UNITED ARAB EMIRATES
MINISTRY OF ENVIRONMENT & WATER

الإمارات العربية المتحدة
وزارة البيئة والمياه

UAE STATE OF GREEN ECONOMY

تقرير حالة الاقتصاد الأخضر
دولة الإمارات العربية المتحدة

REPORT 2014

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United Arab Emirates
Ministry of Environment and Water

The UAE launched a national long-term initiative to make our country one of the international leaders in the Green Economy and a centre for export and re-export of green products and technologies. There is a need for public awareness, along with government effort, to promote production and deployment of renewable energy. Adoption of the Green Economy is yet another important step towards *the UAE Vision 2021*.

on the occasion of the 17th National Environment Day, 3 February 2014

His Highness Sheikh Khalifa bin Zayed Al Nahyan

President of the United Arab Emirates

We in the UAE, within *the Vision 2021*, are striving to build a diversified economy based on knowledge and innovation, through which we can provide excellent employment opportunities to our citizens. Through this, we can protect our natural and environmental resources, and strengthen our competitive position in global markets, especially in the areas of renewable energy products and technologies on the Green Economy. We are serious about the transformation of our development process to reach the first position on the global level. During the next nine years and up to the year 2021 we will launch a range of initiatives and projects in all areas to achieve our goal. I ask everyone to prepare for a new phase in the growth of the UAE.

on the launch of *the UAE Green Growth Strategy*, 15 January 2012

His Highness Sheikh Mohammed bin Rashid Al Maktoum

Vice President and Prime Minister of the
United Arab Emirates and Ruler of Dubai

Welcome to the first edition of *the UAE State of Green Economy Report*

Dr. Rashid Ahmed bin Fahad
Minister of Environment and Water
United Arab Emirates

Today, the world faces multiple global challenges in regard to food, water, energy, climate and financial system, as well as wars and conflicts. These affect our everyday life in varying degrees. Overcoming these challenges and restoring global equilibrium apparently requires highly innovative thinking and the adoption of unconventional solutions.

This is also the case for protecting and repairing our planet – the model of "grow first, clean up later" needs to be shifted towards the one which enables economic development and environmental sustainability to work together. In the last few years, the emerging concept of Green Economy has therefore been taken up by many countries around the world. In June 2012, more than 190 nations, including the UAE, agreed on Green Economy at the United Nations Rio+20 Summit as one of the important tools available for the achievement of sustainable development and poverty eradication.

The UAE's successful economic development means that the country has faced serious environmental challenges arisen from the record pace of growth in population, energy and water demand, and urban areas. However, with the objective set out under *the UAE Vision 2021* to become among the best countries in the world, the country has decided to steer its course towards Green Economy and to achieve green objectives and economic growth simultaneously. In January 2012, His Highness Sheikh Mohammed bin Rashid Al Maktoum, the Vice-President and Prime Minister of the UAE and Ruler of Dubai, launched *the UAE Green Growth Strategy* as a long-term national initiative under the slogan "A Green Economy for Sustainable Development". Under this strategy, the UAE seeks to become a global hub and a successful model of the new economy through the enhancement of the country's competitiveness and the sustainability of its development, thus preserving its environment for future generations.

Following the launch, the strategy began to be implemented with the acceleration of greening efforts in both the public and private sector. Initiatives were commenced or scaled up in energy diversification, renewable energy deployment, resource efficiency enhancement, waste reduction and recycling, green buildings, sustainable transport systems, energy and water-saving home appliances, etc. In the coming years, relevant national and local policies will be reinforced in a more coordinated manner, and industry and citizens will be encouraged to come up with more eco-innovative solutions and to adopt more environmentally sound behaviour.

The UAE State of Green Economy Report aims to present the country's current status according to international benchmarking, and the progress made on diverse public and private initiatives. It will report on a regular basis in order to help the country to take the right course and make solid advances towards a Green Economy. The first version explains the rationale for *the Green Growth Strategy*, and introduces the plan and structure for its implementation. It is hoped that this report will help the reader understand the UAE's national context and be encouraged to take part in the ongoing and forthcoming initiatives. This publication is the first of its kind in the world, in that it reports Green Economy status at country level. Accordingly, we have put our best efforts into establishing a valuable benchmark for capturing the country's status and for measuring performance. Based on this, we hope other countries can also engage in similar practices. The report also guides the reader to good practices and the experiences of public and private-sector initiatives aiming for Green Economy in the UAE and around the world, and outlines promising green investment opportunities.

As part of our contributions to the international community that promotes Green Economy, we hosted the first Global Conference on the Partnership for Action on Green Economy (PAGE) with UN agencies in March 2014. Over 650 participants from 66 countries, including 27 Ministers, shared a clear sense of urgency to pursue a low-carbon, socially inclusive and resource-efficient development model that improves human well-being and values natural capital. It was decided to hold another conference in Dubai, taking place simultaneously with Expo 2020. We will work hard in the next six years to make sure that we can present to the world advances in our knowledge, innovation and creativity, and that we can contribute to guiding countries around the world towards a promising, sustainable future.

Foreword from UNEP

Achim Steiner
United Nations Under-Secretary-General
Executive Director, United Nations
Environment Programme (UNEP)

The thinking on Green Economy has made remarkable advances in the last few years. From being little more than an intriguing idea on the margins of environmental economics, it has now becoming a known and powerful policy framework for governments around the world in reaching their sustainable development targets. Globally, over 65 countries have embarked on Green Economy and related strategies, and 48 of them are taking steps to develop national Green Economy plans. The UAE has been a front runner by making important commitments on their own national strategy and taking leadership in the international scene.

At the national level, this report traces notable progress on Green Economy made by the UAE over the last years. *The UAE Green Growth Strategy* was an important step in aligning the development of Green Economy thinking across all sectors. The very significant investments in renewable energy and water management described in this report are examples of this vision being put into practice.

At the international level, the UAE has also been an important contributor. The first Global Conference on the Partnership for Action on Green Economy (PAGE) was hosted by the UAE in March 2014, with five United Nations agencies. It was a huge success, with more than 650 participants from 66 countries participating, including 27 ministers. The fourth PAGE conference, to be held in six years' time simultaneously with Dubai Expo 2020, will be an important occasion to showcase innovation and advances in policy, technology and financing made across the world.

Driven by a growing understanding of ecological constraints and the intuition that economic prosperity must fundamentally derive from good stewardship of natural resources and environmental wealth, governments throughout the world have started to explore ways to decouple growth from environmental degradation. Although Green Economy is still in an early phase, new knowledge and experiences are constantly being generated by the front runners, and the experiences of an increasing number of countries worldwide show promising signs of their potential to achieve increased well-being with a lower environmental footprint.

As the Green Economy concept takes root around the world, the lessons emerging from countries like the UAE take on increasing importance. I invite the reader to closely examine the elements of the UAE strategy for pursuing Green Economy as an example of what is possible when sustainability is put at the heart of national priorities and planning.

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Chapter 1

The UAE Approach towards an Inclusive Green Economy introduces the UAE's socio-economic background and explains the rationale, focuses and potential benefits of greening the economy.

Chapter 2

Sectoral Initiatives towards a Green Economy provides highlights of ongoing public and private-sector efforts for enabling Green Economy in the country's nine key sectors: Oil and Gas; Water and Electricity; Industry; Buildings, Construction and Real Estate; Transport and Logistics; Waste Management; Land use and Agriculture; Financial Services; and Tourism and Hospitality.

Chapter 3

Measuring the Transformation towards a Green Economy reports the UAE's performance measured according to the 30 UAE *Green Economy Indicators*. The performance data sets a baseline for regular monitoring and establishing future targets.

Chapter 4

Future Outlook: *The UAE Green Agenda* outlines the governance and programmatic structure for implementing the Green Growth Strategy, potential Green Economy actions, and next steps.

Chapter 5

Inclusive Green Economy from a Global Perspective is contributed by the United Nations Environment Programme (UNEP). It introduces other leading countries' approaches to Green Economy and how the United Nations aims to support the Green Economy transition and mobilise green financing and investment around the world.

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Abbreviations

ADFSC	Abu Dhabi Farmers Service Centre
ADNOC	Abu Dhabi National Oil Company
ADSG	Abu Dhabi Sustainability Group
ADWEA	Abu Dhabi Water and Electricity Authority
ADX	Abu Dhabi Securities Exchange
AED	UAE dirham(s)
AMI	advanced metering infrastructure
AUD	Australian dollar(s)
BAU	business-as-usual
CCS	carbon capture and storage
CNG	compressed natural gas
CO_2	carbon dioxide
CRB	Centre for Responsible Business, Dubai Chamber
CSP	concentrated solar power
CSR	corporate social responsibility
DCCE	Dubai Carbon Centre of Excellence
DCS	district cooling system(s)
DESA	Department of Social and Economic Affairs, UN
DEWA	Dubai Electricity and Water Authority
DFM	Dubai Financial Market
DIFC	Dubai International Financial Centre
DLD	Land Department, Government of Dubai
DoT	Department of Transport, Abu Dhabi
DSCE	Dubai Supreme Council of Energy
DSM	demand-side management
DTCM	Dubai Department of Tourism and Commerce
Dubal	Dubai Aluminium
E&P	exploration and production
EAD	Environment Agency – Abu Dhabi
EGA	Emirates Global Aluminium
EGBC	Emirates Green Building Council
EGS	environmental goods and services
Emal	Emirates Aluminium
ENEC	Emirates Nuclear Energy Corporation
ENOC	Emirates National Oil Company
EOR	enhanced oil recovery
EPC	energy performance contracting
EPE	environmental protection expenditure
EPI	Environmental Performance Index
ESCAP	Economic and Social Commission for Asia and the Pacific, UN
ESCO	energy service company
ESCWA	Economic and Social Commission for Western Asia, UN
ESG	environmental, social and governance
ESMA	Emirates Authority for Standardisaton and Metrology
EU	European Union
EWS-WWF	Emirates Wildlife Society in association with WWF
FANR	Federal Authority for Nuclear Regulation, UAE
FAO	Food and Agriculture Organization, UN
FDI	foreign direct investment
FEWA	Federal Electricity and Water Authority, UAE
GCAA	General Civil Aviation Authority, UAE
GCC	Cooperation Council for the Arab States of the Gulf (Gulf Cooperation Council)
GCI	Global Competitiveness Index
GDP	gross domestic product
GEDI	Global Entrepreneurship and Development Institute
GGGI	Global Green Growth Institute
GGKP	Green Growth Knowledge Platform
GHG	greenhouse gas
GNI	gross national income

Abbreviations

HDI	Human Development Index, UNDP
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IRENA	International Renewable Energy Agency
IUCN	International Union for Conservation of Nature
JAFZA	Jabel Ali Free Zone, Dubai
KPI	key performance indicator
LED	light-emitting diode
LEED	Leadership in Energy and Environmental Design
Masdar	Abu Dhabi Future Energy Company
MCTF	Masdar Clean Technology Fund
MENA	Middle East and North Africa
MOENR	Ministry of Energy, UAE
MoEW	Ministry of Environment and Water, UAE
MOFA	Ministry of Foreign Affairs, UAE
MoPW	Ministry of Public Works, UAE
NAMA	Nationally Appropriate Mitigation Action
NBS	National Bureau of Statistics, UAE
NGO	non-governmental organisation
NMC	National Media Council, UAE
OECD	Organisation for Economic Cooperation and Development
PAGE	Partnership for Action on Green Economy, UN
PISA	Programme for International Student Assessment, OECD
PM	particulate matter
PMO	Prime Minister's Office, UAE
PPP	purchasing power parity
PV	photovoltaic
R/P	reserves-to-production ratio(s)
R&D	research and development
REN21	Renewable Energy Policy Network for the 21st Century
RMB	renminbi (Chinese yuan)
RSB	Regulation and Supervision Bureau, Abu Dhabi; Dubai
RTA	Roads and Transport Authority, Dubai
SDSN	Sustainable Development Solutions Network
Shurooq	Sharjah Investment and Development Authority
SME	small and medium-sized enterprise
SWF	sovereign wealth fund
Tabreed	National Central Cooling Company, UAE
Tadweer	Centre of Waste Management, Abu Dhabi
TAQA	Abu Dhabi National Energy Company
TCA	Tourism and Culture Authority, Abu Dhabi
TDIC	Tourism Development and Investment Company, Abu Dhabi
UAE	United Arab Emirates
UK	United Kingdom (of Great Britain and Northern Ireland)
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEP FI	UNEP Finance Initiative
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UPC	Urban Planning Council, Abu Dhabi
US	United States (of America)
USD	United States dollar(s)
WAM	Emirates News Agency
WEF	World Economic Forum
WGES	World Green Economy Summit
WTTC	World Travel and Tourism Council
WWF	Worldwide Fund for Nature
YCELP	Yale Centre for Environmental Law and Policy, Yale University
ZAR	South African rand(s)
ZHO	Zayed Higher Organisation for Humanitarian Care and Special Needs

Units

%	percent
$	US dollar(s)
bcm	billion cubic metre(s)
bpd	barrel(s) per day
°C	degree Celsius
g	gramme(s)
gCO_2e	gramme(s) of carbon dioxide equivalent
gha	global hectare(s)
GW	gigawatt(s)
GWh	gigawatt-hour(s)
ha	hectare(s)
kg	kilogramme(s)
kgoe	kilogramme(s) of oil equivalent
km^2	square kilometre(s)
kW	kilowatt
kWh	kilowatt-hour(s)
l	litre(s)
m^2	square metre(s)
m^3	cubic metre(s)
mm	millimetre(s)
MW	megawatt(s)
MWp	megawatt peak
ppm	part(s) per million
ppt	part(s) per thousand
RT	refrigerated tonne(s)
t	tonne(s)
tCO_2e	tonne(s) of carbon dioxide equivalent
TEU	twenty-foot equivalent unit
TWh	terawatt-hour(s)
μg	microgramme(s)

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The UAE Approach towards an Inclusive Green Economy

UAE's socio-economic landscape

The economy of the United Arab Emirates (UAE) has prospered and its nominal gross domestic product (GDP) has grown 27 times since 1975, becoming the second largest economy in the Arab world after Saudi Arabia. The high pace of growth over the past years has been largely supported by the revenues from oil and gas, which the country has systematically reinvested in economic diversification in preparation for the approaching post-oil era. These efforts have paved the way for strong growth momentum in the non-hydrocarbon economy, driven primarily by solid performance in trade, financial services, tourism, real estate, logistics, communications and manufacturing. The country has a uniquely flexible, globalised labour market, and the track record of economic growth has also ensured a very high growth rate in population.

UAE's environmental challenges

The UAE's rapid economic development means that the country is facing serious environmental challenges that arise from the record pace of population growth, energy and water demand rise, and fast-paced urban development. On a per-capita basis, the UAE's energy, water and carbon footprints are amongst the highest in the world as the hot and dry climate requires a high amount of energy and import of many goods which cannot be produced in the country. The UAE's natural freshwater sources are extremely limited and the government is increasingly resorting to desalinated water, which has been produced using excess heat from electricity generation. While the UAE has been reliant on fisheries as main sources of diet but the stress on marine habitat is increasing. The UAE's per-capita waste generation is also among the world's highest, the majority of which ends up in landfills. These pressures have motivated the government to take effective policy actions and to build scenarios and coordinated strategies to reduce any significant negative environment impact and to protect biodiversity and ecosystems.

Emergence of the Green Economy thinking

Following the recent multiple global crises in food, water, energy, climate and financial systems, it is increasingly recognised that the paradigm based on a trade-off between economic development and environmental sustainability – "grow first, clean up later" – requires revision towards a model which is able to tackle both outcomes together. Conventional economic development and growth strategies have encouraged rapid accumulation of physical, financial and human capital, but at the expense of excessive, often irreversible, depletion and degradation of natural capital. This pattern of development has had detrimental impacts on the well-being of current generations and presents tremendous risks and challenges for the future.

There is now substantial evidence that there is not necessarily a trade-off between "green" and "growth", and that the greening of economies has the potential to become a new engine of growth, a net generator of decent jobs and a vital strategy to eliminate persistent poverty. To realise such a green economy, new enabling conditions are required to shift both public and private investment to support the transition to a greener economy. Over the last years, the emerging concept of Green Growth or Green Economy has been taken up by many governments around the world. In June 2012, more than 190 nations including the UAE agreed at the United Nations Rio+20 Summit to consider Green Economy in the context of sustainable development and poverty eradication as one of the important tools available for achieving sustainable development.

The case for Green Economy in the UAE

Green Economy may be a new expression but the concept has been deeply embedded in the UAE's thinking of societal development since the country's establishment in 1971. The UAE's development for the last four decades owes a great debt of gratitude to the perseverance, wisdom and forward vision of its founding father, former president, His Highness the late Sheikh Zayed bin Sultan Al Nahyan. In the early years of the country's establishment, he made great efforts to take care of the limited resources while improving the harsh desert environment and charting the future development path.

Making a transition to a greener economy could bring significant opportunities and advantages for the country. Renewable energy sources can help reduce the country's dependence on fossil fuel and lower carbon emissions, while allowing it to reserve more crude oil for earning export revenues. Cleaner transport and cooling systems mean less pollution and better health. Energy efficiency can help reduce production cost, while low-carbon technologies and new green products and services can open up new sources of jobs and help economic diversification. Retaining abundant capital reserves and significant returns from investment, the UAE is in a good position to shift the course of national development and to invest in perpetual assets including human capital, innovative capacity and technological leadership that will enable to realise Green Economy in the next few decades. In November 2013, the UAE won the bid to host the World Expo in Dubai in 2020. The UAE aims to show the world the advancement of its knowledge, innovation and creativity to help guide all countries towards a promising, sustainable future.

The UAE Green Growth Strategy

Building upon *the UAE Vision 2021* and influenced by international initiatives for Green Economy, His Highness Sheikh Mohammed bin Rashid Al Maktoum, the Vice-President and Prime Minister of the UAE and Ruler of Dubai, launched in January 2012 ***the UAE Green Growth Strategy*** as a long-term national initiative under the slogan "A Green Economy for Sustainable Development". Under this overarching strategy, the UAE seeks to enhance the country's competitiveness and the sustainability of its development. Thereby it seeks to preserve its environment for future generations while becoming a global hub and a successful model of sustainable development. In the strategy, six focus areas were presented: Green Energy; Green Investment; Green City; Climate Change; Green Life; and Green Technologies.

To further concretise *the Green Growth Strategy* and provide a clear structure that can harmonise the implementation of different initiatives under a unified pathway, the Ministry of Environment and Water (MoEW), the Prime Minister's Office (PMO) and the Ministry of Foreign Affairs (MOFA) jointly led a stakeholder engagement and consultation process that ran from January 2013 for over a year. As a result of this consultation with over 160 people, a number of gaps in the current sector initiatives were identified. Four background studies were conducted to inform the prioritisation and design of actions and policies under the strategy.

Potential benefits of Green Economy

As one of the background studies, a specific macro-economic model was developed, along with a business-as-usual (BAU) scenario and four ambitious Green Economy scenarios, to estimate the impact of greening the UAE economy. The model assumed average annual investment in green measures of 1.0-1.9% of GDP, until 2030. The study of the four Green Economy scenarios projected that GDP in 2030 would achieve 4.0-5.5% above BAU by 2030. The expected trade boost from those scenarios was estimated at AED 24-47 billion (USD 6.5-12.8 billion) in 2030.

The economic benefits would also include reduced domestic consumption of oil by 7-10% per year, natural gas by 7-20% and electricity by 11-15% through 2030. A reduction in carbon intensity is expected in all four scenarios, ranging between 18-25% of cumulative emissions between 2013-30. The creation of 139,000-165,000 new jobs (1.9-2.3% above BAU) is also anticipated. This detailed modelling strongly supports the hypothesis that greening the developmental path would not necessarily hinder economic growth for the UAE if it was conducted in the correct way.

Sectoral Initiatives towards a Green Economy

The UAE has come a long way in the past few years to meet the challenges of energy and climate change, under the framework of *the UAE Vision 2021* and the strategic plans of each emirate. The nationwide efforts will be further accelerated and scaled up in the coming years as *the UAE Green Growth Strategy* provides a clear, holistic direction for the country's long-term development. Highlighted below are selected public and private-sector efforts for enabling Green Economy, categorised according to the UAE's nine key sectors: Oil and Gas; Water and Electricity; Industry; Buildings, Construction and Real Estate; Transport and Logistics; Waste Management; Land use and Agriculture; Financial Services; and Tourism and Hospitality.

Oil & Gas

Zero flaring: The UAE has succeeded in radically reducing flaring of natural gas from the oil and gas industry since the 1990s and its policy is shifting from minimal flaring to zero-tolerance. The Abu Dhabi National Oil Company (ADNOC) group aims to eliminate routine flaring and has reduced flaring by 2013 by 76.4% compared to 1995 levels.

CCS technologies: ADNOC set up a joint venture with the Abu Dhabi Future Energy Company (Masdar) in 2013 to implement carbon capture and storage (CCS) projects by which 800,000 tonnes of CO_2 emitted annually from Emirates Steel's plant will be piped 50 km to onshore oilfields to enhance oil recovery.

Water & Electricity

Renewable energy projects: In March 2013, Masdar commenced the operation of Shams 1, a 100-MW concentrated solar power (CSP) plant in the Western Region of Abu Dhabi. Dubai will construct a 1-GW Mohammed bin Rashid Al Maktoum Solar Park and its first phase, a 13-MW solar photovoltaic (PV) plant was inaugurated in October 2013. The region's first wind turbine was installed on Sir Bani Yas Island where an onshore wind farm with a capacity of up to 30 MW is planned. Dubai's recent approval for feeding the generated excess electricity to the power grid is expected to boost the installation of rooftop PVs.

Efficiency standards: The Emirates Authority for Standardization and Metrology (ESMA) is gradually introducing a mandatory efficiency rating and labelling system on domestic electrical appliances and water fixtures to help consumers make resource-efficient choices. *The UAE Lighting Standard* was also introduced in December 2013 to prevent inefficient incandescent light bulbs from entering the market.

Industry

Efficient factories: Dubai Aluminium (Dubal) and Emirates Aluminium (Emal), which were merged into Emirates Global Aluminium (EGA) in 2013, introduced a co-generation and combined cycle configuration in their power stations, achieving 46-48% thermal efficiency. Dubal's greenhouse gas (GHG) intensity in production was reduced by 12% in five years. Dubal also introduced a waste heat-based absorption chiller, which can reduce 60% of electricity required for cooling.

A green business park: EnPark is a free zone business park in Dubai dedicated to fostering the growth of alternative energy and environment businesses. Besides providing sustainably designed facilities, it offers legislative support, facilitates public-private partnerships, helps identify business opportunities and shares experiences with industry peers.

Buildings, Construction & Real Estate

Sustainable cities: Abu Dhabi's Masdar City project is seeking to provide a commercially viable eco-city model that delivers the highest quality living and working environment with the lowest possible ecological footprint. In November 2014, the Dubai Government's Land Department and UNEP launched the Centre for Resource Efficient and Sustainable Cities for the Arab Region.

District cooling systems: The UAE is a leader in adopting district cooling systems (DCS) as the preferred alternative to conventional air conditioning. In general, DCS consume 50% less energy than the conventional systems. A number of district cooling utility companies have emerged and more than one in ten residents now use the systems.

Green building codes: In 2010, *the UAE Green Building Guidelines* were developed for new projects to be carried out by the Ministry of Public Work (MoPW). Dubai introduced green building regulations containing 79 specifications, which is now mandatory for all developments. Abu Dhabi introduced the five-level Estidama Pearl Rating System. It is mandatory for all new buildings to obtain a one-pearl rating, while all government buildings and residential villas must obtain two pearls.

Transport & Logistics

New modes of public transport: Dubai Metro has revolutionised the way both residents and tourists move around the city. The number of daily passengers has jumped from 60,000 at the launch in 2009 to about 500,000 in 2014. Dubai Tram has been launched in November 2014, while Abu Dhabi also began work on a 131 km-long metro system. Etihad Rail's 200-km freight services will be operational soon.

Controlling private transport: To cope with the ever-rising traffic volume and road congestion in Dubai, the Salik toll collection system was rolled out in 2007. Salik operates without toll booths, allowing traffic to move freely at highway speeds. In October 2013, car-pooling was legalised with conditions in Dubai to increase vehicle occupancy rates.

Waste Management

Biodegradable plastic bags: MoEW conducted the UAE Free of Plastic Bags Initiative since 2009 and promoted biodegradable plastic and other long-lasting, reusable bags. As the use of non-biodegradable bags is not permitted since 2013, the manufacturers and suppliers of plastic bags now have to register their biodegradable products.

Waste-to-energy: A project for extracting biogas from Dubai's Al Qusais landfill site was launched in 2013 and registered under the UN Clean Development Mechanism (CDM) for the first time in the UAE. From gas wells drilled some 22 metres deep, a total of 6,000 m^3 of methane has been collected every hour, reducing the emissions of 250,000 tCO_2e annually. A 100-MW waste-to-energy facility, one of the world's largest, is planned in Abu Dhabi.

Land use & Agriculture

Hydroponics: MoEW has put a priority on increasing the use of hydroponic technology among farmers, which relies on nutrient-rich water to grow plants with the use of little or no soil. The method saves up to 70% of water, while allowing for a longer growing season and avoiding harmful chemicals. To date, there are 87 commercial farms using this technology.

Organic farming: ESMA introduced an organic food certification scheme in February 2012, which comes with a logo by which consumers can easily distinguish organic products from conventional ones. About half of the 40 existing organic farms have already been certified and others are under process.

Financial Services

ESCOs: An energy service company (ESCO) arranges initial financing of energy-efficient equipment, subject to a guaranteed level of energy saving, and the owners can repay the cost of the equipment from the captured revenue streams. Dubai established in July 2013 a "Super ESCO", Etihad Energy Services Company to help jump-start local ESCOs, with a target of retrofitting over 30,000 existing buildings.

Tourism & Hospitality

Green hotels: The Emirates Green Building Council (EGBC) has been the national operator of the internationally recognised Green Key labelling scheme since 2013. As of June 2014, 24 UAE hotels have been awarded this certification. Abu Dhabi plans to give all hotels in the emirate a green rating along with the existing star ranking.

Eco-tourism: Thanks to decades of intensive conservation work, Sir Bani Yas Island in Abu Dhabi's Al Gharbia region is now home to 68 bird species, about 13,000 free-roaming animals and several million plants, which are being appreciated by visitors. The Mangrove Natural Reserve of Kalba on the east coast is also scheduled to be developed as an eco-tourism destination by 2017.

Measuring the Transformation towards a Green Economy

Framework of the UAE Green Economy Indicators

In order to guide the formulation of policy instruments as well as voluntary activities to the right course, it is critical to establish a set of indicators that will provide an effective compass for the monitoring and assessment of the progress, and that will help identify potential opportunities and risks. A framework of ***the UAE Green Economy Indicators*** was developed in a way to integrate environmental considerations into the conventional input-productivity-output economics model. This is intended to help policy makers and industry understand the dynamics of the economy-environment nexus. The Indicators are structured into the four categories – Inputs, Efficiency, Outputs and Policies (**Figure i**):

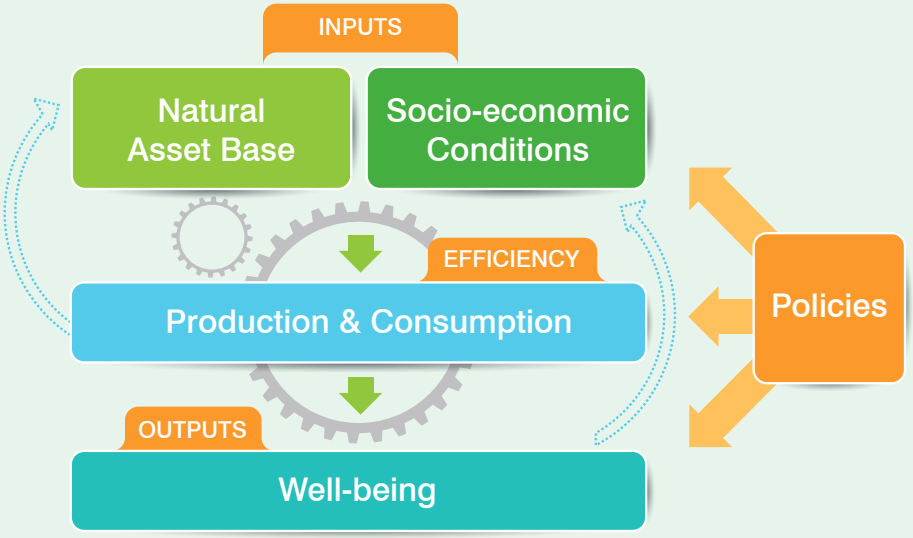


Figure i: Framework of *the UAE Green Economy Indicators*

Based on this framework, 30 performance indicators were defined, which originate from the recommendations from inter-governmental organisations and the input during the consultation process for developing the implementation plan of *the Green Growth Strategy*. Relevant National Key Performance Indicators (KPIs), which were developed to measure the fulfilment of *the UAE Vision 2021*, are also adopted as part of the indicator set. The 30 indicators were classified and coded according to the five groups (**Figure ii**):

Figure ii: List of *the UAE Green Economy Indicators*

- **Inputs I**: Natural asset base (N)
- **Inputs II**: Socio-economic conditions (C)
- **Efficiency**: Production and consumption (E)
- **Outputs**: Well-being (W)
- **Policies** (P)

UAE's Performance towards a Green Economy

The current UAE performance reviewed according to *the Green Economy Indicators* is summarised as below:

Natural resource base: The UAE is blessed with the world's seventh largest oil and gas reserves which have transformed the desert country into one of the most advanced nations with high standards of living. Oil and gas have acted as the driving force of the UAE economy as the sector still provides around one-third of the total GDP. On the other hand, land and soil resources suitable for agriculture are limited and subject to irrigation. Forest areas have increased by 30% between 1990 and 2012 owing to an extensive afforestation programme. Fish stocks in both the Arabian Gulf and the Gulf of Oman have recorded an alarming rate of decline (more than halved between 2002-11), while various natural and anthropogenic factors have caused the loss of biodiversity. The availability of freshwater (mostly groundwater) is one of the lowest in the world. The government enforces strategies and regulatory measures to protect those indispensable natural resources.

Socio-economic conditions: The UAE was ranked 36th in the latest Global Innovation Index and has kept the leading position among the GCC countries. However, the country's R&D spending (0.49% of the total GDP) lags far behind the Organisation for Economic Cooperation and Development (OECD) member countries' average of 2.47%. The country's competitiveness in the global market is also perceived as quite high together with its business-friendly environment and improving entrepreneurship ecosystems. The UAE was ranked 12th in *the Global Competitiveness Index 2014-15*, 22nd in the 2015 East of Doing Business Index, and 20th in the 2015 Global Entrepreneurship and Development Index.

The country's working population is growing at a record pace, reaching around 6.25 million in 2012, 67.9% of the total population, while women's participation in the labour market is rapidly increasing (46.6% in 2012). The proportion of pupils who reached Grade 5 has risen from 95.0% in 1990 to 97.4% in 2010, having achieved near universal education at the first cycle. The number of graduates from the country's higher education institutions has been rapidly rising (over 19,000 in 2011-12), while there are also a large number of graduates from foreign universities.

Production and consumption: The UAE's per-capita Ecological Footprint was estimated as the 3rd largest (7.75 global hectares) in the world in *the Living Planet Report 2014*, after Kuwait and Qatar. The country's total GHG emissions have increased from 74 million tCO_2e in 1994 to 173 million tCO_2e in 2012. Since 2007, the country's annual electricity consumption has increased by more than 8% per annum, exceeding 100 TWh in 2012. The total use of steel has been steady since the sharp drop at the time of the financial crisis. Despite the lack of freshwater resources, the per-capita intensity of water use has been among the world's highest as the daily consumption of water for domestic (household and commercial) purposes was recorded 353 litres per capita in 2013. The daily municipal waste generation was 1.82 kg per capita in 2014. Meanwhile, agricultural production in terms of weight has fallen to one-tenth of previous levels, and the area of cultivated land had been more than halved by 2012 since the peak in 2002 as the government aimed to reduce the cultivation of fodder crops which consume a large amount of water. The quantity of fish catches in the UAE keeps declining since the peak recorded in 1999, falling to less than two-thirds of the peak amount by 2012.

The positive news is that the relative decoupling of consumption from population and economic growth has started being observed in some areas. The GHG emissions per capita have declined by over 50% between 2005 (38.8 tCO_2e) and 2012 (18.8 tCO_2e), and emissions per GDP have also decreased by nearly a quarter during the same period (from 422 gCO_2e/USD to 324 gCO_2e/USD). The carbon intensity of electricity production has also been steadily improving as CO_2 emissions per kWh was 600 grammes in 2011, 34% decrease from the peak recorded at 913 grammes in 2004. Furthermore, the UAE has shown its ambition and leadership in advancing renewable energy technologies with the development of large-scale projects (138.5 MW capacity by 2013).

Although the UAE's per-capita steel use was the world's highest until the crisis, it had dropped to the 5th position by 2013 (756.8 kg/capita/year) despite the rapid market recovery which resulted in many large-scale developments. The level of per-capita waste generation has been declining overall after the financial crisis and the relative decoupling of municipal water use from economic growth is also seemingly being realised. Meanwhile, the value-added by agricultural production is rapidly rising (USD 926.9/ha in 2012) due to the shift of cultivation from fodders to vegetables and fruits.

The government supports the dissemination of organic farming practices (4,446 ha by April 2014) and stimulates the recovery of fish stocks. Over 300,000 fingerlings were released and 3,600 coral reef colonies were farmed in 2013, while 15,000 mangrove trees were planted in 2012. It is also observed that environmental awareness and behaviour among residents have been rapidly improving in the last few years. As an overall index of those improvements, the UAE's Ecological Footprint shows a decline since 2010.

Well-being: The UAE's share of revenues from non-oil sectors has increased from 57% of the total GDP in 2001 to 67% in 2013, helping mitigate the impact from the fluctuation of oil revenues. The share of non-oil export in total export has also risen from 17.5% in 2001 to 28.5% in 2013. The gross national income (GNI) per capita, which indicates average personal income, was recorded at USD 58,090 in 2012. This was the 11th highest in the world though the level has been declining since 2004. The UAE's Human Development Index value has improved by nearly 30% from 0.640 in 1980 to 0.827 in 2013, positioning the country at 40th in the world, one of the "very high human development" group. The country was also ranked 14th, the highest in the Arab world in *the World Happiness Report 2013*, showing the positive trend in both perceived happiness and quality of life for inhabitants. The UAE's Environmental Performance Index results have shown a dramatic upturn from the 152th out of 163 countries benchmarked in 2010 (Score: 40.7) to 77th in 2012 (50.91) and 25th out of 178 countries in 2014 (72.91).

Policies: Since the issuance of the Federal Law No. 24 of 1999 as the fundamental law of environmental protection, laws, executive orders and ministerial decrees regulating specific environmental issues such as biodiversity, air quality and water conservation have been gradually promulgated. MoEW is making efforts to further develop regulations in emerging areas as its budget is steadily increasing. The designation of nature reserves started in 1995 and the total number of terrestrial and marine protected areas has reached 35 by 2014. In addition to the conventional "command-and-control" policies, a market-based approach has started being introduced to encourage greener behaviour among industry and consumers. Local authorities are pursuing a utility tariff reform to encourage rational use of water and electricity and reduce fossil fuel subsidies.

Eco-labelling and certification criteria have been established for air conditioning units, washing machines, refrigerators, light bulbs and water fixtures as well as organic food.

Overall, the UAE has faced severe constraints in non-oil resources and a rapid rise in the consumption of energy, water and materials as well as in waste generation and GHG emissions. However, various different types of initiatives to overcome these issues have been initiated by both the public and private sector in recent years. The relative decoupling of consumption from population and economic growth has started being observed in some areas, while even higher quality of life is being enjoyed by people.

The collected performance data should serve as a baseline for monitoring annual changes and analysing the interaction between different factors so as to better judge whether the country is on the right course towards a Green Economy and to plan effective Green Economy policies and initiatives.

Future Outlook: *The UAE Green Agenda*

Governance for Green Economy

The implementation of *the Green Growth Strategy* needs to be supported by a clear structure and a unified pathway that can synergise the scattered efforts and fill the gaps in the actions. To ensure effective decision-making and transparent implementation, a central governing body will be designated for overseeing overall planning, implementation, monitoring and evaluation. This body will subsequently define lead responsibilities at the federal level and designated roles for local authorities for each Green Economy programmatic area.

The UAE Green Agenda

Through the extensive consultation process outlined earlier, ***the UAE Green Agenda*** has been established as a grand umbrella that would overarch the activation of *the Green Growth Strategy* through concrete actions for the coming years. *The Green Agenda* aims to help streamline diverse Green Economy actions and give a unified framework to plan additional initiatives in line with the overall objectives. The following three pillars were derived from the proposal made through the consultation process, where Green Economy actions were originally categorised into five areas and twelve programmes. Those pillars primarily indicate what Green Economy means for the UAE and the directions where the country should strive in the long run across diverse sectors:

3 Pillars of *the UAE Green Agenda*

1. **Green Technology and Market Development**

   The additional growth driven by low-carbon technologies and eco-efficient production and consumption methods will greatly help the diversification of the UAE economy. This will also help to increase national competitiveness, establish more enterprises in the environmental goods and services (EGS) sector, and create export opportunities.

2. **Integrated Social and Spatial Development**

   The Green Growth Strategy aims to realise 'Green Life' among residents through building 'Green Cities' and smart communities that use the country's resources in a sustainable manner. Nurturing local talent into knowledge-based green sectors would help create new jobs and multiple developments improving the quality of life.

3. **Clean Energy and Sustainable Use of Resources**

   Supporting the energy transition from fossil fuel by increasing power generation from renewable sources and nuclear energy will help reduce carbon emissions and tackle climate change. More efficient use of resources will bring direct benefits to the public through savings in water, electricity, transport fuels as well as reducing waste, and in turn will make the wider economy more efficient, competitive and sustainable.

Green Agenda programmes

Based on the above three pillars, a programmatic structure of activities for realising a Green Economy has been developed. Eight prospective programmes (which consolidated twelve programmatic areas originally proposed) were identified which cover all key aspects for a Green Economy transition – from technology, human capital, regulatory environment, green finance, international trade, local content and intellectual property, consumer awareness and information, integrated national planning, and cooperation across the emirates (**Figure iii**). This structure would ensure the government and stakeholders plan and implement joint Green Economy actions in a systematic way:

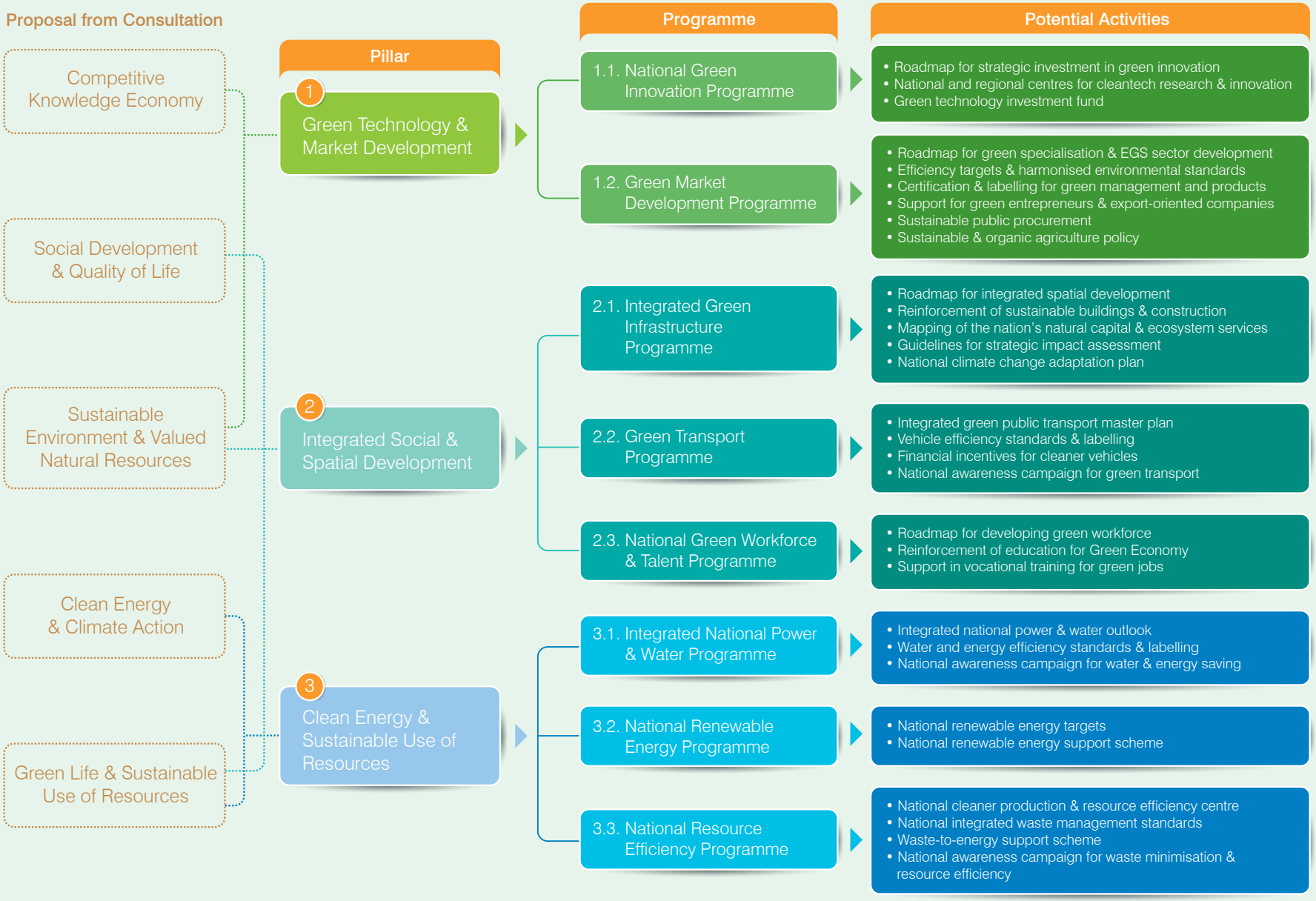


Figure iii: Structure of *the UAE Green Agenda*

Next steps

The prospective Green Agenda programmes will be complemented by sector-specific actions based on further consultation with key stakeholders in each sector. These consultations will elaborate action plans along with identifying supportive policy tools. The UAE will continuously engage stakeholders in 2015 to determine concrete actions under the eight programmes, clarify the role of government and stakeholders in those actions, develop roadmaps for actual implementation, and oversee the progress.

The roadmaps could be roughly divided into three milestones: short-term (up to 2017); medium-term (up to 2021) and long-term (up to 2030 and beyond). 2021 is a major milestone where the country will see the initial fruits of Green Economy actions which can already be showcased at Dubai Expo 2020. By 2030, all major structural changes to the UAE economy would have been achieved, extending the horizon towards 2050 to keep track of the ultimate future vision which *the Green Growth Strategy* envisages.

Inclusive Green Economy from a Global Perspective

Green Economy approaches around the world

Driven by looming ecological constraints and the intuition that economic prosperity must fundamentally derive from good stewardship of natural resources and environmental wealth, governments throughout the world have started to explore ways to decouple growth from environmental degradation, resulting in the increasing adoption of the Green Economy concept seen today. Even though each country faces different circumstances, some common features in the experiences from introducing Green Economy concept and policies have been identified through the review of practices in Germany, Republic of Korea, China and Chile.

First and foremost, Green Economy needs high-level political commitment and support, resulting from a clear vision of the future and the role of environmental sustainability in securing it. In addition, given the cross-cutting nature of Green Economy, strong institutional capacity and arrangements are indispensable. An inter-ministerial coordination mechanism is a common and effective factor to the success. Credibility of the governmental commitments and engagement in the decision-making processes is important to ensure fundamental public support.

Third, private-sector resources and ingenuity will play a key role in delivering long-term prosperity once governments provide an enabling investment policy environment and mobilise initial investment. Proper incentives provided through economic instruments, regulations and distributional policies can help channel investments towards targeted sectors and enhance the effectiveness and fairness of such investments.

UN's approach towards building green and inclusive economies

Over 20 UN agencies are engaged in Green Economy activities. Among those activities, the Partnership for Action on Green Economy (PAGE) is the UN's response to the Rio+20 call to assist countries on Green Economy. Gathering expertise from five major agencies, the programme aims to assist 30 countries by 2020, with 20% of this goal already underway in 2014.

In March 2014, the UAE hosted the first Global Conference on PAGE in Dubai. More than 650 participants from 66 countries, including 27 Ministers, gathered at the conference. This clearly shows that the shift towards an inclusive Green Economy is no longer a luxury preserved for wealthy countries but has now become imperative to all. It was agreed to hold the fourth biennial PAGE Conference again in Dubai in six years' time, simultaneously with Expo 2020. The Fourth PAGE Conference and Dubai Expo 2020 will be a great opportunity to bring innovative ideas and promising solutions together and to truly realise a global collaboration for sustainable living.

Mobilising finance and investment for an inclusive Green Economy

Achievement of global climate goals will explicitly require investment in new climate-friendly technologies across all areas of commercial activity. In this scenario, there will be requirements to measure and disclose openly the finance sector's exposures to carbon-intensive assets, the carbon footprint of investment and portfolios, and natural capital-dependent commercial interests. This ultimately will require all listed entities to provide comprehensive data on

non-financial performance. It is highly likely that there will be a price on carbon either formally set within specific jurisdictions and/or reinvigorated carbon trading schemes. Risks associated with climate change will increasingly be factored into corporate and sovereign bond ratings. At the UN Climate Summit in September 2014, investors representing some USD 24 trillion in assets called for governments to set a price on carbon.

Responding to these emerging risks and opportunities, many leading banks already incorporate environmental and social risk analysis in the credit approval processes, and a few at the forefront are developing methodologies to rate all clients against environmental, social and governance (ESG) benchmarks. Standards will also be developed for the issuance of “green bonds” as this nascent market is rapidly growing (USD 40 billion in issuance in 2014 and forecast to be 100 billion in 2015). In the developed markets, energy efficiency finance will particularly be an area for increased focus and opportunity.

To enable a more comprehensive, systemic uptake of climate-friendly, sustainable finance, what is now needed is to create a bridge between the “trillion dollar funding gap” worldwide and the financial institutions, and to break this down into country-specific funding plans in a way to be consistent with Green Economy plans where they exist like the UAE. The available funding mix will clearly differ by country or region: Economies with very thin or non-existent capital markets need to leverage support from multilateral development banks, public funding and the banking sector, whereas others – including the UAE – may be able to look into a broader mix of private-sector investors via the capital markets with, for example, green bonds.

1 The UAE Approach towards an Inclusive Green Economy

1-1. UAE's overview

Geography

The United Arab Emirates (UAE) was formed as a constitutional federation of seven emirates: Abu Dhabi, Dubai, Sharjah, Ajman, Umm Al Quwain, Ras Al Khaimah and Fujairah, which came together as one state on 2 December 1971 under the former president, His Highness the late Sheikh Zayed bin Sultan Al Nahyan. Through exploitation of the UAE's abundant oil and natural gas resources starting in the 1960s, the country has been transformed from a tribal society reliant on agriculture and fishing to a significant and respected supplier in global energy markets as well as an important member of the international community. During this period, the UAE has forged a distinct national identity and enjoyed a high degree of political stability.

The UAE is located at the tip of the Arabian Peninsula with coastlines on the Gulf of Oman and the Arabian Gulf. It lies between Oman and Saudi Arabia, and is a strategic location along the Strait of Hormuz, a vital transit point for the world's crude oil. According to the National Bureau of Statistics (NBS), the UAE's total land area is 71,023.6 square kilometres (km^2). The Emirate of Abu Dhabi accounts for 59,435 km^2, 83.7% of the total land area, while the smallest emirate, Ajman, encompasses only 0.4% of it, 268 km^2.

Four-fifths of the land is desert but the country has contrasting landscapes — from the towering red dunes of the Liwa desert in the south to the rich palm-filled oasis of Al Ain in the east, from the precipitous Hajar Mountains to the more fertile stretches of coastal plains in the north-east. The climate of the UAE is sub-tropical arid, generally warm and sunny in winter, hot and humid during the summer months. The hottest months are July and August, when average maximum temperatures reach up to 50 degree Celsius (°C) with over 90% humidity on the coastal plain. The average annual rainfall between 2003-12 was 81.1 millimetres (mm), while some mountainous areas get higher rainfall and are cooler.[1] [2]

Socio-economic landscape

Building on the endowment of considerable oil and gas reserves, the UAE's economy has prospered and its nominal gross domestic product (GDP) has grown 27 times since 1975, totalling USD 402 billion in 2013, and becoming the second largest economy in the Arab world after Saudi Arabia. The high pace of growth over the past years has been largely supported by the revenues from oil and gas, which have been systematically reinvested in economic diversification in preparation for the approaching post-oil era. These efforts have paved the way for strong growth momentum in the non-hydrocarbon economy, driven primarily by solid performance in trade, financial services, tourism, real estate, logistics and manufacturing (**Figure 1.1**; **1.2**; see also 3-2-4).[3] The currency used in the UAE is called the dirham, which is abbreviated as AED in this report. The dirham is tied to the United States dollar (USD) at a steady exchange rate of USD 1 = AED 3.67.

1. MOFA (UAE Ministry of Foreign Affairs), *About the UAE* webpage, http://mofa.gov.ae/mofa_english/portal/b98b7b22-783e-4f48-b1b2-1b52bd473225.aspx, accessed on 9 November 2014.
2. Data from the UAE National Center for Meteorology and Seismology (NCMS) quoted in MoEW (UAE Ministry of Environment and Water) (2015, forthcoming), *UAE State of the Environment Report 2014* (in Arabic with an English summary), MoEW, Dubai.
3. Elite Media and NMC (UAE National Media Council) (2013), *United Arab Emirates Yearbook 2013*, Elite Media, Dubai.

The UAE has developed world-class assets in terms of both physical infrastructures and soft assets (such as fiscal prudence and knowledge capital). The country has a uniquely flexible, globalised labour market and is investing in the human capital needed to underpin its growth ambitions. This long-term investment and the track record of economic growth have ensured continued growth in both local Emirati and expatriate population. According to NBS, the population had reached around 8.26 million by the end of 2010, of which UAE nationals account for just 11.5%, approximately 948,000. Males outnumber women by around three to one, due to the migration flow of working-age men.[1] The latest estimate of the UAE population by the United Nations (UN) is about 9.45 million by July 2014, growing nearly 35 times since the country's establishment in 1971 (272,000) (**Figure 1.2**).[2]

Governance

Since the Federation was established, the UAE's seven emirates have forged a single identify while maintaining a large degree of control over their internal affairs, each having its own separate institutions of government. The Constitution granted the federal authorities explicit powers over such areas as foreign affairs, security and defence, education, public health and communications services. The federal system of government includes the Federal Supreme Council, the Council of Ministers (the Cabinet), the Federal National Council (a partly elected parliamentary body), and an independent judiciary overseen by the Federal Supreme Court. The Federal Supreme Council comprises the rulers of the seven emirates and has both legislative and executive powers. The Council of Ministers is headed by a prime minister, chosen by the President in consultation with the Supreme Council.

The City of Abu Dhabi was officially made the permanent capital of the Federation in 1996. Following his succession in November 2004 as Ruler of Abu Dhabi, His Highness Sheikh Khalifa bin Zayed Al Nahyan has served as the UAE President. His Highness Sheikh Mohammed bin Rashid Al Maktoum, new Ruler of Dubai, was elected as Vice-President and appointed Prime Minister in early 2006.[3]

The UAE is a member of the UN and the League of Arab States as well as the Cooperation Council for the Arab States of the Gulf (GCC), a regional political and economic union consisting of six member countries: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the UAE.

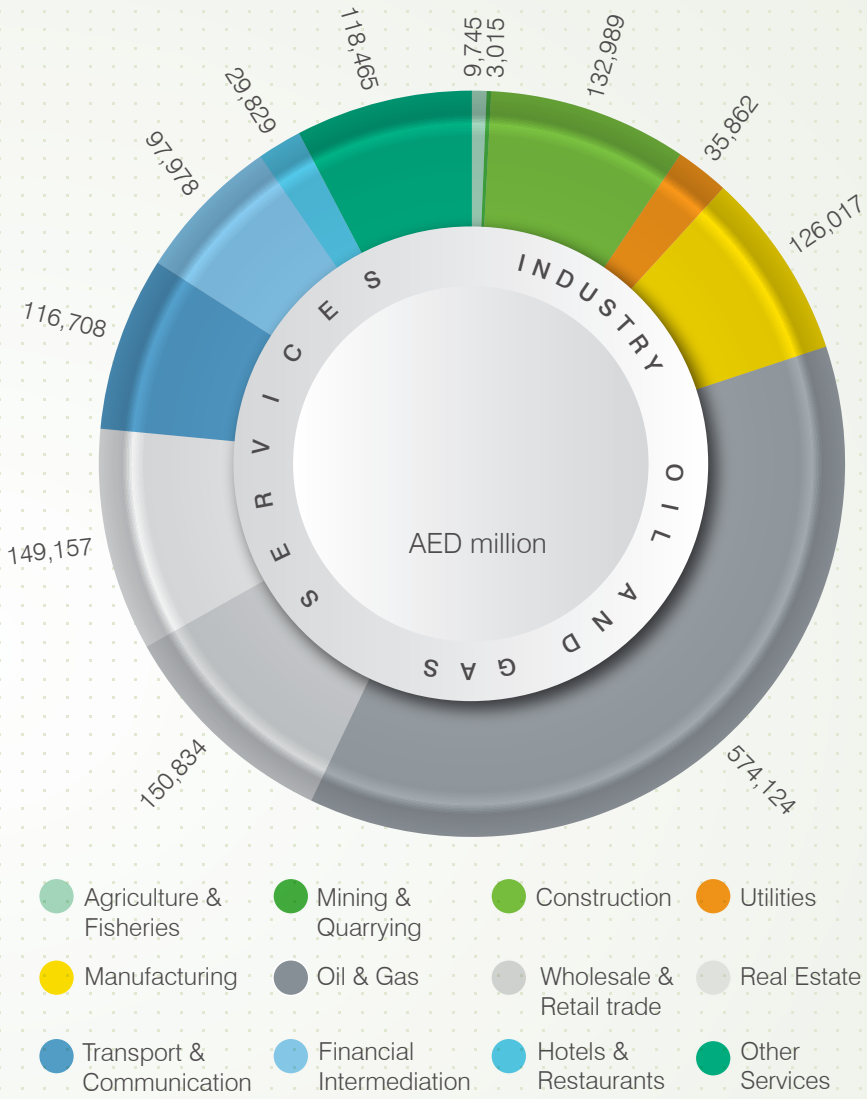


Figure 1.1: Nominal GDP of the UAE by sector, 2013

Source: UAE National Bureau of Statistics (preliminary estimates)

1. Elite Media and NMC (2013)
2. UN-DESA (UN Department of Social and Economic Affairs), Population Division (2013), *World Population Prospects: The 2012 Revision*, June, medium fertility estimates.
3. Elite Media and NMC (2013)

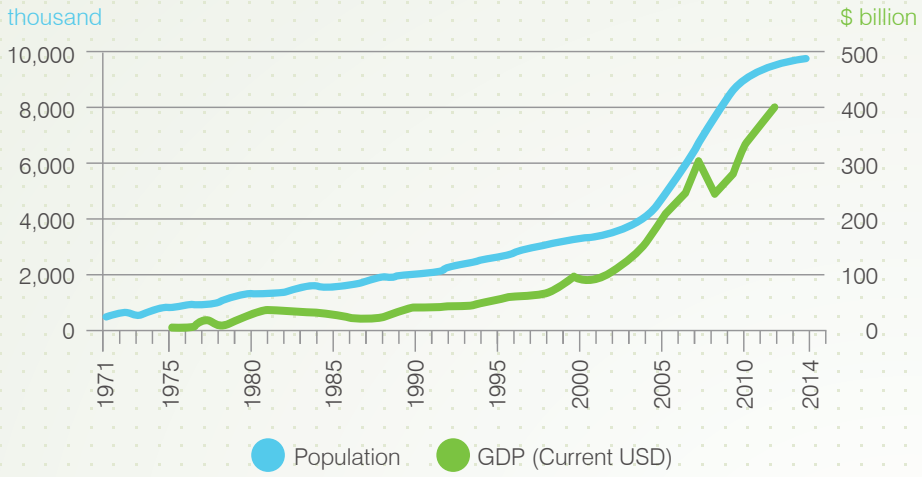


Figure 1.2: Growth in nominal GDP and population of the UAE

Source: World Bank, *World Development Indicators*; UN-DESA, *World Population Prospects* (2012 revision; medium fertility)

Environmental challenges

The UAE's rapid economic development means that the country is facing serious environmental challenges that arise from the very high pace of population growth, the increase in the demand for energy and water, and the fast-paced urban development. On a per capita basis, the UAE's energy, water and carbon footprints are amongst the highest in the world as the hot and dry climate requires a high amount of energy and import of many goods which cannot be produced in the country (see 3-2-3). Meanwhile, there is an ever-increasing need for continued stewardship of limited natural resources.

The UAE's natural water sources are limited to groundwater and the country is resorting to desalinated water to meet the rapidly increasing requirement. In the UAE, desalinated water has been produced using excess heat from electricity generation but has also caused impact on the marine environment from discharging highly concentrated brine to the Arabian Gulf, etc. Marine life also faces a number of other threats such as over-fishing and habitat loss. Marine species including fish and coral are also increasingly affected by climate change (see 2-2; 2-7; 3-2-1; 3-2-3).

Keeping the ambient air quality within required standards has been one of the main challenges to the environment authorities in the country, as it is largely affected by human activities, the emissions from fuel combustion for energy, water and transport, and industrial activities. The UAE's per-capita waste generation is also among the highest in the world, the majority of which (77% of solid municipal waste) ends up in landfills due to lack of separation schemes across the country (see 2-6; 3-2-3).[1] These pressures have motivated the government to take effective policy actions and to build scenarios and coordinated strategies to reduce any significant impact and to protect biodiversity and ecosystems. The Ministry of Environment and Water (MoEW), together with local authorities and conservation groups, has actively promoted the protection of natural resources through legislation, education and engagement with international bodies as well as through scientific research.[2]

A Ghaf tree in the desert

1. MoEW (2015)
2. Elite Media and NMC (2013)

1-2. The case for Green Economy in the UAE

Emergence of the Green Economy thinking

Following the recent multiple global crises in food, water, energy, climate and the financial system, it is increasingly recognised that the conventional paradigm based on a trade-off between economic development and environmental sustainability – "grow first, clean up later" – requires revision towards a model which is able to tackle both outcomes together.

Conventional economic development and growth strategies have encouraged rapid accumulation of physical, financial and human capital, but at the expense of excessive, often irreversible, depletion and degradation of natural capital. This pattern of development has had detrimental impacts on the well-being of current generations and presents tremendous risks and challenges for the future. The recent crises could be all considered to be linked with the misallocation of capital – overflow of money into property, conventional energy and structured financial assets, as well as lack of investment in clean energy and energy efficiency, sustainable agriculture, sustainable transport and protection of biodiversity and natural resources.

There is now substantial evidence that there is not necessarily a trade-off between "green" and "growth" but that the promotion of the green economy has the potential to become a new engine of growth, a net generator of high-quality jobs and a vital strategy to eliminate persistent poverty. However, new enabling conditions are required to shift both public and private investment towards green development promotion. It is necessary to consider ecological resources, such as safe drinking water, clean air and a stable climate, not as free goods but as real resources that provide added value to productive activities and that therefore need to be utilised sustainably. The government needs to implement policies that enable this shift in investment by addressing market failure created by externalities or imperfect information, introducing market-based incentives, installing appropriate regulatory frameworks, implementing sustainable public procurement, reducing or eliminating perverse subsidies, and supporting innovation and entrepreneurship.[1]

Over the last five years, the emerging concepts of Green Growth or Green Economy have been taken up by many governments around the world. Under the Republic of Korea's leadership, 30 member states and four candidate states of the Organisation for Economic Cooperation and Development (OECD) signed a Declaration on Green Growth in June 2009.[2] At the United Nations, the concept of Green Economy was proposed as a means of catalysing renewed national policy development, international cooperation and support for sustainable development. In June 2012, more than 190 nations including the UAE agreed at the UN Rio+20 Summit to consider Green Economy in the context of sustainable development and poverty eradication as one of the important tools available for achieving sustainable development.[3]

Green Economy for the UAE

Green Economy may be a new expression but the concept has been deeply embedded in the UAE's societal development thinking ever since the country's establishment. The UAE's development for the last four decades owes a great debt of gratitude to the perseverance, wisdom and forward vision of its founding father, the former president, His Highness the late Sheikh Zayed bin Sultan Al Nahyan. He made great efforts to carefully preserve the limited existing resources while improving the harsh desert environment. He charted the future development path of the UAE in the early years of the country's establishment. In 2005, the late Sheikh Zayed was recognised as a Champion of the Earth by the United Nations Environment Programme (UNEP).

> "In a strong and safe union, knowledgeable and innovative Emiratis will confidently build a competitive and resilient economy. They will thrive as a cohesive society bonded to its identity, and enjoy the highest standards of living within a nurturing and sustainable environment."
>
> ***The UAE Vision 2021*** **summary**

The UAE continues to aim for improvement in its development path in order to become among the best countries in the world by the time of the celebration of its golden jubilee in 2021. To chart the next stage of the nation's journey and present its united ambition and determination, ***the UAE Vision 2021*** was launched in February 2010, being inspired by the principles of the founding fathers and guided by the National Work Programme launched by His Highness Sheikh Khalifa bin Zayed Al Nahyan, the President of the UAE.[4] This document

1. UNEP (2011a), *Introduction: Setting the stage for a green economy transition*, UNEP, Nairobi.
2. OECD (2011a), *Towards Green Growth*, OECD, Paris.
3. UN General Assembly (2012), *The Future We Want*, Resolution 66/288 adopted on 27 July, New York.
4. UAE Government (2010), *Vision 2021: United in ambition and determination*, Abu Dhabi.

Guiding message

Vision 2.1 Upholding the legacy of the nation's founding fathers	The UAE Federation will uphold the legacy of our Founding Fathers to ensure balanced development throughout the Emirates, through active coordination among levels of Government and integrated national planning and execution in all policy areas. Integrated planning and execution will ensure that social and economic development across the entire nation is balanced, sustainable, rationalised and efficient.
Vision 2.3 Enhanced international standing	The UAE's international standing will continue to grow as its successes highlight its prestige as a regional and international role model, developing sectors of excellence and national champions.
Vision 3.2 Sustainable and diversified economy	The UAE will benefit from a sustainable and diversified economy, flexible in adopting new economic models, and capitalising on global economic partnerships to guarantee long-term prosperity for current and future generations of Emiratis. Balanced growth must be fuelled by a sustainable range of energy sources, within which the UAE will ensure an important role for alternative and renewable options.
Vision 3.3 Knowledge-based and highly productive economy	Innovation, research, science and technology will form the pillars of a knowledge-based, highly productive and competitive economy, driven by entrepreneurs in a business-friendly environment where public and private sectors form effective partnerships.
Vision 4.2 First-rate education	All Emiratis will have equal opportunity and access to first-rate education that allows them to develop into well-rounded individuals, enhance their educational attainment, and achieve their true potential, contributing positively to society.
Vision 4.3 Well-rounded lifestyle	The UAE will nurture high quality of life built on world-class public infrastructure, government services, and a rich recreational environment.
Vision 4.4 Well-preserved natural environment	As a leader of the green revolution, the UAE is conscious of its responsibility to safeguard nature and mitigate the effects of climate change on its habitat and ecosystems in order to ensure that future generation inherit an environmentally sustainable world. The UAE is committed to playing its part in developing and implementing innovative solutions to protect and sustain the environment. New energy-efficient technologies will harness the UAE's pioneering role in the green revolution and reduce its carbon footprint. The government will act decisively to reduce the nation's ecological deficit, promoting environmental awareness and responsible behaviour among Emiratis.

Table 1.1 Highlights of guiding messages related to Green Economy from *the UAE Vision 2021*

Source: UAE Vision 2021

outlines six principles that will provide a vital compass to enable the nation to steer a course through challenges to the family ties that bind together the strong fabric of the cohesive society; challenges to economic competitiveness; challenges to national identity; and challenges to health, education, the environment and well-being. **Table 1.1** extracts where the idea of Green Economy is already taken into consideration in *the Vision 2021*.

At the local level, each emirate also sets its own medium to long-term strategic goals for development, most of which reflect the commitment to elements of the Green Economy:

- *Abu Dhabi Vision 2030*: Consists of the Economic Vision and the Urban Planning Vision, supplemented by Visions for each region in the emirate and the maritime area. The core commitment is to build a sustainable and diversified, high value-added economy and to filter all planning decisions through environmental, social and economic criteria.
- *Dubai Integrated Energy Strategy 2030*: Aims to drive energy diversification and decarbonisation and ensure sustainable supply and efficient use of energy.
- *Dubai Plan 2021*: To ensure sustainable and systematic developments of the emirate throughout sectors, "a smart and sustainable city" is firmly placed among the six core themes of the plan unveiled in December 2014.[1]
- *Ajman 2021 Vision*: Launched in February 2014, its objective is to create a happy society through an active economic movement contributing in building a Green Economy and enhancing sustainable development, aiming to achieving prosperity in the various fields.
- *Fujairah Master Plan 2040*: Is under development with an aim to achieve sustainable development in the emirate in the light of its rapid economic growth, through the establishment of an effective infrastructure that is balanced and environmentally friendly.

Given the current pace of increasing environmental impacts and carbon emissions together with the prospective growth in population and demand for energy and resources, it is evident that the UAE's ambition for further economic growth and high-quality lifestyles and the targets set by *the Vision 2021* and emirate-level strategies will not be met by simply continuing the current development path. The only way to manage both its economic aspiration and natural heritage is through a greatly accelerated effort to decouple environmental impact from economic growth by putting sustainable development at the heart of the UAE's development in the coming decades.

In fact, it has been found that making a transition to a greener economy will bring significant opportunities and advantages for the country as demonstrated in

An image from Dubai Expo 2020 plan

1. Basit, A. (2014), "Dubai Plan 2021: People first in Dubai roadmap", *Khaleej Times*, 18 December.

the macro-economic analysis presented in the next section. Utilising renewable energy sources can help reduce the country's dependence on fossil fuel and lower carbon emissions, while allowing it to reserve more crude oil for export thus generating extra trade revenues. Cleaner transport and cooling system mean less pollution and better health. Low-carbon agriculture with innovative technologies will be both more productive in terms of labour, energy and water, and more climate-resilient. Energy efficiency can help reduce production cost, while low-carbon technologies and new green products and services can open up new sources of growth and jobs and help economic diversification.

Retaining abundant capital reserves and significant returns from local and foreign investment, the UAE is now in a good position to change the course of national development and prepare for a shift of capital investment towards perpetual assets including human capital, innovative capacity and technological leadership that will enable the Green Economy within the next few decades.

In November 2013, the UAE won the bid to host the World Expo in Dubai in 2020. This will be the first time that the World Expo is staged in the Middle East and North Africa (MENA) region. The UAE would like to make this forthcoming event the greatest opportunity to bring innovative ideas and promising solutions together and to truly realise a global collaboration for sustainable living. Dubai Expo 2020 will be designed around the three themes: *Sustainability*, *Opportunity* and *Mobility*. Sustainability will inform every aspect of Expo 2020 from the overarching philosophy to the physical design of the site and infrastructure.[1]

Mega-events like the Expo have proven to be powerful forces shaping the sustainability of cities and countries. From infrastructure to economic development, from urban planning to quality of life, the legacy of mega-events is inextricably linked to the environmental, economic and social sustainability goals of a nation. The Expo should serve as a powerful springboard to realise a progressive and sustainable vision for the coming decades, while celebrating the country's Golden Jubilee. Running from 20 October 2020 to 10 April 2021 with an estimated 25 million visitors, the UAE strongly believes that the country will be able to show the world the advances it has made in its knowledge, innovation and creativity, and will be able to help guide all countries towards a promising, sustainable future.

1-3. The UAE Green Growth Strategy

Six focus areas towards "A Green Economy for Sustainable Development"

Building upon *the UAE Vision 2021* and influenced by international initiatives for Green Economy, His Highness Sheikh Mohammed bin Rashid Al Maktoum, the Vice-President and Prime Minister of the UAE and Ruler of Dubai, launched in January 2012 ***the UAE Green Growth Strategy*** as a long-term national initiative under the slogan "A Green Economy for Sustainable Development". This strategy primarily aims to provide existing national and emirate-level strategies and plans with a clear, unified umbrella for guiding the course of development towards a Green Economy. Under this overarching strategy, the UAE seeks to enhance the country's competitiveness and sustainability of its development and preserve its environment for future generations, with an ambition to become a global hub and a successful model of sustainable development.

In the strategy, six focus areas were presented along with a list of general actions as a reference point, namely Green Energy; Green Investment; Green City; Climate Change; Green Life; and Green Technologies (**Table 1.2**).

Madinat Jumeirah, Dubai

13. Expo 2020 Dubai, *Born through Partnership* webpage, http://expo2020dubai.ae/en, accessed on 11 November 2014.

Focus area	Proposed general actions
Green Energy	• Promote the production and use of renewable energy and related technologies • Promote the use of clean fuel for energy production • Develop standards to promote energy efficiency in the public and private sectors
Green Investment	• Develop government policies to encourage Green Economy investments • Facilitate the production, import and export and re-export of products and green technologies • Capacity building and preparation of local Emiratis and create employment opportunities for them in all fields related to Green Economy
Green City	• The development of urban planning policies aimed to preserve the environment • Raise the efficiency of household and buildings from environmental perspectives • Encourage sustainable transport • Develop policies to improve indoor air quality for cities
Climate Change	• Develop policies and programmes to reduce carbon emissions from industrial and commercial establishments • Promote organic farming through series of incentives at the federal and local levels • The conservation of biological diversity and protect the ecological balance for all terrestrial and marine areas
Green Life	• Save water and electricity, and other natural resources • Waste recycling projects • Develop environmental awareness and education to raise the level of interaction of the public with all the Green Economy initiatives
Green Technologies	• Carbon capture and storage (CCS) technologies • Waste-to-energy technologies • Energy efficiency technologies

Table 1.2: Focus areas and actions proposed in *the UAE Green Growth Strategy*

Source: UAE Prime Minister's Office

Developing an implementation plan of the Strategy

To further cement *the Green Growth Strategy* and provide a clear structure that can harmonise the implementation of different initiatives under a unified pathway, MoEW, the Prime Minister's Office (PMO) and the Ministry of Foreign Affairs (MOFA) jointly led a stakeholder engagement and consultation process that extended for over a year from January 2013. This process was supported by the Abu Dhabi Office of the Global Green Growth Initiative (GGGI), an inter-governmental organisation headquartered in Seoul.

The consultation with key stakeholders was conducted mainly through workshops with seven Technical Task Forces each of which focused on particular sector – Water and Electricity; Oil and Gas; Industry; Land use and Agriculture; Transport; Buildings; and Waste. Over 160 people took part in those workshops with representation from across the country including federal and local government agencies, the private sector and non-governmental organisations (NGOs). The workshops were complemented by bilateral consultation meetings and validation workshops with over 30 entities from the private and public sector (**Figure 1.3**; **1.4**). The consultation identified a number of gaps in the current sector initiatives compared to the visions which the workshop participants projected for the prospective Green Economy. This knowledge on the action gaps was applied for planning future activities for greening the economy as outlined in Chapter 4.

Principles for implementing *the UAE Green Growth Strategy*

The implementation process of *the UAE Green Growth Strategy* is adhering to the following agreed principles to ensure alignment and collaboration between stakeholders for informed, integrated decisions:

- **Build on existing policies and strategies**: Help deliver goals of *the UAE Vision 2021* and enable emirate-level strategies and plans;
- **Stakeholder-driven**: Apply extensive and continuous stakeholder engagement and consultation process across sectors at the federal and local level;
- **Evidence-based**: Build on past and ongoing UAE and international studies and qualitative and quantitative research; and
- **Cross-sectorally integrated**: Span across all sectors of the UAE economy and enable cross-sectoral development opportunities.

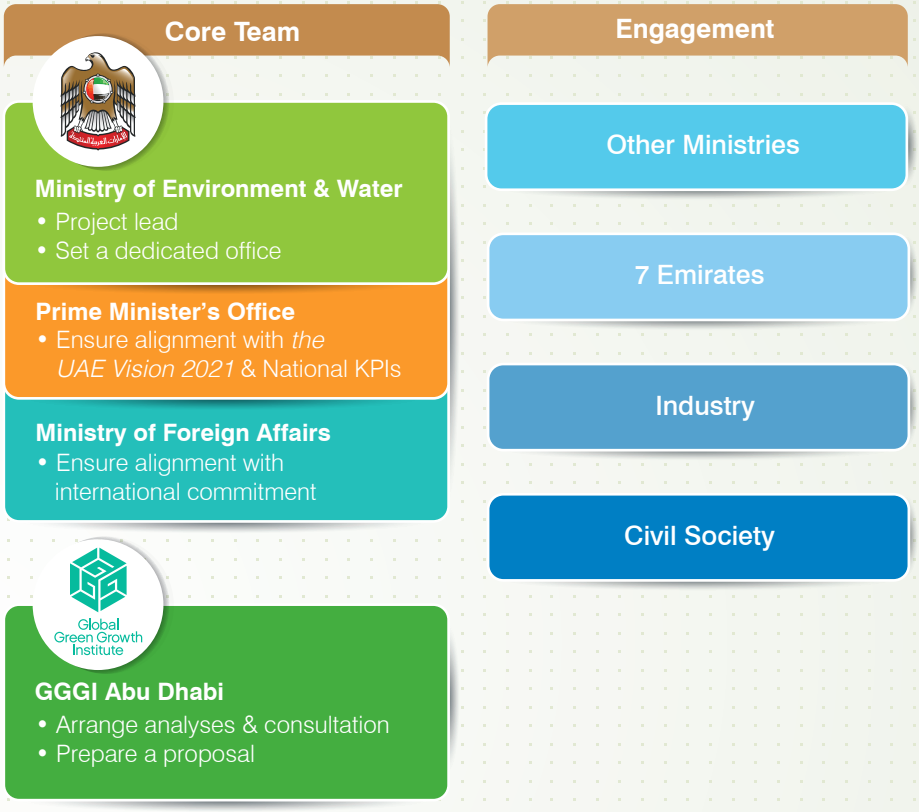


Figure 1.3: Structure of Green Economy implementation plan development

Alongside the extensive stakeholder consultation process, the following four background studies were conducted to provide an evidence base for informing the policy design:

- Analysis of the UAE's status on Green Economy challenges and existing policy initiatives;
- Benchmarking of 5 countries (Brazil, Denmark, Indonesia, Republic of Korea, and the UAE) on Green Economy policy and activities;
- Cost analysis of key technology options for GHG abatement for realising Green Economy; and
- Macro-economic impact assessment of Green Economy policies.

These studies allowed an integrated assessment of Green Economy opportunities, specific technologies and potential policies, and informed the prioritisation and design of actions and policies under the strategy.

Figure 1.4: Process of Green Economy implementation plan development

Potential benefits of Green Economy

As one of the background studies, a specific macro-economic model was developed for the UAE, along with a business-as-usual (BAU) scenario and four ambitious Green Economy scenarios. This was developed in order to estimate the potential impact of the changes from green technology and policy interventions in the short, medium and long-term (until 2050).

With an assumption of average annual investment of 1.0-1.9% of GDP in diverse green measures until 2030, the modelling of the four Green Economy scenarios projected GDP in 2030 would be 4.0-5.5% higher than GDP forecasted under the BAU scenario. The expected trade boost from the Green Economy scenarios was estimated at AED 24-47 billion (USD 6.5-12.8 billion) in 2030. This would result from reduced domestic consumption of oil by 7-10% per year, natural gas by 7-20% and electricity by 11-15% through 2030 (resulting in avoided imports or enabled exports of freed-up hydrocarbons from demand-side savings and supply diversification), and increased local production over the period driven by growth in innovation leading to increased exports.

Such growth would be accompanied by additional 139,000-165,000 new jobs (1.9-2.3% above BAU) by 2030 as the economic benefits will flow down to the population. All four Green Economy scenarios would also bring significant potential reductions in the carbon intensity of the UAE economy, with estimates ranging from 18% to 25% of cumulative emissions between 2013-30 (**Table 1.3**; **Figure 1.5**).

Even though it has to be clearly noted that these potential Green Economy benefits are highly hypothetical, this modelling suggests that greening the developmental path would not necessarily hinder economic growth for the UAE if properly managed. A green pathway for the UAE rather offers additional economic growth, based on successful industrial diversification that makes the economy more resilient and sustainable in that it creates economic and social added value from resource efficiency and clean technologies that reduce negative environmental impact.

Stakeholder consultation at a Technical Task Force workshop

Scenarios	Capital expenditure required till 2030	Average investment required till 2030 (% GDP)	GDP in 2030	Jobs in 2030	Export boost in 2030	Domestic oil consumption (average annual % 2013-30)	Domestic gas consumption (average annual % 2013-30)	Electricity demand (average annual % 2013-30)	GHG emissions (cumulative % 2013-30)
"Green Growth"	AED 673.1 billion	1.6%	+4.0%	+160,000 (+2.2%)	+AED 34 billion	-7%	-13%	-11%	-20%
"Green Growth Plus"	AED 724.8 billion	1.9%	+5.5%	+165,000 (+2.3%)	+AED 47 billion	-10%	-17%	-15%	-25%
"Carbon Pricing"	AED 455.5 billion	1.0%	+4.1%	+139,000 (+1.9%)	+AED 24 billion	-10%	-20%	-14%	-18%
"Cost Reflective Pricing"	AED 437.3 billion	1.0%	+4.1%	+161,000 (+2.2%)	+AED 24 billion	-9%	-7%	-13%	-21%

Table 1.3: Potential sustainability benefits under 4 Green Economy scenarios in comparison to BAU scenario

Source: Internal study

4 scenarios

"Green Growth": Moderate, mandatory deployment of green technologies, behavioural change and economic diversification

"Green Growth Plus": Aggressive, mandatory deployment of green technologies, behavioural change and economic diversification

"Carbon Pricing": Market-based approach that envisages a carbon price being applied across the UAE

"Cost Reflective Pricing": Market-based approach that envisages a movement of domestic energy pricing towards international market prices over a five-year period

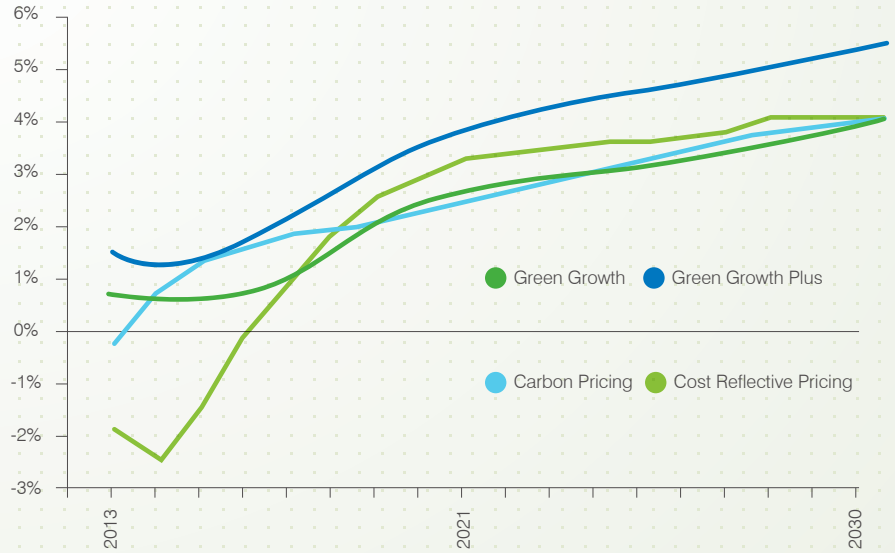


Figure 1.5: Potential changes in GDP under 4 Green Economy scenarios in comparison to BAU scenario

Source: Internal study

2

Sectoral Initiatives towards a Green Economy

Sectoral Initiatives towards a Green Economy

The UAE has come a long way in the past few years to meet the challenges of energy and climate change under the framework of *the UAE Vision 2021* and the strategic plans of each emirate outlined in Chapter 1. The nationwide efforts will be further accelerated and scaled up in the coming years as *the UAE Green Growth Strategy* provides a clear, holistic direction of the country's long-term development. This chapter provides highlights of the public and private-sector efforts for realising Green Economy, which have been implemented mainly during the reporting period of this publication (2010-14). A non-exhaustive list of ongoing Green Economy initiatives is introduced in this chapter according to the UAE's nine key sectors: Oil and Gas; Water and Electricity; Industry; Buildings, Construction and Real Estate; Transport and Logistics; Waste Management; Land use and Agriculture; Financial Services; and Tourism and Hospitality.

2-1. Oil & Gas

The oil and gas industry has been the backbone of the UAE economy since its foundation. The UAE has the seventh largest proven oil and natural gas reserves in the world[1] and is the third largest exporter of crude oil after Saudi Arabia and Russia[2] (see 3-2-1). The sector contributed 33% of the total GDP in 2013, although this rate is steadily declining due to the successful policy of economic diversification (see 3-2-4). Around 95% of oil reserves and more than 92% of gas reserves belong to the Emirate of Abu Dhabi. Oil and gas revenues account for over 80% of its government revenues. Other emirates benefit from the revenues through the federal budget, as well as through development grants from Abu Dhabi and employment opportunities.[3]

The oil policy for the Emirate of Abu Dhabi is determined by the Supreme Petroleum Council, which has management control of the Abu Dhabi National Oil Company (ADNOC). ADNOC in turn owns a range of subsidiaries in the UAE and overseas which specialise in upstream and downstream oil and gas operations, as well as distribution, shipping and all other aspects of the hydrocarbon industry. Abu Dhabi retains foreign partners on a production-sharing basis, rather than ADNOC acquiring full control of oil operations, thus helping the faster development of the sector.

The Emirate of Dubai's oil production peaked in 1991 and has been steadily declining ever since. The contribution of oil and gas is less than 6% of the emirate's GDP. The Dubai government established the Emirates National Oil

An offshore drilling rig, Emirate of Abu Dhabi

1. BP (2014), *BP Statistical Review of World Energy 2014*, June, BP plc., London.
2. OPEC (Organization of the Petroleum Exporting Countries) (2014), *OPEC Annual Statistical Bulletin 2014*, OPEC, Vienna.
3. Elite Media and NMC (2013)

Company (ENOC) in 1993 to promote joint venture petroleum projects in refining and distribution both inside and outside Dubai. The Emirates of Sharjah and Ras Al Khaimah also have small reserves. The Emirate of Fujairah facing the Indian Ocean is now home to the second largest bunkering port in the world (after Singapore), ensuring that the country could still import and export even if the Straits of Hormuz were to become impassable. Overall the UAE is seeking to increase its production capacity of crude oil from the current 2.7 million barrels per day (bpd) to 3.5 bpd by 2017 to meet the increasing global demand.[1] [2]

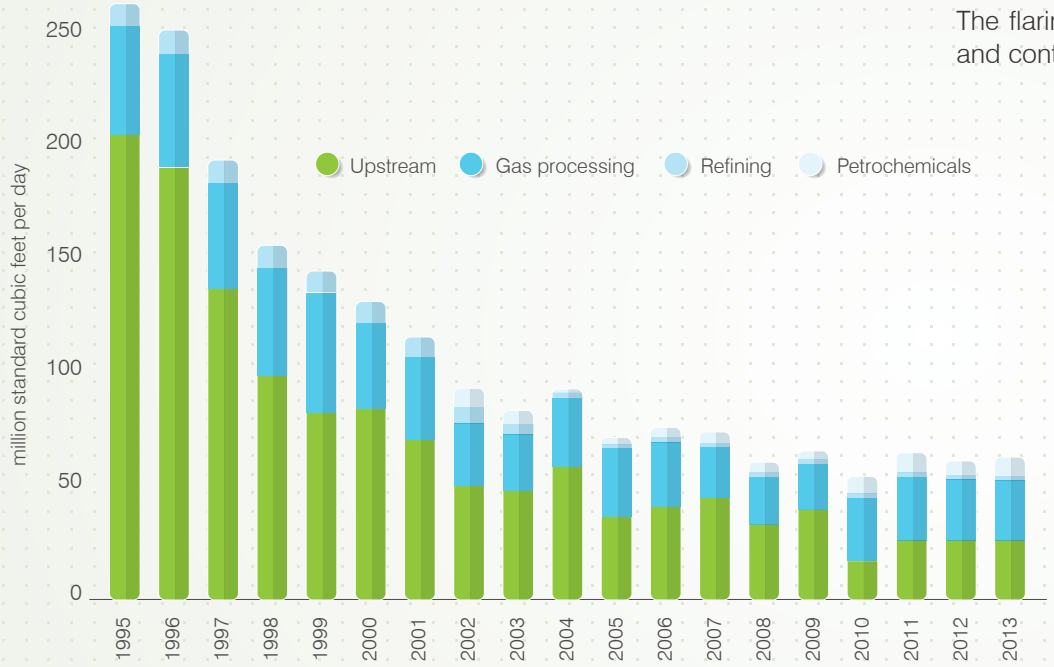


Figure 2.1: Trend in the volume of hydrocarbon flaring from ADNOC operations

Source: ADNOC Sustainability Report 2013

On the other hand, the scale of the oil and gas industry has also contributed to the high level of GHG and other emissions in the UAE. To mitigate this, the government has introduced stringent environmental regulations, while the industry itself has played a significant role in ensuring responsible, secure and environmentally safe development. Following are some of the highlights from the industry's efforts for supporting the realisation of a Green Economy:

Aiming for zero flaring of natural gas

The flaring of natural gas as a by-product of oil production wastes resources and contributes to severe air pollution and GHG emissions. Globally, the World Bank estimates that approximately 140 billion cubic metres (bcm) of natural gas is flared each year, equivalent to about 30% of the European Union's annual gas consumption, resulting in CO_2 emissions of about 350 million tonnes a year.[3]

To date, the UAE has succeeded in radically reducing flaring since 1990s and its policy is shifting from minimal flaring to zero-tolerance of flaring. The ADNOC group aims to eliminate routine flaring and by 2013 had reduced flaring by 76.4% compared to 1995 levels. Within the ADNOC group, an offshore exploration and production (E&P) company has already achieved zero flaring at its Zakum oilfields for the first time. Onshore, an ADNOC gas E&P company developed a flare management strategy for its Shah Gas Development Project, with the aim of minimising flaring from well-testing and clean-up operations (**Figure 2.1**).[4] [5]

The Abu Dhabi Future Energy Company (Masdar) has accumulated knowledge on formulating policies and projects to reduce flaring and has been serving as a partner of the World Bank's Global Gas Flaring Reduction Partnership since 2009. To share its advanced experiences of flaring reduction, Abu Dhabi has been hosting the annual Flare Management and Reduction Summit since 2012.

1. Elite Media and NMC (2013)
2. Butt, G. (2001), "Oil and gas in the UAE", in Al Abed, I. and P. Hellyer (eds), *United Arab Emirates: A new perspective*, 2nd edition, pp.231-48, Trident Press, London.
3. World Bank, *Natural Gas and Global Gas Flaring Reduction* webpage, http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:21032487~menuPK:34480~pagePK:64257043~piPK:437376~theSitePK:4607,00.html, accessed on 2 November 2014.
4. ADNOC (2013), *ADNOC Sustainability Report 2012: Strengthening our energy presence*, ADNOC, Abu Dhabi.
5. ADNOC (2014), *ADNOC Sustainability Report 2013: Sustainable development through partnership and clean technologies*, ADNOC, Abu Dhabi.

Developing a win-win technology

Mature oil reservoirs where the oil does not easily flow out have been applying enhanced oil recovery (EOR) methods that inject natural gas contained in the reservoirs to add pressure and boost output. As local demand for natural gas is surging, using CO_2 as an alternative by applying carbon capture and storage (CCS) technologies could potentially provide a win-win solution that helps slow down the pace of climate change while meeting the increasing demand for oil.

In 2012, an ADNOC E&P company completed a two-year pilot project that involved injecting 60 tonnes per day of CO_2 into its Al Rumaitha oilfield. ADNOC set up a joint venture with Masdar in 2013 to implement CCS projects by which 800,000 tonnes a year of CO_2 emitted from Emirates Steel's plant in Mussafah will be piped 50 km to the Rumaitha field in 2016 and later to Bab, its largest onshore oilfield. It is estimated that if CCS technologies are applied for EOR on all Abu Dhabi's onshore oilfields, 7 billion barrels will be added to crude production, equivalent to 7% of the UAE's total proven reserves. The additional cost of applying this technology is estimated around USD 20 per barrel and considered to be viable.[1][2][3][4]

The International Energy Agency (IEA) estimates as many as 3,000 CCS projects are needed by 2050 to mitigate the most damaging effects of climate change, although the technologies are not yet commercially viable.[5] The Abu Dhabi National Energy Company (TAQA), the largest independent power producer in the MENA region, is taking part in the Rotterdam Storage and Capture Demonstration Project (ROAD) which plans to transform depleted gas fields in the North Sea to permanently store over one million tonnes of CO_2 per year produced by industry located in the port of Rotterdam, the Netherlands.[6] This is one of the first projects worldwide to realise an integrated chain of CO_2 capture, transport and storage on a large scale. The ROAD project aims to demonstrate the technical and economic feasibility of CCS, and the knowledge and experience acquired can be instrumental in the commercial introduction of CCS in the near future.[7]

Gas flaring

Promoting cleaner fuels for vehicles

Natural gas is a viable cleaner alternative fuel to gasoline as it produces fewer emissions and the running cost of vehicles is around 30% less. In the Emirate of Dubai, Emirates Gas (EMGAS), an ENOC subsidiary, started an initiative to popularise compressed natural gas (CNG) as an automotive fuel as early as 2006. A pilot project was conducted with Dubai's Roads and Transport Authority (RTA) that converted diesel-operated wooden abras (water taxis) running on the Dubai Creek to operate on CNG. The company also introduced CNG to fleet

1. Oxford Business Group (2013), *The Report: Abu Dhabi 2013*, OBG, London.
2. Saadi, D. (2014), "Adnoc to boost oil output by injecting CO_2 into reservoirs", *The National*, 21 January.
3. Barakat, N. (2012), "Plans for carbon capturing and storage in GCC to cut carbon emissions", *Gulf News*, 9 December.
4. Elite Media and NMC (2013)
5. IEA (2013a), *Technology Roadmap: Carbon capture and storage*, 2013 edition, OECD/IEA, Paris.
6. TAQA, *Energy Innovation* webpage, www.taqaglobal.com/our-regions/netherlands/energy-innovations?sc_lang=en, accessed on 28 November 2014.
7. ROAD website, http://road2020.nl/en, accessed on 28 November 2014.

users such as Dubai Municipality, DP World, Emirates Group, Transguard and the Dubai Electricity and Water Authority (DEWA) among others.[1]

In the Emirate of Abu Dhabi, more than 3,000 public transport vehicles have been adapted to run on CNG to date. ADNOC's gas processing and fuel distribution subsidiaries are leading the way to expand the use of CNG for vehicles by investing in the infrastructure to ensure that there are enough filling stations to support additional demand for such vehicles. The first phase of the Natural Gas for Vehicles (NGV) Project involves the installation of CNG pumps at 16 stations in Abu Dhabi and Al Ain as well as the Emirate of Sharjah, with capacity to fill 10,000 vehicles per day. ADNOC's fuel distribution subsidiary is also carrying out the conversion of petrol-operated vehicles to run on both petrol and CNG, with the facility to switch over to either fuel by simply touching a button located on the dashboard. Nine conversion centres are planned with a retrofitting capacity of 20,000 vehicles per year.[2]

In July 2014, the UAE became the first country in the Middle East to make the use of "green diesel" in all commercial diesel vehicles mandatory. The new Cabinet decree and the updated guidelines from the Emirates Authority for Standardisation and Metrology (ESMA) requires replacement of the current diesel fuel that contains 500 parts per million (ppm) of sulphur with diesel fuel that contains only 10 ppm similar to Euro 5 standards. This reduction in sulphur levels will significantly reduce particulate matters (PM) and pollutants and contribute to cleaner and healthier environment.[3]

Introducing green service stations

ENOC introduced the first "green service station" in The Greens neighbourhood in Dubai. This station applies a variety of state-of-the-art technologies and features including devices to contain petrol fumes released by the pump, new waste segregation systems that provides colour-coded bins, use of furniture made from recycled materials, and a centralised vacuum system to support power conservation and reduce waste and noise.

CNG pumps at an ADNOC station

The station generates half of its energy requirements from renewable sources as it uses solar-powered pole and light-emitting diode (LED) lights. Diverse sustainable water features have been installed to reduce water use by a quarter. It uses sensor water taps and two-stage flush systems in the toilets, and recycles carwash water while also providing customers the option to use a waterless carwash system with an all-in-one eco-friendly liquid.[4]

1. UNDP (United Nations Development Programme) and DCCE (Dubai Carbon Centre of Excellence) (2014), *State of Energy Report Dubai 2014*, DCCE, Dubai.
2. ADNOC (2013)
3. *Emirates 24/7* (2014c), "UAE makes 'Green Diesel' mandatory", 22 July, www.emirates247.com/business/energy/uae-makes-green-diesel-mandatory-2014-07-22-1.557369.
4. UNDP and DCCE (2014)

2-2. Water & Electricity

The UAE's electricity sector has been dominated by natural gas-powered utilities. In 2012, the total installed capacity of electricity generation was 27.2 gigawatts (GW) (see also 3-2-3).[1] Demand for electricity and water continues to grow at a fast pace driven by a steep rise in population, an expanding economy and climatic considerations. According to Business Monitor International, a sharp increase in annual power demand throughout the country is expected over the period 2012-21, with an anticipated average annual increase in consumption of 5.6%.[2]

To meet this rising demand in a sustainable manner, the UAE is increasingly focusing on coming up with a balanced energy mix. The country is in a unique position to leverage its resources to advance the economic, social and environmental benefits of clean energy. Both Abu Dhabi and Dubai have set ambitious targets for increasing renewable energy generation. Masdar was established in 2006 to conduct strategic investment in research and innovation of renewable energy technologies as well as in clean technology companies and large-scale renewable power and sustainable city projects at home and abroad. Abu Dhabi has also hosted the International Renewable Energy Agency (IRENA) since 2009, which is the first inter-governmental organisation setting headquarters in the Middle East.

To date, the Abu Dhabi government has set a target that by 2020 at least 7% of power generation capacity should be renewable energy. The Government of Dubai established the Dubai Supreme Council of Energy (DSCE) in 2009 which oversees all aspects of energy in the emirate and developed *the Dubai Integrated Energy Strategy 2030* to drive energy decarbonisation and ensure efficient use of energy. The emirate sets plans to generate at least 5% of its power from renewable energy by 2030, as well as 12% from clean coal and 12% from nuclear power, as part of the policy to use alternative energy sources (In January 2015, Dubai announced a revision of its targets for the share of renewable energy in the total energy mix to 7% by 2020 and 15% by 2030). The UAE has instituted a comprehensive civil nuclear energy programme under the direct supervision of the International Atomic Energy Agency (IAEA) and the construction of the first nuclear power plants started in 2013.

A combined cycle power plant, Abu Dhabi

The UAE has only limited natural water resources at its disposal and has employed thermal desalination as the dominant technology. Today, most of the country's portable water (or 42% of the total water requirement) comes from some 70 major desalination plants, which account for around 14% of the world's total production of desalinated water. In 2012, the UAE had an installed desalination and groundwater capacity of 7.2 million cubic metres (m^3) per day which has expanded by as much as 35.8% since 2008 (see also 3-2-3).[3] However, the country is not just focusing on increasing capacity but efficiency and conservation are also high on the agenda. The energy-water nexus is one of the most challenging aspects of sustainable development, particularly in countries like the UAE. His Highness General Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces, emphasised the importance of water security to the country by stating in 2011 that "water is more important than oil for the UAE".[4]

1. MOENR (UAE Ministry of Energy) (2013), *Statistical Annual Report Electricity and Water 2008-2012*, MOENR, Abu Dhabi.
2. Elite Media and NMC (2013).
3. MOENR (2013)
4. *Emirates 24/7* (2011), "Water is more important than oil for UAE: Mohammed bin Zayed", 13 December, www.emirates247.com/news/government/water-is-more-important-than-oil-for-uae-mohammed-bin-zayed-2011-12-13-1.432657.

The UAE's water and electricity sector is generally managed and financed at the local level in major emirates, having their own water and electricity authority responsible for the provision and distribution of water and electricity. The Abu Dhabi Water and Electricity Authority (ADWEA) is responsible for the generation, transportation and distribution of water and electricity within the Emirate of Abu Dhabi. In Dubai and Sharjah, these tasks are the responsibility of the Dubai Electricity and Water Authority (DEWA) and the Sharjah Electricity and Water Authority (SEWA) respectively. The remaining emirates of Ajman, Ras Al Khaimah, Umm Al Quwain and Fujairah are served, for the most part, by the Federal Electricity and Water Authority (FEWA).[1]

Those authorities have been applying cutting-edge technologies and global practices in power generation and water desalination stations to enhance their efficiency and reliability. In January 2014, DEWA won the Emirates Appreciation Award from the Zayed International Foundation for Environment for its successful introduction of wet compression and inlet air chilling technologies that enable cooling gas turbines in hot climate.[2]

Leading the world in renewable energy projects

Despite its abundant hydrocarbon deposits, the UAE is aiming to become a global hub of renewable energy research and industry as part of contributions towards the diversification of its economy and energy mix as well as reducing carbon footprint. Most notable in this direction are the ongoing development of a few high-profile solar power plants which are among the largest in the world.

In March 2013, Masdar commenced the operation of Shams 1, a 100-megawatt (MW) concentrated solar power (CSP) plant near the city of Madinat Zayed in the Western Region of Abu Dhabi. Working together with Total and Abengoa Solar with a total project cost of USD 600 million, this is one of the largest CSP plants in the world and the first of its kind in the MENA region. CSP generates electricity from the heat of the sun rather than sunlight as used by solar photovoltaic (PV) technology. Spread over an area of 2.5 km^2, 768 parabolic troughs that consist of 258,000 mirrors concentrate the heat from the sun into oil-filled central tubes.

Shams 1 CSP plant

The collected heat in turn is used to produce steam, which powers a turbine and generates electricity. The plant relies on some natural gas, which helps boost its efficiency during the day and allows it to produce electricity at night. It produces enough energy to power 20,000 homes and displaces approximately 175,000 tonnes of CO_2 annually.[3] [4]

1. UAE Embassy Trade and Commercial Office in Washington, DC, *Water & Electricity* webpage, www.uaetrade-usa.org/index.php?page=economic-sectors-in-uae&cmsid=53, accessed on 11 September 2014.
2. DEWA (2014a), "DEWA wins Emirates Appreciation Award from Zayed International Foundation for Environment", press release, 15 January.
3. Masdar Clean Energy, *Shams 1* webpage, www.masdar.ae/en/energy/detail/shams-1, accessed on 4 November 2014.
4. UNDP and DCCE (2014)

The Emirate of Dubai announced in January 2012 that a 1-GW Mohammed bin Rashid Al Maktoum Solar Park would be built in phases and completed by 2030 in Seih Al Dahal, around 50 km south of Dubai city, to meet its renewable energy supply target. This mega-project is undertaken by DSCE and managed and operated by DEWA, as one of the biggest renewable energy projects in the MENA region with an expected total cost of AED 12 billion (USD 3.3 billion). The first phase, a 13-MW solar plant with advanced thin-film PV modules, was built at a cost of AED 120 million (USD 32.7 million) and was inaugurated on 22 October 2013 to mark World Energy Day. This plant can be responsible for the reduction of approximately 15,000 tonnes of CO_2 annually. The second phase of the project covers the construction of a 100-MW installation expected to be completed by 2017.[1]

The UAE is not only looking into solar technologies. Even though wind power is more challenging to develop due to the generally light breeze in the Gulf region, the region's first wind turbine, which stands 65 metres high with a production capacity of 850 kilowatts (kW), was installed on Sir Bani Yas Island, located 250 km south-west of Abu Dhabi city. Masdar and Abu Dhabi's Tourism Development and Investment Company (TDIC) aim to develop an onshore wind farm on this island with a capacity of up to 30 MW (see also 3-2-3).[2]

A roadside billboard promoting Powerwise campaign, Abu Dhabi

Producing water by power of the sun

It is critical that the UAE identifies a sustainable desalination solution to meet long-term water needs as most portable water relies on desalination due to lack of freshwater sources. Connecting desalination technologies to renewable energy is one such solution.[3]

Masdar announced in January 2013 the Advanced Energy-Efficient Desalination Pilot Project which aims to develop and demonstrate seawater desalination technologies efficient enough to be powered by renewable energy. In May 2014, four companies – Abengoa, Degrémont, Sidem/Veolia and Trevi Systems – were awarded with contracts to each build and operate their own test plant in Ghantoot, some 90 km north-east of Abu Dhabi city, to develop and demonstrate desalination technologies over the course of 18 months. All four plants will demonstrate innovations in advanced membrane technologies, such as reverse osmosis and forward osmosis, which are more energy-efficient than the thermal processes currently in use in most desalination plants. During the course of the project, the test plants will also provide 1,500 m^3 of potable water per day to Abu Dhabi's water infrastructure enough to meet the requirements for around 500 homes. The new technologies are expected to allow the implementation of cost-competitive, large-scale seawater desalination plants powered by renewable energy in the UAE and abroad.[4]

The reverse osmosis desalination plant under construction at Al Qidfa in the Emirate of Fujairah is also aiming to set a new standard for energy efficiency. The plant, part of an extension to Fujairah F1, targets a specific energy consumption of 3.7 kilowatt-hours for every cubic metre (kWh/m^3) of water produced, which will be a record for the Gulf region.[5]

1. Shahbandari, S. (2013), "Mohammad Bin Rashid Solar Park goes live", *Gulf News*, 22 October.
2. Al Makahleh, S. (2012), "Sir Bani Yas Island is home to largest wind turbine in the region", *Gulf News*, 30 January.
3. UAE Interact, *Infrastructure* webpage, www.uaeinteract.com/business/infrastructure.asp, accessed on 11 September 2014.
4. *Gulf News* (2014b), "Masdar awards contracts for advanced energy-efficient desalination pilot project", 5 May.
5. UAE Interact, *Infrastructure* webpage.

Managing energy demand in a smart way

Contrary to the conventional notion of meeting the rising energy demand by increasing energy generation and import, demand-side management (DSM) focuses on reducing and optimising energy consumption as an additional option to meet network demand, particularly that at peak time, at the lowest cost. DSM activities generally comprise a portfolio of policies and programmes for improving energy efficiency and demand response. Some countries started putting an obligation on utilities to deliver a certain quantity of energy savings.

As the Emirate of Dubai set a target of 30% reduction in energy demand by 2030 as a key objective of *the Dubai Integrated Energy Strategy 2030*, DEWA has developed a DSM roadmap and action plan over the short, medium and longterm to 2030. These include 8 DSM programmes and 24 initiatives covering all the potential saving areas, and include cost-benefit analysis, implementation and financing mechanisms, and measurement and verification methodology. At the core of this demand-side approach is the introduction of smart meters that can provide more precise information about energy use and ensure faster responses to changing supply and demand through automatic reconnections. Smart meters also facilitate the installation of renewable energy in residential, commercial and industrial sectors as the feedback of the generated excess electricity to the power grid has officially been permitted by the resolution issued in December 2014.[1] DEWA has started a five-year plan to replace conventional meters and will install 200,000 smart meters all over Dubai by the end of 2015.[2 3]

ADWEA also launched a DSM programme defining a holistic energy efficiency strategy that ensures a shift towards the development of a smart grid that will support the future needs of the society. It has completed an implementation roadmap for the programme and has already made significant progress in rolling out advanced metering infrastructure (AMI) over 400,000 of the existing 680,000 consumer points in the municipalities of Abu Dhabi and Al Ain. AMI remotely collects consumption data via smart meters, which is validated and transferred through data management systems to its customer billing system. The Abu Dhabi government-led taskforce on cooling is analysing the benefits of DSM interventions, leveraging detailed metering and customer data enabled by AMI.[4]

Making people wiser for sustainable consumption

In order to realise energy efficiency and savings for which DSM programmes aim, the understanding and collaboration from people is essential. Abu Dhabi's Regulation and Supervision Bureau (RSB), the water, wastewater and electricity sector's independent regulatory body, launched Waterwise and Powerwise initiatives in 2013. They aim to empower wise attitudes and behaviours of consumers by helping them understand how they can save water and electricity and why it is important to do so based on the collection and sharing of reliable data and a comprehensive knowledge base. In addition to various awareness raising campaigns, RSB introduced a new utility bill that shows the actual cost of supplying water and electricity to customers as well as the government's subsidy. It also advises the level of usage with green and red symbols – red

Abu Dhabi utility bills indicate the level of usage and subsidies.

1. *The National* (2014d), "Dubai announced resolution on diversification of energy sources", 15 December.
2. UNDP and DCCE (2014)
3. DEWA (2014b), "DEWA powers Dubai's smart strategy", in World Green Economy Summit (WGES) (2014), *State of Green Economy Report 2015*, DCCE, Dubai, pp.59-60.
4. Information from ADWEA

warns that consumption is above the level of average households.[1] In Dubai, since June 2013 DEWA has included in the utility bill a statement of CO_2 emissions equivalent to customers' electricity consumption to raise awareness over the impact of climate change.[2]

Responding to the findings of *the Living Planet Report 2006* compiled by the Worldwide Fund for Nature (WWF) that the UAE recorded the world's highest Ecological Footprint (see 3-2-3), the Emirates Wildlife Society in association with WWF (EWS-WWF) and the Environment Agency – Abu Dhabi (EAD) started the Heroes of the UAE campaign, with the spirit of "it's only in times of crisis that the heroes emerge". The campaign has been centred on a website, where people can find out everything they need to know about the causes of the problem and also find out what they can do to help solve it. Targeting school children, households and corporate offices, principal features of the website included an animated sequence that explains the present energy and environment situation, along with a long list of energy saving tips, a calculator that enables people to establish how and where they can make real savings on their consumption, and a unique pledge facility which enables them to positively state their intention to make a difference.[3]

Standards and labels for intelligent choices

In many countries, standards and labelling have been considered as one of powerful policy tools to help consumers to make better choices and be environmentally more responsible. One of the major tasks of the Emirates Authority for Standardization and Metrology (ESMA) has been to set authoritative national efficiency standards adapted to local climatic conditions, and to provide information to consumers through eco-labelling of products. A mandatory water and energy efficiency rating and labelling system is being gradually introduced on domestic electrical appliances and water fixtures to help consumers make intelligent choices. Those electrical appliances for sale must have a label showing how much electricity they consume in a year, together with a five-star rating to show how energy-efficient they are. The first product category undergone this scheme in 2011 was household air conditioning units, followed by washing machines and dryers and household refrigerators in 2013 and storage water heaters in 2014. This initiative is expected to save the government's subsidies of AED 400 million (USD 109 million) a year by 2016 from energy savings on air conditioners alone.[4]

As part of the UAE Ecological Footprint Initiative, a partnership project between EWS-WWF, EAD, ESMA and MoEW, *the UAE Lighting Standard* was introduced in December 2013 to prevent low-quality incandescent light bulbs from entering the market and to ensure the advancement of energy-efficient light bulbs such as compact fluorescent lamps (CFLs) and LED lamps. All lighting products entering the UAE or manufactured locally must include third-party product certifications with correct labelling that clearly indicates their specifications. Any bulbs that do not meet the minimum requirements are excluded from the market. As lighting accounts for 20% of household energy consumption globally, this measure can help make a significant difference. It is estimated that the application of this standard in the residential sector alone could save about half of an average gas power station's capacity. It would also lower CO_2 emissions equivalent to removing 165,000 cars off the road every year, while saving approximately AED 668 million (USD 182 million) a year (see also 3-2-5).[5]

UAE energy efficiency labels

1. RSB, *Waterwise* and *Powerwise* webpages, www.waterwise.gov.ae; www.powerwise.gov.ae, accessed on 5 November 2014.
2. WGES (2014)
3. EWS-WWF, *Heroes of the UAE* webpage, www.heroesoftheuae.ae, access on 5 November 2014.
4. McGinley, S. (2013), "UAE appliances get mandatory energy efficiency labels", *Arabian Business*, 9 July.
5. EWS-WWF, *UAE Lighting Standard* webpage, http://uae.panda.org/what_we_do/reducing_footprint/ecological_footprint_initiative/uae_lighting_standard, accessed on 6 November 2014.

Reforming tariffs to rationalise usage

One further effective demand-side policy option for energy efficiency is to control power usage by means of tariffs. The UAE's water and electricity tariffs have been kept low by government subsidies. However, both the Emirates of Dubai and Sharjah introduced in 2008 a slab tariff system for water and electricity consumption in residential, industrial and commercial customers, under which as consumers use more power, the unit of power becomes more costly.[1] [2] From January 2011, a further fuel surcharge was added for water and electricity consumption in Dubai, which varies based on the rate of increase or decrease of the actual fuel cost supplied to DEWA generation plants. Fuel surcharge is added according to usage (per imperial gallon and per kWh) and shown separately in monthly bills.[3]

In November 2014, Abu Dhabi's RSB announced new utility tariffs to be applied from 1 January 2015. For water, tariffs for expatriates living in a flat will increase from AED 2.20 (USD 0.60) per 1,000 litres to AED 5.95 (USD 1.62) for those using up to 700 litres per day. For those using more than this volume, a cost reflective tariff will be applied. The electricity tariffs for expatriates living in a flat or a villa will also rise from AED 0.15 (USD 0.04) per kWh to AED 0.21 (USD 0.06) for those with a daily consumption of up to 20 kWh and a cost reflective tariff will be applied for those using more.[4] FEWA already introduced a slab tariff to the customers in the Northern Emirates, while also incrementally raising the tariff level. From January 2015, the subsidy for water to Emirati residents will be cut from 70% to 55%.[5]

Introducing peaceful nuclear technologies

As the energy demand in the UAE is growing as fast as three times the global average, developing a reliable supply of electricity is the country's urgent priority to safeguard its future growth while reducing carbon emissions. The UAE has thus instituted a comprehensive civil nuclear energy programme under the IAEA's direct supervision. Established in December 2009, the Emirates Nuclear Energy Corporation (ENEC) is responsible for implementing the country's nuclear energy programme, paying particular attention to training Emirati specialists in the field. A consortium led by the Korea Electric Power Corporation (KEPCO) was awarded the contract to design, build and help operate the first four nuclear reactors at Barakah, around 220 km south-west of Abu Dhabi city.

Meanwhile, the Federal Authority for Nuclear Regulation (FANR) was established in September 2009, in accordance with the Federal Law Concerning the Peaceful Uses of Nuclear Energy, to regulate the nuclear sector in line with international treaties, such as the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), and best practices. In July 2012, FANR granted a construction licence to ENEC for two of the four advanced pressurised water reactors, which are scheduled to start supplying electricity in 2017.[6] The construction licence for the remaining two reactors was also granted in September 2014. With four plants with a total capacity of 5.6 GW operational by 2020, nuclear energy is expected to deliver up to a quarter of the UAE's electricity needs and save up to 12 million tonnes of CO_2 emissions a year.[7]

Supporting developing countries for green future

As part of its commitment to the UN Sustainable Energy for All initiative, the UAE has also acted as a catalyst to open up a new horizon for deploying renewable energy technologies in developing countries where energy access to remote and poor populations is still a paramount concern. A special soft loan facility run by the Abu Dhabi Fund for Development (ADFD), in partnership with IRENA, will disburse USD 350 million of loans for renewable energy projects in developing countries. The first loan round resulted in awards in January 2014, during the Abu Dhabi Sustainability Week, to Ecuador (small-hydro), the Maldives (waste-to-energy), Mali (PV-diesel hybrid), Mauritania (wind), Samoa (biodiesel) and Sierra Leone (PV). In 2013, Masdar executed major grant-funded projects in Mauritania (15-MW PV plant), the Seychelles (6-MW wind farm) and Afghanistan (600 off-grid solar home systems in 23 remote villages). A USD 50-million Pacific Partnership Fund was also launched in 2013 under which Masdar custom-designs renewable energy facilities with the governments of Pacific island states and provides capacity building. A 500-kilowatt (kW) solar PV plant in Tonga and

1. *Khaleej Times* (2008), "Dewa introduces slab system tariff from March 1", 17 February.
2. Abdullah, A. (2008), "Sewa launches slab tariff system", *Khaleej Times*, 6 April.
3. DEWA, *Slab Tariff* webpage, www.dewa.gov.ae/tariff/tariffdetails.aspx, accessed on 8 September 2014.
4. *The National* (2014a), "New utility tariffs for Abu Dhabi residents", 13 November.
5. Shahbandari, S. (2014c), "Fewa bills increase by 5 fills per kw/h", *Gulf News*, 15 December.
6. UAE Interact, *Infrastructure* webpage.
7. Malek, C. (2014), "Abu Dhabi gets licence for third and fourth reactors at Barakah", *The National*, 15 September.

30 villages in Mali are benefitting from 4-MW hybrid PV-diesel power, supported by ADFD/IRENA

a 550-kW wind installation in Samoa have been completed by 2014, while PV installations are also ongoing in Fiji, Tuvalu, Kiribati and Vanuatu.[1]

In July 2014, His Highness Sheikh Mohammed bin Rashid Al Maktoum, the Vice-President and Prime Minister of the UAE and Ruler of Dubai, announced the establishment of the UAE Water Aid Foundation. This foundation has the aim of conducting research and studies to support the production of clean water using solar energy, thereby providing new, cheap and innovative solutions for millions around the world who suffer from scarcity of water and polluted drinking water. Sheikh Mohammed also announced the launch of an international prize of USD 1 million for finding sustainable solutions to water shortage all over the world through the use of solar energy to desalinate and purify water.[2]

2-3. Industry

Over the last few decades, the UAE has been pursuing its economic diversification through large-scale investments in the manufacturing sector. Manufacturing activities tend to be energy-intensive but the country has taken advantage of the abundance of energy sources and feedstock as petrochemicals and metals along with ceramics and cement have dominated this sector. Meanwhile, downstream industries such as automotives, chemicals, electrical machinery, power equipment and food processing are gaining momentum, as partnerships with foreign enterprises and joint ventures have allowed them to benefit from the most up-to-date technologies. There has also been strong growth in biotechnology, pharmaceuticals, telecommunications, aerospace and healthcare equipment.[3] Consequently, the manufacturing sector has been amongst the highest contributors to the UAE's non-oil GDP, maintaining around 13% since 2007 (around 9% of the total GDP).[4] The sector has also driven much of the country's non-oil trade. In 2012, manufacturing exports (including re-exports) accounted for 53% of the UAE's total non-oil exports of merchandise goods (22% of total exports).[5]

Among all industries, the UAE has particularly emerged as a metals production powerhouse in the Middle East, with aluminium and steel producers expanding rapidly, although the demand for raw materials has been met by imports. The country is the leader with a 46% share of the total Middle East's aluminium production, followed by Bahrain and Qatar. In June 2013, the country took a significant step to improve efficiency and remain competitive within the region by merging the two state aluminium companies – Dubai Aluminium (Dubal) and Abu Dhabi-based Emirates Aluminium (Emal) – to form the world's fifth largest aluminium company, Emirates Global Aluminium (EGA), with a total value of USD 15 billion. EGA will have a production capacity of 2.4 million tonnes per year from 2015. The UAE is also the second largest steel producer in the GCC behind Saudi Arabia and is expanding capacity rapidly after a drop in demand during the post-financial crisis period.[6]

1. McQueen, D. (2014), "Renewable energy exported: Renewable energy as development assistance", in MOENR (2014), *UAE State of Energy Report 2015*, DCCE, Dubai, p.73.
2. WAM (Emirates News Agency) (2014), "VP launches UAE Water Aid Foundation and award", *Khaleej Times*, 16 July.
3. Elite Media and NMC (2013)
4. Based on data from NBS
5. *Emirates 24/7* (2013b), "UAE manufacturing poised for large-scale investments", August 14, www.emirates247.com/business/economy-finance/uae-manufacturing-poised-for-large-scale-investments-2013-08-14-1.517694.
6. Elite Media and NMC (2013)

The UAE has vast resources of limestone and hard rock in the Northern Emirates, which are currently exploited by quarrying companies to produce construction aggregate, cement, rock wool, gypsum, etc.[1] The Emirate of Ras Al Khaimah is home to the world's largest ceramics manufacturer, RAK Ceramics, which exports 75% of its output and supplies over 160 countries, exploiting the large limestone deposits. The UAE is also ranked as the second largest producer of cement in the MENA region after Saudi Arabia. There are currently 12 cement factories in the UAE, producing clinker, Portland cement and white cement.[2]

The development of free zones has also spurred investment in the manufacturing sector. The largest and most high-profile in the country is Dubai's Jebel Ali Free Zone (JAFZA) that hosts over 6,000 businesses from over 110 countries; 75% of them are involved in trading, warehousing and distribution while 20% in manufacturing and the rest in services. The bulk of industrial investment in Jabel Ali is concentrated on light engineering and final-stage assembly in sectors such as electronics.[3]

Some manufacturing activities are amongst the major GHG emitters, particularly aluminium, steel and cement production. The GHG emissions from the industry process and product use (IPPU) were recorded in 2012 at nearly 29 million tonnes of carbon dioxide equivalent (tCO_2e), 16.7% of the total GHG emissions in the country (see 3-2-3).[4]

World-class efficiency to build an industry for the future

Aluminium is one of the most energy-intensive industries, but it is also increasingly valued by the automotive and building industries that face stringent environmental demands, owing to its lightness, flexibility and recyclability. Under these circumstances, EGA aims to create an aluminium industry at the forefront of the UAE's efforts to diversify its economy, while continually reducing the impact of its operations on the environment and its surrounding communities.

Dubal and Emal plants have their own power stations with a total capacity of 5.45 GW, primarily fuelled by purchased pipeline natural gas. However, since the co-generation and combined cycle configuration of those power stations

Presenting Dubal's waste heat-based absorption chiller

means that more than one-third of the power generated is fuel-free through the steam turbines, the thermal efficiency of Dubal plant has reached 46% and that of Emal 48% in 2013. Dubal developed a comprehensive carbon management strategy in 2009 including diverse monitoring, abatement and procurement initiatives, and as a result of those efforts annual CO_2 emissions were reduced by approximately 1.19 million tonnes by April 2014, nearly 12% from the 2009 baseline. Its GHG intensity was also declined from 10.08 tCO_2e per tonne of aluminium production in 2009 to 8.89 in April 2014.[5]

EGA also looks for ways not only to conserve energy but also to source energy through alternative methods. Dubal has recently started using a small volume of steam produced by its captive co-generation and combined cycle power plant to drive the UAE's first waste heat-based absorption chiller. Built on the rooftop of its desalination plant control building, the new absorption chiller can replace the

1. MOENR, Department of Geology and Mineral Resources (n.d.), *The Rock Resources of the Northern Emirates*, Abu Dhabi.
2. Elite Media and NMC (2013)
3. *Emirates 24/7* (2013b)
4. MoEW (2014b), *UAE GHG Inventory 2012*, MoEW, Dubai.
5. Al Mazrooei, S. (2014), "Aluminium industry drives strong sustainability agenda", in WGES (2014), pp.246-7.

electrically-driven vapour compression air-conditioning chillers used for comfort cooling of the building. The absorption chiller process uses just 40% of the electricity consumed by conventional chillers and utilises a nominal 0.6 tonnes of steam per hour to produce sufficient cooling for the same purpose. It has the capacity to reduce the company's energy consumption by approximately 626,800 kWh per year, while removing the need for ozone-depleting substances since water serves as the refrigerant.[1]

Improving local environment by in-house recycling

Sharjah Cement Factory, which was established in 1977 at 25 km east of Sharjah city, now has a total annual capacity of 2.2 million tonnes for clinker production and 4.27 million tonnes for cement grinding. The factory has recently installed three sewage treatment units that handle about 300 m^3 of domestic water daily used in workers' camps, offices and a canteen (the cement plant itself does not use much water as most is evaporated or recycled back into the production process). In addition to the benefit of avoiding groundwater contamination from wastewater seepage, the treated water has been used to create a green belt on the southern boundary of the factory along the Sharjah-Al Dhaid highway where about 200 palm trees have been planted.

In the cement industry, alkali dust is generated during the pyro-processing in the rotary kiln. This is considered as a hazardous material but many cement plants dump it in solid waste disposal yards, causing soil degradation. The factory has managed to fully recycle alkali waste through controlled feeding into a cement mill, without affecting the quality of product. It is also currently installing a waste heat recovery (WHR) power plant to effectively utilise waste gases from two kiln lines. With the expected completion in early 2015, the WHR plant will reduce dependence on local grid power and reduce thermal load on the environment as gases will be vented out at much lower temperature.[2]

A business park dedicated to green industry

EnPark, a member of Tecom Investments, is a free zone business park dedicated to facilitating and fostering the growth of alternative energy and environment

EnPark dedicated to green businesses in Dubai

businesses. Located a short driving distance from the centre of Dubai, EnPark caters to companies and organisations operating in energy efficiency, renewable energy, green building and waste management sectors by providing a cost-effective business environment and raising the profiles of potential investment opportunities. Besides providing a full range of sustainably designed real estate products, it also offers regulatory and legislative support to its licensees and strives to provide a platform to facilitate public-private partnerships, identify business opportunities and share experiences of operations, products and services with industry peers. To date, more than 50 organisations from cleantech start-ups to large energy multinationals operate under EnPark's licenses.[3]

Shifting to local cleantech manufacturing

The UAE is not only a big importer of clean energy technologies. Microsol International was set up in the Fujairah Free Zone on the east coast of the

1. Al Awadhi, T. (2014), "Harnessing 'free' energy", in WGES (2014), pp.122-3.
2. Information from Sharjah Cement Factory
3. Abdulaziz, M. (2014), "Building a platform for Dubai's green economy", in WGES (2014), pp.205-6.

country in 2003 by Indian entrepreneurs with extensive experience in the solar PV industry. The company specialises in manufacturing of crystalline silicon (c-Si) solar cells and its products are highly competitive in the market while providing green jobs to more than 200 employees. Customers comprise leading solar energy players across the world including Germany, Italy, Portugal, Spain, Czech Republic and India.

The company's expansion plans include setting up of further cell, module and wafer manufacturing capacities in India and the UAE to achieve an integrated capacity of 500 megawatt peak (MWp). In March 2012, Microsol bought Germany-based Solon Group, which is specialised in design and construction of solar farms as well as tracker and mounting structures. This will allow Microsol to become a vertically integrated player which can provide turnkey solutions from rooftop installation to large-scale solar parks, while ensuring low-cost but German-quality production.[1 2 3]

Beloved animal turned into sustainable products

The camel was and still has been a fundamental part of life in the UAE. The value derived from the practical use of this beloved animal has recently been rediscovered. It provides a source of meat and milk, and increasingly a source of leather material. The Government of Abu Dhabi established Al Khaznah Tannery in 2006 next to the dunes on the Abu Dhabi-Al Ain truck road as one of the most advanced leather processing plants in the world. The plant transforms locally sourced camel hides and skins, alongside those of cows, goats and sheep, into premium quality leathers for a wide range of applications including shoes, bags, interior and fashion design, automotive, aviation and yachting.

The plant is not only technically advanced but also among the first in the world to apply the most advanced environmentally sound production processes in the industry that has been seen as highly polluting. Most tanning processes use chromium salts, which become toxic and carcinogenic if products are incinerated. Al Khaznah manages to totally stay away from chromium and other metals and its products are biodegradable within several months if they are composted. The tanning process is also very water-intensive but the plant is treating and reusing up to 80% of the water, resulting in using less than one-tenth of water used in conventional tanneries. Leveraging these competitive advantages, the company aims to break into export markets, including reputable fashion houses in Europe.[4 5 6 7]

Camels in Liwa Desert, Emirate of Abu Dhabi

Protecting communities from environmental violators

MoEW is monitoring the activities of crusher plants and quarries in the country to ensure the health and welfare of nearby residents and the protection of surrounding communities. In cooperation with local authorities, the ministry conducts regular day-time and night-time field visits to these facilities. Since the beginning of 2014, MoEW has made 50 field visits to different facilities across the UAE.

1. Microsol International, *About Microsol* webpage, www.microsolinternational.com, accessed on 8 September 2014.
2. Todorova, V. (2013c), "Fujairah solar power company predicts bright future for industry", *The National*, 23 December.
3. Montgomery, J. (2012), "UAE's Microsol buying Solon's assets", *RenewableEnergyWorld.com*, 6 March.
4. Al Khaznah Tannery, *Environment* webpage, www.alkhaznahtannery.com, accessed on 16 November 2014.
5. General Holding Corporation, *Al Khaznah Tannery* webpage, www.ghc.ae/alkha.php, accessed on 16 November 2014.
6. Ali, E. (2012), "Tanning responsibly", *Time Out Abu Dhabi*, 2 April.
7. Denman, S. (2012), "Camel leather is poised for the mainstream, but not quite over the hump", *The National*, 18 May.

In August 2014, MoEW ordered the temporary shutdown of a crusher plant in the Emirate of Fujairah due to violations of regulations, and the operations of the plant were suspended for a month. A cement factory in Fujairah was also ordered to close for a month due to violations in September 2014, and three quarries in the Emirate of Ajman were also forced to shut down for three months as the result of a night inspection campaign during November 2014. The ministry also issued a warning to several other facilities. During 2013, 16 plants were shut down and four others were given warnings. The notable decrease in the number of closed plants between 2013 and 2014 is viewed as owing to the successful efforts and robust measures taken by the ministry.[1][2][3]

Industry groups promote sustainable practices

Corporate social responsibility (CSR) has become a powerful business concept that helps industry consider and take responsibility for the wider impact of their conduct. It encourages companies to make a positive impact on the environment and on stakeholders including consumers, employees and communities as well as investors. To stimulate the UAE industry to play a more prominent role in sustainable practices, the Dubai Chamber of Commerce and Industry established the Centre for Responsible Business (CRB) as early as 2004 to assist its members and the rest of the business community in adopting responsible business practices that enhance their performance and competitive advantage. Whilst it started with raising awareness on CSR and sustainability, CRB soon recognised the demand for specific services that help build technical capacities of companies as well as the need for acknowledging and sharing best practices.

In 2010, CRB therefore launched the Dubai Chamber CSR Label, a voluntary standard that supports CSR implementation in the UAE by providing a valuable framework that helps participating companies review and benchmark their CSR policy and practices themselves. By 2014, the label has been awarded 138 times (some companies were awarded more than once), giving an external recognition for their efforts. Also in 2010, the Dubai Chamber Sustainability Network was launched where companies and key stakeholders across the country have been engaged in an ongoing process of creating tools and sharing expertise through different task groups to scale up CSR and sustainability practices. As of the end of 2014, the network consists of 58 members.[4]

In Abu Dhabi, the Abu Dhabi Sustainability Group (ADSG) was established in 2008 as a public-private partnership among organisations committing to adopt best practices of sustainability management and performance reporting. Locating its secretariat at EAD, around 30 members consisting of companies, local authorities and NGOs are working together to improve knowledge and capacity, share experiences and report performance as well as to advocate systemic change towards sustainable development.[5]

From a ceremony awarding Dubai Chamber CSR Label

1. MoEW (2014a), "MoEW shuts down crusher plant in Sakamkam, Al-Fujairah, for one month", press release, 10 August.
2. *Gulf News* (2014d), "Cement factory suspended for rule violations", 16 September.
3. WAM (2014c), "MoEW orders three-month closure of three quarries in Ajman", wire report, 29 November.
4. Information from Dubai Chamber
5. ADSG, *About Us* webpage, https://www.adsg.ae/about/Pages/AboutUsHome.aspx, accessed on 16 November 2014.

2-4. Buildings, Construction & Real Estate

The UAE has been renowned across the globe for the innovative city planning of Dubai and Abu Dhabi, as well as for iconic buildings and developments such as Burj Khalifa, Burj Al Arab, Palm Jumeira, Aldar Headquarters and Sheikh Zayed Grand Mosque. The UAE's real estate and construction sector bounced back in 2012, following a major slowdown in the property market since 2009. The total value of the construction sector in the country at the end of 2012 stood at AED 375 billion (USD 102 billion), which accounted for almost 44% of the entire GCC market. Favourable government policies, such as permitting non-UAE nationals to own freeholds and leaseholds, are also attracting foreign direct investment in properties and construction.

The Emirate of Abu Dhabi has been actively and effectively managing its burgeoning development since the launch of *the Abu Dhabi Vision 2030* in 2007. This was designed to help the emirate filter and respond to current and future development needs, establish a planning culture and introduce strong guidelines for sustainable development. Central to *the Vision 2030* is the transformation of the capital into a sustainable city built around vibrant neighbourhoods. This means concentrating growth, introducing transport choice, creating mixed-use, pedestrian-friendly streets, implementing more sustainable, cost-effective infrastructure, and protecting and enhancing the natural environment. Abu Dhabi's development spending has been steadily rising in recent years reaching 15.2% of the emirate's GDP in 2011, amounting to AED 27 billion (USD 7.4 billion). TDIC has been working on a number of significant projects, including its flagship development of Saadiyat Island, where several major museums are planned such as Louvre Abu Dhabi which began construction in early 2013. A new business district, Sowwah Square is under development by Mubadala on Al Maryah Island off Abu Dhabi coastline and started first-phase operations in March 2012.

Burj Khalifa, the world's tallest building, and Downtown Dubai

The Dubai Strategic Plan 2015, launched in 2007, recognises that urban planning is a pre-requisite for optimising land use to meet the needs of development while preserving natural resources. Dubai's general economic improvement, coupled with returning investor confidence and rising occupancy rates in the hotel and retail segments, gave the local government and developers the impetus to plan and launch an array of new projects. One of the largest new project is the Mohammed bin Rashid City, launched in November 2012 as a joint venture between Emaar Properties and Dubai Holding. This multi-billion dollar project includes the world's largest shopping mall, a Universal Studios theme park and a park that is a third bigger than London's Hyde Park. Another mega-project to develop world-class theme parks has also been approved, whilst a master plan has been published for the Dubai Trade Centre – Jabel Ali, where Dubai Expo 2020 is expected to attract 25 million visitors. *Dubai Plan 2021* has been inaugurated in December 2014 to further look at the emirate's development for the next seven years.

The UAE has also continued to invest heavily in vital aspects of its infrastructure in recent years, with a number of new facilities unveiled and substantial budget allocations granted to power generation, ports, healthcare and education. New roads and bridges are being constructed and public transport systems installed. An industry report indicates that the

UAE's governments, both federal and local, are investing AED 213 billion (USD 58 billion) on roads and bridges alone, including projects underway and in the planning stage.[1]

UNEP roughly estimates that buildings use about 40% of global energy, 25% of global water, 40% of global resources, and they produce approximately a third of global GHG emissions.[2] The growth in the buildings sector hence implies potential for increasing environmental impacts from material and land use at the construction stage as well as energy and water consumption by occupants. Against this backdrop, the UAE government has emphasised policy measures to increase sustainability in the sector including improving building efficiency standards. In 2010, the Ministry of Public Works (MoPW), together with the Government of Dubai's Executive Council, developed *the UAE Green Building Guidelines* for new projects to be carried out by the ministry, addressing six focal areas: envelope efficiency; cooling systems; energy efficiency; water use and efficiency; indoor environmental quality; and site heat island.[3]

Making a global model of sustainable cities

The concept of smart, sustainable cities has been widely embraced in the UAE. Particularly, Abu Dhabi's Masdar City project has attracted worldwide attention as a future model eco-city since its construction started in 2008. Located close to the Abu Dhabi International Airport, Masdar City is seeking to be a commercially viable development that delivers the highest quality living and working environment with the lowest possible ecological footprint. The city combines ancient Arabic architectural techniques with modern technologies in order to enable people to spend more time outdoors and function as a lively community. The streets act as wind tunnels with help from a large wind tower inspired by that of traditional local houses. The buildings have a thick layer of insulation and the windows are arranged to give enough light but to prevent the sun from overheating. The required energy comes from the city's own 10-MW PV plant and a rooftop solar installation totalling 1 MW.

Masdar City and a wind tower for cooling

The largest part of the city to date is the campus of the Masdar Institute of Science and Technology, where cutting-edge cleantech research and world-class post-graduate education programmes have been conducted in conjunction with the Massachusetts Institute of Technology (MIT). Alongside various shops and restaurants, Siemens opened its new Middle East headquarters in one of the region's most energy-efficient buildings where up to 65% less energy is required compared to an average building in Abu Dhabi. It has been labelled as Platinum under the Leadership in Energy and Environmental Design (LEED) scheme. The city's first commercial property, the Incubator Building, is now home to more than 60 companies from start-ups and small and medium-sized enterprises (SMEs) to the regional offices of multinational corporations. IRENA will soon locate its

1. Elite Media and NMC (2013)
2. UNEP Sustainable Buildings and Climate Initiative, *Why Building*? webpage www.unep.org/sbci/AboutSBCI/Background.asp, accessed on 15 September 2014.
3. MoPW (2010), *UAE Green Building Guidelines*, MoPW, Dubai.
4. Masdar, *Masdar City* webpage, http://masdar.ae/en/#city, accessed on 16 November 2014.

permanent headquarters in the city's new three-block building.[4] The first phase of residential development with 500 homes will also soon be contracted for construction.[1]

The Dubai Sustainable City, which claims to be the first "net zero energy city" in the emirate, is being developed by Diamond Developers under the direct supervision of the Land Department of the Dubai Government (DLD). Its objective is to become an international model of sustainable living, work, education and entertainment, providing the amenities and luxuries of modern life with no detriment to the environment.[2] Located in Dubailand, an entertainment complex under development in the south of Dubai, the city will have 500 villas and townhouses ranging from 290-390 square metres (m^2) to be completed by mid-2015. It will also include an environmental sciences university, a school, a commercial centre, a shopping mall, and a deluxe sustainable hotel and resort with a world-class spa centre. Villa owners will not need to pay any community and maintenance fees by becoming a shareholder in its retail area and office block.[3]

Furthermore, the AED 20 billion (USD 5.4 billion) plan to build the Dubai Smart Sustainable City, a new residential city for Emiratis which will be self-sufficient in terms of resources, transport and energy, has been approved in March 2014 by His Highness Sheikh Mohammed bin Rashid Al Maktoum, the Vice-President and Prime Minister of the UAE and Ruler of Dubai. 160,000 people are expected to live in a total area of 140 km^2 to be completed by the time Dubai hosts Expo 2020.[4] In September 2014, DLD announced the development of The Perfect City to be completed by 2021. The city will be developed around the three essential qualities – Smart, Sustainable and Safe – and will feature green space in 75% of the site and a 500-metre canal.[5] In November 2014, DLD and UNEP jointly launched the Centre for Resource Efficient and Sustainable Cities for the Arab Region, which will be located in The Perfect City.[6]

Making green buildings a norm

Recognising the need to improve sustainability in buildings and the opportunity for potential efficiency gains from existing solutions, local building codes have evolved to incorporate some fundamental sustainability aspects. In 2001, Dubai Municipality introduced energy efficiency standards for new buildings, including the provision of insulation standards for building envelopes. Subsequently, green building regulations and specifications were introduced in 2010 as one of eight initiatives launched by the municipality towards the goal of becoming one of the top ten sustainable cities in the world by 2020. They were initially mandated to all government buildings, resulting in 43% reduction in energy use and 15% reduction in water use. Since March 2014, they have also been mandatory for all private developments, which are now required to meet 79 specifications.[7][8][9]

Estidama (the Arabic word for sustainability) is a sustainable building framework introduced in April 2010 by Abu Dhabi's Urban Planning Council (UPC) as a key component of *the Abu Dhabi Vision 2030*. At the heart of this framework is the Estidama Pearl Rating System for the design, construction and operation of buildings, villas and communities. The five-level rating provides guidelines covering the use of natural systems, an integrated development process, conservation of water, energy and materials, the incorporation of innovative practices and the creation of liveable communities. The assessment criteria cover the building's lifecycle (design, construction and operation). In the emirate, all new buildings are required to obtain at least a one-pearl rating, whereas all government buildings and villas must obtain at least two pearls. While the majority of rated projects still fall within the one and two-pearl

1. Barnard, L. (2014), "Green community gets green light", *The National*, 24 April.
2. Diamond Developers, *The Sustainable City* webpage, www.diamond-developers.ae/thesustainablecity, accessed on 16 November 2014.
3. Deulgaonkar, P. (2014), "Sustainable City in top gear", *Emirates 24/7*, 18 March.
4. Saseendran, S. (2014), "Dubai to have sustainable residential city for Emiratis", *Khaleej Times*, 4 March.
5. *Emirates 24/7* (2014d), "Dubai unveils plans for 'Perfect City'", 23 September, www.emirates247.com/news/emirates/dubai-unveils-plans-for-perfect-city-get-details-here-2014-09-23-1.563899.
6. *Emirates 24/7* (2014e), "Dubai's Mena centre for sustainable cities", 25 November, www.emirates247.com/business/dubai-s-mena-centre-for-sustainable-cities-2014-11-25-1.571205.
7. Al Abbar, S. (2014), "Green buildings", in UNDP and DCCE (2014), pp.120-4.
8. *Construction Week Online* (2014), "Positive response to Dubai's green building codes", 5 March, www.constructionweekonline.com/article-26895-positive-response-to-dubais-green-building-codes.
9. Al Khan, M.N. (2013), "Dubai's new buildings have 79 more requirements to meet", *The National*, 23 May.

rating, the Abu Dhabi International Airport's Midfield Terminal Building project was awarded a three-pearl design rating in September 2013.[1]

The LEED rating system administered by the US Green Building Council has also been widely adopted in the UAE following the mandating of its implementation within Dubai World's jurisdiction.[2] As of April 2014, the UAE is ranked the ninth in the world (outside the US) in terms of cumulative gross square metres of space certified to LEED (1.82 million m^2). 850 projects have been either already certified or registered for certification to LEED.[3]

Adopting efficient cooling systems

As air-conditioning typically accounts for 70% of energy consumption during the peak summer months in the UAE, the development and widespread adoption of energy-efficient and environmentally-friendly cooling solutions is a pressing concern. In the Gulf region, district cooling systems (DCS) have been adopted as the preferred alternative to conventional air conditioning systems. Working on broadly similar principles to district heating, DCS deliver chilled water from a central plant to residential buildings, offices and factories through an underground insulated pipes network. The systems can run on electricity or natural gas, and can use either regular water or seawater. In general, DCS consume 50% less energy than the conventional systems, while maintenance costs are substantially lower as equipment only needs to be replaced every 30 years. DCS combined with thermal energy storage solutions further help in effectively managing and reducing peak load requirements.[4] [5]

The UAE has been one of the leading nations adopting DCS. A number of district cooling utility companies have emerged and more than one in ten residents now use the systems. Commissioned by the UAE government in the late 1990s, the National Central Cooling Company (Tabreed) has grown into the region's leading district cooling provider. Its portfolio now includes 67 plants in the GCC that deliver 938,000 refrigerated tonnes (RT) to many of the landmark projects

Empower's district cooling station, Dubai

including the Sheikh Zayed Grand Mosque, Ferrari World and Dubai Metro. Its services have helped reduce energy consumption in the GCC by more than 1,000 gigawatt-hours (GWh) annually, which has led to the reduction of over 570,000 tonnes of CO_2 emissions.[6] Established as a joint venture between DEWA and Tecom Investments in 2003, Empower has grown exponentially and is currently the largest DCS provider in the world serving almost 1 million RT through plants and networks spread all over Dubai. The company is providing its services to world-class projects such as Business Bay, Dubai Health Care City, the Dubai International Financial Centre (DIFC) and Palm Jumeirah.[7]

1. Everington, J. (2013a), " Abu Dhabi's Estidama programme at vanguard of green building revolution", *The National*, 31 October.
2. Al Abbar, S. (2014)
3. *Gulf News* (2014a), "UAE on list of Top 10 green building nations", 2 May.
4. Empower, *What is District Cooling?* webpage, www.empower.ae/php/what-is-district-cooling.php?id=1, accessed on 17 November 2014.
5. Tabreed, *Benefits of District Cooling* webpage, www.tabreed.ae/en/district-cooling/benefits-of-district-cooling.aspx, accessed on 17 November 2014.
6. Tabreed, *Our Story* webpage, www.tabreed.ae/en/about-us/our-story.aspx, accessed on 17 November 2014.
7. Empower, *About Empower* webpage, www.empower.ae/profile.php, accessed on 17 November 2014.

Leading by example in sustainable buildings

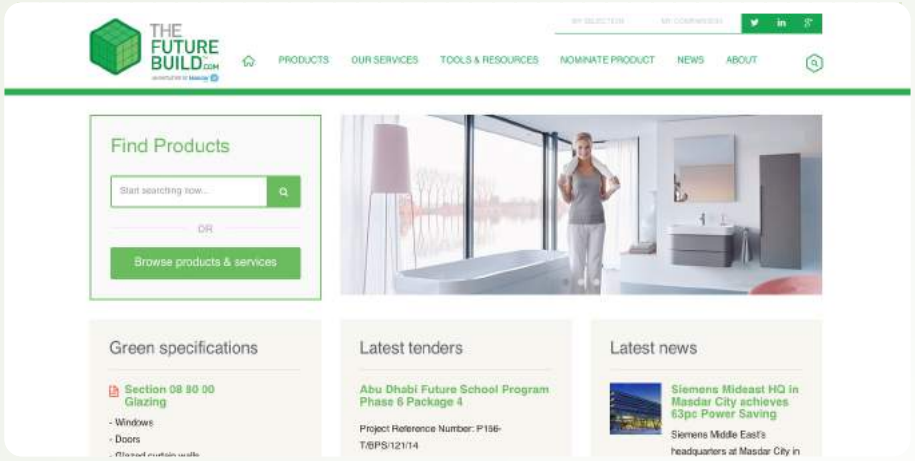
Among the rapidly increasing number of green buildings in the UAE, one of the most advanced is the DEWA's Sustainable Building completed in February 2013 in Al Quoz area in Dubai. This is the largest government building in the world that has secured a LEED Platinum rating, acquiring 98 out of 110 points. The green features help the building reduce consumption of energy by 66% and water by 48%, whereas 36% of construction material used was recycled content. Special glass has been installed to reduce heat transfer into the building and highly efficient water-cooled chillers cut down energy consumption. The building installed LED lights and automatic lighting control systems with occupancy sensors. Renewable energy is also available through an on-site 660-kW PV plant, thereby reducing the building's carbon footprint even further. More than 20% of the project site area features vegetated open spaces, while waste reduction is aided by an easily accessible dedicated area for the collection of recyclable materials.[1]

Al Bahr Towers, Abu Dhabi

In March 2014, Al Fahidi Souq (market) was opened in Bur Dubai area in Dubai as Dubai Municipality's first commercial green building. The complex, which was built with a traditional look, is estimated to use 45% less energy and 20% less water compared to conventional systems by applying energy-saving systems, natural lighting arrangements, eco-friendly building materials and insulation methods.[2] In July 2014, a "green mosque", which is claimed to be the first of its kind in the Islamic world, was opened in Port Saeed area in Dubai. The mosque, which can accommodate 3,500 worshippers, aims to achieve a LEED Silver certification, integrating latest green technologies. The water flow from taps is adjusted in the ablution areas and the used water is reused for plant irrigation. Solar systems are installed to light outside, charge batteries and heat water. LED lights, occupancy sensors and a climate control system are applied to minimise energy consumption.[3]

Completed in 2012 in the northern side of Abu Dhabi Island, the twin 29-storey Al Bahr Towers, which house the headquarters of the Abu Dhabi Investment Council (ADIC), an investment arm of the Government of Abu Dhabi, has managed to strike a balance between the cultural and architectural heritage of the region and latest environmental requirements. The buildings are known for their distinctive façade covered by over 2,000 umbrella-like elements, which make them look like giant pineapples or honeycombs. Inspired by the mashrabiya, geometrically designed wooden lattice screens used in traditional Arabic architecture, this intelligent façade can open and close to keep the sunshine off the glass building as the sun moves across the sky, while letting in daylight. This structure reduces solar gain by up to 50% and helps reduce the building's overall energy consumption by 20%, whereas the roofs are equipped with PV

1. *Construction Week Online* (2013), "DEWA's LEED Platinum sustainable building opens", 20 February, www.constructionweekonline.com/article-21017-dewas-leed-platinum-sustainable-building-opens.
2. *Emirates 24/7* (2014a), "Dubai's Dh50 million eco-friendly Al-Fahidi souq to open soon", 14 January, www.emirates247.com/business/economy-finance/dubai-s-dh50-million-eco-friendly-al-fahidi-souq-to-open-soon-2014-01-14-1.534662.
3. Barakat, N. (2014), "First green mosque opens in UAE", *Gulf News*, 18 July.



The Future Build green building procurement portal

systems generating around 5% of their total energy demand.[1] [2] The buildings came the second in the Emporis Skyscraper Awards for projects completed in that year.[3]

Spreading sustainable procurement in buildings

Building upon its own experiences in sourcing sustainable materials for constructing a future eco-city, Masdar established *The Future Build* online platform www.thefuturebuild.com. This allows suppliers of green building products to bring their products and materials to the attention of the construction industry, particularly in the UAE and the Arab region. Listings include a brief product description, supplier contact information and an assessment of the product across 15 sustainability criteria. It also provides the latest green building news, lifecycle project management and carbon tracking tools, and sustainable procurement and supply chain consulting and training services.[4] The Emirates Green Building Council (EGBC) also launched in December 2014 an online database that helps energy-efficient companies to find partners and potential customers.[5]

2-5. Transport & Logistics

The UAE has built a major industrial pillar in transport and logistics by strategically positioning itself as a global hub. As the economy is recovering from the global financial crisis, the government has increasingly focused on the expansion of the country's transport and logistics infrastructure such as ports, airports and roads. Increasing the capacity of public transport has also been a priority, with ambitious targets set by both the Emirates of Abu Dhabi and Dubai to reduce commuters' reliance on private vehicles. The UAE's transportation sector has been managed mainly through local authorities. The major local government agencies in the sectors include the Department of Transport (DoT) for Abu Dhabi, the Roads and Transport Authority (RTA) in Dubai and Sharjah Public Transport Corporation (SPTC).

The Abu Dhabi Vision 2030 calls for shifts from private modes of transport to public transport as well as for reducing congestion levels. DoT launched its *Surface Transport Master Plan* in 2009, laying out guidelines to achieve the goals set out in *the Vision 2030*. It intends to boost the use of public transport

Dubai International Airport

1. Abraham, A. (2011), "ADIC Headquarters unveil new dynamics of architecture", *Arabian Gazette*, 18 September, www.arabiangazette.com/adic-headquarters-unveil-dynamics-architecture.
2. Leech, N. (2011), "Desert-smart towers carry their own sunscreen", *The National*, 17 September.
3. Al Sayegh, H. and L. Barnard (2013), "Abu Dhabi's Al Bahr Towers second to Canada's Marilyn Monroe buildings in best architecture awards", *The National*, 19 September.
4. *The National* (2014b), "Masdar website will connect green builders with materials", 16 November.
5. Todorova, V. (2014d), "UAE database to help energy-efficient companies collaborate", *The National*, 30 December.

in Abu Dhabi City to 35-40% of all daily trips by 2030.[1] The guiding policy document for Dubai's transportation policy is *the Dubai Strategic Plan 2015*. The plan emphasises the need for improving mobility and safety, including an increased use of public transport, less use of private cars, and the building of more roads, bridges and links. RTA set a target of 30% of the population using public transport in 2020, compared with 12% in 2010. The emirate's public transport system served 368 million passengers during 2012, implying that on average more than a million commuters a day used public transport.

The UAE's strategic location has made the country a global hub for air travel, a one-stop connection facilitating flights to a vast range of destinations across the globe. The scale and appeal of the country's national airlines such as Emirates Airline and Etihad Airways has made them game changers in the global aviation industry and ensured that passenger numbers continue to increase at the UAE airports. By July 2014, the Dubai International Airport became the world's busiest airport topping London Heathrow in terms of international passenger traffic (67.8 million in the past 12 months),[2] with passenger traffic projected to rise to 98 million by 2020. The passenger terminal of the Dubai World Central Al Maktoum International Airport opened in October 2013, which upon completion around 2025 will become the world's largest airport with an ultimate capacity of 160 million passengers and 12 million tonnes of cargo per annum. The construction of the Abu Dhabi International Airport's Midfield Terminal Complex commenced in 2013, which will provide capacity for over 40 million passengers per year when fully completed.[3]

Taking a pre-emptive step of aligning the industry's rapid growth with the needs of environmental protection, the UAE General Civil Aviation Authority (GCAA) adopted a national environmental policy for the civil aviation sector in 2012. As a member state of the International Civil Aviation Organization (ICAO), GCAA committed to preparing a State of Action Plan on carbon emissions reduction and is encouraging strategic partners in the domestic aviation sector to produce regular environmental reports.[4] In August 2013, it announced the country's official position on aviation and climate change.[5]

At the heart of Dubai's trade and logistics sector is Jabel Ali Port. Operated by DP World, it is the largest port in the Middle East. Jabel Ali's annual container throughput has increased more than 150% over the past decade, from around 5 million twenty-foot equivalent units (TEUs) in 2003 to 13.3 million TEUs in 2012. Abu Dhabi's new Khalifa Port opened in 2012 which will replace Mina Zayed as the emirate's main general cargo port. By 2030, the Khalifa Port will have the capacity to handle 15 million TEUs and it is estimated that the Port and the surrounding Khalifa Industrial Zone Abu Dhabi (KIZAD) will contribute 15% of Abu Dhabi's non-oil GDP.[6]

Introducing modern public transport modes

For the last few years, the UAE has been making large-scale investment in introducing various advanced public transport modes to ease road congestion and provide people with low-cost, convenient alternatives. Dubai Metro, which

Dubai Tram inaugurated in November 2014

1. DoT (2009), *Surface Transport Master Plan: A vision for connecting Abu Dhabi*, DoT, Abu Dhabi.
2. ACI (Airport Traffic International), *ACI Annual World Airport Traffic Report* webpage, www.aci.aero/Data-Centre/Monthly-Traffic-Data/International-Passenger-Rankings/12-months, accessed on 18 November 2014.
3. UAE Interact, *Infrastructure* webpage, www.uaeinteract.com/business/infrastructure.asp, accessed on 17 September 2014.
4. Information from the GCAA
5. ICAO (2013), "UAE's views on aviation and climate change" (presented by the UAE), working paper, A38-WP/258, EX/85, 9 September.
6. Elite Media and NMC (2013)

was inaugurated in September 2009 on the 52-km Red Line with 10 stations, has revolutionised the way both residents and tourists move around the city. Guinness World Records acknowledged it as the world's longest fully automated metro network. The 23-km Green Line was added in 2011 and 47 stations, including 10 underground, are currently operational. The number of daily passengers has jumped from 60,000 in 2009 to about 500,000 in 2014.[1] RTA estimates that Dubai Metro helps reduce CO_2 emissions by over 645 tonnes per day thanks to the reduction of vehicles from road and the resulting reduced congestion.[2] The authority plans to launch three more metro lines by 2030, as well as an extension of the Red Line to the Expo 2020 site, covering 421 km with 197 stations.[3]

Built on the success of Dubai Metro, Dubai Tram has been launched in November 2014 as the first tramway outside Europe powered by ground-based electric supply system. The first phase of the project has 11 stations and 11 seven-car trams which runs 10.6 km along Al Sufouh Road from Dubai Marina to Burj Al Arab. The second phase will add 4 km of track, six stations and 14 trams. RTA expects that about 27,000 people will use it every day by 2015 and the passenger number will rise to 66,000 by 2020.[4] Abu Dhabi also began work on the design of a 131 km-long metro system. The first phase of the metro is expected to run 18 km from north to south of Abu Dhabi Island, supplemented by two light railways or tram lines linking with surrounding islands.[5]

Furthermore, the development of a 1,200-km national railway network for passengers and freight is underway since the establishment of Etihad Rail in June 2009. It will link the principal centres of population and industry, as well as to form a vital part of the wider 2,000-km GCC railway network linking the UAE with Saudi Arabia, Qatar, Oman, Bahrain and Kuwait. The project will be implemented in three stages and the first phase of 200 km freight services will be operational in the near future between Shah, Habshan and Ruwais in the Western Region of Abu Dhabi. The second stage will provide a 630-km network for both passengers and freight between Musaffah, Khalifa Port in Abu Dhabi and Jebel Ali in Dubai, as well as extension to the Saudi and Omani borders. The freight trains will travel at 120 km per hour and the passenger trains will run at up to 200 km per hour.[6] [7]

In search for appropriate and sustainable transportation solutions inside communities, Madar City (see 2.4) has been piloting a personal rapid transit (PRT) system of electric-powered, automated, single-cabin vehicles that have offered the privacy, comfort and non-stop travel of a taxi service since November 2010.[8]

Converting conventional transport clean and green

More conventional transport modes familiar to UAE inhabitants such as buses and taxis also started their upgrade to a greener and cleaner fuel. RTA introduced the first "green bus" fuelled by biodiesel in 2012 as a pilot project and is now

An hydrid taxi in Dubai

1. Kannan, P. (2014a), "Five years of success but sky's the limit for Dubai Metro", *The National*, 8 September.
2. Shahbandari, S. (2014b), "Dubai Metro completes five successful years", *Gulf News*, 8 September.
3. Elite Media and NMC (2013)
4. Kannan, P. (2014b), "Get on board, waiting in over", *The National*, 11 November.
5. Barnard, L. and F. Neuhof (2013), "Firms plan their bids for Abu Dhabi's Dh7 billion metro and light-rail line", *The National*, 10 June.
6. Elite Media and NMC (2013)
7. El Gazzar, S. (2014), "Etihad Rail aims to award contracts for stage two of network", *The National*, 20 May.
8. Vorano, N. (2011), "Masdar City's PRT, a test drive for future of transport", *The National*, 21 January.

converting a total of 118 Mercedes buses to be powered by biodiesel by the end of 2014. All internal lighting is powered by solar energy and retreated tyres are applied, whilst the material used for seats and flooring is also eco-friendly. It is estimated that green buses will emit 33% less CO_2 compared to the conventional buses. RTA aims to make its entire fleet green buses by the time of Expo 2020.[1]

RTA conducted a pilot operation of hybrid vehicles for the first time in the Gulf region between 2008 and 2011. Results of this experiment showed that the vehicles had been driven for more than 550,000 km without breakdowns or major maintenance, and the percentage of rationalisation in the use of fuel reached 33% and CO_2 emissions has been lowered also by 33%. Professor Bassam Abu-Hijleh at the British University in Dubai estimated that replacing the entire fleet of taxis in Dubai could save AED 104 million (USD 28 million) of fuel cost annually, while more than 109,000 tonnes of CO_2 emissions could be reduced. Following the successful piloting, Dubai Taxi Corporation introduced 20 Toyota Camry hybrid taxi units in September 2013. Those units display a slogan and the "Hybrid Taxi" green logo on both doors to distinguish them from the conventional taxis.[2] Cars Taxi introduced first two hybrid taxis in Dubai in 2012 and now plans to operate 100 hybrid vehicles across the country by the end of 2014. It estimates that even though each Camry hybrid car costs AED 30,000-40,000 (USD 8,200-10,900) more than the normal Camry, it can save more than AED 50,000 (USD 13,600) in fuel costs for driving every 700,000 km. The company which owns 6,000 vehicles aims to operate an all-hybrid taxi service eventually.[3] [4]

Making bicycles viable for mobility and sporting

Cycling is rapidly becoming popular among health-conscious UAE residents as an option for commuting as well as sport and leisure, but the absence of dedicated lanes and purpose-built tracks in the country has led to the risk of more accidents on busy roads. To respond to the rising popularity and to promote healthy and greener lifestyles, RTA developed *the Dubai Bicycle Master Plan* that aims at providing 850 km of strategic bikeways in central business district areas and newly developed localities as suitable transit alternatives. The authority completed by August 2013 the construction of 104-km cycling tracks in various parts of Dubai, including a 23-km track along Jumeirah Street and a 11-km track at the centre of Bur Dubai, and plans to expand the coverage based on the tourist environment, popularity of the area, accessibility to public transport and the fulfilment of safety and aesthetic elements.[5] Abu Dhabi opened the 16-km Al Wathba Cycle Track in September 2013 to cater for sportive riders, whereas the Corniche seafront and the Formula One race track Yas Marine Circuit, which is open every Tuesday for cyclists and athletes, have drawn many enthusiasts.[6]

A bike-sharing station in Abu Dhabi opened in December 2014

1. Shahbandari, S. (2014a), "RTA expands green bus fleet", *Gulf News*, 24 May.
2. Libo-on, L.B. (2013), "Dubai Taxi launches 20 eco-friendly hybrid cabs", *Khaleej Times*, 25 September.
3. Al Taher, N. (2014), "Cars Taxi gets 15 more hybrid vehicles", *Gulf News*, 23 September.
4. Ruiz, R. (2014), "Cars Taxi introduces hybrids to Abu Dhabi", *The National*, 23 September.
5. *Gulf News* (2013), "RTA completes 104km cycling tracks in Dubai", 10 August.
6. Sankar, A. (2014a), "Cycling takes off big time in Abu Dhabi", *XPRESS*, 12 February.

Further to the expansion of bicycle tracks, a European-style bike-sharing scheme was launched in Dubai in February 2013. This novel service has been rolled out by a German company Nextbike which operates in 30 cities in Germany and several other countries. Over 100 bicycles have been installed at the docking stations in Downtown Dubai and Dubai Marina areas where tourists congregate. They can be rented for 30 minutes or for up to 24 hours through an easy and flexible process.[1][2] Abu Dhabi has also started a similar scheme between Al Raha Beach and Yas Island with 10 stations in December 2014. Sponsored by Abu Dhabi Commercial Bank (ADCB), bicycles are free for the first 30 minutes. If the bike is not docked after 30 minutes, users will be charged AED 15 (USD 4.1) for a one-day pass.[3] The Sharjah Investment and Development Authority (Shurooq) also introduced the system in early 2014, with an intention to eventually cover all touristic areas of Sharjah city.[4]

Promoting more responsible use of private cars

The RTA analyses have demonstrated that the high reliance on private cars and low usage of group transport (7% of the total traffic) are the main causes of traffic congestion in Dubai's roads on peak hours. The rate of private car ownership in Dubai has reached 541 cars per 1,000 inhabitants with an average number of passengers in each car as low as 1.3. The number of private cars is expected to increase by 1.5 million in the emirate by 2020.[5]

To cope with the ever-rising traffic volume and road congestion, the Salik (the Arabic word for open or clear) toll collection system was launched in July 2007. Using radio frequency identification (RFID) technology, Salik operates without toll booths or barriers, allowing traffic to move freely through toll points at highway speeds. Vehicle owners passing Salik gates need to purchase a Salik tag and attach it to the windshield in advance. Each time a vehicle passes under one of the six Salik gates, the toll of AED 4 (USD 1.1) is deducted from the vehicle owner's prepaid Salik account.[6][7] In October 2013, RTA announced the legality of car-pooling in the emirate to increase vehicle occupancy rates and help mitigate

A Salik toll gate, Dubai

congestion. Drivers and potential passengers can register their details on the Sharekni ("share with me" in Arabic) online system www.sharekni.ae for free, which helps them find those commuting in the same direction. On the other hand, anyone using car-pooling for picking up random strangers or for profit motives is fined.[8]

In January 2014, DoT launched a new park-and-ride service in Abu Dhabi city as part of its efforts to provide convenient, sustainable integrated transportation services. Under this scheme, shuttle bus services from the city's outskirts to different central locations are provided. In the first phase, the services are free to and from Zayed Sports City, from 6 am to 8:30 pm on weekdays, where 600 free parking lots are provided. The buses are equipped with free Wi-Fi and run every 15 minutes during peak hours and every half an hour at other times. The daily pass for this free service covers the driver and up to three passengers, who are also allowed unlimited bus trips inside Abu Dhabi Island.[9] DoT also allocated 500 parking permits in the Central Business District to encourage neighbouring offices to provide park-and-ride services for employees.[10]

1. *Emirates 24/7* (2013a), "Now you can pedal your way through Downtown Dubai", 23 February, www.emirates247.com/news/emirates/now-you-can-pedal-your-way-through-downtown-dubai-2013-02-23-1.496078.
2. Hilotin, J.B. (2013), "Last mile woes? Hire a bike", *XPRESS*, 20 February.
3. Al Wasmi, N. (2014), "New bike-sharing scheme comes to Abu Dhabi", *The National*, 28 December.
4. Libo-on, L.B. (2014), "Go around Sharjah on cycle for Dh80 as part of 'Bicycle Sharing' programme", *Khaleej Times*, 5 February.
5. RTA, *About Carpooling* webpage, www.sharekni.ae/dcp/Home.do, accessed on 20 November 2014.
6. RTA, *About Salik* webpage, www.salik.gov.ae/en/about, accessed on 20 November 2014.
7. Haine, A. (2012), "Dubai's Salik experiment makes a clear case for toll roads", *The National*, 28 June.
8. RTA, *About Carpooling* webpage
9. *Emirates 24/7* (2014b), "Park for free, ride for free, wi-fi for free: Abu Dhabi's new bus service", 18 January, www.emirates247.com/news/emirates/park-for-free-ride-for-free-wi-fi-for-free-abu-dhabi-s-new-bus-service-2014-01-18-1.535160.
10. DoT (2014), "Department of Transport in Abu Dhabi provide 'Park and Ride' service in Sector 45 West for government and private-sector staff", press release, 20 February.

Contributing to greener air transport

As the UAE has one of the fastest-growing aviation industries in the world, it recognises the urgent need to find the best way to contribute to significant cuts in the aviation industry's carbon footprint. In January 2014, Etihad Airways, Boeing, Takreer (ADNOC subsidiary), Total and the Masdar Institute of Science and Technology announced a new collaborative initiative *BIOjet Abu Dhabi: Flight Path to Sustainability* to support a sustainable aviation biofuel industry in the UAE. This will engage a broad range of stakeholders to develop a comprehensive framework for a UAE biofuel supply chain, including research and development and expanded investment in feedstock production and refining capability in the country and globally.

Etihad Boeing 777 filled with biofuel for a demonstration flight

The day before this announcement, Etihad Airways made a 45-minute demonstration flight in a Boeing 777 powered partly by UAE-produced biofuel, which was partially converted from plants by Total and refined into jet fuel by Takreer. The UAE has become among a handful of countries that have produced and flown on their own aviation biofuel, which is estimated to reduce carbon emissions by at least 50% compared to fossil fuel over its lifecycle.[1]

Emirates Airline is making efforts to improve eco-efficiency of fleets and operations as the company tracks environmental performance and publishes an environmental report annually. With an average fleet age of only 6.2 years versus the global fleet average of 11.7 years, Emirates' fuel efficiency results in the 2013-14 fiscal year were 14.5% better than the International Air Transport Association (IATA) members' average. The total fuel efficiency for all passenger and freighter flights improved by 0.5% since the last fiscal year, dropping to 0.309 litres per tonne-kilometre. Similarly, carbon emissions dropped to 0.764 kilogrammes (kg) of CO_2 per tonne-kilometre, improving efficiency by 0.4%.[2]

The Abu Dhabi International Airport achieved in November 2011 the 'Mapping Level' of the Airport Carbon Accreditation, a carbon management standard for the airport industry, making it the first "carbon-accredited airport" in the Asia-Pacific. The Abu Dhabi Airports Company (ADAC) initiated its application to the programme by mapping emission sources within the direct operational boundaries of the airport as defined by the GHG Protocol, calculating the annual carbon emissions, compiling a carbon footprint report and verifying it independently. The airport footprint forms the baseline measure to which future activities and targets will be aligned.[3]

Building on its CSR policy, safety policy and environmental management plan, Dubai Airports also began in 2013 to establish its carbon emission baseline which will set the foundation for environmental priorities and action plans to demonstrate its commitment to limiting both Dubai International and Dubai World Central Airports' carbon footprint while supporting the growth of the aviation sector and the broader UAE economy.[4]

1. Masdar Institute (2014), "New BIOJET Abu Dhabi initiative to develop comprehensive framework for UAE biofuel supply chain", press release, 19 January.
2. Emirates Group (2014), *The Emirates Group Environmental Report 2013-2014*, Dubai.
3. ADAC (2011), "Abu Dhabi International Airport first to become Airport Carbon Accredited in Asia-Pacific", press release, 30 November 2011.
4. Dubai Airports (2014), *Dubai Airports Yearbook 2013*, Dubai.

2-6. Waste Management

Due to the high level of population growth and economic activities, the quantities of wastes in the UAE have increased in an unprecedented pace in the last decade. The total amount of solid waste collected in the country has reached more than 26 million tonnes in 2012. Most of the waste ends up in municipal landfills or dump sites, where organic waste generates a large amount of methane which is a potent greenhouse gas. Little of the waste is incinerated at the moment; the rate of municipal waste recycling has been rapidly rising but still relatively low (see 3-2-3).

Waste management in the country has been mainly coordinated through local authorities. However, common strategies for tackling waste issues are reducing the waste, recycling, and converting waste to energy and resources, through education and awareness raising, investment in new technologies and infrastructure, and improved waste separation and collection systems. The Government of Abu Dhabi established the Centre of Waste Management (Tadweer) in 2008 as the lead agency responsible for coordinating and controlling the policy, strategy and contractual systems of waste management across the emirate. The emirate aims to divert 85% of its waste from dumping grounds by 2018.[1] Dubai Municipality's Waste Management Department compiled *the Dubai Integrated Waste Management Master Plan* in 2012 with an aim to reduce the amount of waste being sent to the landfills to zero in 20 years by using an integrated and innovative approach.[2]

The Emirate of Sharjah set up a municipal waste management company Bee'ah (the Arabic word for environment) in 2007 in the form of a public-private partnership. In October 2011, Sharjah announced an ambitious plan for 100% landfill diversion by 2015. To attain this goal, Bee'ah developed a state-of-the-art waste management centre to process and recycle waste. In 2012, the company introduced two-stream waste collection and a new tipping fee structure to incentivise waste reduction and to closely regulate landfill contents. Improved blue and green, odour-proof bins have been deployed across the emirate.[3][4][5]

A recycling bin on the street, Abu Dhabi

Wastewater treatment is managed by water and electricity authorities who are also responsible for the generation, transportation and distribution of water and electricity. Following the unprecedented rate of urbanisation, local governments are investing in large-scale upgrades and extensions of sewer systems. The Abu Dhabi Sewerage Services Company (ADSCC) launched an AED 5.7 billion (USD 1.6 billion) Strategic Tunnel Enhancement Programme (STEP) in 2009, which includes building 41 km of deep sewer tunnels, which is expected to be completed by the end of 2015. Sharjah Municipality opened a new underground sewage treatment plant in April 2012 to cater for residential areas.[6]

1. EcoWASTE 2014 (2014), "Sweden and Qatar show potential of waste-to-energy technology in the Gulf", press release, 14 January.
2. *Gulf News* (2012), "Dubai plans integrated waste management", 26 January.
3. Bee'ah (n.d.), *2015 Zero Waste to Landfill*, corporate brochure.
4. Todorova, V. (2013b), "UAE working hard to reduce waste", *The National*, 5 July.
5. Landais, E. and D.K. Yousef (2011), "Sharjah vows to eliminate garbage by 2015", *Gulf News*, 18 October.
6. Elite Media and NMC (2013)

No more non-biodegradable plastic bags

Among various waste types, the public concern over the use of non-biodegradable plastic bags became prominent, as the deaths of camels and sea turtles in the UAE after consuming plastic bags were highlighted by the media. According to EAD, around half of camel deaths in the UAE were considered attributable to plastic bags they had eaten assuming them to be food.[1] The MoEW's survey found that 11.6 billion plastic bags were used annually in the country, of which 53.3% were non-biodegradable, and plastic bags and other plastic material consisted of 10.9% of the total household waste.

As a response, MoEW launched the UAE Free of Plastic Bags initiative in October 2009. This campaign aimed to cut down the quantity of non-biodegradable bags in a gradual step towards the final prohibition and replacement with biodegradable plastic and other long-lasting, reusable bags. The initiative was rolled out in four phases, including awareness raising and alternatives finding, and the ministry finally issued a decree banning the use of non-biodegradable plastic bags by the end of 2012. Manufacturers and suppliers of plastic bags now have to register their biodegradable products in accordance with the Emirates Conformity Assessment System (ECAS). The requirements and conditions listed in the UAE standard specifications (5009:2009) have to be met by the manufacturers.[2 3 4]

Not to waste wastewater

Although the water produced after wastewater is treated is not fit for drinking, it is well suited to irrigation or use in district cooling systems and other industrial processes, where non-potable water can be utilised. Since recovering usable non-potable water from municipal wastewater cost only a fraction of the costs for desalination, wastewater treatment operations can be considered as an added source of water supply. Lowering desalinated water demand would also reduce energy consumption and the associated carbon emissions from the desalination process.[5]

The UAE aggressively started using wastewater for irrigation and the proportion of treated wastewater in total water use has reached 14% in 2013 (see 3-2-3). In the Emirate of Abu Dhabi, 60% of the 284 million m^3 of sewage generated each year is currently treated and reused. The remaining 40% is being discharged into the sea, affecting the environment and wasting the precious resource. In a new environmental plan from EAD announced in January 2014, Abu Dhabi aims to treat and reuse all of its wastewater to irrigate farms and parks by 2018. The main challenge is to efficiently link the supply and demand for treated

A sewer tunnel under construction in Abu Dhabi

1. Kader, B.A. (2012), "Plea to save camel habitat", *Gulf News*, 8 January.
2. MoEW, *UAE Free of Plastic Bags 2010-2013* webpage, www.moew.gov.ae/en/about-ministry/activities/campaigns/uae-free-of-plastic-bags-campaign.aspx, accessed on 22 November 2014.
3. *Khaleej Times* (2011), "UAE to meet plastic bag-free deadline", 9 January.
4. WAM (2012), "3rd phase of make UAE plastic bags free drive", *Khaleej Times*, 12 February.
5. Tuxford, K. (2013), "Can wastewater help the UAE meet growing water demands?", *Cities Today*, 16 October, http://cities-today.com/2013/10/can-wastewater-help-the-uae-meet-growing-water-demands.

wastewater as it cannot be stored under the prevailing climate.[1] A technical committee comprised of the utilities and regulators proposed an investigation into where new infrastructure is required and the cost and benefit associated with such infrastructure.[2]

Turning waste into future energy sources

In the last few years, waste-to-energy is becoming an attractive option to the UAE as one of the best ways to manage the increasing amount of waste and a few projects are already ongoing. Al Qusais landfill site is one of the largest municipal waste collection sites in Dubai, receiving about 5,000 tonnes daily in the 3.5-km^2 site. A project for extracting landfill gas was commissioned by Dubai Municipality in January 2012 and officially launched in July 2013. It was designed, constructed and implemented by an eco-venture Green Energy Solutions & Sustainability, with horizontal and vertical gas wells being drilled some 22 metres deep into the waste to extract gas.

The network of 22-km underground pipes and twelve collection chambers collects a total of 6,000 m^3 of gas per hour, most of which is currently burned in a flare. Even though this results in the release of CO_2, the project has an overall environmental benefit since it prevents the release of methane (CH_4), which is 25 times more potent to cause global warming than CO_2. Therefore this has been registered as the UAE's first project under the Clean Development Mechanism (CDM) of the United Nations Framework Convention on Climate Change (UNFCCC), as reducing the emission by approximately 250,000 tCO_2e annually. To date, some of the landfill gas recovered has also been used to generate 1 MW of electricity that can cover the landfill operation's energy needs. The amount of gas recovered by this project would be enough to power a 12-MW engine. Dubai Municipality has pledged to generate 20 MW of power from landfill gas by 2020.[3] [4] Meanwhile, Emirates Gas is also setting up an advanced facility to compress methane from sewage and landfill sites in Dubai to be used as an alternative fuel for vehicles.[5]

A biogas project at Al Qusais landfill site, Dubai

Neutral Fuels, a Dubai-based venture, struck a deal in 2011 with McDonald's, the world's largest fast-food chain, to convert the cooking oil used in all 80 of its UAE outlets into biodiesel at a factory located in the outskirts of the city. The waste oil collected from McDonald's kitchens is heated and chemicals are added, which turn into a fuel that can power specially adapted lorries. Under the agreement, McDonald's collect 22,000 litres of cooking oil a month in the UAE, and the biofuel now powers all of its UAE fleet without extra cost.[6] Neutral Fuels had their eye on the McDonald's waste oil since it does not contain too much animal fat, water or particles and its quality and quantity are highly predictable. This initiative represents the GCC's first step into a biofuels market that is expected to account for 27% of transport fuel worldwide by 2050. The factory's annual capacity starts at 1 million litres and could increase if the company finds other suitable waste oil suppliers.[7]

1. Leijen, van M. (2012), "UAE's water problem: why waste, waste water?", *Emirates 24/7*, 25 August, www.emirates247.com/news/emirates/uae-s-water-problem-why-waste-waste-water-2012-08-25-1.472595.
2. Todorova, V. (2014a), "Plans to reuse 100% of Abu Dhabi's waste water in four years", *The National*, 15 January.
3. WAM (2013), "Dubai Municipality launches region's first landfill gas recovery system at Al Qusais", *UAE Interact*, 15 January, www.uaeinteract.com/docs/Dubai_Municipality_launches_regions_first_landfill_gas_recovery_system_at_Al_Qusais/52882.htm.
4. MOENR (2014)
5. Al Bawaba Business (2013), "ENOC signs MoU with Dubai Municipality to produce CNG from waste for use as automotive fuel", press release, 12 February, www.albawaba.com/business/pr/enoc-dubai-municipality-470122.
6. Bitar, Z. (2011a), "Big Mac cooking oil will be converted into biofuel", *Gulf News*, 3 July.
7. Yee, A. (2011), "McDonald's frying oil to fuel lorries in Emirates", *The National*, 4 July.

Neutral Fuels' system for producing biodiesel from used cooking oil

TAQA and Tadweer plan to build one of the world's largest waste-to-energy facilities at the Industrial City Abu Dhabi (ICAD) at an estimated cost of AED 3.1 billion (USD 840 million). The plant will receive approximately one million tonnes of municipal solid waste a year and convert it into 100 MW of alternative power, enough to power more than 20,000 households. It is expected to begin operations in 2016-17. As a pilot to this major project, they are developing a waste-to-energy demonstration facility on Delma Island, 32 km offshore the Western Region of Abu Dhabi, where waste is currently shipped to landfills in the mainland. Bee'ah in Sharjah also plans to build a similar facility near the emirate's main landfill site.[1] [2]

Automating waste collection

Waste collection is a both labour and energy-intensive process, involving hundreds of trucks and workers busily loading waste along pick-up routes. Aldar Properties, Abu Dhabi's leading property developer, has recently introduced an automated vacuum waste management system on Yas Island, the city's major leisure and entertainment destination. The system consists of 5.3 km of pipes that can suck 40 tonnes of waste every day from Yas Marina Circuit, which hosts Formula One Grand Prix races, Ferrari World, seven hotels and Yas Marina. Domestic waste can be deposited by hand at one of the 43 inlet points, which provide separate chutes for recyclable and non-recyclable materials. The vacuum created by motors whisks away waste to the central collection station through underground pipes at the speed of up to 75 km per hour. The collected waste is then compressed and transported to an off-site waste facility where it is further sorted for recycling or disposed of in the landfill. Even though this final part requires trucks, this new system saves up to 90% of truck journey times, greatly reduces emissions and provides a hygienic environment.[3]

Extending product life through online trading

Since the majority of the UAE population are expatriates who live in the UAE for a short period of time, the country is an ideal place to buy and sell second-hand goods instead of opting for new items every time they need to acquire. *Dubizzle.com* is the leading free classifieds website launched by an entrepreneurial duo Sim Whatley and JC Butler in 2005 from a shared bedsit with little investment. It has been promoting the concept of "disrupting consumer exploitation" which means a service that allows a more sustainable way of living through trading second-hand goods. On this website, registered sellers can post the list of unwanted items – from cars and furniture to toys and books – with photos, specifications and asking prices. Potential buyers visiting the website can directly contact the sellers and some items could be sold within minutes.

Within eight years of the launch, the website has seen extraordinary growth with 3.5 million unique visitors every month, and is now the largest local site, after Google and Facebook. It has become firmly ingrained in the UAE's day-to-day life. The company is expanding into the region and the website is now also available in Algeria, Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia and Tunisia, employing over 150 people in total.[4] [5]

1. Todorova, V. (2014b), "UAE turns to waste burning to generate greener energy", *The National*, 21 January.
2. Todorova, V. (2013a), "Delma Island houses could soon be powered by burning refuse", *The National*, 2 April.
3. *CLEAN Middle East* (n.d.), "Aldar begins operation of vacuum waste management system at Yas Island", Issue No. 5, Vol. 3., www.cleanmiddleeast.ae/articles/312/aldar-begins-operation-of-vacuum-waste-management-system-at-yas-island.html.
4. Judge, B. (2013), "dubizzle appoints CEO to support successful expansion of the region's leading online classifieds portal", *Dubizzle* blog, 25 August, http://blog.dubizzle.com/2013/08/25/dubizzle-appoints-ceo.
5. TimeOut Dubai, *Sell your stuff in Dubai* webpage, www.timeoutdubai.com/community/features/54451-sell-your-stuff-in-dubai, accessed on 23 November 2014.

2-7. Land use & Agriculture

Agriculture, including livestock, fishery and forestry, has been a minor part of the UAE economy and its contribution has declined to less than 0.1% of the total GDP by 2013. Nevertheless, the availability of capital and the demand for local fresh produce have encouraged agricultural development in the last few decades. Both federal and local governments provide incentives to farmers including a substantial subsidy on fertilisers, seeds and pesticides, as well as loans for machinery and technical assistance. Most of the country's cultivated land is taken up by date palms, which are traditionally cultivated in the arc of small oases, while the production of vegetable and fruit crops such as tomatoes, cabbage, eggplant, squash, cauliflower, cucumber, citrus, melons and mangos is rapidly increasing. Poultry farms and dairies have been developed in recent years to fulfil a substantial portion of domestic demand.[1]

Lack of arable land, intense heat, periodic locust swarms and limited water supplies are the main obstacles to agriculture. The renewable water resources in the UAE are among the lowest in the world (see 3-2-1). The increase in cultivated land has resulted in the rapid depletion of underground aquifers, precipitous drops in water tables and serious increases in soil and water salinity in some areas. Against this backdrop, MoEW launched *the UAE Water Conservation Strategy* in 2010, which introduces an integrated approach to meeting future water demand through both investments in new water infrastructure and efficiency improvements to the existing water supplies. The ministry has focused on both water-efficient farming practices and sustainable development of water resources, including the development of dams and the appropriate maintenance of springs and streams.[2]

Fisheries in the UAE are artisanal in nature while they still retain a significant heritage value and are an important part of social fabric of coastal villages. The government has supported traditional finishing by offering a substantial subsidy on fishing boats and equipment and opening marine workshops that offer free repair and maintenance. Fishermen's cooperatives in each emirate assist in marketing the catch. Demersal stocks and commercial catch rates have fallen sharply over the past decades. MoEW has introduced restrictions to control

A farm in Fujairah

fishing activities and to regulate the size of capture. There are also initiatives to develop a series of artificial reefs to increase fish abundance, while investment in aquaculture has taken off to supplement supply (see 3-2-1; 3-2-3; 3-2-5).[3] [4]

Planted forests have provided a number of benefits to the desert country: providing greenery and amenities; combating desertification; protecting cities from sandstorms; providing natural sanctuaries for breeding animals; and protecting farmland and rangeland. Substantial investments in developing forestry in agricultural and rangeland areas and green spaces in urban areas have been made in the last few decades. Most forest plantations are established in fenced-off areas, while drip irrigation from groundwater, treated sewage effluent or desalinated water is used over the entire life of trees. It is estimated that each tree receives between 18-30 litres (l) of water per day, leading to an annual consumption of 2,135 m^3 per hectare (ha).[5]

The UAE has earned the status of being one of the regional leaders in terms of

1. MoEW (2015)
2. MoEW (2010), *United Arab Emirates Water Conservation Strategy*, MoEW, Dubai.
3. Elite Media and NMC (2013)
4. FAO, *Fishery Country Profile – United Arab Emirates* webpage, www.fao.org/countryprofiles/index/en/?iso3=ARE, accessed on 26 November 2014.
5. FAO (2008), *The Status and Trends of Forests and Forestry in West Asia: Subregional report of the Forestry Outlook Study for West and Central Asia*, Forestry Policy and Institutions Working Paper 20, FAO, Rome.

the conservation of its environment and wildlife as well as associated scientific research. The protection of the terrestrial and marine environment is guaranteed by federal legislation and often supplemented by emirate-level decrees.[1] To implement the UN Convention on Biological Diversity (CBD), *the UAE National Biodiversity Strategy and Action Plan* was developed in 2014. It aims to ensure fragile ecosystems conservation with a special attention to endangered species, and to prevent the introduction of alien species. MoEW issued a resolution in 2014 which limits the use of some fishing tools and forbids the targeting of shark species protected under the UN Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES). The country is also committed to the goals of the UN Convention to Combat Desertification (UNCCD) and aims to continue improving the protection of fragile habitats and underground water reservoirs, and to manage desert lands using integrated sustainable land management practices. *The UAE National Strategy to Combat Desertification* has been updated in 2014 in harmony with the UNCCD 10-year strategic plan (see 3-2-5).[2]

A hydroponics farm in Al Bahia near Abu Dhabi

Modern technologies in the traditional sector

Most UAE farmers rely on groundwater to irrigate their crops but the amount and quality of the country's groundwater reserves has been steadily declining after years of exploitation. MoEW has therefore given priority to increasing use of hydroponic technology, which relies on nutrient-rich water to grow plants with use of little or no soil. This technique not only helps to avoid soil-borne pests, insects or diseases but also to eliminate the need for potentially harmful chemical pesticides and herbicides. However, the most convincing reason for embracing hydroponics in the UAE is water efficiency as it allows reuse and recycling of water. The ministry estimates that hydroponic farming is up to 70% more water efficient than traditional methods, while allowing for a longer growing season. To date, there are 87 commercial farms using this technology. As lack of knowledge and experience is identified as a significant barrier to spreading this modern farming method, the ministry has started a series of lectures and field sessions around the country to educate farmers and their workers on correct use of such systems, in addition to providing financial support.[3] [4]

Organic farming fulfilling health and social needs

In the last few years, demand for organic food has rapidly risen among health-conscious consumers in the UAE. The country's organic market is valued at AED 367-550 million (USD 100-150 million) per year. However, the number of domestic organic farms is limited and most organic (as well as non-organic) foodstuff inevitably comes from abroad. Winning the trust of consumers for claims made by producers is key to the successful dissemination of organic products, thereby encouraging local farmers to convert their practices. ESMA hence introduced an organic food certification scheme in February 2012 that is applied both domestic and imported foodstuff. The certification comes with a logo by which consumers can easily distinguish organic products from conventional ones. About half of the existing organic farms have already been certified and others are under process.[5]

1. Elite Media and NMC (2013)
2. MoEW (2015)
3. Todorova, V. (2014c), "Boost for hydroponic farming in the UAE", *The National*, 26 February.
4. Rowlins, Z. (2014), "The wonder of water", *The National Weekend*, 24 October.
5. Masudi, F. (2012), "UAE moves to certify organic food", *Gulf News*, 21 November.

Among the UAE's pioneering organic farms, one of the most distinguished is the 35-ha farm in Bani Yas, on the outskirts of Abu Dhabi city. There, around 75 men and women with autism and Downs Syndrome are making a living by growing organic vegetables under an initiative by the Zayed Higher Organisation for Humanitarian Care and Special Needs (ZHO). They grow, pick and pack five tonnes of vegetables (including cucumbers, cherry tomatoes and eggplants) every week and earn AED 2,500 (USD 680) per month. The farm also produces cheese from goats. In April 2013, Lulu Hypermarket signed a memorandum of understanding with ZHO under which Lulu would buy their agricultural produce. A similar deal has also been struck with Carrefour and the Abu Dhabi Cooperative Society.[1]

Promoting local produce

Farms across Abu Dhabi grow some 42 varieties of vegetables and fruits, with cucumbers and potatoes accounting for the bulk of the produce. About 14,000 farmers work with the Abu Dhabi Farmers Service Centre (ADFSC) across the emirate and around 1,000 of them supply their produce to the centre. The ADFSC brands the locally sourced produce as 'Local Harvest' and markets it through 15 ADFSC Souq outlets, besides prominent retail chains. ADFSC is also rolling out "farmers' markets" around Abu Dhabi city where shoppers can purchase fresh produce directly from local farmers. Farmers could be seen selling fresh vegetables, dates, eggs, honey and live birds directly to customers at those markets.[2]

In Dubai, a private business Ripe Farm Shop opened in 2011 where a mixture of seasonal vegetables are sold in boxes. Rapid expansion and popular demand has meant that the company now runs a weekly food and craft market in Dubai and Sharjah, as well as offering an online ordering and home delivery service.[3] In November 2014, a weekly market also opened on Saadiyat Island in Abu Dhabi, and has drawn an enthusiastic response from residents.[4]

An ADFSC shop selling local produce

Eating fish with peace of mind

To encourage sustainable seafood choices among consumers in the UAE, EWS-WWF launched the Choose Wisely awareness campaign in 2009. As part of this campaign, the conservation group introduced a fish labelling scheme carrying red, orange or green tags depending on whether they are over-fished, rare or sustainably available in the country. The classification is based on scientific assessments carried out by fisheries experts at EAD. The heavily over-fished species where customers are urged to think twice before buying include the country's most popular fish such as hammour and shaari. Several supermarket chains such as Lulu Hypermarket, Choithrams and Spar participate in this scheme, while some local restaurants have started indicating the sustainability of fish on their menu.[5]

As an alternative to the rapidly depleting local fish stock, the application of aquaculture has been gaining momentum in the last few years. The world's

1. Kumar, A. (2013), "People with special needs grow organic vegetables in 35-hectare farm", *XPRESS*, 1 May.
2. Kader, B.A. (2013), "Taste of local harvest catches on in Abu Dhabi", *Gulf News*, 12 February.
3. Shardlow, E. (2012), "Ripe Farm Shop organic store is fresh out of the box", *The National*, 23 May.
4. Sankar, A. (2014b), "New organic market on Saadiyat is a big hit", *XPRESS*, 26 November.
5. Dhal, S. (2010), "Supermarket chain in UAE adopts green fish drive", *XPRESS*, 23 September.

largest aquaculture farm (56,000 m^2) was opened by Emirates AquaTech Caviar Farm in November 2013, utilising leading fish breeding technologies that allow for an economically viable, eco-friendly fish farming. Based in an industrial part of Abu Dhabi, the farm produces premium caviar and sturgeon meat. With a maximum capacity to produce 35 tonnes of caviar and 700 tonnes of sturgeon meat per year, it could meet 10% of the world's Caspian caviar demand eventually. By supplying premium caviar all year round, the company aims to play an important role in supporting the protection of the globally endangered wild sturgeon species.[1] [2] EAD is currently formulating an aquaculture development plan in collaboration with stakeholders. Hammour, cobia, qabit (gold-lined sea bream), yellowfin tuna and abalone, which are in high demand in the UAE market but whose stocks are seriously declining due to over-fishing, have been identified as priority species to promote farming in the Emirate of Abu Dhabi.[3]

Sustainability of fish is labelled at supermarkets.

Reviving a tradition in a sustainable way

The Arabian Gulf has a rich and long tradition in natural pearls but the invention and introduction of cultured pearls by the Japanese in the 1920s killed off the trade that had been the lifeblood of the UAE for millennia. The RAK Pearls project aims to revive the pearling industry in the UAE by creating a unique attraction in the Emirate of Ras Al Khaimah. Established in 2005 as an Emirati-Japanese partnership, the project includes a tourist site dedicated to pearling, with a museum that combines education, experience and entertainment. It not only promotes tourism in the emirate but reinstates the pearling culture to the region which was once known for the most valued pearls in the world.[4]

The RAK Pearls farm is located in a mangrove ecosystem and is culturing pearls using local Pinctada Radiata oysters. The establishing of a pearl farm in a sensitive ecosystem has put this zone under protection from rapid industrial development.[5] The farm operates with almost 30 lines of beds and 200,000 shellfish. Some 40,000 implanted oysters are harvested each year with an 80% success rate. Only 5-10% of the pearls are of the highest quality with rare lustre and colouring, which have been sold to exclusive clients, jewellers and royalty. In June 2013, some 5,000 pearls were sold at auction at the Dubai Pearl Exchange, the first trade of UAE pearls after several decades.[6]

Finding a pearl grown in an oyster

1. Emirate AquaTech Cavier Farm (2013), "Emirates AquaTech The world's most technologically advanced aqua-farm launched in Abu Dhabi", press release, 26 November.
2. Al Bustani, H. (2014), "Abu Dhabi's resurgence of sturgeon", *The National*, 2 January.
3. Kader, B.A. (2014), "Aquaculture farms to revive plunging fish stocks", *Gulf News*, 1 August.
4. RAK Pearls, *Our History* webpage, http://rakpearls.com/web/our-history, accessed on 27 November 2014.
5. Sustainable Pearls Project, *UAE: Mangrove Protection* webpage, www.sustainablepearls.org/sustainability/sustainability-case-studies/uae, accessed on 27 November 2014.
6. Doran, J. (2013), "UAE pearl industry to rise from the depths after lost decades", *The National*, 6 June.

2-8. Financial Services

The UAE's financial sector largely escaped the battering felt by international banks in 2012 in the wake of the euro-zone crisis. There have been increases in bank assets and loans, prompt repayment of bonds and loans, and progress in key restructurings. The sector's contribution to non-oil GDP has risen steadily from 6.8% in 2001 to 10.2% in 2013.[1]

Dubai International Financial Centre

The UAE Central Bank's *Financial Stability Report* in 2012 assessed that banks operating in the UAE were well equipped to deal with major stress scenarios and contingencies. At the end of June 2013, the Central Bank recorded UAE bank assets of AED 1,878 billion (USD 512 billion), ensuring that the UAE maintains its position as having the largest bank asset base in the Middle East. Combined deposits with the country's 23 national and 28 foreign banks rose to AED 1,256 billion (USD 342 billion) at the end of June 2013. In order to mitigate the concentration of risk due to the high share of government-related entities in the economy, the Central Bank requires banks to hold capital in excess of the Basel Committee recommendation. The biggest challenge in the UAE banking system is non-performing loans amounting to AED 72.9 billion (USD 19.9 billion) in the first half of 2013. In 2012, the net earnings of the 17 national banks listed on the UAE stock exchange increased by around 11.4%. National Bank of Abu Dhabi (NBAD) recorded the highest profits of AED 4.3 billion (USD 1.2 billion), followed by First Gulf Bank (FGB), Abu Dhabi Commercial Bank (ADCB) and Emirates NBD. *The Financial Stability Report* evaluates that the UAE banking system would continue to show a high level of resilience.[2]

The UAE has three separate stock exchanges: the Abu Dhabi Securities Exchange (ADX), the Dubai Financial Market (DFM), and NASDAQ Dubai operating in the free zone of the Dubai International Financial Centre (DIFC). NASDAQ Dubai and the Emirates Securities and Commodities Authority (ESCA), which regulates ADX and DFM, took steps in 2012 to encourage the listing of SMEs. In ADX, the real estate sector was responsible for the largest contribution to total trading value in 2012, contributing 39.6%, followed by banks and telecommunications with 24.9% and 17.4% respectively. Also, the real estate and construction sector ranked highest in terms of traded value, accounting for 47.7% of the DFM's traded value in 2012. This was followed by the banking sector, which accounted for 18.2% of traded value.[3]

Leveraging the substantial amount of wealth from oil and gas revenues, the UAE's sovereign wealth funds (SWFs) have played a significant role in the global investment market. These state-owned investment funds help the government reduce the volatility of its revenues reliant on oil and gas, advance the emerging technologies and industries that support the future non-oil economy and build up savings for future generations. Among the world's largest SWFs are the Abu Dhabi Investment Authority (ADIA), the Abu Dhabi Investment Council (ADIC), the Investment Corporation of Dubai (ICB), the International Petroleum Investment Company (IPIC) and Mubadala Development Company.[4]

Abu Dhabi's renewable energy and sustainable technology company Masdar is one of the business units under Mubadala (the Arabic word for exchange)

1. Based on data from NBS
2. UAE Interact, *Financial Services* webpage, www.uaeinteract.com/business/financial.asp, accessed on 18 September 2014.
3. Elite Media and NMC (2013)
4. Kane, F. (2014), "Adia among leaders in record year for sovereign wealth funds", *The National*, 29 March.

that was established in 2002 as a principal agent in the diversification of the emirate's economy. Whereas the market for investment products taking into account environmental, social and governance (ESG) aspects of companies or projects is still in its infancy in the UAE, the public interest in impact investment such as green bonds or "green sukuks" is rapidly emerging as a viable option for financing cleantech and renewable energy businesses and projects.[1]

Investing in future energy globally

Established in 2006 as one arm of Masdar initiative, Masdar Capital seeks to build a portfolio of the world's most promising renewable energy and clean technology companies. It targets investments that have the greatest potential globally and helps its portfolio companies scale up by providing capital and management expertise. Investment in these markets is made via two funds: the Masdar Clean Technology Fund (MCTF) launched in 2006, and the DB Masdar Clean Tech Fund (DBMCTF) launched in 2009. MCTF, a fully deployed USD 250 million fund, invested USD 45 million in three cleantech funds and the remaining USD 205 million in 12 direct investments in companies as lead or co-lead investor. Both funds follow an active management investment strategy and seek to realise strong risk-adjusted returns. Through these funds, Masdar Capital also seeks to demonstrate, commercialise and promote renewable energy technologies in the UAE, and to identify synergies between its investments and other Masdar activities, as well as the country's long-term energy and development programme.[2]

The world's largest operational offshore wind farm, London Array was opened by the UK Prime Minister David Cameron in July 2013. Its 175 turbines are capable of generating enough energy to power nearly half a million UK homes and reduce CO_2 emissions by more than 900,000 tonnes a year. London Array Limited is a consortium of three world-leading renewable energy companies: E.On, Dong Energy and Masdar. Masdar's AED 11 billion (USD 3 billion) investment in this project furthered the company's ambition to be a global player in the most advanced renewable energy technologies.[3] As a joint venture with Sener, Masdar also has three CSP plants already built or under construction in Spain: 20-MW Gemasolar plant and Valle 1 and Valle 2 plants with a capacity of 50 MW each.[4]

In November 2013, the Jordan Wind Project Company, in which Masdar Clean Energy owns a 31% stake, announced a financing agreement to begin construction of a 38-turbine, 117-MW wind farm in Tafila, southern Jordan. This will be the first major Middle East wind farm Masdar has invested outside of the UAE.[5] In September 2014, Masdar invested AED 3.16 billion (USD 860 million) for a 35% stake in the Dudgeon offshore wind project off the UK's Norfolk coast, in partnership with Statoil and Statkraft, Norwegian state-owned energy firms. The project, which is planned to complete in late 2017, is set to have a capacity of 402 MW, enough to power about 410,000 UK homes.[6] Furthermore, Masdar has signed a deal in October 2014 with Oman's Rural Areas Electricity Company to build a 25-turbine, 50-MW wind farm for USD 125 million. This deal represents the first large-scale wind project in the GCC.[7]

London Array, the world's largest offshore wind farm invested by Masdar

1. Cowman, A. (2014), "The search for new financing options in the clean energy business", in UNDP and DCCE (2014), pp.193-4.
2. Mubadala, *Masdar Capital* webpage, https://www.mubadala.com/en/who-we-are/organization-structure/masdar/masdar-capital, accessed on 9 September 2014.
3. London Array website, www.londonarray.com, accessed on 6 November 2014.
4. Masdar, *Torresol Energy* webpage, http://masdar.ae/en/investment/detail/torresol-energy, accessed on 6 November 2014.
5. Everington, J. (2013b), "Masdar invests in Jordan's first major wind farm", *The National*, 28 November.
6. Bouyamourn, A. (2014), "Masdar buys UK wind farm stake", *The National*, 25 September.
7. McAuley, A. (2014), "Masdar signs landmark Oman wind farm deal worth $125 million", *The National*, 22 October.

As a first step in the evolution of its global strategy for alternative energy sources, TAQA agreed in January 2013 to buy a 50% interest in the 205.5-MW Lakefield wind project in Jackson County, Minnesota, United States from a subsidiary of Electricité de France (EDF). The project consists of 137 General Electric 1.5-MW wind turbines with a capacity to generate 205.5 MW of clean electricity for more than 68,000 homes.[1] The company is also developing the Energy Innovation Park, an incubator for innovative developments in energy technology, in Alkmaar, the Netherlands. This new industrial park, which includes TAQA's Gas Storage Bergermeer, Europe's largest, open-access gas storage in an underground reservoir that will be operational in 2015, contributes to the development of new energy initiatives and promotes the North Holland region as an important, national energy cluster.[2]

Empowering efficiency by innovative financing

Upfront cost of investment in new equipment has been a huge barrier for the owners of buildings and facilities to implement energy efficiency measures, even though the return for investment is substantial in the long run. Energy performance contracting (EPC) provides an innovative financing solution to this dilemma as an energy service company (ESCO) initially arranges the financing of energy-efficient equipment, with a guarantee on the level of energy saving. The owners can repay the cost of the equipment from the captured revenue streams received over the tenure of the project. As a key element of the Dubai's programme for demand-side management (see 2-2), DEWA established in July 2013 a "Super ESCO" under the name of Etihad Energy Services Company (Etihad ESCO) to jump-start the creation of a viable EPC market for local ESCOs, with a target of retrofitting more than 30,000 existing buildings.[3]

Etihad ESCO is responsible for creating the right environment for local ESCOs to ensure the market is thriving with a minimum number of hurdles and building the confidence in the EPC model. Alongside the capacity building of local ESCOs, it organises workshops with leading financial institutions to engage them in financing EPC projects. It has also introduced an official accreditation

Gemasolar CSP plant invested by Masdar

by Dubai's Regulatory and Supervisory Bureau (RSB) under which four ESCOs have already certified. Etihad ESCO also provides building owners with a number of assessment and auditing services, prior to initiating a competitive selection process for third-party ESCOs, as well as measurement and verification (M&V). During 2014, the company released the first two EPC tenders to existing ESCOs and signed an agreement with DEWA to retrofit their existing buildings. It also made agreements with JAFZA and DIFC to retrofit their existing buildings for improving energy efficiency.[4] [5] [6]

1. TAQA (2013), "TAQA expands in North America with wind power investment", press release, 9 January.
2. TAQA, *Energy Innovation Park* webpage, www.taqaglobal.com/our-regions/netherlands/energy-innovations?sc_lang=en, accessed on 28 November 2014.
3. Le Gentil, S. (2014b), "Etihad Energy Services (Etihad ESCO): A year in motion", in WGES (2014), pp.187-8.
4. Le Gentil, S. (2014a), "Turning one", in MOENR (2014), p.138.
5. WAM (2014a), "Etihad ESCO, EZW complete first phase of energy efficiency programme in Jafza", *Gulf News*, 14 May.
6. DIFC (2014), "Etihad Energy Services (Etihad ESCO) and DIFC launch energy efficiency program", press release, 25 June.

2-9. Tourism & Hospitality

The tourism and hospitality sector has been of critical importance to the UAE's ambitious economic development plans over the past two decades. While the country's tourism industry began in the late 1980s in Sharjah, the inauguration of Burj Al Arab in 1999 sparked a subsequent flood of hotels, resorts, shopping malls and entertainment facilities in Dubai, making the country one of the fastest-growing travel destination in the world. Abu Dhabi is also making major strides to establishing tourism as part of the economic diversification outlined in *the Abu Dhabi Vision 2030*, including the development of high-profile museums such as Louvre and Guggenheim. Now each of the seven emirates has orchestrated its own unique action plans, usually by establishing a tourism authority or launching an economic vision roadmap. Tourism has benefited from and helped spawn a number of high-growth areas of the UAE economy, most notably, hotels, airlines and airports, and retail. In addition to standard leisure tourism, the UAE also attracts visitors around business conferences, special events, cruises and, increasingly, eco-tourism (**Figure 2.2**).[1]

According to a report by the World Travel and Tourism Council (WTTC),[2] the UAE was ranked 31st in 2012, and 1st in the Arab world, ahead of Egypt, in terms of receipts from hotels and air travel, which were valued at USD 10 billion. The estimated total value added generated by the country's travel and tourism sector, either directly or indirectly, reached about AED 193.6 billion (USD 52.8 billion) in 2012, accounting for approximately 14.3% of total GDP. In terms of its direct contribution to GDP, travel and tourism is slightly smaller than the financial services sector. In 2012, the total contribution of the sector to employment was estimated at 383,500 jobs, representing 11.3% of total employment. The sector is also estimated to have attracted capital investment of about AED 82.8 billion (USD 22.6 billion) in 2012.

WTTC forecasted that international tourist arrivals to the UAE would reach a total of 26 million by 2023, up from around 16 million in 2012. Over the next 10 years, the share of the travel and tourism sector's economic contribution is expected to reach about 16.4% of the total GDP, with an average annual growth rate of 5%, and the total value added would reach AED 325.4 billion (USD 88.7 billion). The sector is expected to create 245,000 jobs directly by 2023 and the capital investment in the sector will grow annually on average by 4.5% to reach AED 143.4 billion (USD 39.1 billion) in 2023.[3] The subsequent success of the bid to host Dubai Expo 2020 is expected to provide a further boost in investments by the private and public sector. The UAE is also ranked 28th out of 139 countries, and the top in the Middle East, in *the Travel & Tourism Competitiveness Report 2013* of the World Economic Forum (WEF).[4]

Tourists gathering to watch a Dubai Fountain show

1. Elite Media and NMC (2013)
2. WTTC and Oxford Economics (2013), *Benchmarking Travel & Tourism in United Arab Emirates: How does Travel & Tourism compare to other sectors?*, WTTC, London.
3. *Khaleej Times* (2014), "Stronger UAE travel and tourism sector seen", 6 May.
4. Blanke, J. and T. Chiesa (eds) (2013), *The Travel & Tourism Competitiveness Report 2013: Reducing barriers to economic growth and job creation*, WEF, Geneva.

Responding to the increasing demand resulting from Expo 2020, which expects 25 million visitors, the number of hotel rooms is expected to reach 160,000 in Dubai alone by 2020, nearly double the current capacity.[1] This implies that the government will have to anticipate this sector's potentially negative impact on

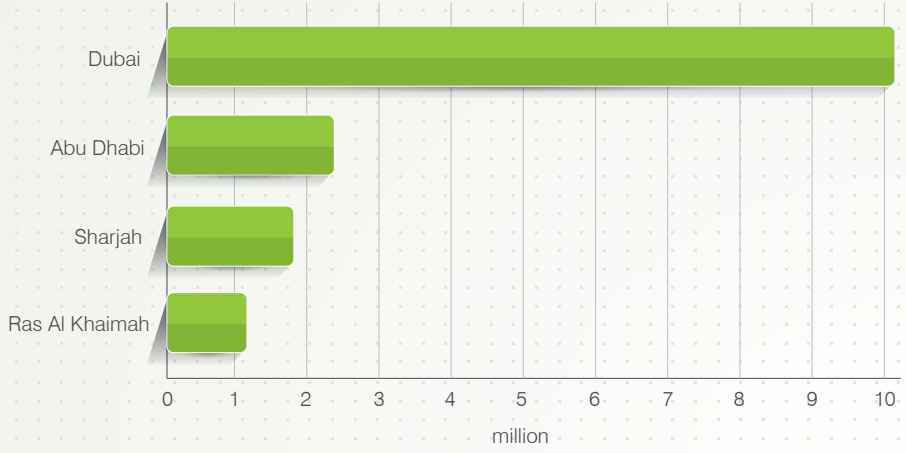


Figure 2.2: Number of tourist arrivals in the top 4 emirates of the UAE, 2012

Source: UAE Yearbook 2013

the environment.[2] Sustainable tourism development has already been integral to the UAE's commitment to building a sustainable future. The Abu Dhabi Tourism and Culture Authority (TCA) introduced *the Sustainable Tourism Framework*, which consists of four pillars of sustainability: economic sustainability; social responsibility; environmental sustainability; and organisational excellence. TCA also launched the world's first environment, health and safety management system (EHSMS) for the emirate's entire tourism sector in 2010.[3] The Dubai Department of Tourism and Commerce Marketing (DTCM) launched the Dubai Green Tourism Award programme in 2009 to encourage sustainable innovation in the tourism sector. This Award encourages efforts to reduce the carbon footprint of the sector's sprawling developments as well as activities that encourage celebration of the UAE's natural assets.[4]

Providing tourists with greener hotel choices

Tourists visiting the UAE from around the world now have high expectations of green measures in the hospitality sector. UAE hotels increasingly need to respond to such a demand if they want to stand against the increasing competition. The prominence of various green or sustainability certifications in this sector confirms this trend. Among them, DTCM is working with the Emirates Green Building Council (EGBC) to operate the Green Key labelling scheme. Firstly developed in 1994 in Denmark, Green Key has been recognised by the UN World Tourism Organisation (UNWTO) and UNEP and has grown into the world's largest eco-label for accommodation, with more than 2,100 hotels certified in 45 countries. It covers various sets of criteria including energy, water, waste, food and beverage, as well as the education of staff and guests. Becoming the national operator for the label since 2013, EGBC provides a platform to share best practices and is developing a set of training modules that cover key areas of greening action. As of June 2014, 24 UAE hotels have been awarded with this certification while more are currently engaged in the review and auditing process.[5]

Green Key

TCA and UPC in Abu Dhabi developed and introduced *the Green Hotel Guidelines* in 2010 that advise green design for new hotels as an extension of the UPC's Estidama Pearl Rating system (see 2-4). It has been pilot-tested with the forthcoming five-star hotel in Al Ain Wildlife Park and Resort becoming the first hotel to be assessed by the Estidama scheme, showcasing sustainable hospitality that blends nature and wildlife in harmony. TCA plans to further develop and integrate the guidelines into Abu Dhabi's hotel classification system under which all new hotels in the emirate will be given a green rating alongside their star ranking.[6]

1. El Baltaji, D. (2014), "Dubai eases laws to double hotel rooms ahead of 2020 Expo", *Bloomberg*, wire report, 18 March.
2. Westholm-Knebel, M. (2014), "A change of heart and colour in tourism", in WGES (2014), pp.162-4.
3. TCA, *Sustainability* webpage, http://tcaabudhabi.ae/en/tourism/sustainability/Pages/sustainability.aspx, accessed on 9 September 2014.
4. DTCM, *Dubai Green Tourism Award* webpage, http://green.dubaitourism.ae, accessed on 9 September 2014.
5. Westholm-Knebel (2014)
6. TCA, *Environment, Health & Safety* webpage, http://tcaabudhabi.ae/en/tourism/sustainability/Pages/environment-health-and-safety.aspx, accessed on 9 September 2014.

Taking advantage of green profiles

Alongside the strong drive from the authorities, leading hotels in the UAE also started taking voluntary initiatives to raise their sustainability profiles and create competitive advantages. The UAE-based hospitality group, TIME Hotels launched the Middle East's first carbon offset accommodation scheme in May 2014 at TIME Oak Hotel & Suites and TIME Grand Plaza Hotel in Dubai as part of its sustainability strategy. Each guest is given the option to make a voluntary contribution to climate protection at check-in. A payment of AED 15 (USD 4.1) offsets the emissions generated during the guest's stay for a night. Their contribution is transferred to the Foundation myclimate, a Swiss NGO that helps companies around the world to offset their carbon emissions. The goal of TIME Hotels is to save over 320 tonnes of CO_2 emissions by the end of 2014 by investing in two projects managed by the foundation in Ethiopia and Darfur, Sudan.[1] [2]

Westin Abu Dhabi Golf Resort and Spa installed a machine named Waste Food Eater to eliminate food waste by recycling 150-200 kg of food generated each day by its six restaurants and staff canteen. This machine processes food waste into one-third its size by generating heat and through high-pressure mixing. It takes 10 hours to complete a single cycle and the end product, a dry brown powder compost, is used to fertilise the hotel's organic herb garden. The hotel has a plan to further distribute the compost to local farmers and buy local produce from them for the hotel kitchen. There is also a plan to roll out the machine in seven Starwood hotels in Abu Dhabi as part of the group's green initiative.[3]

Emerging eco-tourism destinations

Sir Bani Yas Island is one of the eight "Desert Islands" in Abu Dhabi's Al Gharbia region. The 87-km² island was originally designated in 1971 by the late former president, His Highness Sheikh Zayed bin Sultan Al Nahyan as Arabia's largest wildlife reserve. Thanks to decades of intensive conservation work and

Arabian Wildlife Park on Sir Bani Yas Island

ecological investment, it is now home to 68 bird species, about 13,000 free-roaming animals and several million trees and plants. Along the island's shore are sandbanks, inlets and mangrove-fringed inter-tidal lagoons frequented by flamingos, seagulls and cormorants. The island has been open to tourists since 2008 where visitors can enjoy the UAE's nature and wildlife through diverse activities including adventure safaris, kayaking, mountain biking, archery, hiking and snorkelling.[4] [5]

The Mangrove Natural Reserve of Kalba on the east coast near Oman border is home to a number of rare bird species as well as endangered green sea turtles

1. *Gulf News* (2014c), "TIME Hotels launches Middle East's first carbon offset accommodation initiative", 6 May.
2. Foundation my climate (2014), "myclimate partner announces first climate-neutral accommodation in Saudi Arabia", press release, 8 May.
3. Sankar, A. (2013), "Westin Abu Dhabi Golf Resort and Spa introduces food waste recycling unit", *XPRESS*, 10 April.
4. *Gulf News* (2009), "Abu Dhabi unveils big eco-tourism project", 3 May.
5. *The National* (2014c), "Milestone for nature reserve", 30 November

Kayaking through Abu Dhabi mangroves

and long-fingered lizards. Launched in 2012, the Kalba Eco-tourism Project aims to harness the natural beauty and tourism potential of Kalba by implementing an integrated and eco-friendly mixed-use development. The project is being developed by Shurooq in collaboration with the Sharjah Environment and Protected Areas Authority (EPAA) and the International Conservation Services, with a plan to complete in 2017. The planned turtle rehabilitation centre will house green, loggerhead and hawksbill sea turtles and visitors will have the chance to witness turtles laying eggs. The project will also provide outdoor adventure opportunities such as kayaking through the mangroves, while overnight guests will have options to stay at lodges or rustic camp grounds.[1] [2]

Reviving artisan skills for local souvenirs

Sougha (souvenir in a local dialect) initiative was started in 2009 by the Khalifa Fund for Enterprise Development to preserve the Emirati heritage through head-hunting skilled local artisans. It aims to enable them to seize new market opportunities by improving their technical and entrepreneurial skills. Khalifa Fund organises workshops and training where a concentration of local craft skills are practised, in a way that does not conflict with the local culture. They are intended to make local artisans aware of the importance of preserving and passing down their skills and then help them weave their crafts back into today's

Demonstrating local artisan skills

competitive market. This initiative has also helped encourage Emirati women to join the workforce as well as to develop artisanal souvenirs for tourists. Around 400 artisans from towns and villages around the country now take part in the initiative, and run their home-based business and market their products after having received training. The Sougha product line – including bags, clutches and iPad cases – is for sale online and in retail outlets across the country. From March 2014, all the amenity bags handed out to Etihad Airways passengers are made by Sougha artisans, featuring centuries-old Sadou patterns of weaving which were traditionally used on blankets, cushions and Bedouin tents.[3] [4]

1. Al Serkal, M.M. (2012), "Kalba wildlife reserve prepares ground for eco-tourism project", *Gulf News*, 13 May.
2. Shurooq, *Kalba Eco-tourism Project* webpage, http://shurooq.gov.ae/project/kalba-eco-tourism-project, accessed on 30 November 2014.
3. ThinkUp (2011), "Khalifa Fund supports 'Sougha' initiative", news, June, http://thinkup.ae/think_skills/culture-khalifa-fund-supports-sougha-initiative.
4. McQueen, A. (2014), "Sougha provides a local touch to Etihad amenities bags", *The National*, 5 February.

3 Measuring the Transformation towards a Green Economy

Measuring the Transformation towards a Green Economy

The green transformation of the UAE economy requires an activation of both enabling government policies and initiatives from the private sector and civil society. In order to guide the formulation of policy instruments and incentives as well as voluntary activities to the right course, it is critical to establish a set of indicators as an effective compass which will allow for monitoring and assessment of the underlying developments, progress and potential opportunities and risks. The refined indicators should be able to serve to provide solid evidence based on which policy makers can set clear goals, formulate policies, review progress and evaluate impacts. They should also improve the level of debate on Green Economy and inform the wider public.

Measuring the complex and multi-dimensional nature of Green Economy and identifying relevant indicators is a challenging task. Inter-governmental organisations such as OECD, UNEP, the World Bank and GGGI are making a joint effort to develop a common framework and a set of indicators for monitoring progress towards a Green Economy but no agreement exists to date.[1] Whereas standardisation and comparability are desired for such indicators, countries also require flexibility to meet their different needs and pathways, which largely depend on national circumstances, capacities and levels of development.[2] Lack of available data is another barrier to developing a meaningful set of Green Economy indicators.

Building on the international efforts,[3] this chapter determines the framework and list of Green Economy indicators which fit for the UAE's Green Economy objectives and reports the performance of each indicator as far as data for the reporting period (2010-14) is available. As the first edition, the main focus of reporting *the UAE Green Economy Indicators* is setting a baseline for regular monitoring and establishing future targets as well as for allowing international benchmarking. As knowledge and experiences are accumulated in the coming years, the framework and set of these indicators and the associated methodology may be regularly revised.

1. GGKP (Green Growth Knowledge Platform) (2013), *Moving towards a Common Approach on Green Growth Indicators*, GGKP Scoping Paper, GGKP, Geneva.
2. UNEP (2014a), *Using Indicators for Green Economy Policymaking*, Green Economy Working Paper, UNEP, Nairobi.
3. Other major contributions to Green Economy indicators include: UNEP (2012), *Measuring Progress Towards a Green Economy*, draft working paper, UNEP, Nairobi; OECD (2011b), *Towards Green Growth: Monitoring progress – OECD indicators*, OECD, Paris; OECD (2014a), *Green Growth Indicators*, OECD, Paris; World Bank (2012), *Inclusive Green Growth: The pathway to sustainable development*, World Bank, Washington, DC.; UN-ESCAP (UN Economic and Social Commission for Asia and the Pacific) (2013), *Green Growth Indicators: A practical approach for Asia and the Pacific*, UN-ESCAP, Bangkok; UN-ESCWA (UN Economic and Social Commission for Western Asia) (2013a), *Monitoring the Transition to a Green Economy in the Arab Region: The SME perspective*, UN, New York; UN-ESCWA (2013b), *Mapping Green Economy in the ESCWA Region*, draft report for discussion, UN-ESCWA, Beirut; and the GGGI's diagnostic indicators for assessing country sustainability in green growth planning as quoted in GGKP (2013).

3-1. Framework of the UAE Green Economy Indicators

In order to understand the course towards sustainable development, the indicators that independently measure the performance of each economic, social or environmental aspect are broadly available at the United Nations. The UN is currently developing the Sustainable Development Goals (SDGs) as a successor to the Millennium Development Goals (MDGs) set to be attained by 2015. However, Green Economy indicators need to go a step further in capturing the economy-environment nexus — the extent to which economic activity is being greened and green initiatives contribute to economic growth.[1]

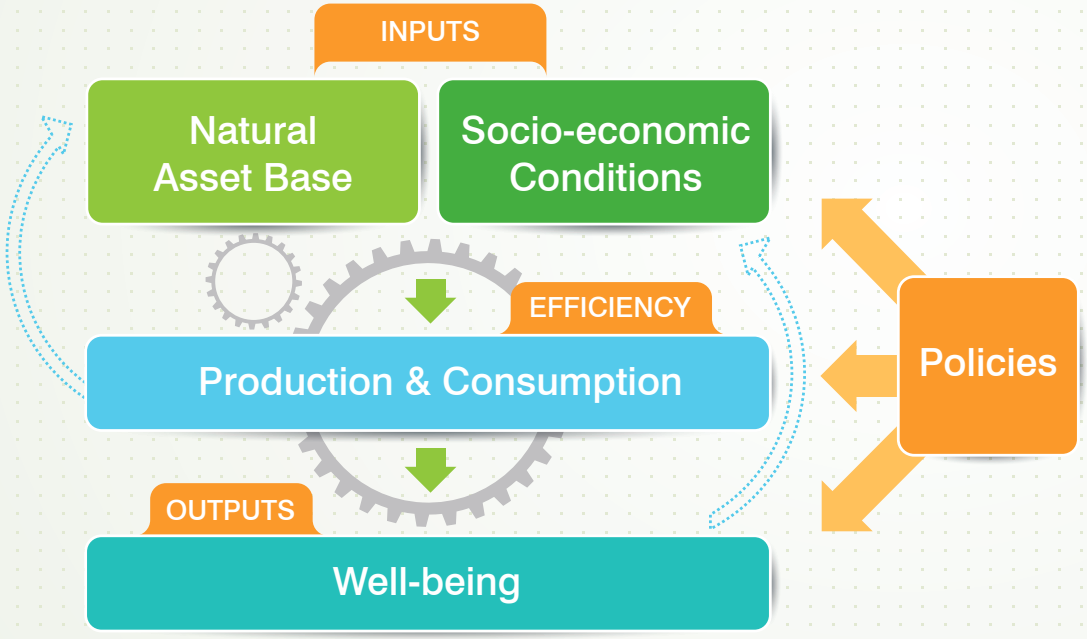


Figure 3.1: Framework of *the UAE Green Economy Indicators*

The traditional macro-economic model is based on the basic concept of production where economic inputs are transformed into economic outputs such as goods and services. A direct source of economic growth is the growth of inputs including labour, produced capital such as machines, and intermediate inputs in production such as steel in the automobile industry. The role of inputs in economic growth has been primarily valued by partial productivity measures such as labour and capital productivity or multi-factor productivity – i.e. efficiency of producing outputs which can be increased by improved human capital and organisation as well as technological change.[2]

Such a traditional measurement of production does not properly reflect "natural capital" as production inputs like other forms of capital, despite the fact that they constitute essential inputs into production and consumption. The lack of markets and prices for many natural assets and environmental services has led to their overuse and deterioration as an economy grows, and has created negative externalities associated with public goods and services, for example, health damages from pollution and global warming. Furthermore, the amenity services that support a broader notion of well-being are often not traded and hence not well captured by standard economic indicators, while the progress in an economy tends to be simply measured by growth in GDP alone.[3] [4]

The UAE Green Economy Indicators intend to integrate environmental considerations into this conventional input-productivity-output model, in a way to help policy makers and industry understand the dynamism of the economy-environment nexus. This framework would also help policy makers to better plan and improve Green Economy policies and activities through the analysis of correlation between indicators. The Indicators are structured into the following four categories (**Figure 3.1**):

1. GGKP (2013)
2. OECD (2011b)
3. GGKP (2013)
4. UNU-IHDP (UN University – International Human Dimensions Programme) and UNEP (2014), *Inclusive Wealth Report 2014: Measuring progress towards sustainability*, Cambridge University Press, Cambridge.

Category 1. Inputs:

In addition to the conventional economic inputs, two other types of inputs are considered: a) environmental inputs; and b) socio-economic inputs. The former is the natural capital or natural asset base which provides both services (including sink services for pollution) and natural resources, which constitute crucial inputs into production or directly affect people's well-being (Category 3). There is a need to monitor the risks related to possible overuse and depletion that may threaten future prosperity as the ability to replenish these inputs is limited. Indicators capturing the state of the natural asset base are crucial for identifying such risks.[1] Socio-economic inputs consist of factors or framework conditions that may indirectly but critically influence the eco-efficiency of production and consumption (Category 2), which in turn affects overall well-being of the population (Category 3). These determining factors include innovation, workforce, entrepreneurship, competitiveness, investment friendliness, education, etc.

Category 2. Efficiency:

This category comprises measures focusing on eco-efficiency, which indicates the progress in the manner of producing and consuming environmental services and natural assets. This efficiency can be measured by linking with a measure of economic activity such as GDP or population (per capita). More eco-efficient production and consumption would help maintain the natural capital while increasing economic outputs, – i.e. realising "green" and "growth" simultaneously. As outlined in Chapter 1, decoupling economic growth from environmental impact is a pre-requisite for Green Economy. The change in these eco-efficiency indicators would clearly demonstrate whether certain environmental factors are progressing in the direction of decoupling. The eco-efficiency can be generally improved by innovation in production methods or changes in behaviour and choices made by consumers. These may be influenced by socio-economic conditions (Category 1). Recycling of materials, higher productivity or finding alternatives to harmful substances would also help the reduction or even improvement of the natural assets.

Category 3. Outputs:

This category refers to a broad notion of well-being that can be acquired by the population as the consequences of production and consumption activities – including material well-being represented by conventional economic measures such as GDP and disposable income, as well as non-material well-being which comprises environmental and social quality of life. Environmental quality of life relates to the quality and availability of certain environment-related services and amenities, whereas social quality of life relates to safety, health, sense of security and community, etc. As well-being and quality of life are often referred to as "happiness", such a broad measure of outputs is inevitably subjective and difficult to measure in a quantitative manner. The resulting well-being or quality of life would also affect socio-economic conditions (Category 1).

Category 4. Policies:

Policies affect the behaviour of economic agents and can correct or distort the incentives for economic decisions. This category of indicators focuses on policy measures specially targeting at greening the economy – those that promote progress in eco-efficiency of production and consumption and improve the management of natural assets. Apart from popular measures like regulations and subsidies, sustainable public procurement, standards and labelling, environmental taxes and reducing harmful subsidies could help shift in the investment towards environmental technologies and products by leveraging consumer preference.[2] The policies specifically targeted at improving human capital and innovation in environmental fields (i.e. green jobs and green innovation) can also be included in this category as key drivers for eco-efficiency.

Figure 3.2 lists *the UAE Green Economy Indicators* defined in this report. Those indicators originate from the recommendations from inter-governmental organisations and the input during the consultation process for developing the implementation plan *of the Green Growth Strategy*. As the UAE government has

1. GGKP (2013)
2. OECD (2011b)

Figure 3.2: List of *the UAE Green Economy Indicators*

also recently developed its National Key Performance Indicators (KPIs) to measure the fulfilment of *the UAE Vision 2021*, relevant National KPIs are also adopted as part of *the Green Economy Indicators*. In the selection of a limited set of indicators, the four criteria suggested by OECD[1] – policy relevance; analytical soundness; measurability; and usefulness in communication – were taken into consideration, as well as the availability of data in the country. The selected 30 indicators were classified and coded according to the five groups:

- **Inputs I**: Natural asset base (N)
- **Inputs II**: Socio-economic conditions (C)
- **Efficiency**: Production and consumption (E)
- **Outputs**: Well-being (W)
- **Policies** (P)

This set of indicators should be considered as the first attempt at capturing Green Economy performance in the country, not a definitive or exhaustive list. They will be refined or new indicators may be added as the experiences and data availability will improve in the coming years. The reader is also advised that indicators are mere proxies and may over-simplify the underlying reality so that they should be interpreted in an appropriate manner, recognising their limitations. The figures of the UAE's population and GDP are taken from international sources[2] to allow the UAE's standings to be benchmarked against other countries in the GCC and around the world.

1. OECD (2011b)
2. The population data is based on UN-DESA Population Division (2013), medium fertility estimates. Unless specified, the GDP data applied is that converted to current international dollars using purchasing power parity (PPP) rates complied in the World Bank's *World Development Indicators*.

3-2. UAE's performance towards a Green Economy

3-2-1. Inputs I (Natural resource base)

N1: Reserves of minerals

Oil reserves (end of 2013): **97.8 billion barrels** (**7**th in the world; **3**rd in the GCC; **5.8%** of the global reserves); Reserves-production ratio (R/P)[1] **73.5 years**

Gas reserves (end of 2013): **6.1 trillion m³** (**7**th in the world; **3**rd in the GCC; **3.3%** of the global reserves); R/P **over 100 years**

The UAE's major mineral resources are petroleum and natural gas. The discovery of abundant oil and gas reserves has transformed the desert country into one of the most advanced nations with high standards of living. The oil and gas industry has been the driving force of the UAE economy as it still provides around one third of the total GDP, while economic diversification is progressing. The UAE has the world's seventh largest proven reserves of both oil and natural gas, estimated at 97.8 billion barrels (5.8% of the world's total reserves) and 6.1 trillion m³ (3.3% of the world's total) respectively, with a prospect to exploit for many decades.[2] The country is seeking to increase its production capacity of crude oil from the current 2.7 million barrels per day (bpd) to 3.5 bpd by 2017 to meet the increasing global demand and maintain the stability of markets.

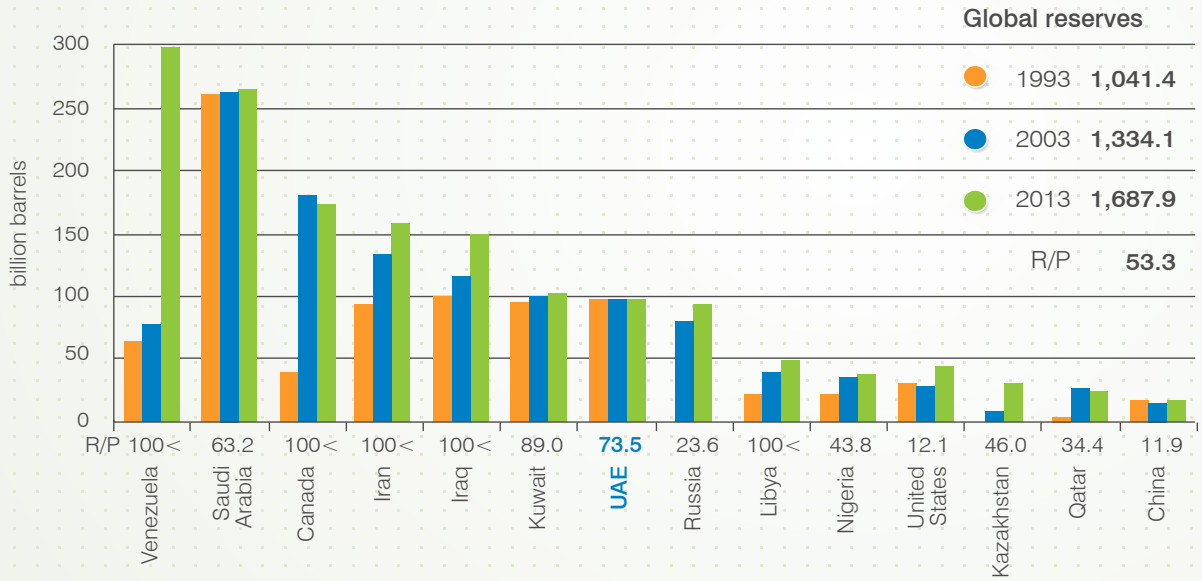


Figure 3.3: Amount of proven oil reserves in top countries, with reserves-to-production ratios

Source: BP Statistical Review of World Energy 2014

The UAE does not have significant ore reserves of any metals, whereas it has vast resources of limestone and hard rock in the Northern Emirates, which are currently exploited by quarrying companies to produce construction aggregate, cement, rock wool, gypsum, etc.[3] [4] Urea, ammonia and sulphur have been produced as by-products of oil and gas operations.[5]

Leveraging the country's low energy costs and industrial infrastructure, downstream metal industries such as aluminium and steel have been flourishing (see 2-3) but the demand for raw materials has been met by imports.

1. Reserve-to-production ratio indicates the number of years that can be exploited in the current production rate.
2. BP (2014)
3. Thomas, G.P. (2013), *United Arab Emirates: Mining, Minerals and Fuel Resources*, AZoNetwork UK Ltd., Macclesfield.
4. MOENR, Department of Geology and Mineral Resources (n.d.)
5. Taib, M. (2014), "The Mineral Industry of the United Arab Emirates", in United States Geological Survey (2014), *2012 Minerals Yearbook Volume III: Area Report – International*, pp.59.1-10, US Government Printing Office, Pittsburgh, PA.

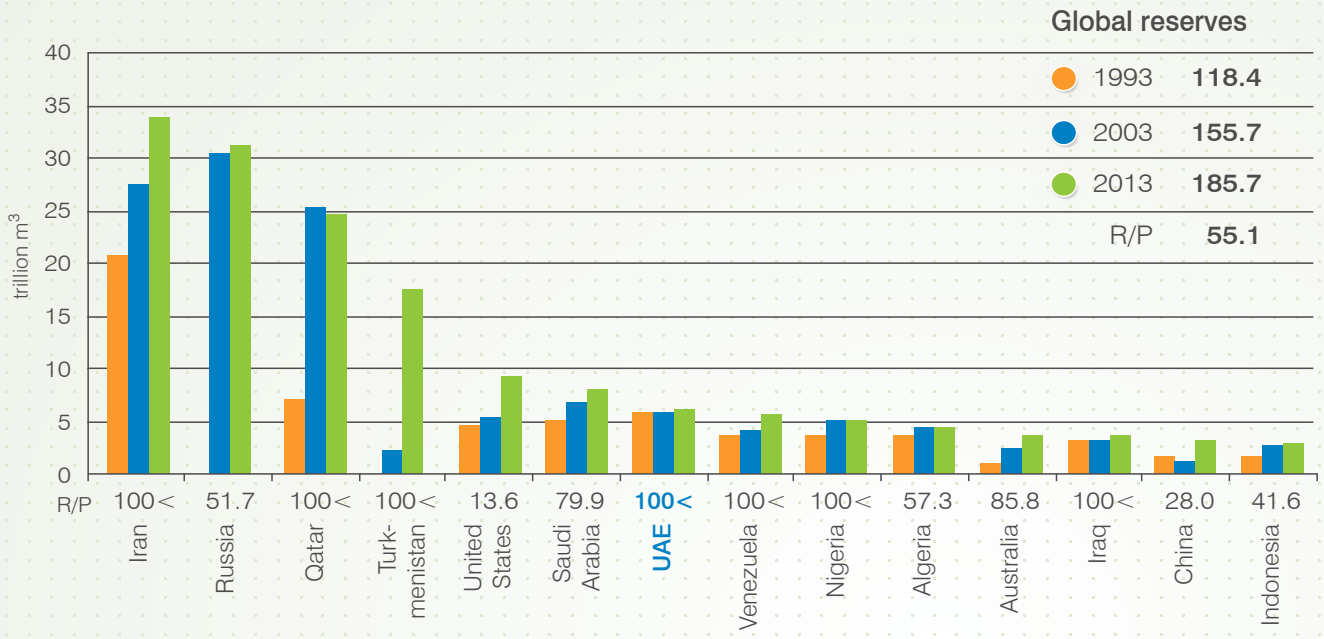


Figure 3.4: Amount of proven natural gas reserves in top countries, with reserves-to-production ratios

Source: BP Statistical Review of World Energy 2014

N2: Land resources

Economically cultivatable land: Abu Dhabi (2009) **311,000 ha** (5.2% of total area); **Northern Emirates** (2012) **101,678 ha** (13.4% of total area)
Forest areas (2012): **319,400 ha** (4.5% of total land area)

Land and soil resources are critical for the production of food and other biomass, the preservation of biodiversity and the productivity of ecosystems. The main challenge is to ensure a sustainable management of these resources so as to reconcile competing economic and environmental interests and to achieve an optimal level of land use.[1]

Soil surveys were conducted separately for the Emirate of Abu Dhabi (published in 2009) and the Northern Emirates (2012). 311,000 ha or 5.2% of the total land area of Abu Dhabi was classified as "highly suitable" to "moderately suitable" to the specified use. In the Northern Emirates (Sharjah, Ajman, Umm Al Quwain, Ras Al Khaimah and Fujairah), 31,331 ha (7.8% the surveyed area; 4.1% of the total area) is "highly suitable" and 70,347 ha (17.5%; 9.3%) is "moderately suitable".[2,3]

Forests also play a crucial role in terrestrial ecosystems and provide a multitude of services including support to stabilise the global climate.[4] 4.5% or about 320,000 ha of the UAE's land is forested, nearly all of which is plantation. An extensive afforestation programme has been carried out in the past decades using underground water and treated wastewater, mainly for protection, recreational and aesthetic purposes.[5] As a result, the UAE has gained an average of 3,380 ha per year, 74,420 ha or around 30.4% in total between 1990 and 2012.[6] It is estimated that these forests contain 16 million tonnes of carbon, which has increased by one third between 1990 and 2010.[7] The UAE has also 12,750 ha of mangrove forests along coastlines and their areas are steadily increasing due to plantation and protection activities, providing a safe haven for fish species, turtles and birds.[8]

1. OECD (2011b)
2. MoEW (2015)
3. The Emirate of Dubai also conducted and published a soil survey in 2005 but the classification of soil was different from the other emirates' surveys. Hence, Dubai's data of cultivatable land cannot be aggregated for this report.
4. UNEP (2012), *Global Environmental Outlook 5: Environment for future we want*, UNEP, Nairobi.
5. FAO (2012), *Forests and the Forestry Sector: United Arab Emirates*, www.fao.org/forestry/country/57478/en/are/, FAO, Rome.
6. World Bank (2014), *World Development Indicators 2014*, World Bank, Washington, DC.
7. FAO (2010), *Global Forest Resources Assessment 2010*, FAO, Rome.
8. MoEW (2015)

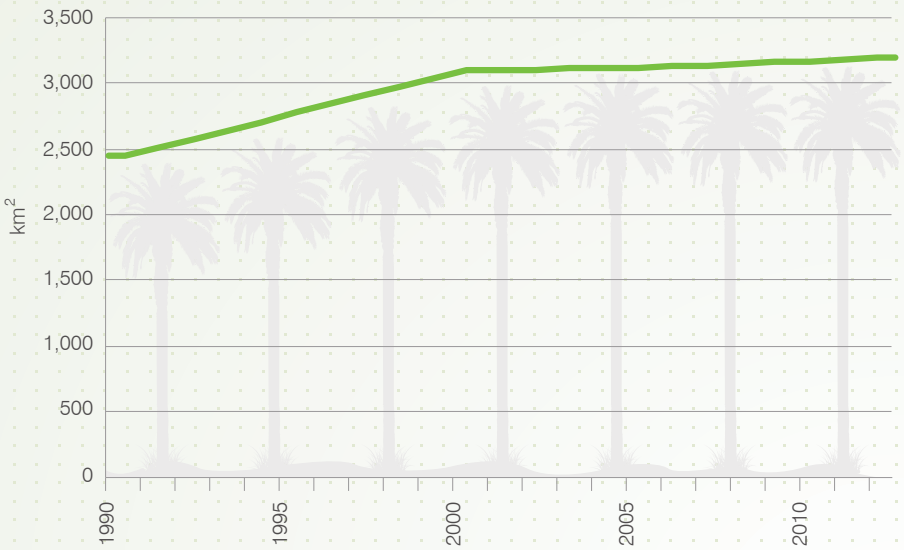


Figure 3.5: UAE's forest areas

Source: *World Development Indicators*; FAO, *Global Forest Resources Assessment 2010*; FAOSTAT

N3: Marine resources

Fish stocks in the Arabian Gulf (2011): **599 kg/km²** (53.0% down from 2002)

Fish stocks in the Gulf of Oman (2011): **529 kg/km²** (69.5% down from 2002)

Globally, it is considered that the maximum potential of wild capture fisheries from the oceans has probably been reached and UNEP warns that 30% of fish stocks have already collapsed and virtually all fisheries risk running out of commercially viable specimens by 2050.[1]

The Arabian Gulf is shallow with average depths of 35 metres and its water is relatively calm. The Gulf of Oman consists of a broad basin where the water depth goes more than 2,500 metres. The Arabian Gulf is surrounded on all sides by dry deserts, which make the cycle of water exchange with the Indian Ocean slow (about 2-5 years). This results in having the pollutants remain for a longer period and making environmental impact greater than open seas. Due to rapid evaporation, the Arabian Gulf loses its water about 10 times faster the inflow from freshwater and its salinity reaches 40-70 parts per thousand (ppt), while the water temperature reaches over 40°C in the summer.[2]

Various aspects of economic development in recent decades have influenced environmental impact on the Arabian Gulf and the Gulf of Oman. Pollutants and wastewater released by human activities, contaminants from oil exploitation activities, bridging and reclamation of coastal areas, increased commercial

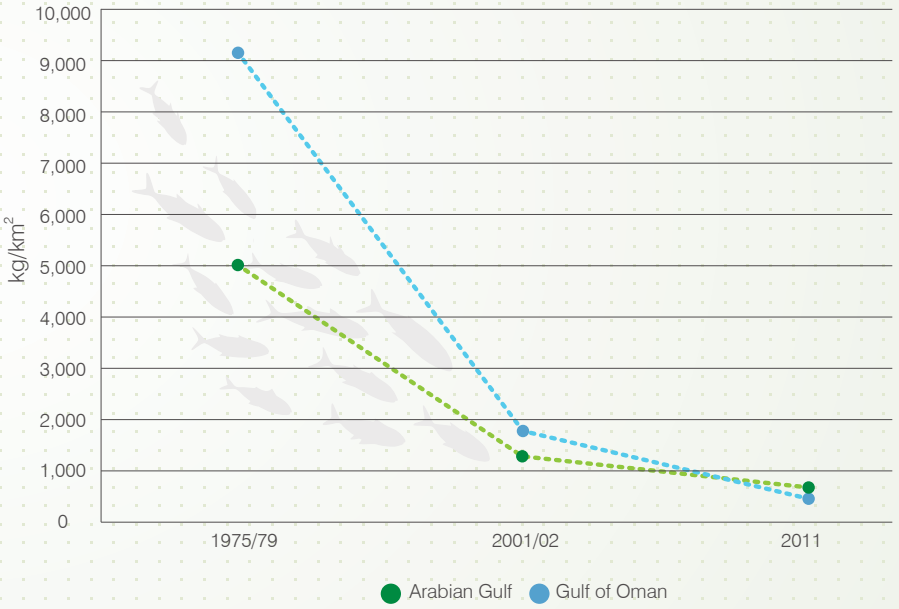


Figure 3.6: Fish biomass density estimates in UAE's territorial water, 1975-2011

Source: MoEW, *UAE State of the Environment Report 2014*

1. Cosgrove, C.E. and Cosgrove, W.J. (2012), *The Dynamics of Global Water Futures: Driving forces 2011-2050*, UNESCO, Paris.
2. MoEW (2015)

shipping, as well as over-fishing, have all contributed in varying degrees to disruption to the status of marine resources. The comparison of three studies – by FAO in the late 1970s, by EAD in 2002-03 and by the GCC in 2008-11 – indicates an alarming rate of decline in fish stocks in both sides of the UAE water (see also 3-2-3).[1]

N4: Wildlife resources

Number of plant species (2014; at least): **800**
Number of animal species (2014; at least): Mammals **48**; Birds **440**; Reptiles **70**

Biological resources provide the raw materials for production and growth in many sectors of the economy. The main challenge is to maintain and restore the diversity and integrity of ecosystems, to conserve species and genetic resources and to ensure a sustainable use of biodiversity.[2] Historically in the UAE, different types of plants have adapted to the harsh climate and desert environment, serving as an important source for feeding animals, stabilising sand dunes and providing humans with medications. The mountain areas have provided an ideal refuge for wildlife, whereas the marine and coastal environment has played an important role in providing food and livelihood as pearling was once the cornerstone of the economy.[3]

Within the UAE territory, more than 800 species of plants are spread with varied vegetation. For terrestrial wild animals, 48 species of mammals and over 440 bird species have been recorded, while around 70 species of reptiles and two species of amphibians are known today. However, various natural and anthropogenic factors such as climate change, urban development, habitat destruction, invasive species, red tide, waste, over-grazing, logging and poaching have led to the loss of biodiversity.[4]

Among them, plants such as *Nannorrhops ritchiana*, *Desmidorchis flavus*, *Limonium carnosum* and *Salix acmophylla* are endangered. Some species of terrestrial mammals like Arabian oryx, Arabian wolf, striped hyena and Arabian leopard are considered to be facing risk of extinction in the country, while the International Union for Conservation of Nature (IUCN) registers some bird species observed in the UAE such as Saker falcon, Asian houbara and Socotra cormorant as globally threatened species. A number of migratory species including sea turtles, dugongs, birds of prey and sharks are also threatened.[5] [6]

A flock of flamingos gathering in Ras Al Khor Wildlife Sanctuary, Dubai

N5: Freshwater resources

Fresh groundwater reserves: **20 billion m³**
Annual renewable internal freshwater resources per capita (2011): **16.8 m³**

Traditionally, groundwater was the main natural water source in the UAE, and is now primarily used for irrigating farmland and forests. The total volume of groundwater accounted for around 740 billion m³ in 2005 but only 20 billion m³, 3% of this source, is considered to be "fresh" with salinity of less than 1,500 ppm.

1. MoEW (2015)
2. OECD (2011b)
3. MoEW (2015)
4. MoEW (2015)
5. MoEW (2015)
6. IUCN's *Red List of Threatened Species* (version 2014.3) designates 49 species as "threatened species" out of 756 animal species identified within the UAE. No plant species has been recognised as threatened.

Over-extraction of groundwater for agriculture has resulted in a sharp drop in water levels, as the proportion of rainwater feeding the aquifer has been less than 10% of the amount of groundwater withdrawn. Estimates in the Emirate of Abu Dhabi show the depletion of about 47% of the groundwater reserves in the north-eastern region due to over-pumping, and the level of groundwater is lowering at a rate of 5 metres per year since 1999. The deterioration of groundwater quality has also been observed due to the overuse of fertilisers and over-irrigation, as well as the intrusion of saline water in coastal regions.[1 2 3]

There are 60 surface water catchments (wadis) in the UAE where the annual surface water flow ranges between 23-138 million m^3. To manage the wadi flows and occasional flash flooding, a series of multi-purpose dams have been constructed since the early 1980s, mainly in mountainous areas in the north of the country. 117 dams with a total storage capacity of 120 million m^3 have harvested around 130 million m^3 between 2001-10 and recharged groundwater. However, surface water still does not exceed 1% of the available annual freshwater resources.[4 5] Coupled with the rapid population growth, the per-capita availability of renewable internal freshwater resources (surface water and groundwater) has become among the lowest in the world. The UAE cannot meet its water demand without resorting to sources of non-conventional water such as desalinated water and treated wastewater (see also 3-2-3).

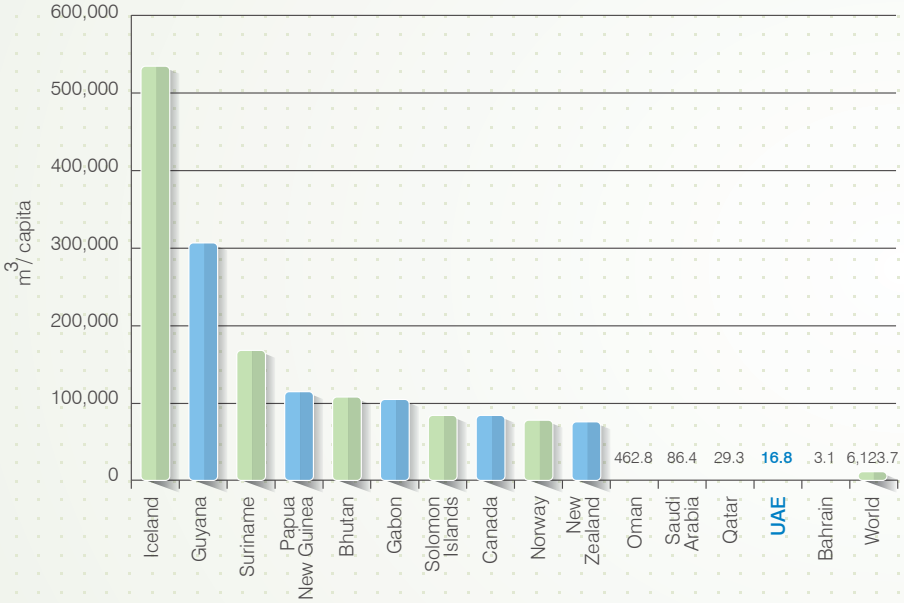


Figure 3.7: Annual renewable internal freshwater resources per capita in top 10 countries and the GCC, 2011

Source: FAO AQUASTAT; *World Development Indicators*

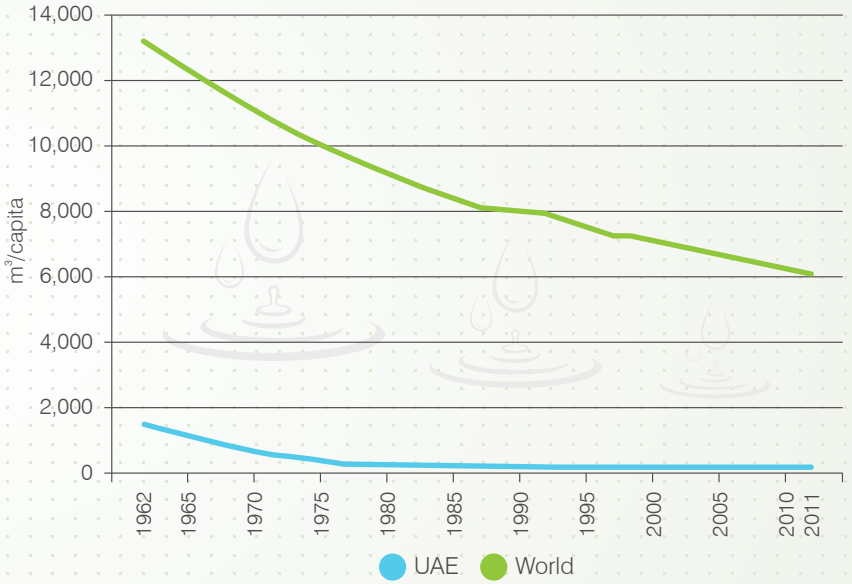


Figure 3.8: Trends in annual renewable internal freshwater resources per capita in the UAE and the world, 1962-2011

Source: AQUASTAT; *World Development Indicators*

1. MoEW (2010)
2. Al Mulla, M.M. (2011), "UAE State of Water Report", presentation at the 2nd Arab Water Forum, Cairo, 20-23 November, MoEW, Dubai.
3. MoEW (2015)
4. Al Mulla (2011)
5. MoEW (2015)

3-2-2. Inputs II (Socio-economic conditions)

C1: Innovation

Global Innovation Index (2014) National KPI **36th** in the world (2 places up from 2013); **1st** in the GCC

R&D expenditure (2011) National KPI **0.49%** of GDP (**48th** in the world)

Technology developments and innovation are important drivers for growth and productivity in an economy. They are important for managing energy and material flows in a more sustainable manner and also have a bearing on policies intended to preserve natural resources and minimise pollution. Spending on research and development (R&D) and the use of intellectual property rights (IPRs) such as patents and trademarks are considered to be one of the key factors to spur innovation and technology advances.[1]

The Global Innovation Index (GII) is an annual publication which was launched in 2007 and has been valued globally as one of the most comprehensive measures to understand different countries' enabling environment for innovation and their innovation outputs. The 2014 version of the GII was co-published by the World Intellectual Property Organization (WIPO), Cornell University and INSEAD Business School. It ranks the innovation performance of 143 economies based on a composite of 81 indicators, and the UAE's overall score and world ranking have been stable and has kept it in the leading position among the GCC countries since 2011.[2] [3] As one of the National KPIs, the UAE aims to become among top 20 economies in the GII by 2021.

According to the statistics of the United Nations Educational, Scientific and Cultural Organization (UNESCO), the current and capital expenditures (both public and private) on R&D activities in the UAE during 2011 were 0.49% of the nation's total GDP, which is far behind the average spending of OECD countries (2.47%). The UAE sets a target of raising this rate to 1.5% by 2021. It should be noted that while technology and innovation has huge potential for greening the economy, they may also generate additional environmental pressures or strain material availability.[4]

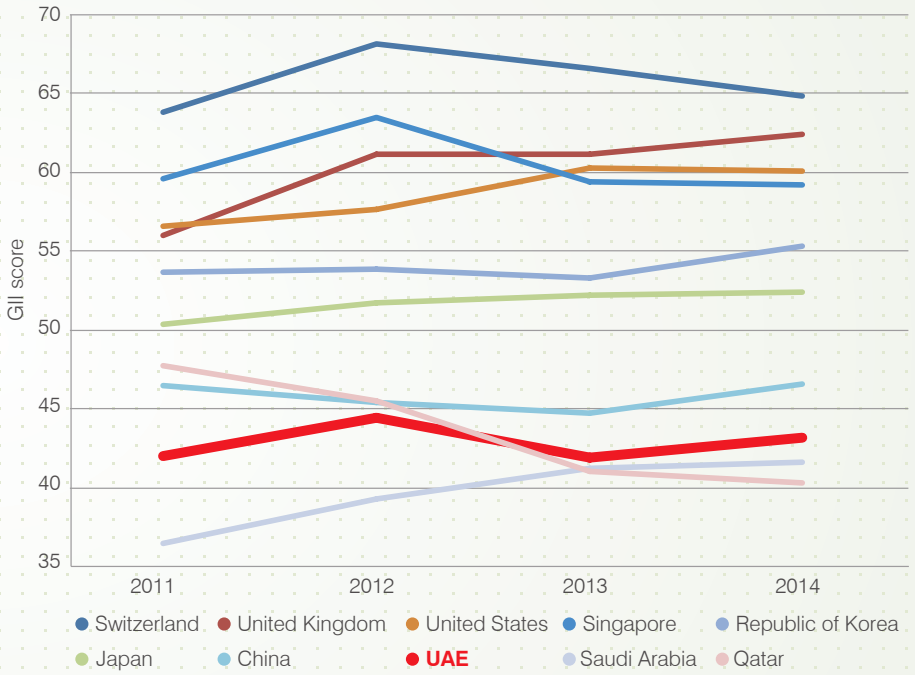


Figure 3.9: Trends in the score of the Global Innovation Index in major economies, 2011-14

Source: INSEAD, et al., *Global Innovation Index*

1. OECD (2011b)
2. Cornell University, *The Global Innovation Index* webpage, www.globalinnovationindex.org, accessed on 9 October 2014.
3. The scores and ranking of 2007-10 cannot be compared with those of 2011-14 as the scoring method is different.
4. OECD (2011b)

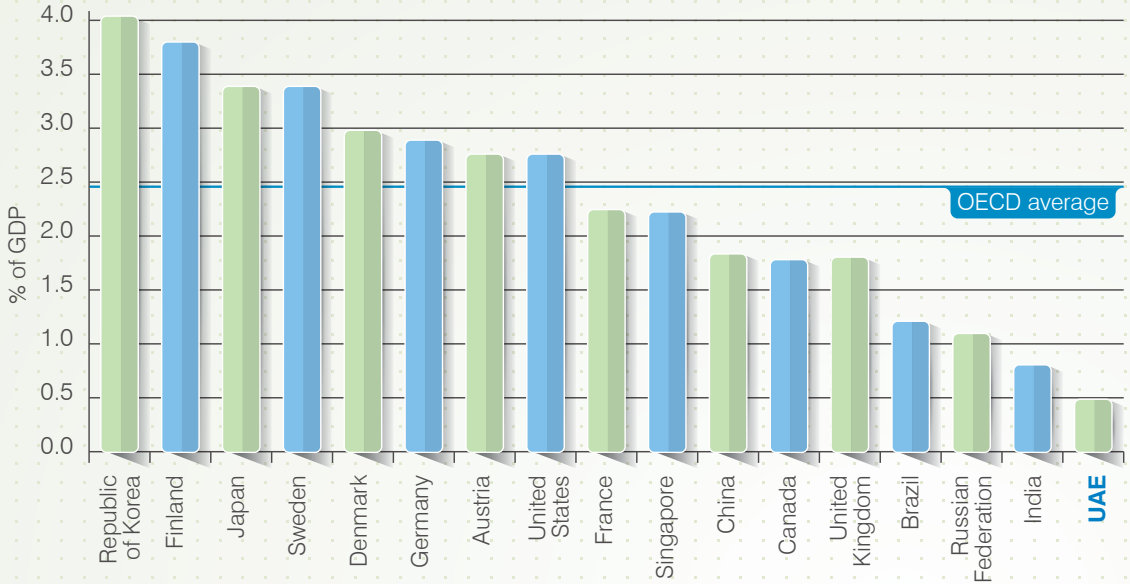


Figure 3.10: R&D expenditure of major economies as a proportion of GDP, 2011

Source: UNESCO; *World Development Indicators*

C2: Business environment

Global Competitiveness Index (2014-15) **National KPI** **12th** in the world (7 places up from 2013); **1st** in the GCC

Foreign direct investment net inflows (2012) **National KPI** **2.5%** of GDP (**108th** in the world); **2nd** in the GCC

Ease of Doing Business Index (2015) **National KPI** **22nd** in the world (1 place up from 2014); **1st** in the GCC

National competitiveness is considered to be particularly important for small open economies like the UAE to attract foreign investment, talented workforce, and new technologies and knowledge. These in turn will provide the scale necessary for productivity increases, including those in green sectors. Competitiveness is generally defined as "the set of institutions, policies, and factors that determine the level of productivity of a country".[1] Given the strategic importance of raising national competitiveness, the UAE established the Emirates Competitiveness Council (ECC) that serves as a conduit between the public and private sectors, actively informing policy creation and process development of federal and local government bodies.

The World Economic Forum (WEF) has been ranking the competitiveness of countries on a yearly basis since 2004 through the Global Competitiveness Index (GCI), which integrates macro-economic and micro and business aspects of competitiveness into a single index. The UAE's GCI ranking is steadily moving up and has reached the 12th position in the latest 2014-15 results, showing a remarkable improvement in the general business environment. In this latest version, WEF introduced for the first time scoring adjusted for environmental and social sustainability of countries, which reflects the readiness for greener and more inclusive growth. For the UAE, low youth unemployment and wide access to basic necessities positively influenced social sustainability and raised the score (from 5.3 to 6.1). On the other hand, severe water stress, pressure on fish stocks, a high concentration of particulate matter (PM) and GHG emissions, and signatory status to fewer international environmental treaties made the UAE's environment sustainability-adjusted score lower than its GCI (from 5.3 to 5.16).[2] The UAE targets becoming one of the top 10 countries in the GCI by 2021.

The UAE has excellent conditions for foreign direct investment (FDI) and many investors, both regional and international, have sought opportunities to place capital in the country. The UAE's attractiveness as an FDI destination stems from many factors including world-class infrastructures, political stability and an expatriate-friendly culture.[3] FDI net inflows, the value of inward direct investment

1. WEF (2009), *The Global Competitiveness Report 2009-2010*, p.3, WEF, Geneva.
2. WEF (2014), The Global Competitiveness Report 2014-2015, WEF, Geneva.
3. Elite Media and NMC (2013)

made by non-resident investors, are rapidly recovering from the financial crisis and have reached 2.5% of the total GDP in 2012. The UAE aims to double the proportion of FDI inflows against GDP by 2021.

Launched in 2002, the World Bank's Ease of Doing Business Index has promoted business-friendly regulatory environments by assessing regulations affecting domestic firms across 10 categories. The UAE climbed its global ranking to 22nd out of 189 economies in *Doing Business 2015* published in October 2014, moving up from the bottom amongst GCC countries in 2006-7 to the top by 2014. The UAE has an ambition to attain the world's top position in this index by 2021. The World Bank also provides a Distance to Frontier Measure, which evaluates the absolute distance of economies to the best performance on regulatory practices on a scale from 0 to 100. The UAE has shown a substantial improvement in regulatory efficiency, moving up from 70.6 in 2010 to 76.8 in 2015.[1,2]

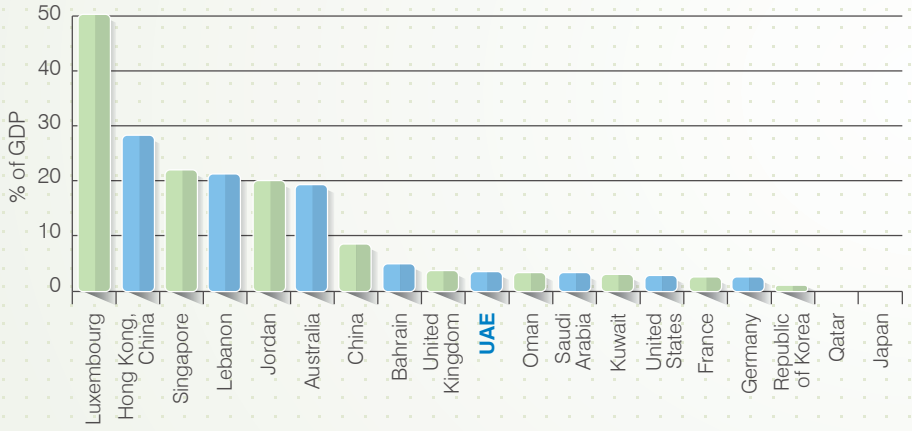


Figure 3.11: FDI net inflows in major economies as a proportion of GDP, 2012

Source: World Development Indicators

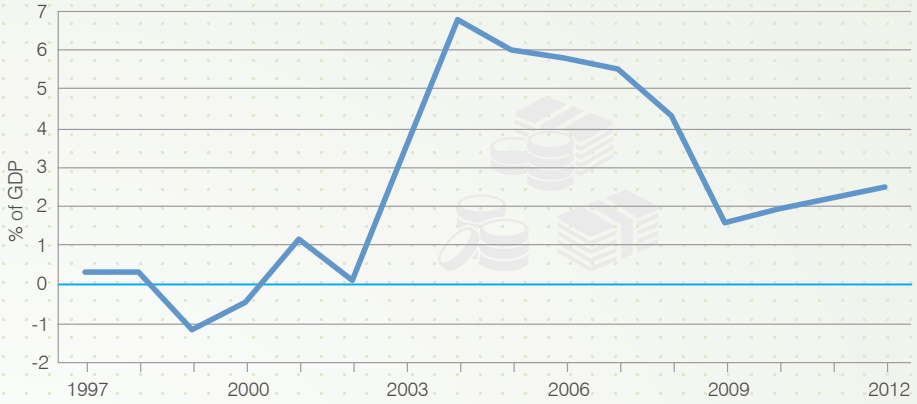


Figure 3.12: Trend in the UAE's FDI net inflows, 1997-2012

Source: World Development Indicators

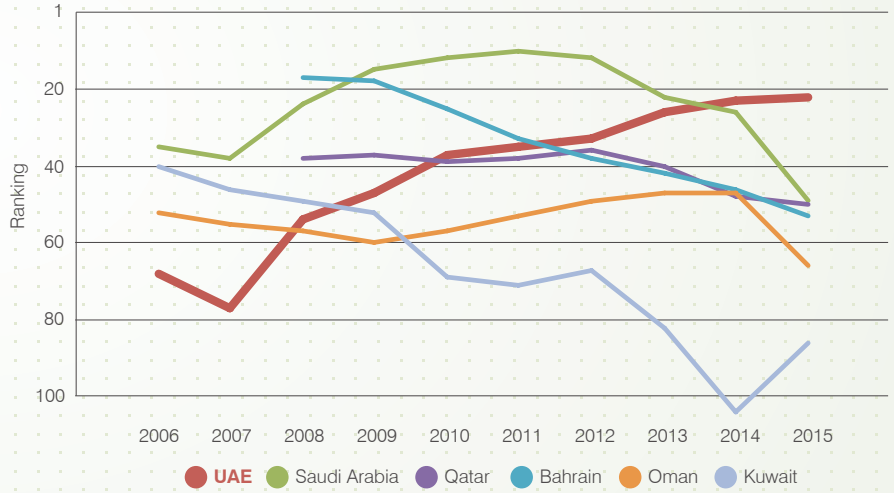


Figure 3.13: Trends in the ranking of Ease of Doing Business Index in GCC countries, 2006-15

Source: World Bank, Doing Business, 2006-15

1. World Bank (2014), *Doing Business 2015: Going beyond efficiency*, Washington, DC.
2. The East of Doing Business Index has been shifted to that based on a Distance to the Frontier Measure in the latest *Doing Business 2015*. Each economy from the 189 economies measured is now ranked wholly based on how close its business regulations are to the best global practices. A higher score indicates a more efficient business environment and stronger legal institutions.

C3: Entrepreneurship

Global Entrepreneurship and Development Index (2015) **National KPI**

20th in the world (8 places up from 2014); **1st** in the GCC

Entrepreneurship is becoming one of the most important inputs in the economic development in advanced, emerging and least developed economies alike. The entrepreneur who looks for new ideas and puts them into effect provides a spark to economic activities by his or her bold decisions and could eventually contribute to growth and employment creation. Entrepreneurial solutions would also be required to intricate global challenges such as poverty and climate change and to enable a greener economy.[1]

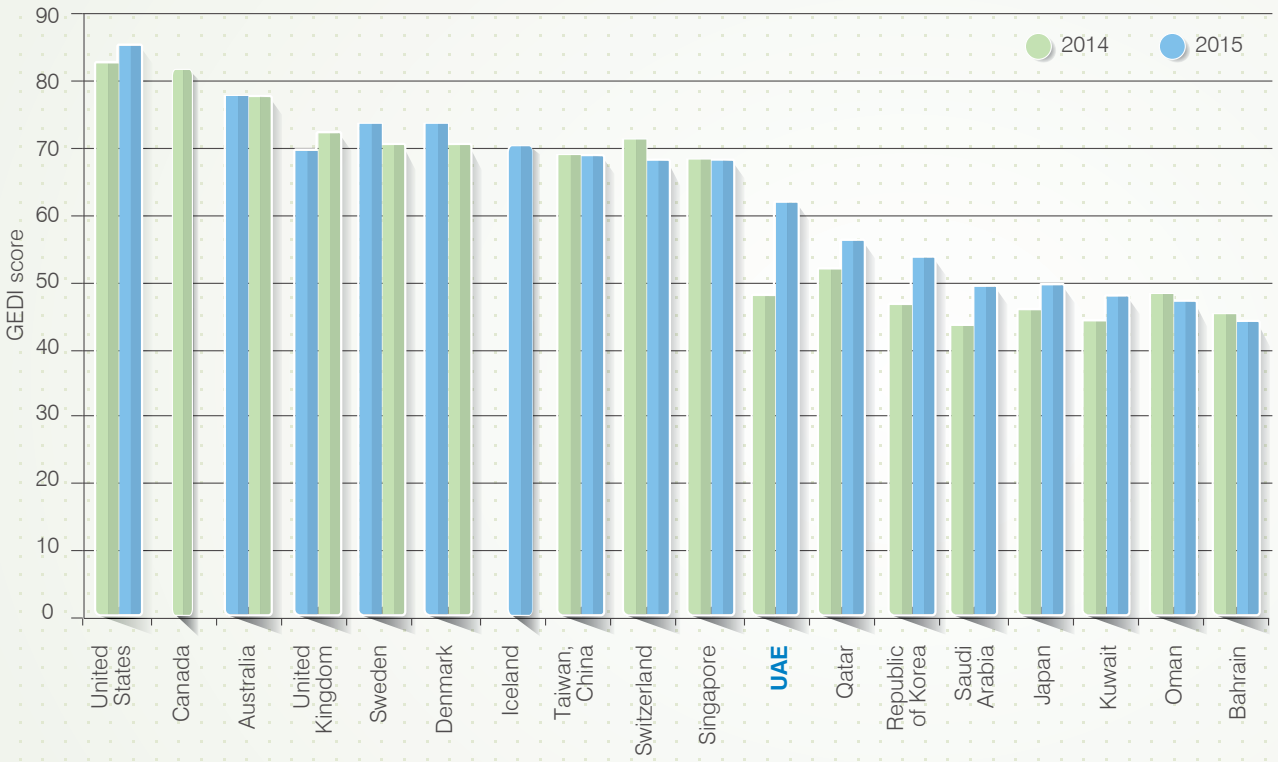


Figure 3.14: Scores of top and GCC countries in the Global Entrepreneurship and Development Index, 2014-15

Source: GEDI

Note: 2014 scores of Canada and Iceland are not available.

The Global Entrepreneurship and Development Institute (GEDI), an US-based policy development organisation, has been measuring the health of "entrepreneurship ecosystems" in 15 pillars – a mix of attitudes, abilities and socio-economic infrastructure – in over 100 economies through the Global Entrepreneurship and Development Index since 2011. The UAE was ranked 20th out of 130 economies in its 2015 version announced in November 2014 with its score of 61.6, leaping from 28th out of 120 economies with a score of 48.2 in the last 2014 version.

Looking into the breakdown of the scores in the 15 pillars, the UAE is one of the top performers globally in human capital, risk capital and high growth. On the other hand, bottlenecks are also observed in the areas of start-up skills, technology absorption and process innovation. GEDI evaluates that "an investment in entrepreneurship training and research capacity could bring about quite substantial improvements in the country's overall entrepreneurship performance".[2]

1. Naudé, W. (ed.) (2011), *Entrepreneurship and Economic Development*, Palgrave Macmillan, Basingstoke.
2. Acs, Z., Szerb, L. and E. Autio (2014), *The 2015 Global Entrepreneurship Index*, p.37, GEDI, Washington, DC.

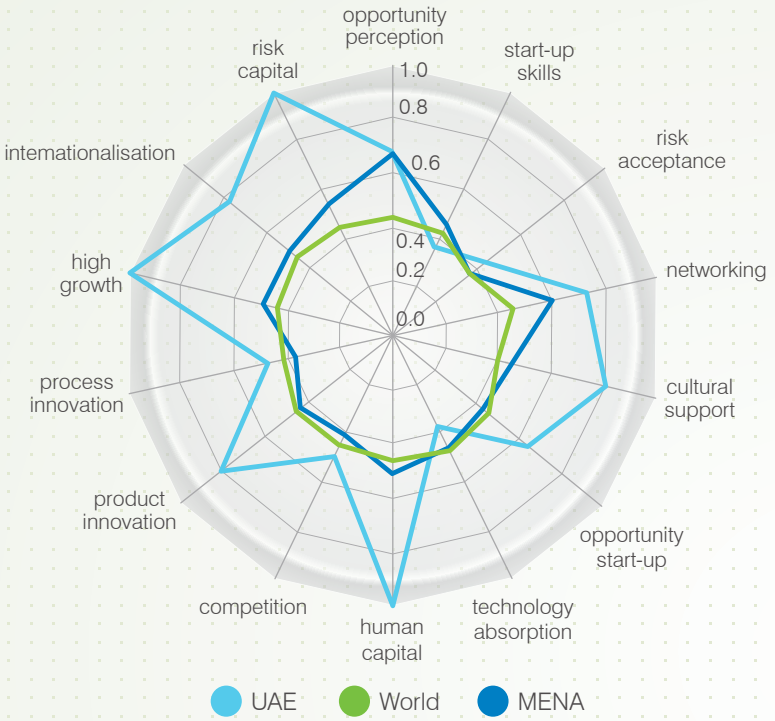


Figure 3.15: UAE's scores in 15 pillars of the Global Entrepreneurship and Development Index in comparison with the world and MENA averages, 2015

Source: GEDI

C4: Workforce

Working population (2012): **6.25 million** (3.4% up from 2011; 67.9% of total population)
Labour participation rate (2012; % of total population of over 15 years old): Total **79.3%**; Male **91.0%**; Female **46.6%**

Needless to say, labour is one of the most essential inputs for the production of goods and services. OECD guides to measure labour market dynamics by labour force participation rates and unemployment rates.[1] According to the World Bank's statistics, the UAE's working population in 2012 reached around 6.25 million, growing at a historic pace along with the country's population growth. The proportion of the population aged 15 and older that is economically active was 79.3% in 2012, indicating the high level of labour supply. The rapid increase of female participation in labour market is notable, recording 46.6% in 2012. Nevertheless, women remain a relatively untapped resource in the UAE compared to the rate of male workforce. The UAE government has recognised that women will be a key factor in the state's future prosperity and is pursuing a strategy to empower women. One study shows that if female employment rates were to match those of men, it could boost the country's GDP by some 12%.[2]

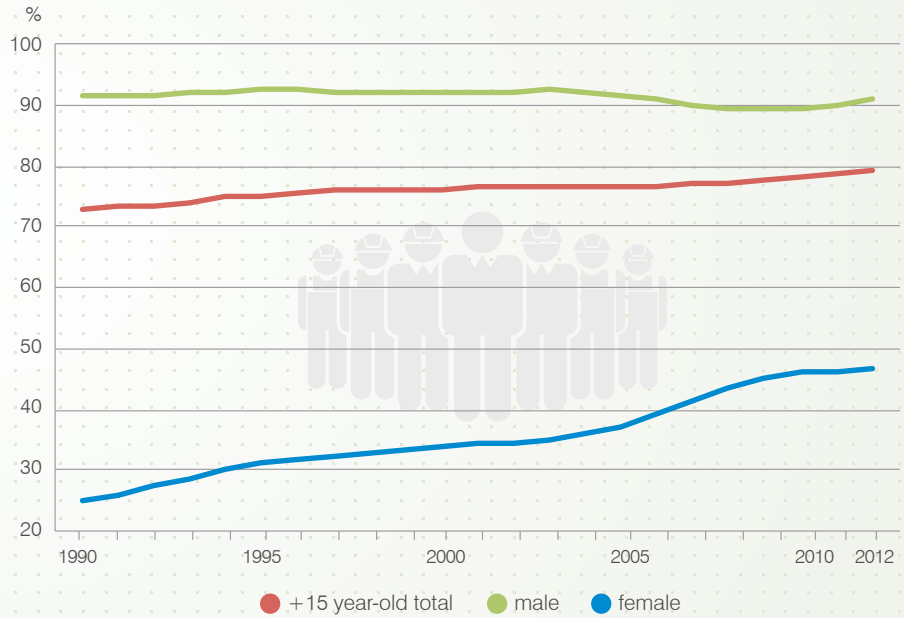


Figure 3.16: Trends in the UAE's labour participation and unemployment rate, 1990-2012

Source: *World Development Indicators*

1. OECD (2011b)
2. Elite Media and NMC (2013)

Foreigners comprise over 95% of the UAE workforce, with the largest communities coming from South Asia and a substantial presence from the MENA region. The government is working to ensure that the imbalance of workforce is addressed with active "Emiratisation" efforts, aiming to achieve 8% of the total workforce coming from UAE nationals by 2021. Public bodies such as the UAE National Human Resource Development and Employment Authority (Tanmia) are working to develop the skills and competitiveness of Emirati citizens.[1]

C5: Knowledge & education

Pupils who reached Grade 5 in primary education (2010): **97.4%**
(0.6 points up from 2005)
Graduates from higher education in the UAE (2011-12): **19,257**
(3,012 up from 2010-11); Male: **7,229** (37.5%); Female: **12,028** (62.5%); UAE national: **10,952** (56.9%); Non-national: **8,305** (43.1%)
Programme for International Student Assessment (PISA) (2012)
National KPI **Average 441** (**46th** out of 65 economies)

Knowledge has recently been recognised in advanced economies as the driver of productivity and economic growth, leading to a new focus on the role of information, technology and learning in economic performance.[2] The successful transition to a Green Economy will also be largely dependent on the knowledge assets of the country. Building human capital through education and training programmes is considered particularly important to reinforce the competitiveness of the workforce and equip it to hold its own in the rapidly developing global knowledge economy. Young people who complete secondary or tertiary education will likely face fewer difficulties to find work and will be equipped to take up green jobs as well as be disposed to environmentally friendly behaviour.[3]

The education system in the UAE witnessed remarkable developments over the past decades thanks to the high rates of government expenditure on education. Over the period 1990-2010, the number of students in primary education increased at an annual rate of 10.3%, the number of schools increased by the same percentage, while the number of teachers increased at 13.3% per annum. The net enrolment ratio in the first education cycle increased from 97.1% in 1990 to 98.3% in 2010, and the proportion of pupils who reached Grade 5 also rose from 95.0% in 1990 to 97.4% in 2010. The UAE is likely to achieve universal primary education – for both girls and boys – by 2015, which is set as one of the eight UN Millennium Development Goals.[4]

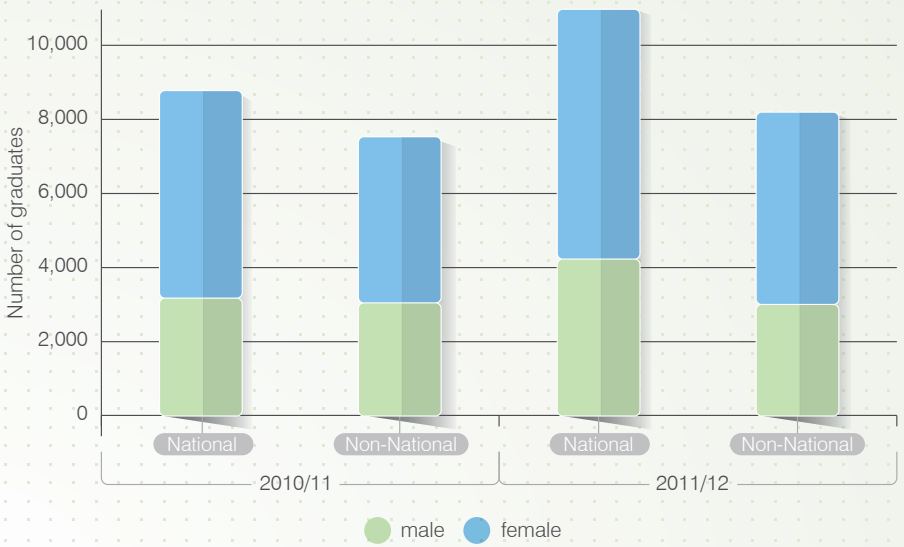


Figure 3.17: Number of graduates from UAE higher education institutions, 2010-11 and 2011-12

Source: NBS

The number of graduates from the UAE's higher education institutions has been rapidly rising and was counted over 19,000 in the academic year of 2011-12, with 62.5% occupied by female students.[5] It should be noted that there are also a large number of graduates from foreign universities, which have not been captured in national statistics. The rate of upper secondary graduation, which indicates the level of education, was 74% in 2012, whilst the government has set a target of 90% by 2021.[6]

1. Elite Media and NMC (2013)
2. OECD (1996), *The Knowledge-based Economy*, OCDE/GD(96)102, OECD, Paris.
3. OECD (2011b)
4. NBS (2012), *The Millennium Development Goals Third Report - United Arab Emirates*, NBS, Abu Dhabi.
5. Data from NBS based on the information from UAE Ministry of Higher Education and Scientific Research (MOHESR)
6. PMO, *Vision 2021: First-rate Education System* webpage, www.vision2021.ae/en/national-priority-areas/first-rate-education-system, accessed on 6 December 2014.

Since 2000, OECD has been conducting the Programme for International Student Assessment (PISA), a triennial international survey which aims to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students. The tests are designed to assess what extent students at the end of compulsory education can apply their knowledge to real-life situations and be equipped for full participation in society. The UAE joined the PISA 2012 assessment of reading, mathematics and science for the first time. Around 510,000 students from 65 economies took part in the tests.[1] The UAE came out the 46th (mathematics: 48th; reading: 46th; science: 44th) but aims to be among top 20 by 2021.

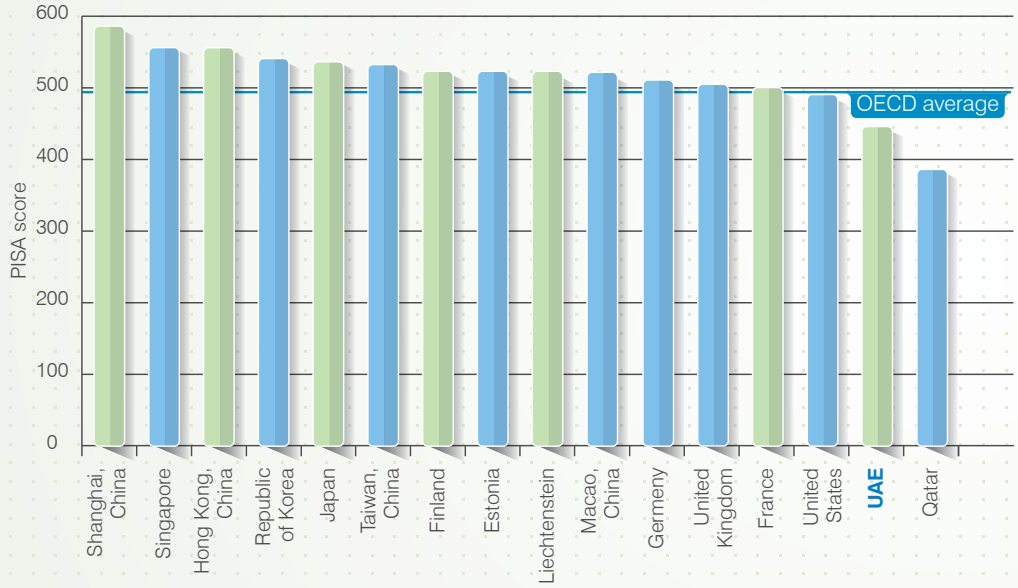


Figure 3.18: PISA 2012 average score of 3 subjects in top 10 and major economies

Source: OECD

3-2-3. Efficiency (Production and consumption)

E1: Ecological Footprint

Ecological Footprint (2014[2]; per capita): **7.75 global hectares** (8.2% down from 2012; **3rd** in the GCC counting from the lowest)

Ecological Footprint is a measure of human demand for natural capital in contrast with the planet's ecological capacity (biocapacity) to regenerate. It adds up all the ecological services a human population demands, including the amount of biologically productive area needed for crops, grazing land, built-up areas, fishing grounds and forest products. It also includes the area of forest needed to absorb carbon emissions that cannot be absorbed by the ocean. Both biocapacity and Ecological Footprint are expressed in a common unit, global hectare (gha). This indicator was developed in the early 1990s and has been promoted by WWF International and the Global Footprint Network through the biennial Living Planet Report. To date, humanity uses the equivalent of 1.5 planets to provide the resources we use and absorb our waste, resulting in the state of "global ecological overshoot".[3]

Compared to the last version issued in 2012, the UAE's Ecological Footprint revealed in *the Living Planet Report 2014* went down from 8.4 gha to 7.75 gha per capita, putting the UAE in the third place again behind Kuwait and Qatar, and ahead of Denmark and Belgium.[4] Despite the notable improvement in the results[5], the UAE's consumption level remains high and unsustainable in contrast to the low amount of productive land and sea areas (The UAE's biocapacity in 2014 is 0.63 gha per capita). CO_2 emissions from burning fossil fuels for generating energy and water has been the dominant component of the UAE's Ecological Footprint, comprising 74% against the global average of 53%. Once ranked as the country with the world's largest footprint, the UAE launched the Ecological Footprint Initiative in 2007 to make proactive efforts to improve energy efficiency and consumer behaviour (see also 2-2).

1. OECD, *PISA* webpage, www.oecd.org/pisa, accessed on 9 October 2014.
2. The 2014 results of Ecological Footprint are based on the data from 2010.
3. WWF International, *Ecological Footprint* webpage, http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/ecological_footprint, accessed on 12 October 2014.
4. WWF International et al. (2014), *Living Planet Report 2014: Species and spaces, people and places*, WWF International, Gland.
5. The Global Footprint Network notes that the values reported for the different years are not directly comparable or appropriate for analysis of the change in the UAE's Ecological Footprint over time.

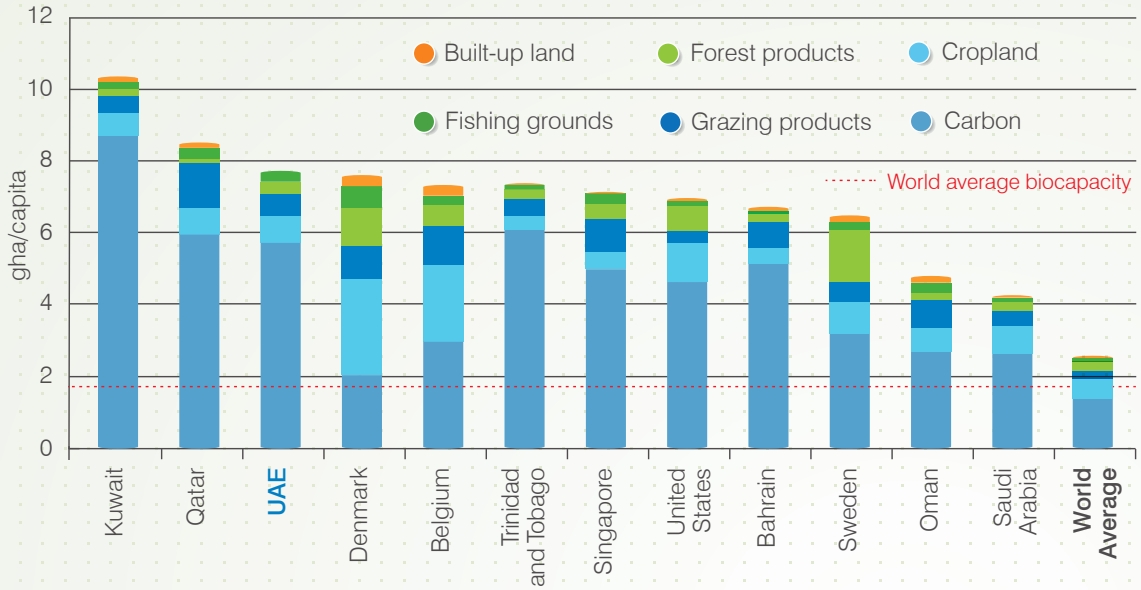


Figure 3. 19: Ecological Footprint in the largest 10 and GCC countries, 2014 (based on 2010 data)

Source: Global Footprint Network; WWF, *Living Planet Report 2014*

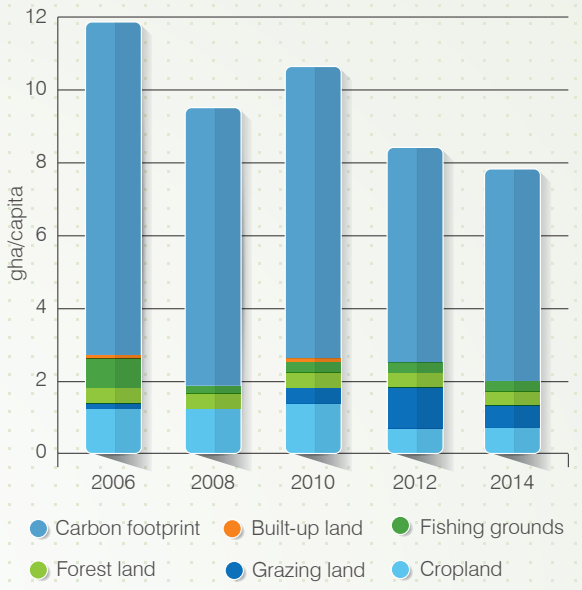


Figure 3.20: Trend in the UAE's Ecological Footprint per category

Source: Global Footprint Network

E2: GHG intensity

GHG emissions (2012; including land use): **173.2 million tCO_2e** (7.5% up from 2005)

GHG emissions per capita (2012): **18.8 tCO_2e** (51.6% down from 2005; **3rd** in the GCC in 2010 counting from the lowest)

GHG emissions per GDP (2012): **324 gCO_2e/USD** (23.3% down from 2005; **1st** in the GCC in 2010 counting from the lowest)

Climate change is a major issue that could have significant effects on the global economy as well as the realisation of sustainable development. The effects of the increasing atmospheric greenhouse gas (GHG) concentrations on global temperatures and the earth's climate will lead to significant changes in ecosystems, human settlements, agriculture and other socio-economic activities that could ultimately affect economic output. Major GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydro-fluorocarbons (HFCs) and sulphur hexafluoride (SF_6). CO_2 from the combustion of fossil fuels and biomass is a major contributor to GHG emissions. Other GHGs have a much higher per-weight impact on climate change. Progress in stabilising the concentration of GHGs in the atmosphere is dependent on whether and how fast GHG emissions can be decoupled from economic and population growth.[1]

The UAE's total GHG emissions have increased from 74 million tonnes of carbon dioxide equivalent (tCO_2e) in 1994 to 173 million tCO_2e in 2012 due to a strong economic growth and an increase in the population. However, the emissions per capita has declined by 51.6% between 2005 and 2012. The emissions per GDP has also decreased by 23.3% during the same period, making the UAE the least carbon-intensive economy in the GCC, almost equivalent to Australia.[2]

1. OECD (2011b)
2. MoEW and DCCE (2014) indicates that per capita GHG emissions was 20.63 tCO_2e and per GDP emissions was 481 gCO_2e/USD in 2012. This is due to the use of different population and GDP data. As indicated earlier, this report adopts the UN-DESA's *World Population Prospects* and the World Bank's *World Development Indicators* data to allow international comparison.

There are no significant changes in the sectoral distribution of emissions; energy generation represents more than 80% of the total emissions followed by industrial processes and product use (IPPU) and waste.[1]

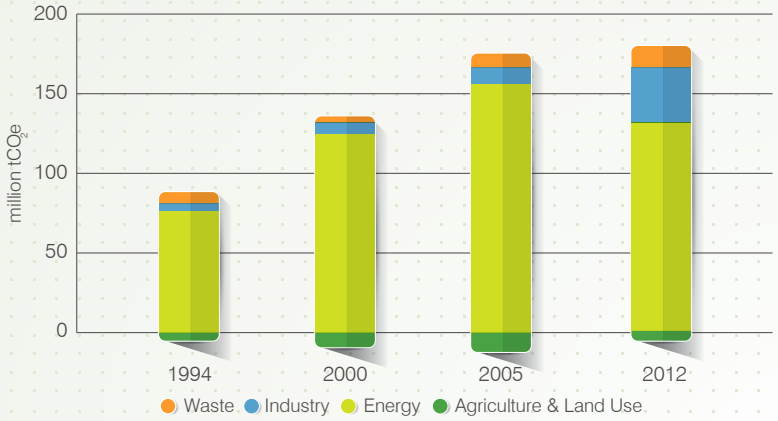


Figure 3.21: Trend in UAE's GHG emissions by sources, 1994-2012

Source: UAE National Communications to the UNFCCC; *UAE GHG Inventory 2012 Report*

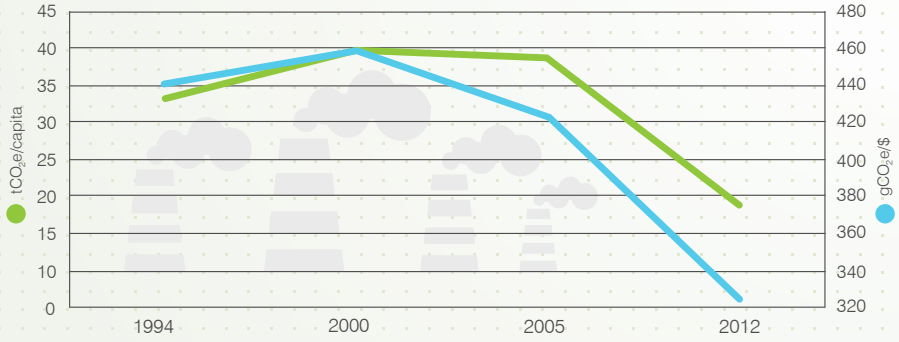


Figure 3.22: Trends in the UAE's GHG emissions per capita and GDP (PPP), 1994-2012

Source: UAE National Communications to the UNFCCC; *UAE GHG Inventory 2012 Report*; *World Development Indicators*

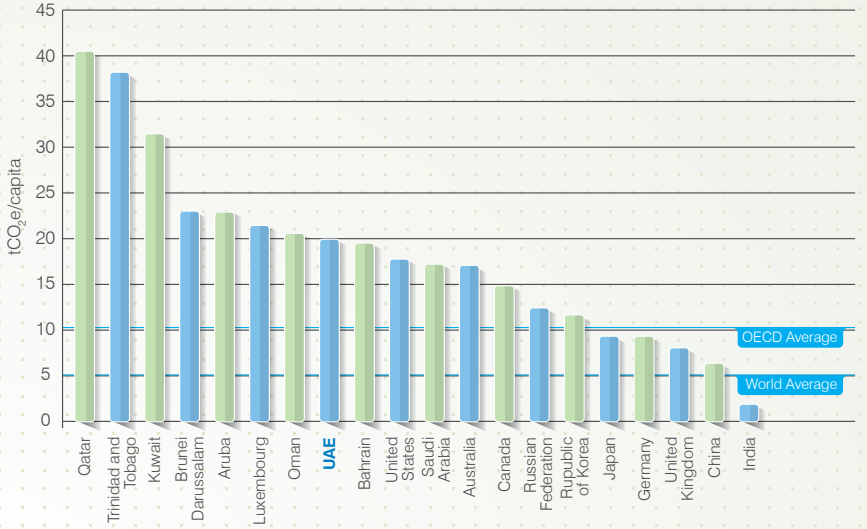


Figure 3.23: Annual per-capita CO_2 emissions from fossil fuel combustion and cement production in major economies, 2010

Source: US Oak Ridge National Laboratory; *World Development Indicators*

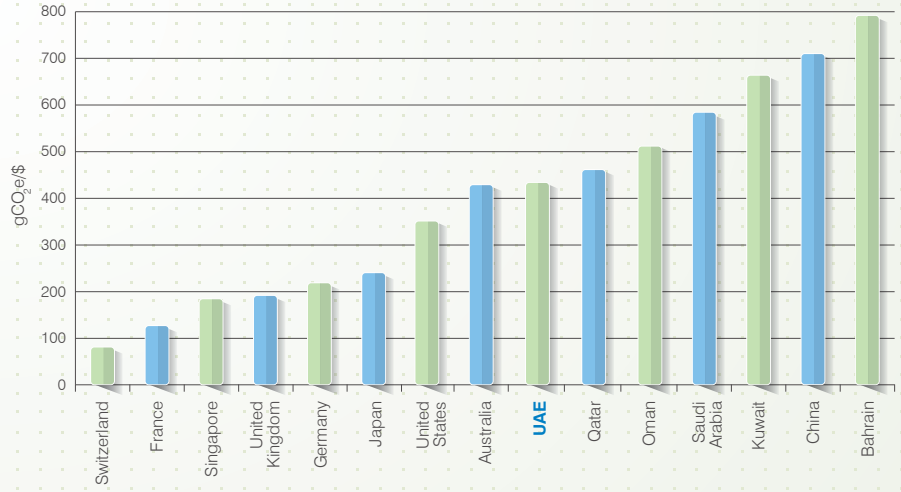


Figure 3.24: GHG emissions per GDP (2000 constant USD) in major economies, 2010

Source: World Resources Institute, *Climate Analysis Indicators Tool*; YCELP, *Environmental Performance Index 2014*

1. MoEW and DCCE (2014)

E3: Energy intensity

Electricity consumption (2012): **101.45 TWh** (6.2% up from 2011)
Electricity use per capita (2012): **11.0 MWh** (3.0% up from 2011)
Electricity use per GDP (2012): **0.19 kWh/USD** (little change from 2011)

Energy is a major component of the economy, both as a sector in itself and as a factor input to all other economic activities. The structure of a country's energy supply and the intensity of its energy use, along with changes over time, are one of the key determinants in enabling a Green Economy. The main challenge is to decouple energy use and related emissions from economic growth, through improvements in energy efficiency and the development and use of cleaner energy resources. Progress towards a Green Economy can be assessed against the energy productivity or intensity of the economy.[1]

Figure 3.25: Trend in total electricity consumption in the UAE, 2007-12

Source: MOENR, *Statistical Annual Report Electricity and Water for 2008-2012*; *State of the Environment Report 2014*

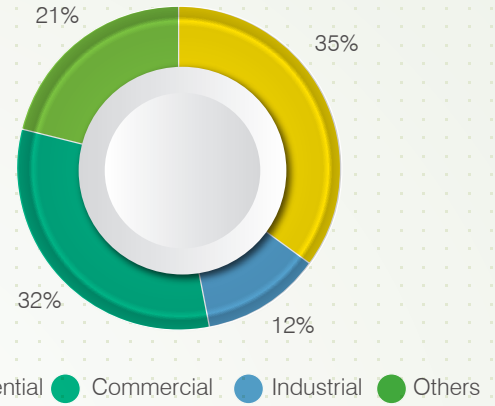


Figure 3.26: Sources of electricity consumption in the UAE, 2012

Source: *Statistical Annual Report Electricity and Water for 2008-2012*

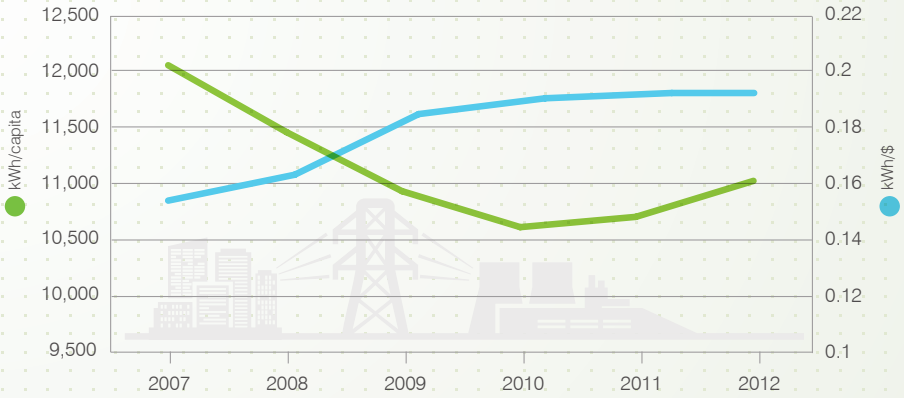


Figure 3.27: Trends in electricity consumption per capita and GDP (PPP) in the UAE, 2007-12

Source: *Statistical Annual Report Electricity and Water for 2008-2012*; *State of the Environment Report 2014*; *World Development Indicators*

1. OECD (2011b)

Along with its population increase and growth in the industrial sectors, the UAE's electricity demand has been rapidly increasing in recent years. Between 2007 and 2012, the country's annual electricity consumption increased by more than 8% per annum, exceeding 100 terawatt-hours (TWh) in 2012. The residential and commercial segments are the biggest users of power, consistently accounting for 62-70% of the total electricity use.[1] The intensity of electricity use per capita has been slightly increasing after the financial crisis, while the intensity per GDP has been stable. The UAE's per-capita and per-GDP energy use (including the use of fossil fuels in industrial processes, heating and cooling, transport, etc. as well as electricity) was the third lowest among GCC countries in 2011.[2] More analysis is needed to understand these trends, which do not always correspond with the results of GHG intensity (Indicator E2).

E4: Clean energy deployment

Electricity generation from renewable sources (2011) National KPI
0.02% (1st in the GCC)
Renewable energy capacity: **138.5 MW** (2013); **230 MW** (planned)
Carbon intensity of electricity production (2011): **600 gCO_2e/kWh** (34% down from 2004)

The use of renewable energy sources and of low-carbon and clean fuel technologies plays an important role in addressing climate change as well as energy security.[3] Despite the abundance of conventional energy sources, the UAE has shown its ambition and leadership in advancing the development and deployment of renewable energy technologies in the last decade as both Abu Dhabi and Dubai governments set an aspiring target of renewable energy integration in their energy mix.

One of the world's largest concentrated solar power (CSP) plants, Shams 1 was launched in March 2013 in the Western Region of Abu Dhabi, with a capacity of 100 MW. The first phase of Dubai's Mohammed bin Rashid Al Maktoum Solar Park was inaugurated in October 2013 with 13 MW of photovoltaic (PV) panels.

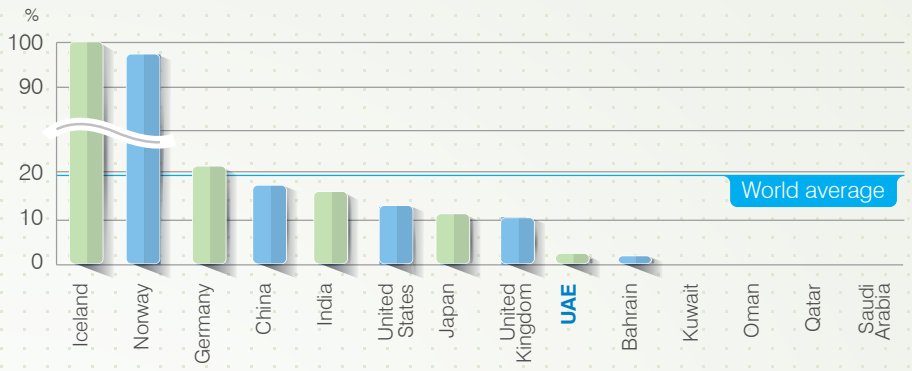


Figure 3.28: Proportion of electricity generation from renewable sources (incl. hydro), 2011

Source: US Energy Information Administration

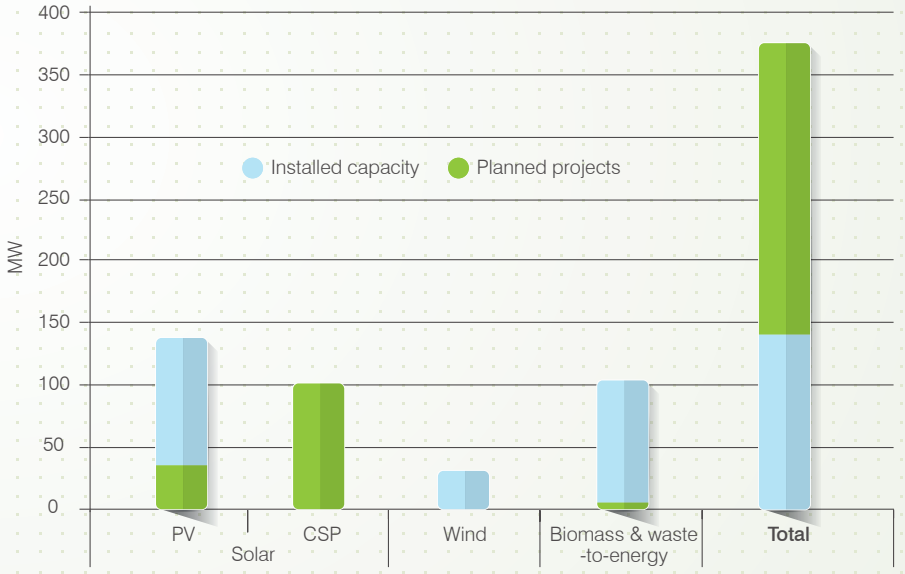


Figure 3.29: Capacity of renewable energy generation in the UAE, 2014 and planned

Source: MOFA, IRENA & REN21, *MENA Renewables Status Report*, updated

1. MOENR (2013), *Statistical Annual Report Electricity and Water 2008-2012*, MOENR, Abu Dhabi.
2. World Bank, *World Development Indicators*.
3. OECD (2011b)

As a result, the UAE's total renewable energy capacity jumped up to 138.5 MW, within a year from around 25 MW in 2012. There are also plans to build in the coming years the second phase of Mohammed bin Rashid Solar Park with a capacity of 100 MW, 30 MW of wind turbines on Sir Bani Yas Island, and a 100-MW waste-to-energy plant in Abu Dhabi (see also 2-2).[1]

According to the IEA's estimates, the carbon intensity of the UAE's electricity production has been steadily improving due to the active deployment of latest, efficient technologies in power plants. CO_2 emissions per 1 kWh of electricity generation was 600 grammes in 2011, 34% decrease since the peak recorded at 913 grammes in 2004, and is rapidly closing the gap with the global average of 536 gCO_2/kWh.[2,3] As the introduction of renewable and nuclear energy advances, the carbon intensity is expected to improve even faster. The UAE sets an ambitious target of 24% of the total electricity demand sourced from clean energy by 2021.

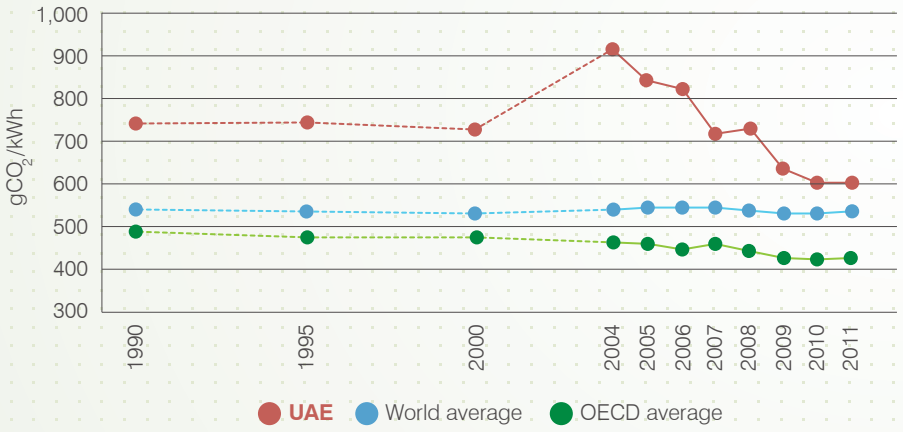


Figure 3.30: Trends in electricity consumption per capita and GDP (PPP) in the UAE, 2007-12

Source: Statistical Annual Report Electricity and Water for 2008-2012; State of the Environment Report 2014; World Development Indicators

E5: Material intensity

Total apparent steel use in finished products (2013): **7.07 million tonnes** (3% down from 2012)

Apparent steel use in finished products per capita (2013): **756.8 kg**[4] (**5th** highest in the world; **2nd** in the GCC; 4.5% down from 2012)

Apparent steel use in finished products per GDP (2012): **13.7 g/USD** (2.5% down from 2011)

Economic growth is generally accompanied by growing demand for raw materials. The main challenge is to ensure that materials are managed well and used efficiently at all stages of their lifecycle (extraction, transposition, transportation, consumption and disposal) so as to avoid waste of resources and reduce the associated negative environmental impacts. Progress towards a greener economy can be assessed through changes in the extraction of resources and domestic consumption of materials, and in the associated material intensity per capita and economic output.[5]

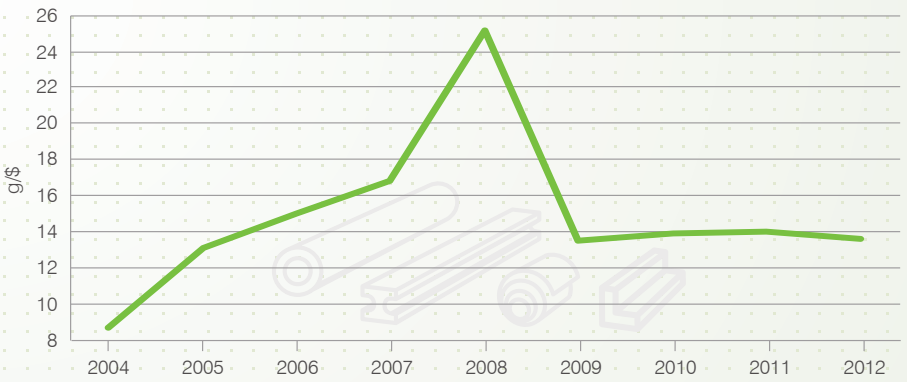


Figure 3.31: Trend in the UAE's apparent steel use (in finished products) per GDP (PPP), 2004-12

Source: World Steel Association, *Steel Statistical Yearbooks*; *World Development Indicators*

1. Sheikh Mohammed Solar Park is expected to eventually have a capacity of 1 GW by 2030. There is also a plan to build a 100-MW Nour 1 PV plant in Abu Dhabi, which has not been confirmed to date.
2. MoEW and DCCE (2014) estimated the UAE's carbon intensity of electricity production in 2012 at 690 gCO_2e/kWh.
3. IEA (2013b), *CO_2 Emissions from Fuel Combustion: Highlights 2013*, OECD/IEA, Paris.
4. UAE's per-capita figures are adjusted according to the latest *World Population Prospects* (UN-DESA Population Division, 2013) as *the Steel Statistical Yearbooks* apply previous population estimates of UN-DESA.
5. OECD (2011b)

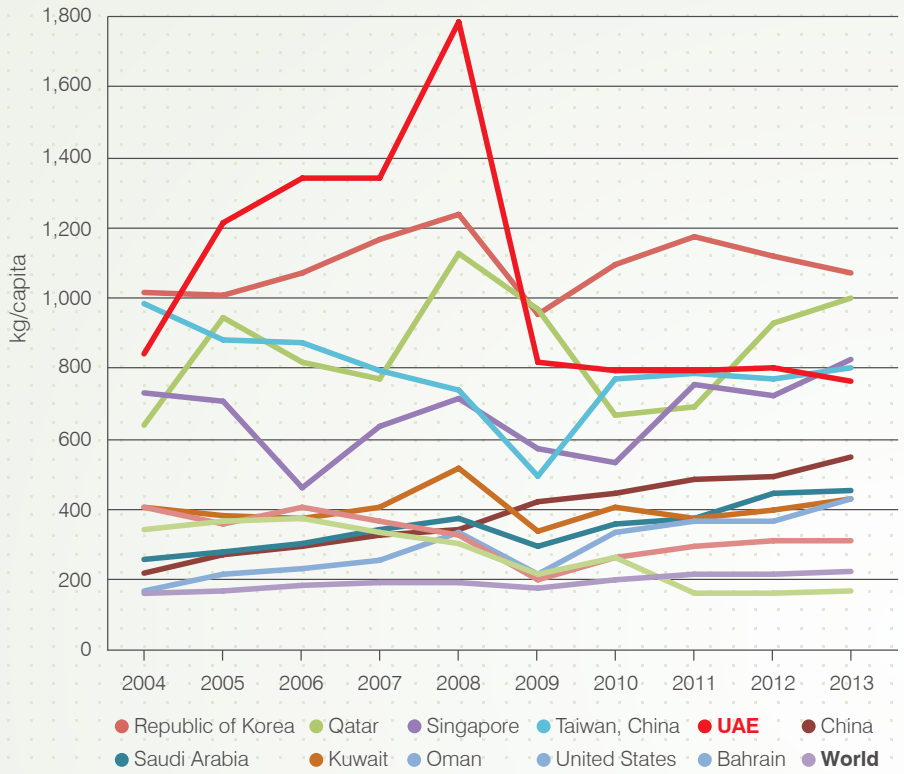


Figure 3.32: Trends in the apparent steel use (in finished products) per capita in major economies, 2004-13

Source: Steel Statistical Yearbooks, UAE figures are adjusted.

Since there is no material flow account available for the UAE, domestic steel consumption is here taken as a proxy to assess the intensity of total material use since steel is one of the most essential materials used in the large part of economic activities. The UAE's per-capita steel use was the highest in the world until the financial crisis and then after a radical drop it has remained stable, despite many ongoing large-scale developments, all of which require steel in their construction. The UAE is also the second largest steel producer in the GCC behind Saudi Arabia and the steel plants such as Emirates Steel Industries (ESI) are counted among the major heavy industries of the country. While the production capacity is expanding, it is still insufficient to meet the growing domestic demand and the country keeps relying on imports to fill the gaps.[2] The intensity of steel use per economic output (GDP) has been also stable at the 2005 level after the crisis.

E6: Water intensity

Annual municipal water consumption (2012): **1,680.8 million m³** (6.3% up from 2011)
Daily domestic water use per capita (2013): **353 litre** (3% down from 2008)
Municipal water use per GDP (2012): **3.1 litre/USD** (little change from 2011)

The efficiency of water use is key to ensuring the sustainable management of water resources, avoiding over-exploitation and degradation. Due to the lack of freshwater resources, the UAE relies for most municipal water (42% of total water sources) on modern desalination technologies. Wastewater is aggressively being recycled for irrigation (14% of total water use).[3] When looking at the domestic

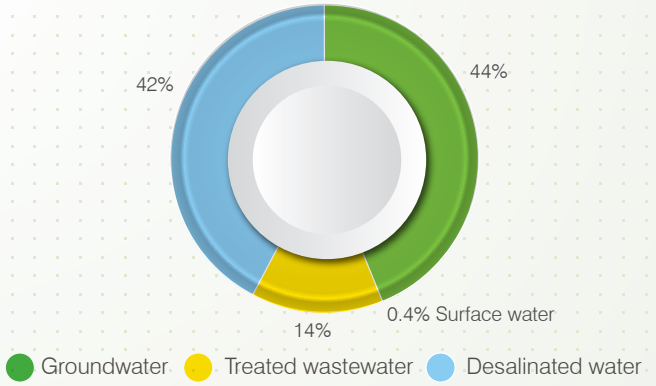


Figure 3.33: Water consumption per source in the UAE, 2013

Source: State of the Environment Report 2014

1. OECD (2011b)
2. Elite Media and NMC (2013)
3. MoEW (2015)

sector (household and commercial), the UAE's per-capita consumption in 2013 was 353 litres per day which is ranked among the highest in the world. It should be noted that domestic water use in the UAE differs significantly between populations, emirates and residential types.[1]

However, progress in the intensity in water use has been observed in recent years as per-capita consumption of municipal water (household, commercial, industrial and landscaping use) is gradually declining overall. The relative decoupling of municipal water use from economic growth has also been materialised after the financial crisis. The energy use and carbon intensity from desalination water production also needs to be monitored, as there is good potential to improve efficiency in desalination technologies and to encourage the use of alternative energy sources.

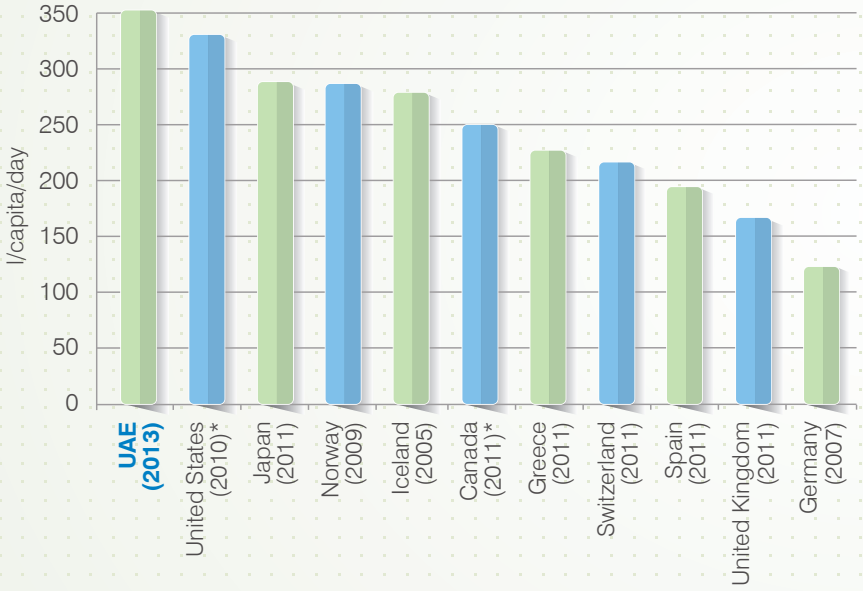


Figure 3.34: Daily domestic water consumption (household &commercial) per capita in major countries, latest

Source: MoEW; Eurostat; US Geographical Survey; Environment Canada; Japanese Ministry of Land, Infrastructure, Transport and Tourism

* The data of United States and Canada cover consumption by households only.

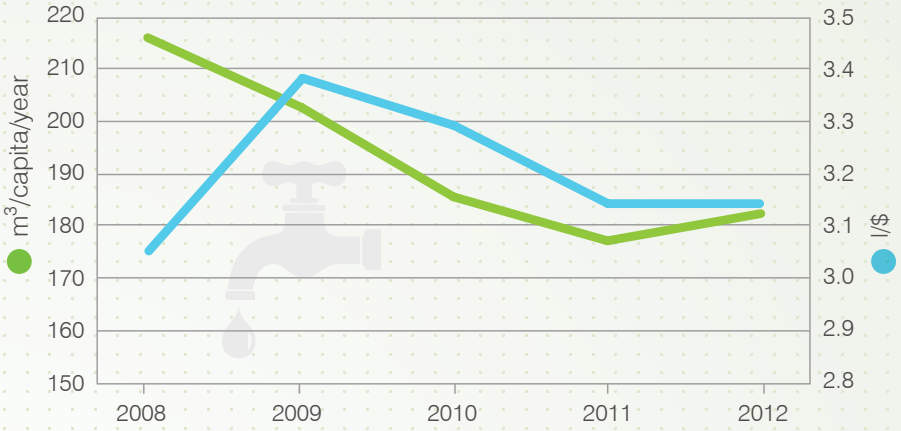


Figure 3.35: Trend in municipal water consumption per capita and GDP (PPP) in the UAE, 2008-12

Source: *Statistical Annual Report Electricity and Water for 2008-2012*; *World Development Indicators*; *World Population Prospects*

E7: Waste intensity

Daily municipal solid waste generation per capita (2014)**: 1.82 kg**
Total solid waste generation per GDP (2012)**: 49.0 g/USD** (1.5% up from 2011)
Recovery rate of municipal solid waste (2013) National KPI **23%** (Recycled: 15%; Composted: 8%)

The amount of waste generated by economic activity tends to rise in line with growing demand for raw materials. At the end of their use, many valuable materials contained in waste may be disposed of and are potentially lost to the economy if they are not reused or recycled. This affects both efficiency of material use and environmental quality in terms of land use, water and air pollution, and GHG emissions.[2] The quantity of solid wastes collected in the UAE in 2012 was more than 26 million tonnes. Nearly two-thirds of it (17 million tonnes) originated from construction and demolition, followed by municipal waste consisting of 24% (6.2 million tonnes).[3]

1. MoEW (2010)
2. OECD (2011b)
3. MoEW (2015)

The level of per-capita waste generation has been declining overall after the financial crisis and that of municipal waste is recorded 1.82 kg per day in 2014, even though it is still ranked high in the world.[1] [2] Relative decoupling of total waste generation from economic output has also been observed in the last few years.

Each emirate started its efforts for reducing and recycling waste in the last few years (see 2-6). The country's recovery rate of municipal waste has reached 23% in 2012 (15% recycled; 8% composted).[3] The government aims to achieve a 75% recovery rate and 0.9 kg of per-capita daily municipal waste generation by 2021.

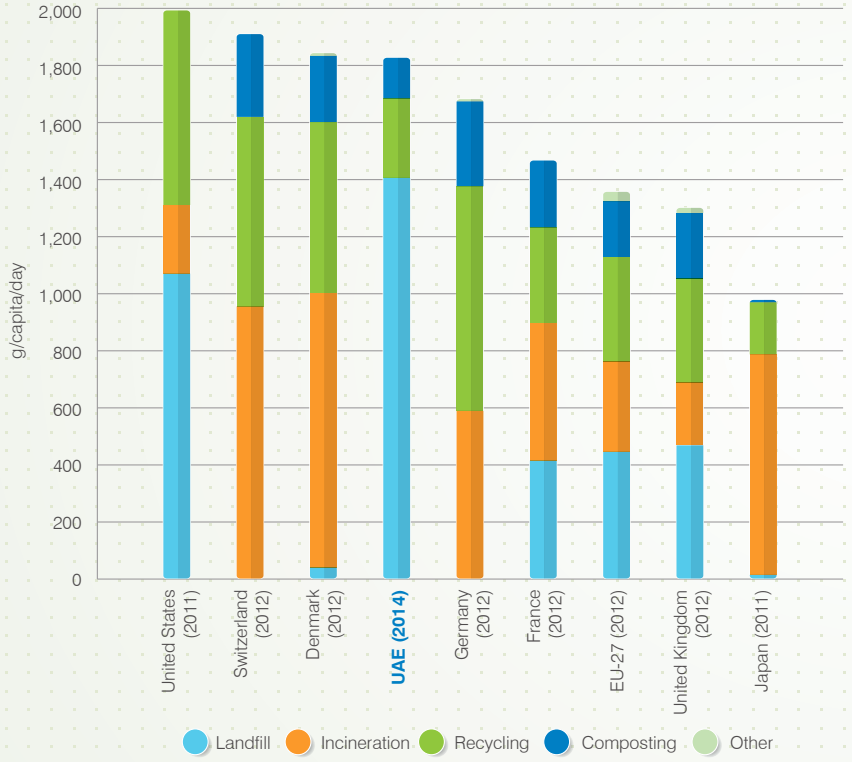


Figure 3.36: Municipal solid waste generation per capita and its treatment, latest

Source: MoEW; Eurostat; US Environment Protection Agency; Japanese Ministry of the Environment

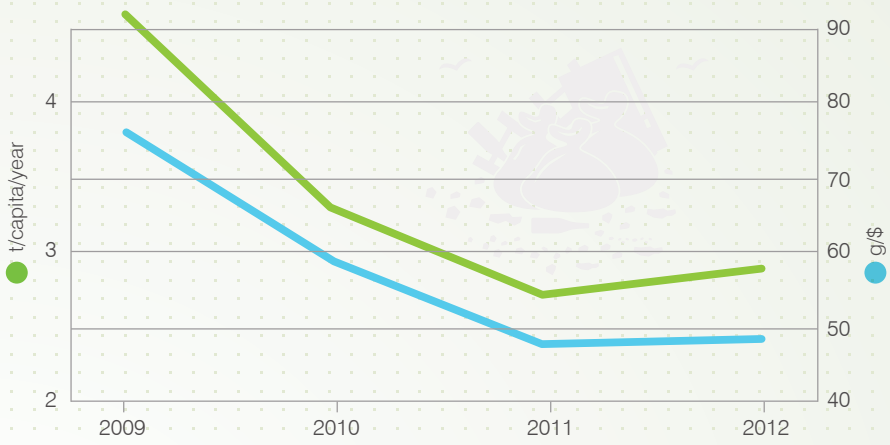


Figure 3.37: Trend in total collected wastes per capita and GDP (PPP) in the UAE, 2009-12

Source: NBS, *Wastes Survey*; *World Development Indicators*; *World Population Prospects*

E8: Land use sustainability

Agricultural production (2012): **567,664 tonnes** (51% down from 2011)
Agricultural productivity (2012): **11.6 t/ha** (28.7% down from 2011)
Value added of agricultural production (2012): **USD 926.9/ha** (55.6% up from 2011)

To preserve the limited freshwater resources, the efforts in improving agricultural land use have been focused on the adoption of modern, efficient irrigation systems that replace traditional surface irrigation. Modern systems that include the use of sprinklers, drips and fountains had been adopted in 91% of arable land in the country by 2011, a significant increase compared with 32% in 1999.

Meanwhile, the area of cultivated land and the amount of agricultural production reached a peak in 2002 at 2,400 km^2 with 5.7 million tonnes, but in the decade since, the production has fallen to one-tenth of the peak and the cultivated land has been more than halved. This is because the federal and local governments

1. Hoornweg, D. and P. Bhada-Tata (2012), *What A Waste: A global review of solid waste management*, Urban Development Series – Knowledge Papers, no. 15, World Bank, Washington, DC.
2. MoEW (2015)
3. MoEW (2015)

have aimed to reduce the cultivation of fodder crops, which constitute the majority of cultivated area but also consume a large amount of water, by cutting subsidies. MoEW has directed to increase agricultural productivity per unit of water used by shifting the cultivation to more value-added products such as vegetables and fruits. As a result of such efforts, the value added measured in terms of revenue per amount of production is rapidly increasing.

MoEW has also actively disseminated organic farming practices with support of the Emirates Organic Foods Certification Scheme (see 2-7; 3-2-5). The area of organic production is increasing in an exponential pace and has reached 4,446 ha by the end of April 2014 (54 crop farms and 3 livestock farms). The variety of organic products has been extended to about 60.[1]

Figure 3.38: Trend in annual agricultural production in the UAE, 2009-12

Source: State of the Environment Report 2014

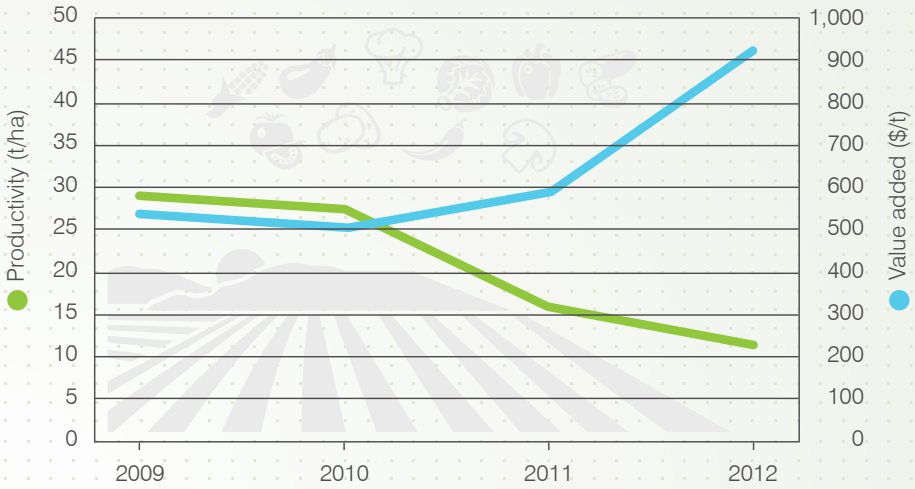


Figure 3.39: Trends in annual agricultural productivity and value added in the UAE, 2009-12

Source: State of the Environment Report 2014

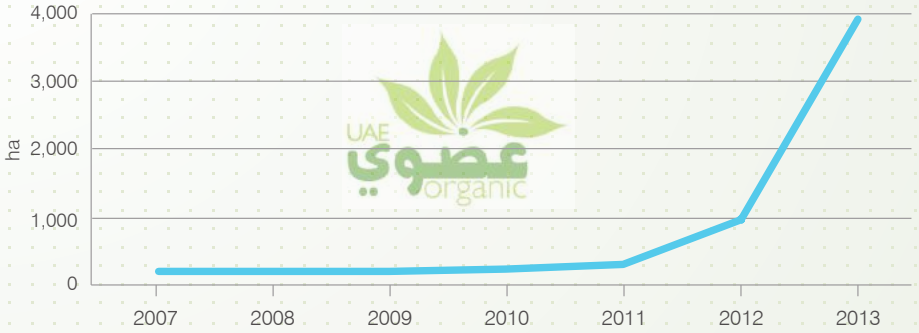


Figure 3.40: Trend in farming areas applying organic production methods in the UAE, 2007-13

Source: State of the Environment Report 2014

1. MoEW (2015)

E9: Marine resource use sustainability

Estimated total fish catches (2012): **72,728 tonnes** (3.2% down from 2011)
Number of fingerlings raised and released (2013): **301,634** (8.9% down from 2012)
Number of coral reef colonies farmed (2013): **3,600** (80% up from 2012)
Number of Crimean trees planted (2012): **15,000** (50% up from 2011)

Corresponding to the dramatic decline in fish stocks in both the Arabian Gulf and the Gulf of Oman (see 3-2-1), the quantity of fish catches in the UAE has kept declining since 1999, reaching less than two-thirds the peak amount. The UAE's efforts to limit unsustainable exploitation of marine resources and to compensate declined stocks have been focused on the release of fingerlings into the sea and the preservation of natural reserves where marine species are safely sheltered so as to strengthen existing fish stocks and stimulate the recovery of stocks. The country also started looking into the development and commercial production of farmed fish (see 2-7).

Since the establishment of MoEW's Marine Environmental Research Centre in the Emirate of Umm Al Quwain in 1984, over 2.8 million fingerlings including grouper, mullet and sea bream have been released into the sea, including over 300,000 per annum in the last two years of 2012-13. The ministry has succeeded in farming coral reefs using modern techniques, and between 2011-13, 4,400 colonies had been grown in the east coast (the Gulf of Oman) and 2,000 colonies in the coast of Umm Al Quwain (the Arabian Gulf). The ministry is also experimenting with the germination and cultivation of Crimean trees (a type of mangroves) and the grown seedlings have been distributed to different parts of the coastal areas and

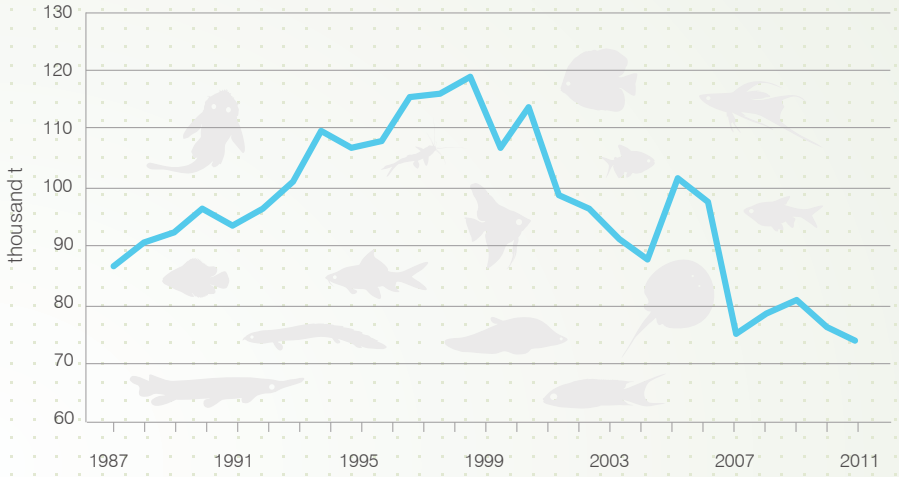


Figure 3.41: Trend in total fish catches in the UAE, 1987-2012

Source: State of the Environment Report 2014

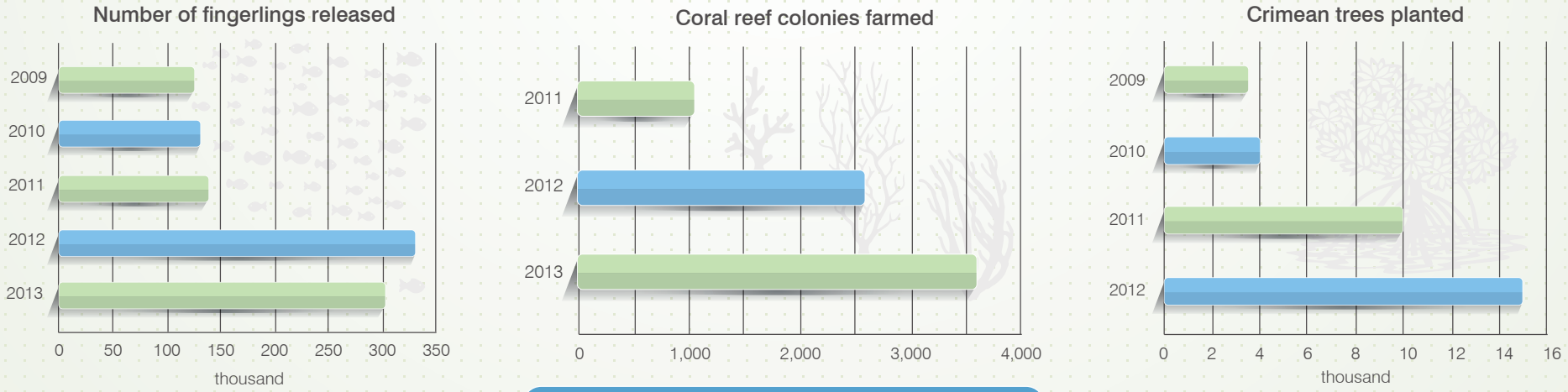


Figure 3.42: Trends in efforts for improving fish stocks in the UAE

Source: State of the Environment Report 2014

islands. The number of Crimean trees planted in the country is rapidly increasing and there is an expectation for the improvement in the environment for marine species and birds.[1]

E10: Consumer attitude and behaviour

Environmentally aware citizens (Abu Dhabi; 2013): **60%** (16 points up from 2012)

Citizens taking environmentally sound behaviour (Abu Dhabi; 2013): **68%** (13 points up from 2012)

Figure 3.43: Trends in environmental awareness and behaviour of Abu Dhabi residents, 2008-13

Source: EAD, *Abu Dhabi Environmental Awareness & Behaviour Surveys*
Note: No survey was conducted in 2011.

Personal behaviour and choices in daily life – such as what to eat, what to wear and how to get to work or school – are one of the most critical factors to determine the success in greening the economy as they have a significant effect on the environment as well as on economic outcomes. Capturing the trends of this aspect, however, has been very complex since not only they are highly qualitative and diverse among people but also there is a substantial gap between good intentions of people (attitude) and their actual behaviour.

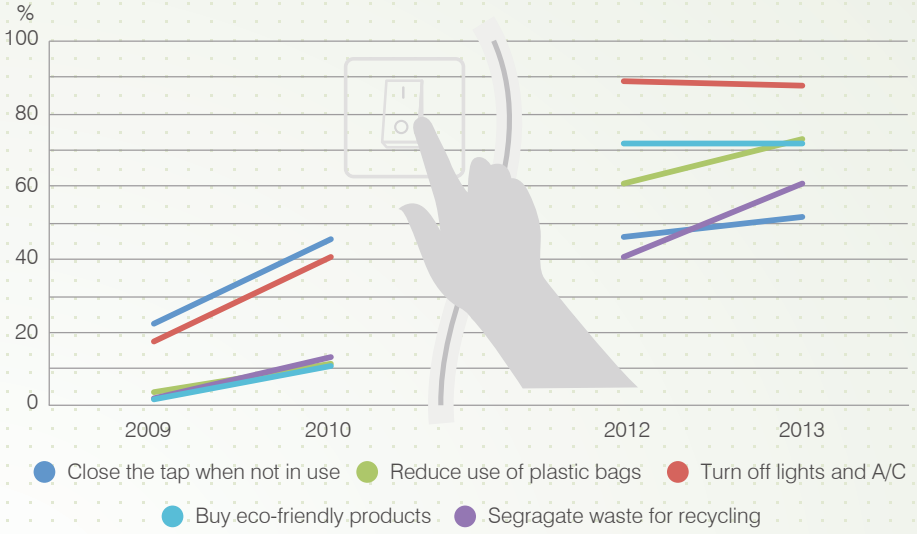


Figure 3.44: Trends in 5 environmental actions by Abu Dhabi residents, 2009-13

Source: *Abu Dhabi Environmental Awareness & Behaviour Surveys*
Note: No survey was conducted in 2011.

EAD has invested in efforts to monitor and analyse the residents' environmental awareness and eco-friendly actions by regularly conducting the Environmental Awareness and Behaviour Survey since 2008 among nearly 2,000 people representing various nationalities, ages and industries in the emirate.[2] The results show that the overall level of awareness on environmental issues was recorded the highest in 2013 at 60% of all respondents. In 2013, 68% of the survey participants reported pro-environment practices, compared to 55% in 2012. Looking into specific areas, the proportions of people buying eco-friendly products, reducing use of plastic bags and segregating waste for recycling have drastically increased.[3] This is probably because the products and options for allowing people to take those actions have been provided in the UAE only in the last few years.[4] This survey is currently limited to the Emirate of Abu Dhabi and may well be extended nationwide for a better understanding and monitoring.

1. MoEW (2015)
2. No similar survey was conducted in 2011.
3. EAD (2011), *The Environment: What do we think about it? – The Abu Dhabi Environmental Awareness & Behaviour Survey*, EAD, Abu Dhabi; EAD (2014), *Awareness & Behaviour Survey – 2012 & 13: Summary report*, EAD, Abu Dhabi.
4. The questions and methodology used for the surveys in 2008-10 and in 2012-13 are different. Please note that the results of 2008-10 and 2012-13 are not directly comparable.

3-2-4. Outputs (Well-being)

W1: Economic contributions from non-oil sectors

Non-oil GDP (2013): **AED 732 billion** (USD 199 billion; 5.5% up from 2012); **67.3%** of total GDP (0.1 point up from 2012)

Non-oil real GDP growth (2013) National KPI **5.4%** (2.1 points up from 2012)

Non-hydrocarbon export (2013): **28.5%** of total export (0.9 point up from 2012)

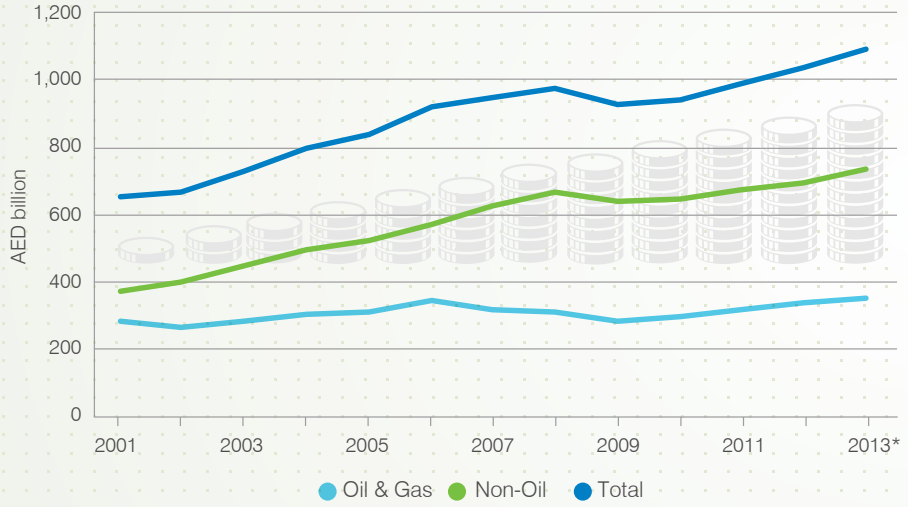


Figure 3.45: Trends in the UAE's total, oil & non-oil GDP (constant 2007), 2001-13

Source: NBS
* 2013 data is preliminary

GDP and rate of change in real GDP is the most common, conventional measure of economic activity of a nation. As called for in *the UAE Vision 2021*, the country aims to accelerate the reinvestment of revenues from exporting oil and gas into economic diversification in preparation for the approaching post-oil era

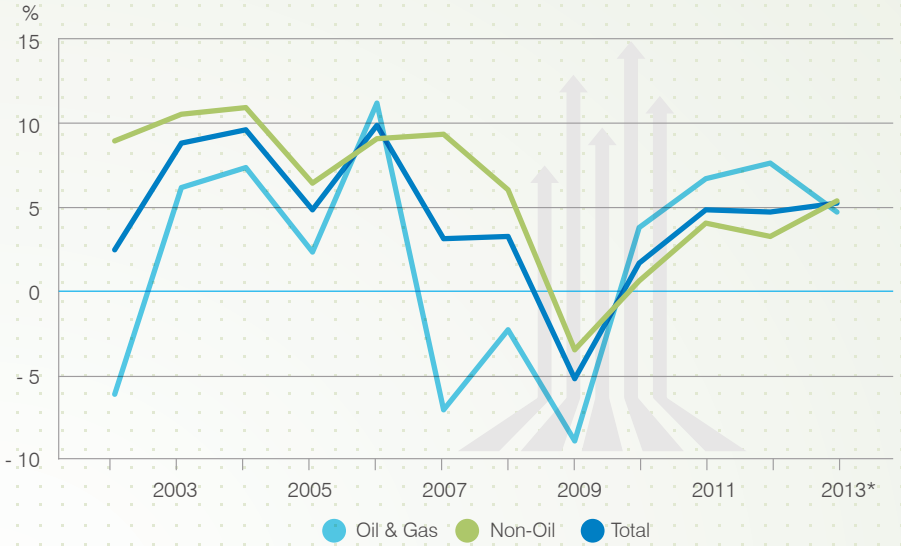


Figure 3.46: Trends in the UAE's total, oil & non-oil GDP growth rates (constant 2007), 2002-13

Source: NBS
* 2013 data is preliminary

and knowledge-based economy. The revenues from the non-oil sectors has increased significantly over the years at an annual growth rate of 10%, whilst the GDP from fossil fuels has shown only a relatively modest growth. Non-oil revenues represented approximately 57% of the UAE's total GDP in 2001 and had increased to 67% by 2013. The non-oil real growth rate has reached 5.4% in 2013 after recovering from a contraction caused by the financial crisis.[1] The increasing economic contribution from the non-oil sector has greatly helped mitigate the fluctuation of oil revenues. The UAE aims to maintain 5% of annual real GDP growth from the non-oil sector.

The balance of trade for the UAE is driven by significant imports of products and services not produced locally as well as significant oil and gas export revenues. The further stimulation of export of non-oil goods and services and the promotion of import substitution are key to maintaining a healthy level of trade balance. Non-oil export has been rapidly rising in the last decade, its proportion of the total export increasing from 17.5% in 2001 to 28.5% in 2013.[2]

1. Central Bank of the UAE (2001-13), *Annual Reports*, Central Bank of the UAE, Abu Dhabi.
2. Central Bank of the UAE (2001-13)

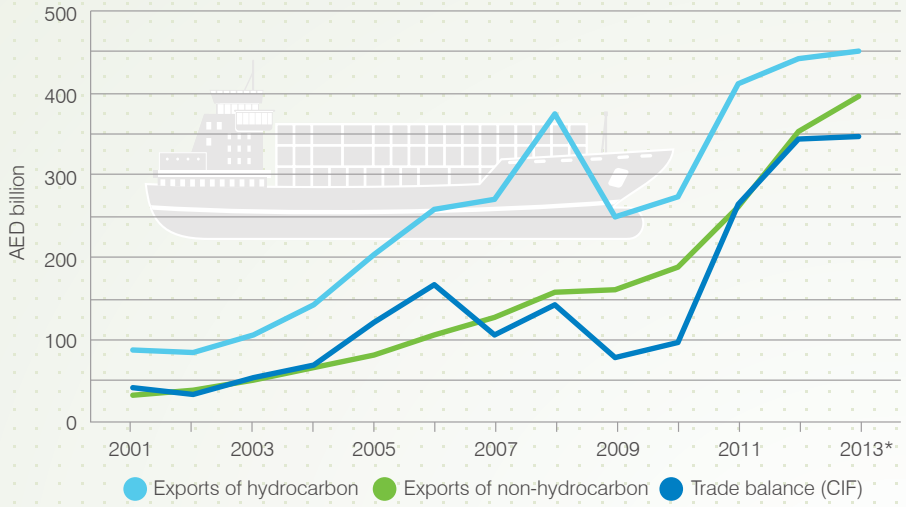


Figure 3.47: Trends in the UAE's export and trade balance, 2001-13

Source: Central Bank of the UAE, *Annual Reports*
* 2013 data is preliminary
Note: "Hydrocarbon" includes crude oil, petroleum products and gas; CIF = Cost, insurance and freight

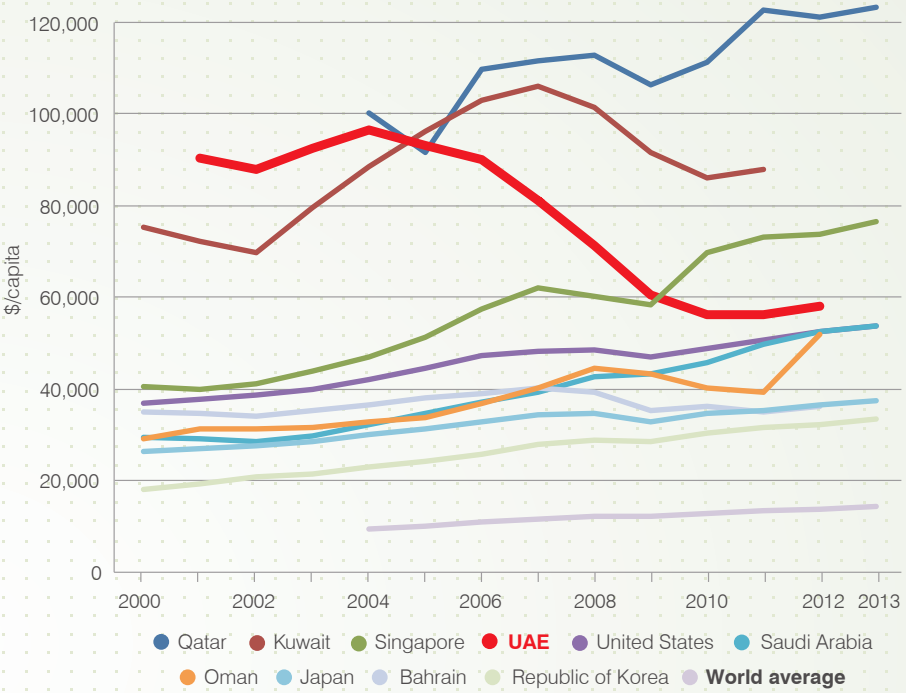


Figure 3.48: Trends in GNI per capita (PPP-based) in major economies, 2000-13

Source: *World Development Indicators*

It should be noted that GDP does not address all aspects of welfare and GDP growth is limited as an output indicator. It is important to understand the outcomes of economic activities, as well as the progress in greening the economy, in combination with other indicators such as those presented below.

W2: Standard of living

GDP per capita (2012): **USD 58,042** (PPP-based) (**8th** in the world; **3rd** in the GCC)
Gross national income (GNI) **per capita** (2012) National KPI
USD58,090 (PPP-based) (**11th** in the world; **3rd** in the GCC)

While GDP is used to analyse and forecast on the state of the national economy, it is more relevant to study gross national income (GNI) to analyse and compare living standards between countries and over time. GNI is defined as GDP plus net primary income from abroad, which consists of interest, dividends on shares, the return on direct investment, wages and salaries and certain taxes and subsidies made in other countries. That is, GDP measures the output within a country, whereas GNI measures the income received by inhabitants of the country and GNI per person indicates average individual income in the country.[1] Net primary income from abroad seems negligible for UAE inhabitants as the development of GDP and GNI is similar.

In most advanced economies, both GDP and GNI per capita generally show a growth even though differences are observed in its speed. However, the trends

1. Swedish National Institute of Economic Research (NIER) (n.d.), *GDP and Demand in Sweden*, Konjunkturinstitet, Stockholm.

in the UAE's GDP and GNI per capita are unique as they kept declining after a peak was recorded at over USD 96,000 in 2004. This is probably due to a rapid population growth particularly that of unskilled workers from abroad whose economic output is relatively low.[1] After the financial crisis, both GDP and GNI per capita have remained stable at around USD 60,000.[2] The UAE aims to increase its GNI per capita by 65% by 2021, becoming among top 10 countries.

W3: Human development

Human Development Index (2013) National KPI **40th** in the world (no change from 2012); **3rd** in the GCC

Measuring "human development" is an alternative approach to measuring welfare by the single focus on economic growth. Human development is defined as "the process of enlarging people's choices", which allows them to "lead a long and healthy life, to be educated, to enjoy a decent standard of living".[3] The Human Development Index (HDI) was developed and has been measured by the United Nations Development Programme (UNDP) since 1990. UNDP's *2014 Human Development Report* presented the HDI values for 2013 for 187 countries and UN-recognised territories.

The UAE's HDI value for 2013 is 0.827, positioning the country at the 40th, one of the "very high human development" group. The fundamental drivers of the UAE's strong performancwe in the HDI are health, education and social improvements which have delivered consistently better life chances and life expectancy for people.[4] Between 1980-2013, the UAE's HDI value increased from 0.640 to 0.827, an increase of 29.2% or an average annual increase of about 0.78%. During the same period, the UAE's life expectancy at birth increased by 9.2 years, mean years of schooling increased by 5.5 years and expected years of schooling increased by 4.7 years.[5] The UAE aims for further advancement in human development, targeting its HDI ranking to be among the top 10 by 2021.

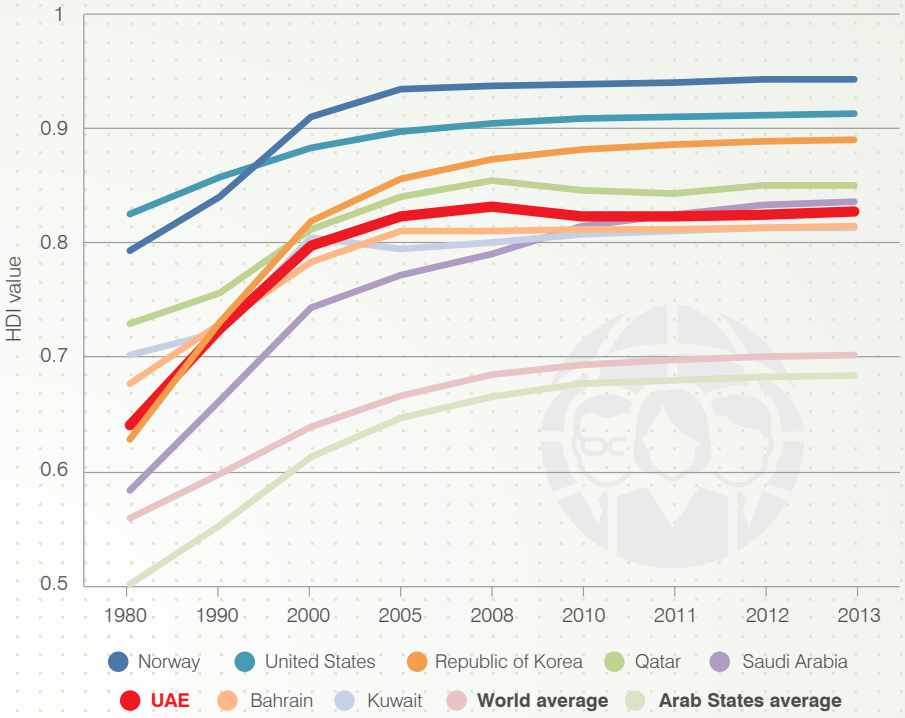


Figure 3.49: Trends in the Human Development Index in major countries 1980-2013

Source: UNDP, *Human Development Reports*

W4: Quality of life

World Happiness Index (2013) National KPI **14th** in the world; **1st** in the GCC

The gap between statistical measurements and public perception of socio-economic progress has become a subject of political discussions over the last few

1. Gini co-efficient, which is commonly used as a measure of inequality of income or wealth, is not available in the UAE.
2. To smooth fluctuations in prices and exchange rates, World Bank uses a special Atlas method which applies a conversion factor that averages the exchange rate for a given year and the two preceding years, adjusted for differences in rates of inflation between major advanced economies. According to this method, the UAE's GNI per capita in 2012 was adjusted to USD 38,620, ranked the 35th in the world. The trends show a modest growth from USD 33,720 in 2001. This report uses PPP-based GNI measures as set as one of the National KPIs.
3. UNDP (1997), *Human Development Report 1997*, p.15, UNDP, New York.
4. Elite Media and NMC (2013)
5. UNDP (2014), *United Arab Emirates: Explanatory note on the 2014 Human Development Report composite induces*, UNDP, New York.

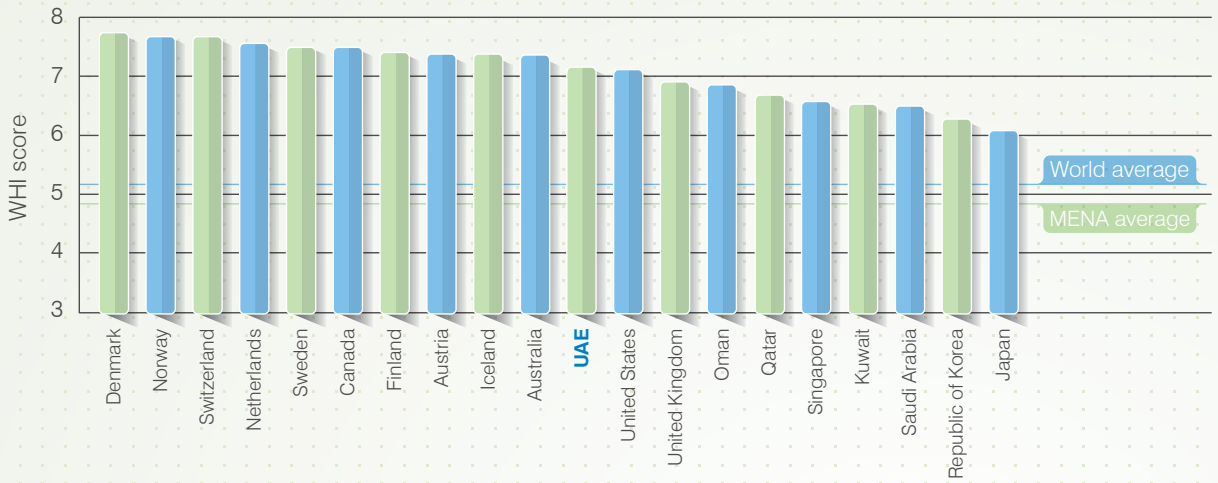


Figure 3.50: Results of the World Happiness Index in top 10 and major countries, 2010-12

Source: SDSN, *World Happiness Report 2013*

years, as the exclusive use of GDP as a global indicator of the country's progress has been called into question. In 2009, the Commission on the Measurement of Economic Performance and Social Progress led by Joseph Stiglitz, Amartya Sen and Jean-Paul Fitoussi recommended broadening the scope of traditional measures for economic performance to include measures of quality of life, inequalities and well-being, as well as better taking into account sustainability and environmental conditions.[1]

Following this development, in July 2011, the UN General Assembly passed a resolution inviting member countries to measure the happiness of their people and to use it to help guide their public policies. At the first UN High-level Meeting on Happiness and Well-Being in April 2012, *the World Happiness Report* was launched by the Sustainable Development Solutions Network (SDSN) as a global measure of happiness.[2] The second edition was published in September 2013. The report uses data from the Gallup World Poll (the first edition used data set from 2005-07; the second from 2010-12) to assess the extent to which individuals feel happy and satisfied with their lives. On a scale running from 0 to 10, six key variables explain three-quarters of the variation in annual national average scores of happiness, including real GDP per capita, healthy life expectancy, having someone to count on, perceived freedom to make life choices, freedom from corruption, and generosity.[3]

In the first edition of 2012, the UAE was ranked the highest in the Arab world at global rank of the 17th out of over 150 countries with a score of 6.734. This has further improved to the 14th in 2013 with a score of 7.144 (the global average was 5.16), indicating the positive trend in perceived happiness and quality of life.[4] The UAE is targeting to get into the top five by 2021.

Performing a traditional Emirati dance

1. Stiglitz, J.E., A. Sen and J. Fitoussi (2009), *Report by the Commission on the Measurement of Economic Performance and Social Progress*, French National Institute of Statistics and Economic Studies (INSEE), Paris.
2. Helliwell, J., R. Layard and J. Sachs (eds) (2012), *World Happiness Report*, Columbia University, New York.
3. Helliwell, J., R. Layard and J. Sachs (eds) (2013), *World Happiness Report 2013*, SDSN, New York.
4. Helliwell, J., R. Layard and J. Sachs (eds) (2013)

W5: Environmental health

Environmental Performance Index (2014): **25th** in the world (52 places up from 2013); **1st** in the GCC

Population weighted exposure to PM2.5 (2012): **11.68 μg/m³** (67% up from 2000; **2nd** in the GCC counting from the lowest)

Access to sewage treatment (2012): **67.1%** (**32nd** in the world; **2nd** in the GCC)

Environmental conditions affect the quality of life of people in various ways. They affect human health through air and water pollution, exposure to hazardous substances and noise, as well as through indirect effects from climate change, transformations in water cycles, biodiversity loss and natural disasters. People also benefit from environmental services, such as access to clean water and nature. Degraded environmental quality can have substantial economic and social consequences, from health costs to reduced agricultural output, impaired ecosystem functions and a generally lower quality of life. As such, environmental outcomes are important determinants of well-being and one of the ultimate objectives for greening the economy.[1]

The Environmental Performance Index (EPI) is a method of quantifying the environmental performance of countries, which was designed to supplement the seventh target ("Ensure environmental sustainability"), set forth in the UN Millennium Development Goals. It was developed by the Yale Centre for Environmental Law and Policy (YCELP) at Yale University and the Centre for International Earth Science Information Network (CIESIN) at Columbia University in partnership with WEF. Since a pilot version was issued in 2006, the index has been published every two years. The 2014 EPI is constructed through the calculation and aggregation of 20 indicators from nine issue categories, including air quality, forests, fisheries, and climate and energy. Scores are converted to a scale of 0 to 100, with 0 being the furthest from the target and 100 being the closest.[2]

The UAE's EPI results have shown a dramatic upturn from the 152th out of 163 countries benchmarked in 2010 (Score: 40.7) to the 77th in 2012 (50.91) and the 25th out of 178 countries in 2014 (72.91).[3] When looking into the issues directly related to human health, 67.1% of wastewater received treatment in 2012 in the UAE, which indicates relatively high quality of water infrastructure and sanitation (see also 2-6). On the other hand, one of the air quality indicators, population weighted exposure to fine particles with diameter of 2.5 micrometres or less (PM 2.5) was recorded at 11.68 microgrammes (μg) per m³ in 2012, increased by 67% from 2000.[4]

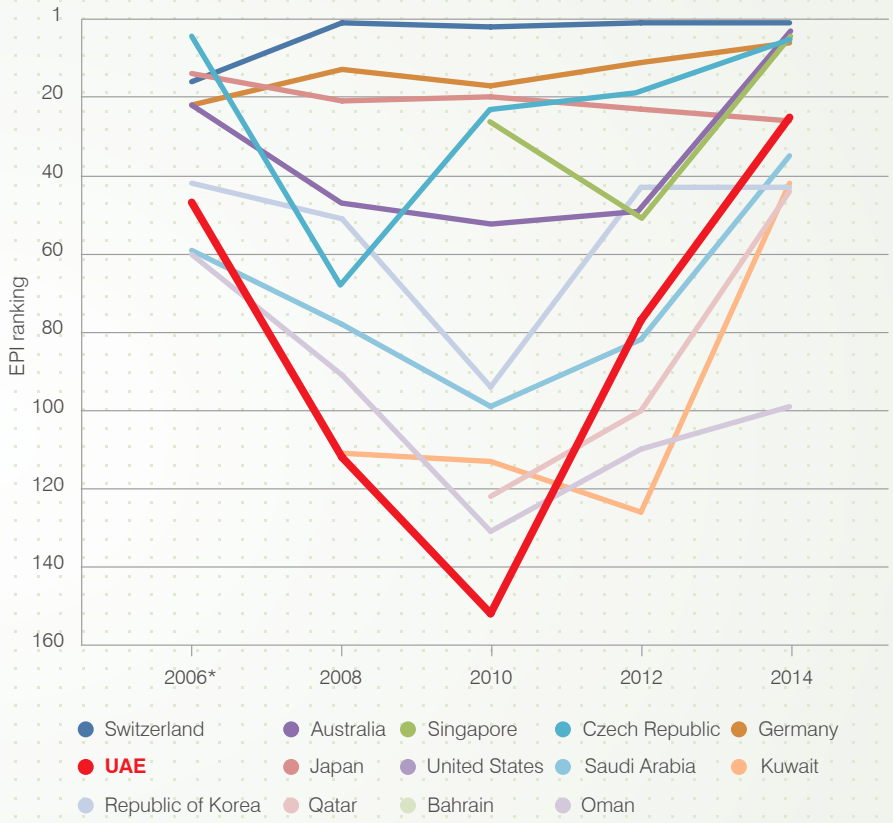


Figure 3.51: Trends in the Environmental Performance Index in major countries, 2006-14

Source: YCELP et al., *Environmental Performance Index Reports*
*2006 survey was a pilot.

1. OECD (2011b)
2. YCELP, *Environmental Performance Index* webpage, http://epi.yale.edu/, accessed on 16 October 2014.
3. The results of the EPI are not simply comparable between different years since the composition and weighing of indicators have been greatly revised each time. The EPI therefore provides back-casted indicator scores which apply the 2014 EPI methodology to historic data starting from 2002. According to back-casted results, the UAE's overall score declined by 0.95% in 10 years from 2002 to 2012.
4. YPELP, *Environmental Performance Index* webpage.

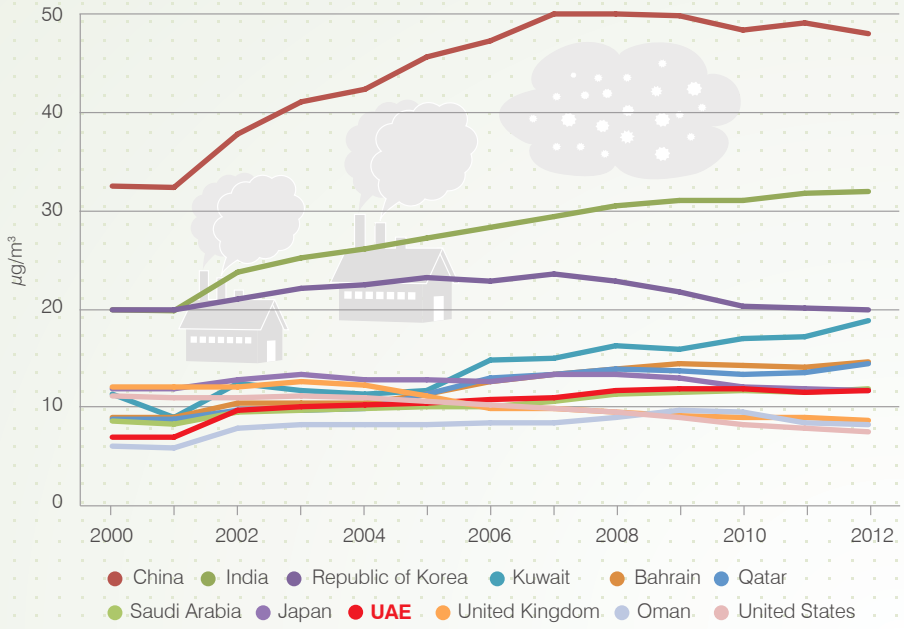


Figure 3.52: Population weighted exposure to PM2.5 in major countries, 2000-12

Source: Environmental Performance Index Reports

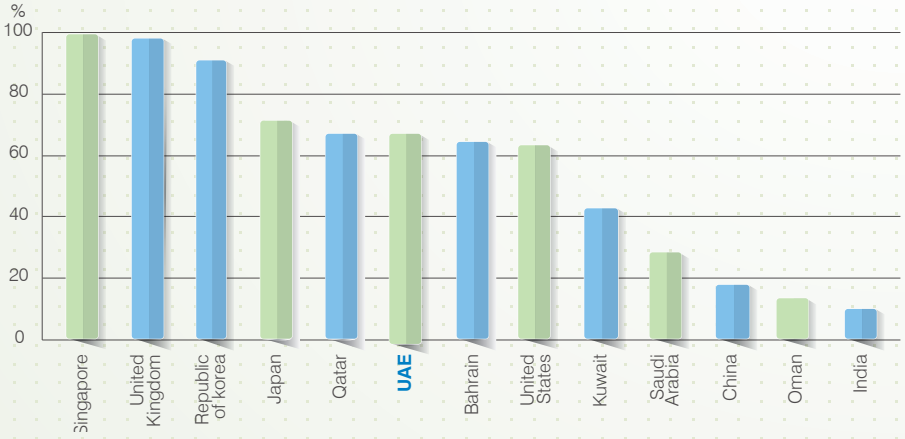


Figure 3.53: Rates of anthropogenic wastewater receiving treatment in major countries, 2012

Source: Environmental Performance Index Reports

3-2-5. Policies

P1: Environmental expenditure

MoEW budget (2014): **AED 308.71 million** (USD 84.1 million) (2.2% down from 2013; **0.66%** of the total federal budget)

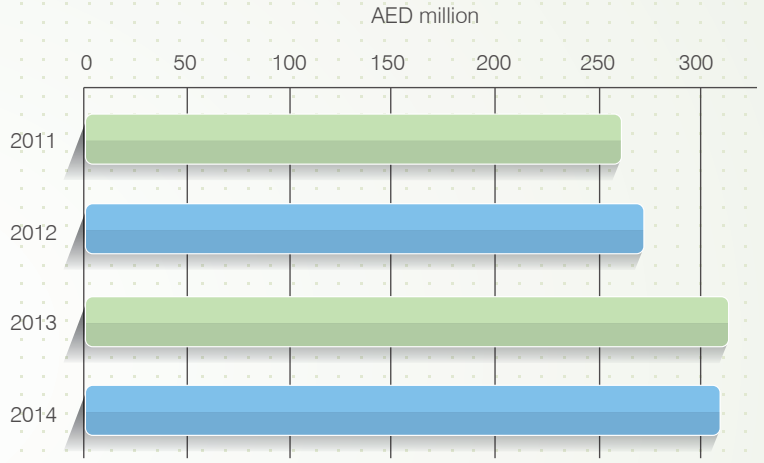


Figure 3.54: Trend in annual budget of UAE Ministry of Environment and Water, 2011-14

Source: MoEW

Environmental expenditure is the primary indication of what extent the country considers environmental sustainability as a priority for running its economy and society. Environmental protection expenditure (EPE), which was recognised by the UN Statistical Commission (UNSC) in 2012 as part of the System of Integrated Environmental and Economic Accounting, compiles all goods and services aimed at protecting the environment and encouraging the sustainable use of natural resources, including those provided by the public sector, industry and environmental services providers. This measure helps assess the effectiveness of environmental regulations and policies as well as analyse the links between environmental pressures and economic structure. In the European Union (EU), Eurostat collects this data through a joint Eurostat/OECD questionnaire. The total EPE in EU 28 Member States in 2012 amounted 2.2% of the bloc's total GDP. The

public sector spending was 0.67% of GDP, for which waste management and wastewater treatment were the two main components.[1,2]

At the moment, the only available national data related to environmental expenditure in the UAE is the budget of MoEW. The UAE's federal budget is set for every three-year term, and the total budget for 2011-13 amounted AED 122 billion (USD 33.2 billion) and that for 2014-16 increased by nearly 15% to AED 140 billion (USD 38.2 billion). The MoEW's budget for 2011-13 was AED 854 million (USD 232.7 million) and that for 2014-16 was set at AED 926 million (USD 252.3 million), 8.5% increase from the previous term. The proportion of the MoEW budget in the total federal budget fell from 0.7% to 0.66%. Since MoEW was established in 2006 by replacing the Ministry of Agriculture and Fisheries and absorbing the Federal Environment Agency, these figures include the budget which is usually allocated for the agriculture ministry in many other countries. On the other hand, it should be noted that other ministries in charge of energy, economy, health, labour, public works, education, etc. also spend a part of their budget for environmental protection. Local authorities also have an agency or a department for environmental protection, dedicating a substantial budget.

P2: Environmental regulations

Number of national environmental regulations (federal laws, executive orders and ministerial decrees) (2013): **42** (2 up from 2012)

Environmental regulations, often referred to as "command-and-control" policy instruments, have been a most fundamental tool for policy makers around the world to tackle pollution and the degradation of natural resources and wildlife since the 1960s. A regulation prescribes the maximum amount of pollution that a source can emit or the use of a particular technology, or bans particular environmentally harmful actions, as well as defines penalties for non-compliance and administrative procedures. This policy approach was backed up by the establishment of environmental regulatory agencies in national and local government over the last few decades. Meanwhile, the use of market-based and voluntary instruments for environmental policies has become more popular, responding to the industry's criticism of procedural and economic burdens from complying with regulations. Nevertheless, environmental regulations have remained the tool of choice for governments mainly because, when properly enforced, they offer a high degree of assurance that the objective will be achieved.[3]

The UAE's environmental regulations at federal level have been underpinned by the Federal Law No. 24 of 1999 for the protection and development of the environment. Since then, more specific regulations have been gradually adopted as federal laws, executive orders or ministerial decrees in the areas of biodiversity, air quality and water conservation. Due to the MoEW's history and scope of work (see Indicator P1), the larger number of regulations have been developed for agriculture, veterinary and fisheries. There are a number of emerging environment-related issues where regulations are still needed and the ministry is making efforts to catch up with such new development. Each emirate has also its own environmental regulatory body, which issues detailed local rules and guidelines and monitors violations, following the federal regulations and the ministry's guidance.

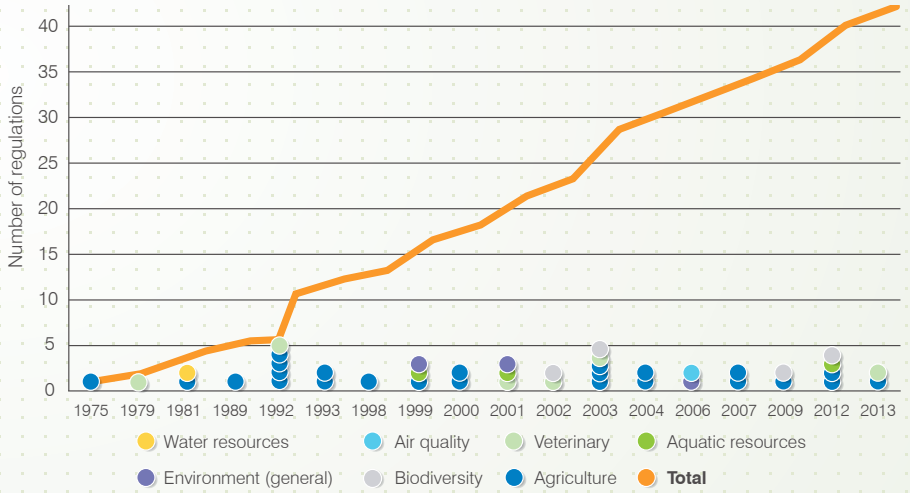


Figure 3.55: Trends in national environmental regulations in the UAE, 1975-2013

Source: MoEW, *Laws and Regulations 2013-2014*

1. Eurostat (2007), *Environmental Expenditure Statistics: General government and specialised producers data collection handbook*, Office for Official Publications of the European Communities, Luxembourg.
2. Eurostat, *Environmental protection expenditure* webpage, http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Environmental_protection_expenditure, accessed on 7 December 2014.
3. Long, B.L. (1997), "Environmental regulation: the third generation", *OECD Observer*, No. 206, OECD, Paris.

P3: Fossil fuel subsidies

Subsidisation rate per total cost of supply (2013): **65.0%** (**10th** highest out of 37 economies; **1st** lowest in the GCC; 0.9 point up from 2012)

Fossil fuel subsidies per GDP (2013): **5.6%** (**14th** highest out of 37 economies; **3rd** lowest in the GCC; 0.7 point down from 2012)

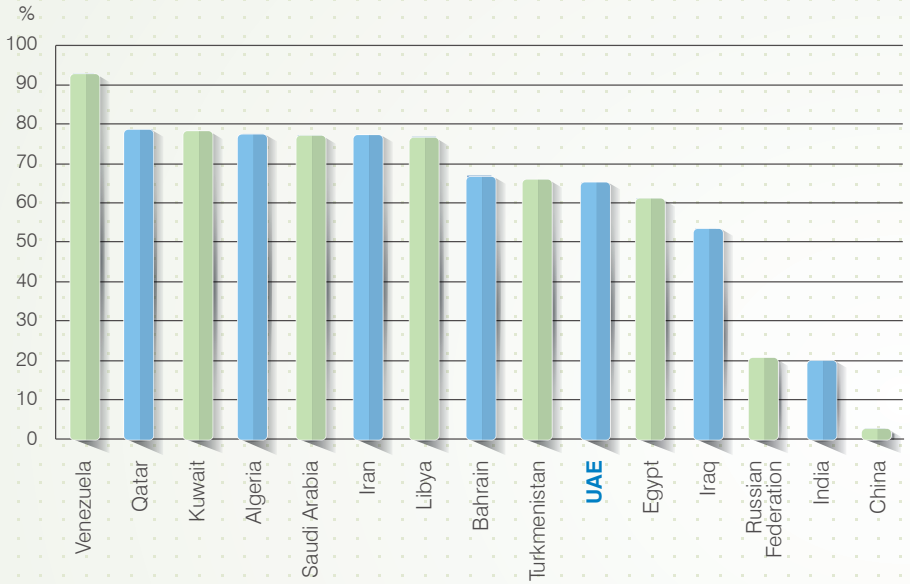


Figure 3.56: Rate of fossil fuel subsidisation per supply cost in major economies, 2013

Source: IEA, *World Energy Outlook 2014*

Market signals strongly influence the behaviour of producers and consumers alike and hence provide a powerful vehicle for addressing environmental externalities of economic activity. "Getting the prices right" has been considered as one of the major policy instruments to promote a faster and wider adoption of environmental innovation and eco-friendly behaviour. This market-based policy approach is mainly concerned with environmental taxes and the suppression of environmentally harmful subsidies, particularly those on fossil fuels.[1] According to IEA, global fossil fuel subsidies totalled USD 550 billion in 2013, which exceeded four times the subsidies for renewable energy which amounted to USD 120 billion.[2] In an annual summit held in September 2013 in St. Petersburg, Russia, the G-20 leaders agreed to phase out inefficient fossil fuel subsidies as well as on the methodology for a new peer-review process of fossil fuel subsidies as an important step in combating climate change.[3]

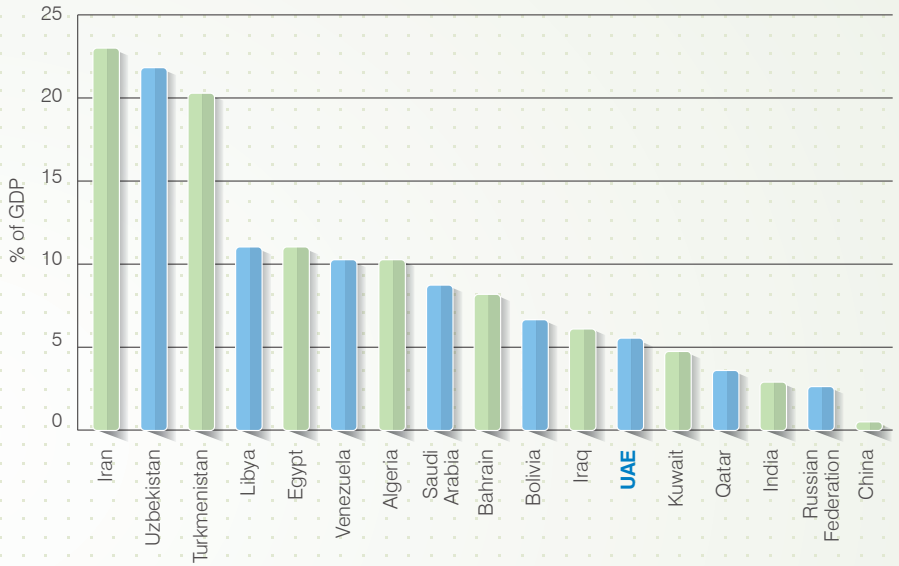


Figure 3.57: Share of fossil fuel subsidies in GDP in major economies, 2013

Source: World Energy Outlook 2014

IEA has been estimating subsidies to fossil fuels that are consumed directly by end-users or consumed as inputs to electricity generation. The UAE's level of fossil fuel subsidies has been among the highest group in 37 economies which IEA records in its database, in terms of both per capita and per GDP as well as subsidisation rate per supply cost.[4] Within the GCC, the UAE is still among the lower half.[5] The UAE also subsidises the cost of water which consumes energy in desalination process. Despite economic, political and social hurdles, however, utility authorities started pursuing a tariff reform (see 2-2).

1. OECD (2011b)
2. IEA (2014), *World Energy Outlook 2014*, OECD/IEA, Paris.
3. Environment News Service (2013), "G-20 to Phase Out Super Greenhouse Gas, Fossil Fuel Subsidies", 6 September, http://ens-newswire.com/2013/09/06/g-20-to-phase-out-super-greenhouse-gas-fossil-fuel-subsidies/.
4. IEA, *Fossil Fuel Subsidy Database* webpage, www.iea.org/subsidy/index.html, accessed on 26 October 2014.
5. Oman's fossil fuel subsidy data is not recorded in the IEA database.

P4: Nature conservation

Total protected areas (2014): **15,855 km²** (35 designations; **12.5%** of total land and sea areas)

Dugong

The main challenge for conservation of nature is to maintain or restore the diversity and integrity of ecosystems, species and genetic resources and to ensure a sustainable use of biodiversity. This implies the need for policies strengthening the protection of habitats and species, eliminating illegal exploitation and trade, integrating biodiversity concerns into economic and sectoral policies, and raising public awareness. Protected areas are at the core of those policy efforts for protecting ecosystem services that provide food, clean water and medicines as well as carbon sink and protection from natural disasters.[1]

The UAE is not an exception to this trend. The registration of protected areas was initiated in 1995 and their number has grown up to 35 designations (including both terrestrial and marine areas) by 2014.[2] In total, 15,855 km², 12.5% of the country's land and sea areas, has been designated as protected areas. The 2014 EPI ranked the UAE among the top countries in the sub-index of marine protected areas.[3] Among those protected areas, five wetland reserves are recognised in the List of Wetlands of International Importance under the inter-governmental Ramsar Convention (Ramsar Sites). Moreover, the Marawah Marine Reserve off the western coastline of Abu Dhabi is listed in the UNESCO World Network of Biosphere Reserves as it is considered to be globally important as a shelter and feeding ground for the vulnerable dugongs.[4]

P5: Environmental standards

Number of national environmental standards (2014): **27** (1 up from 2013)

Environmental standards have increasingly been recognised as one of the most important policy instruments that enable greening the economy. An environmental standard provides a set of quality conditions in a way to specify either a desired state or a limit to alterations so as to control the effect of human activity upon the environment. Standards may be defined by laws so as to be legally binding but may also be non-statutory protocols, guidelines, targets and sets of criteria. The standards that intend to encourage innovation and adoption of efficient technologies by creating a "level playing field" and stimulating demand have been more widely applied in recent years.[5]

The setting of national environmental standards in the UAE was started in 1984 and the coverage has rapidly grown up in the last decade, mainly adopting multilateral standards of the International Organization for Standardization (ISO) and the GCC Standardization Organization (GSO). The focus of standard setting was initially put on the control of air and noise pollution from motor vehicles, and was gradually expanded into indoor and industrial air pollution. In recent years, the Emirates Authority for Standardization and Metrology (ESMA) has embarked on new scope and forms of standard setting as eco-labelling and certification criteria have been established for electrical appliances, light bulbs, water fixtures

1. IUCN defines that a protected area is "a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values".
2. Protected areas here refer to areas under management categories I to VI of the IUCN classification that refer to different levels of protection, as well as protected areas without a specific IUCN category assignment. For the details on the IUCN classification, see www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories.
3. YCELP, *Environmental Performance Index* webpage.
4. UNESCO, *Marawah Marine Biosphere Reserve* webpage, www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/arab-states/united-arab-emirates/marawah, accessed on 30 December 2014.
5. Royal Commission on Environmental Pollution (RCEP) (2004), *Environmental Standards and Public Values: A summary of the Twenty-first Report*, RCEP, London.

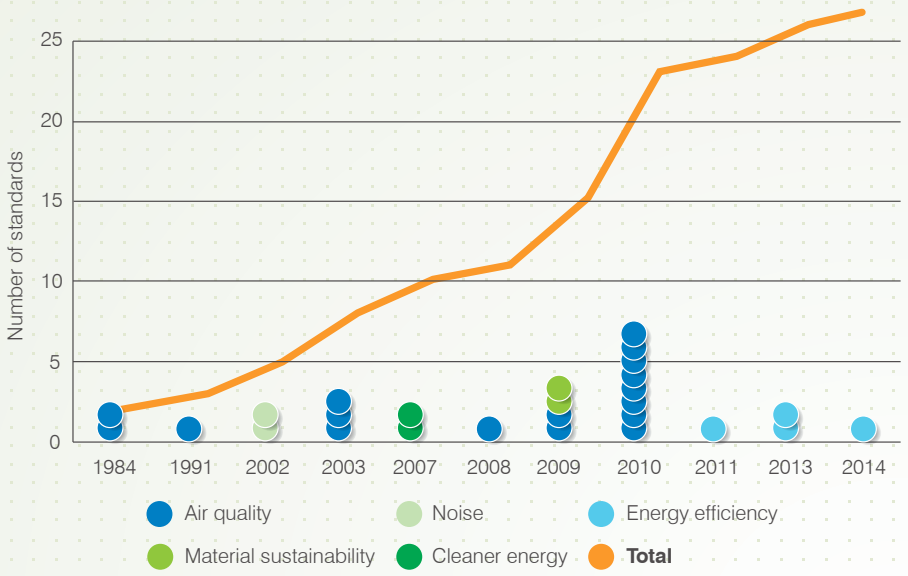


Figure 3.58: Trends in of national environmental standards in the UAE, 1984-2014

Source: ESMA

and organic food, whereas new specifications have been set for packaging and cleaner energy sources such as natural gas and clean diesel (see also 2-2; 2-7).

Sheikh Zayed Grand Mosque, Abu Dhabi

3-2-6. Synthesis

The following and **Annex** provides the highlights of the UAE's national-level performance measured by the 30 *Green Economy Indicators*:

Natural resource base

The UAE is blessed with the world's seventh largest oil and gas reserves which have transformed the desert country into one of the most advanced nations with high standards of living. Oil and gas have acted as the driving force of the UAE economy as the sector still provides around one third of the total GDP. On the other hand, land and soil resources suitable for agriculture are limited and subject to irrigation. Forest areas have increased by 30% between 1990 and 2012 owing to an extensive afforestation programme. Fish stocks in both the Arabian Gulf and the Gulf of Oman have recorded an alarming rate of decline (more than halved between 2002-11), while various natural and anthropogenic factors have caused the loss of biodiversity. The availability of freshwater (mostly groundwater) is one of the lowest in the world. The government enforces strategies and regulatory measures to protect those indispensable natural resources.

Whilst blessed with large oil and gas reserves, land, marine and wildlife resources are very limited and deteriorating further in recent years.

Socio-economic conditions

The UAE was ranked 36th in the latest Global Innovation Index and has kept the leading position among the GCC countries. However, the country's R&D spending (0.49% of the total GDP) lags far behind the OECD average of 2.47%. The country's competitiveness in the global market is also perceived as quite high together with its business-friendly environment and improving entrepreneurship ecosystems as the UAE was ranked 12th in the Global Competitiveness Index 2014-15, 22nd in the 2015 East of Doing Business Index, and 20th in the 2015 Global Entrepreneurship and Development Index. The country's working population is growing at a record pace, reaching around 6.25 million in 2012, 67.9% of the total population, while women's participation in the labour market is rapidly increasing (46.6% in 2012). The proportion of pupils who reached Grade 5 rose from 95.0% in 1990 to 97.4% in 2010, having achieved near universal education at the first cycle. The number of graduates from the country's higher

education institutions has been rapidly rising (over 19,000 in 2011-12), and there are also a large number of graduates from foreign universities. The UAE took part in OECD's PISA assessment of 15-year-olds in reading, mathematics and science for the first time in 2012 and was ranked 46th.

The environment for innovation and entrepreneurship has been well fostered, while there is still significant room for improvement in knowledge and skills of the population.

Production and consumption

The UAE's per-capita Ecological Footprint was estimated as the 3rd largest (7.75 gha) in the world in *the Living Planet Report 2014*, after Kuwait and Qatar. The country's total GHG emissions have increased from 74 million tCO_2e in 1994 to 173 million tCO_2e in 2012. Since 2007, the country's annual electricity consumption has increased by more than 8% per annum, exceeding 100 TWh in 2012. The total use of steel has been steady since the sharp drop at the time of the financial crisis. Despite the lack of freshwater resources, the per-capita intensity of water use has been among the world's highest as the daily consumption of water for domestic (household and commercial) purposes was recorded 353 litres per capita in 2013. The daily municipal waste generation was 1.82 kg per capita in 2014. Meanwhile, the agricultural production in terms of weight has fallen to one-tenth of previous levels, and the area of cultivated land had been more than halved by 2012 since the peak in 2002 as the government aimed to reduce the cultivation of fodder crops which consume a large amount of water. The quantity of fish catches in the UAE keeps declining since the peak recorded in 1999, falling to less than two-thirds of the peak amount by 2012.

The positive news is that the relative decoupling of consumption from population and economic growth has started to be observed in some areas. The GHG emissions per capita have declined by over 50% between 2005 (38.8 tCO_2e) and 2012 (18.8 tCO_2e) and emissions per GDP have also decreased by nearly a quarter during the same period (from 422 gCO_2e/USD to 324 gCO_2e/USD). The carbon intensity of electricity production has also been steadily improving as CO_2 emissions per kWh was 600 grammes in 2011, 34% decrease from the peak recorded at 913 grammes in 2004. Furthermore, the UAE has shown its ambition and provided leadership in advancing renewable energy technologies with the development of large-scale projects (138.5 MW capacities by 2013). Although the UAE's per capita steel use was the world's highest until the crisis, it had dropped to the 5th position by 2013 (756.8 kg/year) despite the rapid market recovery which resulted in many large-scale developments. The level of per-capita waste generation has been declining overall after the financial crisis and the relative decoupling of municipal water use from economic growth is also seemingly being materialised. Meanwhile, the value-added by agricultural production is rapidly rising (USD 926.9/ha in 2012) due to the shift of cultivation from fodders to vegetables and fruits.

The government supports the dissemination of organic farming practices (4,446 ha by April 2014) and stimulates the recovery of fish stocks. Over 300,000 fingerlings were released and 3,600 coral reef colonies were farmed in 2013, while 15,000 mangrove trees were planted in 2012. It is also observed that environmental awareness and behaviour among residents have been rapidly improving in the last few years. As an overall index of those improvements, the UAE's Ecological Footprint shows a decline since 2010.

Corresponding to the rapid economic and population growth, the overall consumption of energy, water and materials as well as waste generation and GHG emissions have been increasing. However, a relative decoupling started being observed in some areas, as eco-friendly behaviour and practices have been firmly advocated by the government.

Well-being

The UAE's share of revenues from the non-oil sectors has increased from 57% of the total GDP in 2001 to 67% in 2013, helping mitigate the impact from the fluctuation of oil revenues. The share of non-oil export in total export has also risen from 17.5% in 2001 to 28.5% in 2013. The GNI per capita, which indicates average personal income, was recorded at USD 58,090 in 2012, the 11th highest in the world though it has been declining since 2004. The UAE's Human Development Index value has improved by nearly 30% from 0.640 in 1980 to 0.827 in 2013, positioning the country at the 40th in the world, one of the "very high human development" group. The country was also ranked 14th, the highest in the Arab world in *the World Happiness Report 2013*, showing the positive trend in both perceived happiness and quality of life for locals and expatriates alike. The UAE's Environmental Performance Index results have shown a dramatic upturn from the 152th out of 163 countries benchmarked in 2010 (Score: 40.7) to the 77th in 2012 (50.91) and the 25th out of 178 countries in 2014 (72.91).

While economic diversification ensures a continuously high level of income, perceived happiness and quality of life among the population have also become high as environmental health is increasingly being safeguarded.

Policies

Since the issuance of the Federal Law No. 24 of 1999 as the fundamental law of environmental protection, laws, executive orders and ministerial decrees regulating specific environmental issues such as biodiversity, air quality and water conservation have been gradually promulgated. MoEW is making efforts to further develop regulations in emerging areas as its budget is steadily increasing. The designation of nature reserves started in 1995 and the total number of terrestrial and marine protected areas has reached 35 by 2014. In addition to the conventional "command-and-control" policies, the market-based approach started being introduced to encourage greener behaviour among industry and consumers. Local authorities are pursuing a utility tariff reform to encourage rational use of water and electricity and reduce fossil fuel subsidies. Eco-labelling and certification criteria have been established for air conditioning unites, washing machines, refrigerators, light bulbs, water fixtures and organic food.

While there is still need to develop environmental regulations, the market-based policy approach also started being introduced, aiming to shift consumer and business behaviour.

Overall, the UAE has faced severe constraints in non-oil resources and a rapid rise in the consumption of energy, water and materials as well as in waste generation and GHG emissions. However, various types of initiatives to overcome these issues have been initiated by both the public and private sector in recent years. Relative decoupling of consumption from population and economic growth has started being observed in some areas, while even higher quality of life is being enjoyed by people.

The performance data in this chapter should serve as a baseline for monitoring annual changes and analysing the interaction between different factors so as to better judge whether the country is on the right course towards a Green Economy and to plan effective Green Economy policies and initiatives.

3-3. Filling data gaps

Since the UAE is still a young country with a short history of statistical work, general improvement in collecting basic national data and its consistency with authoritative international data sources is an urgent priority to enable evidence-based policy-making. Even further, in order to quickly improve the coverage and reliability of *the Green Economy Indicators*, a consistent nationwide data system based on globally recognised, standardised methods of data collection and management will be required. Coordination between national and local statistics agencies needs to be ensured to streamline data collection and sharing and to improve consistency and national aggregation, while smaller emirates need further support for data collection that would allow local-level analyses. The following actions can particularly be considered to improve *the Green Economy Indicators* in the near term:

- *Establishment of national Green Economy database:* Build an appropriate technical platform that will compile and manage data inflows from domestic and international sources. This may be maintained by a competent authority to set a common procedure to collate national and local information (both quantitative and qualitative) and ensure data accuracy and appropriate estimation. The collection and benchmarking of the government's own sustainability performance data can also be encouraged to ensure "walking the talk".
- *Development of input-output table:* Input-output (I/O) table is a matrix representation of a national economy which shows how output from one industrial sector may become input to another sector. This provides critical data that enables a variety of macro-economic analyses, which would in turn help formulate appropriate sector and value chain-specific policies including those aimed for a Green Economy. Preparation for material flow accounting could also be considered to capture a clear overview of resource efficiency in specific sectors and the entire economy.
- *Defining scope of green measurements:* To better capture the extent of a Green Economy transformation, there is an increasing importance of measuring indicators that segregate green components from general economic activities – environmental protection activities, environment goods and services (EGS) sector, green investment, green jobs, green R&D and innovation, green patents, etc. Although there is no internationally agreed way to define these aspects to date, the methodologies to define the scope of diverse green measurements should be explored based on the efforts and experiences of inter-governmental organisations, statistical agencies and other governments.

4

Future Outlook:
The UAE Green Agenda

Future Outlook: *The UAE Green Agenda*

The last two chapters provided an overview of the ongoing public and private-sector initiatives for greening the UAE economy and the status of progress based on selected performance indicators. The implementation of *the UAE Green Growth Strategy* will further accelerate and diversify Green Economy efforts throughout the country in the coming years. This will be supported by the provision of a clear structure and a unified pathway that can synergise the efforts and fill the gaps in actions with additional initiatives and policy measures. This chapter outlines the governance and programmatic structure for implementing *the Green Growth Strategy*, potential Green Economy action plans to fill identified gaps, and next steps to be taken collectively by the UAE government, local authorities and stakeholders.

4-1. Governance for Green Economy

Effective and transparent governance is considered to be one of the most critical success factors for implementing national Green Economy strategies. Governance needs to be carefully designed and to follow a set of clear and agreed principles. The following five principles are considered necessary for the UAE to allocate responsibilities for taking action to each ministry and emirate as well as to stakeholders in the private sector and civil society:

- Visionary government leadership at the highest level;
- Shared responsibility across ministries;
- Close collaboration between federal and local authorities;
- Centralised policy coordination authority across sectors and emirates; and
- Stakeholder consultation across sectors.

To ensure effective decision-making and transparent implementation, a central governing body will be designated for overseeing overall planning, implementation, and monitoring and evaluation. This body will subsequently define lead responsibilities at the federal level, and designated roles for local authorities for each Green Economy programmatic area (see 4-2; 4-3).

4-2. The UAE Green Agenda

Through the extensive consultation process outlined in Section 1-3, ***the UAE Green Agenda*** has been established as a grand umbrella that will activate *the Green Growth Strategy* and initiate concrete actions for the coming years. *The Green Agenda* aims to help streamline diverse Green Economy actions and provide a unified framework to plan additional initiatives in line with the overall objectives. As part of the process to synergise the UAE's overall development objectives set by *the UAE Vision 2021* and each emirate's long-term strategy and plan with those of *the Green Growth Strategy*, the following three pillars guiding the Green Economy transition have been identified. They were derived from the proposal made through the consultation process, where Green Economy actions were originally categorised into five areas and twelve programmes. These pillars indicate what Green Economy means for the UAE and the directions where the country should strive in the long run across diverse sectors in a simultaneous pursuit of economically, socially and environmentally sustainable development.

Briefing stakeholders about *the Green Growth Strategy*

3 Pillars of *the UAE Green Agenda*

1. Green Technology and Market Development

The UAE Vision 2021 aims for a 'Sustainable and Diversified Economy' (Vision 3.2) as well as a 'Knowledge Based and Highly Productive Economy' (Vision 3.3). These goals are also highlighted in *the UAE Green Growth Strategy* through 'Green Investment'. The additional growth driven by low-carbon technologies and eco-efficient production and consumption methods will greatly help the diversification of the UAE economy which has traditionally been reliant on oil and gas. This will also help to increase national competitiveness, to establish more SMEs and a competitive environmental goods and services (EGS) sector, and to create export opportunities from freed-up hydrocarbons.

2. Integrated Social and Spatial Development

The Green Growth Strategy aims to realise 'Green Life' among UAE inhabitants through building 'Green Cities' and smart communities that use the country's resources in a sustainable manner. *The Vision 2021* also seeks 'well-rounded lifestyles' (Vision 4.3) and a 'Sustainable Environment and Infrastructure' for realising the 'well-preserved natural environment' (Vision 4.4), which could be supported by improved valuation of the nation's natural capital and development of resilient infrastructures. *The Vision 2021* also seeks to realise 'the highest standards of living' and 'harnessing the full potential of national human capital' through 'first-rate education' (Vision 4.2). Nurturing local talent into knowledge-based green sectors would help create new jobs and multiple developments improving the quality of life.

3. Clean Energy and Sustainable Use of Resources

The Green Growth Strategy targets 'Green Energy' and addresses 'Climate Change'. Supporting the energy transition from fossil fuel by increasing power generation from renewable sources and nuclear energy will help reduce carbon emissions and tackle climate change. More efficient use of resources will bring direct benefits to the public through savings in water, electricity, transport fuels as well as reducing waste, and in turn will make the wider economy more efficient, competitive and sustainable. *The Vision 2021*'s aim for 'Enhanced International Standing' (Vision 2.3) will be supported by pioneering clean energy technology and project development in an open, business-friendly economic environment.

4-3. Green Agenda programmes

Based on the above three pillars of *the UAE Green Agenda*, a programmatic structure of activities for realising a Green Economy has been developed. The gaps and opportunities in each of key sectors identified by stakeholders during the Technical Task Force workshops (see 1-2) were synthesised into a number of programmatic areas where the efforts of government, private sector and citizens can be focused across sectors. This process was designed to ensure the government and stakeholders plan joint actions towards a Green Economy in a systematic way that encompasses all fronts of sustainable development throughout the country.

The twelve programmatic areas identified through this consultation were further consolidated into eight programmes, which cover all key aspects for a Green Economy transition – from technology, human capital, regulatory environment, green finance, international trade, local content and intellectual property, consumer awareness and information, integrated national planning and cooperation across the emirates. These Green Agenda programmes are illustrated below under each of the three pillars, together with potential activities to propel each programme into action that were proposed and generally agreed by stakeholders during the consultation process (**Figure 4.1**):

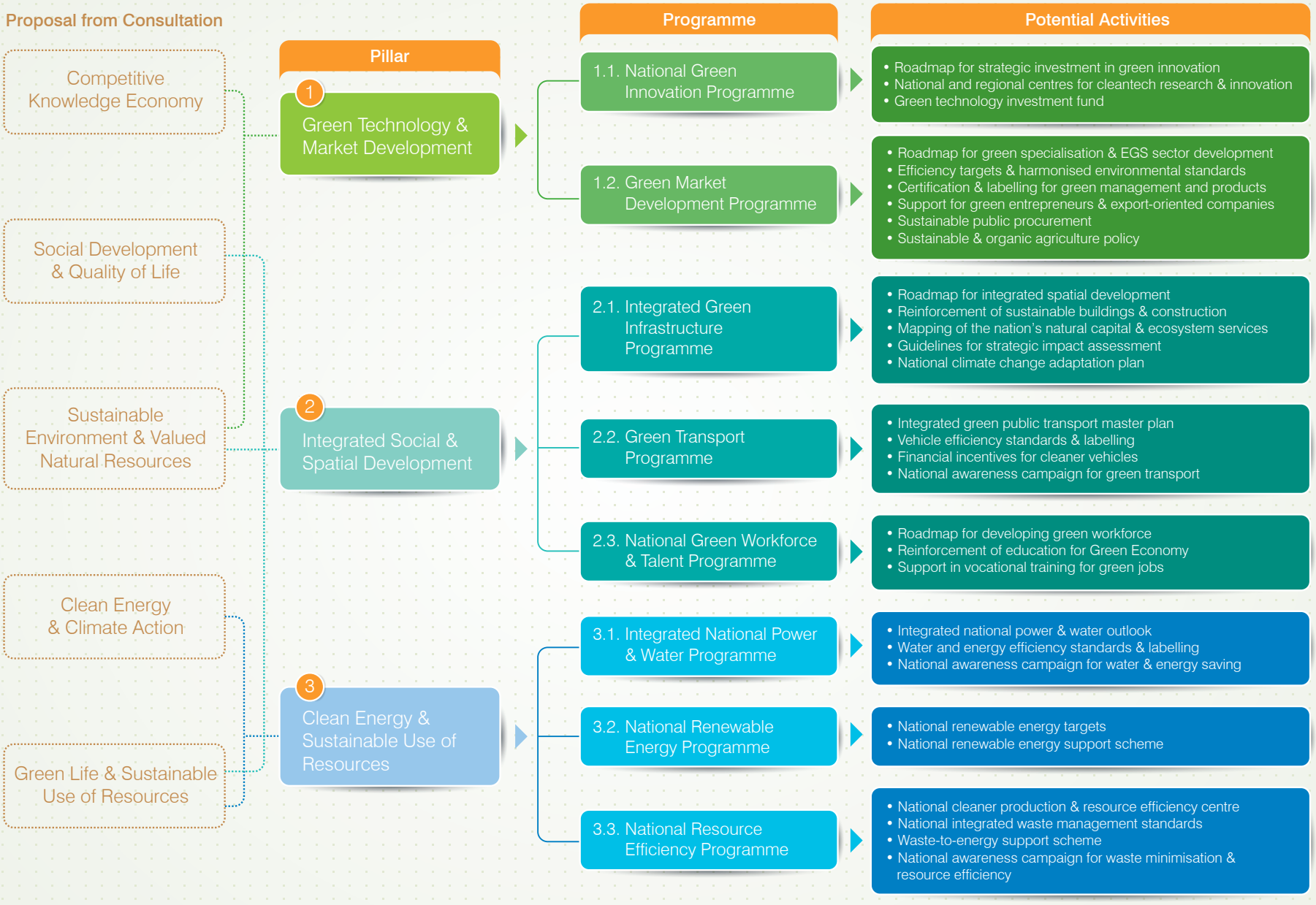


Figure 4.1: Structure of *the UAE Green Agenda*

1. Green Technology and Market Development

1.1 National Green Innovation Programme

An advanced industrial structure and diversified economic activities require long-term strategic investment in the advancement of promising technologies. The policy goal is to strategically nurture R&D in clean technologies attractive to the UAE whilst simultaneously strengthening the behavioural and institutional environment for effective adoption and absorption of green innovation.

Potential activities under Programme 1.1

- **Roadmap for strategic investment in green innovation**

  A systematic prioritisation of the most attractive clean technologies, identifying implementation challenges and devising an integrative investment strategy for those technologies.

- **National centre and regional centres for cleantech research and innovation**

  Build strong in-country capacity in R&D of green technologies and allow high-quality research to be translated into policy and institutional development. The establishment of regional incubation and demonstration centres would further ensure benefits from the national centre to reach every corner of the society by facilitating the commercial development of promising green technologies.

- **Green technology investment fund**

  A fund could be established to nurture and activate green technologies by incentivising the research community and industry to capture emerging opportunities. This fund could be managed by the above national centre and also be utilised for acquiring “green patents” from abroad, awarding top innovators, translating scientific contents into Arabic, etc.

1.2 Green Market Development Programme

This programme aims to provide a comprehensive solution for promoting the economic activities of green industries to help shift the UAE economy beyond hydrocarbon resources. In combination with the National Green Innovation Programme (Programme 1.1), where technological contents will be advanced, this could focus on market creation for high value-added green industries and the EGS sector, while increasing green credentials of existing sectors by enhancing resource and energy efficiency.

Potential activities under Programme 1.2

- **Roadmap for green specialisation and EGS sector development**

  Draw a concerted economic development trajectory that articulates which sectors and industries each emirate can focus on for Green Economy.

- **Efficiency targets and harmonised environmental standards**

  The establishment of targets for industrial efficiency and accompanying measurement, reporting and verification (MRV) mechanism could provide a framework for possible introduction of market-based policy tools such as labelling and tradable permits. The harmonisation of existing standards would further encourage industry to adopt sustainable practices.

- **Certification and labelling for green management and products**

  Eco-labelling and product and process certification can be effective instruments to encourage sustainable consumption and production. The harmonised certification and labelling schemes would also help implement sustainable procurement.

- **Support scheme for green entrepreneurs and export-oriented companies**

  Green start-ups and SMEs would be supported by providing access to finance and credit guarantees, guidance and training, preferred supplier status, etc. Green businesses could advance into export markets through export credit guarantee, knowledge sharing, etc.

Sustainable public procurement

Procurement is a proven instrument to generate significant demand for sustainable products and services and therefore can help enhance market penetration of green businesses.

Sustainable and organic agriculture policy

Set out core principles for good practices applicable to the UAE environment, issue guidelines on the multitude of irrigation technologies, and determine appropriate support schemes and non-compliance penalties to help foster smart, sustainable development of the agriculture sector.

2. Integrated Social and Spatial Development

2.1 Integrated Green Infrastructure Programme

Addressing economic and infrastructure disparities across the UAE is an important pre-requisite to enable Green Economy. The comparative advantages of each emirate need to be leveraged, while identifying and filling important gaps in support of a balanced, prosperous and sustainable UAE economy. Development of public infrastructure supporting greener development needs to be clearly prioritised and accelerated. This Programme would also help recognise the role of natural capital as a driver of economic development and the need to internalise traditionally unaccounted environmental and social impacts into economic decision-making processes as well as criteria-based assessments for climate risk exposure.

Potential activities under Programme 2.1

Roadmap for integrated spatial development

Help ensure the forthcoming infrastructure establishment to follow integrated planning and best available sustainability standards in every aspect. Organise regular capacity building sessions designed to meet specific needs so as to fill the gaps in spatial planning and infrastructure development.

Reinforcement of sustainable buildings and construction

Promote further and seek harmonisation of green building codes and rating schemes across the emirates and elaborate additional support and tools where needed. Accelerate the green retrofitting of existing buildings and infrastructure through legislation and innovative financing schemes.

Mapping of the nation's natural capital and ecosystem services

Help prioritise which aspects of the country's biodiversity should be protected and enhanced, based on an integrated approach that balances development and conservation objectives.

Guidelines for strategic impact assessment

Broaden future impact assessments for all large-scale investments in new commercial, residential and industrial development to ensure taking into account the externalities and the long-term climate risks.

National climate change adaptation plan

Provide a strategic response to the potential impacts of climate change and its consequences for the economy, thereby improving the country's resilience through a systematic mapping and assessment of associated risks affecting each type of asset class and each spatial area.

2.2 Green Transport Programme

This Programme would aim to help build emirate-level initiatives, policies and plans for sustainable transport, in a more coordinated, pan-emirates way by providing a federal framework. It would also support the increased coverage and use of public transport and more efficient use of private and commercial vehicles through better land use, awareness raising and other incentives.

Potential activities under Programme 2.2

Integrated green public transport master plan

Establish a nationally integrated public transport system with enhanced coordination between jurisdictions, functions and operations to make

public transportation more attractive to people and more competitive with private cars.

- **Vehicle efficiency standards and labelling**

  Develop nation-wide standards and standardised labelling of passenger vehicles sold in the country to enable consumers to make more informed choices and improve the availability of efficient models.

- **Financial incentives for cleaner vehicles**

  Elaborate the best way to make cleaner and more efficient vehicles attractive to consumers in the country where fuel prices are relative low, e.g. rebates or discount of the purchase price of greener vehicles in combination with commensurate penalties.

- **National awareness campaign for green transport**

  The campaign, in collaboration with local partners, would highlight the benefits of low-emission vehicles and public transport.

2.3 National Green Workforce and Talent Programme

A successful transition to Green Economy rests on the skills and expertise of the country's workforce and its ability to leverage local talent. This Programme would aim to strengthen the national workforce to meet the needs of the UAE's ambitious Green Economy goals by addressing the skill gaps through federally coordinated and guided quality education and vocational training programmes.

Potential activities under Programme 2.3

- **Roadmap for developing green workforce**

  Demonstrate expected skill and labour force requirement and gaps to fill by classifying green jobs, and estimating the potential for new job opportunities and shift of workers from conventional to new and fast-growing green sectors.

- **Reinforcement of education for Green Economy**

  Foster green-themed educational programmes, drawing on the already strengthened knowledge foundation and curricula and upgrading the existing higher education.

- **Support in vocational training for green jobs**

  Strengthen vocational training for careers in para-professional or practical activities with a particular emphasis on green occupations by encouraging academic-industrial partnerships.

3. Clean Energy and Sustainable Use of Resources

3.1 Integrated National Power and Water Programme

This Programme would aim to help develop an integrated national energy and water desalination plan for sustainable supply and effective demand management. This would include strategic development of clean technology options attractive to the UAE. Such an approach would support the coordination of planning future plants and knowledge sharing across the emirates as well as foster comparative advantages in the chosen energy technologies for the country. It would also include policies and institutional support to increase energy and water use efficiency across the country, building on success stories and creating enablers for private-sector participation in the new green services sector. This Programme would particularly help the UAE to make a cost-effective transition to a Green Economy.

Potential activities under Programme 3.1

- **Integrated national power and water outlook**

  Develop a clear and agreed national roadmap for nation-wide power and water plants development and retrofit. This would also include clear targets for medium to long-term efficiency improvement to help align efforts and maximise the wider economic benefits. The resulting prospective energy mix would enable more integrated policy-making and investment decisions for the chosen power and water production, transmission and storage technologies.

Water and energy efficiency standards and labelling

The continued development and harmonisation of standards across the emirates and the adoption of common, clear product labels for efficient appliances to encourage sustainable use of resources.

National awareness campaign for water and energy saving

A nation-wide multimedia awareness campaign with local partners under one common brand targeting water and energy conservation through appropriate habits in the household and office.

3.2 National Renewable Energy Programme

To continue to meet the strong and growing electricity demand, the UAE is increasingly turning to new energy sources including renewable energy – particularly solar PV and CSP technologies. This Programme would aim to provide policies and institutional support to accelerate the uptake of renewable energy technologies with proven applicability in the UAE and enhance the positive impact on the economy, including job creation and the emergence of competitive technology and services sectors.

Potential activities under Programme 3.2

National renewable energy targets

Establish a nationally agreed and internationally recognised UAE commitment to renewable energy deployment, building upon Abu Dhabi and Dubai's established targets for 2020 and 2030, alongside the integrated national power and water planning process (Programme 3.1). The breakdown of the national targets into technology-specific targets in each emirate would further provide market signals that could attract the appropriate investment from the private sector.

National renewable energy support scheme

The support scheme would focus on i) facilitating concerted R&D efforts; ii) outlining practical measures to secure the necessary technologies and to increase domestic production of core technologies; iii) improving business environment for successful commercialisation of promising technologies; and iv) measures to increase domestic market and required human resources development.

3.3 National Resource Efficiency Programme

This Programme would aim to provide practical support to industry to improve the resource and energy efficiency of their products and production processes, and to provide knowledge (where lacking) on available technologies, financing options and monitoring and management systems, as well as to improve general awareness. As part of improving resource utilisation rates, it would also provide institutional support for immediate improvements in waste management throughout the country as well as a transformation plan towards a long-term solution. The initial target would be waste reduction (prevention and recycling) but lifecycle approaches would be encouraged to take advantage of new and improved green technologies and services across value chains, as well as waste-to-energy options.

Potential activities under Programme 3.3

National cleaner production and resource efficiency centre

Provide industry (particularly SMEs) with technical and management assistance as well as capacity building and knowledge transfer for improving their operational efficiency and developing green products, building upon the existing capacities of the public and private sector.

National integrated waste management standards

Harmonise the emirate-level waste management plans in waste classification, treatment and transport (including inter-emirate movement which is currently restricted) to facilitate improved actions. This would include a national commitment and clear targets for decoupling waste generation from economic and demographic growth.

- **Waste-to-energy support scheme**

  Provide financial support and enabling policy conditions for deploying proven waste-to-energy technologies, alongside waste reduction measures such as introduction of "waste generator to pay" policies and financial support for the recycling industry.

- **National awareness campaign for waste minimisation and resource efficiency**

  Conduct educational and capacity building activities to change the attitude and behaviour of households and businesses towards "reduce, reuse and recycle".

4-4. Next steps

The potential Green Agenda programmes listed above will also be complemented by sector-specific actions based on further consultation with key stakeholders in each sector. These consultations will be used to develop action plans as well as identifying supportive policy tools. Building upon the consultation process following the issuance of *the UAE Green Growth Strategy*, during 2015, the UAE will continuously engage with stakeholders to determine concrete actions under the eight prospective programmes, will clarify the role of government and stakeholders in those actions, will develop roadmaps for actual implementation, and will oversee progress (**Figure 4.2**).

Green Economy is as much a long-term ambition as an immediate call for action. The UAE's rapid economic development provides a unique opportunity to capture a first-mover advantage in establishing comparative strengths in emerging green technologies and markets. However, the country should also prepare for multiple, long-term transformations that will only come to fruition by 2030 and beyond. Therefore, the roadmaps to be developed should support a step-by-step implementation of the elaborate Green Agenda programmes according to sectoral needs, and depending on the time and resources required.

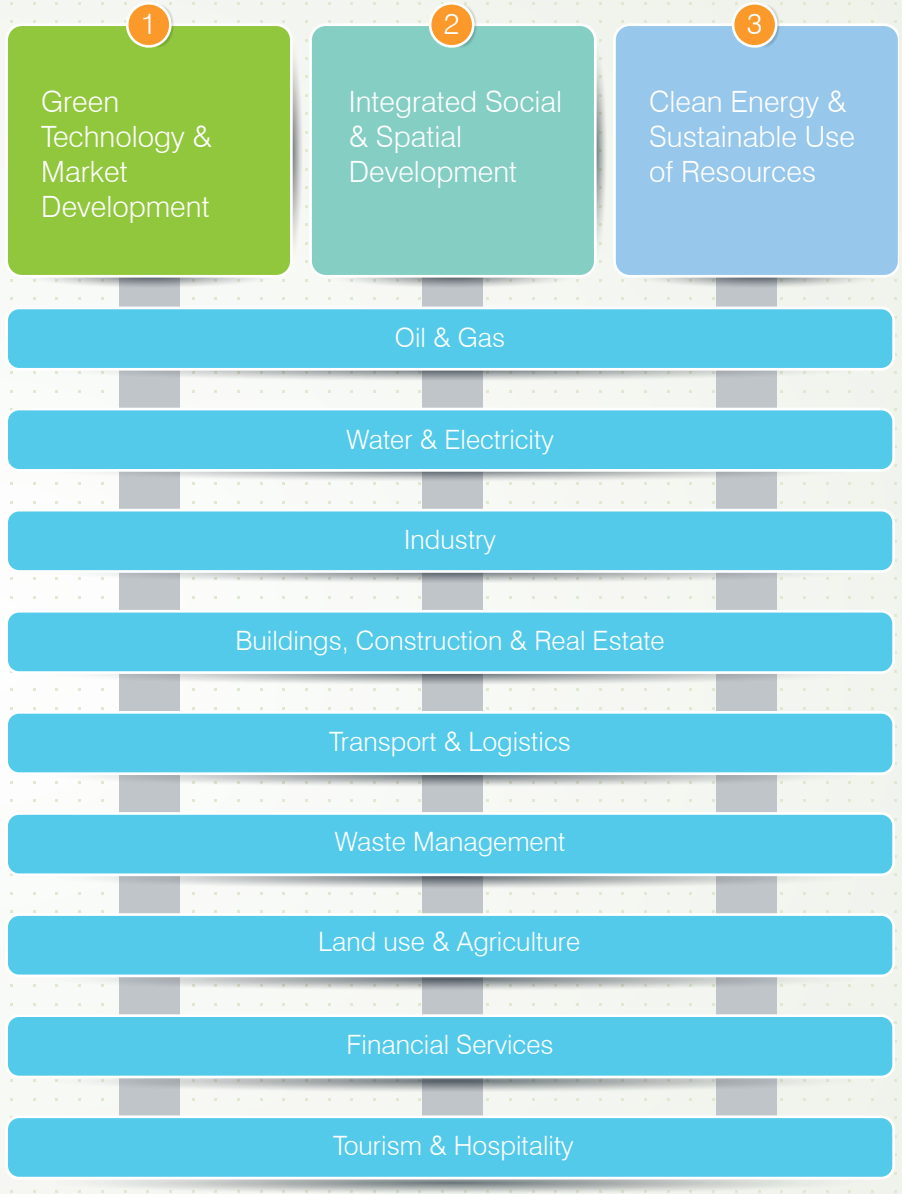


Figure 4.2: Concept for the development of Green Economy action plans at the sectoral level

Such roadmaps could be roughly divided into three milestones: short-term (up to 2017); medium-term (up to 2021) and long-term (up to 2030 and beyond). By the time the UAE is halfway to its golden jubilee in 2021, major groundwork could be well the advanced, including the introduction of a functional data system and key policies. The second major milestone is 2021 when the country will see the initial fruits of Green Economy actions which can already be showcased at Dubai Expo 2020. By 2030, all major structural changes to the UAE economy would have been achieved. The horizon will then be extended towards 2050 to keep progress on track towards the ultimate future vision which *the Green Growth Strategy* envisages (**Figure 4.3**).

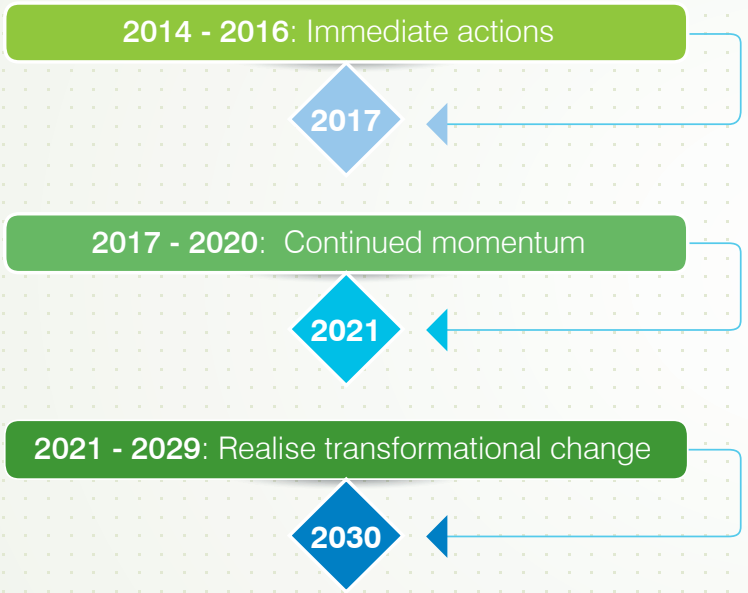


Figure 4.3: Structure of roadmaps for implementing Green Agenda programmes

Sheikh Zayed Grand Mosque, Abu Dhabi

5 Inclusive Green Economy from a Global Perspective

Inclusive Green Economy from a Global Perspective

In the last few years, Green Economy has gone from an idea confined to specialists to a vision shared, discussed and put into practice by policy makers all across the world, including in the UAE. This final chapter is contributed by UNEP to provide the reader with a global perspective of Green Economy policies and initiatives. It describes some selected country experiences with Green Economy-related strategies and outlines the efforts of UNEP and other UN agencies in this arena. This chapter also refers to one of the most significant barriers to realising Green Economy – finance and investment, where new opportunities from climate-friendly technologies and projects have been increasingly recognised and realised.

5-1. Global trends in Green Economy and the UN approach

Steven Stone
Chief, Economics and Trade Branch
UNEP

Green Economy approaches around the world

Since Green Economy[1] was recognised as a tool for achieving sustainable development at the 2012 UN Rio+20 Conference, an increasing number of countries have adopted the concept and used it in their national planning: more than 65 countries have now embarked on Green Economy and related strategies, while 48 countries are developing national Green Economy or Green Growth plans. The worldwide uptake results from the efforts of countries to achieve sustainable development targets and the need for economic tools to deliver both environmental sustainability and increased well-being as one of the most central and compelling tasks of our times.

Yet, it is not always an easy task. An inclusive Green Economy puts the environment and people at the centre of national policy-making, and thus goes beyond one dimensional approaches. It is a comprehensive economic approach for achieving increased human well-being and social equity, while reducing environmental risks and ecological scarcities – as UNEP has defined Green Economy in the past.

The movement towards Green Economies started almost a decade ago when the world saw multiple global crises, involving food, finance and fuel. Green Economy was seen as a possible way to steer through the crises and come out with a stronger and more resilient economy. Since 2007, the movement has gained support and momentum. UNEP in its 2011 Green Economy report[2] showed that green investments would not only be good for the environment but also deliver more in terms of economic growth and poverty reduction than business-as-usual practices.

Driven by looming ecological constraints and the intuition that economic prosperity must fundamentally derive from good stewardship of natural resources and environmental wealth, governments throughout the world have started to explore ways to decouple growth from environmental degradation, resulting in the increasing adoption of the concept seen today. Although Green Economy is still in an early phase, and new knowledge and experiences are constantly generated by the front runners, the experiences by an increasing number of countries worldwide show promising signs of their potential to achieve increased well-being with lower environmental impact.

1. Formally referred to as "green economy in the context of sustainable development poverty eradication" in the Rio+20 Outcome Document; shorthand used here and throughout this chapter for sake of brevity.
2. UNEP (2011b), *Towards a Green Economy: Pathways to sustainable development and poverty eradication*, UNEP, Nairobi, www.unep.org/greeneconomy/GreenEconomyReport.

Green Economy around the world

- More than 10 African countries have adopted or are developing Green Economy policies and plans, including Ethiopia, Mozambique, Kenya, Rwanda and South Africa among others.
- In the Asia-Pacific region, national Green Economy strategies are spreading with recent advances in Vietnam, Mongolia and Cambodia, and important steps forward have been taken in China with leadership on what it calls an "ecological civilisation".
- Across the spectrum of Small Island Developing States (SIDS), Barbados adopted Green Economy strategies years before the Rio+20 Summit, and several islands are now moving in this direction, including Jamaica, Mauritius, Seychelles, St. Lucia, and Trinidad and Tobago.
- In Latin America, countries such as Chile, Mexico, Peru and Uruguay are working towards greener and more inclusive economies as part of overarching strategies to achieve sustainable development.
- In South-east Europe (SEE) and Eastern Europe, Caucasus and Central Asia (EECCA), 11 countries, including Azerbaijan, Moldova, Serbia and Ukraine, have been conducting Green Economy assessments and are developing strategies and policies to move towards greener economies.

Each country follows its own pathway towards greener and more inclusive economies. Potentials for green investments will differ, as well as the policy context. However, common aspects are still not few, and by sharing knowledge and experiences, govern ments have been able to adopt new tools and policies domestically. The following four country cases illustrate different strategies that have been used for integrating Green Economy into national policy.

Germany

Germany has been a leading example of transitioning towards a Green Economy. Germany adopted the National Sustainable Development Strategy entitled *Perspectives for Germany – Our Strategy for Sustainable Development* in 2002. The strategy states that sustainable development is Germany's guiding principle for national policy formulation and integrates the three dimensions of sustainable development in four main areas: inter-generational equity, quality of life, social cohesion and international responsibility, which are closely linked to Green Economy.[1]

The organisational structure of Germany's sustainable development is comprehensive and effective. The State Secretaries' Committee for Sustainable Development known as the "Green Cabinet" was established in 2000. Chaired by the Head of the Federal Chancellery, the committee consists of high-level representatives from all ministries and serves as the leader of the national sustainable development process. This mechanism is considered as a key factor in the country's success of sustainable development. Apart from the national-level efforts, the strategy has also been collaborated at local, regional and international levels.

The Federal Government reports the progress made in the implementation of the strategy every four years, while every two years the Federal Statistical Office independently valuates the progress made towards achieving the sustainability goals. The latest progress report released in October 2014 indicates that there was positive progress on 16 indicators out of 38. The main progress was seen in climate protection, renewable energy, innovation, employment and economic performance.[2]

Germany's efforts of combating climate change are demonstrated through the Energiewende (energy transition), which was adopted in 2011 aiming to transform the country to one of the most energy-efficient and greenest economies in the world. In particular, the goal of the Energiewende is to make renewable energy account for 60% of the gross final energy consumption and 80% of the gross electricity consumption in 2050.[3] The 2014 progress report shows that renewable energy already accounts for 12.3% of the gross final energy consumption and 25.4% of the electricity consumption.[4]

1. German Federal Government (2002), *Perspectives for Germany: Our strategy for sustainable development*, Bundesregierung Deutschland, Berlin, www.bundesregierung.de/Content/EN/StatischeSeiten/Schwerpunkte/Nachhaltigkeit/Anlagen/perspektives-for-germany-langfassung.pdf?__blob=publicationFile&v=1.
2. German Federal Statistical Office (2014), *Sustainable Development in Germany: Indicator report 2014*, Statistisches Bundesamt, Biesbaden, https://www.destatis.de/EN/Publications/Specialized/EnvironmentalEconomicAccounting/Indicators2014.pdf;jsessionid=322F28B2E2F07770DFB70B59748BC3E2.cae2?__blob=publicationFile.
3. BMWi (German Federal Ministry of Economic and Technology) and BMU (German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety) (2010), *Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply*, Bundesregierung Deutschland, Berlin, www.germany.info/contentblob/3043402/Daten/3903429/BMUBMWi_Energy_Concept_DD.pdf.
4. German Federal Statistical Office (2014)

The energy targets set in the strategy were also updated in the 2012 Renewable Energies Act (EEG). The EEG provides a feed-in-tariff (FIT) for renewable energy and its priority access to the national grid for 20 years, therefore providing investment security. The EEG has proven to be effective as indicated by the growth in Germany's renewable energy industry as one of the world's leading economies. In 2013, the country was ranked fifth in the world in terms of renewable energy investment, and 371,000 jobs were created in the sector.[1]

Germany has also been a pioneer in the environmental technology industry and maintains its competitiveness in the global market. The High-Tech Strategy 2020[2] and the Master Plan on Environmental Technologies have been adopted to strengthen the country's environmental technology and ultimately accelerate innovation processes. Prioritised in the national strategy and policy, environmental industry has also become one of the most important economic sectors in Germany. The country's global market share of green technologies is 15%: the share of recycling technologies is 24%, that of sustainable water technologies is 20%, and material separation devices has 64% of the global market.[3] The country is also leading Europe in green technology patents submissions,[4] while approximately 1.8 million people are employed in the environmental sector.[5]

Republic of Korea

Among one of the first countries in the world, Republic of Korea incorporated Green Growth in its national development strategy in 2008 and launched the National Strategy and the Five-Year Plan (2009-2013) entitled *Road to Our Future: Green Growth*. In 2009, the Framework Act on Low-carbon Green Growth was enacted, which provides a legal foundation to inform the country's Green Growth policies. The three main objectives of the strategy are: 1) to promote eco-friendly new growth engines for the national economy; 2) to enhance the quality of life for the members of the society; and 3) to contribute to the international efforts to fight climate change (see **Figure 5.1**). The strategy committed to spending 2% of GDP per year on promoting the shift to greener technologies, to increasing its share of green technologies to 10% of the global market in 2020, and to raising public credit advanced to green technology sectors to USD 6.4 billion by 2020.[6]

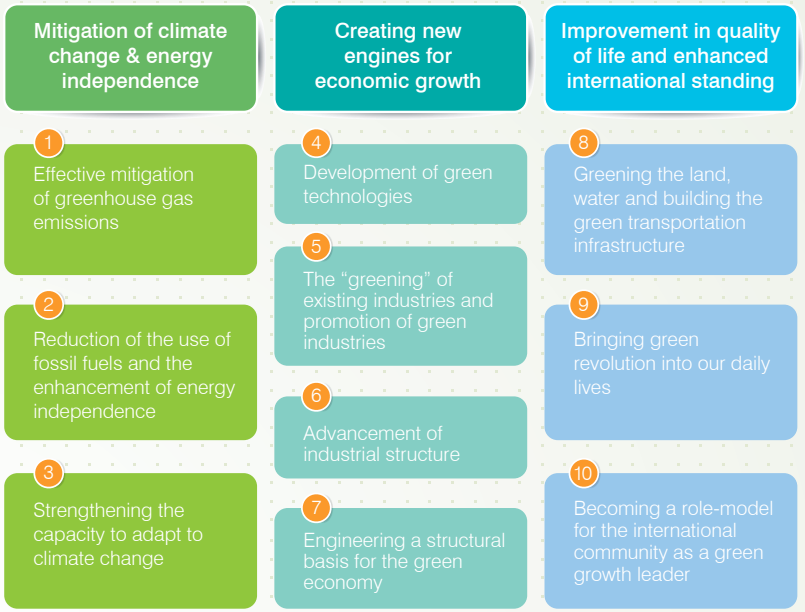


Figure 5.1: Republic of Korea's 3 objectives and 10 policy directions for Green Growth

Source: Korean Presidential Commission on Green Growth, *Road to Our Future: Green Growth*

The Presidential Committee on Green Growth was established in 2009 as the main body to implement the national strategy while all ministries are involved in the planning of the strategy. The committee consists of representatives from all government ministries, the private sector, academia and civil society. In each ministry, a Director General-level Chief Green Officer is designated as the focal point to coordinate and interact with the committee.[7]

Energy is one of the most important sectors in Republic of Korea's Green Growth Strategy. The Energy Master Plan was released in 2008 to provide mid to long-term policy recommendations and targets for the country as well as detailed

1. REN21 (Renewable Energy Policy Network for the 21st Century) (2014), *Renewables 2014: Global status report*, REN21 Secretariat, Paris, www.ren21.net/REN21Activities/GlobalStatusReport.aspx.
2. BMBF (German Federal Ministry of Education and Research) (2010), *Ideas, Innovation, Prosperity: High-Tech Strategy 2020 for Germany*, BMBF, Bonn, www.bmbf.de/pub/hts_2020_en.pdf.
3. BMU (2012), *GreenTech Made in Germany 3.0: Environmental technology atlas for Germany*, BMU, Berlin, www.bmub.bund.de/fileadmin/Daten_BMU/Pools/Broschueren/greentech_3_0_en_bf.pdf.
4. Germany Trade & Invest, *Environmental Technologies* webpage, www.gtai.de/GTAI/Navigation/EN/Invest/Industries/Energy-environment-resources/environmental-technologies.html, accessed on 5 December 2014.
5. German Federal Government (2012), *National Sustainable Development Strategy: 2012 progress report*, Press and Information Office of the Federal Government, Berlin, www.bundesregierung.de/Content/DE/_Anlagen/Nachhaltigkeit-wiederhergestellt/2012-06-07-fortschrittsbericht-2012-englisch-barrierefrei.pdf?__blob=publicationFile&v=5.
6. Korean Presidential Commission on Green Growth (2009), *Road to Our Future: Green Growth – National Strategy and the Five-Year Plan (2009-2013)*, Presidential Commission on Green Growth, Seoul, www.greengrowthknowledge.org/resource/road-our-future-green-growth-national-strategy-and-five-year-plan-2009-2013.
7. UNEP (2010), *Overview of the Republic of Korea's National Strategy for Green Growth*, UNEP-DTIE Economics and Trade Branch, Geneva, www.unep.org/PDF/PressReleases/201004_unep_national_strategy.pdf.

development plans for each sub-sector. The updated Energy Master Plan in 2014 assessed the progress achieved in the first phase and placed targets for 2035. The assessment shows that between 2007 and 2011, the number of enterprises doubled, the number of employees increased four times, the volume of sales increased eight times and the volume of exports and amount of private investment seven times.[1] The government introduced a renewable portfolio standard (RPS) in January 2012, under which electricity companies are required to produce or buy a specified share of their electricity from renewable sources, and targets that 10% of electricity supply will be from renewables by 2022.[2]

Green innovation has been identified by the country as one of the drivers to achieve the Green Growth objectives. The country spent 3.6% of GDP for R&D in 2009, ranked as the third in the OECD area, well above the OECD average of 2.4%.[3] In addition, a Green Technology Centre was established in March 2012 to improve the competitiveness of the country's green technology industry and make it a global leader in the sector. With the arrival of the new President and administration in February 2013, the emphasis on innovation has been put front and centre in the concept of a "Creative Economy," one that focuses on human talent and creativity to deliver growth and decouple it from environmental degradation.

China

China's efforts to pursue "green development" can be traced back to the 1970s or earlier. The high-level commitment on Green Economy has been reaffirmed through the latest national development strategy, the 12th Five-Year Plan (2011-2015), which devoted an entire chapter to green development. A series of policies and regulations have been put into place and a remarkable amount of investment has been mobilised.

In China, "Ecological Civilisation" has been identified as the guiding principle and priority for national development. The concept was first introduced in October 2012 at the 17th National Congress of the Communist Party and it has received unprecedented political attention thereafter. The central government of China is aiming to incorporate the construction of an Ecological Civilisation into economic, political, cultural and social development. Broader than the concept of Green Economy, Ecological Civilisation consists of the traditional environmental protection element (such as resource management, pollution control and ecological protection) as well as the economic opportunity element, which is the key of Green Economy, including low-carbon and circular economy development.[4]

UNEP and the Institute of Science and Technological Information of China (ISTIC) conducted a study using the Threshold 21 (T21) model to simulate the cost and benefit of basic, green and brown scenarios in seven sectors (agriculture; forestry; green building; renewable and unclean energy; municipal solid waste; cement; and urban transportation) in China. The result shows that the green scenario may slow down the speed of development somewhat while maintaining a decent growth rate, if environmental costs are taken into account (from 7.46% to 7.28% over the period of 2015-20; from 4.75% to 4.52% over the period of 2020-30; and from 2.73% to 2.4% over the period of 2030-50). However, the green scenario would increase the country's competitiveness by reducing the dependence on import and the economic impact from oil price fluctuation. As shown in **Figure 5.2**, the energy consumption and CO_2 emission would decline more rapidly than the economic indices.[5]

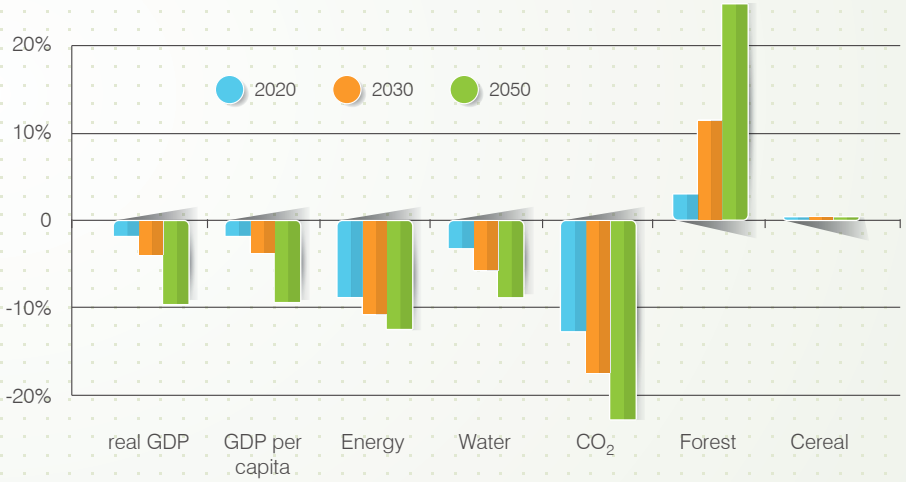


Figure 5.2: Changes in main indicators under the green scenario from the baseline scenario

Source: UNEP, *Modelling China's Green Economy 2010-2050*

1. MOTIE (Korean Ministry of Trade, Industry and Energy) (2014), *Korea Energy Master Plan: Outlook and policies to 2035*, MOTIE, Seoul, www.motie.go.kr/language/eng//policy/Epolicies.jsp.
2. Jones, S. and B. Yoo (2012), *Achieving the "Low Carbon, Green Growth" Vision in Korea*, OECD, Paris, www.oecd-ilibrary.org/docserver/download/5k97gkdc52jl.pdf?expires=1416498543&id=id&accname=guest&checksum=DAB9AA59BE354E39239F1598ACD4B0C6.
3. Jones and Yoo (2012)
4. Tongji University and UNEP (forthcoming), *Green Economy: UN's theory, approaches and cases* (in Chinese).
5. UNEP (2014b), *Modelling China's Green Economy 2010-2050: A synthesis report* (in Chinese), UNEP, Nairobi.

In the last decade, China has achieved tremendous progress on advancing a green transition, especially in renewable energy and environmental industries. For example, China has become the world leader in renewable technology investment. Ranked the first worldwide in 2013, China's new renewable energy investment accounted for USD 56.3 billion (including R&D), which is more than all of Europe combined and it is the first time the investment in renewables surpassed fossil fuels. Benefitting from the investment, 2.64 million jobs have been created in the sector in 2013 and 36 million people have acquired access to electricity through off-grid sources between 1998 and 2012.[1] [2]

China is becoming a leader in renewable technologies. (Mulan Wind Farm)

As a result of the economic stimulus plan, the annual income of the environmental industry was around RMB 300 million (USD 48 million) and the annual compound growth rate reached 30% in 2012.[3] This significant development also benefited from the supporting policies on encouraging investment. The energy savings and environmental protection industry was listed as one of the seven National Strategic Emerging Industries by the government. The other six industries identified as key for 2011-2015 were new auto industry, new-generation information technology, biology, high-end equipment manufacturing, new energy and new material. According to the 12th Five-Year Plan, these seven industries are expected to produce a value-added of 8% of the country's GDP in 2015 and 15% in 2020.[4]

While China's growth has been tremendous, it has not been without its costs: research shows that 1.23 million premature deaths in 2010 was linked to PM 2.5 pollution, which in monetary terms is equivalent to 9.7-13.2% of GDP.[5] In addition, out of 469 monitored sections of China's key national river basins, almost 40% of them were assessed as Grade IV [6] or worse, deemed inappropriate for contact with human skin.[7] More attention and investment in creating an Ecological Civilisation will be required in the coming years to address the growth aspirations of the economy with looming ecological constraints.

Chile

In December 2013, the Government of Chile launched its National Green Growth Strategy which was developed by the Ministry of Finance and the Ministry of the Environment. The strategy aims to adequately ensure that the risks to public health are reduced, improve the quality of life and protect the environment through strengthening existing environmental management instruments, designing new instruments, following the best international regulatory practices and creating a national market for environmental goods and services.[8]

The strategy is divided into three axes along which the lines of action fall. These are: 1) internalisation of environmental externalities through the implementation of environmental management instruments; 2) promotion of markets of environmental goods and services; and 3) the monitoring and measuring through indicators (see **Figure 5.3**).[9] This structuring is meant to be progressive such that the implementation of environmental management instruments creates an opportunity for the development of environmental goods and services and that the strategy will require continuous measurement of progress through indicators.

1. REN21 (2014)
2. Chinese National Energy Administration (2013), "National Energy Board meeting on solutions to the problem of people without electricity", news release (in Chinese), 31 July, www.nea.gov.cn/2013-07/31/c_132590749.htm.
3. Xinhua (2013), "Income from China's environmental industry is around RMB 300 million and compound growth rate reached 30%", wire report (in Chinese), 10 December, www.bjcankao.com/index.php?m=content&c=index&a=show&catid=144&id=25284.
4. Chinese State Council (2011), *National 12th Five-Year Plan of Environmental Protection* (in Chinese), Government of China, Beijing, www.gov.cn/zwgk/2011-12/20/content_2024895.htm.
5. New Climate Economy (2014), *Better Growth, Better Climate: The new climate economy report*, World Resources Institute, Washington, DC.
6. Grade I water is the highest quality and Grade V-plus the worst. Water meeting at least Grade II is deemed useable for drinking and water quality Grade IV or worse is inappropriate for contact with human skin.
7. Hill, S. (2013), *Reforms for a Cleaner, Healthier Environment in China*, OECD Economics Department Working Papers, No. 1045, OECD, Paris.
8. Chilean Government (2013), *National Green Growth Strategy*, Gobierno de Chile, Santiago de Chile, www.mma.gob.cl/1304/articles-55866_National_Green_Growth_Strategy.pdf.
9. Chilean Government (2013)

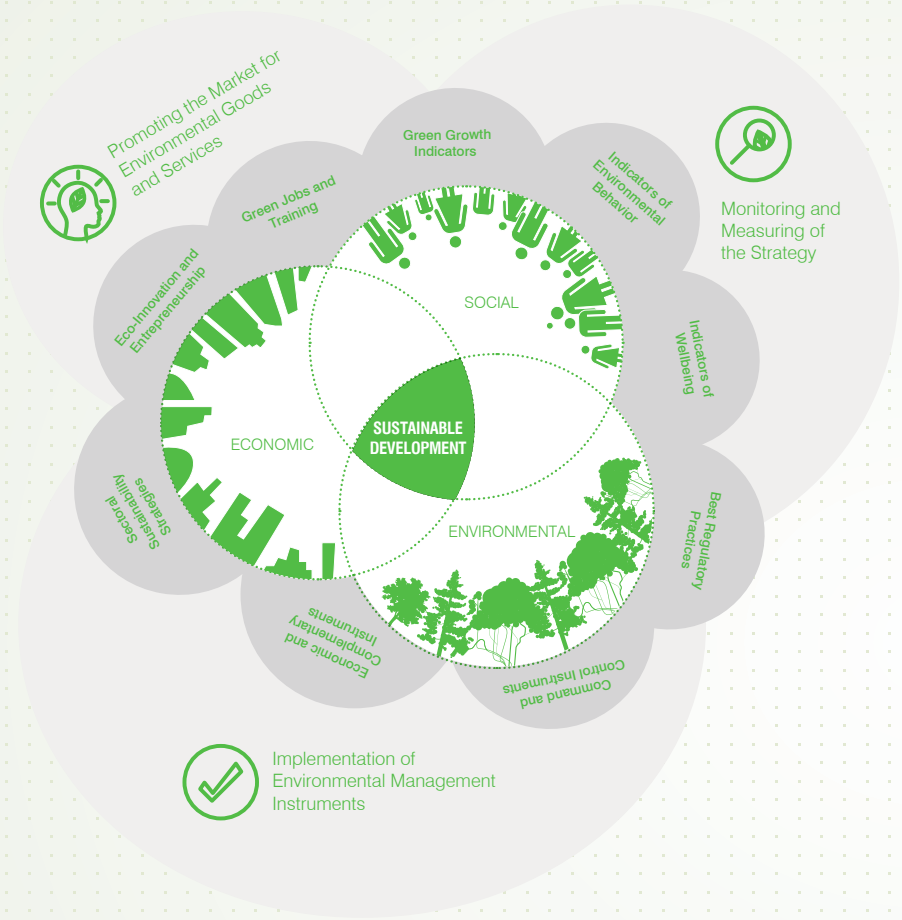


Figure 5.3: Chile's 3 strategic axes and lines of action for Green Growth

Source: Chilean Government, *National Green Growth Strategy*

The implementation of the National Green Growth Strategy is being led jointly by the above two ministries. Coordination between ministries will be overseen by the Office of the Undersecretary of the Environment so as to ensure that the strategy is incorporated into the policy-making processes at all levels. This is to be achieved through the creation of a Committee on Sustainable Consumption and Production consisting of representatives from the Council of Ministries on Sustainability. Stakeholders from international organisations and the civil society will be engaged through consultations.

Even before the adoption of the strategy, the Chilean government had already begun working towards a low-carbon economy. For example, in 2008 the government adopted the National Action Plan on Climate Change and set the target for GHG emission reduction by 20% by 2020 compared to 2007 levels.[1] This is being done through Nationally Appropriate Mitigation Actions (NAMAs), which are essentially voluntary mitigation actions achieved through signing clean production agreements with companies. Chile was the first country in the world registered in NAMAs to pursue domestic mitigation based on reductions achieved by energy efficiency improvements in companies. The country also formulated the Energy Efficiency Action Plan 2012-2020 (PAEE20), managed by the Agency for Energy Efficiency (AChEE), which aims to cut energy consumption by 12% by 2020. In 2013, the government committed to provide USD 14 million to implement energy efficiency measures.[2]

Common success factors

The transition towards a Green Economy is a long-term process, and it is too soon to judge whether the efforts being undertaken will lead to desired changes countries are seeking. Nonetheless, the above country examples could provide reference on the leading country practices in pursuing green transition. Each example is cited within the unique circumstances of the country in which it is enacted; however, there are some common features that positively contribute to the success of a Green Economy transition.

First and foremost, Green Economy needs high-level political commitment and support, resulting from a clear vision of the future and the role of environmental sustainability in securing it. All of the examples discussed above illustrated that high-level leadership plays a critical role in initiating and sustaining the national Green Economy strategy and practices.

In addition, given the cross-cutting nature of Green Economy, strong institutional capacity and arrangements are indispensable. An inter-ministerial coordination mechanism is a common and effective factor to the success. For example, Germany's Green Cabinet and Chile's Committee on Sustainable Consumption and Production are essential parts of delivering on their national strategies. While national coordination is crucial, coordination at various levels of government, such as sub-national and community level, contributes largely to the final result.

1. Chilean Ministry of the Environment (2011), *Official Environment Status Report*, p.448, Gobierno de Chile, Santiago de Chile.
2. OECD (2014b), *Chile's Pathway to Green Growth: Measuring progress at local level*, OECD, Paris.

The disparities between national and sub-national governments are often observed because sub-national governments are more focused on short-term priorities such as health and economic development rather than long-term environmental concerns or broader national priorities. The key to success is in aligning them early on in the policy process. Building greener and more inclusive economies is a society-wide exercise that cannot be undertaken without a deep anchoring across social groups. Credibility of the governmental commitments and participation in the decision-making processes is important to ensure fundamental public support.

Third, investment is the engine to boost a green transition by building green infrastructures and creating new markets for environmental goods and services. Backing up the UNEP's Green Economy approach of creating new capital, such as low-carbon, technological and human capital, investment has been identified by most countries as a powerful tool to achieve a Green Economy. For example, Republic of Korea's investment in green R&D and China's remarkable investment in renewable energy and environmental industry both illustrate the key role that finance and investment play in shaping the future profile of an economy. Private-sector resources and ingenuity will play a key role in delivering long-term prosperity once governments provide a suitable enabling investment policy environment and mobilise public and private investment at the initial stage. The encouraging figures from Germany's environmental technology market share, China's income and growth rate from the environmental industry and jobs created by greening the economy are indicative of the results that can flow from this kind of strategy. Proper incentives provided through economic instruments, regulations and distributional policies can help channel investments towards targeted sectors and enhance the effectiveness and fairness of such investments.

Green Economy policies are being implemented worldwide, like in Mongolia, one of PAGE countries.

An inclusive Green Economy has the potential to deliver increased well-being while decoupling growth from ecological constraints. However, this cannot be achieved without carefully addressing the social and distributional aspects. The building of a greener and more inclusive economy is an environmental, social and economic transition, and puts a healthy environment and increased well-being at the centre of the process. Inclusion of the social and environmental dimensions in central policy design and targets is fundamental for achieving a successful and sustainable Green Economy.

UN's approach towards building green and more inclusive economies

Green Economy is a holistic concept involving policy reforms in a number of key sectors in a country. Macro-economic policy reforms, creating fiscal space, promoting investment in greening key sectors for economic growth and job creation are some of the important areas of engagement with the overall goal of poverty reduction and environmental sustainability.

While there are multiple pathways for achieving sustainable development, UNEP has found the following elements to be particularly useful for advancing a Green Economy agenda:

- **Generating global knowledge:** With an emerging adoption, there is an increasing need of better understanding and sharing of knowledge in relation to Green Economy approaches. Although the exact approach taken varies, a considerable amount of lessons learned and advice can be pulled out from country experiences. This global knowledge can be an important reference for governments embarking on a Green Economy pathway. For example, *UNEP Green Economy Toolkit for Policymakers* (see next page) provides countries with practical guidance on how to formulate and assess policies, measure progress and model future effects of the transition.

- **National-level dialogue and consultation:** Ownership at the highest political level with participation of all stakeholders forms the basis of advancing transition to a Green Economy at country level. National-level dialogues and consultations via multi-stakeholder engagement with policy-makers, sector specialists, civil society, international organisations and donor agencies provide information and awareness, prepare ground for conducting country assessments, and identify opportunities for greening the economy.

- **Macro-economic assessments:** Economy-wide assessments are conducted by UNEP together with its national partners with a specific focus on economic growth and development, potential for green jobs creation, poverty effects, resource efficiency and environmental improvement, among others. National Green Economy Reports including scoping studies, sectoral assessments, fiscal policy studies, investment plans and national implementation strategies and actions plans are developed through a combination of multi-disciplinary research, system dynamic modelling and a multi-stakeholder participatory process to identify opportunities and options for the transformation towards an inclusive Green Economy.

- **Training and capacity building:** Capacity enhancement of government departments, private sector, civil society and other stakeholders for implementing Green Economy policies, strategies, plans and projects is a key element in building more inclusive and greener economies. UNEP brings global knowledge and experience for capacity building to enhance skills for green jobs, policy development, international standards and other approaches in order to assist countries in this process.

- **Partnerships:** Building partnerships from inception by engaging regional and national-level research and academic institutes, international organisations, civil society actors and other stakeholders in the entire process ensures enhancing national and regional capacity and institutionalising Green Economy across all levels.

- **South-South cooperation:** Drawing on shared economic, environment and social aspirations, South-South cooperation is increasingly playing a key role in identifying solutions to today's sustainable development challenges, as well as delivering new ideas and resources to advance the global transformation to an inclusive Green Economy. UNEP organises regional and inter-regional policy dialogues and conferences for cross-fertilisation and replication of successful experiences and South-South cooperation in identified areas to strengthen existing common regional agreements and standards, enhance investment, trade and other mutually beneficial exchanges.

UNEP Green Economy toolkit for policy makers

UNEP published *the Green Economy Toolkit for Policymakers* in 2014, which consists of the following three publications:[1]

- ***Guidance Manual for Green Economy Policy Assessment*** advises governments on how to set targets, identify policy reform needs, estimate the amount of investment and assess policy impacts.

- ***Guidance Manual for Green Economy Indicators*** explores the use of indicators to measure progress towards a more resource-efficient and inclusive economy. The report provides practical guidance on how to use indicators in specific national contexts.

- ***Using Models for Green Economy Policymaking*** concerns macro-economic planning for both short and long-term, and provides countries with a range of modelling tools for formulating and evaluating the impacts of green economy policies.

Over 20 UN agencies are engaged in Green Economy activities, in addition to the International Monetary Fund (IMF), the World Bank, OECD, private and civil society partners. Within the UN, *the Green Economy Initiative* and a number of activities are supporting greener and more inclusive economies at the global level, some of which are summarised below:

- *Partnership for Action on Green Economy (PAGE):* The UN's response to the Rio+20 call to assist countries on Green Economy combines the collective expertise of UNEP, the United Nations Institute for Training and Research (UNITAR), the International Labour Organization (ILO), the United Nations Industrial Development Organization (UNIDO) and UNDP. The programme aims to assist 30 countries by 2020, with 20% of this goal already underway in 2014.

1. Available from http://unep.org/greeneconomy/ResearchProducts/tabid/4605/language/en-US/Default.aspx

- *Green Growth Knowledge Platform (GGKP)*: Founded by GGGI, OECD, UNEP and the World Bank, this platform is a global partnership of 36 leading organisations working to collaboratively identify and address major knowledge gaps in Green Growth theory and practice.

- *UNEP-UNDP Poverty-Environment Initiative (UNPEI)*: UNEP and UNDP lead a global programme that supports country-led efforts to mainstream poverty-environment objectives into national development and sub-national development planning, from policy-making to budgeting, implementation and monitoring, now in 26 countries. The overall aim is to bring about lasting institutional change and to catalyse key actors to increase investment in pro-poor environmental and natural resource management.

- *UN Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD Programme)*: FAO, UNDP and UNEP jointly support country-led REDD+ processes currently in 56 partner countries, promoting the informed and meaningful involvement of all stakeholders, including Indigenous Peoples and other forest-dependent communities, in national and international REDD+ implementation.

- *Inquiry into the Design of a Sustainable Financial System*: Extending over 18 months from early 2014 to mid-2015, UNEP investigates options that will accelerate and scale emergent policy innovations that better align the financial system to sustainable development and associated positive environmental and social outcomes.

PAGE and the UAE's contributions to the world

The outcome document of the UN Rio+20 Summit *The Future We Want* invited "the United Nations System, in cooperation with relevant donors and international organizations, to coordinate and provide information upon request" for countries choosing to implement Green Economy policies.[1] The Partnership for Action on Green Economy (PAGE) was created as a direct UN response by drawing on expertise across the UN system starting with UNEP, UNITAR, ILO, UNIDO and UNDP.

PAGE was formally launched at the UNEP Governing Council in February 2013 with the vision to assist 30 countries to embark on Green Economy pathways by 2020. The partnership provides access to research, knowledge and tools, organises policy dialogues with and between governments, and provides capacity building and support for policy design and implementation to advance the sustainable development agenda. The UAE has played an important role in the establishment of PAGE. In March 2014, the UAE hosted the first Global Conference on PAGE with UN agencies in Dubai. More than 650 participants from 66 countries, including 27 Ministers, gathered at the conference. The conference clearly showed that the shift towards an inclusive Green Economy is no longer a luxury preserved for high-income countries but has now become relevant to all, as the countries across the globe take positive actions in this direction. The conference also provided an opportunity to welcome the engagement of Burkina Faso, Ghana, Senegal and Mauritius who joined Mongolia and Peru as official PAGE countries.

First PAGE Conference in Dubai (March 2014)

At the end of the event, it was agreed to organise the conference every two years to share country efforts and to hold the fourth PAGE Conference again in Dubai in six years' time, coinciding with Expo 2020. The Fourth Conference and Dubai Expo 2020 will be a great opportunity to bring innovative ideas

1. UN General Assembly (2012), para. 66.

From the First PAGE Conference

and promising solutions together and to truly realise a global collaboration for sustainable living. Committed to investing in innovation and knowledge sharing, the UAE also announced its additional important contribution to PAGE through the establishment of a Green Economy Centre of Excellence in Dubai as well as the development of a toolkit.

Through its initiatives in developing Green Economy policies and innovation, the UAE is in an excellent position to demonstrate its leadership in the worldwide transition to greener and more inclusive economies. *The UAE Green Growth Strategy* and the publication of *the UAE State of Green Economy Report* is an important first step and puts the UAE in a pole position to inspire more countries to bring Green Economy into the centre of national planning.

The Green Economy approach has the potential to address the large challenges related to social equity and the environment that the world is facing today. Front runners have already demonstrated its feasibility, and more countries are expected to follow. However, considerable efforts will still be needed in order to achieve economies that truly put people and the environment at their centre and that create enhanced human well-being and strengthened ecological resilience. Transitioning away from current patterns of development and consumption will not be easy, but over time will become both a source of innovation and opportunities for sustained and sustainable prosperity well into the future.

5-2. Mobilising finance and investment for an inclusive Green Economy

Charles Anderson
Director
UNEP Finance Initiative

Risks of financing carbon emissions

The UNEP Finance Initiative (UNEP FI) is a strategic public-private partnership between UNEP and the global financial sector established in the context of the 1992 UN Earth Summit in Rio de Janeiro. Its mission is to identify, promote, and realise the adoption of best environmental and sustainability practice at all levels of financial institution operations.

Finance, in any of its forms, may be deployed to support activities that may have a positive impact in the social and environmental context, or that facilitate activities that have negative impacts. Historically, with limited exceptions, the capital markets and banking and finance industry in general have allocated finance without active consideration of these impacts to entities that do not consider the cost of externalities. However, if such "business as usual" is not an option any longer as concerns over climate change and other environmental challenges keep rising, what are the implications for the finance system?

If one accepts the science, carbon emissions are going to be required to peak by 2030 and to reduce annually thereafter with carbon neutrality to be achieved by the second half of the century.[1] It is expected that countries will plan to achieve their own contribution to this in a way that reflects the reality of their economies and stage of development. Europe[2],China and the United States[3] have announced

1. UNEP (2014c), *Emissions Gap Report 2014*, UNEP, Nairobi; Caring for Climate Business Forum, A Global Call for Climate Action webpage, http://caringforclimate.org/forum, accessed on 18 December 2014.
2. European Council (2014), *2030 Climate and Energy Policy Framework*, Note SN79/14, 23 October, www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/145356.pdf.
3. White House Office of the Press Secretary (2014), "Fact Sheet: U.S.-China joint announcement on climate change and clean energy cooperation", press release, 11 November, www.whitehouse.gov/the-press-office/2014/11/11/fact-sheet-us-china-joint-announcement-climate-change-and-clean-energy-c.

officially their intentions in this respect and others will follow. Achievement of these goals will explicitly require investment in new climate-friendly technologies across all areas of commercial activity, but with particular emphasis on renewable energy and phasing out climate-unfriendly activities.

In this scenario, there will be requirements, likely to be mandatory, to measure and disclose openly the finance sector's exposures to carbon-intensive assets, the carbon footprint of investment and banking-sector portfolios ("financed emissions"), and natural capital-dependent commercial interests. This will require, ultimately, all listed entities to provide much more comprehensive data on non-financial performance indicators. Gathering momentum in the Sustainable Stock Exchange (SSE) movement[1] is a positive sign in this direction, which can be reinforced by universal investors calling for a globally consistent approach. The work which has been done by the International Integrated Reporting Council (IIRC) and its Dialogue for Corporate Reporting (CRD)[2] will hopefully produce the international standard being called for.

It is highly likely that there will be a price on carbon either formally set within specific jurisdictions and/or reinvigorated carbon trading schemes with consequential profit impacts on carbon-intensive activities. At the UN Climate Summit in September 2014, 359 investors representing some USD 24 trillion in assets called for governments to set a price on carbon.[3] Some investors are already disinvesting from carbon assets or de-carbonising their portfolios.[4] [5] The techniques and different approaches required to achieve this will be refined and ultimately institutionalised in the investment community.

Over time, fiscal measures, industry standards and policy frameworks will act further to incentivise investment in climate-friendly technologies and dis-incentivise the opposite. Financing the "losers" will potentially result in non-performing loans and write-offs, investment write-downs and capital losses. Also, there could well be a spread of direct financial sector regulation seeking to influence the allocation of finance to specific types of activity and away from others (e.g. China's Green Credit Guidelines, Bangladesh Central Bank's refinancing priorities).[6]

Examples on growing green bond market

- **Zurich Insurance Group** will invest up to USD 2 billion in AAA-rated green bond funds. Nearly 30% of the group's investment portfolio is in government or supra-national bonds. Zurich hopes that its contribution can have the additional benefit of developing scale and liquidity in the green bond market and encourage new issuers to come to market, while promoting robust and transparent project selection and the reporting standards for impact.

- **Bank of America Merrill Lynch** joined in corporate green bond issuance and set a ten-year goal to reach USD 50 billion environmental business. The proceeds are used to finance renewable and energy efficiency projects via loans and credit lines.

In the banking sector, "lender liability" to remedy environmental contamination caused by financed assets, which has been already a feature of some markets (South Africa, UK to a degree), could become more prevalent raising the need for pre-funding involvement by financiers in robust environmental impact assessments, the identification of mitigation measures and subsequent monitoring and verification. Many leading banks already incorporate environmental and social risk analysis (ESRA) in the credit approval processes, principally to identify risks, and a few at the forefront are developing methodologies to rate all clients against environmental, social and governance (ESG) benchmarks and set targets for improving the rating of their overall portfolio over time. Potentially techniques to incentivise long-term equity investment will emerge in an attempt to counter the prevailing short-termism of the capital markets.

1. SSE (Sustainable Stock Exchanges) Initiative website, www.sseinitiative.org, accessed on 18 December 2014.
2. IIRC (International Integrated Reporting Council) (2014), *Corporate Reporting Dialogue*, IIRC, London, www.theiirc.org/wp-content/uploads/2014/06/Corporate-Reporting-Dialogue.pdf.
3. UNEP FI (UNEP Financial Initiative) et al. (2014a), *Global Investor Statement on Climate Change*, September, UNEP FI, Geneva, www.unepfi.org/fileadmin/documents/GlobalInvestorStatementOnClimateChange.pdf
4. UNEP FI et al. (2014b), *The Portfolio Decarbonization Coalition: Mobilizing financial markets to catalyze economic decarbonization*, UNEP FI, Geneva, www.unepfi.org/fileadmin/documents/PortfolioDecarbonizationCoalition.pdf; Cameron J. (2014), "UN Climate Summit: A call to action for low carbon investors and advisors", CCC Thinktank website on Rockerfeller Foundation's announcement, 1 October, www.climatechangecapital.com/thinktank/opinion/un-climate-summit-a-call-to-action-for-low-carbon-investors-and-advisors.
5. Schwartz J. (2014), "Rockefellers, heirs to an oil fortune, will divest charity of fossil fuels", *New York Times*, 21 September, www.nytimes.com/2014/09/22/us/heirs-to-an-oil-fortune-join-the-divestment-drive.html?_r=0.
6. UNEP Inquiry into Design of a Sustainable Financial System (2014), *Aligning the Financial System with Sustainable Development*, October, UNEP, Geneva, www.unep.org/inquiry/Portals/50215/Documents/Inquiry_Summary2_Insights_v3.pdf.

Risks associated with climate change will increasingly be factored into corporate and sovereign bond ratings with implications for bond investors.[1] [2] Unfortunately, this could well lead to the cost of financing rising in the countries most at risk, reducing their capacity to fund adaption measures unless special support measures are put in place by multilateral development banks.

Standards will also be developed for the issuance of "green bonds"[3] to accelerate the rapid growth of this nascent market (USD 40 billion in issuance in 2014 and forecast to be USD 100 billion in 2015) where examples are shown in the previous page.[4]

In the developed markets, energy efficiency finance will particularly be an area for increased focus and opportunity as it is now formally on the G20 agenda. Good work has already been done in a number of relevant areas[5] and in resolving the technical aspects of financing large-scale residential properties and renewable energy infrastructure.

Scaling up sustainable finance

To enable a more comprehensive, systemic uptake of climate-friendly, sustainable finance, what is now needed is to create a bridge between the "trillion dollar funding gap"[6] worldwide and the financial institutions and to break this down into country-specific funding plans in a way to be consistent with Green Economy plans where they exist like the UAE. Such a breakdown would clearly identify priority areas for investment (and disinvestment) and map the associated mix of funding sources required. In developed economies, this would include transitional finance as existing infrastructure is wound down or disestablished in favour of sustainable replacements.

The available funding mix will clearly differ by country or region: Economies with very thin or non-existent capital markets need to leverage support from multilateral development banks, public funding and the banking sector, whereas others – including the UAE – may be able to look into a broader mix of private-sector investors via the capital markets with, for example, green bonds. The funding plan would also address incentives, fiscal measures and other policy initiatives.

Examples on supporting renewable energy projects

- **ING Group** grows its renewable energy project loan portfolio to more than USD 1.5 billion. ING has reduced its project loan portfolio exposure to coal power from 63% in 2006 to 13% in 2013 and at the same time increased its exposure to renewables from 6% to 39%. ING Commercial Banking's Sustainable Lending Strategy strives to embed sustainable development at the core of its business. It has achieved this transformation in its loan book as a result of its own efforts (sector knowledge and risk appetite) and external factors (economic and political influences on markets).

- **Westpac** commits up to AUD 6 billion (USD 4.9 billion) for lending and investment in clean technology and environmental services by 2017. This will double the Group's investment in the sector and includes renewable energy, the property sector, water efficiency and environmental services. Progress to date has been primarily in renewable energy, including two major wind farms and a solar farm, and the greening of the property sector.

- In the past three years, **Standard Bank Group**, which is the largest bank in Africa by assets and turnover, has underwritten renewable energy projects in Angola, Ghana, Kenya and Nigeria. In South Africa, it has supported projects to the value of ZAR 16.1 billion (USD 1.4 billion) in the country's Independent Power Producer Programme. Renewable energy has become a significant portion of Standard Bank's energy portfolio and has earned it top 10 international ranking for renewable energy funding.

1. S&P (Standard & Poors) (2014), *Sovereign Risk Indicators*, S&P, New York, www.standardandpoors.com/ratings/news-and-commentary/govs-sovereigns/en/us/?titleId=1221190976553&pTitleId=1221190976151.
2. Sahai, N. (2014), "Climate change: What are the risks to Corporations?", *Fortune*, 9 July, http://fortune.com/author/neeraj-sahai.
3. Green bond is a fixed-income security that raises capital for a project with specific environmental benefits, where the proceeds are ring-fenced for climate mitigation or adaptation efforts.
4. CBI (Climate Bonds Initiative) (2014), *Bonds and Climate Change: The state of the market in 2014*, CBI, London, www.climatebonds.net/files/post/files/cb-hsbc-15july2014-a3-final.pdf
5. UNEP FI Property Working Group (2014), *Commercial Real Estate: Unlocking the energy efficiency retrofit investment opportunity*, UNEP FI Investor Briefing, February, UNEP FI, Geneva, www.unepfi.org/fileadmin/documents/
6. IEA (2014b), *Special Report: World Energy Investment Outlook*, OECD/IEA, Paris.

While the development of national Green Economy funding plans is promoted, there are also actions that the finance-sector actors can take for sustainable finance in the meantime, such as:

- At the industry sector (banking, investment, insurance) and institutional level, develop practice guidelines that integrate ESG factors in core operations and develop the capacity to implement these across the business and at depth with integrity;
- Support the call for global action by governments and regulators to set standards for sustainable activities;
- Identify existing financial support for carbon-intensive activities and define a transition plan to reduce exposure;
- Do not finance additional capacity in the worst-performing carbon-intensive industries. Allocate new financing to activities that support Green Economy, i.e. energy-efficient, low-carbon production and consumption;
- Identify new technologies, create centres of excellence that understand how to finance these initiatives and set targets for levels of investment and finance; and
- Develop the capacity to work in partnership with public-sector funding agencies.

UNEP Finance Initiative
Changing finance, financing change

UNEP FI's Africa and Middle East Task Force works to support and expand sustainable finance practices in the regions. The top priority of this task force is to create a critical mass of signatories in these regions that are able to exchange ideas and best practices as well as learn about global developments in the field. UNEP FI particularly welcomes the UAE's financial institutions to become our members.

Annex: Summary of the UAE's latest performance according to *the Green Economy Indicators*

	Indicator	Performance	Year	Source	World ranking	GCC ranking	Recent trend	2021 target
Inputs I (Natural resource base)	**N1. Reserves of minerals**							
	Oil reserves	**97.8 billion barrels** (R/P: 73.5 years)	2013	I	7th	3rd	→	
	Gas reserves	**6.1 trillion m³** (R/P: >100 years)	2013	I	7th	3rd	→	
	N2. Land resources							
	Economically cultivatable land	Abu Dhabi: **311,000 ha** (5.2% of total land)	2009	L				
		Northern Emirates: **101,678 ha** (13.4% of total land)	2012	L				
	Forest areas	**319,400 ha** (4.5% of total land)	2012	I			↗	
	N3. Marine resources							
	Fish stocks (Arabian Gulf)	**599 kg/km²**	2011	L+I			↘	
	Fish stocks (Sea of Oman)	**529 kg/km²**	2011	L+I			↘	
	N4. Wildlife resources							
	Number of plant species	**800** (at least)	2014	L				
	Number of animal species	Mammals: **48**; Birds: **440**; Reptiles: **70** (at least)	2014	L				
	N5. Freshwater resources							
	Fresh groundwater reserves	**20 billion m³**		L			↘	
	Renewable internal freshwater resources per capita	**16.8 m³/year**	2011	I	173rd /174	4th	↘	

Source **L**: Data from a local source (UAE); **I**: Data from an international or regional source (UN, World Bank, GCC, etc.)
Ranking Where marked with a symbol *, the ranking is counting upwards from the lowest performing economy, which has the largest value for that indicator.
Recent trend ↗: Improving →: Stable ↘: Deteriorating

	Indicator	Performance	Year	Source	World ranking	GCC ranking	Recent trend	2021 target
Inputs II (Socio-economic conditions)	**C1. Innovation**							
	Global Innovation Index National KPI	**36th** in the world	2014	I	36th /143	1st	→	Among top 20 countries
	R&D expenditure National KPI	**0.49%** of GDP	2011	I	48th /77			1.5%
	C2. Business environment							
	Global Competitiveness Index National KPI	**12th** in the world	2014-15	I	12th /144	1st	↗	Among top 10 countries
	Foreign direct investment net inflows National KPI	**2.5%** of GDP	2012	I	108th /186	2nd	↗	5%
	Ease of Doing Business Index National KPI	**22nd** in the world	2015	I	22nd /189	1st	↗	1st in the world
	C3. Entrepreneurship							
	Global Entrepreneurship & Development Index National KPI	**20th** in the world	2015	I	20th /130	1st	↗	Among top 10 countries
	C4. Workforce							
	Working population	**Approx. 6.25 million**	2012	I			↗	
	Labour participation rate	**79.3%** (male 91.0%; female 46.6%)	2012	I			↗	
	C5. Knowledge & Education							
	Pupils who reached Grade 5	**97.4%**	2010	L			↗	
	Graduates from higher education	**19,257** (male 7,229; female 12,028)	2011-12	L			↗	
	OECD PISA score National KPI	**441** (mathematics 434; reading 442; science 448)	2012	I	46th /65			Among top 20 countries

Source **L**: Data from a local source (UAE); **I**: Data from an international or regional source (UN, World Bank, GCC, etc.)
Ranking Where marked with a symbol *****, the ranking is counting upwards from the lowest performing economy, which has the largest value for that indicator.
Recent trend ↗: Improving →: Stable ↘: Deteriorating

	Indicator	Performance	Year	Source	World ranking	GCC ranking	Recent trend	2021 target
Efficiency (Production and consumption)	**E1. Ecological Footprint**							
	Ecological Footprint per capita	**7.75 global hectares**	2014	I	146th * /148	3rd *	↗	
	E2. Greenhouse gas intensity							
	GHG emissions per capita	**18.8 t/year**	2012	L+I			↗	
		19.9 t/year (only CO_2 from fossil fuel combustion and cement production)	2010	I	192nd * /199	3rd *		
	GHG emissions per GDP	**324 g/$**	2012	L+I			↗	
		451 g/$	2010	I	152nd * /187	1st *		
	E3. Energy intensity							
	Electricity use per capita	**11.0 MWh/year**	2012	L+I			↘	
	Electricity use per GDP	**0.19 kWh/$**	2012	L+I			→	
	Energy use per capita	**7,407 kgoe**	2011	I	129th * /136	3rd *		
	Energy use per GDP	**0.13 kgoe/$**	2011	I	79th /132	3rd		
	E4. Clean energy deployment							
	Electricity generation from renewable sources National KPI	**0.02%**	2011	I	165th /213	1st	↗	24% (including nuclear)
	Renewable energy capacity	**138.5 MW**	2013	L			↗	
	Carbon intensity of electricity production	**600 gCO_2e/kWh**	2011	I		2nd *	↗	
	E5. Material intensity							
	Apparent steel use (in finished products) **per capita**	**756.8 kg**	2013	I	127th * /131	5th *	→	
	Apparent steel use (in finished products) **per GDP**	**13.7 g/$**	2012	I			→	

Source **L**: Data from a local source (UAE); **I**: Data from an international or regional source (UN, World Bank, GCC, etc.)
Ranking Where marked with a symbol *, the ranking is counting upwards from the lowest performing economy, which has the largest value for that indicator.
Recent trend ↗: Improving →: Stable ↘: Deteriorating

	Indicator	Performance	Year	Source	World ranking	GCC ranking	Recent trend	2021 target
Efficiency (Production and consumption)	**E6. Water intensity**							
	Total water use per capita	**449.4 m³/year**	2013	L			↗	
	Domestic water use per capita	**353 l/day**	2013	L			→	
	Municipal water use per capita	**500 l/day**	2012	L+I			→	
	Municipal water use per GDP	**3.1 l/$**	2012	L+I			↗	
	E7. Waste intensity							
	Municipal solid waste generation per capita	**1.82 kg/day**	2014	L				0.9 kg/day
	Recovery rate of municipal solid waste National KPI	**23%** (recycled 15%; composted 8%)	2013	L			↗	75%
	Total solid waste generation per GDP	**49.0 g/$**	2012	L+I			→	
	E8. Land use sustainability							
	Agricultural productivity	**11.6 t/ha**	2012	L			↘	
	Value added of agricultural production	**$ 926.9/ha**	2012	L			↗	
	Farming areas with modern irrigation	**91%**	2011	L			↗	
	Areas of organic farming	**3,920 ha**	2013	L			↗	
	E9. Marine resource use sustainability							
	Total fish catches	**72,728 t**	2012	L			↘	
	Number of fingerlings raised and released	**301,634**	2013	L			→	
	Number of coral reef colonies farmed	**3,600**	2013	L			↗	
	Number of Crimean trees planted	**15,000**	2012	L			↗	
	E10. Consumer attitude & behaviour							
	Environmentally aware citizens	**60%** (Abu Dhabi)	2013	L			↗	
	Citizens taking environmentally sound behaviour	**68%** (Abu Dhabi)	2013	L			↗	

Source **L**: Data from a local source (UAE); **I**: Data from an international or regional source (UN, World Bank, GCC, etc.)
Ranking Where marked with a symbol *, the ranking is counting upwards from the lowest performing economy, which has the largest value for that indicator.
Recent trend ↗: Improving →: Stable ↘: Deteriorating

	Indicator	Performance	Year	Source	World ranking	GCC ranking	Recent trend	2021 Target
Outputs (Well-being)	**W1. Economic contributions from non-oil sectors**							
	Non-oil GDP	**67.3%** of total GDP	2013	L			→	
	Non-oil real GDP growth National KPI	**5.4%**	2013	L			↗	5%
	Non-hydrocarbon export	**28.5%** of total export	2013	L			↗	
	W2. Standard of living							
	GDP per capita	**$ 58,042** (PPP-based)	2012	I	8th /173	3rd	→	
	Gross National Income (GNI) per capita National KPI	**$ 58,090** (PPP-based)	2012	I	11th /213	3rd	→	Among top 10 countries
	W3. Human development							
	Human Development Index National KPI	**40th** in the world	2013	I	40th /187	3rd	→	Among top 10 countries
	W4. Quality of life							
	World Happiness Index National KPI	**14th** in the world	2010-12	I	14th /156	1st	↗	Among top 5 countries
	W5. Environmental health							
	Environmental Performance Index	**25th** in the world	2014	I	25th /178	1st	↗	
	Population weighted exposure to PM2.5	**11.68 $\mu g/m^3$**	2012	I	168th * /224	2nd *	→	
	Access to sewage treatment	**67.1%**	2012	I	32nd /146	2nd		

Source **L**: Data from a local source (UAE); **I**: Data from an international or regional source (UN, World Bank, GCC, etc.)
Ranking Where marked with a symbol *, the ranking is counting upwards from the lowest performing economy, which has the largest value for that indicator.
Recent trend ↗: Improving →: Stable ↘: Deteriorating

	Indicator	Performance	Year	Source	World ranking	GCC ranking	Recent trend	2021 Target
Policies	P1. Environmental expenditure							
	Budget of the Ministry of Environment and Water	**AED 308.71 million** ($ 84.1 million)	2014	L			→	
	P2. Environmental regulations							
	Number of national environmental regulations	**42**	2013	L			↗	
	P3. Fossil fuel subsidies							
	Subsidisation rate per total cost of supply	**65.0%**	2013	I	28th * /37	1st *	↘	
	Fossil fuel subsidies per capita	**$ 2,378**	2013	I	35th * /37	3rd *	↗	
	Fossil fuel subsidies per GDP	**5.6%**	2013	I	24th * /37	3rd *	↗	
	P4. Nature conservation							
	Terrestrial and marine protected areas	**15,855 km²** (35 designations; 12.5% of total land and sea areas)	2014	L			↗	
	P5. Environmental standards							
	Number of national environmental standards	**27**	2014	L			↗	

Source **L**: Data from a local source (UAE); **I**: Data from an international or regional source (UN, World Bank, GCC, etc.)
Ranking Where marked with a symbol *, the ranking is counting upwards from the lowest performing economy, which has the largest value for that indicator.
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Unless specified, the data and information on the activities of UAE and overseas entities presented in this publication are taken from the publicly available sources.

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For further information or for provision of feedback:

UAE Ministry of Environment and Water
Green Development Department

PO Box 1509, Dubai, United Arab Emirates

E-mail: greendevelopment@moew.gov.ae

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