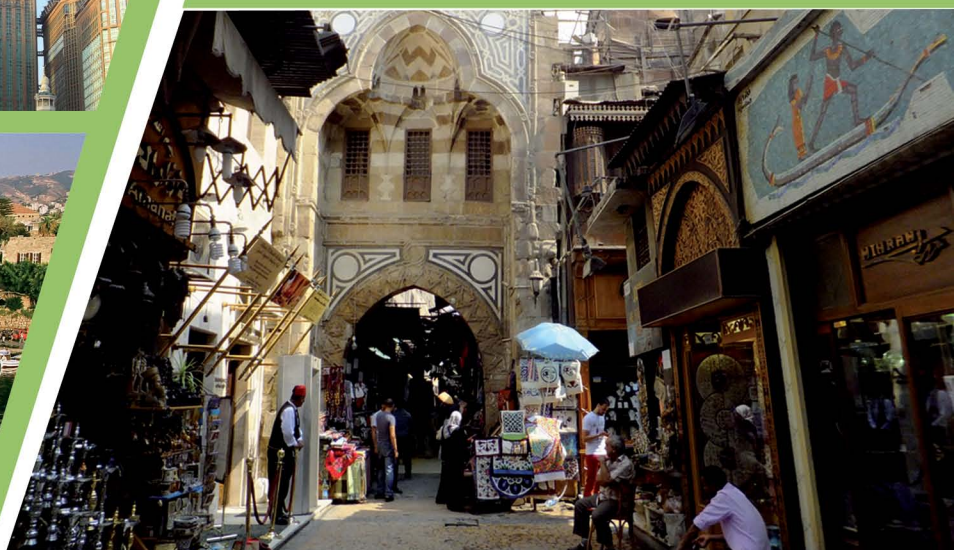




STATE OF PLAY OF SUSTAINABLE CITIES AND BUILDINGS IN THE ARAB REGION — 2016 —



وزارة التغير المناخي
والبيئة
MINISTRY OF CLIMATE CHANGE
& ENVIRONMENT



GOVERNMENT OF DUBAI

دائرة الأراضي والأموال
Land Department



switchmed

CREDITS

General Coordination: Hossam Allam (Regional Programme Manager, CEDARE), Ghada Moghny (Senior Programme Specialist, CEDARE)

Editor: Khalid Zakaria El Adli, Professor of Urban Design and Landscape Architecture, Cairo University; and Principal Partner and Managing Director, EAG Consulting

Arab Region GBC Coordination: Mohammad Asfour

UN Environment Coordination: Arab Hoballah (Chief SLCI/SCP-DTIE), Curt Garrigan (Cities and Buildings Programme Officer), Luc Reuter (SwitchMed Programme Coordinator), Fareed Bushehri (Regional Resource Efficiency Officer), Jacob Halcomb (Consultant)

Dubai Land Department Coordination: Ibrahim Al-Zu'bi (Senior Sustainability Advisor)

Authors: Ali Harbi (Algeria), Daneh Al Rayes, Waleed Khalaf (Bahrain), Manal El-Batran (Egypt), Majd Fayyad (Emirates Green Building Council), Bushra Hattab, Maysoon Al-Khuraissat (Jordan Green Building Council), Rima Al-Housseiny (Lebanon Green Building Council), Wiam Samir (Morocco Green Building Council), Khamis Al Souli (Oman Green Building Council), Ghadir Qawariq (Palestine Green Building Council), Rashed Al Nasa'a (Qatar), Samer Kamal (Saudi Arabia), Rym Baoundi (Tunisia Green Building Council)

Graphic Design: Mohamed Sami, MISC Communication Agency

Copyright © United Nations Environment Programme, 2016

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. The United Nations Environment Programme would appreciate receiving a copy of any publication that uses this publication as a source.

No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from the United Nations Environment Programme.

DISCLAIMER

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the United Nations Environment Programme, the Ministry of Climate Change and Environment of the United Arab Emirates or the European Union concerning the legal status of any country, territory, city or area or of its authorities, or concerning delimitation of its frontiers or boundaries. Moreover, the views expressed do not necessarily represent the decision or the stated policy of the United Nations Environment Programme, the Ministry of Climate Change and Environment of the United Arab Emirates or the European Union, nor does citing of trade names or commercial processes constitute endorsement. Photos in this report are the sole responsibility of the authors/Arab GBCs, who provided them. UN Environment and CEDARE take no liability for any photo credits. Some photos used are licensed for non-commercial reuse with modification.

On The Cover:

Nizwa Fort (Source: <https://upload.wikimedia.org>)

Jbeil (Byblos)-Lebanon (Source: Lebanon GBC)

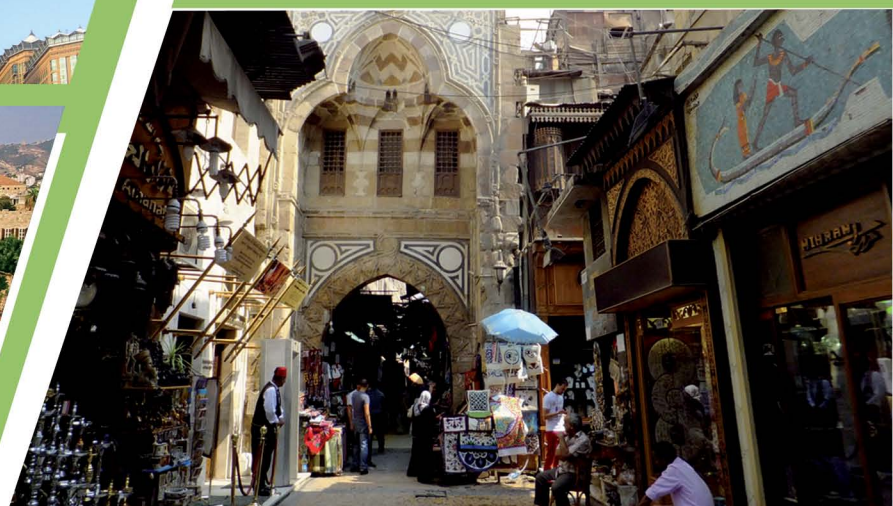
Mecca Tower (Source: photographed by Ziyad Al Beltagy)

Bab Al-Badistan, a gate in Khan El-Khalili, Egypt (Source: <https://commons.wikimedia.org>)

Burj Khalifa, Dubai (Source: Dubai Land Department)

UNEP promotes environmentally sound practices globally and in its own activities. This publication is printed on 100% recycled paper, using vegetable-based inks and other eco-friendly practices. Our distribution policy aims to reduce UNEP's carbon footprint.

STATE OF PLAY OF SUSTAINABLE CITIES AND BUILDINGS IN THE ARAB REGION — 2016 —



This report was prepared by
CEDARE for UN Environment



JORDAN GBC
المجلس الأردني للأبنية الخضراء
Jordan Green Building Council



Acknowledgements

The following report is the result of a joint effort between United Nations Environment Programme (UNEP), Dubai Land Department, and Centre for Environment and Development for the Arab Region & Europe (CEDARE) and the Green Building Councils (GBCs), in the Arab Region, namely in Jordan, Lebanon, Morocco, Oman, Palestine, Tunisia, and United Arab Emirates.

Special thanks are due to Dr. Khalid Z. El Adli for his substantive contribution and valuable input for editing this report. We also appreciate the valuable collaboration of the GBCs in the Arab Region and experts, coordinated by Mr. Mohammad Asfour.

Great appreciation for the efforts exerted and commitment of the CEDARE team consisting of Ghada Moghny, Terry Fahmy and Lamia Nabil. Gratitude due to the collaboration and support of our colleagues from UN Environment, especially Fareed Bushehri, Luc Reuter, Curt Garrigan and Jacob Halcomb under the guidance of Arab Hoballah.

Contributors:

Ali Harbi (Algeria), Daneh Al Rayes, Waleed Khalaf (Bahrain), Khalid El Adli, Hossam Allam, Ghada Moghny, Mohammad Asfour, Ramy Lotfy, Lamia Nabil, Terry Fahmy (CEDARE), Manal El-Batran (Egypt), Majd Fayyad, Lora Shrake, Tara Tariq, Marie-Helene Westholm-Knebel (Emirates Green Building Council), Alaa Shahwan, Linar Yasin, Hiba Nazer, Ruba Al Zu'bi (Jordan Green Building Council), Rima Al Housseiny, Ziad Haddad, Walid Baba (Lebanon Green Building Council), Wiam Samir (Morocco Green Building Council), Khamis Al Souli (Oman Green Building Council), Ghadir Qawariq (Palestine Green Building Council), Rashed Al Nasa'a, Hamoda Youssef (Qatar), Samer Kamal, Abdullah Bedeir (Saudi Arabia), Rym Baoundi (Tunisia Green Building Council)

Table of Contents

ACRONYMS.....	VI
FOREWORD BY DLD	X
FOREWORD BY UN ENVIRONMENT	XI
INTRODUCTION.....	1
ABOUT THIS REPORT.....	3
EXECUTIVE SUMMARY.....	5
SUSTAINABLE CITIES AND BUILDINGS IN THE ARAB REGION	17
I. ALGERIA	18
1.1 Context	19
1.2 Baseline	20
1.3 Case Studies	21
1.4 Future Actions	21
1.5 Lessons Learned	21
II. BAHRAIN	22
2.1 Context	23
2.2 Baseline	24
2.3 Case Studies	24
2.4 Future Actions	24
2.5 Lessons Learned	25
III. EGYPT.....	26
3.1 Context	27
3.2 Baseline	28
3.3 Case Studies	30
3.4 Future Actions	31
3.5 Lessons Learned	32
IV. JORDAN	33
4.1 Context	34
4.2 Baseline	36
4.3 Case Studies	38
4.4 Future Actions	40
4.5 Lessons Learned	40
V. LEBANON.....	41
5.1 Context	42
5.2 Baseline	43
5.3 Case Studies	45
5.4 Future Actions	46
5.5 Lessons Learned	46

VI.	MOROCCO.....	47
6.1	Context	48
6.2	Baseline	49
6.3	Case Studies	50
6.4	Future Actions	52
6.5	Lessons Learned	52
VII.	OMAN.....	53
7.1	Context	54
7.2	Baseline	54
7.3	Case Studies	55
7.4	Future Actions	55
7.5	Lessons Learned	55
VIII.	PALESTINE.....	56
8.1	Context	57
8.2	Baseline	59
8.3	Case Studies	60
8.4	Future Actions	60
8.5	Lessons Learned	60
IX.	QATAR	61
9.1	Context	62
9.2	Baseline	63
9.3	Case Studies	65
9.4	Future Actions	67
9.5	Lessons Learned	67
X.	SAUDI ARABIA	68
10.1	Context	69
10.2	Baseline	70
10.3	Case Studies	71
10.4	Future Actions	71
10.5	Lessons Learned	71
XI.	TUNISIA.....	73
11.1	Context	74
11.2	Baseline	76
11.3	Case Studies	78
11.4	Future Actions	79
11.5	Lessons Learned	79
XII.	UNITED ARAB EMIRATES	80
12.1	Context	81
12.2	Baseline	82
12.3	Case Studies	84
12.4	Future Actions	86
12.5	Lessons Learned	87

XIII.	SUSTAINABLE AFFORDABLE HOUSING IN THE ARAB REGION.....	88
13.1	Sustainable Affordable Housing in Algeria	88
13.2	Sustainable Affordable Housing in Bahrain	90
13.3	Sustainable Affordable Housing in Egypt	90
13.4	Sustainable Affordable Housing in Jordan	90
13.5	Sustainable Affordable Housing in Lebanon	90
13.6	Sustainable Affordable Housing in Morocco.....	91
13.7	Sustainable Affordable Housing in Palestine.....	91
13.8	Sustainable Affordable Housing in Qatar	92
13.9	Sustainable Affordable Housing in Saudi Arabia.....	92
13.10	Sustainable Affordable Housing in the UAE	93
XIV.	CONCLUSIONS AND RECOMMENDATIONS	94
XV.	NEXT STEPS.....	97
XVI.	REFERENCES	99

Acronyms

General

AFD	French Development Agency
CDM	Clean Development Mechanism
CEDARE	Centre for Environment and Development for the Arab Region & Europe
CSP	Concentrated Solar Power
DTR	Compendium of Standards and Regulated Technical Directives
EE	Energy Efficiency
ESCOs	Energy Service Companies
EU	European Union
GEF	Global Environmental Fund
GHGs	Green House Gases
GI-REC	Global Initiative for Resource Efficient Cities
GIZ	German Federal Enterprise for International Cooperation
ICT	Information & Communication Technologies
LEED	Leadership in Energy & Environmental Design
MDG	Millennium Development Goals
MED	Multi Effect Desalination
NGO	Non-Governmental Organizations
RCREEE	Regional Centre for Renewable Energy and Energy Efficiency
RE	Renewable Energy
SBCI	Sustainable Building & Climate Initiative
SDG	Sustainable Development Goals
SIDA	Swedish International Development Agency
SUSHI	Sustainable Social Housing Initiative
UNDP	United Nations Development Programme
UNEP/ UN Environment	United Nations Environment Programme
UN-Habitat	United Nations Human Settlements Programme

USD	United States Dollar
WorldGBC	World Green Building Council

Algeria

A.A.D.L	National Agency for Improvement and Housing Development
APRUE	National agency for Energy Rationalization Promotion
CNERIB	National Centre for Studies and Integrated Research Building
CTC	Construction Technical Control Centre
ECOBAT	BATIMENT ECOLOGIQUE
ENPI	Entreprise Nationale de Promotion Immobilière
LPA	Participatory Assisted Housing
LPL	Public Rented Housing
LPP	Public Housing Promotion
LR	Rural Accommodation
OPGI	Les Offices de Promotion et de Gestion Immobilières

Bahrain

NAC	National Action Charter
------------	-------------------------

Egypt

ADAPT	Appropriate Development, Architecture & Planning Technologies
BEEC	Egyptian Building Energy Efficiency Code
CSP	Concentrated Solar Power
Egypt-GBC	Egyptian Green Building Council
GPRS	Green Pyramid Rating System
GTU	Green Tourism Unit
HBRC	Housing and Building National Research Centre
MoHUUD	Ministry of Housing, Utilities and Urban Development
MOT	Ministry of Tourism
NEAP	National Environmental Action Plan

NREA	New and Renewable Energy Authority	EE	Energy Efficiency
PLEV	Productive Low Cost Environmentally Friendly Village	ENPI	European Neighborhood & Partnership Instrument
SDPM	Sustainable Design Process Model	IFC	International Finance Corporation
<u>Jordan</u>		IMF	Independent Municipal Fund
ASEZ	Aqaba Special Economic Zone	LCEC	Lebanese Centre for Energy Conservation
BRC	Building Research Centre	LEPAP	Lebanese Environmental Pollution Abatement Project
DSDZ	Dead Sea Development Zone	LGBC	Lebanon Green Building Council
GAM	Greater Amman Municipality	LIBNOR	Lebanese Standards Institution
GIM	Greater Irbid Municipality	MoEW	Ministry of Energy and Water
JISMO	Jordan Standards and Metrology Organization	MPWT/DGU	Lebanese General Directorate of Urban Planning
JNBC	Jordanian National Building Council	NEEAP	National Energy Efficiency Action Plan for Lebanon
Jordan GBC	Jordan Green Building Council	NEEREA	National Energy Efficiency & Renewable Energy Action
MOENV	Ministry of Environment	NREAP	National Renewable Energy Action Plan
MOPIC	Ministry of Planning & International Cooperation	NRES	National Renewable Energy Strategy
RSS	Royal Scientific Society	OEA	Order of Engineers and Architects
<u>Lebanon</u>		RCREEE	Regional Centre for Renewable Energy & Energy Efficiency
ADEME	French Environment and Energy Management Agency	RE	Renewable Energy
ALMEE	Lebanese Association for Energy Saving & for Environment	SEAP	Sustainable Energy Action Plan
ARZ NC	ARZ Building Rating System for New Construction	SIDA	Swedish International Development Agency
ARZBRS	ARZ Building Rating System	Sissaflebanon	Support Program for Infrastructure Sector Strategies and Alternative
BDL	Central Bank of Lebanon	SWH	Solar Water Heater
BEI	Baseline Emission Inventories	TSBL	Thermal Standards for Buildings in Lebanon
BLC	Banque Libanaise pour le Commerce	<u>Morocco</u>	
CAPP	Community Awareness Promotional Plans Actions	ADEREE	Agence nationale pour le Développement des Energies Renouvelables et de l'Efficacité Energétique -National Agency for the Development of Development of Renewable Energy and Energy Efficiency
CEDRO	Country Energy Efficiency and Renewable Energy Demonstration Project for the Recovery of Lebanon	BREEAM	Building Research Establishment Environmental Assessment Method
CESMED	Cleaner Energy Saving Mediterranean Cities Project	CEEB	Code de l'Efficacité Energétique dans le Bâtiment - Code for Energy Efficiency in Buildings Program
CFLs	Compact Fluorescent Light Bulbs	CEO	Chief Executive Officer
DGUP	Directorate General of Urban Planning	CFCIM	Chambre Française de Commerce et de l'Industrie au Maroc – French Chamber of Commerce and Industry in Morocco
EDL	Electricité Du Liban		
EDZ	Electricité de Zahlé Financing Project		

Cluster EMC	Cluster de L'efficacité des Matériaux de Construction - Cluster for Energy Efficiency in Building Materials	SDRT	Société de Développement de Résidences Touristiques - Tourist Residence Development Corporation
FNPI	Fédération Nationale des Promoteurs Immobiliers - National Federation for Property Developers	SGTM	Société Générale de Travaux du Maroc - General Firm for Moroccan Construction Work
GEF- UNDP	Global Environment Facility- United Nations Development Programme	SIE	Société d'Investissement Energétique - Energy Investment Company
HQE	High Environmental Quality	SMIC	Salaire Minimum Interprofessionnel de Croissance – Minimum Professional Salary
IFMEREE	Institut de Formation aux Métiers des Energies Renouvelables et de l'Efficacité Énergétique – Institute for trainings on Renewable Energies and Energy Efficiency Jobs	TRCM	Thermal Regulation of Construction in Morocco
INDH	Initiative National pour le Développement Humain - National Initiative for National Development	VAT	Value Added Tax
IRESN	Institut de Recherche en Energie Solaire et Energies Nouvelles - Research Institute for Solar Energy and New Energies	<u>Palestine</u>	
IWRM	Integrated Water Resources Management	BZU	Birzeit University
LEED	Leadership in Energy & Environmental Design	EEBC	Energy Efficient Building Code
LEED ND	Leadership in Energy & Environmental Design for Neighborhood Development	EQA	Environment Quality Authority
LEP	Logement à Energie Positive – Positive Energy Housing	LEED	Leadership in Energy and Environmental Design
MAD	Moroccan Dirham	MOF	Ministry of Finance
MASEN	Moroccan Agency for Solar Energy	MoLG	Ministry of Local Government
ND	Neighbourhood Development	PaIGBC	Palestine Green Building Council
OCF	Office Chérifien des Phosphates – Cherifien Phosphates Office	PCBS	Palestine Central Bureau of Statistics
OFPP	Office de la Formation Professionnelle et de la Promotion du Travail – Office of Vocational Training and Work Promotion	PENRA	Palestinian Energy and Natural Resources Authority
PDGC	Plan de Développement du Grand Casablanca – Development Plan for Casablanca Region	PHG	Palestinian Hydrology Group
RCREEE	Regional Centre for Renewable Energy and Energy Efficiency	PIPA	Palestinian Investment Promotion Agency
SADV	Société d'Aménagement et de Développement Vert – Green Development Company	PRICO	Palestine Real Estate Investment Company
SAPST	Société d'Aménagement et de la Promotion de la Station de Taghazout – Development and Promotion of Taghazout Station Company	PWA	Palestinian Water Authority
		UNRWA	United Nations Relief and Works Agency
		<u>Qatar</u>	
		BRE	Barwa Real Estate
		DSWMC	Domestic Solid Waste Management Centre
		GORD	Gulf Organization for Research and Development
		GSAS	Global Sustainability Assessment System
		Kahramaa	Qatar General Electricity and Water Corporation

QatarGBC	Qatar Green Building Council	ONAS	National Sanitation
QCS	Qatar Construction Specification	PST	Plan Solaire Tunisien
QNV	Qatar National Vision	S.PRO.L.S	Social Housing Development Company
Saudi Arabia		SEACNVS	Société d'Etude et Aménagement des Côtes Nord de la Ville de Sfax
KA.CARE	King Abdullah City for Atomic and Renewable Energy	SNIT	National Real Estate Institute
KACST	King Abdul Aziz City for Science and Technology	STEG	Tunisian Company for Electricity and Gas
KAFD	King Abdullah Financial District	UAE	
KAPSARC	King Abdullah Petroleum Studies and Research Centre	DIES	Dubai Integrated Energy Strategy 2030
KAPT	King AbdulAziz for Public Transportation	EHS	Environment Health Safety
KAUST	King Abdullah University for Science and Technology	Emirates GBC	Emirates Green Building Council
MED	Multi Effect Desalination	ESCO	Energy Service Company
MOMRA	Ministry of Municipal and Rural Affairs	GBR&S	Green Building Regulations & Specifications
MOWE	Ministry of Water and Energy	MRHE	Mohammed Bin Rashid Housing Establishment
NEEP	National Energy Efficiency Program	PRS	Pearl Rating System
PME	Presidency of Meteorology and Environment	RSB	Dubai Regulatory and Supervisory Bureau
SEEC	Saudi Energy Efficiency Centre	SZHP	Sheikh Zayed Housing Program
SR	Saudi Riyal	UAE	United Arab Emirates
Tunisia		UPC	Abu Dhabi Urban Planning Council

AFH	Habitat and Land Agency
ANGED	National Waste Management Agency
ANME	National Agency for Energy Conservation
ANPE	National Agency for Environment Protection
APAL	Agency for protection and Development of the Coastline
ARRU	Agency for Urban Rehabilitation and Regeneration
CATU	Code de l'Aménagement du Territoire et de l'Urbanisme
CITET	International Centre for Environmental Technologies of Tunis
CTMCCV	Technical Centre for Construction Materials, Ceramics and Glass
GDPB	General Directorate of Public Buildings
HVAC	Heating, Ventilation & Air Conditioning

Foreword by DLD

H.E. Sultan Butti Bin Mejren

Director General
Dubai Land Department
United Arab Emirates



We are very proud to have advanced the UAE towards its leading position amongst the world's most sustainable nations, as Dubai Land Department (DLD) applies premium international standards for Dubai's real estate sector.

In light of the many challenges faced by various communities around the globe, and the threats posed by various ecosystems and resources of various kinds, there is a critical need in the modern world for a sustainable approach towards urban development. Dubai Land Department achieves this by promoting green standards all across the Emirate's construction industry, in addition to developing highly sophisticated systems to further these objectives. The overall goal is not just evaluating the performance of entities and companies working solely in this sector, but also imposing the strictest possible standards in order to safeguard our cities from the multiple environmental hazards that threaten our collective wellbeing. Through this work, we will ensure the delivery of a clean and healthy environment for future generations.

The Dubai Land Department has become a global model for sustainability initiatives and has built mutually beneficial relationships with many international organisations. The department offers its hard-earned expertise across the region and around the world, gained from the remarkable successes it has achieved in this field throughout its journey. In addition to all of this, it makes essential contributions towards the knowledge economy through enhancing understanding of real estate, serving to meet the needs and aspirations of communities through preserving their health and protecting their environment, enhancing their lives with luxury and comfort.

DLD will continue to exceed its abilities and achievements with highly creative innovations aimed at achieving the enlightened vision of our wise leadership and government. The department will preserve its leading global position and contribute towards making the UAE a modern cultural beacon across all fields.

Foreword by UN Environment

Arab Hoballah

Chief
Sustainable Lifestyles, Cities and Industry/
Economy Division
United Nations Environment Programme



Cities are where much of the consumption and production happens today, and with growing levels of urbanization, the importance of city-level action will only be reinforced. It has been increasingly recognized that in an urbanized world, cities are both the source and solution of many, including global, problems. Furthermore, the level of ambition demonstrated by cities and sub-national authorities has often paved the way for or reinforced national commitments and actions.

The building sector is recognized as offering among the greatest potentials to contribute to significant reduction of greenhouse gas emissions, while most of the Sustainable Development Goals (SDGs) in the 2030 Agenda for Sustainable Development intersect with cities and the building sector. Ensuring Sustainable Consumption and Production Patterns – SDG 12 - is a key prism through which we will be able to realize the potential, by delivering SCP at city level, notably through SDG 11- to make cities and human settlements inclusive, safe, resilient and sustainable.

For countries in the Arab region, rapid economic growth and associated urban development have presented challenges for policy-makers to realize the goal of ‘decoupling’ growth from resource use and environmental impact. A number of countries already face issues of water scarcity, air pollution and traffic congestion, in addition to a lack of local material resources which are essential to develop the buildings and infrastructure needed to meet the demands of economic growth and increasing populations. In this context especially, how cities and buildings are planned, built, and managed is critical to sustainable development throughout the region.

Policy-makers therefore need to know the ‘State of Play’-- how the building sector and cities are currently developing, the policies and best practices being applied and the opportunities to scale up actions to achieve common objectives. This report provides a basis for stakeholders in countries and cities to continue a dialogue on how to maximize energy and resource efficiency. We must look at sustainable buildings and sustainable cities not as separate goals but develop integrated solutions that address buildings, infrastructure, and the way cities develop if we are to fully address the environmental challenges the world, and this region in particular, face. Some of the policies, programmes and initiatives associated with sustainable cities and buildings in twelve countries in the region (Algeria, Bahrain, Egypt, Jordan, Lebanon, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Tunisia, and the United Arab Emirates) are presented here to help develop a better understanding of the opportunities to create more sustainable communities.

These examples illustrate the need for integrated, mutually reinforcing policies - vertically between different levels of government, and horizontally between sectors. In this context, the national SCP strategies developed by various countries in the context of SwitchMed can be translated and implemented at city level together with specific needs to be better identified at city level with regards to buildings and construction, transport and mobility, water, food and waste efficient management needs.

The development of this report was made possible through the generous financial support of the Dubai Land Department (DLD) and the EU funded SwitchMed project, with the supervision and technical support of the UN Environment concerned experts. UN Environment and DLD are pleased to have worked with all of the many partners involved in this report, including CEDARE and national Green Building Councils, and expect that the findings will be useful in identifying greater actions and initiatives to build sustainable buildings and cities.

Introduction



(Photo credit: MISC Advertising Agency)

No single nation in the world can reduce CO₂ emissions and meet its set targets without including the building sector in their national strategies and action plans, (UNEP, 2011). In June 2012 at Rio+20, the United Nations Environment Programme (UNEP) launched the Global Initiative for Resource Efficient Cities (GI-REC) to capitalize on the potential for cities to lead action towards greater resource efficiency. These efforts are aimed at enhancing the quality of life in urban areas, in particular rapidly growing cities in emerging and developing countries, by minimizing resource extraction, energy consumption, and waste generation through safeguarding ecosystem services and decoupling city development from resource use and environmental impacts. To further inform the strategic direction of GI-REC, UNEP is undertaking a comprehensive review and analysis of resource efficiency in cities.

The United Nations Environment Programme's Sustainable Building and Climate Initiative (UNEP-SBCI), is a partnership of major public and private sector stakeholders in the building sector, working to promote sustainable building policies and practices worldwide. UNEP-SBCI seeks to promote a worldwide adoption of sustainable building and construction practices. It draws on UNEP's unique capacity to provide a global platform for collective action. To accomplish this mission, UNEP-SBCI has developed tools and strategies, established baselines and demonstrated, through pilot projects, the important role of the building sector in mitigating climate change. UNEP-SBCI has developed tools and protocols with the objective of integrating sustainable building practices to the construction sector.

UNEP also promotes specific actions in the social housing sector through its Sustainable Social Housing Initiative (SUSHI). This initiative draws the most relevant research conclusions and experiences of UNEP-SBCI and aims to find the best cost-effective strategies to incorporate sustainable solutions in low-cost housing. It works to strengthen local capacities for their incorporation in national social housing programs. The initiative was implemented in Sao Paulo - Brazil and Bangkok - Thailand from 2009 to 2011; and in India and Bangladesh from 2012 to 2014.

At the United Nations Sustainable Development Summit in September 2015, 193 countries adopted the 2030 Agenda for Sustainable Development including 17 Sustainable Development Goals (SDGs). SDGs build on the Millennium Development Goals (MDGs) with the aim of ending poverty, fighting inequality and injustice, and tackling climate change by 2030.

The 2030 Agenda for Sustainable Development tackles challenges facing cities through its Sustainable Development Goal No. 11: “Sustainable Cities and Communities”, which aims to “make cities and human settlements inclusive, safe, resilient and sustainable”.

Yet, planning, constructing and managing cities in a sustainable manner also contributes to a number of other SDGs, including: #6 Clean Water and Sanitation; #7 Affordable and Clean Energy; #8 Decent Work and Economic Growth; #9 Industry, Innovation and Infrastructure; and #12 Responsible Consumption and Production.

On a similar note, the World Green Building Council (World GBC) through its global network of national green building councils in more than one hundred countries empowers industry leaders to effect the transformation of the local building industry towards sustainability.

The EU funded SwitchMed program assists southern Mediterranean countries in switching to Sustainable Consumption and Production patterns. Under the SwitchMed program UNEP-DTIE coordinates the development of SCP-National Action Plans (SCP-NAPs), national policy frameworks for concrete and tangible actions at country level. SwitchMed participates in this study, which covers several of the SwitchMed countries (Algeria, Egypt, Jordan, Lebanon, Morocco, Palestine, and Tunisia).

In this respect, and as a joint and coordinated effort between UNEP and CEDARE, and the national Green Building Councils in the Arab Region, a regional research mapping the state of play of sustainable cities in the Arab Region has been undertaken, the findings of which are documented and presented in this report. The report includes a regional review of 12 countries illustrating key policies, initiatives, and case studies supporting city level resource efficiency in the region, prepared in cooperation with the respective national Green Building Councils and/or specialized experts. Regional reviews serve as a necessary ‘baseline’ for policy making and cooperation as pertains to sustainable buildings (including affordable housing), and resource efficient cities in the region. They complement the results of the institutional mapping exercise conducted by the GI-REC (UNEP, 2013).

About this report



Sustainability, Vector shapes (Source: <http://www.freepik.com>)

The State of Play of Sustainable Cities and Buildings in the Arab Region is a compilation of the main public policies, programs, case studies, organizations, and initiatives associated with sustainable city and building practices in twelve countries in the Arab Region, namely: Algeria, Bahrain, Egypt, Jordan, Lebanon, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Tunisia, and the United Arab Emirates. It builds on UNEP's experience in developing a similar report for the Latin America region, but expands in terms of coverage and scope to include sustainable cities as well. While the Latin America report focuses on two aspects within green buildings mainly energy efficiency initiatives and sustainable practices, this report addresses issues pertaining to both sustainable buildings, sustainable cities and sustainable affordable housing with an aim to inform the strategic direction of GI-REC and UNEP in undertaking a comprehensive review and analysis of resource efficiency in Arab cities.

As with the Latin America report, the first phase of research was carried out in collaboration with the national Green Building Councils (GBCs) and specialized local experts. During this phase, local experts and GBCs investigated the current state of affairs as relates to sustainable cities and the building sectors in their respective countries. Phase two provided a detailed account including country initiatives as well as reports presented in January 2016 at a two day Sustainable Cities Regional Workshop held in Cairo, with the objective of affording participants a platform for deliberation, sharing knowledge and expertise. The workshop was hosted by the Centre for Environment and Development for the Arab Region and Europe (CEDARE) in cooperation with the United Nations Environment Program (UNEP) and Dubai Sustainable Cities Centre as an integral part of the "State of Play of Sustainable Cities and Buildings in the Arab Region Report". Panelists, authors, participants, and experts from various parts of the Middle East and UN-Habitat, exchanged concepts and ideas and reflected on the discussions and initiatives only to enrich an already inspiring debate. The final phase however, involved review and consolidation of all thoughts and ideas by the experts and regional GBCs.

Consequently, the report provides a general overview of key sustainable city and building initiatives in twelve Arab countries; it does not intend, however, to present a comprehensive list of all existing programs and initiatives in the region, but rather a compilation of the most relevant based on

available data during the period between December 2015 to February 2016 in which time the research took place.

The report presents the various concepts, policies, standards, practices and initiatives as relates to sustainable cities, sustainable building practices, and sustainable affordable housing in each of the twelve Arab Region countries through a carefully planned and structured framework. Each country review is methodologically organized according to the following:

- I. **Context** - Provides a general overview of the state of play as pertains to sustainable cities and sustainable buildings. An attempt was also made to consider urban metabolism, defined as “the sum total of the technical and socio-economic processes that occur in cities, resulting in growth, production of energy, and elimination of waste” (Kennedy et al., 2007), as a guide for assessing the sustainability of cities. As such, and for the purpose of quantifying material flows at the urban scale, input flows such as energy, water, food and construction materials; and outputs, including emissions, solid wastes, and construction wastes were considered whenever feasible.
- II. **Baseline** - Identifies those fundamental public policy frameworks that help promote energy efficiency, sustainable green practices, initiatives and construction in each country. An overview of key policies, laws, decrees and technical standards adopted as well as a listing of institutional programs established by local or international bodies to advance sustainable development is reviewed and documented.
- III. **Case Studies** - Presents specific cases and pilot projects where sustainable green practices have been adopted and implemented in construction projects.
- IV. **Future Actions** - Highlights proposed initiatives in the process of realization and provides recommendation for possible future action.
- V. **Lessons Learned** - Reviews key progress and limitations of current policies and practices.
- VI. **Sustainable Affordable Housing** - Illustrates the state of play of sustainable affordable housing practices.

It must be noted however, that for the purpose of this report, **sustainable building** refers to the approach in which the construction industry acts to promote sustainable development principles, taking into account environmental, social, economic and cultural aspects in construction projects. Sustainable buildings seek to minimize the environmental impacts of constructions in all of its stages (design, construction, operation and maintenance), employing solutions such as energy efficiency, renewable energies, bioclimatic design and passive solar systems, low environmental impact materials, site selection, water management and reuse, social welfare and air quality, among other principles.

On a similar note, **energy efficiency in buildings** refers to buildings that minimize the use of conventional energy, with the objective of promoting a rational use of the resource. Some of the most common strategies to achieve energy efficient buildings are the implementation of thermal, heating, lighting and refrigeration technical standards, among other measures.



Executive Summary

This report presents an objective overview of the state of play of sustainable cities and buildings in twelve countries in the Arab Region; namely: Algeria, Bahrain, Egypt, Jordan, Lebanon, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Tunisia, and the United Arab Emirates. The report is relatively inclusive, represents the authors' viewpoint, and is not intended to present a comprehensive listing of all efforts conducted in their respective countries, but rather a compilation of the most relevant based on available data during the period in which the research was undertaken (December 2015 to February 2016). As a joint and coordinated effort between UNEP and CEDARE, research was conducted through national Green Building Councils in cooperation with local experts and was facilitated by the World GBC Arab network.

Regional reviews of the 12 countries illustrate key policies, initiatives, and case studies supporting city level resource efficiency in the region. Through an in-depth investigation of policies, laws, decrees, and technical standards established by national or local authorities to support sustainable development and promote efficient use and management of resources, country reviews examine the state of sustainable cities and buildings. Additionally, reviews go on to identify stumbling blocks impeding implementation, future actions, and lessons learned through selected case studies illustrating:

- policies and approaches that govern urban metabolic flows and resource use in selected cities with particular focus on water, energy, waste, construction materials, and land; and
- relevant institutions, initiatives, and approaches that promote efficient and sustainable use of resources at the city level for selected case studies.

The report also includes recommendations for implementing sustainable building practices in affordable housing and concludes with a draft program of work that outlines a framework for the next 1, 3 and 5 years, in terms of actions at local, national and regional levels, including the need for legislation, data, capacity building, partnerships, etc. with the hope that the proposed program outline constitutes the basis for a full program of work to be implemented in the near future.

The first chapter outlines the current status of sustainable cities and buildings in Algeria.

Though the concept of sustainable cities and buildings is not widespread in Algeria, the government's quest to promote sustainable city development is evident. The Algerian government is keen to collaborate, share experiences and best practices with neighboring countries; build local capacities; and promote sustainability as a strategic goal and priority through legal, regulatory, and other frameworks. Government policies are trending towards integrating certain sustainability concepts into existing and new cities. This includes improvement of waste management at city level, development of sustainable public transport systems using tramways and clean fuel, integration of sustainability concepts in new cities, improvement of living conditions, and introduction of green open spaces, parks and walkways in cities.

Moreover, in an attempt to face demand and future urban development challenges, the government has been launching huge housing programs since 2001. Yet, these programs have been conceived and developed in an emergency framework with little or no reference to the notion of sustainability.

Current regulatory frameworks ensure compliance to international standards but are not specifically linked to sustainability performance improvement. While efforts have been developed; control is still poor and there are no ways to ensure that standards for emission control, thermal insulation levels and electrical consumption levels, are implemented. Moreover, there are no standards for domestic solar energy use and citizens are unable to sell generated solar energy surplus. The regulatory and standards' frameworks thus need further improvement including explicit sustainability measures and procedures that ensure implementation.

Procedures, standards and technical specifications in line with the concept of sustainable cities and buildings need to be developed in order to achieve a more functional approach facilitating their use, implementation, and control. Furthermore, a comprehensive local approach to sustainable building needs to be formulated within set standards and guidelines in order to promote sustainability concepts.

Pilot programs to raise awareness and promote sustainability have also been introduced, but are yet to be developed with a need to upscale dissemination levels as relates to best practices and development regulations. Nevertheless, the concept of sustainability is becoming more and more popular among the population, regulators, as well as the government. Several initiatives, programs, as well as pilot projects are currently under review for possible implementation. New policies, regulations as well as best practices are being considered and integrated in the system. New building programs for 2015-2019, aim at introducing new standards in high energy performance buildings.

An end to the enduring confusion between affordable housing and government funded social housing should also be clarified to avoid undermining research and development efforts to reduce building costs. Capacity building initiatives, benchmarking as well as knowledge transfer among neighboring countries in the region should also be embraced. There is also a need to launch an Algerian GBC to promote the concept of green buildings and increase awareness among concerned stakeholders.

Chapter II provides an overview of the state of sustainable development in Bahrain.

During the past few years, the Kingdom of Bahrain has made considerable efforts to ensure the sustainability of its development process, this has been reflected in the Constitution of the Kingdom in 2001. The National Action Charter (NAC) ensures protection of the environment and balances social and economic aspects of development.

As part of the Cabinet's initiative for optimum use of energy, several programs were instigated and resolutions amended to conform to the concept of sustainable development. An initiative for "Optimum Use of Natural Wealth & Available Resources for Public Sector" was launched in conjunction with the World Bank to support the design and implementation of large scale efficient lighting. A committee on alternative green energy sources was also instigated encouraging their use in the Kingdom. Initiatives included launching an electric power plant with a total capacity of 5 MWs, replacing traditional street lighting with LED, and increasing cost of traditional energy sources to minimize consumption.

Resolutions pertaining to maintenance of aquatic resources, water use, protection, development, and groundwater management were also passed to ensure environmental sustainability and included an integrated program to detect water leaks, and expand use of treated wastewater for irrigation. A strategy for sustainable agricultural development was introduced in 2010, for the next two decades, with the aim of attaining high economic efficiency while preserving available environmental resources and achieving relative food security.

Numerous institutions, agencies, and commissions have also been established to develop programs, policies, and strategies to pursue sustainability. A detailed strategic plan for 2030, based on sustainable development concepts, is in the workings with the objective of sustaining the environment and preserving its resources. Additionally, sustainable buildings / city policies and by-laws conforming to sustainability concepts are currently in the process of development, without which progress will remain

limited. Furthermore, both public and private sectors have adopted sustainable initiatives in pursuit of sustainable goals.

Yet, for Bahrain to follow a sustainable development path, new buildings and cities should adopt a green and sustainable approach to building and avoid inefficient use of natural resources. The government and professional institutions should recognize individual efforts pursuing sustainable development practices.

Egypt's efforts and initiatives to promote sustainable cities and buildings are illustrated in Chapter III.

Being a low-middle income developing country with nearly 40% of population living with under 1 US\$ per day, and nearly 18-20 million citizens living in informal settlements, the general society in Egypt is rarely interested in sustainability issues.

Yet, efforts towards greening both the construction industry and housing sectors in Egypt have been apparent since 2009. The Green Pyramid Rating System (GPRS) was instigated by Egypt's Green Building Council as a national building rating system assessing ecology, energy efficiency, water efficiency, materials and resources, indoor environmental quality, as well as management and innovation. A Sustainable Design Process Model (SDPM) has also been developed to offer professional advice pertaining to the construction of environmentally sound buildings.

Moreover, Egypt's 2014 constitution emphasizes the promotion of sustainable development, increased use of renewable energy, better management of natural resources, as well as efficient and effective use of resources. The Central Unit for Sustainable Cities and Renewable Energy was thus launched in 2014 and entrusted with the planning, design, construction, and operation of green and sustainable communities while adopting concepts of energy efficiency, water desalination, waste management, sustainable transportation, and implementation of green economy.

Additionally, and in line with the government's efforts to pursue eco and sustainable tourism, a

ministerial decree was issued to transform the city of Sharm El Sheikh into a Green City. Other national initiatives include the Productive Low Cost Environmentally Friendly Village (PLEV) which involves housing 25,000 beneficiaries in a sustainable-village framework.

Other initiatives include development of low-cost environmental-friendly housing while reducing dependency on high-cost and environmentally unstable building materials with the objective of promoting the use of native building materials in low-income and informal communities; encouraging simpler, faster, and more affordable building techniques; as well as supporting transfer of expertise and know-how to younger generations.

Egypt's government has also asserted a firm commitment to renewable energy with an objective to generate 20% of Egypt's energy needs from renewable sources by 2020. This commitment is backed by tax exemptions on renewable energy equipment, and benefits from carbon credits. Numerous projects including hybrid plants planned for completion by 2017, large-scale wind farm developments along the coast, as well as a series of photovoltaic and Concentrated Solar Power (CSP) installations are also being implemented to increase the overall electric energy generated.

The Egyptian Building Energy Efficiency Code (BEEC) has also been issued for residential and commercial prototypes (industrial and public building codes are still underway) affording substantial energy savings.

Nevertheless, and in spite of all efforts, numerous initiatives and constructive steps are needed to reshape current legislations and codes. Existing local building laws and regulations need to be revisited especially as numerous parts of the Unified Building Law no. 119 and its executive appendix show negligence of important green concepts. Egypt needs to adopt a green construction strategy, to develop and establish standards as well as incentives for green construction.

Greening the building stock (new and existing) is thus Egypt's key path to achieve sustainable development. In order to instigate economic

development on sound basis, sustainable development approaches in policy design and implementation is needed. Policies need to be developed to ensure that environmental and social objectives are at the core of the planning and decision making process. Particular emphasis should be laid on equity considerations, social justice, and the right of all citizens for a respectful and dignified life. Efforts should focus on enhancing capacities for developing policies designed to maximize benefits resulting from investing in environmental infrastructure and guarantee trickling down of benefits to the poor, underprivileged, and marginalized segments of the society.

Chapter IV addresses progress made in Jordan.

Jordan has for long faced challenges with regards to securing water, energy, and food supplies for its growing population. This augmented by waves of immigration and resettlement from neighboring countries as well as changes in the energy market and has presented the issue of sustainability as both vital and crucial for the country. Recognizing water and energy as the biggest constraints to Jordan's sustainable economic growth, the government has developed strategies targeting both the water and energy sectors, including a number of mega-projects at the national level. Moreover, the concept of smart cities and the integration of Information and Communications Technology (ICT) in cities of the future are becoming more popular with applications in transportation, energy efficiency, and renewable energy as well as infrastructure. From city-level transportation projects in Amman to renewable energy mega projects in Irbid and Sahab as well as a sustainable mainstream plans in the Dead Sea Development Zone and large privately owned Renewable Energy (RE) projects in the Aqaba Special Economic Zone, Jordan has placed itself on the sustainability roadmap.

Recognizing the grave challenges, the city of Amman embarked on developing a sustainable blue print for development addressing issues relating to the built and natural environment, culture and heritage, transportation and infrastructure, as well as community development. A Clean Development Mechanism (CDM) program was also developed to ensure that

activities adopt low-carbon options. The city has also been promoting the concept of "Smart Cities" and has initiated a number of initiatives relating to sustainable energy, urban transport, municipal waste, as well as urban forestry with the ultimate goal of arriving at a green, sustainable, and smart Amman.

Furthermore, the Kingdom has for the past 15 years focused on a balanced approach towards development and preservation of the natural environment in order to capitalize on increased tourism and provide improvements to local communities. Initiatives and projects setting high environmental standards, especially in the Dead Sea, are being developed embracing the pillars of sustainability.

On a similar note, a number of policies associated with control, management and protection of the natural environment and sustainability have been adopted in Aqaba. Environmental policies require preservation and protection of the environment and the sustained development of the zone's natural resources with a rigorous policy of "Zero Discharge" to the sea. A water policy demanding the protection and management of groundwater resources, as well as the development of wastewater management and reuse schemes has also been enforced.

Additionally, efforts to adopt and enforce water and energy efficient measures in buildings are currently ongoing and are seen as the first step towards more sustainable buildings. Codes as well as standards have also been developed in response to energy challenges utilizing local, regional, as well as international related resources.

The Jordanian experience clearly indicates the development of a robust sustainability scheme that provides an enabling environment for businesses to participate in implementation. Yet, numerous entities, with different mandates, play a role in supporting city-level sustainability projects in Jordan. Efforts to coordinate and collaborate with various ministries and institutions have thus to be addressed further in the green growth roadmap.

Lebanon is the focus of Chapter V.

Lebanese municipalities are unable to promote sustainability initiatives due to legal constraints and financial dependency. Yet, several strategies, programs and initiatives have been launched and implemented at both the local and national levels to promote sustainable development. These include among others, a ministerial decree in 2009 targeting to supply 12% of total electricity generated from renewable energy sources by 2020. A Sustainable Energy Action Plan (SEAP) was also launched in 2014 and the National Sustainable Development Strategy of Lebanon was signed in 2015 and is currently underway with the objective of elaborating a detailed roadmap leading to the achievement of sustainability goals. Additionally, and in an attempt to reduce energy bills and emissions of greenhouse gases (GHGs), solar street lighting as well as Compact Fluorescent Light Bulbs (CFLs) have been installed free of charge while incentives to promote energy savings have been offered.

Moreover, founding of the Lebanon Green Building Council (LGBC) in 2008 has instigated sustainable Green construction in Lebanon. A noticeable but limited progress has since been witnessed in terms of green construction, with a total of 15 certified buildings and around 70 registered. An initiative to green the construction law is currently underway awaiting review and adoption by the House of Parliament. In the meantime, Green Criteria are being voluntarily applied by the Directorate General of Urban Planning (DGUP) to major projects.

Nonetheless, absence of legislation constitutes the major hurdle in implementing sustainability concepts especially as initiatives continue to be applied on voluntary basis. More decentralization and local authorities' empowerment coupled by modifications to the legal framework are also needed in order for municipalities to keep up with increasing local demands, challenges and provide for sustainable development. Lack of awareness represents another stumbling block in adopting sustainability measures. It is thus imperative that the government takes constructive steps towards advancing the concept of sustainable development in Lebanon.

Morocco's initiatives to promote sustainable green development are discussed in Chapter VI.

Given the fact that Morocco imports 95% of its energy to meet demands, the government has focused on implementing policies oriented towards the efficient use and production of energy. Accordingly, the country has adopted the concept of sustainable development within the framework of its development strategy, in order to achieve a balance between environmental, social and economic spheres. It aims at improving the living environment, strengthening sustainable management of natural resources and promoting environmentally friendly economic activities. Initiatives were launched to realize the sustainable development vision and drive political, institutional, legal and socio-economic reforms forward. This included adoption of the National Charter of Environment and Sustainable Development starting 2009.

Several other national initiatives aimed at integrating and implementing sustainability practices at the national and city levels have been adopted including a resolution signed and enacted by his majesty the King asserting generation of 42% of electric power from renewable sources by 2020 and 52% by 2030. Several institutions were also established to ensure achievement of these objectives.

The government has also placed sustainable "Smart Cities" at the heart of several sectors including transportation, waste, and energy production among others with the objective of providing a healthy, safe, and efficient living environment. Furthermore, the government is encouraging green building initiatives and is establishing intrinsic sustainability parameters positioning green building as a topic of national importance. The launch of national initiatives to configure the future development of sustainable building practices including the implementation of a National Energy Strategy through introducing energy efficiency and renewable energy laws, set in parallel to the Sustainable Development Policy, has advanced the concept of sustainability and prompted projects receive Green Building Solution Awards.

In addition, to achieve set goals, Morocco is also engaged in launching several institutional

programs to help realize its targets including a Code for Energy Efficiency in Buildings (CEEb) with the objective of decreasing energy consumption in the building sector. The building sector, being one of the most energy intensive, is targeted as one of the foremost fields of action to mitigate negative impacts of climate change.

It is thus safe to conclude that the Kingdom has gone beyond incentives for energy efficiency through a synergy between laws, decrees, institutional programs and the use of international voluntary green building certification tools (High Environmental Quality (HQE), LEED, and BREEAM) to promote and generalize sustainable city practices across the country. Initiated programs have led to the adoption and implementation of several practices and procedures such as thermal isolation, LED lighting, solar water heaters, efficient construction materials, rainwater harvesting, as well as waste management demonstrating progress towards sustainable building.

Nevertheless, it is recommended that a government incentive program including lower taxes for green buildings be implemented to encourage such practices. It would also be beneficial to establish a financial mechanism to evaluate the performance of existing buildings. On a similar note, it would be beneficial to introduce procedures and mechanisms to link critical components together including: water, energy, and food with the objective of reaching a holistic synergy for city metabolism. Public-private partnerships are also essential if the government is to share implementation responsibilities with industries closer to the market. Finally, COP22 should be considered an opportunity to promote the concept, increase awareness, sensitize the population and enhance sustainable projects.

Chapter VII addresses the state of play of sustainable cities in Oman.

The Sultanate of Oman has adopted a number of initiatives as part of its ambition to adopt the sustainability concepts. Government efforts to advance sustainability measures include establishing a public company entrusted with the treatment of the domestic waste water and the development of a distribution network of treated sewage effluent across the capital Muscat – with

a plan to cover 80% of Muscat Governorate by 2020. The company is currently delivering recycled water for irrigation of public gardens and is working towards the construction of a sewage network for the collection of domestic wastewater. Another public company was also founded to manage solid waste in Oman; establish required infrastructure; restructure municipal waste collection services; and improve public awareness of waste management.

Furthermore, to promote energy efficiency the Authority for Electricity Regulation sponsored a number of pilot projects including solar and wind power generation.

Yet, unlike high-end real estate developments and the tourism industry, the concept of sustainability is far from embraced in full by the construction and real estate sectors. Several enterprises are committed to employ sustainability measures in all their new projects and have implemented policies, guidelines, best practices, and received LEED certification.

What's more, is that sustainability and green design programs have recently been integrated in academic curricula. The Research Council, a public institution, is also supporting research programs related to the sustainable construction and green buildings.

In addition, public awareness initiatives such as the Muscat Green Days and the Muscat Green Awards are dedicated to the promotion and recognition of best practices by individuals, companies, or projects.

Nonetheless, the current legal framework pertaining to sustainable design and construction is non-existent with no significant progress made to date to amend it, thus impeding key industry players from implementing sustainable projects. Consequently, a well-structured legal framework coupled by an incentive system is crucial to support ongoing and future green initiatives.

Efforts and initiatives to promote sustainable cities and buildings in Palestine are presented in VIII.

The State of Palestine suffers from a grave shortage of natural resources, particularly energy and water, while its needs continue to

grow rapidly. It imports 93% of its current energy needs from Israel and neighboring countries. Natural resources conservation is thus highly supported by the government and is welcomed by both the population and businesses with efforts and financial resources invested to transform Palestine into a more sustainable nation.

On one hand, an energy efficiency strategy was thus developed in 2012 and a National Energy Efficiency Action Plan set a target of realizing 5% savings in overall electricity demands by 2020. The Palestine Energy and Natural Resources Authority (PENRA) has since taken the lead for implementing the plan initiating a number of projects and initiatives with the objective of saving energy usage at city level. These included, among others, replacing street lighting with energy efficient bulbs, raising awareness and educating citizens as well as businesses, and shifting from using diesel fuel to natural gas. PENRA has also drafted the renewable energy law to regulate generation of electricity from renewable energy resources.

Moreover, a new law promoting environmentally friendly projects was passed offering income tax incentives during the first 4 years for eco-friendly or green initiatives complying with environmental protection conditions.

On the other hand, determined to resolve water shortage, the Palestinian Water Authority (PWA) is taking meaningful steps towards setting Integrated Water Management policies and laws, promoting tools to save water, raising awareness, and is implementing projects to resolve water shortage.

The Palestinian Hydrology Group (PHG), has also implemented a number of projects with the objective of rehabilitating water springs all over the West Bank for irrigation purposes, ensuring water sanitation and water resource development, rainwater harvesting, as well as improving access to food and food security.

Furthermore, investments in both in large-scale solid waste management programs as well as in medium-scale projects with high impact, such as the construction of desalination facilities to provide safe potable water, are also underway.

The Ministry of Local Government (MoLG) has invested in establishing 3 sanitary landfill sites in the West Bank. Nonetheless, attempts for waste separation and recycling were not successful and the relation between consumption and waste generation has yet to be developed.

Interest in green buildings however, only started following the registration of the Palestine Green Building Council (PalGBC) in 2011. The Ministry of Local Government (MoLG) developed the Energy Efficient Building Code (EEBC) with the objective of reducing energy consumption for residential and commercial buildings through adequate insulation. MoLG's intention was to make the EEBC mandatory and enforceable; however, this aim was never realized.

It is thus apparent that sustainable cities and green buildings is a relatively new concept in Palestine. Yet, moving towards a green building culture and practice warrants awareness, capacity building, as well as a persuasive environment featuring success stories. Policies and laws to advance the concept of green buildings are currently unavailable in Palestine but are expected to be developed in the new strategic plan to be launched in 2017. More decisive action is thus needed to guide development and implementation of laws, policies, and incentives. Steps should also be taken to increase awareness campaigns, intensify capacity building programs, as well as train and educate young Palestinians. Lack of surveillance and monitoring of policies should also be considered.

Chapter IX presents sustainable building initiatives in Qatar.

Qatar's commitment to sustainable cities stems from a conviction that development of existing and new infrastructure networks that support the urban built environments provide safe, connected, and healthy living conditions. As such, sustainable buildings, transport, infrastructure, and solid waste management have been identified as vital components for sustainable urban development in Qatar and form the backbone for a number of key institutions and initiatives that support city level resource efficiency and sustainability.

On a national scale, the Doha Metro has been introduced as a sustainable transportation mode addressing urban connectivity as well as current traffic problems. At a governmental level, the Public Works Authority “Ashghal” established in 2004 is committed to adopting best practices, standards, as well as warranting environmental protection in all its building and infrastructure projects. The authority is aiming to achieve Global Sustainability Assessment System (GSAS) certification for all future building projects. Large scale infrastructure projects such as the “Expressway Program” are also subject to international environmental standards as pertains to noise, air quality, water quality, waste management, habitat preservation, and recycling of construction materials.

Furthermore, according to Qatar National Development Strategy 2011-2016, a comprehensive solid waste management plan is being implemented with the objective of recycling 38% of solid waste, up from the current 8%, and reducing domestic per capita waste generation. Five waste transfer stations with material recovery facilities for separating recyclables such as glass, paper, aluminum, and plastic have been setup across the country to reduce the quantity of waste.

One of the most prominent developments however, has been the creation of Domestic Solid Waste Management Centre (DSWMC) designed to maximize recovery of resources and energy from waste through separation, pre-processing, mechanical and organic recycling, and composting. Nonetheless, while many steps have already been taken, Qatar is yet to witness a comprehensive solid waste management program that promotes recycling as a norm at the national level.

Moreover, and as a commitment to adopt sustainable measures at city level, Lusail City is one of the first and largest developments in Qatar to achieve a 4 Star rating under the GSAS Districts rating system. It encompasses new residential, commercial, retail opportunities, in addition to a full array of community facilities, including schools, medical facilities, as well as entertainment and shopping centers.

Efforts have also been made to implement sustainability measures in Doha with the objective of re-shaping the built environment, creating pleasant and comfortable outdoor environments, and introducing green areas within the city. While this is yet to be implemented on a wider scale, particularly in existing and denser neighborhoods, it is critical to the provision of a sustainable city that is adequately served and safely connected.

Moreover, Qatar has adopted several policies, procedures, and initiatives that support sustainable green building concepts. One of four pillars of Qatar’s National Vision (QNV) 2030, Environmental Development, aims to achieve “a balance between development needs and protecting the environment”, and identifies the need for a legislative framework to govern Qatar’s booming construction sector.

Design integration requires cross-disciplinary teamwork at the planning, scoping, design, and construction stages. It promotes comprehensive performance improvements, compounds environmental benefits and potentially offers substantial cost savings. Undertaking design integration is beneficial for upgrading existing buildings and infrastructure and it is critical in creating new ones. While it may be considered that they may have had varied success with the process itself, green building and city projects in Qatar have highlighted the importance of integrated design and the need to create a shift in the way buildings are conceived from early stages all the way through to construction and operation. There is a critical need to assess the entire lifecycle of a project from design to post occupancy and beyond.

Additionally, and in order to promote a culture of positive change and innovation, successful initiatives should be recognized and celebrated. This would increase the level of sustainability awareness and raise the bar as relates to practice and implementation of sustainable designs.

A review of progress made in Saudi Arabia is illustrated in Chapter X.

The Kingdom has adopted several initiatives and programs related to sustainable development at city level. Policies, laws, decrees, technical

standards, and guidelines to enforce the application of sustainability concepts are being introduced at various levels of governance and the urban development process.

In April 2010, King Abdullah City for Atomic and Renewable Energy (KA.CARE) was established in pursuit of a substantial alternative energy program. A comprehensive national program to rationalize and enhance energy consumption is also being launched to warrant cooperation between governmental agencies responsible for execution and implementation.

Additionally, guidelines for applying sustainability concepts in urban planning and design illustrating environmental assessment methodologies, a strategy, and municipal policies have been developed by the Ministry of Municipal and Rural Affairs (MOMRA) in 2005.

MOMRA and the United Nations Human Settlements Program (UN-Habitat) have also developed the “Future Saudi Cities Program” with the objective of promoting sustainable urban development in Saudi Arabia. The program supports sustainable urbanization in the Kingdom through assessment of the status quo of Saudi cities in terms of their capacities to provide a sustainable urban environment. The program involves development of detailed strategic plans as well as pilot projects in hope of transforming Saudi cities into sustainable, productive, and livable urban areas that provide equitable distribution of development gains. Nevertheless, and despite the many initiatives and programs, only a few cities, including the Royal Commissions for Yanbu and Jubail, have applied sustainable practices.

In Yanbu, considerable energy savings and a lower environmental footprint have been achieved by adopting a “Multi Effect Desalination” (MED) process at the new Industrial Wastewater Treatment Plant industrial city. The process utilizes the power plant’s thermal output to heat and evaporate sea water at low temperature consuming 33.3% less energy than other thermal processes.

In addition, several mega projects in the Kingdom have pursued sustainable development goals and have sought LEED

certification including King Abdullah’s University for Science and Technology (KAUST) which received the LEED Platinum certificate. KAUST’s campus utilizes smart design, new technology, and innovative approaches to mitigate effects of the harsh climate and reduce the overall carbon footprint of the project. Many private and public buildings have or are also in the process of receiving LEED certification; the intention being to implement the concept of sustainability at both building and city levels.

Furthermore, as part of the Kingdom’s resolve to move towards more sustainable development, King Abdul-Aziz for Public Transportation (KAPT) initiative aims at availing access to mass transportation modes to a large segment of the population with the objective of decreasing CO₂ emissions.

Yet, Saudi Arabia’s sustainable development initiatives and programs remain uncoordinated and unpublicized. Progress in adopting and implementing sustainability measures in the Kingdom are mainly limited to mega projects funded by local government and large organizations. Private projects including housing and commercial buildings are however much less enthusiastic and seldom employ sustainable practices in their projects. This is partially due to absence of awareness as to the methods, benefits, and values of adopting sustainability concepts. Public awareness, training, and incentives are thus much needed to encourage professionals and developers alike to implement sustainable practices at the building, neighborhood, and city levels.

Government incentives for sustainable green building could also get the wheel spinning for major developers as well as individual owners. One approach would be to start enforcing implementation on mega projects and large buildings, since they have the highest impact, while commissioning LEED certified professionals and well-established engineering firms to review and ensure compliance.

Chapter XI focuses on sustainable developments in Tunisia.

Following the first 1992 United Nation Summit for Sustainable Development, the Mediterranean

Environmental Technical Assistance Program, and in response to a growing energy deficit, Tunisia has engaged in several efforts to ensure the adoption of sustainable development principles in all sectors and has opted for comprehensive and scalable policies to ensure a sound balance between the country's environmental health and its socio-economic development.

The Tunisian Ministry of Environment and Sustainable Development, in collaboration with other stakeholders from the public and private sectors and with international partners developed an overarching National Sustainable Development Strategy (2014-2020) that is both progressive and proactive. This strategy cascaded into a series of policies and programs that pertain to cities and the building sector, which are in the process of being implemented by relevant governmental institutions. Key agendas include: environmental protection and quality of life; energy conservation and renewable energy; sustainable planning and construction; as well as sustainable transport.

Yet, relevant urban planning policies were launched in Tunisia as early as 1977, with the regional master plan for Greater Tunis integrating the basic principles of sustainable development including spatial, economic, and demographic dynamics as well as social, ecological, and cultural realities. The master plan promoted good urban governance and engagement of a wide range of stakeholders, tackling challenges such as neighborhood rehabilitation, public transport, social housing, industrial as well as domestic pollution, and more.

Furthermore, as a consequence of Tunisia's proactive policy for the promotion of renewable energy and energy efficiency, the National Agency for Energy Conservation, was established in 1985 and a number of ambitious energy efficiency and renewable energy programs developed with the prime objective of meeting national energy needs in a cost-effective manner while reducing the economy's vulnerability to rising fossil fuel prices.

Additionally, following the Earth Summit and the Mediterranean Environmental Technical Assistance Program, a number of initiatives and

policy efforts followed to shape sustainable development. Particular attention was given to the construction sector for its significant contribution to the overall national energy consumption. In response, programs and initiatives were developed ranging from building energy codes, energy labeling schemes, to solar hot water and photovoltaic incentive programs. In parallel, the government also tackled a number of other sustainable development challenges including waste management, natural ecosystem protection, and urban mobility, to name a few. Eco-labels or sustainability management and rating systems for buildings are also being developed by the government and are anticipated to play an important role in engaging the construction sector on the path of green market transformation.

Yet, and despite early engagement in sustainable policy development and significant urban planning efforts, the City of Tunis and the majority of other Tunisian cities still lack a comprehensive and integrated approach to sustainable urban planning. One exception is the city of Sfax where the local government followed a participatory approach to develop a Sustainable Development Strategy establishing a clear vision for the metropolitan area as well as supporting plans and projects in relation to the natural environment, infrastructure development, mobility, housing, public space, socio-economic development, and culture.

Furthermore, challenges facing the implementation of sustainability concepts and measures in Tunisia relate primarily to the implementation process. It is thus recommended that city governments initiate a participatory, multi-stakeholder process to develop a comprehensive and integrated sustainability strategy defining the vision, timeline, as well as implementation programs. A more comprehensive approach to urban sustainability should also address other areas of impact such as water conservation, sustainable procurement, and user wellbeing; seek higher performance beyond code compliance; demonstrate impact through measurement; and address sustainability at various scales - from urban to building and product levels.

Sustainable initiatives and efforts undertaken by the United Arab Emirates are addressed in Chapter XII.

Mitigation and adaptation measures and policies at both the federal and local level have been launched by the United Arab Emirates (UAE) to address climate change. As a consequence, several sustainability strategies and initiatives were instigated by federal and local institutions and are aligned in UAE's Vision 2021 as well as the Federal Green Economy Strategy for Sustainable Development.

In line with these national initiatives, the Ministry of Energy's National Environmental and Awareness Strategy 2015-2021 targets youth, communities, industries, as well as governmental stakeholders inculcating in them a sense of responsibility toward environmental protection. A Strategic Plan for 2014-2016 was also launched by Ministry of Public Works stressing the development of sustainable infrastructure and promoting the use of energy efficient systems. The Emirates Authority for Standardization and Metrology has also commenced enforcement of mandatory energy efficiency requirements and labeling schemes as pertains to water fixtures, lighting, electrical appliances, and air conditioners.

In addition, and in order to ensure a sustainable approach, numerous industry stakeholders are engaged in the process and include government bodies, semi-government entities, non-governmental organizations, academia, finance, business, industry, and private foundations.

On the federal level, the UAE's Vision 2021 targets raising air quality index to 90%, as well as increasing clean technologies to 24% and treated waste to 75%. At the emirate level, both Dubai and Abu Dhabi have reviewed their urban metabolic flow of energy, water, and waste as major indicators for sustainability, resource efficiency, and ecological footprint.

On the one hand, Dubai Municipality's goal is to make the Emirate the most sustainable city in the world by year 2020. Dubai's Integrated Energy Strategy 2030 (DIES) aims to achieve a 29% clean energy share in the total fuel mix by 2030 of which 15% is generated through solar energy, 7% through nuclear, and 7% from clean

coal. Furthermore, Dubai Electricity and Water Authority is focused on reducing the ecological footprint of the public grid by adopting a carbon dioxide emission reduction program. The authority is also introducing smart grid initiatives that include smart meters as well as electrical vehicles charging stations as part of its efforts to encourage use of solar renewable energy.

Abu Dhabi on the other hand, is planned to increase the share of nuclear and renewable energy in the electricity production category to 25% and 7% respectively by year 2020. Masdar City in Abu Dhabi is planned to provide a spotlight as a comprehensive and sustainable city conserving 70% water, 40% energy and reducing up to 60% of its waste generation. The city is anticipated to contribute to Abu Dhabi's target to attain 7% renewable energy generation by year 2020 and is home to two buildings that have received Leadership in Energy and Environment Design (LEED) Platinum certification.

The UAE government has also placed a concerted focus on the consumption of underground and desalinated water due to its impacts on food and energy production. With more than 90% of its food being imported, the government has addressed the food security challenge by diversifying its food sources, investing in agricultural projects, and launching several biodiversity strategies.

Moreover, several green building regulations and policies have been developed at the Emirate level, particularly in the Emirates of Dubai and Abu Dhabi, with the objective of reducing the impact of conventional construction, improving the built environment, and operational performance of new and existing buildings.

In 2008, the Estidama framework was developed addressing the four pillars of sustainability (environment, economy, society, and culture) and has since been rapidly embraced, adopted, and implemented in the Emirate of Abu Dhabi (over 1,000 buildings and 12,500 villas were awarded the design Pearl Rating System (PRS) as of October 2015).

Local governmental bodies are also focused on adopting sustainable transportation means


and green waste management techniques. Recent initiatives include among others: Dubai's Green Transport Initiative; schemes to enhance mobility and promote healthy lifestyle for both cities; Dubai's door-to-door waste collection and recycling program; and Abu Dhabi's emirates-wide Waste Management Strategy.

Yet, in comparison to the rapid and pioneering progress in Abu Dhabi and Dubai, other Emirates in the UAE have been slower at adopting green building codes and/or energy efficiency strategies. This is likely due to diversified economic priorities, fragmented local and national laws, and limitations with respect to resources, technical expertise, and financing capabilities.

It is thus safe to conclude that all withstanding, the UAE is committed to attaining sustainable development. The enforcement of green building regulations, energy efficiency policies, and waste management initiatives in the UAE actively follow internationally recognized and established best practices and are designed to facilitate the creation of sustainable cities and neighborhoods in the country as exemplified by the Green Building Regulations and Specifications in Dubai, the Estidama Pearl Rating System in Abu Dhabi, and the Zero Waste Initiative in Sharjah.

Yet, a common barrier faced by the construction industry is lack of awareness. To address this challenge, local academic, and industry platforms need to demonstrate the applicability and affordability of green building practices in the UAE. Local Non-Governmental Organizations (NGOs) such as the Emirates Green Building Council and other business forums should continue working closely with the UAE government to foster awareness of the benefits of adopting and implementing green strategies, provide capacity building, and influence policies to catalyze growth of the green construction sector. Government bodies should also consider reviewing and amending policies to catalyze the growth of green construction sector especially in northern Emirates.

Sustainable Cities and Buildings in the Arab Region



This section provides a general introduction to the status of sustainable cities and green buildings. It sets the general context illustrating how countries in the Arab Region are handling the concept of sustainable cities and green buildings in light of recent challenges including climate change, rapid urbanization, scarcity of natural resources, and shrinking public budgets.

The report presents the various concepts, policies, standards, practices and initiatives as relates to sustainable cities, sustainable building practices, and sustainable affordable housing in each of the twelve Arab countries. A review of national development plans; strategies to improve economic, social, and environmental welfare; key public policies, laws, decrees, building codes, standards and practices; as well as programs and initiatives intended to promote sustainable green development and efficient use and management of resources is undertaken to ensure fit and relevance. Energy efficiency and renewable energy programs and initiatives as well as green building certification, among others, are appraised while specific case studies and pilot projects embracing sustainable green practices are presented. Progress and limitation of current policies and practices as well as progress attained is illustrated with the intention of serving as the spring board for future initiatives.

I. Algeria

Cover: Mémorial du Martyr, Alger, Algérie (Source: https://commons.wikimedia.org/wiki/File:Alger_Memorial-du-Martyr_IMG_1135.JPG)

1.1 Context

1.1.1 Sustainable Cities

The concept of Sustainable Cities is not widespread in Algeria, though the government has adopted several policies in an attempt to integrate sustainability concepts into existing and new cities. This includes policies pertaining to the improvement of waste management at the city level, development of sustainable public transport systems using tramways and clean fuel, improvement of living conditions, and the introduction of green areas, parks, and walkways in cities.

The new City of Sidi Abdellah, 25 km south west of Algiers is a witness to the government's keen interest to integrate the concept of sustainable development in the design and management of the city - a 7,000 hectares' development - with the prime objective of creating a livable and sustainable environment for its residents. Specific measures have been taken by the government to ensure successful implementation including introduction of several guidelines relating to the conservation of resources, development of transport links, soft traffic, and limiting pollution.

Another good example of the government's intent to adopt sustainability measures is Oued El Harrach Development and Rehabilitation Project. Oued El Harrach runs through the city of Algiers with a watershed area of approximately 1,200 km² and a basin population of 3,000,000 inhabitants. The project aims to restore the natural corridor of Oued El Harrach River through a sustainable green network. The objective here is the cleansing of the river's water, provision of open and recreational areas for residents, reinstating the river's hydraulic functions, mitigating the hazard of damaging floods, and supporting the river's low flow. The project extends to cover 18.2 km across the city and has an anticipated construction cost of Euros 380 million and a time line of 42 months starting June 2012.

The Algerian government's quest to promote sustainable city development is thus evident.

The government is keen to collaborate, share experiences and best practices with neighboring countries, build local capacities through training and awareness raising, and introduce sustainability as a strategic goal and priority through the use of legal, regulatory, and other frameworks.

1.1.2 Sustainable Buildings

Since the government's launch of the huge housing program in 2001 to face increasing demands and future urban development challenges, public programs were developed to build 1 million new homes during 2010-2014, 1.2 million throughout 2015-2019, in addition to 1 million homes built during 2005-2009.

The programs, envision constructing 6 to 14 floors high apartment buildings in new cities and neighborhoods. Yet, due to the urgency of the issues at hand, the programs were developed and conceived with little or no reference to the notion of sustainability.

Nevertheless, the concept of sustainable buildings and cities is becoming more and more popular among the population, regulators, as well as the government in Algeria. Several initiatives, programs, as well as pilot projects are currently under review for possible implementation. New policies, regulations as well as best practices are being considered and integrated in the system. New building programs for 2015-2019, aim at introducing new standards in high energy performance buildings and include the BATIMENT ECOLOGIQUE (ECOBAT) platform launched by the National Agency for Energy Rationalization Promotion (APRUE), ECOBAT acronym being a brand name for ecological construction platform.

LAFARGE Algeria, a multinational organization in the construction industry, has also promoted initiatives aimed at significantly reducing CO₂ emissions produced by the cement industry and is also proposing smart building concepts based on sustainable solutions.

Furthermore, 'Construction 21', an international collaborative platform and an information portal dedicated to building professionals, has also been developed and made available to professionals interested in sustainable building and cities. It was designed to help develop new ways to construct and renovate buildings while accelerating the transition to a green economy. The Construction 21 network has also selected a cluster to promote eco-construction in the City of Oran.

1.2 Baseline

1.2.1 Policies, Laws, Decrees and Technical Standards

The Algerian government has not set a clearly written sustainable building policy, in particular from an environmental perspective; focus is more on building and housing delivery. However, the provision of affordable housing may be considered as an economic and social pillar for sustainability.

At present, national authorities ensure the enforcement of building standards inspired by Eurocode, with the support of the National Centre for Studies and Integrated Research Building (CNERIB) under the supervision of Habitat and the Urban Planning and Cities Ministry.

Although chapter 21 of the Compendium of Standards and Regulated Technical Directives (DTR) of March 1, 2011 covers thermal insulation which is controlled by the Technical Control Centre for Construction (CTC) and Section 22 covers Acoustic insulation, verification of insulation control in buildings is non-existent and it is unclear to which extent these regulations are applied.

In conclusion, the regulatory framework in Algeria ensures compliance to international standards but is not specifically linked to sustainability performance improvement. While efforts have been developed for a regulatory framework; control is still poor and there are no ways to ensure that standards for emission control, thermal insulation levels, and electrical

consumption levels are implemented. Moreover, there are no standards for domestic solar energy use and it is not possible to sell generated solar energy surplus. Regulatory and standards' framework also need development with more precise sustainability procedures introduced to ensure implementation.

1.2.2 Institutional Programs

The Algerian government is developing institutional pilot programs in order to raise awareness on sustainability issues and is developing new standards and regulations for sustainable buildings. Within this context, the National Agency for Energy Rationalization Promotion (APRUE) has developed several programs promoting:

- use of LED lamps instead of tungsten wired bulbs;
- thermally insulated buildings using glass wool and stone wool; and
- use of double glazed windows instead of single glazed windows.

In 2015, a pilot program of 600 houses was completed and a new program was introduced for "2030 horizon" and is based on:

- thermal insulation in existing buildings - installation of 10,000 m² of double glazing;
- installation of 4000 m² of solar water heaters;
- installation of 3000 m² of collective solar water heater;
- dissemination of one million low-energy bulbs;
- substitution of 50,000 mercury lamps with high pressure sodium lamps, replacement of existing fixtures with more efficient lighting, and installation of public lighting management systems; and
- introduction of energy efficiency measures in building regulations and programs.

In addition, APRUE is promoting the use of low consumption electrical house appliances by setting a rating mechanism for these appliances.



Hassi-Messaoud Project (Source: Author)

13 Case Studies

Integrated green building case studies are limited and not common in Algeria except for the 600 pilot houses project which is still under evaluation.

1.4 Future Actions

The government needs to develop procedures, standards and technical specifications in line with the concept of sustainable cities and buildings. Furthermore, a comprehensive local approach on green buildings within set standards and guidelines is to be formulated in order to promote concepts of sustainable planning and design. Capacity building initiatives, benchmarking as well as knowledge transfer among countries in the region should also be embraced.

Furthermore, there is a need to launch an Algerian GBC to promote the concept of green buildings and increase awareness among concerned stakeholders.

1.5 Lessons Learned

Pilot programs on energy efficiency and low emissions in Algeria are yet to be developed with a need to upscale dissemination levels as relates to best practices and development regulations. Confusion between affordable housing and government funded social housing should also be clarified to avoid undermining research and development efforts seeking to reduce building cost through the introduction of new construction materials and processes.

II. Bahrain



Arab Regional Centre for World Heritage (Source: <https://www.pinterest.com>)

2.1 Context



Bahrain World Trade Centre (Source: Author)



Smart Solar Power Plant (Source: Author)

2.1.1 Sustainable Cities

As part of the Cabinet's initiative for optimum use of energy (Decree 05-2042 of 2011) the government decided to increase the energy efficiency of street and highway lighting and replace all traffic lights with LED lighting. It is also considering introducing new energy tariffs in an effort to reduce consumption by increasing its price.

Additionally, several initiatives were instigated to encourage sustainable development, including forming a committee to research alternative green energy sources while encouraging their use in the Kingdom. This included launching an electric power plant with a total capacity of 5 MW.

A number of resolutions were also amended to conform to the concept of sustainable development. This included resolution No.10 of 1999 pertaining to the environmental standards of air and water which was amended by resolution No. 2 and 3 of 2001. The Water Resources Council was also established to oversee and review the Kingdom's water policy including the protection, development and sustainability of water resources, groundwater management, as well as other administrative and regulatory procedures. In addition, a ministerial decree was also introduced aiming at preventing water

leakage as well as maintenance of aquatic resources. This involved implementing an integrated program to detect water leaks in internal networks and expand the use of treated wastewater for agricultural irrigation.

The Kingdom is also working on preparing a detailed strategic structural plan for 2030 that is based on sustainable development concepts with the objective of sustaining the environment and preserving its resources.

In January 2010, the government introduced a vision and strategy for sustainable agricultural development for the next two decades. The strategy aimed at attaining high economic efficiency while preserving available environmental resources and achieving relative food security.

2.1.2 Sustainable Buildings

In the last few years, the Kingdom of Bahrain made considerable efforts to ensure the sustainability of its development process in multiple areas; this is reflected in the constitution of 2001. The National Action Charter (NAC) approved by 98% of the citizens - ensured the protection of the environment while balanced the requirements of both social and economic development.

The Kingdom has also established several institutions, agencies, and commissions to develop programs, policies, as well as strategies to achieve sustainability in various dimensions. The government is developing laws and policies for sustainable buildings in both the public and private sector and has enacted a number of bylaws to ensure economic, social, and political inclusion.

2.2 Baseline

2.2.1 Policies, Laws, Decrees and Technical Standards

Bahrain is currently in the process of developing its Sustainable Building/City by-laws and policies to conform to the sustainability concept. Without these laws progress will remain limited. Furthermore, both public and private sectors have adopted sustainable initiatives in pursuit of sustainable goals.

2.2.2 Institutional Programs

A Government initiative for “Optimum Use of Natural Wealth & Available Resources for Public Sector” was promulgated by the Prime Minister’s Cabinet in 2011 Decree number 05-2042. To implement this decree an official working committee was created in 2011 headed by the Ministry of Finance, which developed Bahrain’s Energy Efficient Lighting Initiative in conjunction with the World Bank. Furthermore, the World Bank is providing technical assistance to the Kingdom to support the design and implementation of a large scale efficient lighting program for the residential sector as well as a pilot project for sustainable Public Schools (5 public schools were selected as part of this pilot project).

2.3 Case Studies

Bahrain World Trade Centre: The building designed to protect and sustain the environment,

won the carbon LEAF award in 2006 within the category “Best Use of Technology within a Large Scheme” and received the Arab Construction World award for the “Sustainable Design Award”. The Bahrain World Trade Centre in Manama is the first building in the Kingdom to use suspended windmills 787 feet high to generate electric power. The mills generate 1,200 megawatts of electric units supplying 15% of needed electrical energy to the towers – equivalent to the estimated consumption of 300 houses.

Bahrain International Airport Expansion Project:

The project consists of the construction of a new terminal building to accommodate 13.5 million passengers to keep pace with the demands of tomorrow’s aviation growth. The project, anticipated to be completed by 2019, is pursuing LEED certification and is pioneering novel approaches to maximizing energy and water efficiency.

Ministry of Finance Headquarters: In 2010, the Minister of Finance approved a “Go Green Policy Committee” responsible for introducing sustainable green practices within the Ministry’s existing building. The committee set a number of green goals that involved among others the reduction of paper consumption, attaining a 10% reduction in 2011; increasing electric energy efficiency within the building, attaining a 10% reduction in consumed electric energy in 2013; reduction of generated waste, attaining a 15% reduction in 2011; as well as recycling of office waste, attaining a 70% recycling rate in 2011 and handing over all returns from recycled material to charitable institutions.

2.4 Future Actions

New buildings and cities should adopt a green and sustainable approach to buildings to avoid inefficient use of natural resources. The government as well as professional institutions should recognize individual efforts to adopt the concept of sustainable development.



Northern City (Source: Author)

2.5 Lessons Learned

Bahrain is currently in the process of developing its sustainable building and city law and policies.

Though public and private sector initiatives are encouraging, without clear binding laws progress pertaining to sustainable development will remain at a slower pace than hoped, since it will be based on individual schemes rather than a nationwide law.

It is thus crucial that sustainable building/city laws and policies in Bahrain are developed and implemented as soon as possible. New buildings and cities should meet minimum sustainability requirements; otherwise inefficient use of natural resources will continue.

Yet and at the same time, a nationwide recognition for individual efforts in buildings and cities should be acknowledged. Projects should be rewarded for their pioneering vision and proactive stance while not waiting for official policies to be enforced.

III. Egypt



Giza Pyramids (Source: <https://www.flickr.com/photos/trodel/3598767832/>)

3.1 Context

Egypt's population is currently estimated at around 89.58 million people with a 2.2% annual population growth rate. Around 43.8% of the population live in urban areas with a rate of urbanization at 2.1%. Egypt ranks amongst the 16 to 20 highest nations in terms of population increase. Its GDP as of 2014 is at US \$ 286.5 billion with a 6.8% growth recorded in the second quarter of 2014, (World Bank, 2015 and CIA, 2015).

Hence, demand in the building sector in Egypt is driven by high population growth and rapid urbanization. These trends make the construction sector one of the fastest growing sectors in Egypt, with a contribution of around 6-12% of GDP and an employment rate reaching 8-10% of the local workforce, making it one of the most labor-intensive sectors. In addition, the construction sector is considered as one of the sectors that has an immense and strategic impact on the economy as it is linked to and affected by more than 90 industries including cement, steel, gypsum, paint, ceramics, wood and other industries.

Being a low-middle income developing country with nearly 40% of population living with under 1 US\$ per day, and nearly 18-20 million citizens living in informal settlements, the general society in Egypt is rarely interested in sustainability issues. Moreover, the real estate sector has suffered from inappropriate policies. The government failed to adopt measures and policies to provide affordable housing for middle and low-income groups.

Consequently, the 2007-2012 five years plan targeted key priorities including promoting economic growth and employment by promoting investment; encouraging public participation as an essential approach for fostering the development process; preserving natural wealth and its rational management to achieve sustainable development; and enhancing national competitiveness in international markets. Yet, the political stalemate and

transition that followed the 25 of January 2011 revolution have had a grave toll on the Egyptian economy. The country is currently going through a transitional period offering great challenges and opportunities. Conventional approaches for development are no longer an option as they will not achieve the desired outcome. At present, Egypt is determined to pursue a sustainable green growth path, adopting green economy as a tool.

3.1.1 Sustainable Cities

Efforts towards greening both the construction industry and housing sectors in Egypt have been ongoing since 2009. The Egyptian Green Building Council developed the Green Pyramid Rating System (GPRS), which was issued by a ministerial decree in 2010, as a national building rating system. GPRS reviews sustainability characteristic within green buildings and cities while assessing ecology, energy efficiency, water efficiency, materials and resources, indoor environmental quality, as well as management and innovation. A Sustainable Design Process Model (SDPM) has also been developed to offer professional counsel to the construction of environmentally sound buildings.

Moreover, Egypt's 2014 constitution emphasizes the promotion of sustainable development, increased use of renewable energy, better management of natural resources, as well as efficient and effective use of resources. In 2014 the government approved the creation of the Central Unit for Sustainable Cities and Renewable Energy (Cabinet Decision No. 512, 2014) as part of the New Urban Communities' Authority. The Unit is entrusted with the planning, design, construction and operation of green and sustainable communities while adopting concepts of energy efficiency, water desalination, waste management, sustainable transportation, and implementation of green economy.

Additionally, and in line with the government's efforts to promote eco and sustainable tourism in

Egypt, both the Ministry of State for Environmental Affairs and the Ministry of Tourism have signed a cooperation agreement to transform the city of Sharm El Sheikh into a Green City.

Other national initiatives include the Productive Low Cost Environmentally Friendly Village (PLEV) which involves the collaborative efforts of the Housing and Building National Research Centre (HBRC), El-Fayoum Governorate, Ministry of State for Environmental Affairs, Agency of Building and Development of Egyptian Villages, and the Desert Research Institute with the objective of housing 25,000 beneficiaries on 2000 feddans in a sustainable village framework.

Nevertheless, the need for both primary and secondary energy continues to constitute a prime challenge for the Egyptian government. The government has thus asserted its firm commitment to “Renewable Energy”, with an objective to achieve 20% of energy needs from renewable sources by 2020. This is further backed by a 20-25 years power purchase agreements with government guarantees, tax exemptions on equipment used for renewable energy, and benefits from carbon credits under the “Clean Development Mechanism”. The Wind Atlas of Egypt estimates a potential for electricity from wind farms of up to 20 GW. Current plans for solar energy show a target of 100 MW by 2017.

As such, the newly instituted New and Renewable Energy Authority (NREA) is pursuing numerous projects including hybrid plants in Kom Ombo as well as Kuraymat, both of which are planned for completion by 2017. Several other plants are in design with the aim to produce 7,200 MW. What is more is that the government has begun large-scale wind farm developments along the coastal area between Hurghada and Zafarana with a capacity of 430 MW and a plan to increase the overall energy production from wind to 7.2 GW, (Ellis and Nakhodka, 2012). A series of photovoltaic and Concentrated Solar Power (CSP) installations are also being implemented to generate electricity in part for water pumps, desalination, and rural electrification.

3.1.2 Sustainable Buildings

According to Mejía Dugand et al (2011), Cairo’s environmental problems include: water

supply/quality, urban waste, traffic, energy and congestion. Access to basic urban services, such as water, power and food remain a major challenge for millions of urban dwellers living in informal settlements in and around metropolitan Cairo.

Organizations such as ADAPT are thus contributing to the development of low-cost environmental-friendly housing while reducing dependency on high-cost, imported and environmentally unstable building materials. ADAPT’s goal is to promote the use of native building materials in low-income and informal communities; encourage simpler, faster, and more affordable building techniques; as well as support the transfer of expertise and know-how to younger generations.

The Ministry of Housing, Utilities and Urban Development (MoHUUD) through HBRC has also issued the Egyptian Building Energy Efficiency Code (BEEC) for residential and commercial prototypes (industrial and public building codes are still underway). By improving building design and adopting related technologies such as insulation, solar heaters and efficient lighting systems among others, substantial energy savings is expected to be achieved to counterbalance capital investment required in energy efficiency improvements and ensure pay back within an acceptable time frame.

3.2 Baseline

3.2.1 Policies, Laws, Decrees and Technical Standards

Building Energy Efficiency Codes: According to Egyptian Law, the Ministry of Housing, Utilities, and Urban Development is responsible for developing and updating national Building Energy Efficiency Codes (BEECs). The residential BEEC was introduced by a ministerial decree in 2005 and a commercial BEEC was established in 2009. The codes were developed with international assistance provided through the United Nations Development Programme and the Global Environment Facility. A number of researchers from the US collaborated with

the Housing and Building National Research Centre (HBRC), to develop the basis for the first code for energy efficiency in buildings. The residential BEEC is expected to reduce electricity consumed for cooling new homes by 20% while improving levels of heat comfort in non-air conditioned homes. These codes and another for public buildings are mandatory. The process of BEEC enforcement is still in its early stages, and compliance is negligible. A comprehensive implementation program was designed but has yet to be implemented. Basic compliance tools are thus still lacking and capacity building has not been adopted.

The Unified Building Law No. 119/2008 and its executive appendix ministerial decree no.144/2009: Law no.119 for the year 2008, also known as the “Unified Building Law” was released by a presidential decree and ratified by the house of parliament in May, 2008 in order to systemize and regulate the process of building in the whole republic. It was decreed in amendment and in integration with previous laws. However, as a reflection of a diminished public interest, the Unified Building Law was passed, with no reference to energy efficiency, or green buildings, and without giving incentives for applying them.

The National Environmental Action Plan (NEAP) for Egypt identifies seven main areas to be addressed during the period between 2002 and 2017. Water, Land, Solid Waste Management and Biodiversity are among the seven areas.

- Water: with the objective of improving sanitation coverage for urban and rural areas including implementation of low-cost non-conventional treatment technologies increasing potentiality for wastewater reuse.
- Land: targeting sound environmental management of urban settlements including the provision of new settlements with essential infrastructure services to decrease dependency on primary cities thus limiting commute distance. This is expected to increase the inhabited areas of Egypt from 4% to 25%; afford dwellers access to land, and secure tenure; and upgrade slums and squatter settlements.

- Solid Waste Management: targeting the development and implementation of an integrated system for waste collection and recycling including the design and production of containers and trucks and involvement of the private sector.
- Biodiversity: with the objective of conserving biodiversity resources, including the promotion of eco-tourism projects and contributing to the regional development of South Sinai.

The Green Pyramid Rating System (GPRS) was issued by a ministerial decree in December 2010, to look into all aspects of sustainability towards greening buildings and cities, including ecology, energy and water efficiency, materials and resources, indoor environmental quality, management and innovation. A Sustainable Design Process Model (SDPM) was also developed to guide professionals build environmentally sound buildings.

Green Economy: As a tool to achieve sustainable development in Egypt, A study was prepared by the Green Economy Working Group of the Ministry of Planning in September 2014 and was funded by UNEP, UNDP, and Global Environmental Fund (GEF). Members of the Ministry of Planning Task force are currently developing “Egypt’s Green Economy Strategy 2025-2030” as part of the “Sustainable Development Strategy for Egypt”.

3.2.2 Institutional Programs

The Egyptian Green Building Council (Government Egypt-GBC) was established by virtue of Ministerial Decree No. 56, 2009 with an objective to promote green construction. The Council is comprised of government officials, business leaders, NGOs, as well as labor leaders. One of its aims is to encourage investors to adopt BEECs as well as other sections of existing codes targeting energy efficiency and environmental conservation. Egypt-GBC is headed by the Minister of Housing, Utilities and Urban Development and its members include a number of scientists in the fields of environment, energy, and housing from all relevant sectors, as well as representatives of competent ministries. A Ministerial Decree was issued establishing the

appraisal system of GPRS, which is deemed a green building measurement program used for verifying conformity.

The MED-ENEC Project supported energy efficiency in the construction sector of 10 southern and eastern Mediterranean countries including Egypt, and demonstrated - in pilot projects - an average saving of 57% in primary energy for heating and cooling, compared to a conventional building in the same country. Such savings were anticipated to generate strong demand for energy efficiency measures in both new and existing buildings. However, energy subsidies significantly undermined these incentives within Egypt as the payback period before the cost of any initial investment was recouped (in terms of savings on energy bills), was much longer (estimated at 30 years in the case of Egypt) than it would otherwise be.

The Green Star Hotel Initiative is a public/private partnership developed by Orascom Hotels, AGEK Consultants and GIZ. The program is a voluntary eco-label initiative, by which hotels are awarded green stars depending on their adoption of various sustainability and energy efficiency related measures. The initiative is seeking to potentially increase demand for green construction in the hotel sector. It was designed to respond to the growing environmental awareness of international consumers increasingly questioning the environmental credentials of various tourism services. However, this level of environmental awareness is currently seen much less amongst Egyptian consumers.

The Green Tourism Unit (GTU) was established in 2010 at the Ministry of Tourism focusing on green tourism practices within the sector. Especially since Egypt's visitors are becoming increasingly aware of and concerned about environmental protection, a trend that is expected to continue and influence future choices of tourism destinations in the region. The institutional turmoil and the challenges facing the tourism industry since the Egyptian Revolution in 2011 have slowed down activities in this regard but a few activities managed to successfully cruise through these difficult times. In early 2014, the Ministry started revamping efforts in this area and prepared a roadmap to move Egypt up on the sustainability ladder. The

roadmap adopts the concept of having the Green Tourism Unit play its role as a market enabler while promoting new activities, linking existing efforts and providing support to relevant market forces to advance greener practice. This will be accomplished through a green growth-oriented framework, managed by a team of professionals and through effective coordination with a variety of stakeholders within and outside the tourism sector.

The New and Renewable Energy Authority (NREA) has been established to act as the national focal point for expanding efforts to develop and introduce renewable energy technologies in Egypt on a commercial scale together with the implementation of related energy conservation programs. NREA aims to achieve 20% energy production from renewable sources such as solar and wind by 2020.

3.3 Case Studies

UNDP Project for Reducing Energy Consumption of the Transport Sector: The project was recently initiated aiming at reducing the energy consumption of the transport sector by promoting the development of new integrated high quality public transport services for Greater Cairo and its satellite cities; promoting non-motorized transport in medium sized provincial cities; introducing new traffic demand management measures; improving energy efficiency of freight transport; enhancing public awareness; and strengthening the institutional capacity to promote sustainable transport across the country.

Eco/Sustainable Tourism: The Egyptian Ministry of Tourism (MOT) implementing several projects to green the tourism sector and has recently sought ways to promote ecotourism as a new product. Areas in North and South Sinai, Al Fayoum city as well as in the Western and Eastern desert are being promoted as eco-villages meant to cater to high-end nature lovers.

Ecocitizen World Map Project (EWMP): The Project aims to calculate the ecological footprint and urban metabolism of a typical neighborhood in Imbaba.

Imbaba, an informal district in Giza grew in an unplanned pattern. Previously an agricultural land, it was subdivided illegally to accommodate housing needs of the ever growing urban population of Cairo. Currently Imbaba is residence to more than one million inhabitants with a density ranging around 650 persons/ha.

The Project emphasizes how the district performs in terms of consuming and producing resources and how they flow through its various systems. It reviews how informal areas perform as relates to urban metabolism while focusing on water flow as a priority identified by the residents, the results of which demonstrate moderate living conditions in informal areas mainly suffering from lack of health services, recreational facilities and lack of open space. In addition, it highlights huge problems pertaining to resources consumption especially as relates to water, thus prompting an immediate response from various stakeholders and at different levels.

Yet, given the challenges related to water scarcity, if the results of the field study are aggregated to encompass informal areas in Cairo, water consumption/depletion would be alarming. Hence, the study points out the pressing need to address this issue both on policy and local levels. Personal behavior is also highlighted as crucial, as traditional practices relating to water consumption and illegal encroachment on the water network should be reconsidered. Moreover, partnerships between different stakeholders are recommended and could help promote locally appropriate solutions that are both affordable and require minimum technological capacities for maintenance.

The study also identifies points of leakages in the resources flows and possible interventions to improve the quality of life in the area while maintaining an efficient use of local resources and minimizing the impact of urbanization on the ecological footprint. The proposed recommendations, if implemented, could thus make Imbaba more resilient in facing water scarcity and provide a more vibrant life for its residents.

Green Business Initiatives

There are a growing number of green business initiatives in Egypt including:

- El Gouna resort city along the Red Sea is developed along eco-friendly lines.
- SEKEM promotes organic farming and installation of biodynamic farms. The project has reclaimed almost 17,000 acres of agricultural land while allowing for increase in water holding by up to 70%, a decrease in water consumption by 20-40%, and protection of soil from erosion.
- SME's and private enterprises have seized on the opportunities provided by the need for solid waste treatment and recycling. A good example is that of an Egyptian SME realizing the importance and magnitude of recycling printer ink cartridges especially as Egypt discharges more than 300 million printer cartridges every year representing a financial value of more than USD 450 Million, and a waste of more than 4,000,000 gallons of oil. The SME is currently one of the biggest recycling enterprises in the Middle East.
- Florenta Residence Compound has received the silver certification for being the first accredited project by Egypt-GBC in Egypt. GPRS certification is an official recognition that the project complies with the requirements prescribed within the Green pyramids rating. Certification is valid for 5 years, after which a new application for rating may be made under the Green Pyramid Rating System for Existing Buildings. This version of the System is currently in preparation.

3.4 Future Actions

Numerous initiatives and constructive steps to reshape the current legislations and codes should be considered. Existing local building laws and regulations need to be revisited especially as numerous parts of the Unified Building Law no. 119 released in 2008, and its executive appendix released by the Ministerial decree no. 144 in 2009, show negligence of important green concepts.

The Egyptian Competitiveness Report in 2012 recommends that Egypt adopts a green construction strategy, by convening public and private sector representatives from the construction industry, to develop a plan and establish standards and incentives for green construction. Strategy development could build on work adopted by Egypt-GBC in order to review and adjust existing standards, strengthen enforcement, and develop performance rating/labeling schemes. Measures could include:

- **Strengthening the system of progressive electricity tariffs;** a sliding scale for electricity prices which starts low, but escalates with increased energy use. This would strengthen incentives offered by property owners for energy efficiency measures, could present an opportunity to improve access to credit through financial institutions to cover upfront costs resulting from energy efficiency measures, or provide subsidized credit programs or credit guarantee schemes.
- **Enhancing enforcement of building codes;** investing in more inspectors to strengthen enforcement would create green jobs directly, and would raise awareness and compliance, and could even be self-financing through the imposition of fines for non-compliers. This should be accompanied by a review of building regulations and standards to promote energy efficiency. Current regulations may not be effective because they are too ambitious, and thus unrealistic and unachievable for many contractors.
- **Development and marketing of green labeling schemes;** a major marketing strategy and media campaign could be launched to raise awareness regarding the new Green Pyramid Scheme. International quality and energy efficiency management norms (e.g. the ISO standards) could be adopted and promoted in related construction industries.

- **Working with the private sector to identify gaps** as pertains to the availability of suitable materials and technologies within Egypt, and exploring the possibility of promoting and developing these industries locally. This could also involve working through schemes designed to support SMEs and professionals involved in the sector, to raise awareness and build relevant skills and capacity, including helping SMEs comply with standards.

3.5 Lessons Learned

The building sector in Egypt accounts for approximately 0.04% of total CO₂ emissions across the globe and is consuming 72% of the country's total electricity. Greening the building stock (new and existing) is the path to achieve sustainable development and tackle such a burden. Egypt needs to adopt sustainable development approaches in policy design and implementation in order to instigate economic development on sound basis. Policies need to be developed to ensure that environmental and social objectives are at the core of the planning and decision making process. Particular emphasis should be laid on equity considerations, social justice, and the right of all citizens for a respectful and dignified life. Efforts should focus on enhancing capacities and developing policies designed to maximize benefits resulting from investing in environmental infrastructure while ensuring that development benefits trickle down to the poor, underprivileged, and marginalized segments of the society.

IV. Jordan

7

The Monastery (Al Dier), Petra, Jordan Center (Source: [https://commons.wikimedia.org/wiki/File:The_Monastery_\(Al_Dier\),_Petra.jpg](https://commons.wikimedia.org/wiki/File:The_Monastery_(Al_Dier),_Petra.jpg))

4.1 Context

Ensuring access to secure water, energy, and food supplies have long presented challenges to Jordanians. With a growing population, augmented by waves of immigration and resettlement from neighboring countries as well as changes in the energy market, issues of sustainability have never been so pertinent. Recognizing water and energy as the biggest constraints to Jordan's sustainable economic growth, the government has developed strategies targeting both the water and energy sectors, including a number of mega-projects at the national level. Moreover, the concept of smart cities and the integration of Information and Communications Technology (ICT) in cities of the future are becoming more popular with applications in transportation, energy efficiency, and renewable energy as well as infrastructure.

Yet, a number of entities play a role in supporting city-level sustainability projects from legal and regulatory perspectives, to providing technical support, advocacy, financing and implementation. In an institutional and legal assessment conducted by an EU-funded project in 2005, more than eleven ministries were found to have different mandates towards environmental management in Jordan. The Ministry of Environment has thus initiated efforts to coordinate and collaborate with various ministries and institutions. Institutionalized coordination (e.g. Sustainable Development Committee under MoPIC, Climate Change related committees under MoEnv, etc) is essential and should be addressed in Jordan's green growth roadmap.

4.1.1 Sustainable Cities

Jordan is engaged in a number of sustainable city initiatives ranging from city-level transportation projects in Amman to renewable energy mega projects in Irbid and Sahab. This is in addition to a sustainable mainstream plan for the Dead Sea Development Zone and renewable energy projects in the Aqaba Special Economic Zone.

Recognizing grave challenges, including a projected increase in population to reach 6.4 million by 2025, the city of Amman embarked on developing a sustainable blue print for development. The plan addresses issues relating to the built and natural environment, culture and heritage, transportation and infrastructure, as well as community development. As a subset of the Amman Plan, a Clean Development Mechanism (CDM) program was also developed to ensure that activities under this plan adopt low-carbon options.

The city has also been promoting the concept of "Smart Cities" and has initiated a number of initiatives relating to sustainable energy, urban transport, municipal waste, as well as urban forestry. This is in pursuit of attaining the ultimate goal of a green, sustainable, and smart Amman.

The Greater Amman Municipality (GAM) is planning and implementing renewable and energy efficiency projects and regulations; developing public transport systems including a Bus Rapid Transit (BRT) project; upgrading the existing landfills while extracting methane and mitigating greenhouse gas emissions; increasing green areas; and controlling desertification as an outcome of urban sprawl.

Many projects have also been planned by the Greater Irbid Municipality (GIM) and initiated by (GIZ) to mitigate the effects of high flow of Syrian refugees into Irbid while ensuring a more livable and sustainable environment. Projects range from renewable energy production to energy efficiency initiatives, recycling municipal waste, upgrading transportation in the city, and mandating energy efficiency regulations.

Sahab, a municipality located to the south of Amman, has also launched its own sustainability initiative entitled: "Sahab a Green City" with the objective of alleviating and mitigating negative effects of receiving 40,000 refugees.

Furthermore, the Kingdom of Jordan has for the past 15 years focused on a balanced approach towards development and preservation of the natural environment in order to capitalize on increased tourism and provide improvements to local communities. The Dead Sea, a unique landscape with great cultural and economic significance for Jordan, is anticipating an increase of 14,000 new rooms over the next 20 years. Due to its fragile ecosystem, the Jordan Development Zones Company has set high environmental standards for the Dead Sea Development Zone (DSDZ) master plan. Phase I of the master plan, encompassing 40 square kilometers of land along the north and east coast of the Dead Sea, proposes a comprehensive approach to social and economic sustainability. The proposed scheme is highly integrated, vibrant; pedestrian oriented, and envisions a tourism destination with public transit that preserves and enhancing the area's astounding ecological assets and capitalizes on investment. The project embraces the environmental, social, and economic pillars of sustainability strengthening the Dead Sea's sense of place and its communal attachment. The project is thought to serve as a model for future sustainable development of Dead Sea area.

On a similar note, the Aqaba Special Economic Zone (ASEZ) defines itself as a world class business hub and leisure destination on the Red Sea committed to sustainable development. Aqaba Special Economic Zone Authority (ASEZA) has adopted a number of policies associated with control, management and protection of the natural environment. The environmental policy demands the preservation and protection of the environment and a sustained development of the Zone's natural resources. ASEZA has adopted a rigorous policy of "Zero Discharge" to the sea in order to preserve the marine environment. The water policy demands the protection and management of groundwater resources, as well as the development of wastewater management and reuse schemes. Water conservation is to be enhanced by managing both supply and demand and efficiency of use through utilization of improved water-saving technologies and management practices, and modification of current practices through public awareness

programs. The energy conservation policy promotes provision of adequate energy to consumers at the least possible cost while attempting to meet the needs of socioeconomic development in the Zone.

The Jordanian experience thus suggests a noticeably active role of municipalities and local authorities in sustainable city development not only as they are mandated to plan and manage cities but also to provide an enabling environment for businesses to participate in implementation. For without an effective public-private partnership, cities cannot thrive and will only strive to survive. Reforms require innovative partnership models that Jordan is currently exploring.

4.1.2 Sustainable Buildings

Jordan is undergoing a critical phase in terms of energy and water security, making green buildings more significant and vital than ever. Energy use in the residential sector in Jordan accounts for 24% of the total consumed energy and matches that of the industrial sector. Hence, more green buildings are applying for the U.S. Green Building Council (USGBC) green building Leadership in Energy and Environmental Design (LEED) rating and over 70 companies have adopted green solutions and have initiated green business units. Green buildings thus represent an opportunity to move forward with the green agenda in Jordan.

Current efforts to adopt and enforce water and energy efficient measures in buildings are central and are seen as the first step towards more sustainable buildings. Codes as well as standards have been developed in response to energy challenges. Standards have been prepared utilizing local, regional, as well as international related resources. Architectural as well as electro-mechanical aspects were taken into consideration. This calls for architects, urban planners and engineers to embrace, develop, and apply smart and passive design concepts. The development of a robust sustainability scheme is therefore essential if Jordan is to establish a competitive advantage and compete effectively in global markets.

4.2 Baseline

4.2.1 Policies, Laws, Decrees and Technical Standards

Since 2008, the Building Research Centre (BRC) instigated the “Energy Efficiency Building Code” among a package of 5 building codes relating to the subject and mandate of the Jordanian National Building Council (JNBC). The new energy related codes are:

- Mechanical Services Specifications;
- Electrical Services Specifications;
- Gas Piping Code;
- Thermal Insulation Code (Updated); and
- Energy Efficient Building Code.

The Renewable Energy and Energy Efficiency Law No. 33, 2015: The aim is the exploitation and development of renewable energy sources; contribute to the protection of the environment and sustainable development; rationalize energy consumption and improve its efficiency in various sectors; and regulate procedures related to direct supply. Regulation No. 13, 2015 exempts all systems, equipment of renewable energy and efficiency together with inputs, local production and imports from customs fees and sales taxes.

Regulation No. 73, 2012: The regulation is meant to organize procedures and means of saving energy. The aim is to set policy to rationalize energy consumption and improve its efficiency; encourage investment in energy efficiency and improve its adeptness; and raise awareness.

Jordan Standards and Metrology Organization worked on several standards and regulations relating to: materials and environmentally friendly products; electrical appliances that meet energy efficiency; electrical devices, which check the efficiency of water consumption. The aim is to seek domestic energy resources development; installation of renewable energy technologies; and demand-side management, energy conservation, and energy efficiency initiatives.

Greater Amman Municipality Resolution No. 19, 02/25/2015, included Article 9 of the GAM’s requirements for the installation of photovoltaic panels on the roofs of buildings. The aim is to improve the performance of buildings and improve the overall health of citizens; support creating a more harmonious urban environment; and encourage citizens, investors, and entrepreneurs to adopt the concept of green buildings by offering incentives.

4.2.2 Institutional Programs

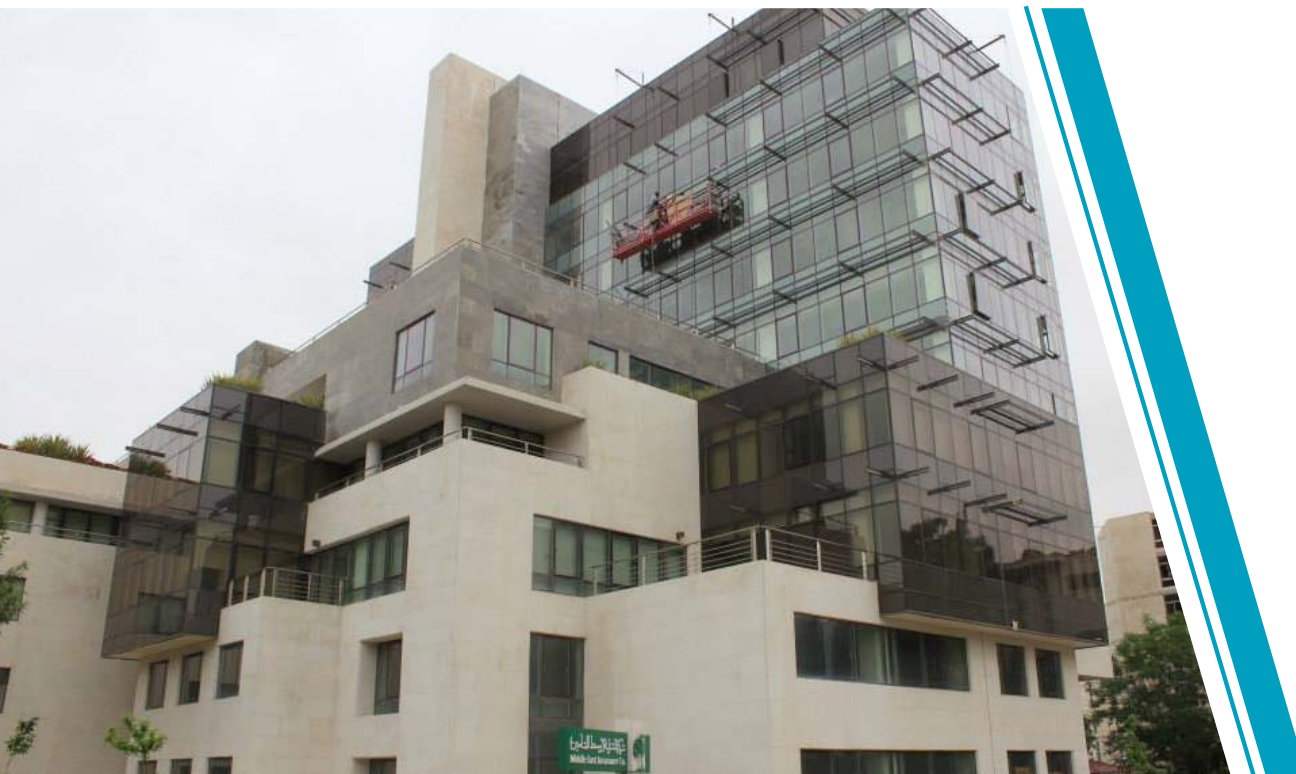
Voluntary-based rating systems: Obtaining certification or a green label is a voluntary process initiated by a client or developer seeking to recognize and qualify their construction. Labels and certifications are indicators of comfort, reduced costs, and environmental respect.

There are two main organizations that lead the green building rating systems in Jordan. On the one hand the Jordan Green Building Council (Jordan-GBC) has created a simplified rating tool customized for both existing and new buildings in Jordan. The tool aims to create a voluntary market-driven simplified checklist that addresses the need for a more efficient and sustainable building. This goes in-line with creating a market for the real-estate developers to distinguish their properties for being operationally more efficient to live-in while having a sustainable impact. As a benchmark, LEED categories constituted the platform for developing the checklist. The local Jordanian building code as well as the Jordanian green building guide has also been referenced to ensure compliance with existing local building codes and regulations.

On the other hand, the Royal Scientific Society (RSS) issued the Jordanian Green Building Guide, established and approved by the Jordan National Building Council (JNBC) in November 2010. The Green Building Guide and rating system is an obligatory reference to Jordan’s Building Codes and to International green rating systems such as Leadership in Energy and Environmental Design

(LEED), Building Research Establishment Environmental Assessment Method (BREEAM), The Sustainability Initiative by Abu Dhabi Urban Planning Council (ESTIDAMA), Global Sustainability Assessment System (GSAS), and others. The guide's parameters are designed to fit local climate, resources, legislation, policies and policy instruments, building techniques, and strategies.

Interventions of a third voluntary party to prevent possible manipulation and assist customers receive credible certification and an independent endorsement for their building is plausible. Voluntary rating entities are also collaborating with public institutions to be connected to incentive schemes offered by the government.



A LEED Certified Building (Source: Jordan GBC)

Entity	Incentives
Ministry of Public Works and Housing – Green Building Housing Award	The Ministry of Public Works & Housing offers an annual award to the most exemplary building in the area of green design while ensuring that construction is as per standards & regulations of the local green building guideline.
Investment Law No. 30, 2014	Offers benefits and incentives from section 8/a, exempting renewable energy projects within development zones from licensing fees for needed infrastructure and limits the license fee structure for these projects.
Regulation No. 49, 2015 (Promotion of renewable energy and energy conservation fund regulation)	Provides necessary funding contributing to the exploitation of renewable energy sources and energy efficiency. Prepares programs and projects in cooperation with international institutions.

Table 4.1 Organizational Incentives

4.3 Case Studies

LEED Certified Buildings	Main highlighted sustainable elements
Netherlands Embassy in Amman – Consolidated Consultants	<ul style="list-style-type: none"> • Reuse of existing building • Transparent elevation • Light court for maximum use of daylight • External sun shading devices • Ventilation space for cooling of building • Reuse of existing swimming pool to meet building cooling capacity • Solar panels • Reuse of existing trees • Low water garden consumption • Rain water collection for irrigation
World Health Organization - Engicon	<ul style="list-style-type: none"> • 22% energy saving • CO₂ emission reduction • 60% water savings • 78% of construction waste was converted from landfill
Middle East Insurance – Faris Bqeen	<ul style="list-style-type: none"> • Front and side facades designed to reduce large direct heat gain • Rain water collection and treatment system in a 380 m³ tank • Energy savings of 27.19% from calculated baseline design • Reduction of potable water usage by 50.2% from calculated baseline design • Landscaping and irrigation systems have been designed to reduce potable water consumption for irrigation by 66.55%

Table 4.2 LEED Certified Buildings & its main sustainable elements

Recognized Sustainable Buildings	Main highlighted sustainable elements
<p>Aqaba Residence Energy Efficiency House</p> <p>Emtairah Consulting Corporation Amman</p>	<ul style="list-style-type: none"> • Orienting the sides of the building mass along an east-west axis allowing the long façades to face north and south • Carefully placed openings opposite each other maximize the effects of cross ventilation • Design incorporates movable and fixed shading elements • Design utilizes site topography to install subsoil pipes to capture the cool air at the building's northern façade, direct it underground where it is further cooled by lower subsoil temperatures, and lead it to an outlet in the living area • Structural design aimed at upgrading conventional wall sections and experimenting with new ideas, keeping in mind the use of locally produced materials as much as possible
<p>Al Kamaleyeh Residence – Abu-Dayyeh received golden prize for the Built Environment in the Middle East 2010, followed by the "Green Hero Award" from the Green Apple organization in the UK, as well as the appreciation emblem of the Jordanian Engineering Association in 2012</p>	<ul style="list-style-type: none"> • Oriented to north-south axis to ensure constant solar access • Openings carefully designed to minimize solar gain by providing optimum shade to avoid direct solar penetration during peak times • Western elevation designed with almost no openings to reduce wind infiltration in winter due to high pressure arising from persistent western winds • Photovoltaic solar cells, geothermal energy, and rain water harvesting which resulted in a zero carbon emission
<p>Abu Nsair Residence – Khaldoun Aqel</p>	<ul style="list-style-type: none"> • Design enhanced the building envelope and included a 10 cm rock wool thermal insulation • Installed sun pipes improve daylight efficiency and minimize the need for artificial lighting • Managing on-site construction waste • Project is being evaluated according to Leadership in Energy and Environmental Design (LEED) for Homes v4 rating system sustainability indicators in an attempt to measure its performance as per USGBC standards as part of a research

Table 4.3 Locally Recognized Sustainable Buildings & its main sustainable elements



One of the Green Buildings (Source: Jordan GBC)

4.4 Future Actions

Increased inter-disciplinary focus on green economy, due to strong links to business and society, is demanding a comprehensive understanding of stakeholder needs and added values. The challenge to include the many companies and civil society organizations in the field favors the engagement of business associations and other platforms that are both inclusive and professionally active.

4.5 Lessons Learned

Governments can set obligatory codes to ensure the adoption of minimum standards of energy, water, and waste in buildings. However, voluntary instruments such as sustainable building guidelines and rating tools should be the responsibility of green building councils (non-government).

Work on transforming the construction market can be achieved by instilling a set of market driven approaches while proving for the economic viability of sustainable projects, products and services.

V. Lebanon



Raouché Rock (Source: https://commons.wikimedia.org/wiki/File:Pigeon%27s_Rock_Beirut_Lebanon.jpg)

5.1 Context

5.1.1 Sustainable Cities

Lebanese municipalities are unable to fulfill their duties and obligations due to legal constraints and financial dependency. The two major financial resources for municipalities including the Independent Municipal Fund (IMF) and local taxation are not sufficient to promote community development and sustainability initiatives. In order for municipalities to keep up with the increasing local demands, and challenges and to provide for sustainable development, more decentralization and local authorities empowerment is needed in addition to necessary modifications to the legal framework. Moreover, both IMF and the taxation system ought to be complemented with other external financial resources.

Nevertheless, there are several strategies, programs, initiatives and planning tools that were launched and implemented at both the local and national levels in Lebanon to promote sustainable development, these include:

In 2010, the Ministry of Energy and Water (MoEW) proposed a policy paper for the electricity sector which was adopted by the Council of Ministers and a ministerial decree issued setting a target to supply 12% of total electricity generated from renewable energy sources by 2020. To meet the set national targets, a National Energy Efficiency Action Plan (NEEAP) for the years 2011-2015 was developed by the Lebanese Centre for Energy Conservation (LCEC) and was adopted by the government. The NEEAP paves the way towards achieving the national target of 12% renewable energy by 2020 and comprises 14 independent but interrelated national initiatives focusing on: Energy Efficiency (EE), Renewable Energy (RE), financial and legal aspects, as well as awareness raising.

To complement the NEEAP, the Lebanese Centre for Energy Conservation (LCEC) is currently developing a National Renewable Energy Strategy (NRES) and subsequently a National Renewable Energy Action Plan (NREAP) as well as a second National Energy Efficiency Action

Plan (NEEAP) 2016-2020 with the objective of elaborating, in detail, a roadmap leading to the achievement of set goals.

A Sustainable Energy Action Plan (SEAP) was also initiated in 2014 and is steadily underway. Municipal teams have been developed and engaged in a joint effort with national partners to collect necessary data and develop Baseline Emission Inventories (BEI). Previous studies and projects relating to traffic, energy, emissions, environmental impact, electricity, solid waste, etc. have been assessed and priority projects identified.

The initiative was undertaken as an on-the-job training exercise, through several training and participatory workshops. SEAP municipal teams were created in each municipality to spearhead the preparation and implementation of plans. Alongside SEAP, the "Recommended National Sustainable Urban and Energy Savings Actions for Lebanon" report was prepared and approved by national stakeholders while the comprehensive guidelines for SEAP preparation were developed and made available through CES-MED website. They include manuals to prepare the Baseline Emission Inventories (BEI) and Community Awareness Promotional Plans (CAPP).

Furthermore, LCEC in collaboration with Electricité de Zahlé (EDZ) installed approximately 1,048 Compact Fluorescent Light Bulbs (CFLs) in the village of Niha in the Bekaa area free-of-charge. The project aims at reducing the energy bill and the emissions of GHGs.

LCEC is also implementing the Beirut Solar Snake (1.08 MW) and the Zahrani Oil Facility 1 MW PV plant in the South of the country.

In another initiative, MoEW and Electricité Du Liban (EDL) installed, at no cost to the residents, 800 solar public street lighting poles. Additionally, incentives were also offered to promote energy

savings. Municipalities paying their energy bill to EDL are thus eligible to receive in kind, solar street lighting poles equivalent to the value of their paid energy bill. Municipalities in debt to EDL are also offered the opportunity to buy solar street lighting poles for the same value of their indebtedness, thus disposing of their debt to EDL (Al Nahar Journal, 2011).

5.1.2 Sustainable Buildings

The first sustainable "Green" construction in Lebanon took place in 2009, by then, only a handful of sustainability professionals were accredited. However, in recent years numerous initiatives have been launched to promote sustainable construction and buildings in Lebanon bringing the number of certified buildings to 11 as well as 7 pre-certified projects.

Greening the construction law is one such initiative. The initiative entails upgrading the existing law by introducing green criteria. The document has been prepared by the Order of Engineers and Architects - Beirut, in close collaboration with the Directorate General of Urban Planning (DGUP) - Lebanese Ministry of Public Works and awaits review and adoption by the House of Parliament. In the meantime, "Green Criteria" are being voluntarily applied by the DGUP to key projects notwithstanding provisions of the current Lebanese Construction Law favoring green construction - such as deducting double wall building envelopes from the total built-up area and mandatory domestic solar hot water provisions in villas.

A Green Building National Coordination Group was also recently initiated by the EU SISSAF project team with the objective of greening the building code. In 2015, the SISSAF project team conducted their first meeting. The national coordination group includes representatives from the main players in the sector namely; Ministry of Energy and Water, Ministry of Industry, Ministry of Public Works and Transportation, the General Directorate of Urban Planning, Lebanese Standards Institution (LIBNOR), Order of Engineers and Architects, Industrial Research Institute, Lebanon Green Building Council, Lebanese Solar Energy Society, American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE),

Lebanese Chapter, and Lebanese Center of Energy Conservation (LCEC). The group is coordinating efforts with EU-funded projects: Energy Efficiency in the Construction Sector in the Mediterranean (MED-ENEC) and CES-MED.

Additionally, the Lebanon Green Building Council (LGBC), a not-for-profit NGO, was founded in 2008 providing stewardship towards a sustainable built environment. The council promotes and assists in implementing high performance environmentally responsible construction concepts that are healthy, and economically viable.

5.2 Baseline

5.2.1 Policies, Laws, Decrees and Technical Standards

The Lebanese Environmental Action (LEA) for Water, Air, and the Environment is another financing mechanism initiated by the Central Bank with assistance from LCEC in 2015 under BDL's "Green Incentives". It is dedicated to financing environmental initiatives such as landscaping, green roofs, green walls, recycling, organic farming, ecotourism, wastewater treatment, rainwater collection, etc.

The Lebanese Environmental Pollution Abatement Project (LEPAP) is a national financing mechanism initiated by the Central Bank of Lebanon (BDL) with a \$1.5 Million loan of World Bank introduced in 2015 under BDL Green Incentives, dedicated to industrial projects, with a 0% interest rate and 7 years maturity.

The Lebanese Standards' Institution (LIBNOR) has issued several documents for solar (Thermal & PV) as well energy efficient air conditioning equipment.

The Thermal Standards for Buildings in Lebanon (TSBL) were first issued in 2005 as a project funded by the Global Environment Facility, managed by the United Nations Development Program (UNDP/GEF), and executed under the

Lebanese General Directorate of Urban Planning, Ministry of Public Works and Transport (MPWT/DGU). In 2010, another Thermal Standard for Buildings in Lebanon (TSBL) was developed by the Order of Engineers and Architects of Beirut (OEA) with the support of the French Agency for Environment and Energy Saving (ADEME), the Lebanese Association for Energy Saving and for Environment (ALMEE), and the contribution of the Lebanon Green Building Council (LGBC) and ASHRAE (Lebanese Chapter). Yet, its application to date remains voluntary not mandatory as initially planned.

The “ARZ” building rating system for existing commercial buildings is a product of the Lebanon Green Building Council (LGBC) in collaboration and with the support of the International Finance Corporation (IFC). Created in 2011, ARZ encourages the owners of existing buildings to introduce green technologies and materials, to reduce energy and water use, cut greenhouse gas emissions, improve indoor environmental quality, and achieve other sustainable benefits. The ARZ Building Rating System for New Construction (ARZ NC) is currently under design by the LGBC targeting a range of new buildings including residential, hotels, schools, etc. ARZ NC is to be launched in 2016 and will incorporate: Energy, Water, Indoor Environment Quality, Waste, Site, Material, Management and Operations, Culture and Economics, as well as Innovation and Design. ARZ building rating system has, to-date, certified three projects while another two are in the pipeline.

Other International Rating systems including Leadership in Energy & Environmental Design (LEED), United States Green Building Council (USGBC), Building Research Establishment Environmental Assessment Method (BREEAM) UK: Excellence in Design for Greater Efficiencies (EDGE) - The International Finance Corporation (IFC), and CEDRE rating system (Industrial Research Institute) are in place. LEED, being the most popular has certified four projects and pre-certified three iconic projects. BREEAM certification has also been awarded to two projects while four are in the interim certification phase. Under the most recent EDGE scheme, there are two projects certified.

5.2.2 Institutional Programs

National Energy Efficiency and Renewable Energy Action (NEEREA) is a national financing mechanism initiated by the Central Bank of Lebanon (BDL) and dedicated to financing green energy projects in Lebanon. It was built and launched in 2010 based on circular 236 of the BDL, which in collaboration with the European Union (EU) listed the terms and conditions for receiving subsidized green loans. In 2013, as per circular 313, 318, and lately 346, the BDL introduced new incentives focused on energy efficiency, renewable energy, and certified green buildings.

NEEREA's green financing mechanism provides interest-free long-term loans to residential, commercial, non-profit, and industrial users for all energy efficiency and renewable energy projects for new and existing facilities. The loan has a ceiling of 20 million USD and is offered at an interest rate of 0.6% for periods that should not exceed 14 years including a grace period ranging from 6 months to 4 years. The green loans are provided through all Lebanese commercial banks.

In addition to the BDL financing tools, technical support and capacity building activities are done by the Lebanese Centre for Energy Conservation (LCEC) to develop know-how among all players. These activities are part of a contract signed between BDL and LCEC offering “Technical Support Consultancy Services Agreement in Energy Efficiency and Renewable Energy”.

Cleaner Energy Saving Mediterranean Cities Project (CES-MED): The project is funded under the European Union's European Neighbourhoods and Partnership Instrument - Enterprise Nationale de Promotion Immobilière (ENPI) launched in January 2013 for a duration of 3 years.

It covers 9 countries, namely Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, occupied Palestinian Territory and Tunisia with a primary goal to support and strengthen the capacity and involvement of the local authorities to embrace and implement Sustainable Development Policies with respect to national regulatory and legislative frameworks.

Support Program for Infrastructure Sector Strategies and Alternative Financing Project (sissaf-lebanon.eu): The EU-funded project SISSAF represents an ambitious effort to tackle critical aspects in Lebanon directly linked to economic and social stability. A well-functioning infrastructure in critical sectors like energy, transport, and water is a basic pre-condition for sustainable growth. The project has a budget of EUR 8.1 million and duration of 36 months since its inception in 2013.

LIVE LEBANON is a UNDP initiative that aims at implementing development projects in underprivileged and underdeveloped Lebanese communities. It involves encouraging Lebanese expatriate communities to re-establish bonds with their villages and hometowns and support their local development.

Country Energy Efficiency and Renewable Energy Demonstration Project for the Recovery of Lebanon (CEDRO) is funded by the European Union with the objective of increasing the energy use and efficiency opportunities in different sectors. The project has implemented a hydroponic intensive green roof (716 m²) on one of the Central Bank buildings at El Hamra in Beirut. The green roof includes growing media composed of: peat, sand, gravel, old rubber tires, rock-wool, perlite or vermiculite and is monitored by sensors connected to a control room to measure water and nutrient levels.

The UNDP, Energy and Environment Program, along with funding from the Swedish International Development Agency (SIDA), has conducted a pilot project to install Solar Water Heaters (SWHs) at public and non-governmental organization (NGO) and facilities in war damaged areas of Beirut, namely Bekaa and South Lebanon. The project consisted of installing 93 individual natural circulation SWHs, and 11 collective forced circulation SWHs, covering a total of 1,040 m² of collection area.

The UNDP-CEDRO project, through phases 1, 2, and 3, funded by the Spanish Government through the Lebanon Recovery Fund, completed over 100 kWp of small-scale solar PV and micro-wind projects distributed across Lebanon. In the current phase 4 of CEDRO, funded by the European Union, over 1 MW of larger commercial

and industrial scale PV systems are to be installed on 7 sites across the country.

5.3 Case Studies

The main initiative that boosted the implementation of green projects in Lebanon is the NEEREA fund through the BDL subsidized financing scheme. The estimated value of cumulative granted loans between 2012 and 2015 is as follows:

- 275 Granted Loans: USD 270 Million with a total project value of \$550 Million
- 65 Pending Loans: USD 45 Million
- Potential Loans: USD 5 Million
- 200 PV Projects: Total installed capacity of 4.5 MWp
- Green Building Loans: Total USD195 Million

The Green Demonstration Room is an interactive indoor and outdoor educational space for school students. The project is a joint effort between the LGBC, the Centre of Research and Development (affiliated with the Ministry of Education), and Makhzoumi Foundation with the objective of demonstrating concepts and principles of green building through experimentation. Construction is expected to be completed by mid-2016. The project aims at raising awareness for future generations.

International College Elementary School is the first project to achieve LEED certification in Lebanon and was awarded the LEED for Schools Gold level in March 2013.

The project consists of 3 interlinked school buildings 3 to 5 stories each, with a basement for parking totaling around 22,670 m². The three buildings are connected at ground floor and through the parking area. This new elementary school houses classrooms, music rooms, art rooms, science labs, workshop areas, offices, an auditorium/theatre, and two gymnasiums. The building complex also houses the central heating, cooling, and power generating plants for the College.



Jbeil (Byblos)-Lebanon (Source: Lebanon GBC)

Casa Batroun House was renovated and built in line with criteria of the BREEAM International Bespoke 2010 certification scheme, and received in February 2014 the BREEAM Excellent (4-star) standard. The project involved the renovation and extension of an old 100 m² family house located in the Mediterranean Sea-side town of Batroun, North of Lebanon.

The Banque Libanaise pour le Commerce (BLC) Headquarters was the first ARZ rated building to meet a credible score in green building and performance measures and was awarded the ARZ Bronze Certificate in December 2011. The building became the first certified green commercial building in Lebanon. With a built-up area of 7,700 m² the building housing the bank's headquarters in Beirut consists of 11 upper ground floors and 4 underground parking levels.

5.4 Future Actions

A major hurdle in implementing sustainability concepts is the absence of legislation for green construction, energy conservation, water

conservation, etc. Initiatives continue to be applied on voluntary basis. Another stumbling block is the lack of awareness particularly since the recent drop in fuel prices hasn't favored the feasibility of alternative energy projects. It is thus imperative that the government take constructive steps towards advancing the concept of sustainable development in Lebanon.

5.5 Lessons Learned

Since 2008, a noticeable yet limited progress has been witnessed in Lebanon in terms of green construction, with a total of 15 certified buildings and around 70 registered ones. Efforts made by LGBC have resulted in an expanding membership (from 10 in 2008 to over 120); has created relative awareness, demand; and aided in realizing green projects but has yet to have a broader application nationally.

VI. Morocco



Majorelle Garden (Source: https://commons.wikimedia.org/wiki/File:Le_jardin_de_majorelle_02.JPG)

6.1 Context

6.1.1 Sustainable Cities

Morocco imports around 95% of its energy to meet demand and is looking forward to improve sustainable national energy production. Sustainable “Smart cities” are in the heart of research and innovation challenges for several sectors including transportation, waste, and energy production among others with the objective of providing a healthy, safe, and efficient living environment for the population.

There are several national initiatives aiming at the integration and implementation of sustainability practices at the national and city levels. Most are based on King Mohammed VI's addresses and signed resolutions that constitute the nation's foundation for generating 42% of electric power from renewable sources by 2020, 52% by 2030 as was agreed following COP21. Hence, and to ensure the achievement of these objectives, several institutions were established.

The National Agency for Development of Renewable Energy and Energy Efficiency (ADEREE) was created with a mission to “Implement government policies aimed at reducing energy dependence, through the democratization of renewable energy (RE) and the promotion of energy efficiency (EE)”.

The Moroccan Agency for Solar Energy (MASEN) was also initiated as a national initiative implemented through law 57-09 while adopting the national strategy to develop integrated projects generating a minimum of 2,000 MW electric power from solar energy.

Additionally, an Energy Investment Company was established as the financial arm of the State with the objective of facilitating the achievement of an energy mix of 42% by 2020 and is at the heart of the national energy strategy.

The Research Institute for Solar Energy and New Energies (IRESEN) was also launched under the umbrella of the energy strategy as an organization dedicated to research and

development with a national objective of assisting the Kingdom meet its growing energy demands from renewable energy sources and become more energy efficient and self-sufficient.

Moreover, Morocco has become a member state of **The Regional Centre for Renewable Energy and Energy Efficiency (RCREEE)** since 2008. The Centre is a regional not-for-profit organization that includes 16 Arab countries promoting energy efficiency and renewable energy in the region.

Furthermore, in the sustainable cities' domain; the **GIZ** is assisting the government implement “Integrated Water Resource Management” (IWRM) as well as the introduction of a model for developing a sustainable energy production and supply systems that mitigate climate change. The GIZ has also instigated a campus of knowledge center promoting green industrial development in Morocco named IFMEREE (Institute for High-Performance Training on Renewable Energy and Energy Efficiency).

Other government initiatives to enhance the advancement of the city on a sustainable basis include, the **Casablanca Development Plan 2015–2020** which was launched based on four strategic pillars targeting four development goals. The first is directed at optimizing citizens' and visitors' mobility in terms of time, cost, and quality through the development of the transportation sector and has allocated a large part of the budget in the framework of the PDGC conventions. The public transport network will be enhanced to cover 80 kilometers, a second tram-line will be implemented, and several relay parking lots will be installed. The other pillars are dedicated to the improvement of: social housing- in particular the implementation of a thermal regulation; water; electricity; and sanitation management. The proposed strategy aims at transforming Casablanca into a more livable and greener city by tackling different components of the city's metabolism including: water, waste, energy, and transportation.

Another major government initiative at national scale which is considered a national achievement, is the Noor Project. It is the world's largest concentrated solar power plant, with the objective of providing 2,000 MW or 42% of the country's electric energy by 2020. The first phase of the project, Noor 1, with its 500,000 crescent-shaped solar mirrors, has been inaugurated and is anticipated to provide 160 MW.

It is apparent that the Kingdom has gone beyond incentives for energy efficiency through a synergy between laws, decrees, institutional programs and the use of international voluntary green building certification tools (HQE, LEED, and BREEAM) to promote and generalize sustainable city practices across the country. Initiated programs have led to the adoption and implementation of several practices and procedures such as thermal isolation, LED lighting, solar water heaters, efficient construction materials, rainwater harvesting, as well as waste management thus demonstrating the progress in the concept of sustainable building in the country.

Now that projects at city level are being implemented, it is important to introduce procedures and mechanisms to link critical components together including: water, energy, and food with the objective of reaching a holistic synergy for city metabolism. It would also be beneficial to enhance knowledge transfer and cross border collaboration as well as alliances. Public-private partnerships are thus essential if the government is to share implementation responsibilities with industries closer to the market. Finally, COP22 should be considered an opportunity to increase awareness, sensitize the population and enhance sustainable projects.

6.1.2 Sustainable Buildings

Within the framework of its development strategy, Morocco has adopted the concept of sustainable development in order to achieve a balance between environmental, social and economic spheres. The country aims at improving its citizen's living environment, strengthening sustainable management of natural resources and promoting environmentally friendly economic activities. Accordingly, it established several stepping-

stones to achieve a sustainable development vision that drives political, institutional, legal and socio-economic reforms forward. This process was strengthened by the adoption of the National Charter of Environment and Sustainable Development in 2009.

The Kingdom is more than ever encouraging green building initiatives and establishing intrinsic sustainability parameters positioning green building as a topic of national importance. Currently, there are two parts to the legislation related to Green Buildings and Energy Efficiency, the Sustainable Development Policy and the National Energy Strategy, both are discussed in detail in the sections to follow.

6.2 Baseline

6.2.1 Policies, Laws, Decrees and Technical Standards

The Kingdom's Sustainable Development Policy is founded on the following axes:

- **Law 99-12**, known as the "Environmental Charter" setting the rights and duties pertaining to the environment and sustainable development, with the objective of engaging the state, authorities, and public institutions; protecting natural resources; and assessing and mitigating negative environmental, economic, and/or social impacts.
- **The Sustainable Development Plan**, targeting energy efficiency in the energy intensive sectors including construction, industry, and transport and the promotion of renewable energy.

In parallel, a National Energy Strategy is in operation with the objective of guaranteeing the availability of energy supply at affordable costs, controlling rise in energy demand, and protecting the environment. In order to achieve these goals several guidelines were set. These include:

- having a diversified and optimized energy mix linked to reliable and competitive technology choices;
- mobilization of national resources to augment renewable energies; and
- making energy efficiency and regional integration a national priority.

The strategy aims at consolidating the reduction of energy consumption and energy production through two laws and decrees:

Law 47-09 relates to energy efficiency in energy intensive sectors, with the aim of establishing an institutionalized system of governance, legislative and regulatory frameworks, as well as standard norms. It regulates inspection, and sets violation penalties at 15,000 to 300,000 Moroccan Dirhams (MAD). The objective is to reduce energy consumption considerably by adopting new practices and energy efficient solutions. This includes adopting the Code for Energy Efficiency in Buildings (CEEb), and the promotion of thermal isolation, solar water heaters, low energy consumption light bulbs, energy audits for industry, as well as low-power car-fleets for transport.

Law 13-09 on renewable energy, promotes renewable energy sources and provides a legal framework for the development of renewable energy projects in Morocco. The law prioritises the development of renewable sources in order to promote energy security, access to energy, sustainable development, reduction of GHG emissions, reduction of deforestation, and integration/harmonisation of Morocco's renewable energy production with other Euro-Mediterranean markets.

Decree No. 2-13-874 of October 15th 2014 relates to construction, sets regulations pertaining to buildings' energy performance, and establishes the national committee for energy efficiency in buildings.

Decree No. 2-10-578 of April 11th 2011 relates to the application of the law 13-09 on renewable energies.

Furthermore, as part of the National Energy Strategy, the media is communicating the

Kingdom's objectives to produce 42% of electric power from renewable sources by 2020 and decrease energy consumption by 25% by 2030.

6.2.2 Institutional Programs

To achieve the set goals, the Kingdom is engaged in the launching of several institutional programs to help realize its targets.

Code for Energy Efficiency in Buildings (CEEb): The program was launched by ADEREE in partnership with the GEF-UNDP (Global Environment Facility - United Nations Development Program) and GIZ to decrease energy consumption in the building sector. It regulates energy efficiency through adoption of the Thermal Regulation of Construction in Morocco (TRCM) and provides energy labeling for household appliances. The thermal regulation is applied following two different approaches: a prescriptive one based on validation using Binayate software or a functional one with a Dynamic Simulation Model. The choice of one or the other is based on the complexity of the evaluated building through its glazing rate. Thresholds are set following the defined climatic zones prescribed by the ADEREE.

6.3 Case Studies

Éco-Cité Zenata is a key urban planning and sustainable metabolism project. The proposed plan includes three main concepts: the "territorial city", "ventilated city", and the "lived city". The first concept refers to a mixed development plan that addresses territorial mobility networks within the city, while the second targets integrating environmental and climatological determinants in the city plan; and finally the third is directed at providing independent pedestrian oriented neighborhoods affording resident needed amenities while minimizing the use of the car. The plan capitalizes on existing natural resources to meet set objectives including natural cooling of neighborhoods during summer - by aligning streets to prevailing wind directions (NW-SE); implementing a water resource management system - by collecting rainwater in retention basins before discharging into the sea thus

minimizing the size of discharge pipes and structures; and linking the commercial hub with the tourist center associated with the coastal park by a green network. Such provisions serve to improve the resilience of the city and contribute to the development of an environment friendly green living conditions.

Taghazout Bay urban development project, undertaken by SAPST (Société d'Aménagement et de Promotion de la Station de Taghazout) is also following a green building development model. The high end eco-resort sits on an area of 615 hectares with over 4.5 km of beaches and incorporates diversified activities including hotels, lofts, apartments, a golf course, and a surf village. SAPST succeeded in becoming the first HQE certified urban planning project internationally and is committed to a High Environmental Quality sustainable approach to achieve triple certification in: urban planning, residential buildings, and non-residential buildings. Moreover, to further enhance recognition as operating within an environmental, social, and cultural responsive approach, the company incorporated both its golf and tourism components (Gold Hotel and Surfing Village) into the international "Green Globe" program. This program works on improving environmental, social, and economic performance through implementing 41 point criteria that cover areas such as water and energy consumption, greenhouse gases, biodiversity, ecosystems and waste management.

Mohammed VI Green City is located in Benguerir, a 30-minute drive from Marrakech and 90 minutes from Casablanca. The project was launched in 2009 by HM King Mohammed VI, as a major ecological project offering an exemplary attractive living environment. Project completion is expected in 2020.

The Green City of Benguerir is designed as a national laboratory where Office Chérifien des Phosphates (OCP) experiments with an ecological model that places nature, knowledge, energy efficiency and renewable energy, governance, as well as climatologically responsive architectural designs and materials, at the heart of the urban planning process. To achieve these goals, the city's implementation plan follows rigorous specifications to achieve

one of the highest certifications: LEED ND (Leadership in Energy and Environmental Design for Neighborhood Development). The project is considered by the CEO of the Urban Planning and Green Development Company (SADV) as "the first project of this magnitude that targets such certification in Africa".

The Eco-Park in Berrechid is a more recent urban development project undertaken by the French Chamber of Commerce and Industry in Morocco (CFCIM) as part of Franco-Moroccan cooperation to host 192 non-polluting industries on 60 hectares and is anticipated to be "the first High Environmental Quality (HQE) certified site".

Casa Finance City is another environmentally responsible development that has followed strict environmental guidelines to certify specific components of the project as part of the urban development of the Casa Anfa region. The project comprises several residential areas as well as office towers and is intended to support Africa's economic growth and development by attracting foreign investments.

Pilot Projects for Energy Efficiency and Thermal Regulation: In 2011, with financial support from the EU, ADEREE selected nine pilot projects for the implementation of energy efficiency standards that were integrated in the new Thermal Regulation of Construction in Morocco. The choice of projects was based on several criteria including: diversity of climatic zones; buildings type (institutional, housing, hotel, etc); and type of constructing organization (private or public). The projects introduced different energy efficiency measures focusing on insulation, double-glazing, efficient ventilation, and solar heating. The projects realized an average additional construction cost of 2.5% and a savings reaching up to 94% on heating, and 50% on cooling.

Five of the projects were carried out by a public institution "Al Omrane" and included 222 homes in Ouarzazate; 280 social houses in Tamansourt; 144 social houses in Al Aroui; 96 social houses in El Hajeb; and the institutions' headquarters in Chrafate. The other four projects were undertaken by private entities and included 637 medium standard apartments in Ain Sebaa, a hotel in Port Lixus and 584 touristic residential units in Marrakech that conform to the TRCM.

Projects Presented at the Green Building Solutions Awards of COP 21: Within the framework of the Green Building Solutions Awards organized by Construction 21; two Moroccan projects were selected to be presented at the Gallery of Solutions at the 21st Conference of Parties in Paris.

The first project awarded; the **International University of Rabat** for its adoption of an environmentally friendly initiative and its commitment to integrate environmental aspects in several stages of construction of its building “Enseignement 2.” Within this context the university engaged experts as well as engineers in bioclimatic architecture and environment to ensure conformance to the High Environmental Quality (HQE) approach. The project received certification as the first “HQE International – Nonresidential” building in Africa. Nonetheless, the university has yet to complete its initiatives by attaining certification for its swimming pool - which will be the first HQE certified indoor pool in the world, outside France.

The second project awarded; the “**Habitat Urbain Autonome**”, in the old Medina of Rabat, which includes the renovation of a former Riad into a bioclimatic, 100% autonomous urban housing (in terms of energy, water and waste) in Morocco. The project offers waste treatment (solid and liquid), production of potable water through storage and filtration of rainwater, as well as localized energy production and is thus off the grid. The project resembles an exemplar for future applications achievement and can be considered as trailer of an Autonomous City.

6.4 Future Actions

It is recommended that a government incentives program including lower taxes for green buildings be implemented to encourage the practice of such solutions. It would also be beneficial to establish a financial mechanism to evaluate the performance of existing buildings and guarantee performance, savings, as well as benefits.

6.5 Lessons Learned

Given the fact that Morocco imports 95% of its energy to meet demand, the government has focused on implementing policies oriented towards the efficient use and production of energy. The building sector, being one of the most energy intensive, represents one of the foremost fields of action to mitigate climate change by implementing such policies.

The launch of national initiatives to configure the future development of sustainable building practices including the implementation of a National Energy Strategy through introducing energy efficiency and renewable energy laws, set in parallel to the Sustainable Development Policy, has advanced the concept of sustainability and prompted projects receive Green Building Solution Awards.

Moreover, “Mohammed VI’s Foundation for Environmental Protection” critical initiative for assessing the performance of green buildings based on ISO 14001, the new regulatory framework, as well as HQE, LEED, and BREEAM is expected to represent a holistic approach for this domain.

Policy, has advanced the concept of sustainability and prompted projects receive Green Building Solution Awards.

Moreover, “Mohammed VI’s Foundation for Environmental Protection” critical initiative for assessing the performance of green buildings based on ISO 14001, the new regulatory framework, as well as HQE, LEED, and BREEAM are expected to represent a holistic approach for this domain.

VII. Oman

7



Nizwa Fort (Source: [https://upload.wikimedia.org/wikipedia/commons/5/5c/Nizwa_seen_from_fort_\(5\).JPG](https://upload.wikimedia.org/wikipedia/commons/5/5c/Nizwa_seen_from_fort_(5).JPG))

7.1 Context

7.1.1 Sustainable Cities

The Sultanate of Oman has instituted a number of initiatives as part of its ambition to adopt the sustainability concepts.

In line with the government's move to advance sustainability measures, Haya, a public company, was established in 2002 and entrusted with the treatment of the domestic waste water and the development of a distribution network of treated sewage effluent across the capital Muscat. The plan is to cover 80% of Muscat Governorate by 2020. The company is currently delivering recycled water for irrigation of public gardens and is working towards the construction of a sewage network for the collection of domestic wastewater.

Be'ah, another public company, was also founded in 2009 to manage solid waste in Oman. The company aims to implement sustainable waste management practices, as per international standards; establish required infrastructure; restructure municipal waste collection services; and improve public awareness of waste management.

Furthermore, and as part of its mandate to promote efficient use of electricity, the Authority for Electricity Regulation sponsored a number of energy efficient pilot projects including solar and wind power generation.

In addition, Oman National Transportation Company, recently renamed Mwasalat, is extending public bus routes across the city of Muscat as part of a larger sustainable mobility initiative to manage traffic and transportation and encourage the use of public transport.

7.1.2 Sustainable Buildings

Though the construction and real estate sectors have yet to embrace the concept of sustainability in full, certain sectors like tourism and high-end real estate developments have, since 2009, spearheaded the industries. Several enterprises

have implemented policies, guidelines, and best practices in their projects. Omran, a public master development company established in 2005 owns the first LEED certified project in Oman and is committed to employ sustainability measures in all its new projects.

What's more, is that sustainability and green design programs have recently been integrated in academic curricula. The Research Council, a public institution, is also supporting research programs related to the sustainable construction and green buildings.

In addition, public awareness initiatives such as the Muscat Green Days and the Muscat Green Awards are dedicated to the promotion and recognition of best practices by individuals, companies, or projects.

7.2 Baseline

7.2.1 Policies, Laws, Decrees and Technical Standards

The current legal framework regarding sustainable design and construction is non-existent. Despite the fact that many of the design consultants and developers established in the country are well aware of the international standards, public authorities have yet to enforce their application.

7.2.2 Institutional Programs

Institutional programs are limited to academia and a few semi-private awards. In this regard, the Oman EcoHouse design competition is worthy of noting. The motto for the competition "Raising Awareness of the Possibilities and Importance of Green Buildings and Eco-Design in Oman" reflects the organizer's enthusiasm as pertains to sustainable green design. The program was launched in 2011 and is sponsored by The Research Council along with other public

institutions and ministries. The annual competition is open to all higher education institutions, both public and private; to design, build, and operate an eco-friendly house. Once complete, the EcoHouses can be visited to better understand how the design has materialized and learn about implementation procedures using different materials and equipment.

7.3 Case Studies

The Oman Botanic Garden located in Muscat is sponsored by the Royal Court “Diwan” with the objective of showcasing the ethno-botanical heritage of Oman. The project adopts a number of sustainable features and technologies that make it almost unique in the nation and is aspiring to receive the LEED Platinum certification.

A photovoltaic farm is to produce electricity to power the buildings during the day and reduce demand from the public network while linear Fresnel reflectors are employed to power the absorption chillers that are to cool the biomes where plants are to grow.

Both the orientation and massing of the buildings have been carefully considered to achieve the right balance between solid and transparent areas of the facades and roofs in order to reduce demand for cooling and allow adequate light levels for the plants. Energy modeling has also been vital during the entire design process as it provided information pertaining to buildings performance and helped multidisciplinary teams assess proposed solutions. In addition, technical specifications for materials used in the building envelopes ensured high thermal insulation contributing to a reduced demand on cooling.

Use of water is also optimized as the irrigation system includes moisture sensors so that plants are watered only when necessary. Storm water is to be harvested from the roofs, treated, and reused in buildings for secondary purposes. Furthermore, water obtained from condensation of the cooling systems is to be treated and stored for future use. Facilities are to be connected

to the public treatment sewage network, thus limiting the use of potable water to human consumption only. A black water treatment plant based on bio-film technology is also planned on-site.

7.4 Future Actions

No significant progress has been made to date in amending the institutional and legal frameworks in terms of sustainable design and construction. It is thus both pertinent and critical that a well-structured legal framework coupled by an incentive system be put in place to support ongoing and future green initiatives.

7.5 Lessons Learned

Due to the absence of a legal framework that supports green sustainable initiatives; key industry players have and continue to experience major challenges and hurdles in implementing sustainable design projects.

VIII. Palestine



Downtown, Nablus District (Source: <https://commons.m.wikimedia.org>)

8.1 Context

8.1.1 Sustainable Cities

The State of Palestine suffers from a grave shortage of natural resources, particularly energy and water, while its needs continue to grow rapidly. Palestine imports 93% of its current energy needs from Israel and neighboring countries. Natural resources conservation is thus highly supported by the government and is welcomed by both the population and businesses.

From the end user's point of view, Palestinians pay the highest rate for their energy and water in the region, consuming a large percentage of their low level income – the current average selling price of electricity is € 0.115 / KWh.

A 2011 report by the Palestine Central Bureau of Statistics' (PCBS) indicates that the three main sources of electric energy generation are: electricity 31%; fossil fuels 51%; and renewable thermal energy 18%. An Energy Efficiency Strategy was thus developed in 2012 and a National Energy Efficiency Action Plan setting a target of realizing 5% savings in overall electricity demands by 2020 was approved by the cabinet. The Palestine Energy and Natural Resources Authority (PENRA) has since taken the lead for implementing the plan initiating a number of projects and initiatives with the objective of saving energy usage at city level. These included, among others, replacing street lighting with energy efficient bulbs, raising awareness and educating citizens as well as businesses, and shifting from using diesel fuel to natural gas. PENRA has also drafted the renewable energy law ratified in November 2015 by the President, to regulate generation of electricity from renewable energy resources.

Moreover, in May 2014, a new law promoting environmentally friendly projects was passed by the Palestinian Investment Promotion Agency (PIPA) in cooperation with PENRA. Law No. 8, article (23) offers special income tax incentives during the first 4 years for any initiative that is

considered eco-friendly or green and complies with environmental protection conditions. Green entrepreneurs could also apply for other services and incentives according to their needs as long as their application complies with environmental protection conditions.

On the other hand, nominal daily supply rates of water to over 25% of the Palestinian population are less than 50 liters/capita per day, with some network services providing as little as 10-15 liter/capita per day. Determined to resolve water shortage, the Palestinian Water Authority (PWA) is taking meaningful steps towards setting Integrated Water Management policies and laws, promoting tools to save water in households and commercial buildings, raising awareness and educating citizens, and is implementing projects to resolve water shortage.

The Palestinian Hydrology Group (PHG), the largest Palestinian NGO, is also working to improve access to water and sanitary services while monitoring pollution and climate change in the occupied Palestinian territory. PHG has implemented a number of projects to improve the means of living including the rehabilitation of water springs all over the West Bank for irrigation purposes, water sanitation, improving access to food and food security, improving the agricultural sector, water resource development, and rainwater harvesting.

The European Union (EU) is another major actor in water and environmental protection in Palestine. Since 2008 it has invested around €95 million in the water, sanitation, and solid waste management sectors. In the West Bank, the EU is supporting the development of wastewater treatment plants in specific areas where water supply is scarce, such as Hebron and Nablus. In Gaza, the EU is investing both in large-scale solid waste management programs as well as in medium-scale projects with high impact, such as the construction of a desalination facility to provide safe water to thousands of Gazans.

Furthermore, Palestine Central Bureau of Statistics (PCBS) estimates the quantity of solid waste produced from the economic establishments in Palestine in 2015 to be 20.2 thousand tons/month. As such, the Ministry of Local Government (MoLG) developed a strategy to establish 3 sanitary landfill sites in the West Bank (north, middle, and south). These landfills are being managed through “Joint Councils for Solid Waste Management”. Nevertheless, the relation between consumption and waste generation has yet to be developed. Preliminary attempts for waste separation and recycling were not successful. “Tadweer Company” established for this purpose has shut down after a few years of operation.

Moreover, the newly constructed modern city of Rawabi, located 9 km north of Ramallah, is a good example of the government’s genuine intent to embrace sustainability concepts and measures. The city’s municipal boundaries encompass 6,300,000 square meters of land and will initially be home to 25,000 residents, housed in 6,000 units. Additional residential and commercial units planned for subsequent construction phases are aimed to ultimately serve a city with a population of more than 40,000. City representatives promote Rawabi as a green city dedicated to sustainable development and view it as a prototype and exemplar assuring present and future generations a high quality of life. On the one hand, the proposed master plan employs environmentally responsible development practices designed to preserve the natural landscape. On the other hand, construction utilizes a large percentage of locally recycled materials from Rawabi’s own natural resources. Furthermore, and in order to reduce CO₂ emissions, a mass public transport system based on electric cars is planned for the city affording residents and visitors alike a pedestrian oriented environment. The city is also developing its own wastewater treatment plant which will collect, treat and reuse reclaimed wastewater.

8.1.2 Sustainable Buildings

According to the records of the PCBS, growth in the Palestinian real estate sector hit new records rising from USD 1173.7 million in 2004 to USD 1363.4 million in 2014. In addition, it is highly expected that the sector is going to further expand due to continued population growth. Hence, in terms of energy, water, and natural resources; green buildings are a strategic choice for Palestine.

Interest in green buildings started in 2009 when a local group of professionals and businessmen officially registered the Palestine Green Building Council (PalGBC) in 2011. The Engineers Association established the Higher Green Building Council during the same period.

Yet, moving towards a green building culture and practice warrants awareness, capacity building, as well as a persuasive environment featuring success stories. Initiatives undertaken by PalGBC have been guided by these concepts.

The Ministry of Local Government (MoLG) has developed the Energy Efficient Building Code (EEBC) funded by GEF and implemented by the UNDP in 2004. The code aims to reduce energy consumption for residential and commercial buildings through providing adequate insulation. MoLG’s intention was to make the EEBC mandatory and enforceable; however, this aim was never realized. In addition, “Guidelines for Energy Efficient Building Design” were prepared within the same project. Both the code and the guidelines were distributed to large numbers of educators, professional engineers, and government institutions. A number of training workshops were also conducted in cooperation with the Engineers Association.

However, and according to officials at the Ministry of Public Work and Housing, policies and laws to advance the concept of green buildings are currently unavailable but are expected to be developed with the new strategic plan to be launched in 2017.

8.2 Baseline

8.2.1 Policies, Laws, Decrees and Technical Standards

The Environment Quality Authority (EQA) has set laws and policies to protect the environment and ensure building sustainability.

- **Article (20) of Law No. (7), 1999** is concerned with the environment, prohibiting discharge of “any leakages or emissions of any pollutants inside or outside the place of work”.
- **Article (33)** states: “The ministry shall determine, in accordance with the competent authorities, the environmental conditions necessary for the erection of any building or construction on the sea shore or inside the waters thereof”.
- **Article (46)** states: “The competent authorities shall, upon licensing any installation, endeavor to avoid environmental hazards by encouraging projects that have the least negative environmental impacts and prioritize them in accordance with economic development benefits”.

Nonetheless, laws and policies are neither implemented nor monitored due to lack of surveillance policies.

8.2.2 Institutional Programs

In addition to efforts by (MoLG) for developing the code and guidelines for energy efficient buildings, the following efforts could also be recognized:

Palestine Green Building Council (PalGBC) is active in seeking Green Building certification in cooperation with local consultants. The Palestinian Museum is the first Green Building in Palestine to receive Leadership in Energy and Environmental Design (LEED) certification. The initiative is thought to provide exemplars for engineers and technicians.

Global Communities Organization (formerly CHF), in partnership with the Palestinian Engineers Association and the Palestinian Higher Green Building Council, gathered 300 community leaders, investors, engineering professionals, academics, and representatives of the Palestinian Authority during summer 2013 in Al-Bireh to introduce the first Green Building Guidelines for the West Bank. The project was originally funded by UNDP. Global Communities is also working with communities in the West Bank and Gaza affected by rapid population growth, urbanization and increased demands for energy, water scarcity, desertification, deforestation, and limited public sector resources. Yet, as in some other parts of the Arab Region, the West Bank and Gaza have witnessed resistance to green initiatives and misconceptions relating to the cost of green building.

Key Innovation - Green Engineering Fellowships are awarded to support green building efforts. Global Communities partnered with Khatib & Alami, a regional engineering firm, to provide up to 10 green fellowships to young engineers from the local government and infrastructure program. During two-month internships, fellows work with Khatib & Alami's sustainability unit in the UAE learning about LEED building and certification processes, and the UAE's ISTIDAMA certification process. Exposure to these regional and international systems is expected to enable fellows to apply green building principles upon their return to the West Bank.

International funding agencies including USAID have worked on green building projects such as “The Safeer Centre”, owned and operated by the Palestinian Child Care Society (nonprofit), to transform it into a healthier and more sustainable facility for children attending the Centre's educational programs. Safeer Centre's electricity costs were cut in half and water usage reduced by two-thirds during its first six months of operation.

United Nations Relief and Works Agency (UNRWA) has recently unveiled plans for the first of 20 zero-emissions schools throughout the Gaza Strip. The schools will support 800 students and will utilize rainwater, geothermal, and solar systems instead of traditional water

and energy grids to provide a sustainable project. At a construction cost of USD 2 million each, the Kuwait Fund for Arab Economic Development is providing financial support for the project.

8.3 Case Studies

The Palestinian Museum to open its doors in 2016 will be Palestine's first LEED accredited building. Green design and construction solutions are anticipated to reduce energy consumption in the building by 23%. The Museum is working with PalGBC to ensure that it adheres to LEED green building design guidelines. The building is a model and case-study for engineers, contractors, academics, students, and other professionals.

M. Qattan Foundation new premises is currently being built according to Palestinian Green Building Guidelines that take into account sustainable measures in architecture, air conditioning, ventilation, local material, natural light, and renewable energy.

8.4 Future Actions

Sustainable cities and green buildings is a relatively new concept in Palestine. Yet, government bodies, NGOs, ministries, and other stakeholders are investing time, effort, and financial resources to transform Palestine into a more sustainable nation. Nevertheless, more decisive action is needed to guide development and implementation of laws, policies, and incentives. Steps should also be taken to increase awareness campaigns, intensify capacity building programs, as well as train and educate young Palestinians. Professional bodies such as Engineers Association, PalGBC, and Global Communities, could work on training and qualifying professional engineers as relates to sustainability concepts.

8.5 Lessons Learned

Although some regulations do exist, implementing them is a major challenge. Yet, PENRA's experience in advancing energy conservation laws, creating policies, and implementing them in cooperation with the Ministry of Finance (MOF) and the Palestinian Investment Promotion Agency attests to the fact that incentives could work whenever law implementation is limited. Green buildings and sustainable development concepts could thus easily be adopted in Palestine if incentives are integrated.

IX. Qatar



Museum of Islamic arts (Source: https://commons.wikimedia.org/wiki/File:Museum_of_Islamic_arts_SOP.jpg)

9.1 Context

9.1.1 Sustainable Cities

Qatar's commitment to sustainable cities stems from a conviction that development of existing and new infrastructure networks that support the urban built environments provide safe, connected, and healthy living conditions. As such, sustainable buildings, transport, infrastructure, and solid waste management have been identified as vital components for sustainable urban development in Qatar and form the backbone for a number of key institutions and initiatives supporting city level resource efficiency and sustainability.

The Doha Metro has also been introduced as a sustainable transportation mode addressing urban connectivity as well as current traffic problems with the first phase opening in 2019 with 37 stations and 75 kilometers of revenue lines. The second phase involves the addition of an extra line and expansion of the first 3 lines to include 60 additional stations bringing the total to more than 130 kilometers of additional revenue lines. The stations are to be built according to GSAS standards under a scheme that was developed specifically for the project.

The Public Works Authority "Ashghal" established in 2004 is responsible for the planning, design, procurement, construction, delivery, and asset management of all infrastructure projects and public buildings in Qatar, with projects valued at over 100 billion Qatari Riyals to be delivered within the next five to seven years. The authority is committed towards adopting best practices, standards, as well as warranting environmental protection in all its building and infrastructure projects. Ashghal is aiming to achieve Global Sustainability Assessment System (GSAS) certification for all future building projects. Large scale infrastructure projects such as the "Expressway Program" are also subject to international environmental standards as pertains to noise, air quality, water quality, waste management, habitat preservation, and recycling of construction materials.

Furthermore, according to Qatar National Development Strategy 2011-2016, a comprehensive solid waste management plan is being implemented, with a target to recycle 38% of solid waste, up from the current 8%, and reduce domestic per capita waste generation. Five waste transfer stations have been setup across the country to reduce the quantity of waste going to Umm Al-Afa'i landfill. These transfer stations are equipped with material recovery facilities for separating recyclables such as glass, paper, aluminum, and plastic.

One of the most prominent developments, however, has been the creation of Domestic Solid Waste Management Centre (DSWMC) at Mesaieed. This centre is designed to maximize recovery of resources and energy from waste by installing state-of-the-art technologies for separation, pre-processing, mechanical and organic recycling, as well as composting technologies.

Moreover, and as a commitment to adopt sustainable measures at city level, Lusail City located north of the West Bay shoreline and about 20 km north of the Doha Centre, represents a good example. The city, consisting of over 35 km² and planned to accommodate approximately 200,000 people and 250,000 visitors and workers, is one of the first and largest developments in Qatar to achieve a 4 Star rating under the GSAS Districts rating system. It encompasses new residential, commercial, retail opportunities, in addition to a full array of community facilities, including schools, medical facilities, as well as entertainment and shopping centers.

Efforts have also been made to implement sustainability measures in cities like Doha with the objective of re-shaping the built environment, creating pleasant and comfortable outdoor environments, and introducing green areas within the city. While this is yet to be implemented on a wider scale, particularly in existing and denser neighborhoods, it is critical to the provision of a sustainable city that is adequately served and safely connected.

9.1.2 Sustainable Buildings

One of four pillars of Qatar's National Vision (QNV) 2030 - Environmental Development, aims to achieve "a balance between development needs and protecting the environment", and identifies the need for a "comprehensive urban development plan for Qatar that adopts a sustainable policy with regard to urban expansion and population distribution". Providing a legislative framework to govern Qatar's booming construction sector was thus necessary for the country to translate this vision and position itself at the forefront of sustainability development in the Gulf region. The country has adopted several policies, procedures, and initiatives that support sustainable green building concepts.

9.2 Baseline

9.2.1 Policies, Laws, Decrees and Technical Standards

To support sustainable building in the country policies have been adopted and standards developed.

Qatar's Construction Specification (QCS) 2014 standard sets requirements for the design and construction of buildings and the quality of construction materials being used. The QCS 2014 standard has been modified from the 2010 version to include mandatory minimum requirements for green buildings based on the Global Sustainability Assessment System (GSAS).

The section is applicable to commercial, governmental, and public buildings including rail buildings, sport facilities, education buildings, mosques, hospitals, health centers, and light industry buildings. It identifies minimum performance requirements to enhance energy and water efficiency and includes requirements for selection of local materials. Furthermore, it includes criteria for natural and mechanical ventilation and low emitting materials for indoor environments. On the operational side, the standard also includes minimum requirements for recycling management in buildings.

Qatar General Electricity and Water Corporation (Kahramaa) launched

"Tarsheed", the National Campaign for the Conservation and Efficient Use of Water and Electricity in Qatar. In alignment with QNV 2030, the campaign aims at empowering Qatar residents to reduce their daily consumption of water and electricity, thereby reducing annual national consumption levels per capita as well as the overall growth of Qatar's resource consumption all while meeting reduction target levels set within a 5-year timeline. The campaign provides information, awareness, encouragement and practical lifestyle suggestions.

9.2.2 Institutional Programs

The main official programs on sustainable building used in Qatar are the Global Sustainability Assessment System (GSAS) and the Leadership in Energy and Environmental Design (LEED) program. While most government authorities have taken on GSAS as the main institutional program providing a sustainability framework for their projects, other major developers like Msheireb Properties adopted LEED since 2006 to showcase Qatar's leading position in sustainable development.

Global Sustainability Assessment System (GSAS) is administered by the Gulf Organization for Research and Development (GORD). It was developed to encourage and promote the design, construction, and operation of responsible and sustainable built environments. Several GSAS schemes have been developed for typologies of buildings. These schemes have a common structure as pertains to criteria and evaluation approach but differ in calculation methodology and some criteria requirements to account for different occupancy patterns and typologies.

Yet, while there are no published official statistics to date relating to the total number of registered and/or certified projects under the rating system, the continuous development of GSAS and the emergence of new schemes to suit new project types is expected to drive the green building movement at the national level. Furthermore, as more projects are certified and financial impact assessed, GSAS could be more attractive for large developers to embrace. The following table illustrates the number of GSAS projects implemented by Ashghal that are under design and construction.

Sector	GSAS Projects In Design	GSAS Projects under Construction
Healthcare	26	6
Education	31	43
General	47	4
Mosques	30	26
TOTAL	134	72

Ashghal projects following the GSAS rating system currently under design and construction by sector (Source: Colletti AJ, Ashghal – Public Works Authority)

LEED was first used in Qatar in 2006 by Qatar Foundation before the development of GSAS and served to excel and pioneer their growing building portfolio varying from convention centers and educational buildings to mixed use developments. A summary of the status of LEED projects in Qatar is shown in the figure below as published by the U.S Green Building Council (USGBC) Qatar Country Market Brief.

Countries
Qatar

LEED project data only includes commercial rating systems. The underlying data does not include LEED ND or LEED for Homes projects.

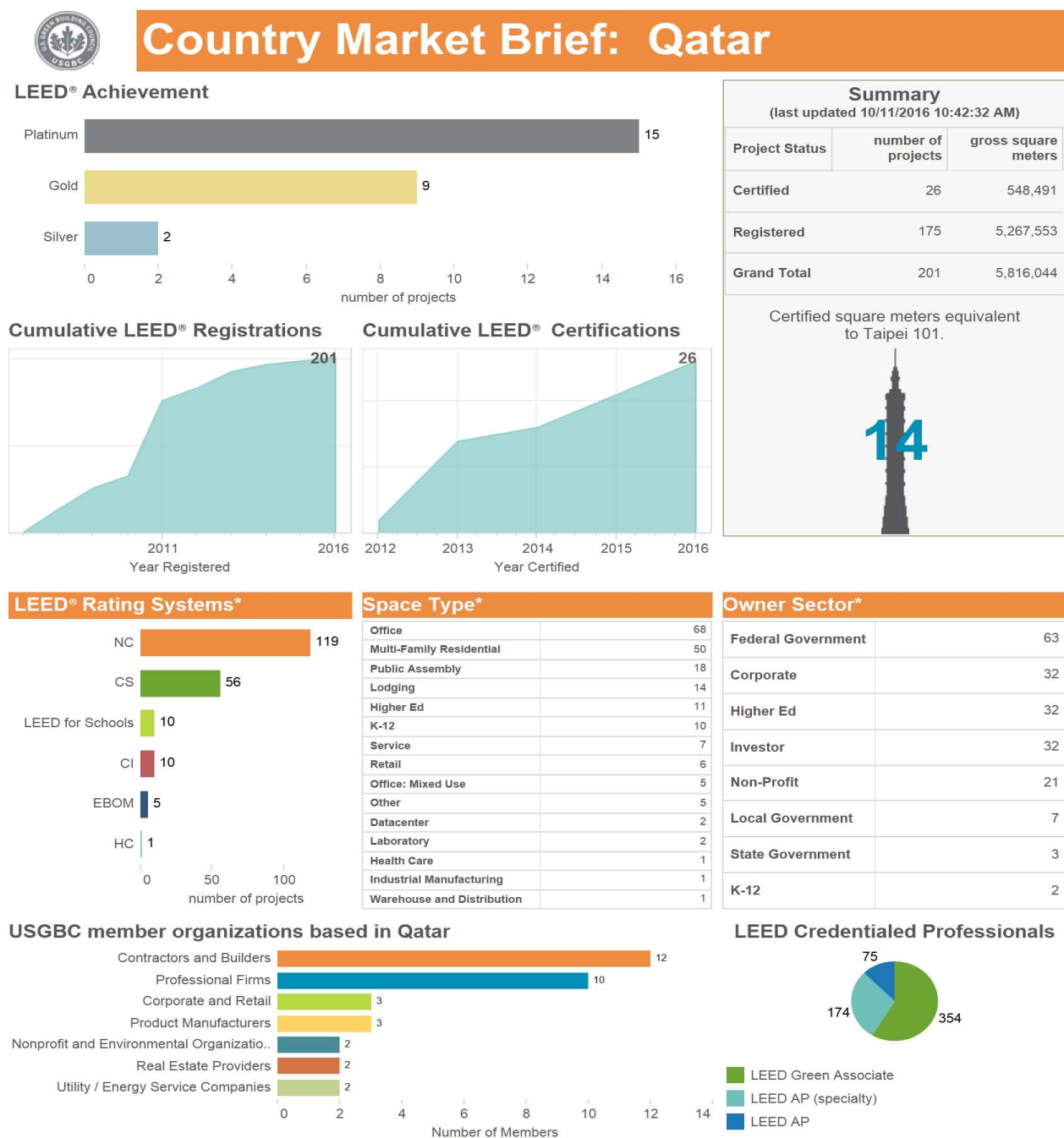


Figure 9.1 Status of LEED projects in Qatar (Source: U.S Green Building Council, <http://www.usgbc.org/advocacy/country-market-brief>)

Nevertheless, the two main stakeholders responsible for promoting sustainable building in Qatar are the Gulf Organization for Research and Development (GORD) and the Qatar Green Building Council (QGBC). While they have both taken slightly different paths, the impact these organizations continue to have is the most prominent locally and regionally. Their role has led other key public and private sector stakeholders to take on their own green building commitments.

In addition, the Supreme Committee for Delivery and Legacy (SC) is a key stakeholder that is playing a pioneering role in promoting sustainability in the built environment and contributing strongly towards Qatar's sustainable development by setting high sustainable design and environmental standards for the FIFA World Cup 2022 venues and creating a legacy for the future.


Gulf Organization for Research and Development (GORD) was established in 2009 as a not-for-profit subsidiary of Qatari Diar Real Estate Investment Company. Its goal is to “promote healthy, energy and resource efficient, and environmentally responsible building practices in Qatar and the entire Gulf region” and “offer new knowledge in sustainability and its applications to empower local and regional construction industry to address environmental challenges”. In 2010, GORD developed the GSAS rating system (formerly known as QSAS) in collaboration with the TC Chan Centre at the University of Pennsylvania in the U.S. Since then, GORD continues to administer and develop

GSAS, which has become the dominant green building rating system in Qatar.

Qatar Green Building Council (QGBC) was formed under the umbrella of Qatar Foundation with the aim of increasing awareness and knowledge of green building practices through capacity building, ongoing professional development, and research. Its efforts to build and engage an active membership body and network of stakeholders to champion the Green Building movement extends to support adoption, legislation, and implementation of green building practices and standards. Since its inception, QGBC has established “Interest Groups” across a variety of sectors which include members and volunteers from the industry who support the council's mission through their projects and activities.

9.3 Case Studies

Msheireb Downtown Doha is one of the first sustainable downtown regeneration projects that attempt to revive the old commercial district utilizing a new architectural language inspired by traditional Qatari heritage and architecture. Buildings are oriented to take advantage of prevailing breezes, while narrow streets, building mass and height are utilized to provide maximum shading of the public realm while regionally and responsibly sourced material are used in construction. The project's other key sustainability highlights are described in the table below.

<p>Energy Efficiency</p>	<ul style="list-style-type: none"> • 30% building average energy efficiency • 6,400 PV panels + 1,400 Solar thermal panels • 4% of site energy from solar energy • 75% of the residential hot water supply from the solar panels • Efficient district cooling system • Improved Insulation, glazing, solar shading and recessed windows to reduce heat gain 	
---------------------------------	---	---

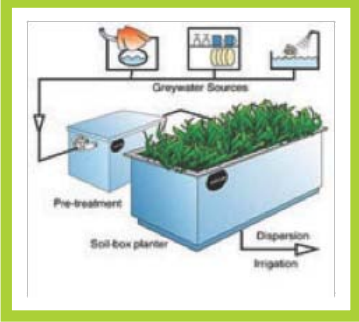


Water Conservation	<ul style="list-style-type: none"> • Using low flow fixtures to achieve a 30% reduction in potable water use • Treating treated sewage effluent (TSE) on site for reuse/ irrigation/ toilet flushing and district cooling • Collecting condensate and storm water for reuse • Using native and adapted plants • Using highly efficient drip irrigation 	
Waste Management	<ul style="list-style-type: none"> • 75% is the minimum construction waste diverted from landfill • Installing an Automated Waste Collection System (AWCS) • Utilizing regional materials such as local stone 	

Figure 9.2 Msheireb Downtown Doha sustainability highlights (Source: Msheireb Properties website: www.msheireb.com)


Passivhaus Project “Baytna” is a partnership between Qatar Green Building Council (QGBC), General Water and Electricity Authority (Kahramaa), Barwa Real Estate (BRE), and a number of scientific partners. The project involves the construction and subsequent operation of a model passive and conventional house. The project's key sustainability features are shown in the image below.

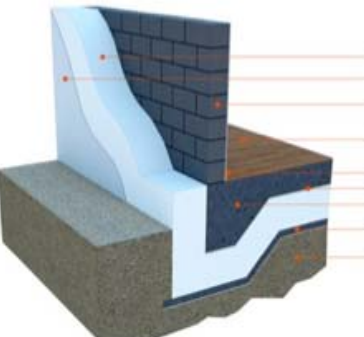
Maximizing natural daylight through the building



**Using eco friendly construction materials
Maximize shading using rooftop PV panels**




First Building in Qatar to Feed excess production of renewable energy to the national grid



High performance insulation building envelope

50%

**Energy consumption reduction
Water consumption reduction
CO2 emissions reduction**



Compact Design principles

Figure 9.3 The Passivhaus Project “Baytna” key sustainable features (Source: Qatar Green Building Council)

9.4 Future Actions

Projects like the Doha Metro, Lusail City and Msheireb Downtown have demonstrated the importance of a well-connected urban environment that encourages alternative and more sustainable modes of transportation. Yet, with the national population anticipated to grow over the next few years, the operation and expansion of a public transit system within and between cities across Qatar is fundamental to a successful sustainable growth and development plan.

What's more, large scale waste and water management projects have demonstrated a close link between sustainable buildings and their context at an urban scale. While many steps have already been taken, Qatar is yet to witness a comprehensive solid waste management program that promotes recycling as a norm at the national level.

9.5 Lessons Learned

Design integration requires cross-disciplinary teamwork at the planning, scoping, design, and construction stages. It promotes comprehensive performance improvements, compounds environmental benefits, and potentially offers substantial cost savings. Undertaking design integration is beneficial for upgrading existing buildings and infrastructure and is critical in creating new projects. While it may be considered that green building and sustainable city projects in Qatar have had varied success with the process itself, there is an urgent need to create a shift in the way projects are conceived from early stages all the way through to construction and operation. There is a critical need to assess the entire lifecycle of a project from design to post occupancy and beyond. Yet, reconsidering Qatar's older building stock and urban fabric could present opportunities and new solutions to the way designers reshape the city. Urban regeneration projects could make use of the existing built environments while outlining improvement through urban infill and adaptive reuse projects that minimize pressure on creating new infrastructure in areas where it is more challenging to do so.

Additionally, and in order to promote a culture of positive change and innovation, successful initiatives should be recognized and celebrated. Not only would this increase the level of sustainability awareness among all sectors, it would raise the bar as relates to practice and implementation of sustainable design - ultimately creating a healthy competitive atmosphere among professionals, developers, and owners.

X. Saudi Arabia

7

Mecca Towers (Source: photographed by Ziyad Al Beltagy)

10.1 Context

10.1.1 Sustainable Cities

The Kingdom of Saudi Arabia has adopted several initiatives and programs related to sustainable development at city level. In April 2010, King Abdullah City for Atomic and Renewable Energy (KA.CARE) was established by a Royal decree with the fundamental aim of developing a substantial alternative energy program to secure a sustainable future for Saudi Arabia.

A comprehensive national program to rationalize and enhance energy consumption is also being launched by the Saudi Energy Efficiency Centre (SEEC). The program is designed to ensure the execution and implementation of a national plan and warrant cooperation between governmental agencies responsible for execution and implementation.

Additionally, in 2005, the Ministry of Municipal and Rural Affairs (MOMRA) developed guidelines for applying sustainability concepts in urban planning and design illustrating environmental assessment methodologies, a strategy, and municipal policies.

MOMRA and the United Nations Human Settlements Programme (UN-Habitat) have also developed the “Future Saudi Cities Program” with the objective of promoting sustainable urban development in Saudi Arabia. The program supports sustainable urbanization in the Kingdom through assessment of the status quo of Saudi cities in terms of their capacities to provide a sustainable urban environment. The program involves development of detailed strategic plans as well as pilot projects as a road map for the transformation of Saudi cities into sustainable, productive, and livable urban areas that provide equitable distribution of development gains.

Nevertheless, and despite the many initiatives and programs, only a few cities, including the Royal Commissions for Yanbu and Jubail, have applied sustainable practices.

The Yanbu Industrial City, located on Saudi Arabia’s Red Sea coast, is the result of a bold vision designed to reduce Saudi Arabia’s dependence on crude oil exports, upgrade precious natural resources, diversify the national economy, and ultimately raise the standard of living in the Kingdom. Industries operating in Yanbu have, and continue to apply, “best available technologies” and are committed to seeking the most sustainable, environmentally friendly, and energy efficient processes and designs.

A new “Centralized Industrial Wastewater Treatment Plant” is responsible for the treatment of large volumes of wastewater generated by industries while a “Multi Effect Desalination” (MED) process utilizes advanced technology to lower the environmental footprint and achieve considerable energy savings. The process utilizes the power plant’s thermal output to heat and evaporate sea water at low temperature consuming 33.3% less energy than other thermal processes.

In addition, several mega projects in the Kingdom have pursued sustainable city development goals and have sought LEED certification.

King Abdullah University for Science and Technology (KAUST) received the LEED Platinum certificate. The campus’ master planning and design adopted sustainability measures and is a direct reflection of the local environment, microclimate, and ecosystem. KAUST utilizes smart design, new technology, and innovative approaches to mitigate effects of the harsh climate and reduce the overall carbon footprint of the project. King Abdullah Petroleum Studies and Research Centre (KAPSARC), a 530000 m² project, is also in the process of attaining Leadership in Energy and Environmental Design, Neighborhood Development (LEED ND) certification.

Other initiatives include King Abdul-Aziz for Public Transportation (KAPT), which aims at availing access to mass transportation modes to a large segment of the population with the objective of decreasing CO₂ emissions.

10.1.2 Sustainable Buildings

As part of the Kingdom's resolve to move towards more sustainable development, a number of private and public buildings have or are in the process of receiving LEED certification; the intention being to implement the concept of sustainability at both building and city levels. Among the prominent projects is King Abdullah Financial District, a landmark project in scale, where rating attainment and innovative technologies have yet to be replicated in the Arab Region.

Nonetheless, there is no official count of the number of sustainable projects/buildings in Saudi Arabia. It is believed however, that until recently, 91 buildings have received LEED certification while another 220 are registered under United States Green Building Council (USGBC) for LEED certification.

10.2 Baseline

10.2.1 Policies, Laws, Decrees and Technical Standards

Policies, laws, decrees, technical standards, and guidelines to enforce the application of sustainability concepts are being introduced at various levels of governance and the urban development process. These include:

- **Saudi Building Code, Energy Consumption (Code601)** establishes minimum prescriptive and performance related regulations for the design of energy efficient buildings and structures or portions that provide facilities or shelter for public assembly, educational, business, mercantile, institutional, storage and residential occupancies, as well as those portions of factory and industrial occupancies designed primarily for human occupancy. Regulations address building envelopes, selection and installation of

energy-efficient water-heating, effective distribution and use of illumination systems and equipment in buildings and structures.

- **Ministry of Water and Energy (MOWE)** Decree mandates the application of thermal insulation in all residential and commercial buildings.
- **The Presidency of Meteorology and Environment (PME) Decree** of March 2014 sets a five-year deadline for all companies to meet new air, water, and noise pollution standards. As part of PME's environmental plan to protect health and natural resources, all projects are to observe the Kingdom's plan for international compliance, and must conform to international benchmark standards. These new regulations align with rules approved by Saudi's Council of Ministers in 2008.
- **HOK and Aramco Development Guidelines** provide culturally and climactically appropriate standards for density, diversity, land use, transport, and design for public realm, district cooling, as well as energy and water consumption. They are mandatory for all new developments serving 5,000 or more people and optional for smaller municipalities. As part of the Saudi Energy Efficiency Program, the guidelines will be phased in across the Kingdom between 2014 and 2040, and will become increasingly stringent over time.

10.2.2 Institutional programs

Though a Green Buildings department at the Saudi Council of Engineers was created to promote the green building concept as an essential component in developing the engineering profession, a Saudi Green Building Council is yet to be registered – but has been in the making for the last few years. It is hoped however, that once established, the Saudi Green Building Council will enable specialists in the industry to contribute the preservation of the environment by advancing engineering performance levels and creating a more sustainable built environment.

10.3 Case Studies

King Abdullah Petroleum Studies and Research Centre (KAPSARC), Riyadh: The complex houses 191 LEED certified residential and communal units and hosts the largest solar energy field powering the 530000 m² project. KAPSARC has managed to attain the very first LEED Home certification outside the U.S. for its housing complex, designed by HOK.

King Abdullah University for Science and Technology (KAUST), Jeddah: KAUST's campus innovative and sustainable architecture earned it the LEED Platinum certification based on five measures of sustainability namely; sustainable site development, water savings, energy efficiency, materials' selection, and indoor environmental quality. University buildings have been constructed to utilize natural lighting and ventilation while the roof, designed to support 12,000 square meters of solar thermal and photovoltaic arrays, is capable of delivering 3,300 megawatt hours of clean energy every year. Recycled products, reaching up to 75%, are also found in construction materials used in buildings on campus.

King Abdullah Financial District (KAFD), Riyadh is to provide more than 3 million square meters of mixed use development, 62,000 parking spaces, and accommodation for 12,000 residents. With a total site area of 1.6 million square meters, the project comprises 45 LEED certified towers (13 silver, 1 gold, 17 platinum, and 14 in progress).

King Fahd National Library, Riyadh offers an exceptional mix of tradition, culture, and passive design concepts. The project's design allows natural lighting to penetrate the building all day long. An arabesque leaf exterior drapes the building envelope acting as a screen mitigating effects of intense sun while serving as a light diffuser to reduce glare and introduce natural lighting into the interior. In consequence, energy consumed by lighting is reduced drastically during the day.

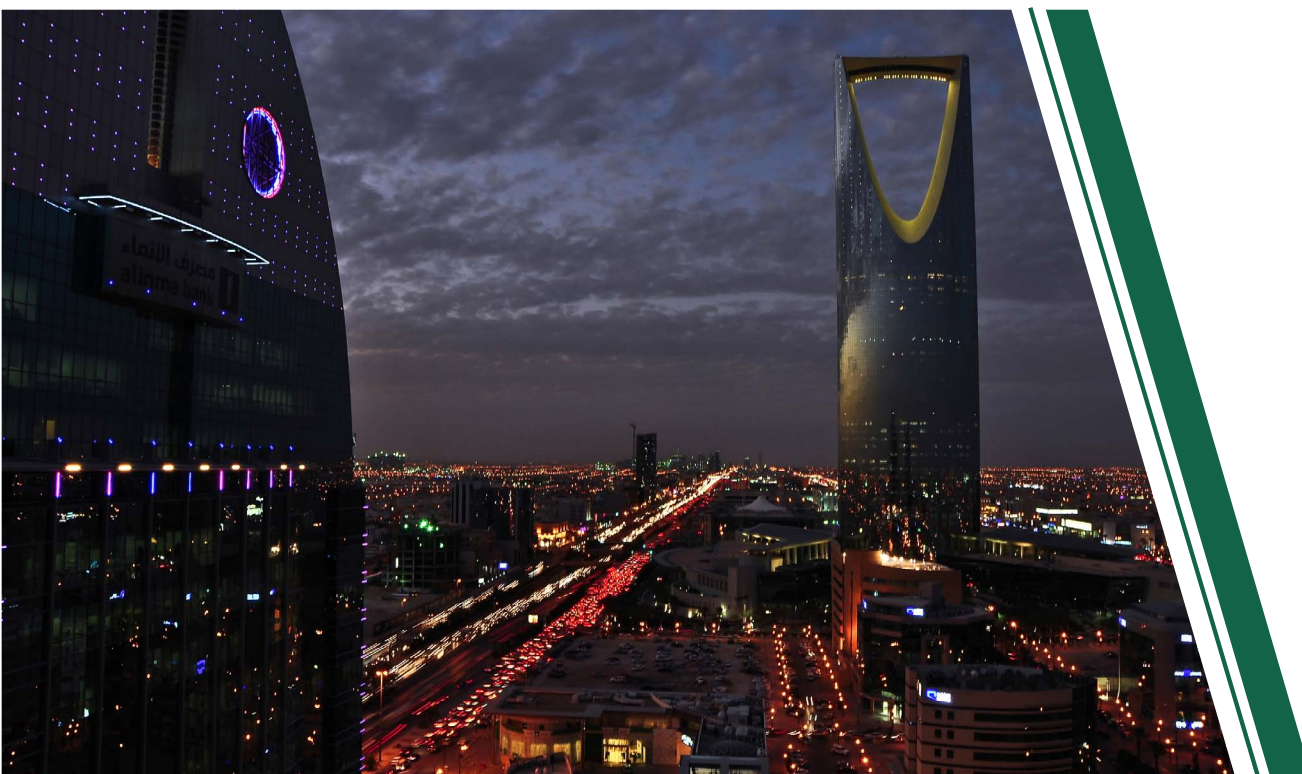
10.4 Future Actions

The Kingdom's sustainable development initiatives and programs remain uncoordinated and unpublicized. Public awareness, training, and incentives are much needed to encourage professionals and developers alike to implement sustainable practices at the building, neighborhood, and city levels.

Government incentives for sustainable green building could get the wheel spinning for major developers as well as individual owners. One approach would be to start enforcing implementation on mega projects and large buildings, since they have the highest impact, while commissioning LEED certified professionals and well-established engineering firms to review and ensure compliance.

10.5 Lessons Learned

Progress in adopting and implementing sustainability measures in the Kingdom are mainly limited to mega projects funded by local government and large organizations. Private projects including housing and commercial buildings are however much less enthusiastic and seldom employ sustainable practices in their projects, therefore the Government lately mandated the application of thermal insulation. This is partially due to absence of awareness as to the methods, benefits, and values of adopting sustainability concepts. Nevertheless, other stumbling blocks impeding sustainable development in the Kingdom include:



Kingdom Centre in Riyadh (Source: Author)

- Relatively low electricity tariffs: The average cost of electricity bills for 65% of consumers is less than Saudi Riyals (SAR) 100 per month (USD 30); consequently, there is little or no motivation to rationalize consumption. Moreover, low cost bills discourage users from investing in energy efficiency systems. In 2014, the International Energy Agency (IEA) fossil-fuel subsidies database released a report indicating electricity subsidies in the Kingdom as incredibly high, at USD 14 billion versus USD 4.3 billion in Kuwait and USD 6.3 billion in Egypt. A report by the International Monetary Fund last year estimated that Saudi Arabia spends about 10% of GDP - roughly USD 60 billion - subsidizing gasoline, diesel, electricity, and natural gas.
- Prevalence of low efficiency devices: Consumers seldom seek high efficiency devices due to limited awareness as relates to energy efficiency and inadequate incentives to replace low energy efficiency products by more efficient ones.
- Weak mechanisms of enforcement: The absence of binding specifications, standards, and mechanisms to supervise and control implementation and product standards including insulation and lighting. As a consequence, more than 70% of residential buildings in the Kingdom are not thermally insulated.

XI. Tunisia



The Ribat at Sousse (Source: [https://commons.wikimedia.org/wiki/File:Town_centre_Sousse_\(239401090\).jpg](https://commons.wikimedia.org/wiki/File:Town_centre_Sousse_(239401090).jpg))

11.1 Context

11.1.1 Sustainable Cities

Following the first United Nation Summit for Sustainable Development in 1992, the Mediterranean Environmental Technical Assistance Program, and in response to a growing energy deficit, Tunisia has engaged in several efforts to ensure the adoption of sustainable development principles in all sectors and has opted for comprehensive and scalable policies to ensure a sound balance between the country's environmental health and its socio-economic development.

The Tunisian Ministry of Environment and Sustainable Development, in collaboration with other stakeholders from the public and private sectors and with international partners developed an overarching National Sustainable Development Strategy (2014-2020), that is both progressive and proactive.

This strategy cascaded into a series of policies and programs that pertain to cities and the building sector. These are in the process of being implemented by relevant governmental institutions, and hold the following key agendas:

- environmental protection and quality of life agenda, led by the Ministry of Environment and Sustainable Development;
- energy conservation and renewable energy agenda, led by Ministry of Industries, Energy and Mining;
- sustainable planning construction agenda, led by the Ministry of Public Works, Housing, and Land Planning; and
- sustainable transport agenda, led by the Ministry of Transport.

Key institutions engaged in this process include:

- The General Directorate for Habitat - Ministry of Public Works, Housing, and Land Planning;

- The General Directorate for Civic Building - Ministry of Public Works, Housing, and Land Planning;
- The Directorate of Urban Planning - Ministry of Public Works, Housing, and Land Planning;
- The National Agency for Energy Conservation (ANME) - Ministry of Industries, Energy, and Mining;
- The National Syndical Chamber for Renewable Energies - Ministry of Industries, Energy, and Mining;
- The Tunisian Company for Electricity and Gas (STEG) - Ministry of Industries, Energy, and Mining;
- The Technical Centre for Construction Materials, Ceramics and Glass (CTMCCV)- Ministry of Industries, Energy, and Mining;
- The National Agency for Environment Protection (ANPE) - Ministry of Environment and Sustainable Development;
- The National Sanitation (ONAS) - Ministry of Environment and Sustainable Development;
- The Agency for Protection and Development of the Coastline (APAL) - Ministry of Environment and Sustainable Development;
- The International Centre for Environmental Technologies of Tunis (CITET) - Ministry of Environment and Sustainable Development; and
- The National Waste Management Agency (ANGED) - Ministry of Environment and Sustainable Development.

Yet, relevant urban planning policies have emerged in Tunisia as early as 1977 together with the development of the Regional Master Plan for Greater Tunis. This effort pioneered an approach that integrated the basic principles

of sustainable development, taking into account spatial, economic, and demographic dynamics as well as social, ecological, and cultural realities. It also promoted good urban governance and engagement from a wide range of stakeholders. Projects tackled challenges such as neighborhood rehabilitation, public transport, social housing, industrial as well as domestic pollution, and more. Government agencies involved in shaping urban development in Tunisia, particularly in the housing sector include:

- the National Real Estate Institute (SNIT);
- the Social Housing Development Company (S.PRO.L.S);
- the Habitat and Land Agency (AFH); and
- the Agency for Urban Rehabilitation and Regeneration (ARRU).

Furthermore, following the Earth Summit and the Mediterranean Environmental Technical Assistance Program, a number of initiatives and policy efforts followed to shape the sustainable development agenda for Tunisian cities including among others:

- **Agenda 21 Program** which was implemented in over 100 cities and towns and was supported by the Ministry of Environment and Sustainable Development and several NGOs,
- **The Code for Territory Planning and Urbanism (Code de l'Aménagement du Territoire et de l'Urbanisme - CATU)** (1994) regulating development and providing guidelines for optimal use of space, planning, and creation of new urban centers. The code aims to ensure quality of urban living, promote efficient use of resources, protect zones of cultural or ecological value, ensure public safety and health, and maintain a balanced distribution between urban and rural areas.
- **The Urban Management Program** (1997 – 2000) initiated by the United Nations, the World Bank and a number of European countries and supported the development of Sustainable Development Strategies for Mediterranean cities and particularly in Sfax and Sousse.

- **The Sustainable Development Strategy of Greater Sfax** (2016) laid out a clear and ambitious vision for the second largest metropolitan area of Tunisia as a competitive Mediterranean metropolis and leader in technologies and innovation, sustainable, inclusive, and attractive. Within this framework, the municipality of Greater Sfax adopted a participatory approach to develop a sustainable development strategy with the objective of promoting sustainable local development and good governance through active implication from civil society, universities, the national government, and the private sector.

Yet, and despite early engagement in sustainable policy development and significant urban planning efforts, the City of Tunis and the majority of other Tunisian cities still lack a comprehensive and integrated approach to sustainable urban planning. One exception is the city of Sfax where the local government followed a participatory approach to develop a Sustainable Development Strategy establishing a clear vision for the metropolitan area as well as supporting plans and projects in relation to the natural environment, infrastructure development, mobility, housing, public space, socio-economic development, and culture.

11.1.2 Sustainable Buildings

Tunisia is one of the few developing countries to have engaged in a progressive and proactive strategy for sustainable development, particularly in relation to environmental protection and the promotion of energy efficiency and renewable energy. This effort was initiated as early as mid-1980s and has since continued to gain momentum mainly as a response to an increasing energy deficit and spiraling international oil prices.

Particular attention was given to the construction sector for its significant contribution to the overall national energy consumption. In response, programs and initiatives were developed ranging from building energy codes, energy labeling schemes, to solar hot water and photovoltaic incentive programs. Comprehensive measurement-based approaches to sustainability in the built

environment mainly focus on buildings, with the aim of advancing the boundaries of sustainable performance beyond basic code compliance. Eco-labels or sustainability management and rating systems for buildings are thus being developed by the government and are anticipated to play an important role in engaging the construction sector on the path of green market transformation. In parallel, the government has also tackled a number of other sustainable development challenges including waste management, natural ecosystem protection, and urban mobility, to name a few. Yet for many years, these challenges were addressed in quasi “silos”, but in recent years multiple stakeholders have been engaged in addressing a wider range of environmental and socio-economic challenges.

11.2 Baseline

11.2.1 Policies, Laws, Decrees and Technical Standards

- **Law No. 2004-72** (August 2nd, 2004), pertains to energy conservation as modified and completed by Law No. 2009-7 (February 9th, 2009).
- **Law No. 2005-82**, relates to the creation of an energy conservation system.
- **Law No. 2015-12**, authorizes the private sector to finance and undertake projects in the field of electric energy production from renewable sources. A decree defining the framework for application of this law is currently being put together.
- **Decree No. 2002-3232** (December 3rd, 2002), relates to cogeneration as modified and completed by Decree No. 2009-3377 (November 2nd, 2009).
- **Decree No. 2004-2144** (September 2nd, 2004), defines conditions for mandatory energy audits of high-consumption establishments.
- **Decree No. 2004-2145** (September 2nd, 2004), relates to labeling of white goods.

- **Decree No. 2005-2234** (August 22nd, 2005), defines rates and conditions for energy conservation grants.
- **Joint Order between the Ministry of Public Works, Housing and Land Planning and the Ministry of Industries, Energy and Small and Medium Enterprises (July 23rd, 2008)**, sets specifications for energy performance of new construction and project extensions for office buildings.
- **Joint Order between the Ministry of Public Works, Housing and Land Planning and the Ministry of Industries, Energy and Small and Medium Enterprises (June 1st, 2009)**, sets specifications for energy performance of new construction and project extensions for residential buildings.
- **Joint Order between the Ministry of Interior and Local Development, the Ministry of Public Works, Housing and Land Planning and the Ministry of Industries, Energy and Small and Medium Enterprises (February 9th, 2006)**, sets specifications for energy performance in public lighting.
- **Joint Order between the Ministry of Industry and Technology and the Ministry of Commerce and Handicrafts (August 18th, 2010)**, prohibits distribution of incandescent lamps for domestic use with power higher or equal to 100 watt and voltage higher or equal to 100 volts.
- **Joint Order between the Ministry of Industry and Technology and the Ministry of Commerce and Handicrafts (September 27th, 2010)**, sets minimum energy performance levels for individual air conditioning systems with cooling capacity of less than 12 KW.

11.2.2 Institutional Programs

As a consequence of Tunisia's proactive policy for the promotion of renewable energy and energy efficiency as early as mid-1980s, the National Agency for Energy Conservation, was established in 1985 and a number of ambitious energy efficiency and renewable

energy programs were developed with the prime objective of meeting national energy needs in a cost-effective manner while reducing the economy's vulnerability to rising fossil fuel prices.

With the building and construction sector playing a major role in the energy balance as the third largest energy consumer in Tunisia with a 27% share of the overall national energy consumption, succeeding the industrial (36%) and transport sectors (30%), a number of initiatives and programs were developed to focus on this particular sector both in relation to energy efficiency (EE) and renewable energy (RE). Three significant programs supported by German cooperation, foreign governments, and international organizations; were thus developed and implemented.

A three-year sustainable energy program (2005-2007) was initiated targeting priority areas and mature industries with the objective of promoting energy efficiency and renewable energy. Nearly 230 energy efficiency (EE) program contracts were established between the government and companies in the industrial sector; 30 contracts were signed in the tertiary sector and 20 in the transportation sector; cogeneration facilities producing around 10 MW were installed in the industrial sector; 120,000 m² of solar water heaters were fitted primarily in the residential sector; natural gas was introduced in both the industrial and residential sectors; and over 1 million energy-saving lamps were distributed in the residential sector. The program achieved, as per the GIZ 2012 report, an accumulated energy savings of around 770 ktoe, representing 8% of national annual consumption, a 2.8% decrease in primary energy intensity, and an estimated 7 MtCO₂eq of avoided GHG emissions.

This was followed by a four-year program (2008-2011) focusing on the establishment of institutional and regulatory measures as well as strengthening initiatives favoring the rational use of energy and renewable energy. Key objectives included reduction of Tunisia's economic vulnerability as pertains to increased energy spending in government budget, estimated in 2007 at 12% of GDP. To that effect, the government set very ambitious goals for 2008-2011 aiming to reduce energy consumption by

3% per year, maintain moderate energy demand growth, and increase the share of renewable energy in primary energy consumption to 4% by 2011. As of the end of 2010, accumulated savings made during 2008-2010, according to the GIZ 2012 report, reached around 1,950 ktoe, of which over 90% can be attributed to four sectors (43% from EE program contracts, 37% from EF in electricity usage, 6% from wind power, and 5% from energy efficiency in transportation).

For the period 2010-2030, a strategic solar plan (Plan Solaire Tunisien – PST) was introduced, promoting energy efficiency in the transport, building, and industrial sectors as well as renewable energy. The plan aims to drive cooperation between public and private sectors through support mechanisms, namely: administrative, regulatory, and financial. The plan aims to achieve a 3.8 GW capacity of electric generation from renewable energy by 2030 (an estimated 30% contribution to the energy mix) and to continue running energy efficiency programs for all sectors to reach cumulative energy savings of 15 Mtep by 2030.

Other initiatives focusing sustainable development, particularly in relation to environmental protection and the promotion of energy efficiency and renewable energy include:

Label Eco-Bat, a voluntary building certification program that was developed by the National Agency for Energy Conservation targeting existing and new multi-story tertiary buildings (hospitality, healthcare, multi-residential and offices). The rating system includes a range of performance-based criteria for the building envelope, heating ventilation and air-conditioning (HVAC), and resource management (water conservation, waste management, and environmental awareness). Projects may attain one of three certification levels ranging from bronze, to silver, and gold.

Ecolabel Tunisien was launched in May 2009 by the International Centre for Environmental Technologies of Tunis (CITET), building on the ISO 14001 framework, as a rating system for products and services. Ecolabel is a voluntary program aiming to incentivize businesses to optimize the use of natural resources in a responsible manner and to adhere to environmental best practices

including: water conservation, energy efficiency, and reducing environmental pollution in all its forms. The program primarily targets the textile, agri-food, and tourism sectors. It provides a set of sustainability performance criteria some of which are mandatory and others voluntary with specific measures to address the three key stages of a product's lifecycle (acquisition, delivery, and disposal).

EU-Tunisia Twinning Program on Sustainable Construction. The Ministry of Public Works, Housing and Land Planning has also led the development of a new rating system for civic buildings through a twinning program that was implemented from March 2012 to February 2014 in cooperation with France, Germany, and Portugal. The program aims to emphasize sustainability concepts in the Tunisian construction laws; develop and promote principles of sustainable construction for all types of projects across the nation; build the capacity of managerial staff at the General Directorate of Public Buildings (GDPB) - a constituent of the Ministry of Public Works, Housing, and Land Planning; and emphasize GDPB's authority and level of intervention in sustainable construction.

The program resulted in creating: a proposal to develop standards with explicit references to sustainable construction principles; a strategic communication plan; nation-wide awareness programs; a national prize for sustainable construction; a higher education help program promoting teachings and applied research in the field; a National Committee for Sustainable Construction; and a green building certification system for civic buildings. The Green Building certification system was applied to a number of projects.

11.3 Case Studies

Project Taparura was developed by the Tunisian State (Ministry of Public Works) and the Société d'Etude et d'Aménagement des Côtes Nord de la Ville de Sfax (SEACNVS), created in 1985. The project is planned over two phases. Phase one, involves the clean-up and restoration

of Sfax's northern coastline which was heavily contaminated by the phosphate industry. Phase two entails the development of 420 hectares of land in order to expand the metropolitan area for the benefit of Greater Sfax and its inhabitants.

With the clean-up phase already completed, the focus at present is on developing a new urban centre to include residential areas, hotels, recreational facilities, commercial activities, as well as public open space. The project will become home to 50,000 residents and is expected to generate significant new employment opportunities upon completion which is anticipated at the end of 2019.

BIC Factory – Tunisia, is BIC world's first green LEED certified factory and Tunisia's first LEED Certified project. The project, which is a combination of industrial and office facilities, was certified under LEED for New Building Design and Construction in its 2009 version.

The project attained a number of key performance targets including: over 14% improvements on baseline building performance rating (mainly through roof insulation); over 10% recycled content building materials; over 20% regionally extracted, harvested, recovered, or manufactured materials; over 75% of occupied space boasts day lighting; 100% reduction in potable landscape water use; and 40% reduction in baseline indoor water use.

The University Dorms in Tataouine draws on a rich architectural language that follows a bio-climatic approach and is in harmony with the traditional built environment of the region. The building envelope is entirely built with local stones providing an appropriate response to harsh climatic conditions while archetypal elements such as domes anchored in traditional know-how are integrated in the planning and design. A multitude of traditional passive design strategies including orientation, natural ventilation, high-inertia walls, reduced façade openings, shading, etc. are employed. Building overall energy performance is further enhanced by making use of roof insulation and small-scale solar hot water systems.



(Source: Tunisia GBC)

11.4 Future Actions

With its early attempts of developing sustainability rating systems for products and buildings in Tunisia, the national government has taken a step in the right direction to activate a green building market transformation. Yet, more collaborative efforts are needed to bring together different ministries and government entities, increase engagement of the private sector, and further raise awareness of end-users.

What's more, implementation of sustainability concepts and measures need to follow suit beyond the establishment of plans and policies that are often challenged, delayed or cancelled. City governments should thus initiate a participatory, multi-stakeholder process to develop a comprehensive and integrated sustainability strategy for their city defining the vision, timeline, as well as implementation plans and programs.

11.5 Lessons Learned

From as early as mid-1980s, Tunisia established a robust base for promoting energy efficiency and renewable energy in the built environment through a comprehensive set of policies, programs and technical guidance. A number of pioneering programs were implemented to ensure wide adoption of the energy code for

buildings, incentivize energy service contracts for major energy consumers in the industrial and tertiary sectors, promote energy efficient measures (e.g. through product labeling), and the utilization of renewable energy both at building level and in decentralized settings.

Today, stakeholders of the building and construction sector have the opportunity to build on this initial success to promote a more comprehensive approach to urban sustainability, one that addresses other areas of impact such as water conservation, sustainable procurement, user wellbeing, etc; one that pushes the boundary for higher performance beyond code compliance; demonstrates impact through measurement; and addresses sustainability at all scales from the urban level to the building and product levels.

XII. United Arab Emirates



Burj Al Arab

(Source: <https://www.goodfreephotos.com/united-arab-emirates/dubai/burj-al-arab-jumeirah-sunset-dubai-united-arab-emirates-uae.jpg.php>)

12.1 Context

12.1.1 Sustainable Cities

The United Arab Emirates (UAE) has addressed climate change by launching mitigation and adaptation measures and policies at both the federal and local levels. The government's commitment towards sustainable development has been also reflected in the UAE's Vision 2021 and the Green Economy Strategy for Sustainable Development. As a consequence, several sustainability strategies and initiatives were instigated by federal and local institutions.

In line with these national initiatives, the Ministry of Environment launched the National Environmental and Awareness Strategy 2015-2021 which targets youth, communities, industries, and governmental stakeholders, and inculcates in them a sense of responsibility toward environmental protection. A Strategic Plan for 2014-2016 was also launched by the Ministry of Public Works stressing the development of sustainable infrastructure and promoting the use of energy efficient systems. The Emirates Authority for Standardization and Metrology has also commenced enforcement of mandatory energy efficiency requirements and labeling schemes as pertains to water fixtures, lighting, electrical appliances, and air conditioners.

Moreover, and in order to ensure a sustainable approach, numerous industry stakeholders are engaged in the process and include government bodies, semi-government entities, non-governmental organizations, academia, finance, business, industry, and private foundations.

Federal ministries, local municipalities and units (e.g. Abu Dhabi Municipality, Dubai Municipality, Abu Dhabi Urban Planning Council, Dubai Supreme Council of Energy); transportation authority (e.g. Dubai Road and Transport Authority, Department of Transport in Abu Dhabi); waste management units (e.g. Bee'ah, Tadweer); environmental agencies (e.g. Ras Al Khaimah Environmental Protection and Development Authority); and regulatory entities

(e.g. Regulatory and Supervisory Bureaus) are but a few government bodies partaking in the sustainable development process.

NGOs such as the Emirates Green Building Council, Emirates Environment Group and Emirates Wildlife Society, Environmental Centre for Arab Towns are also providing feedback as relates to sustainable strategies, policies, and regulations.

At federal level, the UAE's Vision 2021 targets raising air quality index to 90%, as well as increasing clean technologies to 24% and treated waste to 75%. At the emirate level, both Dubai and Abu Dhabi have reviewed their urban metabolic flow of energy, water, and waste as major indicators for sustainability, resource efficiency, and ecological footprint.

In Dubai, Dubai's Integrated Energy Strategy 2030 (DIES) represents a good example and aims to achieve a 29% clean energy share in the total fuel mix by 2030 of which 15% is generated through solar energy, 7% through nuclear, and 7% from clean coal. Furthermore, Dubai Electricity and Water Authority is focused on reducing the ecological footprint of the public grid, has adopted a carbon dioxide emission reduction program, and is introducing smart grid initiatives that include smart meters as well as electrical vehicles charging stations as part of its efforts to encourage use of solar renewable energy. Dubai Municipality also aims to make the Emirate the most sustainable city in the world by year 2020.

Abu Dhabi on the other hand, is planning to increase the share of nuclear and renewable energy in the electricity production category to 25% and 7% respectively by year 2020. As a project spotlight, Masdar City, a 600-hectare site under construction in Abu Dhabi, is planned to provide a comprehensive and livable environment for its residents while conserving 70% water, 40% energy and reducing up to 60% of its waste generation. The city is anticipated

to contribute to Abu Dhabi's target to attain 7% renewable energy generation by year 2020 and is home to two buildings that have received LEED Platinum certification. Since the launch of the Shams solar power station in 2013, Masdar is generating 100 MW of concentrated solar power, leading to a 449% increase in renewable energy production for the year 2014.

The UAE government has also placed concerted focus on the consumption of underground and desalinated water due to its impacts on food and energy production. With more than 90% of its food being imported, the government has addressed food security challenge by diversifying its food sources, investing in agricultural projects and launching several biodiversity strategies.

Local governmental bodies are also focused on adopting sustainable transportation means and green waste management techniques. Recent initiatives include among others:

- Dubai's Green Transport Initiative of 2015, encouraging the use of sustainable transportation, such as hybrid and electric vehicles;
- Dubai and Abu Dhabi's schemes to enhance mobility and promote healthy lifestyle for their citizens by implementing pedestrian and cycle ways;
- Diverting 100% of Sharjah's waste from its landfills by the waste management company, Bee'ah;
- Dubai Municipality's launch in 2012, of "My City, My Environment", a door-to-door waste collection and recycling program that encourages recycling and provides recycling bins in various parts of the city; and
- Abu Dhabi's emirates-wide Waste Management Strategy launched by Tadweer (Centre of Waste Management) in 2008, with the objective of upgrading collection techniques as well as dump site investigation and rehabilitation.

12.1.2 Sustainable Buildings

Inspired by various federal initiatives, several green building regulations and policies have been developed in UAE at the Emirate level, particularly in the Emirates of Dubai and Abu Dhabi, with the objective of reducing the impact of conventional construction, improving the built environment, and operational performance of new and existing buildings. The momentum behind these initiatives is to position the UAE as a regional leader in the move toward sustainability.

As an example, in 2008 the Estidama framework was developed addressing four pillars of sustainability (environment, economy, society, and culture) and has since been rapidly embraced, adopted, and implemented in the Emirate of Abu Dhabi; (over 1,000 buildings and 12,500 villas were awarded the Design Pearl Rating System (PRS) as of October 2015).

12.2 Baseline

12.2.1 Policies, Laws, Decrees and Technical Standards

Both the Abu Dhabi and Dubai governments have placed concerted emphasis on sustainability and the development of green buildings mandating several resolutions including:

Estidama Pearl Rating System (PRS):

Considering the harsh climatic conditions of the region, the Estidama PRS focuses in depth on water conservation and energy efficiency measures. It also ensures that sustainability is addressed throughout the lifecycle of a project from the design phase through construction and onward to operations via comprehensive audits made during the construction process.

In 2010, the Abu Dhabi Urban Planning Council (UPC) mandated the PRS, as the region's first sustainability rating system for buildings in Abu Dhabi. This rating system provides the minimum

requirements for certification of public and private buildings in the Emirate. Executive Council Order, 2010, sets as a mandatory standard a minimum 1 Pearl rating for all buildings, communities, and private villas while the achievement of a 2 Pearl rating is mandatory for all new government-funded buildings, schools, and mosques.

The government of Dubai has also mandated several resolutions and circulars to support the spread of green building practices in the Emirate including:

- **Administrative Resolution No. 125, 2001:** Approving building regulations and specifications;
- **Administrative Resolution No. 66, 2003:** Approving regulations and technical specifications for thermal insulation;
- **Circular No. 161, 2003:** Implementing Green Building Regulations in the Emirate of Dubai;
- **Circular No. 171 and circular No. 174, 2007:** Implementing Building Green Roofs and facades; and
- **Executive Council Resolution No. 33, 2010:** Approving the Green Buildings Policy Project issued on 1 November 2010.

Dubai's Green Building Regulations and Specifications (GBR&S) is a joint initiative by Dubai Municipality and Dubai Electricity and Water Authority. Following the implementation of the above legal policies and based on the Green Economy for Sustainable Development initiative launched in January 2012, the GBR&S was enforced and implemented on government owned buildings in January 2011 (Administrative Resolution No. 344, 2011) and mandated for all new buildings in Dubai starting March 2014.

Environment Health Safety (EHS) regulations enforce regulatory measures which specify Green Building Regulations for the free zone known as Dubai World.

12.2.2 Institutional Programs

Retrofitting Programs: The Dubai Regulatory and Supervisory Bureau (RSB), formed in 2010 under the umbrella of the Dubai Supreme

Council of Energy, has developed a regulatory framework and an accreditation scheme for local Energy Service Companies (ESCOs), intended to support the energy service market in Dubai. Etihad ESCO, a Dubai Electricity and Water Authority (DEWA) venture established in 2013, manages the retrofit of existing government buildings and facilitates the implementation of energy audits. It also presides over Energy Performance Contract (EPC) tenders, measurement, and verification processes, and the financial security of EPCs. Etihad ESCO has set a target to retrofit 30,000 existing buildings in Dubai by 2030. The estimated saving potential is anticipated between 20%-50% depending on energy prices. In parallel with Etihad ESCO, Mabanina, a private program by Etisalat Facilities Management, was also launched in October 2013 with the aim to maximize energy efficiency, reduce water consumption and maintenance expenses by retrofitting existing private buildings in UAE.

Emirates Green Building Council (EmiratesGBC) manages several programs that support the development of sustainable buildings in the UAE; such as the Energy Efficiency Program (EEP), the EmiratesGBC Hospitality Program, and the Green Key Certification Program.

The EEP is a market-influencing and capacity building platform created to facilitate the reduction of the UAE's carbon footprint through energy efficiency retrofits of existing buildings. As a key achievement of the EEP, EmiratesGBC launched in 2015 its Technical Guidelines for Retrofitting Existing Buildings, both in English and Arabic. The EmiratesGBC Technical Guidelines compile a set of retrofit methods that building owners, operators, and end-users can use to improve a building's performance in terms of energy and water management.

The Hospitality Program is EmiratesGBC's first sector-based initiative. The program aims to provide comprehensive information to hotel stakeholders, such as technical knowledge and operational best practices within the hospitality industry. Water and energy benchmarking and reporting help properties assess their performance, while training modules, along with EmiratesGBC's technical expertise, help train hotel staff.

Green Key is the world's largest global eco-certification program and is present in more than 50 countries and awarded to more than 2300 properties. The program awards hotels on their performance in the fields of water, energy and waste management, as well as for their efforts to communicate with and educate staff and guests on environmental best practices. EmiratesGBC has been working as National Operator of Green Key in the UAE since 2013.

LEED Rating System Application: Leadership in Energy and Environmental Design (LEED) is a voluntary rating system that is widely utilized in the UAE. According to statistics provided by U.S. Green Building Council (USGBC), as of October 2015, 142 buildings have been certified and 790 have been registered for LEED certification in the UAE. The trend of LEED certified projects in the UAE is shown in the figure below and illustrates the increase in the total number of certified projects since 2008.



Figure 12.1 Trend of LEED Certified Buildings in UAE up to 19th October, 2015

12.3 Case Studies

Implementation of the green building regulations and specification in Dubai and the Estidama Pearl Rating System in Abu Dhabi support the UAE's national agenda and promotes the efficient use of resources at both city and federal levels.

According to the results of a case study provided by Dubai Supreme Council of Energy, the estimated cost for the application of the Green Building Regulations and Specification on new buildings (between 2014-2030) and for the retrofit of about 25% of the existing buildings in Dubai is AED 30 billion and AED 3 billion, respectively. Both applications are expected to reduce 6.8 TWh in energy consumption,

20.5 billion gallons of water and 3.9 million tons of carbon dioxide emissions by 2030.

Estidama's alternative assessment protocol has been proven to add further value to projects. The Abu Dhabi Airport Midfield Terminal Building (MTB), Zayed Museum, and the Louvre Abu Dhabi Museum are all projects that were mandated to meet a minimum 2 Pearl Rating; however, through the alternative assessment protocol, in collaboration with UPC, they were awarded a 3 Pearl Design rating without any impacts to their budgets and delivery programs. Other success stories are highlighted in the table below.

<p>MASDAR Eco-city</p>	<p>Masdar eco-city is part and parcel of wider, metabolic and economic–environmental transitional strategies aimed at promoting the emergence of new high-value industrial and commercial sectors in the Emirate, and jump-starting metabolic, environmental transitions through the application of new technologies, lifestyles and patterns of consumption and energy use enabled by the urban and other applications of new technologies (Davidson, 2010). The integration of buildings (and their thermal metabolic inputs and outputs) into wider eco-city plans is evident in the case of the Masdar project.</p> <p>Several buildings currently planned or under construction in the city evidence a high level of sensitivity to thermal issues and to the relation between the individual building's thermal metabolism and that of the wider eco-city.</p>	<div data-bbox="887 203 1449 544" data-label="Image"> </div> <p><i>MASDAR Eco-city (Source: Emirates GBC)</i></p> <p>This is the case, for example, Masdar's Headquarters building which highlights the integration of individual buildings within an eco-city project. The structure's main metabolic claim is that it will be the world's first mixed-use, positive-energy building, using sustainable design strategies and systems to produce more energy than it consumes' (Adrian Smith and Gordon Gill Architecture, 2010). In metabolic terms, the building's design features show that the structure is conceived as a system of inputs, outputs and reactions between different climatic elements and energy sources.</p>
<p>Imperial College London Diabetes Centre</p>	<p>Imperial College London Diabetes Centre (ICLDC) in Al Ain achieved the 2 Pearl Building Rating. Referring to the Estidama Project Log and comparing the ICLDC, Al Ain project to the non-rated ICLDC in Abu Dhabi, which was constructed prior to the PRS becoming mandatory, the 2 Pearl Rated Al Ain ICLDC building achieved a 21% reduction in cooling demand, a 60% reduction in water usage and a 62% diversion of waste from landfill with a payback period of 28 months.</p>	<div data-bbox="887 1218 1437 1469" data-label="Image"> </div> <p><i>Imperial College London Diabetes Centre (Photograph Courtesy of Flickr Creative Common user IDF)</i></p>



Sheikh Zayed Desert Learning Centre	<p>The Sheikh Zayed Desert Learning Centre building (SZDLC) is situated within the UAE World Desert section of Al Ain Zoo. Centre achieved the 5 Pearl Building Rating that places it at the top of Estidama's Pearl Rating System. It reduced up to 35-40% of energy consumption by optimizing building orientation and usage of efficient appliances and renewable energy technologies.</p>	 <p>Sheikh Zayed Desert Learning Centre (Photograph Courtesy of Flickr Creative Common user Aldrich Pears)</p>
DEWA Buildings Retrofit	<p>The project aims to improve the energy efficiency for 7 DEWA buildings by installing 55 energy conservation measures including refurbishment of the old and inefficient chillers, implementation of Variable Frequency Drives (VFDs), usage of solar films on windows, timers and controllers, occupancy sensors for lights, water efficient fixtures, energy management center, etc. Starting from 2016, DEWA will benefit from these measures and reduce 31% of the current energy consumption with a 6-year payback period.</p>	 <p>Dubai Water and Electricity Authority – Al Quoz Building (Photograph Courtesy of Dubai Water and Electricity Authority)</p>

Figure 12.2 UAE sustainable success stories

12.4 Future Actions

A common barrier faced by the construction industry is a lack of awareness among building owners and users on the benefits of sustainable buildings. To address this challenge, local academic, and industry platforms need to demonstrate the applicability and affordability of green building practices in the UAE. Local NGOs such as the Emirates Green Building Council and other business forums should continue to foster awareness of the benefits of adopting and implementing green strategies, provide capacity building, and influence policies to catalyze growth of the green construction sector.

Other conditions which deter incentives to decrease energy and water consumption and act as barriers for implementing green building regulations in the UAE include:

- absence of clear financing schemes by local banks;
- limited availability of financing to building owners to perform retrofits;
- utility bills are mostly paid by tenants;
- government subsidies pertaining to water and electricity tariffs in some Emirates; and
- insignificant low utility bills in the commercial sector, especially when compared to the total operating costs.

To address these challenges government bodies should consider reviewing and amending policies to catalyze growth of the green construction sector, especially in northern Emirates.



Dubai Skyline (Photograph Courtesy of Flickr Creative Common user Eiddany)

12.5 Lessons Learned

Despite structural complexity of federal and local governance within the UAE, there are various initiatives, regulations and projects that showcase the country's commitment and progress toward sustainability across various sectors, including transportation, hospitality, and infrastructure. These initiatives are highly effective as they embody strong ties between the private, public and academic sectors. Moreover, ensuring the readiness of local markets for new green building policies and the regular improvement of these policies are key indicators of success for these green initiatives.

In addition, the enforcement of green building regulations, energy efficiency policies, and waste management initiatives in the UAE actively follow internationally recognized and established best practices and are designed to facilitate the creation of sustainable cities and neighborhoods in the country.

Yet, in comparison to the rapid and pioneering progress in Abu Dhabi and Dubai, other emirates in the UAE have been slower at adopting green building codes and/or energy efficiency strategies. This is likely due to the diversified economic priorities between the emirates, fragmented local and national laws, and limitations with respect to resources, technical expertise, and financing capabilities. Despite these limitations, the northern emirates will soon be catching up to adopt their own sustainability plans based on the federal green vision set by the UAE leaders, the growing relationship between government entities inside each emirate, capacity increase in the private sector, more focused academic research, and a sustained development of government bodies.

XIII. Sustainable Affordable Housing in the Arab Region



(Photo credit: MISC Advertising Agency)

13.1 Sustainable Affordable Housing in Algeria

The government's willingness and eagerness to provide a decent home for every citizen in Algeria is clearly demonstrated and evident in the numerous social housing programs and units constructed in recent years. In the past decade alone, the government housing programs included around 3 million units from which 1.3 million are under construction.

Yet, sustainable affordable housing in Algeria is too many a time confused with social subsidized housing. Government policies regarding social housing subsidies include large subsidies for public housing as well as middle income real estate programs. Subsidies include reduced land cost, for state owned real estate companies, in addition to lower pricing and rents for housing units.

Housing initiatives and programs include:

- social rental programs to support low income populations; for households with income levels under USD 240/month;
- rural property access program aimed to improve the rural environment and limit migration to urban areas (A flat fee of USD 7000 per household is offered);
- intermediate income property access program based on a 25 years lease; for households with income levels of USD 240 to 1000/month; and
- middle class program; for households with income levels from USD 1000 to 2000/months. Household with income higher than USD 2000/month are not subsidized.

The government also provides energy subsidies that affect electricity, gas, transportation costs.

Moreover, and on one hand, the Algerian government has developed since the 1970s, a set of construction guidelines in order to lower the cost of state supported constructions for social housing and public buildings. These guidelines are specifically geared to attain the cheapest construction cost possible. On the other hand, guiding principles have also been developed to assess and mitigate any possible negative environmental impacts resulting from buildings.

Research has also been conducted to examine the possibility of utilizing local building material including stabilized earth in the construction of housing units, yet with no significant results due to the surge in social housing needs and the government's emergency programs.

Nevertheless, social housing construction in Algeria continues while taking into consideration the following prime criteria:

- using structural insulated panels in construction (locally produced);

- improving wind and sun orientation and exposure of buildings;
- improving transportation links with new cities and agglomerations through sustainable transportation modes; and
- recycling of construction waste materials.

Yet, a prime requisite for sustainable affordable housing in Algeria remains the development and employment of solar green energy, sustainable water production and consumption, livability and walkability of the developments.

Organization	Program	Description	Status
A.A.D.L	A.A.D.L "National Agency for Improvement and Housing Development"	Public leasing program. Houses are paid for during a 20 years period	250,000 planned + ongoing programs
OPGI	LPL "Public Rented Housing"	Houses are rented to low income earners	350,000 planned + ongoing programs
ENPI	LPA "Participatory Assisted Housing"	Real estate developers are funded by the government with participation from the buyer	150,000 planned + ongoing programs
	LPP "Public Housing Promotion"	A new public housing promotional formula has recently been introduced for middle class intermediate income	150,000 planned for 2015-2019
	LR "Rural Accommodation"	Rural housing fits into the framework of rural development policy with the objective of promoting rural areas and settling local populations. It is meant to encourage households' self-build decent housing in their towns and villages	300,000 planned + ongoing programs

Table 13.1 Affordable public housing programs in Algeria

13.2 Sustainable Affordable Housing in Bahrain

The Bahrain Housing project represents a notable case study as it involves the development of comprehensive social and affordable housing in the Kingdom while pursuing the concept of sustainability. The project encompasses 3,000 social housing units, 1,000 affordable housing units, commercial as well as retail facilities, a school, in addition to other amenities and services. The project is thought to seek LEED Neighborhood Development certification for master planning as well as LEED New Construction certification for the Apartment Blocks. In 2014, a LEED Neighborhood Development pre-certification was attained.

13.3 Sustainable Affordable Housing in Egypt

The government's eagerness to pursue sustainable development concepts in planning affordable non-conventional housing projects is evident in its initiatives to provide quality low and middle income housing in compliance with the BEEC. The projects are planned within large sustainable and fully integrated communities that afford a multitude of services and amenities, including medical, commercial, recreational and educational, with the objective of optimizing both efficiency and comfort.

In 2008, a major pilot project was entrusted to the HBRC to explore the possibility of introducing energy efficient and environmentally friendly housing system for low income families. The plan was to integrate the BEEC into the design and development of a pilot housing project, which would use energy efficient materials. The pilot project would satisfy strict energy, social and aesthetic requirements and would serve as an exemplar for numerous proposed large scale public developments. The project has served to prompt private - public collaboration. Numerous product manufacturers have stepped forward to herald their products, while developers defined their visions for sustainable communities. The exercise has since brought together architects, planners, engineers, developers, as well as manufacturers to forge a green vision that maximizes LEED certifications, satisfies building efficiency requirements, and lays the foundation

for sustainable communities. Ongoing projects include proposals for low income housing in 6th of October City.

13.4 Sustainable Affordable Housing in Jordan

Jordan's Green Building Council (GBC) launched the Green Affordable Housing pilot project in August 2014. The project was inspired by a workshop conducted by Jordan GBC in collaboration with Habitat for Humanity.

The Green Affordable Housing project aims to raise awareness, offer a paradigm shift, and set right misconceptions pertaining to green affordable housing while enabling low-income groups to access adequate green housing.

The delivery of green affordable housing is expected to facilitate the introduction of sustainability concepts to local communities while encouraging green practices and innovative low cost and energy efficient solutions among volunteers as well as workers partaking in the project. It is anticipated that a set of design guidelines be developed and made available for use as reference for green affordable housing in Jordan.

13.5 Sustainable Affordable Housing in Lebanon

Lebanese housing policies have traditionally been very liberal. The State has been reluctant to intervene in both the housing sector as well as land and construction markets, leaving housing provision to market mechanisms.

Currently the only official sustainability practice is the use of double wall construction. As for incentives, there are reduced charges on loans from the Lebanese central bank for solar heaters, wind mills, as well as for projects that achieve international rating system certification.

Since the issues relating to affordable housing in Lebanon are many and complex, the LGBC would like to focus on continuing work completed on local rating system "ARZ" for existing commercial buildings to include existing and new housing stock.

13.6 Sustainable Affordable Housing in Morocco

Current social housing deficit in Morocco is estimated at 608,000 units at the national scale, with 62% of households still living in substandard housing.

As a revision of the National Initiative for National Development (INDH), especially as relates to the program “Cities without Slums”, the government inaugurated a housing policy promoting social housing, the absorption of slums, and sustainable urban development. A tax incentive was also introduced to insight developers construct low cost social housing projects. Consequently, 78.1% of the market share, for the MAD 250,000 housing units launched in 2011, was held by the private sector followed by Al Omrane Group which held 19.5%, while the public sector acquired only 2.4% of the total market share.

But since the concept of social housing in Morocco is based on affordability, an affordable social house, for the period 2010–2020, has thus been envisioned as a 50 to 100 m² apartment unit designated for low and middle class income owners with revenue of less than one and a half times the minimum professional salary (SMIG). Unit cost is not to exceed MAD 250,000.00 (approx. USD 25,600.00) including VAT and is revised periodically according to price variations.

Yet, following the application of the new Thermal Regulation for Construction in Morocco, social housing projects are required to integrate new regulations and standards pertaining to green constructions while preserving their financial feasibility. Amendments to affordable housing specifications have thus included new provisions related to quality, safety, open space, maintenance, energy efficiency, and community services to conform to sustainability concepts. Furthermore, and mindful of the need to consolidate social and sustainable housing, the National Federation for Property Developers (FNPI) has created the “Iltizam Certificate” to verify environmental and ecological conformity. This has posed numerous challenges and has given rise to numerous initiatives pertaining to Sustainable Affordable Housing in Morocco.

The National Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE), under the supervision of the Ministry of Environment and Energy, launched - in partnership with GEF-UNDP and GIZ - a Code for Energy Efficiency in Buildings (CEEB) focusing on two main components: thermal regulation for the envelope, and energy labeling of household appliances.

New laws and regulations for integrating green building components at affordable costs were also introduced. The Thermal Regulation for Construction sets requirements for different socio-economic categories of buildings, while taking into account the difference in climatic zones. In this respect, ADEREE conducted several pilot projects including some social houses only to ascertain compliance with technical specifications at an additional investment in construction cost averaging 3.2%.

“Cluster de l’efficacité des matériaux de construction” (Cluster EMC), an association for energy efficiency in building materials, initiated a new real estate concept entitled “Logement à Energie Positive” (LEP) or positive energy social project, in partnership with OFPPT and SIE (Energy Investment Company). The project targets the design and construction of a social housing unit that conforms to the new code for energy efficiency in buildings (CEEB), new thermal regulation for construction (TRCM), and produces more energy than it needs to operate.

Another interesting initiative was undertaken by “Mohammed VI’s Foundation for Environmental Protection” as pertains to the use of clay, a traditional local building material with high thermal and energy efficiency properties, in the construction of its Centre for Environmental Education.

13.7 Sustainable Affordable Housing in Palestine

The Palestinian Affordable Housing Program is an excellent example of how donor funding can be used to attract private investment. The program is led by the private sector, with developers incentivized to invest by a layer of grant funding made available upfront for infrastructure. Costs are kept low for potential buyers through the development of affordable mortgage products.

The Affordable Housing Program managed by The Portland Trust is a private sector initiative designed to build affordable housing for new communities and neighborhoods across the West Bank. In 2007 The Portland Trust, working closely with the Palestinian private sector and the Palestinian National Authority (PNA), designed a 1-billion-USD program to build 15,000 affordable housing units in new communities across the West Bank.

The program is expected to create thousands of jobs, boost GDP by 8% over five years and improve the lives of over 200,000 Palestinians. Affordable housing was presented as a key priority for the Palestinians at the Paris Donor Conference in December 2007.

Construction is currently underway with private sector developers building new communities of affordable housing across the West Bank. These include:

- Bayti's new city of Rawabi with 5,000 homes outside Ramallah;
- Ammar Group's Al Reehan neighborhood in Ramallah with 2,000 homes;
- Ammar Group's Al Jinan development of 1,000 homes outside Jenin; and
- Palestine Real Estate Investment Company (PRICO) development of 500 homes in Jifna, Ramallah.

Furthermore in 2014, the Portland Trust worked with the Birzeit University (BZU) to develop a student housing proposal that will allow (BZU) to utilize their land resources and generate immediate income to cover the university's financial shortages. The aim is to position (BZU) as a cultural center by providing high quality housing, activity, and service facilities for students to create a new dynamic university environment.

13.8 Sustainable Affordable Housing in Qatar

Qatar is estimated to have over a million laborers, with an annual increase of 7 to 10

percent anticipated over the next 5 years. The 2010 census indicates that there were approximately 920,000 workers accommodated in more than 36,000 compounds of varying sizes located throughout the country. Historically, the availability of housing for lower to middle-income households has been relatively limited. However, over the past few years, there have been some initiatives by both private and semi-government entities to develop more labor housing compounds and the government is keen on developing and improving the standards for labor accommodation.

This part of the construction sector still faces numerous challenges including lack of proper enforcement of laborers' housing regulations and high cost of land. GORD has developed a GSAS scheme that is specific to accommodation buildings which could be applied to affordable housing projects. Yet, it will be some time before proper examples of sustainable affordable housing in Qatar could be studied and developed further.

13.9 Sustainable Affordable Housing in Saudi Arabia

The Kingdom's growing sustainable affordable housing crisis is compounded by lack of regulations relating to the application of sustainable methods. Regulations and compulsory building codes that incorporate the concepts of sustainable development are limited and lacking. Inadequate involvement of the public sector in the housing industry especially in sustainable construction allowed the private sector to dominate the industry while paying little or no attention to implementing sustainability concepts. This is partially due to lack of awareness as to the benefits and cost of applying sustainability measures and techniques to housing construction. Sustainable housing at present still remains a luxury option and is largely provided if and when the financial capacity to pay for it is made available. Scholars have thus argued that setting a coherent set of codes and standards is one cost-effective way to promote widespread sustainable practices, especially with regard to reducing household energy and water consumption.

13.10 Sustainable Affordable Housing in the UAE

Factors such as economic recovery, rapid population growth, and rising rental costs have been pressuring not only the real estate market but also the development of affordable housing in the UAE. The market is characterized by a shortage of middle-class housing.

In recent years, sustainable affordable housing has been addressed in the UAE. On the one hand, housing programs, such as Sheikh Zayed Housing Program (SZHP) and Mohammed Bin Rashid Housing Establishment (MRHE), offer Emirati nationals financial facilities. (SZHP) offers interest-free loans or non-refundable grants for purchasing a new house, maintenance, expansion, construction, or even the purchase of a second home if family circumstances require. On the other hand, large project developers have also been considering the affordable housing market. Tasweek, for example, launched projects in Dubai and Abu Dhabi catering to the middle-class.

New constructions must comply with the Green Building Regulations and Specifications in Dubai and the minimum requirements under the Estidama Pearl Rating System in Abu Dhabi. These sustainability standards provide a base factor for the development of sustainable affordable housing market in the UAE. Yet, how to provide sustainable and affordable accommodations for low and middle class incomes should thus be a focus of government bodies, local academic, and industry platforms.



XIV. Conclusions and Recommendations

In this report, twelve country reviews present a general overview of the state of sustainable cities, buildings, and affordable housing in the Arab Region. Information on policies, trends, regulations, programs, relevant organizations, as well as initiatives both implemented and in the pipe lines are illustrated.

Based on the findings of this report and from the information assembled, it is but apparent that levels of awareness as pertains to sustainable cities and buildings in the Arab Region vary from one country to the other, yet remain limited. Concepts of “Sustainable Cities and Buildings” are not widespread. Despite diverse efforts and initiatives to advance and adopt sustainable green building concepts, it is safe to conclude that the countries reviewed show limited awareness, narrow application, and modest understanding of the concepts, their value, economic viability, and application methods - this is particularly the case of the general public and the construction sector. Nevertheless, the concept of sustainable buildings and cities is becoming more and more popular among regulators as well as governments. Countries reviewed demonstrate a resolve, at the national level, recognizing and embracing sustainability concepts.

Respective national governments have adopted policies in an attempt to integrate sustainability concepts into existing and new cities. Supporting policies, laws, decrees, standards, and initiatives have been launched and in cases enacted in many of the countries reviewed; yet vary greatly in form and level of implementation from one country to another. Various aspects of sustainability including but not limited to renewable energy, energy efficiency, clean water and air, environmental standards, infrastructure, public transport systems, waste management, affordable housing delivery, improvement of living conditions, and greening the economy have been tackled at different levels. Countries such as Egypt, Jordan, Qatar, Lebanon and the UAE

have developed their own rating tools to measure performance and certify buildings. International rating tools were also used in several countries throughout the region. In addition, energy related building codes were introduced on a relatively wide scale, however, the degree by which those codes were implemented varies considerably from one country to another and generally lack enforcement. Nonetheless, governments have not set comprehensive sustainable policies, in particular from a city metabolism and environmental perspective, as focus is mostly on energy, water, building, and housing delivery. Food consumption, waste, health and wellbeing issues within the built environment require further attention from countries observed.

Except for some scattered efforts and a few success stories, focus on sustainable and resource efficient communities and cities has yet to gain momentum on policy level. An integrated, comprehensive and streamlined approach is thus necessary for ensuring dissemination of the concept throughout the Arab Region. In some cases, regulatory frameworks ensure compliance to international standards but are not specifically linked to sustainability performance improvement. While efforts have been developed for a regulatory framework, control is still poor and there are no ways to ensure that standards for resource efficiency are implemented. Absence of standards for issues like domestic solar energy use and lack of ability to sell generated solar energy surplus impede sustainability initiatives. Regulatory and standards' framework thus need further development with more precise sustainability procedures introduced to ensure implementation.

A major hurdle in implementing sustainability concepts is the absence of legislation for green construction, energy conservation, water conservation, etc. as initiatives continue to be applied on voluntary basis. Another stumbling block is the lack of awareness particularly since

recent drop in oil prices hasn't favored the feasibility of alternative energy projects. It is thus imperative that governments take constructive steps towards advancing and integrating sustainable development concepts in legislation.

Furthermore, and in order for municipalities to respond to challenges, keep up with increasing local demand, and provide for sustainable development, more decentralization and local authorities empowerment is needed coupled by necessary modifications to the legal framework. Countries hosting large populations of refugees, however, require further attention in terms of their effect on sustainable development and their vulnerable infrastructures.

Additionally, and in order to move forwards with sustainable cities and buildings in the Arab Region, issues relating to consumer behavior need to be appropriately addressed and improved in parallel to advocating for more sustainable policies and regulations. Retrofitting of the existing building stock should also be addressed in detail as it constitutes excellent business and job creation opportunities.

What's more, countries observed are host to a number of success stories that could be promoted and implemented in neighboring countries of the Arab Region. Knowledge sharing is thus essential in advancing sustainability concepts forward. Experts involved in this report agree on the need to create more awareness especially as relates to social, economic and environmental benefits of creating sustainable communities. Creating platforms for knowledge dissemination, deliberation and exchange of best practices is definitely beneficial. Promoting sustainable affordable housing is relevant to most if not all countries in the region, exchanging best practices with the aim of realizing a balance between affordability and sustainability could thus constitute a twinning opportunity for cities in the Arab Region. It is worth noting here that several members of the World GBC Arab network namely: Jordan, Qatar, Lebanon, Libya, and the UAE had formerly agreed to establish a regional task force with the objective of exploring "Sustainable Affordable Housing" and developing GBC activities to advance this sector both locally and regionally. A pro-active

role which can be played by Regional Centre for Resource Efficient and Sustainable Cities in the Arab Region or Dubai Centre of Excellence in the future, especially on the social and economic benefits of creating sustainable communities amongst decision makers.

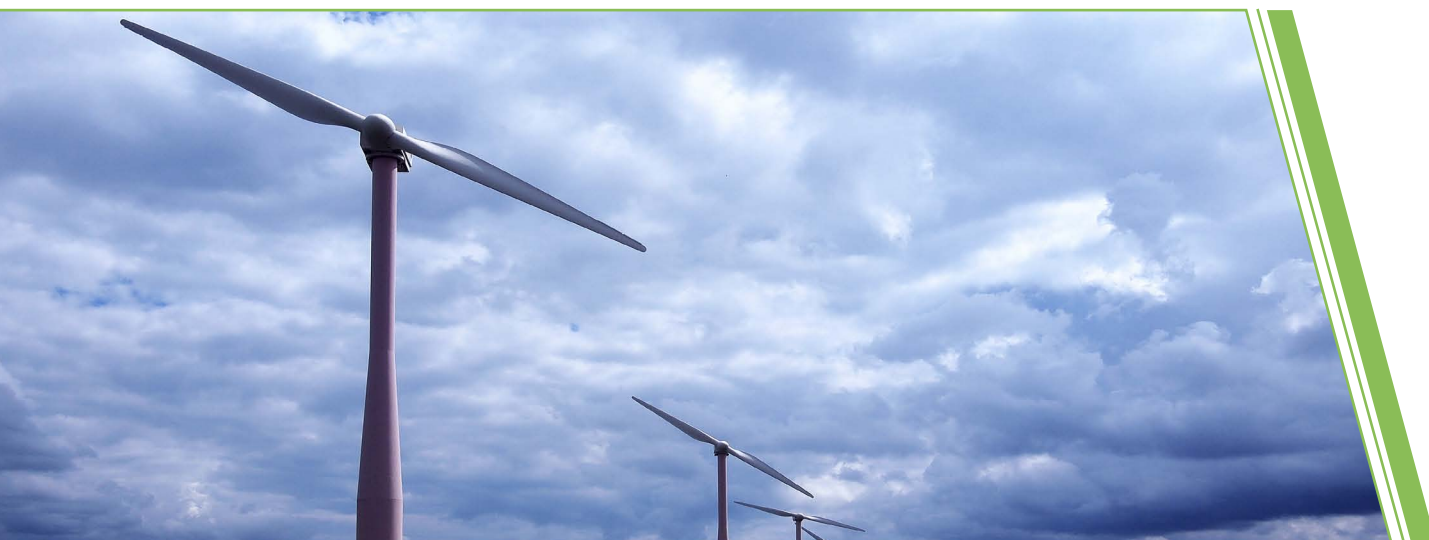
Hence, and in account of the above remarks and recommendations, it is highly advised that governments and local authorities in the Arab Region adopt the following procedures to advance sustainable development in their respective countries:

- Explicitly position sustainable cities and buildings in the public policy agenda, through a national strategy or plan that integrates and directs actions, with the objective of incentivizing sustainable cities and buildings and adopting adequate planning instruments to realize set goal.
- Clearly allocate different mandates among concerned government ministries and institutions avoiding conflicting while ensuring satisfactory adoption of sustainability objectives.
- Integrate sustainable city and building policies and strategies into national transversal policies relating to climate change, energy efficiency and social housing and sustainable development.
- Incorporate sustainable cities and building concepts into strategic urban and city planning agendas.
- Reduce energy subsidies while introducing targeted subsidies relating to energy efficiency and renewable energy - as energy subsidies impede transformation towards clean energy.
- Develop and launch incentives, including financial and taxation measures, to promote sustainability at various levels and scales while adopting instruments to measure and verify compliance.
- Instigate intensive training and capacity building programs catering to the development of public policies and implementation of sustainable building

practices. Programs should consider adequate partnerships and all concerned stakeholders, taking into account various players in the construction sector chain and not be confined to professional architects and engineers.

- Develop guidelines for improvement of sustainable building policies, instruments and programs thus, enabling countries incapable of complying with international certification standards the opportunity to adopt localized tools and programs.
- Advocate and support institutional coordination, partnerships, and team work among public and private sectors, academia, and the civil society.
- Encourage and support eco-innovation as well as small and medium enterprises for mainstreaming environmental sustainability and resource efficiency".
- Emphasize the role of research and NGOs in advocacy and in raising the sustainability bar while asserting the need to develop their capacity in this regard.
- Showcase success stories as well as pilot projects and initiatives.
- Develop regional cooperation initiatives to promote exchange of resources, technology and knowledge.
- Foster knowledge transfer and experience exchange through regional and international sustainability forums.

XV. Next Steps



(Source: <https://pixabay.com>)

Research conducted in 12 Arab countries through this report clearly indicates the need for having a point of reference, to serve and facilitate issues relating to sustainable cities and buildings in the Arab Region. This could include launching a Regional Centre, i.e. Dubai Centre of excellence, for sustainable cities in the Arab Region. The Centre would serve as knowledge hub and platform providing technical assistance, capacity building, develop guidelines, and offer awards for distinguished achievements in the region.

This Centre will report regionally on SDGs and will compile and share good practices in sustainable urbanization and sustainable buildings. Capacity building on data collection and reporting is required in order to provide decision makers with the information they need in order to develop market transforming policies.

The table hereunder illustrates the anticipated activities to be undertaken in the next five years:

No	Activity	Time Frame
1.	Launch a “Knowledge Centre” and research sustainable city trends in the Arab Region.	First Year
2.	Form an advisory board for the Centre including representatives from each GBC/country.	First Year
3.	Identify and involve government partners	First Year
4.	Develop a strategic plan for the Centre, based on the findings of the State of Play Report	First Year
5.	Conduct audits and pilot projects to showcase the applicability of sustainable cities in the region	Second & Third Year
6.	Ongoing research and business development	Fourth & Fifth Year
7.	Develop sustainable city strategies based on the success of pilot projects	Fourth & Fifth Year

Table 15.1 Regional plan of activities in the next five years

During the five-year time line, the Centre will determine responsibilities for identified activities and will focus on developing five areas that impact sustainable cities and buildings in the region namely: pertinent data, legislation, capacity building, partnerships and advocacy. Centre activities will include:

Data collection

Research conducted clearly indicates the absence of relevant data on a regional scale. Yet, little can be achieved on the policy level without relevant and precise data. The Centre will thus seek to:

- identify type of data needed and what it will be used for;
- compile required data at both the national and regional levels and serve as knowledge hub on sustainable cities and buildings;
- serve as a focal clearing point for all data available;
- link regional data hubs with international counter parts;
- exchange resources on available data;
- develop the first regional report on the State of Resource Efficiency in Arab Cities using relevant SDG indicators;
- compile relevant targets and indicators of SDG 6, 11, 12, 13 and 15; and
- identify regional issues for GCC, Levant and North Africa.

Legislation

As each country aspires to introduce Environmental Sustainable Principles into its National Urban Policies, there is pressing need to thoroughly research existing legislation, and evaluate and assess the current state of affairs. Experts have highlighted the need for and significance of studying local communities; recognizing their needs; and ensuring their active participation, as a basis for warranting more proactive laws and regulations and incorporating sustainability concepts into the legal structure. Accordingly, the Centre will compile a database of all relevant regional legislation and will assess current codes

in order to identify areas that require further development. The goal is to integrate sustainable cities and buildings' minimum requirements into existing legislation and codes.

Capacity building

Capacity building and awareness go hand in hand. Therefore, it is of relevance to conduct an inclusive capacity building needs' assessment across different aspects of sustainability in each country, and organize awareness campaigns that reach out to different segments of society, including, but not limited to, decision makers, government officials, professionals, and university and school students. City metabolism, principles of sustainable urban planning, affordable sustainable housing, and building codes are a few areas that require capacity building.

The Centre will thus serve as a platform for training and capacity building as well as for sharing regional success stories.

Partnerships

The Centre will utilize existing networks to identify partnerships and city twinning opportunities within the region and internationally, with the objective of creating regional associations and affiliations with stakeholders from the public and private sectors, NGOs, as well as from academia and research. Such a setup should strengthen cooperation between all stakeholders including governments, municipalities, business associations, civil society and others.

Partnerships could also empower the private sector to drive market transformation toward more sustainable buildings through establishing national urban forums.

Advocacy

Through its research capabilities and in coordination with GBCs and other concerned stakeholders such as cities and local authorities association and networks, the regional Centre will identify key stakeholders in each country; increase their awareness; and launch public campaigns, thus encouraging governments to take on a more proactive role towards sustainable development. The Centre will also seek to engage companies and corporations in voluntary rating schemes.

XVI. References

Introduction

- Towards a Green Economy (UNEP 2011). (Accessed 2015): <http://web.unep.org/greeneconomy/>
- Mapping Exercise GI-REC (UNEP 2013). (Accessed 2015): http://www.unep.org/resourceefficiency/Portals/24147/scp/REC/GI-REC_%20Executive%20Summary%20Mapping%20Exercise.pdf

About this Report

- Kennedy C., Cuddihy J., and Engel-Yan J. (2007), The Changing Metabolism of Cities. (Accessed 2015): <http://onlinelibrary.wiley.com/doi/10.1162/jie.2007.1107/abstract>

Algeria

- Agency for Housing Development AADL (2015), (Accessed 2015): www.aadl.com.dz
- Ministry of Habitat and Cities (2015), (Accessed 2015): www.mhuv.gov.dz
- National Agency for Energy Efficiency and Rationalization APRUE (2015). (Accessed 2015): www.aprue.org.dz
- National Centre for Studies and Research on Building and Construction CNERIB (2015). (Accessed 2015): www.cnerib.edu.com
- National Renewable Energies Development Centre CDER (2015). (Accessed 2015): www.cder.dz
- New City of Sidi Abdellah (2015). (Accessed 2015): www.vnsa.dz
- R20MED Initiative (2015). (Accessed 2015): www.r20med.region20.org

Bahrain

- Airport Expansion (2015). Energy and Sustainability Projects. (Accessed 2015): <http://www.aesg-me.com/project/bahrain-international-airport-expansion/>
- Alnaser W. and Falnagan R. (2005). The_need_of_sustainable_building_construction_in_the_Kingdom_of_Bahrain.(Accessed 2015): <http://www.researchgate.net/publication/228349236>
- Bahrain Housing. (Accessed 2015): <http://aesg-me.com/project/bahrain-housing/>

- Central Informatics Organization (2010). Review of the progress of the millennium development goals in the Kingdom of Bahrain. (Accessed 2015): http://www.cio.gov.bh/cio_eng/English/Publications/Reports/English%202010%2010%2012.pdf
- E. Government (2015). Protection of the environment and the natural resources. (Accessed 2015): <http://www.bahrain.bh/wps/portal/!ut/p/a1/>
- GDN Online (2015) Focus on green technology in construction industry, (Accessed 2015): <http://archives.gdnonline.com/NewsDetails.aspx?date=04/07/2015&storyid=398621>
- Go Green Presentation (2014), Energy and Sustainability Projects (2015), (Accessed 2015): <http://www.mof.gov.bh/categorylist.asp?cType=green>
- Ministry of Energy, National Oil and Gas Authority (2015). (Accessed 2015): <http://www.noga.gov.bh>
- Ministry of Housing (2015). (Accessed 2015): <http://www.housing.gov.bh>
- Ministry of Municipalities (2015). (Accessed 2015): <http://www.municipality.gov.bh/mun/>

Egypt

- Arandel C. and El-Batran M. (1997). "Informal Housing Development Process in Egypt", University College London- UCL, London, (Accessed 2015): <https://www.bartlett.ucl.ac.uk/dpu/publications/dpu-paper-82>
- Attia S. & Khalil H. (2015). "Urban Metabolism and Quality of Life in Informal Areas", in REAL CORP 2015: PLAN TOGETHER-RIGHT NOW-OVERALL, Ghent- Belgium (Accessed 2015): http://conference.corp.at/archive/CORP2015_19.pdf
- Attia S. and Khalil H.A. (2015). "Urban Metabolism and Quality of Life in Informal Areas" "Proceedings REAL CORP 2015 Tagungsband 5-7 May 2015, Ghent, Belgium. (Accessed 2015): <http://www.corp.at>
- Mejía Dugand S., Hjelm O., and Baas L. W. (2011). "Improving energy and material flows: a contribution to sustainability in megacities", World Renewable Energy Congress, Sweden, Linkoping- Sweden. (Accessed 2015): https://www.iei.liu.se/envtech/forskning/forskningsprojekt/megatech/megatech/1.273693/Improvingenergyandmaterialflows_acontributiontosustainabilityinmegacities.pdf
- Central Intelligence Agency-CIA (2015), Egypt- the World fact book. (Accessed 2015): <https://www.cia.gov/library/publications/the-world-factbook/geos/eg.html>
- Egyptian Environmental Affairs Agency (EEAA) (2015). "Integrated Sustainable Communities, Housing and Construction in Egypt", Regional-Governance and Knowledge Generation Project- (GEF Grant), funded by Blue Plan, Second Draft, (Accessed 2015): www.eeaa.gov.eg
- Egyptian National Competitiveness Council (2012). "A Sustainable Competitiveness Strategy for Egypt", The 8th Egyptian Competitiveness Report, Cairo, (Accessed 2015): http://www.encc.org.eg/inside.php?p=temp_text&pid=102&id=28

- Ellis K. & Nakhooda S. (2012). "Green Growth Opportunities and Requirements in Egypt", Funded by Federal Ministry of Economic cooperation and Development and Published by GIZ: Deutsche Gesellschaft für International Zusammenarbeit (GIZ) GmbH (Accessed 2015): <https://www.giz.de/fachexpertise/downloads/giz2012-en-green-growth-egypt.pdf>
- Green Building Council Egypt (Accessed 2015): <http://www.egypt-gbc.org/>
- Huang, J. and Berkely L. (2003), "The Development of Residential and Commercial Building Energy Standards for Egypt", DOE, (Accessed 2015): <http://gundog.lbl.gov/dirpubs/55521.pdf>
- New and Renewable Energy Authority (Accessed 2015): <http://www.nrea.gov.eg/english1.html>
- Trading Economics (Accessed 2015): <http://www.tradingeconomics.com/egypt/gdp-growth-annual>
- United Nations Human Settlements- UN Habitat (2014), "The State of African Cities: Re-imagining sustainable urban transitions". (Accessed 2015): <http://unhabitat.org/books/state-of-african-cities-2014-re-imagining-sustainable-urban-transitions/>
- United Nations Environment Programme-UNEP (2011). "Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication". (Accessed 2015): <https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=126&menu=35>
- World Data Bank (Accessed 2015): <http://databank.worldbank.org/data/reports.aspx?source=2&country=EGY&series=&period>

Jordan

- AL-Zu'bi R. (2015) "ECO-MENA", Article: SEA as Sustainability Mainstreaming and Planning Tool in Jordan (Accessed 2015): <http://www.ecomena.org/sea-jordan/>
- Ayla Project (2008). (Accessed 2015): www.ayla.com.jo
- (NEEAPs), Jordan Energy Efficiency Action Plan, (Accessed 2015): http://www.rcreee.org/sites/default/files/plans_neeap_jordan_2013_en.pdf
- Citerne F., Goldsmith D. and Beliveau Y. (2014). 50th ASC Annual International Conference Proceedings, Associated Schools of Construction "Overview of International Green Building Rating Systems". (Accessed 2015): <http://ascpro0.ascweb.org/archives/cd/2014/paper/CPGT206002014.pdf>
- Jordan Development Zones Company (2015). (Accessed 2015): www.jdz.jo
- Mahroum S., Al-Bdour J., Scott E., Shouqar S. and Arafat A. (2015). Country Case Study, Jordan. Atlas of Islamic World Science and Innovation. (Accessed 2015): <https://royalsociety.org/~media/policy/projects/atlas-islamic-world/atlas-jordan.pdf>
- Stiftung F. and Royal Scientific Society (2013). "Green Building Development in Jordan". (Accessed 2015): <http://library.fes.de/pdf-files/bueros/amman/10678.pdf>
- Stiftung F. (2015). "Green Building Development in Jordan" (Accessed 2015): <http://library.fes.de/pdf files/bueros/amman/10678.pdf>

- Stiftung F. (2015). "Sustainable Energy Mix and Policy Framework for Jordan" (Accessed 2015): <http://library.fes.de/pdf-files/bueros/amman/08883.pdf>
- Visser F. (2013). Arab Forum for Environment and Development Magazine, Article: Dead Sea Development Zone Project – Jordan (Accessed 2015): <http://www.afedmag.com/english/ArticlesDetails.aspx?id=88>

Lebanon

- Arz Building Rating System (2015). (Accessed 2015): www.arzrating.com
- Banque du Liban BDL presentation in Beirut Energy Forum (2015). (Accessed 2015): www.beirutenergyforum.com/
- CEDRO project (2015). (Accessed 2015): www.cedro-undp.org/
- Cleaner Energy Saving Mediterranean Cities (CES-MED) (2015). (Accessed 2015): www.ces-med.eu
- Eco-Consulting (2015). (Accessed 2015): www.Ecoconsulting.net
- Lebanese Center for Energy Conservation (LCEC) (2015). National Energy Efficiency and Renewable Energy Action Plan (NEEREA). (Accessed 2015): <http://www.lcec.org.lb/en/NEEREA/AboutUs>
- Lebanese Green Building Council (LGBC) (2015). (Accessed 2015): www.Lebanon-gbc.org
- National Sustainable Development Strategy (2015). (Accessed 2015): www.nsdspcm.gov.lb
- Support Program for Infrastructure Sector Strategies and Alternative Financing (2015). (Accessed 2015): <http://sissaf-lebanon.eu/>

Morocco

- ADEREE (2015) Our Charter. (Accessed 2015): <http://www.aderee.ma/index.php/en/aderee/notre-charte-en>
- Ammara (2015) speech "Cérémonie de présentation de la revue en profondeur de la politique énergétiques du Maroc," retrieved from. (Accessed 2015): <http://www.mem.gov.ma/SitePages/Discours/DiscoursAmara31oct14.pdf>
- Archimédia (2013). Berrechid accueillera un éco-parc industriel, (Accessed 2015): <http://www.archimedia.ma/a-la-une/concoursdistinctions/3394-berrechid-accueillera-un-eco-parc-industriel>
- Bentahar H. and Mehyaoui M. (2014). "Logement social au Maroc entre logique économique et finalité sociale", Dossier de recherches en économie et gestion, issue 3. (Accessed 2015): http://www.redoreg.com/Tcomplet/MEHYAOUI_3.pdf
- Casa Finance City (2015). Presentation, (Accessed 2015): <http://www.casablancafinancecity.com/en/content/presentation>

- Challenge. ma (2016). « LEP, un premier logement social à énergie positive au Maroc », (Accessed 2016): <http://www.challenge.ma/lep-un-premier-logement-social-a-energie-positive-au-maroc-63498/>
- Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) (2015). Profile, (Accessed 2015): <https://www.giz.de/en/aboutgiz/profile.html>
- Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) (2015). Morocco, (Accessed 2015): <https://www.giz.de/en/worldwide/340.html>
- Institut de Recherche en Énergie Solaire et Énergie Nouvelle (IRESEN) (2015). (Accessed 2015): <http://www.iresen.org/en/index.html>
- L'économiste (February 2016), « Logement à énergie positive et c'est du social! », (Accessed 2016): <http://www.leconomiste.com/article/983812-logement-energie-positive-et-c-est-du-social>
- La Vie Eco (April 2007). "Dérives dans le logement social", (Accessed 2015): <http://lavieeco.com/news/economie/derives-dans-le-logement-social-2503.html>
- Leconomiste (April 2010). "Logement Social ce que contient le cahier de charge", edition n°3262 (Accessed 2015): <http://leconomiste.com/article/logement-socialbrce-que-contient-le-cahier-des-charges>
- Ministère de l'Énergie, des Mines, de l'Eau et de l'Environnement (2015). Documentation (Accessed 2015): <http://www.mem.gov.ma/SitePages/MenuHaut/Documentation.aspx#>
- Moroccan Agency for Solar Energy (MASEN) (2015). (Accessed 2015): Our Missions <http://www.masen.org.ma/index.php?Id=5&lang=en#/>
- National Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE) (2015). Thermal Regulation of Construction in Morocco (Accessed 2015): <http://www.aderee.ma/index.php/en>
- Office Chérifienne des Phosphates (OCP) (2015). Ville Verte Mohammed VI, (Accessed 2015): <http://www.ocpgroup.ma/fr/sustainability/green-cities>
- Regional Centre for Renewable Energy and Energy Efficiency (RCREEE) (2015). Morocco, (Accessed 2015): <http://www.rcreee.org/content/morocco>
- Société d'Investissements Énergétique (SIE) (2015). (Accessed 2015): <http://www.siem.ma/en/the-sie>
- Taghazout Bay (2015). Obtention de la certification HQE Aménagement™, (Accessed 2015): <http://www.taghazoutbay.ma/index.php/en/news/80-obtention-de-la-certification-hqe-amenagement-tm>
- Wilaya de la region du Grand Casablanca (2015), Plan de développement du Grand Casablanca 2015-2020. (Accessed 2015): <http://www.e-madina.org/2015/07/14/casablanca-plan-de-developpement-2015-2020-priorite-a-la-mobilite-et-aux-infrastructures/>

Palestine

- European Union Press Release (2015), Waste Water Treatment Plant in Tubas, (Accessed 2015): http://eeas.europa.eu/delegations/westbank/documents/news/2015/20151022_pr_sewerage_tubas_en.pdf
- Qattan Foundation Building. (Accessed 2015): <http://www.archdaily.com/285678/a-m-qattan-foundation-bulding-winning-proposal-donaire-arquitectos>.
- Green Building Report. (Accessed 2015): <https://www.youtube.com/watch?v=Rtib5Y9b8t0>
- Global Communities (2015). (Accessed 2015): <http://www.globalcommunities.ps/page.php?id=GnQrty7EfYa174033AUGscM0Nem4>
- Going Green in Gaza (2012). (Accessed 2015): <http://urbanpeek.com/2012/01/28/green-school-prototype-gaza-palestine>
- Palestine Central Bureau of Statistics (PCBS) (Accessed 2015): <http://www.pcbs.gov.ps>

Qatar

- Colletti AJ. (2014), Ashghal – Public Works Authority Projects,
- Qatar General Secretariat for Development Planning (2011), Qatar National Development Strategy 2011-2016: Towards Qatar National Vision 2030, (Accessed 2015): <http://www.agenceecofin.com/images/Finance/Qatar%20National%20Development%20Strategy%202011-2016.pdf>
- Qatar Rail (2015), Doha Metro Fact Sheets, (Accessed 2015): www.qr.com.qa
- Zafar S. (2015), Solid Waste Management in Qatar, (Accessed 2015): www.ecomena.org

Saudi Arabia

- Al Surf M. (2014), Challenges Facing the Application of Sustainability to Housing in Saudi Arabia, (Accessed 2015): http://eprints.qut.edu.au/78685/3/Mohammed_Saied_Al_Surf_Thesis.pdf
- Grantham Research Institute, (2015), Climate Change Legislation in Saudi Arabia, (Accessed 2015) :<http://www.lse.ac.uk/GranthamInstitute/legislation/countries/saudi-arabia/>
- Royal Commission Yanbu (2014), Sustainability Report. (Accessed 2015): <https://www.rcjy.gov.sa>
- The Guardian, (2014), Saudi Arabia's green decree brings hopes of sustainability, (Accessed 2015): <http://www.theguardian.com/sustainable-business/saudi-arabia-green-construction-oil-sustainability-environment>

UAE

- Abu Dhabi Urban Planning Council (2015). (Accessed 2015): <http://www.upc.gov.ae/>
- Caprotti F. and Romanowicz J. (2013), Thermal eco-cities: green building and urban thermal metabolism, International Journal of Urban and Regional Research 37(6): 1949-1967.(Accessed 2015): <http://onlinelibrary.wiley.com/doi/10.1111/1468-2427.12049/abstract>
- Davidson, 2010, Social Sustainability (2010). (Accessed 2015): https://www.researchgate.net/publication/50928296_Abu_Dhabi's_global_economy_integration_and_innovation
- Etihad Energy Services ESCO (2015), (Accessed 2015): <http://www.etihadesco.ae/>
- Etihad ESCO. DEWA Building Retrofit (2015). (Accessed 2015): http://www.etihadesco.ae/wp-content/uploads/2015/07/EtihadEsco_ProjectSheet_Dewa_Bldg_Retrofit1.compressed.pdf
- Oil & Gas Journal (2015). Worldwide Look at Reserves and Production. (Accessed 2015):<http://www.ogj.com/articles/print/volume-112/issue-1/drilling-production/worldwide-look-at-reserves-and-production.html>
- Sheikh Zayed Desert Learning Centre (2015). (Accessed 2015): <http://estidama.upc.gov.ae/szdlc/about.html>
- Smith, A. and Gill, G. Architecture 2010, Masdar Headquarters – Abu Dhabi. (Accessed 2015): http://smithgill.com/work/masdar_headquarters/
- Statistic Centre – Abu Dhabi (2015). Statistical Year Book of Abu Dhabi 2015. (Accessed 2015): <http://www.scad.ae/en/Pages/ThemesReleases.aspx?ThemeID=7>
- Statistic Centre – Abu Dhabi Waste Statistics (2013). (Accessed 2015): <http://www.scad.ae/en/Pages/ThemesReleases.aspx?ThemeID=7>
- United Arab Emirates (2015). Intended Nationally Determined Contribution of the United Arab Emirates (Accessed 2015): <http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx>
- US Green Building Council (2015), (Accessed 2015): <http://www.usgbc.org/>

For more information:
UN Environment,
Economy Division,
1 Miollis Street,
Building VII
75015 Paris, France
Tel: +33 (0)1 44 37 14 50
Fax: +33 (0)1 44 37 14 74
E-mail: unep.dtie@unep.org
www.unep.org/resourceefficiency

www.unep.org

United Nations Environment Programme
P.O. Box 30552 Nairobi, Kenya
Tel: ++254-(0)20-762 1234
Fax: ++254-(0)20-762 3927
E-mail: unepub@unep.org

