral fertilizer and combating the loss of soil fertility, in particular in arid areas. The very same technology and even the same infrastructure could be used to co-digest organic municipal solid waste fractions and sewage sludge. The initial investment in such “BioEnergy and Resource Centre (BERC)” are a multiple of the ones associated with the construction of landfills. But they really could be considered to be investments because they are generating income due to the sales of their product. If the levelized cost of waste treatment services (reflecting the cost of capital plus the cost of operation per service unit) of high efficient circular systems are compared with true cost of landfilling (including the cost of up to 50 years aftercare) high-tec recycling and energy recovery structures are becoming extremely competitive. The sales of products such as energy, soil amendment, and secondary resources are creating value added tax, job opportunities and avoid negative externalities such as soil and air emissions.

Other examples are energy efficiencies strategies such as energy efficient lighting by LED, high efficient pumps in water sector, just to name a few. Regional renewable energy strategies, such as solar settlement planning, wind and solar catasters and biomass-to energy decrease the dependency on fossil fuels, create a long-term calculation basis for levelised costs of energy generations and offer plenty of job opportunities in planning, production and maintenance of new energy infrastructure.

**Opportunities are vast. Sound planning is the key. Technologies are usually existing. Debt and equity capital are ready to move into profitable investments. The only thing required is a forward thinking and sound planning of the activation of regional growth potentials. Material Flow Management is an appropriate tool-kit for regional and national Circular Economy planning providing evidence that climate protection and economic growth are not only two sides of one coin but inevitably linked.**

## Dubai Sustainable City: Shaping Future Cities



*Karim El-Jisr*  
*Executive Director, Diamond Innovation Center*  
*Email: karim@diamond-developers.ae*  
*www.thesustainablecity.ae*



The Sustainable City is a modern application of social, economic and environmental sustainability in the built environment. As the first operational Net Zero Energy development in Dubai, the project is an international showcase for sustainable living, work, education, and recreation.

Located in Dubailand and spanning over 460 ha, The Sustainable City provides a complete suite of social amenities and environmental features. Completed in 2016, the first phase of the project is comprised 500 villas grouped into five residential clusters, a mosque, a kindergarten, a 15,000m<sup>2</sup> mixed-use facility, a farm, public amenities, and the equestrian centre. Phase 2 will comprise the Hotel Indigo, a comprehensive rehabilitation hospital, an international school, as well as Diamond Innovation Center.





## Environmental Sustainability

### Energy

For starters, the villas are north-oriented to avoid the sun. The narrow streets (called “sikkas”) inside the clusters maximize shading and reduce physical exposure. A suite of active design features including cutting-edge insulation, UV-reflective paint, energy-efficient air conditioning, LED lighting, solar water heaters, and energy-rated appliances, help reduce electricity consumption by up to 50% compared to conventional villas in Dubai.

The Sustainable City is installing 10MWp of solar panels. Solar rooftop panels in villas further reduce electricity imports by up to 30 percent annually. The combination of demand management and solar rooftop significantly reduce electricity bills, to levels not seen before for comparable buildings. Solar shaded parking bays produce additional electricity which supply common areas including street lights, bio domes, water features, wind towers (called “barajeel”), and public amenities.

### Water

The Sustainable City’s water strategy includes water saving devices and appliances, greywater treatment and reuse in productive landscaping, and blackwater treatment and reuse in non-productive landscaping. Villas consume up to 40 percent less freshwater compared to conventional villas, thereby reducing demand for desalinated water and corresponding

greenhouse gas emissions. The Sustainable City’s topography drains storm water into an intricate network of bioswales and a traditional ‘falaj’ system that help replenish groundwater reserves.

### Waste

The Sustainable City aims to achieve 100 percent waste sorting at source. Disposal bins are conveniently located in each cluster to encourage residents to separate their waste at source into five waste streams. The waste is collected by electric vehicles and sent to Tadweer (Dubai’s largest materials recovery facility), where the waste is recycled and traded. Green waste is composted on site and transformed into compost for public landscaping. Other waste streams are collected and treated separately – for example, used cooking oil from villas and restaurants are sent to a bio diesel production facility in Dubai.

### Air Quality

A number of ‘barajeel’ wind towers are strategically placed within each residential cluster, channelling cooler and less humid air into the plazas. A 30-meter green belt surrounds the development and provides an important ecological habitat for birds and reptiles. This greenbelt also helps reduce air and noise pollution, and provides shade on the cycling and horse tracks.



## Products

The villas were built using precast wall panels and easy-to-install construction elements which helped achieve time-saving and energy-efficient targets. Cut and fill operations were optimized to eliminate the import and export of aggregates further reducing carbon emissions from off-site transport. The street lights use laminated timber from sustainable forests and the rubberized tracks use crumb rubber from used tires. Light-coloured paving materials create a cooler micro-climate. In Phase 2, materials will be selected based on their Life Cycle Assessment.

## Mobility

The Sustainable City's transportation strategy encourages residents to rely less on motorized transport and more on walking and bicycling. The clusters are car-free zones and therefore only accessible on foot or by electric buggies through the sikkas that link the city together. Electric charging stations are available to Electric Vehicle owners, free of charge. The Sustainable City will soon launch an EV car sharing program to encourage its residents to discover solar-powered electric mobility and to forego their second family car.

## Urban Farming

The Sustainable City's central urban farm comprises 11 temperature-controlled bio domes. Residents can grow their own herbs and vegetables inside these bio domes or along the 'falaj' system. The Sustainable City is self-sufficient in herbs and leafy vegetables and has started to grow a selection of other vegetables including zucchini, eggplant, sweet

corn, and tomatoes. Date palms along the ring road and the central farm produce 40-50 tonnes of dates annually. Overall, the city's urban farm and productive landscapes reduce the carbon footprint of the residents by eliminating transportation and storage needs.

## Social Sustainability

The Sustainable City is more than engineering and technology. The project promotes a vibrant culture of sustainability among its residents, staff, and visitors. The infrastructure in The Sustainable City supports cultural events, sports, and recreation through ample outdoor spaces such as playgrounds and plazas. Sports amenities including courts, a community pool, cycling tracks, outdoor fitness stations and an equestrian club help residents to maintain a healthy lifestyle. In addition, The Sustainable City hosts a variety of events throughout the year (such as meet & greets, environmental celebrations, and seminars) to create a cohesive community that advocates tolerance, respect and engagement with people from different cultures, background and beliefs.

Diamond Square will offer cutting-edge healthcare service for adults, and children, including children with special needs. An international school will set a new standard for world-class education, integrating sustainability throughout the learning journey, while delivering high academic standards and innovative teaching practices. For the younger ones, CreaKids nursery offers an international childcare and

educational brand. The curricula in the nursery (and the school) will complement the progressive-minded sustainable model of The Sustainable City, and help shape a new generation of compassionate problem solvers.

## Economic Sustainability

The Sustainable City is demonstrating that environmentally sustainable building is also economically sustainable. During construction, sustainability related investments have been more than compensated by costs savings resulting from sustainable design. Residents benefit from greatly reduced energy and water bills, without paying a premium for their home. Residents also benefit from zero net service and maintenance fees as a result of the unique revenue sharing scheme from mixed-use facilities.



## Dubai Wastewater Treatment and Reuse Comprehensive Sustainable, Social and Economic benefits

*Eng. Mohammed AbdulAziz Najem  
Director of Sewage Treatment Plant Department  
Dubai Municipality  
Email: manajem@dm.gov.ae*



Dubai Municipality under the aegis of the pragmatic Government of Dubai persistently perused ambitious policies of making the City of Dubai, located in the Arabian Desert a Major International City, a competitive player in the World Livability Index and a major Tourist attraction. Management of water resources is one of the most influential factors or the back bone of development for this region, which is among the lowest average annual rain fall. The potable water is produced by desalination of Seawater and costs around US \$ 3.0 per Cubic Meter. The cost of Treating Sewage is only 14 Cents per Cubic Meter. Recycling of treated waste water is the key to meet the horticultural needs.



Realizing this with foresight, Dubai Municipality embarked on proactive planning and implementation of the Sewage Treatment Plants projects , operated and maintained by Dubai Municipality to irrigate the greenery and wonderful Public parks in the city for the last 25 years.



In the process two major Wastewater Treatment Plants were constructed and commissioned to treat and recycle the waste water one in 1990 and another in 2009 having capacity of 260,000 Cubic Meter per day and 300,000 Cubic Meter per day respectively. At present all the Plants provide around 700,000 Cubic Meter per day Treated Effluent for Irrigation to the city and played major role in transforming the arid region in to a beautiful , thriving Tourist haven.

If the same quantity of fresh water is used for irrigation the expenditure will be over 2.0 Million US Dollars per day on the Public exchequer, where as the Treatment cost is around US Dollars 100,000 per day only. This amounts to a saving of around 1.9 Million US Dollars per day. Yearly saving is estimated at 690 Million US dollars.

In line with the strategy of Energy conservation & Sustainability of Government of Dubai, the Plants are designed with rationalized Energy consuming processes and components like using gravity to exclude avoidable pumping, Bio trickling Filters for Ammonia reduction instead of Aeration, Biological Scrubbers for Odor removal, Variable Speed drives for selected pumping needs, Advanced Process Automation systems etc.

In addition to Irrigation, these Treatment Plants greatly contribute to the reputed sanitation of Dubai Sea water Creek and thereby to the Public Health and Environment of the Dubai City at large.

**Dubai Municipality – Sewage Treatment Plants Department – Over view of 300,000 M3 / day Plant - A Completed Project**



The by products 65 % Methane Gas 30 Million Cubic Meters per year and manure 6000 Tons are produced from sewage Sludge. Manure is used for Soil enrichment and Methane Gas is planned to be in Power Generation.

Despite the severely challenging environmental and climatic conditions of Desert, Dust, high temperature, Low rain fall, Scarcity of fresh water sources, Dubai Municipality developed a sustainable role model of Wastewater management by tackling multiple livability factors in the region as explained above.

The Strategy of Dubai City stems from the following policy initiatives:

- De-coupled Economy from the traditional dependence on fossil fuels, a strategy that started over 20 years ago.
- Among the first to try, adapt, modify and fine tune to the local conditions, the Technologies from USA, Europe, Australia, Japan etc.
- Emphasis on happiness and tolerance among Multi cultural society and high rate of floating population.
- All past and current investments consider Sustainability and efficient and effective Energy utilization as first priority.

Dubai Municipality's strong commitment and investment in the Environment Sector and implemented quality reflect in the achieved International status of the city in the comity of developed cities



### Environmental social benefits:

- Treated Sewage Effluent is recycled to irrigate public parks and green areas of Dubai City:
- Raw Sewage Treated in the Treatment Plants: 2010 to 2016: From 179 to 248 Million Cubic meters.
- Treated water used for Irrigation 2010 to 2016: From 139 to 220 Million Cubic meters
- Fertilizer produced in Sewage Treatment plants: 2010 to 2016: 2457 to 5568 Tons
- Increase in Green area of City: 2010 to 2015 Around 145 Million Square meters green areas including Trees, Plants, Bushes, Flower plants and Grass are added since 2010.

All the achievements of this green cover are due to the treated water from the Sewage Treatment plants. Green cover and Flowers and parks adding to the beauty of the city, turned as a pleasure to the visiting tourists.

Conservation of Potable water in large quantity. By such rationalized Desalination, the Arabian Gulf is spared of the possible discharge of high saline content Brine, which is already a concern to the region.

### Economic benefits:

Economic benefit from Sewage Treatment and Recycling of treated water for Irrigation of Public parks, Green cover, Trees and Flowers plantation of Dubai is immense.

Treated water used for Irrigation, conserving the same quantity of potable water. The cost is valued at US \$ 690 Million

Water benefits Certificates program: A Water Benefit Certificate represents a volume of water sustainably supplied, purified, or conserved. Once issued, Water Benefit Certificates can be sold to earn income that supports further water project activity.

- Projects are issued Water Benefit Certificates (WBCs) according to the volume of water benefits they generate per year.
- Depending on the project size the WBC's issued changes according to the following logic:
  1. For the first 40,000 m<sup>3</sup> of water saved per year, 1 WBC = 1 m<sup>3</sup>
  2. For additional savings between 40,000 m<sup>3</sup> and 1,300,000 m<sup>3</sup> per year, 1 WBC = 10 m<sup>3</sup>
  3. Savings beyond 1,300,000 m<sup>3</sup> per year are awarded with 1 WBC = 100 m<sup>3</sup> of water saved.



## Investments :

### 1. Warsan Plant

- Capacity : 260,000 Cubic Meter per day
- Commissioned in 1989 with 130,000 Cubic Meter per day and extended to 260,000 Cubic Meter / day in 2000.
- High rate Plant with Biological trickling Filters for de nitrification.
- Saving Energy that was otherwise required for extended aeration.
- Rotating Drum driers for Sewage Sludge producing A Grade manure for Soil enrichment.
- Bio scrubbers added for Primary operation to remove odors.



- Extension Project for another 65000 Cubic Meter / day is completed in 2015
- Total Cost of Project : US \$ 300 Million



## 2. Jabel Ali Sewage Treatment Plant - Phase - I

- Capacity : 300,000 Cubic Meter per day
- Extended Aeration process with out Bio Trickling Filters.
- Primary Dis-infection by UV and post by Chlorine.
- Odor removal by Bio scrubbers with stand by Chemical scrubbers
- Sludge Drying by Belt Driers using Digester's Gas.
- Commissioned in 2009
- Project Cost : USD 435 Million
- Application of UV Disinfection instead of Chlorine aids the environment.
- The quality of Effluent from this Plant is superior due to extended aeration.
- Effluent analysis data is provided.

## 3. New Project under Construction : Jabel Ali STP Phase - 2

New Project of 375,000 Cubic Meter capacity is under Construction. This Project is envisaged to meet the rapid growth of Dubai city due to the EXPO 2020 being organized in Dubai with an investment of US \$ 430 Million. Scheduled to be commissioned in year 2019

## Green Economy: A Paradigm Shift for sustainable Development

*Dr. Iyad Abumoghli  
Regional Representative and Director  
Regional Office for West Asia  
United Nations Environment Programme (UNEP)*



In June of last year, an important global conference was held to mark 20 years after the first sustainable development conference that was held in Rio De Janeiro in 1992. The outcome document of Rio+20 and the main focus of the conference was to discuss "The Future We Want". The conference adopted two overarching themes of the International Environmental Governance and Green Economy in the context of poverty reduction.



Following up on Rio +20 recommendations, a number of local, national, regional and global consultations have been organized and conducted to discuss the Post 2015 agenda, the Sustainable Development Goals and the new shape for the global environmental governance. Rio+20 did not establish any formal processes with regard to the implementation of green economy. Rather, governments adopted it as a voluntary tool for achieving sustainable development.

The world as we knew it has already ended. If the Mayan Prophecy of end of time is to be interpreted, I would put it in the frame of the unprecedented increase of the population rate of the world, unprecedented increase in the use of the natural resources of our planet, the increase of earth temperature, the changing in lifestyles of the people, the governance challenges in many countries, food shortages for hundreds of millions, disparities between nations and within countries and many more. The world cannot continue at the same pace of over-utilization.

**Green Economy might mean different things to different sectors and in different countries, so what does it mean?**

In its simplest expression, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive. Practically speaking, a green economy is one whose growth in income and employment is driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services. These investments need to be catalyzed and supported by targeted public expenditure, policy reforms and regulation changes. This development path should maintain, enhance and, where necessary, rebuild natural capital as a critical economic asset and source of public benefits, especially for poor people whose livelihoods and security depend strongly on nature.

Development is sustainable only when it meets the needs of the present without compromising the ability of future generations to meet their own needs. Moving towards a green economy can be an important driver in this effort. The environment in a green economy is seen as a determining factor of economic production, value, stability, and long term prosperity. As such, the shift to a green economy can be seen as a pathway to sustainable development, a journey rather than a destination, a process rather than an end.

The wealth of nations, as well as individuals, to a great extent, that we see today, is a result of the overexploitation of earth's natural resources, over

extraction of water, generation of waste that leads to biodiversity and ecosystems destruction. But, with this wealth, came inequity and exclusion of those deprived and most in need for natural resources for their daily living. Therefore, transitioning towards a green economy aims to increase access to basic services and infrastructure as a means of alleviating poverty and improving overall quality of life. Using green economy technologies, such as renewable energy, those 700 million people without adequate access to sustainable energy will have more hope and would receive this environmental service within their own lifetime.

However, it is not technology alone that is needed, but also the supporting legislative and governance systems that are necessary to remove externalities and provide incentives for green growth, green behavior and green lifestyle.

UN Environment considers sustainable consumption and production as synonymous to green economy. Social behavior, of corporations and individuals, is a key driver for sustainability. Sustainable consumption and production is primarily focused on increasing resource efficiency in production processes and consumption patterns. In practice, work towards achieving a green economy and sustainable consumption and production are mutually supportive, covering macro and micro interventions that require change in policy and regulatory instruments, investment and business operations, as well as behavioral change in society.

UN Environment leads 10 Year Framework of Programmes on Sustainable Consumption and Production is a Global Framework for Action to enhance international cooperation to support regional and national initiatives accelerating the shift towards sustainable consumption and production in both developed and developing countries.

UN Environment has also announced the launch of the International Sustainable Public Procurement Initiative (SPPI) during Rio+20. Supported by over 30 governments and institutions, the SPPI aims to scale-up the level of public spending flowing into goods and services that maximize environmental and social benefits.

One of the major challenges facing the world today is employment and in particular youth employment. Therefore, development strategies must think of innovative ways to involve youth in the decision making process, develop specific programmes that can mobilize the potential of youth towards a better future and create decent jobs for the hundreds of millions of them who are seeking better and sustainable lives. A green economy creates jobs in a wide range of sectors of the economy as new markets emerge and grow, such as in organic agriculture, renewable energy, building retrofits for energy efficiency, public transportation, reclamation of brown-field sites, and recycling, among others.

During the First Universal Governing Council session of UN Environment, the Programme of Action on Green Economy (PAGE) has been launched. This 7-year programme responds to Rio+20's call for the UN system to support countries interested in pursuing green economy policies. It will deploy the expertise of four UN agencies – ILO, UN Environment, UNIDO, and UNITAR – to progressively assist a total of 30 countries in their efforts to embark on green economy pathways. The collective endeavor ranges from mobilizing social awareness and providing specialized training to identifying critical bottlenecks, formulating and assessing policy options, and enabling policy implementation for greening the economy. The programme also includes global and regional level capacity development, knowledge creation and sharing, and high level policy dialogues, all to enrich and strengthen country level assistance.

**PAGE aims to provide comprehensive and coordinated support and to closely link it with existing structures and processes in the countries, bringing in relevant expertise of other agencies and building on ongoing cooperation among country initiatives.**

For the Arab region, that faces a unique set of challenges, the implementation of green economy will need to be tailored to regional circumstances and address key economic, social and environmental challenges, which vary significantly between countries. It will also need to take advantage of regional opportunities and competitive advantage, which may manifest in sectors such as energy, water and food through the development or deployment of renewable energy technologies, water management technologies or sustainable agriculture.

UN Environment has been working with a number of Arab Countries, as well as with the League of Arab States, on launching green economy across the region. While UN Environment recognized that much has already been done in a number of countries to green their economies, these efforts have been ad hoc and are considered mainly initiatives that do not follow a structured, comprehensive green economy strategies. While these initiatives do respond to country future visions, they remain less than the potential that exists in the region.

Countries such as Jordan, Morocco, Egypt, UAE and Tunisia, have either initiated national level green economy potential studies or sectoral analysis, or have embarked on mega green initiatives such as the use of renewable energy, resource efficiency, sustainable cities, sustainable transport, etc. The potential of green economy is humungous due to the availability of receptive sectors, essential demand for limited environmental services and the political will. For example, the Arab Forum for Environment and Development report estimated that spending US\$100 billion in greening only 20% of the existing building stock in the Arab countries over the next 10 years is expected to create 4 million jobs.

The Arab region is a diverse region in terms of its geo-political and economic set up. While countries of the Gulf enjoy abundance of energy resources, they lack other environmental services such as water that in turn requires energy to be produced for domestic, industrial as well as agricultural purposes. Water, is also necessary in this region to produce food and maintain biodiversity. Thus, the food-water-energy nexus is of paramount importance here.

While other Arab Countries such as Lebanon and Sudan enjoy, so far, abundant water resources, they lack access to sustainable and affordable sources of energy that do not burden the country's economy. Countries such as Jordan, Morocco, and Tunisia have a mixture of challenges and opportunities that make green economy options very much a transformational need.

UN Environment, with the Economic and Social Council for West Asia, is working with the league of Arab States to conduct a comprehensive study on the investment potential in the Arab States region. This study will identify sectors that can benefit from greening policies and will provide policy options to decision makers to adopt green decisions to achieve sustainable development.

There is a lot of room for regional cooperation to achieve national development goals. The solar energy project of the Sahara is just one example of such potential. However, integration, cooperation and collaboration on standards, markets, incentives, taxes, transportation, etc. are all needed measures to help the region achieve better development goals that will not been possible had each country acted alone.

**The transformation to green economy is the right choice to ensure a sustainable future. This transformation would need a paradigm shift in the way we manage our environmental resources and the way we treat our only planet.**

# Dubai Government Role in Pioneering a Sustainable Energy Model

## Insightful Vision towards Sustainable Development and Security of Supply

*Author: Taher Diab*  
*Senior Director – Strategy & Planning*  
*Dubai Supreme Council of Energy*  
*Taher.Diab@dubaisce.gov.ae*



### Introduction

The Emirate of Dubai is one of the fastest growing cities in the world as it positioned itself on the global map as the regional hub for tourism, logistics and finance. To fuel its economic growth and maintain its regional and global prominent position, Dubai innovated a smart strategy to manage demand, diversify fuel sources, secure supply and foster green growth. Currently, Dubai's installed capacity of about 10GW is powered mainly by imported natural gas making Dubai a net energy importer. Therefore, energy security becomes essential given that forecasted electricity demand for the next decade is projected at 5-6% per year. In addition, the Emirate is compelled to pursue a sustainable development path, particularly given the recent clean technology advances.

Therefore, the success story of Dubai demonstrates how it managed to design and implement an energy strategy that captures the key levers driving its economy; i) energy security, ii) demand side management & iii) sustainable growth. Dubai is therefore a living model of a coherent and cohesive energy strategy that meets future energy needs through an optimal energy mix that delivers affordable, sustainable and clean energy to Dubai's citizens and residents.

### Dubai's Journey to Sustainable Future: The Enabling Environment

Dubai's energy model stems from the Dubai Integrated Energy Strategy (DIES) 2030, which was launched in 2011 by the Dubai Supreme Council of Energy (DSCE), and is reviewed periodically. The DIES was recently extended till 2050 and it details a roadmap to achieve various targets by 2030 and 2050, based on building a world-class regulatory framework to accelerate the diversification of the energy mix, ensure security of supply and facilitate effective demand side management as shown in Figure 1.

The Dubai Integrated Energy Strategy is aligned with the national sustainable development goals making it an effective tool to meet the UAE Vision 2021 and Dubai Plan 2021 by steering the following pillars:

**Governance & Policies:** As part of achieving DIES targets, the policy & regulatory regime in Dubai's energy sector has been overhauled. New principles such as PPP have been put in place to boost the market participation on key projects, such as the clean coal and solar power generation. Also, the regulatory framework for district cooling and energy service companies (ESCOs) is supporting the implementation of DIES 2030.

Dubai Electricity and Water Authority, Dubai Sustainability Report 2013, 2014, Dubai.



**Figure 1: Dubai Integrated Energy Strategy 2050 as a coherent strategy.**

**Energy Efficiency & Demand Reduction:** Demand reduction through energy efficiency has been a focus of Dubai's policy interventions to rationalize the use of power and water. The demand side management (DSM) strategy has led to nine different programs and technical levers for energy efficiency and demand reduction. This resulted in achieved savings in capital, operational & opportunity costs as shown in the next sections.

**Energy Security & Sustainable Cost of Gas:** Diversification of Dubai's energy sources has been a key focus of DIES 2030. This has led to spawning of projects such as clean coal power plant, Solar IPP, etc. The Mohamed bin Rashid Al Maktoum Solar Park has been a critical demonstrator of Dubai's commitment to renewable energy. Imported nuclear energy, clean coal, waste-to-energy, hybrid & electric vehicles, the distributed solar program (Shams Dubai) are other key elements contributing to Dubai's energy diversification.

**Financial Mechanism & Capacity Building:** DIES 2030 has been the launching pad for measures and projects targeting DSM, renewable power, energy service contractors (ESCOs), Green Building Codes, and energy efficiency technologies. Financial mechanisms have been devised & deployed for clean technologies in Dubai. A regulatory framework to attract strategic partnership and joint ventures, in addition, to government support for implementation of new projects and technologies has also been developed.

## Market Transformation

To respond to fast growing demand of infrastructure development, a market-based approach using Public Private Partnerships promises to meet Dubai's needs. Such an approach leverages funding sources and helps balance the risk between the government and private investors. By fostering partnerships with leading international firms in clean energy, Dubai also aims to develop its local capacities through transfer of knowledge and skills.

. Therefore, since its inception, the DSCE has rolled out a series of step by step regulatory reforms and policies to open the electricity market for independent power producers (IPPs). This involved establishing the Regulatory and Supervisory Bureau (RSB) for the electricity and water sector in 2010. Part of RSB responsibilities include licensing of new entrants in the power sector. One of the pillars of Dubai Sustainable Energy Model and a crucial factor in transforming the energy market of Dubai is the review of electricity and water tariff structure. In 2011, DEWA introduced cost-reflective tariffs to incentivize lower consumption and more efficiency in the use of electricity and water. This sent positive signals to clean energy investors as the market became economically attractive for clean technologies, allowing for successful public private partnerships (PPP). In other words, Dubai's robust regulatory framework resembles the tenets for sound policy design to attract investment, namely: 1) Transparency; 2) Longevity; and 3) Certainty.

## Security and Diversification of Dubai Energy Supply while Maintaining Sustainability

The security of supply to power Dubai economy has been thoroughly evaluated where a drastic shift from dependency on fossil fuel to renewables has culminated a target of 25% of clean installed capacity by 2030 and 75% by 2050 using CO<sub>2</sub>-free generation sources. To achieve these targets, Dubai took progressive strides in integrating solar power into its energy mix portfolio, which is currently dependent mainly on imported natural gas. Its robust regulatory framework and commercial terms have attracted international and regional investors to achieve the lowest levelized cost of electricity (LCOE) for the 200MW at 5.64 US cent/kWh and recently announced 800 MW solar photovoltaic (PV) power plant at 3.0 US cent/kWh. This development marked a turning point in the journey to diversify Dubai's energy mix and demonstrated the value proposition of strategic public private partnerships for risk management, knowledge transfer and job creation.

The transformation of the energy sector in Dubai is also taking place at the customer side. Dubai residents can now generate their own electricity using solar panels that can also feed extra energy to Dubai power grid. This step will gradually transform the consumers to prosumers: a term used to describe consumers that also generate part of their own energy consumption. Currently Dubai deploys a simple net-metering system where customers achieve savings by generating their own electricity.

### Demand Side Management

A reduction in Dubai's energy-demand, as compared to the business-as-usual scenario, is one of the objectives of the Dubai Integrated Energy Strategy 2030. In order to achieve its target of a 30% energy demand reduction by 2030, Dubai has implemented a detailed Demand Side Management (DSM) Strategy for electricity and water, an initiative that is the first of its kind in the region. This opened up new business opportunities for sustainable and efficient businesses by outlining policies, regulations, awareness schemes, technologies and finance schemes.

The strategy is based on nine programs with specific database, reduction targets and enablers to influence behavior and unleash thoughtful measures following twenty four months of stakeholders' engagement and global benchmarking: Building Regulations, Building Retrofits, District Cooling, Standards and Labels for Appliances and Equipment, Water Reuse and Irrigation, Outdoor Lighting, Change of Tariffs, Demand Response, and Distributed Solar.

### Green Mobility in Dubai

Striving to become one of the most sustainable, smart cities in the world, the Emirate of Dubai has launched the Green Mobility Initiative to accelerate the uptake of hybrid and electric vehicles (EVs). The initiative complements the spirit of Dubai Plan 2021 by providing alternative modes of transportation that can save fuel and reduce carbon emissions.



Given that road transportation is the third largest source of Dubai greenhouse gas (GHG) emissions, this initiative becomes an important contributor to Dubai Carbon Abatement Strategy 2021 which aims to reduce carbon emissions by 16% in 2021 compared to the business as usual (BAU) scenario.

In order to create the market for such vehicles, the Dubai Supreme Council of Energy (DSCE) and its entities followed a comprehensive approach that is founded on the principle of “leading by example” by government entities. A detailed analysis of market potential and size led to a penetration target of 10% of hybrid and EVs in government fleet by 2021.

In addition to creating a market for hybrids and EVs, leading by example will enable the government to build the learning curve necessary to expand the deployment of such vehicles in the arid climate of Dubai. For example, hybrid vehicles were already proven to function successfully as demonstrated by the Road and Transportation Authority (RTA) of Dubai. They used over 140 hybrid taxis in 2015, reporting about 30% fuel savings and no performance challenges. The RTA is currently planning to convert 50% of its fleet to hybrid taxis by 2021.

### **Dubai Carbon Abatement Strategy 2021: Local Action...Global Change**

In a short span of time, the Emirate has created a platform to drive specific programs and projects where opportunities and innovation can encounter energy challenges. A first-in-the-region, the Dubai Carbon Abatement Strategy 2021, details programs which integrate alternative and renewable energy to diversify Dubai's generation mix, manage its demand to increase efficiency and develop sector-based reduction targets for Greenhouse Gases (GHG).

To design a performance-based program for carbon abatement, the strategy defined major sectors contributing to carbon emissions, referred to as “high impact sectors”. Based on the carbon emissions profile for 2011, these sectors are: power and water, manufacturing, road transportation, and waste. A technical evaluation of the emission reduction potential for these high-impact sectors was carried out with the support of Dubai Carbon Centre of Excellence, resulting in a target of 16% reduction of greenhouse-gas emissions (GHG) by 2021 in comparison with the business-as-usual estimations for the same year.

In 2015, Dubai Carbon Abatement Strategy members saved a staggering 5.7 million ton CO<sub>2</sub>e or what is equivalent to 10.6% reduction from business as usual of 2015.

### **Steady Steps to become a Role Model in Energy Management and Sustainability**

The efforts of UAE and Dubai in spearheading clean energy development in the region contribute greatly beyond the borders of the UAE. In fact, Dubai's achievements directly relate to several United Nation Sustainable Development Goals, such as “providing affordable and clean energy”, “industry innovation and infrastructure”, “sustainable cities and communities” and “climate change”. In a rapidly changing world, Dubai has seized the opportunity to follow a sustainable development pathway as it continues to grow. The clear and supportive vision of its leadership paved the way to develop a long term strategy and deliver phased but steady implementation progress to achieve the goals of its Integrated Energy Strategy 2030. This galvanized the trust of the private sector resulting in successful public private partnerships (PPP) that drove the cost of solar energy to unthinkable ranges, impacting the future of solar not only in Dubai but the entire region.

The Emirate's model is emerging as a benchmark for the transition to a clean energy future in a region historically perceived as a synonym to “oil”. As we approach 2030, Dubai is expected to turn its sunny days into a sustainable fuel for generations to come and deliver strategic programs to support its Green Agenda to become a role model in energy management and sustainability.



**Figure 2: Dubai Sustainable Energy Model and its 10 pillars.**

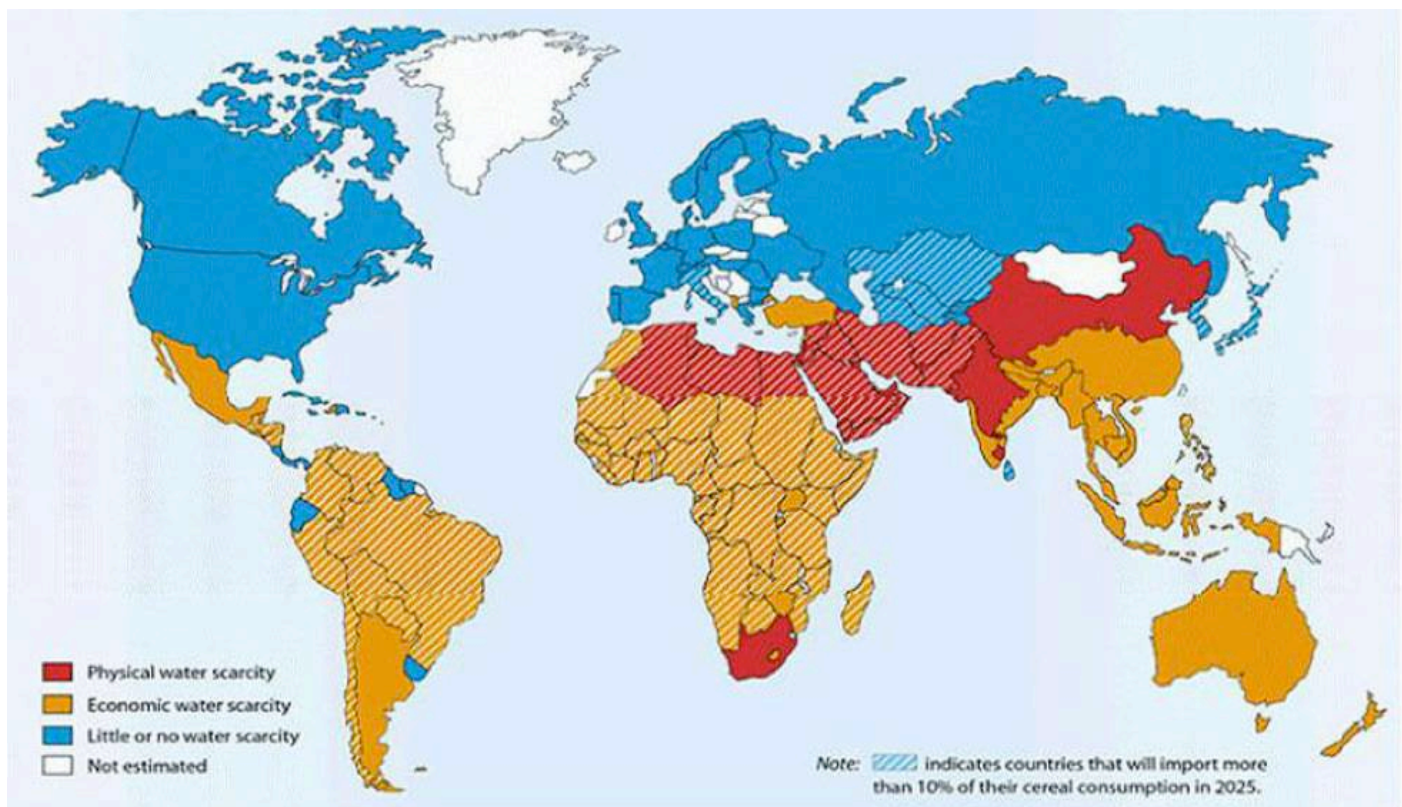
## Foreign green investments: definitions, forms, and risk mitigation

*Ayoola Brimmo,  
Senior Technology Advisor,  
Green Business Norway,  
Email: Ayoola@greenbuisness.no*



Sustainable and green investments generally refer to financing solutions aimed at achieving competitive returns while positively impacting their physical and social environment. These “green” assets typically include low carbon emitting systems, smart grids, pollution control initiatives, recycling, waste management/conversion, social enterprises or technologies solving environmental problems. While being more inclined towards moral uprightness, from a performance perspective, sustainable and green investments are subject to similar ups and downs experienced by regular funds-- they may do very well for some period, then hit a down slope, depending on the uncertainties of external factors like politics, legislations and subsidies. The rollercoaster euphemism of the solar industry serves as a testimony to this. However, history has proven that foreign [green] investments are more prone to having their dreams tragically dashed on the downward slope; mainly due to a lack of in-depth local business insights.

Exporting green technologies from countries with a high expertise and experience in producing them, to other parts of the world, is an important step for propagating a globally green impact. This could also be seen as a “foreign green investment” and while this approach often gives local green businesses a competitive advantage, there are some limitations: adapting these technologies to a local environmental conditions different from the original design criteria could be challenging and, applications of these technologies are mostly limited to the custom forms adapted in the country of origin. Take the solar PV panels as an example; while the US and China are more technologically advanced in these technologies, none of these locations experience the same average temperatures typically recorded in the Middle East. As such, based on the design criteria, the life span of solar panels could dramatically reduce when exported to the Middle East. Furthermore, since access to fresh water is not problematic in both the US and China, PV applications are mostly focused towards energy generation in those regions. However, in the Middle East, same technology can be easily adapted for portable desalination technologies with a little tweak. Undoubtedly, these specific insights are now commonplace but for new technologies, reaching similar realizations requires insights into the social, economic, and technological landscapes in both the originating and destination locations of the investment. As such, a dynamic portfolio, backed by two-sided market and technology intelligence analyses, is key to bridging this gap, and most importantly, in effecting a more sustained social and environmental impact for foreign green investments.



**Figure 1: Water scarcity map of the world. In the US and China, there is no physical water scarcity so desalination is not widely required. Source: [www.kysearo.com/v](http://www.kysearo.com/v)**

Nordic countries – Norway, Sweden, Denmark, Iceland and Finland – are well known for leading the pack in terms of sustainability development. These countries have also previously demonstrated a viable model for promoting green investments towards the export their green technologies. A salient example lays in the facilitation of the export of Tomra's, a Norwegian Waste Management Company, sorting and recycling technologies to Poland. Based on the intelligence gathered by Green Business Norway's (a consortium of Norwegian green businesses) team, who has experience in doing business in both Poland and Norway, adequate product-market fitness was established for each project. The projects, which were co-financed by the Green Industry Innovation program, involved the export of Norwegian automated sorting technologies for Polish Municipality Solid Waste (MSW), and further sorting of metal and plastic waste in recycling factories. Since completing the projects, the overall sorted recyclables from the Municipality Solid Waste (MSW) increased by 20%, and metal and polymer recycling have been increased by an average of 300%. Returns of the facilities have also been improved by an average of 80%. To sustain this green growth and further improve returns on this green investment, Green Business Norway (GBN) is currently involved in; the environmental and economic optimization, development of secondary material production strategies, and the assessments of waste-to-energy opportunities for the current systems.

In a similar fashion, in order to manage the investment risks on Nordic green technologies, from the Middle East, a similar mechanism has been put in place called Green Business Scandinavia (GBS). Green Business Scandinavia (GBS) is a professional organization located in Masdar City Abu Dhabi, with a Business Intelligence program serving to secure international investments for its Nordic members while managing investment risks in the Middle East. The Business Intelligence program achieves this by providing custom-made, robust and dynamic internationalization strategies towards the region. GBS also contributes to innovation, enabling co-operation and project development on behalf of its members. These serve to significantly expand the market size, ease transition from applications in the Nordic context to establishments in the Middle East environmental conditions, and reduce the barrier for entry respectively. A key component of the organization's innovative effort

is discovering alternative Middle Eastern applications of the exported technology for a more dynamic market segment. The organization also has business and technical teams located in the UAE that aids its member company fine tune their exported technologies to local conditions and hence remove all technological barriers. While doing these, GBS is also looking to broadening its spread within region.



Figure 2. Structure of the Business Intelligence program. Source: <http://www.thinksofttech.com>

## Sustainable Investment for Greener Future

### Investments into energy efficiency are now a reality in the Middle East

*Stephane le Gentil*

CEO

Clean Energy Business Council

Dubai – United Arab Emirates (UAE)

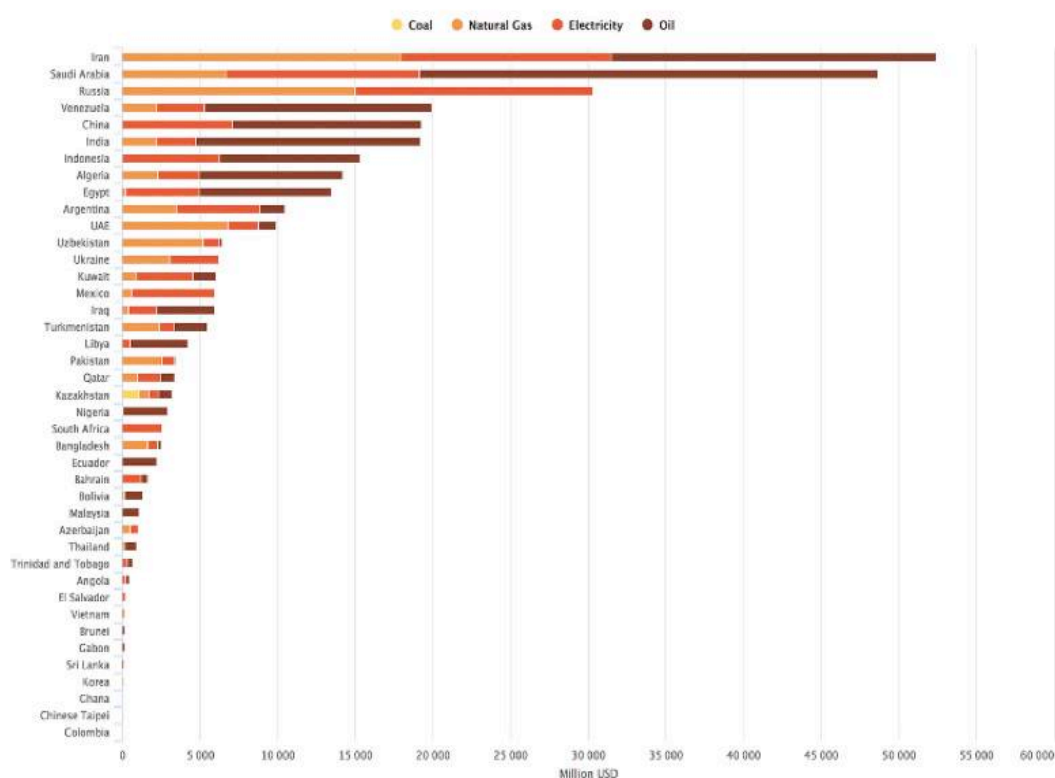


Over the years, oil-rich Arab countries have been developing rapidly attracting more and more people and constructing quickly vast amounts of buildings to host these new comers and to allow them to develop their activities and businesses. Dubai is the typical example of this. The city has developed extremely quickly erecting multiple gleaming residential and office skyscrapers, numerous high-end hotels and all the infrastructure that is needed. During these years, energy was not an issue and was rarely considered when designing these buildings. As a result, the Middle East ends up today with a huge installed base of buildings that are all very nice but that were not conceived to be energy optimized. As an example, about 70% of the existing buildings in Saudi Arabia have no thermal insulation - a madness in a country where temperatures in summer require permanent air-conditioning. That was not a problem when electricity was cheap, the cost to cool these buildings was insignificant and nobody really cared about this.

But this was the past when oil was at a high-price bringing sufficient wealth to the Arab states so they could highly subsidize the energy prices to their citizens.

Energy Subsidies by Country, 2015 (Million USD)

Click on a subsidy type below to add or remove it from the chart



Today with the barrel of oil remaining in a low range, energy subsidies have become unbearable for these nations. For a while they tried to keep these subsidies hoping that the price of oil would increase but after a few years it became financially impossible to sustain. As a result, energy subsidies are being cut progressively across the Middle East. Subsidies for the fuel used in cars were removed by the UAE in 2015 and tariffs for water and electricity are being raised as a consequence. In January 2017 Abu Dhabi doubled the end-user price of water. In Saudi Arabia prices for electricity increased significantly this year and there are plans to raise them further in the near future. Kuwait more than doubled electricity prices in May 2017. In most cases the hikes are impacting commercial, industrial, expatriates and government sectors while protecting the local citizens.

As a result of these price moves, many business owners wake-up with sudden huge energy bills and costs directly impacting their bottom-line. In the industrial sector the impact is severe and can make industries uncompetitive. Saving electricity and water is now a key necessity financially and “energy efficiency” is now becoming the buzz word.

## Energy Efficiency

In parallel to the very visible and communicated projects on renewable solar energy, energy efficiency has become a clear objective for the Arab countries to reduce costs. With energy efficiency, end-users will reduce their energy costs and utilities will defer massive investments into new costly power plants. And the population will get the additional environmental benefits that emission reductions bring in addition to contributing to the commitments taken at the Paris agreement.

## Dubai

Looking specifically at the UAE, which leads the energy efficiency efforts in the region; as usual Dubai was very quick to adopt a sound energy efficiency strategy and took early actions on establishing a Demand Side Management plan. In particular the Dubai Electricity and Water Authority (DEWA)

has established a company fully dedicated to these activities: Etihad Energy Services Co LLC or Etihad ESCO. Started in 2013, Etihad ESCO has executed large energy efficiency projects both in buildings and lighting that are now creating significant reduction on consumptions. Etihad ESCO is investing into the existing buildings to improve them using the ESCO model where the savings generate enough returns for the end-users to be financially attractive. In 2016 Etihad ESCO cut the electricity consumption of its clients by 54GWh generating close to US\$10 million of cost savings.

But by focusing on Dubai, it is easy to overlook what the other UAE emirates are effectively doing on energy efficiency.

## Sharjah

North to Dubai, the Sharjah emirate, known for its cultural activities and variety of museums, and where most of the Dubai workforce is living, is also now very active. In Sharjah, an important change was made three years ago by the ruler to appoint a well-known local personality, Dr Rashid Alleem, as Chairman of Sharjah Electricity and Water Authority (SEWA). Dr Rashid revolutionized SEWA and changed its way of operating bringing it to the 21st century by adopting methods and ideas that you would see in companies such as Google or Facebook while still protecting its authenticity. And this is the vision that he defined for SEWA: “To be among the best authentic organizations in the world”. In 2015, SEWA published “The Declaration of Sharjah City of Conservation”.

The Declaration is a comprehensive and ambitious plan with the goal to make Sharjah the first City of Conservation in the region by promoting Sharjah’s regional and international image to take a lead in sustainability and environmental matters. The Declaration has clear objectives and clear strategies in that matter. It is ambitious and challenging while being realistic and attainable. It also defines the actions that SEWA is taking for conservation and the actions that are shared with other key entities in Sharjah, as well as with the residents. The plan is comprehensive and action has started. For example,

the Declaration states that power saving bulbs will be used for street lighting in the Emirate of Sharjah. Today SEWA have retrofitted many of the street lights with LEDs and installed solar powered street lights in remote areas. And the plan goes on and on about what will be done to improve Sharjah. This is very encouraging and with action and methodology, these goals will be achieved.



## الشارقة مدينة الترشيد SHARJAH CITY OF CONSERVATION

### Abu Dhabi

South of Dubai, the Emirate of Abu Dhabi is also focusing on energy efficiency through a global plan named “Tarsheed” that was created and managed by the Abu Dhabi Water and Electricity Authority (ADWEA). Tarsheed addresses multiple aspects for the conservation of electricity and water. One recent initiative is the launch in March 2017 of Kafa’ati to improve energy efficiency of the existing buildings in the emirate. Through Kafa’ati, Energy Services Companies (ESCOs) will be contracted to reduce the electricity consumption in Abu Dhabi buildings. ESCOs will be asked to invest in the buildings to improve their efficiency and will be paid through the savings that will be generated. Up to 3,000 buildings are to be retrofitted through Kafa’ati to increase energy efficiency and bring an annual consumption reduction of 446GWh by 2022.

### Saudi Arabia

The UAE is clearly leading the energy efficiency efforts but other countries are close followers. Saudi Arabia is following the path of Dubai by creating a company dedicated to reducing the consumption of energy in the Kingdom’s existing buildings. The

National Energy Services Company was recently formed by the Saudi Public Investment Fund (PIF) with the objective to drastically improve the energy efficiency of buildings. With the recent increase of electricity tariffs in the Kingdom, investing in buildings to reduce their consumption provides a fast return on investment. Only a few years will be necessary to see the electricity cost savings surpass the investment needed to achieve these savings.

**This recent regional move towards more energy efficiency is much needed and follows a global trend. Triggered by the increase of energy costs to end-users, it will help the Arab countries reduce their dependency on fossil fuels but also promote more responsible behaviors towards energy and water consumption by their citizens.**





# UN Environment Promotes Sustainable Consumption and Production

By: UN Environment



## Introduction

The sustainable consumption and production is a standalone goal in the 2030 Agenda for Sustainable Development, but also impacts on other goals such as climate change, poverty, zero hunger, and sustained, inclusive and sustainable economic growth – UN environment focuses on three areas:

1. Supporting countries in creating and enabling policy environment that promotes resource efficiency, sustainable consumption and production and the transition to green economy pathways
2. Enhancing the ability of governments, businesses and other parties to adopt sustainable consumption and production practices in key sectors across global supply chains.
3. Enhancing the ability of countries, businesses, civil society and individual consumers to make informed choices for sustainable consumption and lifestyles.

UN Environment supports countries and regions to integrate sustainable consumption and production approaches into policies. Over the last two years, with UN Environment support, eight countries and nine cities developed and/or started implementing sustainable consumption and production. This brings the total to 29 countries and nine cities that have adopted or started the implementation of sustainable consumption and production and green economy pathways since 2011.

Moreover, UN Environment aims to provide enabling conditions for promoting more sustainable consumption choices and lifestyles. Progress is demonstrated by the number of public and private sector institutions that put in place policies and measures conducive to sustainable consumption patterns. Supporting sustainable public procurement is one way to stimulate demand for, and supply of, sustainable products. Over the last two years, UN Environment supported 20 countries on sustainable public procurement. Six of these countries are developing or implementing action plans in close coordination with the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns (10YFP), which is running programmes on Consumer Information, Sustainable Lifestyles and Education, Sustainable Public Procurement, Sustainable Buildings and Construction, Sustainable Food Systems, and Sustainable Tourism. Additionally, with UNEP's support, 27 companies –based in Brazil, Cameroon, Colombia, India, Peru and Uganda – have increasingly used life cycle-based approaches and tools.

Education and awareness-raising are also important enabling conditions for more sustainable lifestyles. Over the last two years, UN Environment supported activities that catalyzed the engagement of 18 stakeholders into the promotion of sustainable lifestyles – including through the joint UNEP/Food and Agriculture Organization initiative on reducing food waste, Think.Eat.Save – bringing the total to 28 stakeholders.

## Sustainable Consumption and Production in the Area of Transportation

As the 3rd session of the United Nations Environment Assembly is fast approaching (4 - 6 December), discussions arise on the best practices to reduce pollution in its various forms –which is the theme of this year's meeting,

Over the last years, many cities in the region have been reexamining current transportation systems to determine how to accommodate a growing and socioeconomically diverse population, while seeking to minimize environmental pollution and urban congestion.

As already known to most of us, the transport sector is responsible for approximately one quarter of all energy related greenhouse gases (GHG) emissions. This is a percentage that can and must be reduced to provide for the future we want for our generation and our children's, thus we need policies, practices, technology as well as an attitude and a lifestyle supporting transformation to sustainable transport.

Transport is only sustainable when it provides for safe, economically viable and socially acceptable access to people, places, goods and services while meeting generally accepted objectives for health and environmental quality, protecting eco systems and minimizing adverse impact on global phenomena such as climate change, stratospheric ozone depletion and the spread of persistent organic pollutants.

There is often a large gap between the technology available and best practice know-how, the networks necessary to build consensus and the actual implementation of transformative change.

Sustainable development is the balance between the three strands of development, be it economic, social or environment. However, in many countries and cities in developing countries that used to have a high share of public transport and non-motorized modes in urban areas, are losing their shares because of their inability to cope with the demand for transport in particular with economic and population growth.

The challenge is to sustain the high modal share by continuously improving the existing systems.

The challenges for the transport sector in becoming “green” are made obvious by observing current trends, whereby the global vehicle fleet is expected to triple by 2050 and most of the growth will occur in developing and transition countries that have immature vehicle emission reduction strategies and increasing private transport practices.

Technological improvements such as fuel-efficient vehicles and alternative power sources have not been rapid enough to offset the impacts of this growth. These trends translate directly into various costs for the environment, society and economy: including Energy consumption and greenhouse gas Emissions, Congestion and associated losses in productivity of urban areas, Resource depletion, Degradation of human health, Reduction in human safety, and Loss of biodiversity.

The United Nations Environment promotes Policies for greening transport that follows three interlinked principles:

1. Avoiding or reducing trips through integration of land use and transportation planning, and localized production and consumption. Not only this contributes to reducing environmental impacts, but also increases socio-economic benefits for local communities.
2. Shifting to more environmentally efficient modes such as public and non-motorized transport for passengers and to rail and water transport for freight.
3. Improving vehicle and fuel technology to reduce the negative social and environmental effects from each kilometer travelled.

Other policies are also required which promote compact or mass transit corridor-based cities, the regulation of fuel and vehicles, and the provision of information to aid decisions by consumers and industry.

The overall benefits of transport sector to human wellbeing can be achieved with the provision of right

and innovative technological options and investments on infrastructure, complemented by appropriate policies and regulatory framework. An efficient and clean public transport system has low specific energy consumption and emission per passenger or goods per kilometer travelled or transported. Public transport (buses, light rail, metros, and trains) uses less space for transporting goods and services as opposed to private vehicles. More importantly, public transport provides equitable transport services to a large segment of the population especially the underserved population.

Strong economic incentives such as taxes, charges and subsidy reform can also support an increase in cleaner private vehicles as well as a shift to public and non-motorized transport. Technology and practices innovations can also provide better socio-economic development while enhancing sustainable transport practices. Taxes should not mean more hardship on unprivileged sectors of the society as that should be integrated into sustainable transport and poverty reduction strategies resulting in a comprehensive, inclusive and equitable sustainability options.

Enabling conditions are necessary conditions in the investment and political environment that collectively allow the transition to a green economy. These enablers will assist the implementation of the green investments for the transport sector that facilitate best available policies and technologies across the world. Key enabling conditions for green transport include:

- Designing appropriate regulation, planning and information systems.
- Setting the right financial conditions and economic Incentives.
- Ensuring technology transfer and access; and
- Strengthening institutions and capacity.

Transport is a major attractor of public and private investment through strong prevalence of public-sector funding for Transport infrastructure and strong preference by international donors and national governments for the roads sector.

To enact green transport, it is clear that financing patterns must be reformed, so that adequate funding is provided for green transport in all aspects including technology, capacity-building, operation, and infrastructure. And Resources would be shifted from supporting non-sustainable forms of transport towards green transport.

There are many revenue-generating opportunities for the private sector to support or complement sustainable transportation systems and operations. These may take the form of public-private partnerships, or a for-profit business providing a service or product directly to users such as Bus Rapid Transit (BRT) systems.

UNEP has four global flagship programmes that are founded on the 'avoid-shift-improve' approach;

1. Partnership for Clean Fuels and Vehicles (PCFV) - providing a range of technical, financial and networking support for governments of developing and transitional countries and other stakeholders to lower vehicle emissions to promote cleaner fuels and cleaner, more efficient vehicles
2. The Global Fuel Economy Initiative - promoting debate and discussion around the issue of fuel economy. The initiative promotes data analysis of fuel economy potentials, support for national and regional policy-making and outreach and awareness raising to stakeholders.
3. Share the Road - A UNEP-led initiative that advocates a systematic inclusion on Non Motorised Transport infrastructure in urban road investments as a matter of policy.
4. Public Transport - Improvements in the public transport sector provide the largest opportunity for avoiding future transport emissions and an optimal development pathway for the transport sector.

Other initiatives include The Green Passport which aims to introduce travelers to some practices to minimize their footprint by choosing the least polluting form of transport. The UNEP Carbon Calculator which informs travelers or commuters how much is the eco- footprint their choice of mode of transport would be contributing.

Municipalities across the world have employed a range of instruments and policies to enhance the efficiency of their transportation systems and improve their quality of life.

- In central London, for example, a "congestion charge" reduced CO2 emissions by 20%.
- Singapore's Electronic Road Pricing and Vehicle Quota System slowed increasing car use and motorization.
- Bogota's bus rapid transit system (BRT) is contributing to a 14% drop in emissions per passenger, replicated across the globe in Lagos, Ahmadabad, Guangzhou and Johannesburg.
- In Europe, Emissions standards and car-sharing schemes have reduced car dependency.
- In the Gulf, a "GCC Railway Authority" is expected to be formed to oversee the overall implementation of the GCC Railway Project
- The underground metro in Cairo is the major public transport project in the region. A 63 km underground network links the three governorates which form the Cairo metropolitan region,
- The high speed railway in Saudi Arabia connect Mecca, Al-Madina and Jeddah

## Untapped alternatives for a sustainable future

*Dr. Asmahan Al Wafi,  
General Director of the  
International Centre for  
Biosaline Agriculture  
(ICBA)*



*Dr. Abdumutalib  
Begmuratov  
International Centre for  
Biosaline Agriculture  
(ICBA)*



This year Earth Overshoot Day, an annual indicator of humanity's ecological footprint, fell on 2 August. By this date the world had arguably used more of the earth's resources than it could produce during the whole year. The global population is projected to consume 170 percent of the planet's natural output in 2017.

The grim milestone came much earlier than ever since 1987 when the measure was first calculated. In other words, humans are consuming far more and faster than the earth's biocapacity could handle. The world is gobbling up more water and other resources, emitting more carbon dioxide into the atmosphere and polluting the environment beyond measure.

### How to feed a growing world, sustainably

While incessant carbon dioxide emissions are making climate change a certainty, poor agricultural practices are increasing soil and water salinity, and unsustainable water use is leading to growing scarcity. As a result, many already dry and water-scarce regions have been hit by more frequent droughts severely affecting agriculture, an average of 2,000 hectares of irrigated land in arid and semi-arid areas across 75 countries is degraded by salt every day and water scarcity already affects every continent.

Through overexploitation, humanity is on course for a dangerously unsustainable future. To avert the worst-case scenario, it is incumbent on the international community to take immediate action. This is one of the reasons why on 25 September 2015, 193 countries adopted a set of goals to, among other things, protect the planet as part of a new sustainable development agenda. Each goal, also known as a Sustainable Development Goal (SDG), has specific targets to be achieved until 2030. The SDGs, which came into effect in January 2016, call for new, integrated approaches to tackling a wide range of global problems, including food and water insecurity, and climate change.

As the world braces for a warmer climate, scarcer resources and a larger population, research and innovation are key to a sustainable tomorrow. Faced with this dilemma, the public and private sectors in many countries have been investing heavily in research and development. Thanks to government and donor funding over the past decades, the international research and development sector has also been actively engaged in addressing a growing number of challenges in different parts of the world, including food insecurity and water scarcity.

However, the focus has been mainly on the mainstream crops and technologies which have not produced sufficiently effective and lasting outcomes. This is particularly true of regions with the least favorable environmental conditions. Major cereal crops like wheat, rice, barley and corn, for example, are progressively failing to withstand increasing salinity and lack of water in marginal areas, home to around 1.7 billion people by one estimate.

As the global population is forecast to hit 9.7 billion by 2050, the Food and Agriculture Organization of the United Nations estimates the world will need 70 percent more food. Yet scientists warn that industrial agriculture might be reaching its limits to produce enough food. What is more, yields of major crops are projected to fall by 25 percent and more by 2050 due to climate change and land degradation in a business-as-usual scenario.

This raises serious concerns about whether traditional agricultural methods and crops will be enough to sustain global food production targets as regions which already suffer from water scarcity and land degradation are forecast to see the largest population growth.

There is, therefore, a pressing need to identify, test and introduce alternative, non-traditional solutions to sustain and possibly increase agricultural productivity in regions where traditional, mainstream approaches are failing or uneconomical.

Alternative, non-traditional crops like quinoa and pearl millet, for example, are better suited to regions affected by salinity and drought. In places where water is in short supply, treated wastewater, saline water and even seawater are good options for agricultural and landscaping purposes.

## Mainstreaming alternative, non-traditional crops and technologies

Over nearly two decades the Dubai-based International Center for Biosaline Agriculture (ICBA) has been at the forefront of alternative, non-traditional crops and technologies that help to produce more food, save more resources and protect the environment. The center has developed and tested a wide range of solutions suited to changing realities in different regions.

One crop of interest is quinoa. Since 2007 ICBA has been leading a global program on quinoa to make it a crop of choice in areas affected by salinity, drought and water scarcity. The program is so far under way in Egypt, Jordan, Kyrgyzstan, Morocco, Oman, Tajikistan, the United Arab Emirates (UAE), Uzbekistan and Yemen. Today the center has four tested lines that do well under highly dry and saline conditions. Multi-year trials have shown that ICBA's lines produce, on average, up to 5.41 tonnes of seed per hectare under highly saline, sandy and arid conditions in the UAE. In Central Asia, the lines have been reported to yield as much as 5.57 tonnes of seed per hectare.

The center also implements research programs on treated wastewater, saline water and seawater irrigation in agriculture and landscaping. In the UAE, for example, scientists have been assessing since 2013 the pros and cons of treated wastewater use. This initiative has major implications for water management as treated wastewater accounts for 12 percent of the total water supply in the country and undergoes tertiary treatment. Long-term experiments have investigated the effect of irrigating vegetables such as carrots, lettuce, eggplant and tomato, as well as landscaping plants and date palms, with treated wastewater. The results indicate that treated wastewater is a good alternative to freshwater when it comes to agriculture and landscaping under arid conditions.

ICBA also considers reject brine and seawater as alternative sources for irrigation. Given that more than 8.7 million cubic meters of desalinated water is used for irrigation and around 3.5 million cubic meters of reject brine is produced globally every day, it is crucially important to ensure safe disposal and sustainable use of this by-product of desalination. The center has operated for several years inland and coastal modular farms jointly with the Ministry of Climate Change and Environment of the UAE to study the use of reject brine and



**[Caption: Unlike major crops like wheat, quinoa is a complete protein - containing all eight of the essential amino acids. It is packed with dietary fiber, phosphorus, magnesium and iron. It is also gluten-free and easy to digest. Quinoa's health benefits have made it a staple for hip restaurants and upscale shops around the world.]**

seawater for aquaculture. The inland modular farm uses desalinated water for vegetables, reject brine for fish, and aquaculture effluents for halophytic plants, while the coastal modular farm uses seawater for fish and aquaculture effluents for halophytic plants.

Scientists also look at how to put seawater to good use. There are many halophytic or salt-tolerant plants like *Salicornia* that grow with seawater and are a good source of forage, food and biofuel. So the center has put considerable efforts into this plant because of its outstanding qualities. In the center's studies to date, the plant has demonstrated remarkable adaptability to harsh climatic conditions of the Middle Eastern region. It is also a promising source of biofuel. The studies show that 225-250 gallons of biodiesel can be produced from one hectare of *Salicornia*. The plant's seeds have high concentrations of poly-unsaturated fatty acids ( $\approx 30$  percent) and low salt content ( $< 3$  percent), which make it an excellent candidate for biodiesel production.





**[Caption: *Salicornia* is a halophyte that can grow with seawater. It can be used for forage, food and biofuel production.]**

ICBA collaborates on *Salicornia* research with different institutions in the UAE and elsewhere. For example, ICBA has been working with the Masdar Institute and the King Abdullah University of Science and Technology since 2011. In partnership with the Ministry of Climate Change and Environment of the UAE, the center launched a new project in 2016 at the Marine Environment Research Center's experimental station in Umm al-Quwain, UAE, to examine potential for *Salicornia* production in coastal regions using seawater and recycled water from fish farming, and scaling it out. Experience so far suggests that if suitable *Salicornia* germplasm is used in combination with appropriate agronomic practices, production of this halophyte could be economically viable and successful in highly saline conditions.

Researchers have also worked since 2015 on a low-cost technology to make biochar from green waste. Biochar is a charcoal used as a soil amendment and produced from plant matter and stored in the soil as a means of removing carbon dioxide from the atmosphere. Plant matter decomposition is a natural source of carbon dioxide emissions. So turning plant waste into biochar instead of dumping it in landfills would benefit the environment and agriculture.

In the UAE, for example, 0.6 million tonnes of green waste is generated from some 40 million date palm trees every year. If left to decompose on the surface or dumped in landfills, this biomass can produce 880 million tonnes of carbon dioxide annually.

The center has tested its low-cost technology in field trials for soil improvement and crop production. The trials have demonstrated that biochar significantly improves soil fertility, helps to save 30-35 percent of water and soil nutrients, and mitigates carbon dioxide emissions.



**[Caption: Biochar is produced by heating biomass in an oxygen-free or low-oxygen environment so that it does not (or only partially does) undergo combustion. In this system, biochar can be produced from green waste, which helps to sequester carbon and improve soil quality. An advantage of this process is that it also produces gases that can be captured as bioenergy and fed back into the energy grid, making it a carbon negative process overall.]**

## A sustainable tomorrow

As climate change and overexploitation pose a growing number of risks to the planet and humanity, it is important to reassess whether mainstream approaches will be enough to deal with ballooning demand for food and other resources. Unless there is a paradigm shift in thinking, efforts to ensure, among other things, food and water security, and save natural resources for future generations are unlikely to succeed. Today it is clear that research and innovation hold the key to a more sustainable future. But it is necessary to pursue alternative avenues wherever conventional wisdom is of little help.

A way forward should consider options that have received little or no attention yet, especially in parts of the world that suffer from lack of water, poor soil, and drought. First, alternative, non-traditional crops should come to the fore in areas where major crops produce little or fail. It will boost productivity and income. Second, there is a need to consider using treated wastewater, reject brine and seawater for farming and other purposes in countries where freshwater resources are scarce. This will help to reduce pressure on freshwater resources. Third, it is crucial that research and development continue to identify and test crops and technologies best suited to these environments.

All this should form part of global efforts towards sustainable management of natural resources and food security for the benefit of future generations.

## Introduction of Seawater Desalination Plant

*Edited and written by Lilly Lee*

*Vice President & Director in charge of Dubai Office*

*Dafeng Port Financial Leasing (Beijing) Co.*

*Email: dr816@hotmail.com*



New Energy Seawater Desalination Co.Ltd. locates in the east of Jiangsu Province. It's a joint venture invested by China National Pharmaceutical Group, China National Salt Industry Corporation, Harbin Electric Corporation, Jiangsu Dafeng Port Holding Group Co.Ltd., Jiangsu High-Tech Investment Group Co.Ltd. The total investment is RMB 288 million and registered capital is RMB188 million. As a solely state-owned enterprise, it's the world's First 1000 T off-grid wind power Seawater Desalination demonstration base and a professional company integrating R&D, production, sale, demonstration and promotion of seawater desalination integrated technology. The company is devoted to the R&D of new energy seawater desalination technology and industrialization development, providing premium drinking water resources and functioning as demonstration for the application and promotion of seawater desalination technology. Its major management scope includes the R&D of seawater desalination technology, R&D and manufacture of wind turbine equipment and seawater desalination equipment, park infrastructure construction, and garden landscape engineering construction.

Jiangsu New Energy Seawater Desalination Development Co.Ltd. has build up the second batch of national seawater desalination industry pilot city, national marine economic innovation development zone demonstration, Harbin Electric Corporation power generation equipment state engineering research center Jiangsu sub branch, state seawater utilization engineering technology research center Jiangsu branch, China Salt manufacturing engineering technology academy Dafeng branch etc. Jiangsu new energy seawater desalination engineering center has been established together with information and automation laboratory, product and process flow laboratory, testing room and so on. All necessary devices like design experiment and testing devices are all equipped as well. A project laboratory

integrating functions including design, test, inspection and industrialization is set up targeting advanced technology of seawater desalination home and abroad and implement theoretical research and provide guidance for new process, technology and product development, based on with Jiangsu energy structure is promoted, energy saving and emission reduction target is reached to achieve good social benefits.

The integrated equipment of container type intelligent micro-grid seawater desalination



### **The composition of container product:**

The container type intelligent micro-grid desalination system is composed of the renewable energy input system (WTGS, photovoltaic power generation system, etc.), the energy storage system (PCS+ energy storage battery), the micro-grid control system, and the desalination system etc. The renewable energy input system includes WTGS, the photovoltaic power generation system, the solar-thermal power generation system etc, which can be selected as required by the customer.

The renewable energy such as solar energy, wind power, tidal energy and geothermal energy comes from nature, which is endless and inexhaustible and of little harm or even harmless to the environment. What's more, these resources are widely distributed. If they are exploited and utilized properly, it'll be of great significance to environmental protection and resources protection.

### **The system has following advantages:**

- High Integration level: except wind turbine generators, photovoltaic equipment and water tanks, other equipment are all put inside the container. With compact layout and good flexibility, it's convenient for transportation;
- Clean Energy: only use clean energy for energy saving and environmental protection, and there is no pollution to marine environment
- Black Start Function: the system can start operation without any support of power
- Highly Automatic: during operation, the system can start with a push of button and the operation is automatic with remote monitoring function
- Protection Design: the system is featured with typhoon defense, corrosion protection and high temperature resistance functions

The system adjusts to a big range of water quality fluctuation; the pretreatment system doesn't need chemical cleaning. Reverse osmosis system doesn't require frequent cleaning. It releases very limited chemical to the environment and therefore is pollution-free. The routine operation cost for the system is very low. The maintenance of the system is simple and convenient, which is not labor intensive.

Not only can the integrated system of modular intelligent micro-grid and seawater desalination can supply living water and electricity to our remote islands and inland brackish water basins, but also the seawater desalination technology is an important part of China marine strategic emerging industry. The technology can be widely applied to vessels to avoid water shortage during long-distance travel. In the meanwhile, the complete container modular intelligent micro-grid desalination system may not only be integrated but also be disassembled into the micro-grid system and the desalination system to be respectively used in the areas lacking in electricity but not lacking in water and areas lacking in water but not lacking in electricity.

## Micro-grid System

The micro-grid system operation mode includes normal operation mode (operation mode combining wind energy with energy storage), complementary operation mode of wind energy and diesel generated energy, complementary operation mode of wind energy, diesel generated energy and energy storage, the operation mode by introducing external power. When the wind power is strong enough to start the wind turbine

generator, the wind turbine generator works normally and the system is in the wind power storage operation mode. Otherwise if the generated wind power cannot meet the operation conditions of seawater desalination equipment, the system needs extra energy supply from the outside to guarantee its operation. The system has various operation modes like complementary operation mode of wind energy and diesel generated energy, complementary operation mode of wind energy, diesel generated energy and energy storage, the operation mode of independent diesel generator power supply, the operation mode by introducing external power.

These modes can be inter-converted. The normal operation mode of the micro-grid system combines wind energy with energy storage. In such mode, it's unnecessary to start diesel generator and diesel generator is only used in special cases or for the purpose of guaranteeing the diesel generator's safe shutdown.



The capacity of the power generator has to meet the corresponding requirement of daily seawater desalination equipment. At the same time, the capacity should also be sufficient for partial power supply to the residents on the island. The power generation mainly relies on wind power and photovoltaic system can be added if the space is allowed.

Generally there're 30kw, 50kw and 100kw wind turbine generator for selection. At present, 100kw is mostly chosen based on the analysis of performance and application maturity. The 100kw wind turbine generator applies automatic pitch control structure and the rest relies on manual control. Therefore, 100kw wind turbine generator is slightly safer.

Seawater desalination technology desalinates seawater through primary and secondary reverse osmosis to make the water meet living drinking water quality. Based on that, the tertiary reverse osmosis is adopted to further remove the irons from the water to acquire bottled (barreled) purified water for drinking. The strong brine, backwater water from the filter tank and filter are released to the neighboring seas after being collected. Dewater the wastewater in the pre-sedimentation tank and clarification tank. The chemical cleaned sewage is neutralized for innocent treatment and then is discharged to municipal sewage pipeline after reaching the sewage standard.

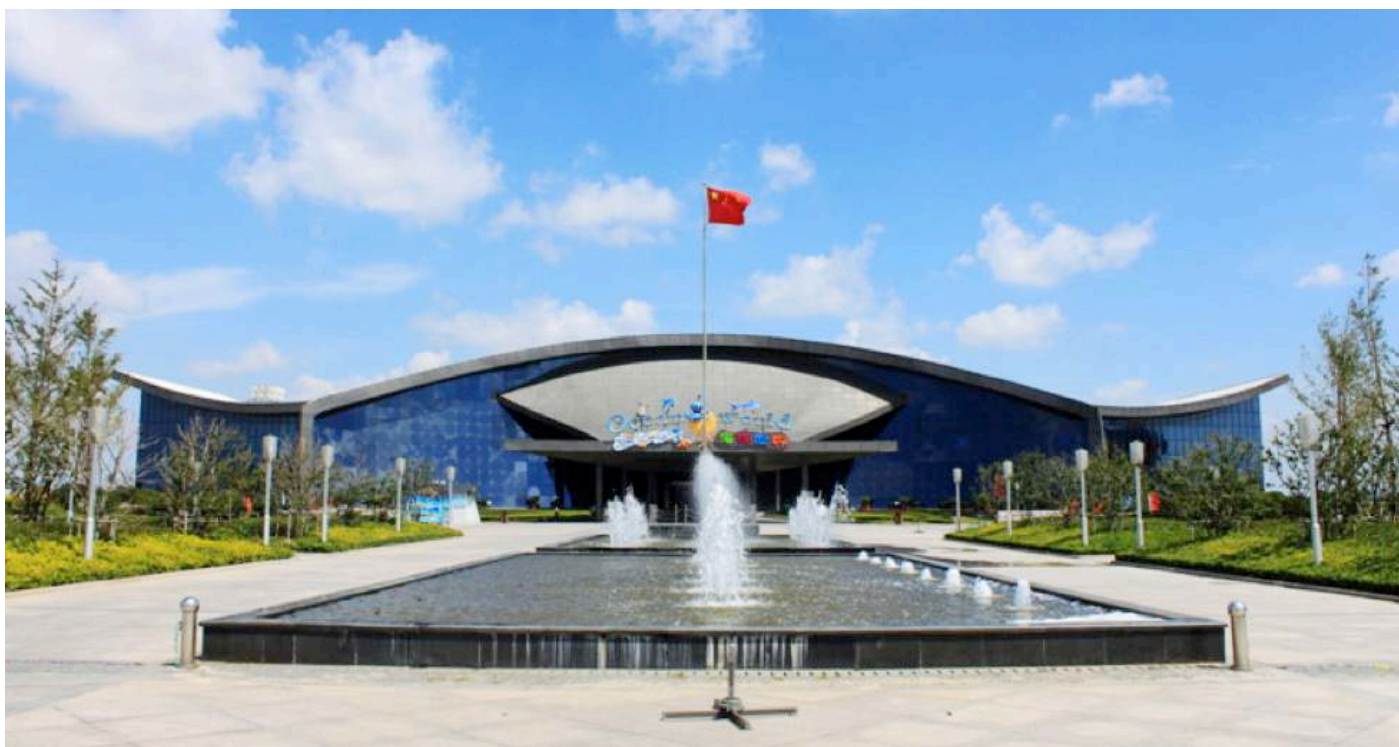
The capacity of seawater desalination system can be customized as per customer's demands. There're mainly 50T, 100T, 200T, 300T, 500T, 1000T specification for customer's choice.



**Seawater Desalination System**



**Site photos of Seawater Desalination Plant in China**



(Headquarter in Dafeng, China)



(Site photo of Desalination plant, wind & solar power combined equipment sets)





**(Auto-production line of Seawater Desalination Plant in Dafeng, China)**



## Hussain Abdulla AlFardan

Director of the Environmental Center for Arab Towns.

### **Education and Eco- Consciousness a true Partnership between Generations for a Safer and Sustainable Future**

As we living on a planet which we inherited its environmental impacts from our ancestors. And as we enjoyed the bounties of this generous planet, and since there are people who attended those natural resources perfectly, thus, it is the right of all future generations to attain the warmth of the earth and enjoy its abundances.

It is our responsibility to cooperate to live on this planet, we ought to take this option, otherwise we shall perish together without any other choice. Thus, the matter of education and environmental consciousness in term of values, is trust and commitment And on national level, is a responsibility and partnership And at the level of social relations community, is committing to an accountable social behavior

At this stage, we notice that all the parties involved in the environmental sense are striving hard to deliver a pure vision of all segments of the society conveying the message that (we are all in the same boat)

Consequently, we notice that all government organizations and departments, business sectors as well as the educational institutions are all working hand in hand to rephrase and reshape the relationship between man and its environment, in order to establish rational ecological behavior that draws upon education and environmental awareness as its sustainable approach

The children and youth shall have the biggest share of attention, as they are the vanguard bearing the huge burden, and as they inherited a legacy that they did not choose nor participated, and as they are the inheritors of massive challenges accumulated by generation of negligence.

**Education and eco -consciousness is a trust..... Deliver it to others**

The Environmental Center for Arab Towns is pleased to invite the professionals and interested persons in environmental issues to send their articles that we believe will enrich the Envirocities e-Magazine and helps raise environmental awareness and education. Please send your contribution to [nedalma@dm.gov.ae](mailto:nedalma@dm.gov.ae) or [ecat@dm.gov.ae](mailto:ecat@dm.gov.ae).