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Arab Climate Resilience Initiative
Climate Change: Economic challenges and Opportunities in the Arab Regions

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ARAB
CLIMATE RESILIENCE
INITIATIVE

Regional/Thematic Consultation on
Climate Change: Economic challenges and Opportunities in the Arab Regions

List of Acronyms

AFED	Arab Forum For Environment and development
BOT	Build-Operate-Transfer
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CERs	Certified Emission Reduction Certificates
CFL	Compact Fluorescent Lamp
CNG	Compressed Natural Gas
CSP	Concentrated Solar Power
DSM	Demand Side Management
EE	Energy Efficiency
EU	European Union
ESCO	Energy Service Company
FDI	Foreign Direct Investment
FIT	Feed-in-tariff
FNME	National Fund for Energy Management, Algeria
GCC	Gulf Cooperating Council
GDP	Growth Domestic Product
GEF	Global Environment Facility
GERD	Gross Domestic Expenditure on R&D
GHG	Greenhouse Gases
HDI	Human Development Index
HVAC	Heating Ventilation and Airconditioning
IPCC	Intergovernmental Pannel on Climate Change
IPPs	Independent Power Producers
IPR	Intellectual Property Rights
KSA	Kingdom of Saudi Arabia
LAS	League of Arab States
LDC	Least Developing Countries
LEED	Leadership in Environment, Energy and Design
LNG	Liquefied Natural Gas
MDGs	Millennium Development Goals
MW	Megawatt
NGOs	Non-Government Organization
ODA	Official Development Assistance
PV	Photovoltaic
R & D	Research and development
RBAS	Regional Bureau of Arab States
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
RE	Renewable Energy
SDIAR	Sustainable Development Initiative of the Arab Region
SLR	Sea Level Rise
TNA	Technology Needs Assessments
TOE	Tonne Oil Equivalent
TPF	Third Party Financing
UAE	United Arab Emirates
UNDP	United Nation Development Programme
UNFCCC	United Framework Convention on Climate Change
USGBC	US Green Building Council
WB	World Bank

1 Introduction

The recently launched 2009 Arab Human Development Report on "Challenges to Human Security in the Arab Countries" identifies the pressure on environmental resources as one of the main dimensions for achieving human security in the region. The Arab region is one of those least responsible for the direct creation of the greenhouse effect - According to the global Human Development Report 2007/2008 and world development indices for 2007, the region's share of carbon dioxide emissions was no more than 4.7 per cent—lower than any other region except Sub-Saharan Africa. However, the region is also the nearest to becoming a direct victim of climate change.

As the United Nations' global development network, The UNDP's goal is to align human development and climate change management efforts by promoting mitigation and adaptation activities that accelerate socio-economic progress. The Regional Bureau for Arab States (RBAS) of UNDP will support the implementation of UNDP's corporate approach and strategy at the regional level. The Bureau will adopt a phased approach in developing and implementing a region specific and demand-driven strategy while ensuring

- Building on existing national efforts led by the Country Offices in the region
- Coordination with other existing actors and establishment of new partnerships
- Securing a high level of engagement and ownership by the national partners and actors, and
- Development and implementation of activities responding to the identified needs.

The RBAS plan to conduct a process of consultations with the two following main results: i) mobilize the key national and regional actors and ii) develop a Common Vision/strategy on Climate Change in the Arab Region that will be translated into a concrete programme.

This working paper aims to suggest a strategic and action oriented recommendations for developing a potential win-win inter-Arab corporations in some specific sectors related to Climate Change (Urban planning, Energy efficiency, Renewable energy, Clean technology transfer, Financial mechanisms, Research and development and knowledge development and management) involving the key actors. To secure early political ownership, the paper has deeply explored policy recommendations included in the Arab policy declarations, and strategies adopted by the governments of the region such as the sustainable development initiative in the Arab region, the Arab strategy for sustainable consumption and production, and the Arab strategy on climate change. The paper was meant to trigger a regional debate on relevant priorities for UNDP interventions as well as opportunities for inter-Arab cooperation.

2 Vision

This working paper aims to promote Arab-Arab cooperation in the areas of climate change (Urban planning, Energy efficiency, Renewable energy, Clean technology transfer, Financial mechanisms, Research and development and knowledge development and management) while contributing to human development.

3 Strategic approach

In response to the phased approach of the RBAS in developing and implementing a region specific and demand-driven strategy while ensuring building on existing national efforts led by the Country Offices in the region, this working paper proposes an approach that capitalizes on the current success stories in some Arab countries in specific areas of concern. It promotes building a platform of cooperation that consists of different nodes addressing specific sub-thematic areas related to climate change. This include, for example, a node for legislative and institutional framework, another for research and

development, a third one for technology transfer, and so fourth. The nodes would represent an Arab country/Arab Institution, which proved to achieve remarkable progress on respective areas. The node would catalyze the process of cooperation through knowledge sharing and dissemination, capacity building, implementation of pilot projects of high potential of replication, and fostering education and awareness on climate change. The structure of the proposed platform of cooperation including nodes' selection will take its final shape after regional consultation with the stakeholders.

4 Climate change and human development

The Arab region is particularly vulnerable to climate change. It is one of the world's most water-scarce and dry regions; with a large share of its population and vital economic activities located in coastal zones vulnerable to see level rise.

The countries of the region vary in size, energy endowments, income levels, human capital and skills, social and political structures, and institutions. However, most of them share a common cultural background. Despite a gradual improved performance, the region continues to face a number of important economic and social challenges including higher unemployment rates, higher illiteracy rates, inadequate funding for research and development, and weak ability to attract foreign direct investments (FDI).

Much of the progress so far achieved by countries in the region to tackle those challenges can be jeopardized by climate change. Income and employment may be lost as a result of more frequent droughts in rural areas, and to floods and sea level rise in urban and coastal areas. Changes in temperature and precipitation patterns may result in damage to strategic economic sectors such as agriculture and tourism. Climate change also poses many challenges to the region's cities, which represent hubs for economic, social, cultural and political activities. Through its far-reaching impacts on ecological systems, patterns of rainfall, temperature and weather systems, global warming will directly affect all Arab countries. According to the 2009 report of the Arab Forum For Environment and development (AFED)[i], "the Arab countries are among the most vulnerable in the world to the potential impacts of climate change, the most significant of which are increased average temperatures, less and more erratic precipitation, and sea level rise (SLR), in a region which already suffers from aridity, recurrent drought and water scarcity".

In 2002, the Arab Human Development Report of the UNDP[ii] revealed many alarming signals concerning population and human development in the region: 65 million Arab adults are illiterate, two thirds of them are women, and 10 million children are out of school. Only 0.6% of Arabs use the Internet, and spending on research and development (R & D) is one seventh of the world average. Arab unemployment, at 15%, is the highest in the developing world.

The UNFCCC recognizes the right to development, the common but differentiated responsibilities, as well as the specific needs and special situations of several groups of countries. In examining national circumstances in the Arab region to determine if any special circumstances exist, several aspects have been identified. In terms of the Human Development Index (HDI), there is considerable variation within the region. In addition to Libya, the Gulf region, except for Saudi Arabia, characterized by a relatively small population and a huge endowment of hydrocarbons retains a significantly higher HDI rating than the other Arab countries. Kuwait is the highest-ranking Arab country on the Global HDI, while Yemen has the lowest value. In the mean time, six Arab countries are included in the world's 50 Least Developing Countries (LDC) list. They are namely Comoros, Djibouti, Mauritania, Sudan, Somalia and Yemen[iii].

According to the World Bank, 23% of the region's population lives in incomes of only $2 a day. The prospects of the Arab region as a whole for poverty eradication are encouraging; however, wide gaps both among and within Arab sub-regions remain. The Arab region would remain to suffer from a high poverty rate if the severe problems of some Arab countries especially the LDCs are not addressed. It is thus obvious that climate change would add extra burden on those countries in order to be able to achieve the MDGs.

5 The CC trends and their impact on the natural resources and social development in the Arab countries

According to the latest IPCC assessment, the climate is predicted to become hotter and drier in most of the Arab region. All predictions revealed that climate change will reduce the overall amount of rainfall in the region by at least 20%, it will increase variability (droughts and floods), and it will make it harder to manage the rain that does fall and increase evaporation through higher temperatures. Arab countries have their own different specific aspects of climatic circumstances including variations in rainfall and their effects on water resources and food production. Due to its geographic location, the Arab region is one of the most water stressed areas in the world. The region accounts for about 3% of the world's population, 10% of its land, but only 1.2% of the world's renewable water resources. The most ten water stressed countries in the world are Arab countries, and there are eight Arab countries with annual per capita water consumption equals less than 500 cubic meters. About 50 million people lack access to safe drinking water and about 80 million people lack access to safe sanitation[iv].

Higher temperatures and reduced precipitation will exacerbate the water scarcity and increase the frequency of droughts. In addition, agriculture yields, especially in rain fed areas, would be adversely impacted worsening the current situation of food security. Over the medium to long term, supply and demand dynamics, high fuel prices, climate change, water scarcity and natural resource degradation are expected to keep global food prices well above their current levels, posing a continuing challenge for the Arab region highly deficient of food production and mainly dependent on foreign exports.

In urban areas in North Africa, a temperature increase of 1-3 degrees could expose 6-25 million people to coastal flooding. In addition, heat waves, an increased "heat island effect," water scarcity, decreasing water quality, worsening air quality, and ground ozone formation are likely to affect public health, and more generally lead to challenging living conditions.

Global models predict sea levels rising from about 0.1 to 0.3 meters by the year 2050, and from about 0.1 to 0.9 meters by 2100. A study concluded that the top 10 Arab coastal cities at risk in terms of percent of coastal area exposed, are Port said (Egypt) ranked number one, followed by Dubai (UAE), Rabat (Morocco), Kenitra (Morocco), Aden (Yemen), Abu Dhabi (UAE), Al Ain (UAE), Ajman (UAE), Mohammedia (Morocco), and Nador (Morocco)[v].

Another studies undertaken by Dasgupta, S, et. al[vi] concluded that the Arab region is projected to have more severe impacts of Sea level Rise (SLR) than any other region. Except for the impacted land area, all other indicators suggest more severe impacts of SLR in this region. In particular, with a 1m SLR, 3.2% of its population would be impacted (vs. 1.28% worldwide), 1.49% of its GDP (vs. 1.30% worldwide), 1.94% of its urban population (vs. 1.02% worldwide), and 3.32% of its wetlands (vs. 1.86% worldwide). The same study reveals that Egypt's population would be most severely impacted by SLR. With a 1m SLR, approximately 10% of Egypt's population would be impacted. Most of this

impact takes place in the Nile Delta. Similarly, a 1m SLR would impact nearly 5% of the population of United Arab Emirates and Tunisia.

Projected Sea Level Rise would have severe impacts on some Arab countries due to risk of storm surges. For example, Kuwait stands on top of the 10 countries at risk with intensification of storm surges. It was reported that 81.1 % of its coastal land area, 70% of its total population, 65.3% of its coastal GDP are at risk.

Further, many countries, particularly oil producers, would witness significant economic losses resulting from the implementation of climate change mitigation response measures by industrial countries in achieving their commitments under the UNFCCC and Kyoto protocol. The Kyoto Protocol commits Parties to strive to minimize adverse economic, social and environmental impacts on other Parties, especially developing country Parties. Article 4.8 of the UNFCCC and Articles 2.3 and 3.14 of the Kyoto Protocol provide a basis for addressing the impacts of the implementation of response measures. Ways, under consideration, of addressing these impacts include the establishment of funding, insurance and transfer of technology. They also include building capacity, at the national level, in the area of economic diversification; modeling to assist developing countries in assessing vulnerability to the impact of the implementation of response measures; and financial risk management[vii].

6 Energy

Rapidly expanding populations, economic growth, and widespread subsidies have contributed to a rising demand for energy in the Arab world since the early 1990s. Normally, there are disparities among Arab countries on levels of energy per capita and energy intensity. The energy sector has adverse impacts on air, water, land and marine resources, and contributes to global climate change. The CO_2 emission increases resulted not only from industrial expansion and use of fossil fuels, but also from a growth in the number of vehicles, energy subsidies, and inefficient or lack of public transportation.

On the other hand, the Arab energy sector, the largest economic sector contributing 40 % of the Arab's total GDP, has played and will continue to play an important role in both the region's and the global economy. In addition to satisfying energy needs for economic and social development, it is the source of oil and gas export revenues estimated as 419 billion US$ in current prices of 2006.

The proven reserves of crude oil in the Arab countries is accounted for nearly 58 % of the world's total, while those of natural gas were estimated at about 30% of the world proven reserves. According to the IEA[viii], Saudi Arabia toped the world lists of oil producers and exporters, while Qatar ranked fourth of the Gas exporters in 2007. Further, Qatar holds the third largest proven supply of natural gas in the world. Its technological advancements, especially in liquefied natural gas (LNG), make it the largest exporter of LNG.

The Arab economies, as well, are heavily dependent on oil and gas to meet their domestic energy demand. Oil contributes about 53.6 % of the total demand and the share of gas represents about 43.9 %, while other resources such as hydropower, coal, and renewable resources represent only about 2 %[ix].

In spite of the vital role of the energy sector in the economic and social development of the Arab countries, the sector has been faced with several challenges that can affect its contribution to the achievement of sustainable development in the region. These challenges are: First, energy accessibility to some segments of the poor and rural

population in some countries such as in Morocco, Algeria, Sudan, and Palestine. Secondly, the large disparity in per capita energy consumption and energy intensity among those countries, and thirdly, the challenge of relying heavily on fossil fuels to meet energy needs. In recognition of the above challenges, countries in the region have been continuously revising their policy framework aiming at promoting sustainable management of the energy sector. Varying degrees of progress have been achieved regarding the relevant key energy issues, particularly on improving energy efficiency using cleaner fuels, promoting renewable energy and enhancing regional energy integration.

The efficiency of energy production and consumption patterns in the region requires improvement. Though the per capita energy consumption in the GCC sub-region are among the world's top list, more than 40 percent of the Arab population in rural and urban poor areas do not have adequate access to energy services. It is also noted that almost one-fifth of the Arab population relies on non-commercial fuels for different energy uses. The electrification rates in the Arab countries in 2007/2008 varied from as high as 100 percent in countries like Kuwait, Lebanon and Bahrain to as low as 25-30 percent in Sudan[x]. Energy consumption indicators in the Arab region in 2007 were as follows:

1. The average primary energy consumption reached 4.88 toe per capita, compared to the world average of 1.8 toe. Wide disparities exist in the levels of energy consumption within and between Arab countries.

2. The average electricity consumption reached 5380 kwh per capita regionally, compared to the world average of 2752 kwh per capita, and

3. The average primary energy intensity in the region is 0.57 toe per (2000) US$ compared to a world average of 0.20 toe, reflecting the low economic returns on energy consumption in the region[xi].

Energy efficiency is an important issue in the Arab countries, the driving forces for improving energy efficiency includes alleviating the financial burden of oil imports in the oil importing countries, reducing energy investment requirement, making the best use of existing supply capacities to improve energy accessibility, improving economic competitiveness, reducing local pollution, and mitigating GHG emissions.

6.1 Energy Efficiency and Renewable Energy

The Arab countries have a great potential for renewable energy, including solar and wind, as well as hydro and geothermal in specific locations, which are still underutilized. The share of renewable energy in the total installed generation capacity of the Arab countries remains relatively low, standing at around 7% in 2007, mostly from hydropower in Egypt, Syria, Iraq, Lebanon, Sudan, Algeria, Morocco, Tunisia, and Mauritania. Solar and wind generation capacity of electricity amounts to more than 750 MW and remains limited to Tunisia, Egypt, Jordan, Morocco, and Palestine.

Due to their geographic location, the Arab countries are blessed with an abundance of solar energy potential. Solar energy generation using photovoltaic (PV) technology is used in several standalone applications especially for water pumping, telecommunications and lighting for remote sites. The largest PV program exists in Morocco, where 160,000 solar home systems in about 8% of rural households are installed with a total capacity of 16 MW. Photovoltaic pumping applications are relatively developed in Tunisia with a total existing peak capacity of 255 MW.

Solar water heaters are achieving different degrees of market penetration, and are currently most successful in the residential and commercial sectors of Palestine, Jordan, Egypt, Morocco, and Lebanon. It should be noted that solar water heaters are mostly used in Arab countries with relatively few or no hydrocarbon resources.

Several Concentrated Solar Power (CSP) projects were announced but not completed in North African countries, namely Egypt, Morocco and Algeria. With escalating concerns of climate change, cost reductions and efficiency improvements of this technology, and the introduction of independent power producers (IPPs), CSP will play an important role in the electricity generation mix in those countries in the near future.

Another remarkable example is the US$ 9 billion Moroccan solar power initiative, which includes installing 2 GW of solar power to meet 10% of Morocco's electricity demand by 2020[xii].

In spite of its abundant hydrocarbon resources, the GCC states have recently witnessed a number of low carbon initiatives. These include the carbon-neutral Masdar City in Abu Dhabi, the integration of renewable energy and energy efficiency into the Energy City in Qatar, the Bahrain World Trade Center, and King Abdullah University of Science and Technology in the KSA.

In addition, there are plans to produce large amounts of solar electricity in the Arab countries and export portions of it to Europe. A group of EU companies has founded the so-called ''DESERTEC Industrial Initiative'' to lobby for this idea. DESERTEC aims to generate up to 550 GW of electricity over the next 40 years, from installations that will initially be located in Algeria, Morocco, Tunisia, Libya and Egypt and later in the deserts of the Middle East from Turkey to Saudi Arabia and Jordan. An initial $5.5 billion in funding was announced in December 2009 by the World Bank's Clean Technology Fund. The power will be used for local needs, as well as for export to Europe, through high-voltage, direct current cables laid under the Mediterranean Sea[xiii].

Relying heavily on fossil fuels, it is evident that the current trends in the Arab energy sector are unsustainable. The move towards achieving the objectives of energy for sustainable development requires policies and measures to address such problems. This is well stipulated in the "The Arab Regional Strategy for Sustainable Consumption and Production"[xiv], which identified a set of strategic objectives, among which are improving energy efficiency, increasing the share of renewable energy in the fuel mix, and disseminating renewable energy technologies especially in rural and remote areas. The same strategy pinpoints a whole list of needed policy interventions to achieve those objectives. These include, but not limited to, reforming existing energy tariffs so as to integrate environmental and social costs while maintaining energy subsidies for the poor; improving energy efficiency, particularly in energy intensive industries, transport, and electricity generation; developing and wide use of renewable energy technologies, and supporting air quality management though better urban planning and land use.

6.2 Barriers for Energy Efficiency and Renewable Energy

A set of barriers often put renewable energy and energy efficiency projects at an economic, regulatory, or institutional disadvantage relative to other forms of energy. These barriers could be classifies as:

6.2.1 Policy barriers

Policy barriers for the promotion of energy efficiency and renewable energy include:

- Lack of or weak political will both at the government and private sector level;

- Lack of national targets or strategies for promoting EE and RE in the national energy policy framework; only 6 Arab countries have announced RE or EE targets[xv]
- Lack of/or weak legal and institutional frameworks. Few Arab Countries have well-developed legislative framework to promote energy efficiency and renewable energy technologies. Only Algeria has had a FIT framework to promote RE resources.
- Slow and incomplete liberalization process of energy and electricity markets. In most Arab Countries, energy markets are still dominated by monopolies. Grid connection and access is not evenly provided to renewable energy technologies, or IPPs.
- Weak or lack of domestic R&D programs, and low government expenditures in R&D. As discussed later, the RE and EE research institutions are heavily under funded.

6.2.2 Market barriers

Energy efficiency and Renewable energy markets in the Arab countries are distorted due to many factors including:

- Week capacity of managing and disseminating information about market opportunities of EE and RE technologies. Except for the "Lebanese Association of Solar Industrials" (ALIS) in Lebanon, there are no similar groups in the region.
- Lack of private sector associations, and other market intermediaries, which promote EE and RE technologies.
- Low level of consumer awareness leading to low market demand. There has been widespread skepticism about performance and reliability of renewable energy technologies due to past technology failures or weak products performances or lack of information.
- Lack of national standards, testing and certification schemes that led to installations of poor quality technologies causing a variety of technical problems and leading to consumers' distrust. For example, Lack of national standards, testing and certification schemes for solar water heaters in Egypt has led to installations of poor quality products causing a variety of technical problems. This has caused widespread negative perception and bad technology reputation among consumers, and severe financial problems to local manufacturers.
- Weak capacity of local assembly/manufacturing, distribution, installation and maintenance of EE and RE technologies. Only few local capacity, such as in Egypt, available for manufacturing/assembly of RE and EE technologies. This has caused countries to rely on more expensive imported systems, and consequently low levels of market penetration due to weak purchasing power.
- Lack of education and training programs for EE and RE professionals at all levels
- Low level of awareness of the local banking sector, and lack of proper financing schemes. Consumers or project developers may lack access to credit to purchase or invest in renewable energy because of lack of collateral, poor creditworthiness, or distorted capital markets. This is also true in rural areas where third party finance or "micro credit" is absent. Morocco and Lebanon offer good examples of overcoming these barriers using innovative financing schemes.
- The energy subsidies issue has had various social implications for decades. Subsidies have been playing a critical role in the development of rural areas and increasing access to modern energy services to the poor. The number of people

below the poverty line in the region is high especially in some countries of low per capita income. Therefore, removing energy subsidies might lead to negative social impacts. However, Jordan and Morocco successfully managed to smoothly phase out energy subsidy.

6.2.3 Economic barriers

Economically, EE and RE technologies often face unfair competition in the market due to economic barriers. These include:

- Heavy subsidies provided by governments for oil and gas, and higher initial capital costs of EE and RE technologies.
- High custom duties on EE and RE technologies adding to high initial costs, and impairing economic feasibility. Custom duties have been a major barrier for disseminating CFL in Egypt. Promoting local manufacture proved to be a sound policy to reduce initial cost.
- Lack of consideration of external costs to Arab societies due to heavy reliance on fossil fuels compared to clean energy technologies. The environmental impacts of fossil fuels often result in real costs to society, in terms of human health (i.e., loss of work days, health care costs), infrastructure decay (i.e., from acid rain), declines in forests and fisheries, and perhaps ultimately, the costs associated with climate change. The World Bank has concluded studies to estimate cost of environmental degradation in 7 Arab countries. The results indicated a highest loss of 4.8% of GDP in Egypt, 3.7% in Morocco, and 3.6% in Algeria. The country with the best environmental performance was Tunisia, losing only 2.1% of its GDP to environmental degradation[xvi]. Yet the capacity to internalize these costs into national accountings is lacking in the Arab region.

6.3 Opportunities for policy interventions

6.3.1 Policy interventions for Energy efficiency

As noted earlier, the Arab strategy for sustainable consumption and production emphasized the importance of improving energy efficiency. To capture the significant benefits associated with energy efficiency, integrated and sustainable national strategies that engage both public and private sector stakeholders are required. National strategies should satisfy both short and long-term objectives. While short-term issues should focus on removing aforementioned barriers that inhibit the development of the energy efficiency market, long-term aspects should focus on ensuring the sustainability of energy-efficient practices in various sectors of the economy. To support strategy planning and implementation, it will be necessary to establish a set of quantifiable goals/targets that can be used to effectively monitor and evaluate the impact of the strategy's initiatives at both macro and micro levels. Key approaches to achieve the goals and objectives of the strategy could be categorized into two groups:

1) Policy measures and market initiatives to stimulate demand for and increasing the supply of energy-efficiency goods and services. These include:

    a. Utilizing regulatory and policy instruments to move towards EE (e.g. prices and subsidies, tax incentives, import duties exemption, codes and standards)
    b. Attracting private sector investments and resources in EE (e.g. Public-private partnerships, private financing schemes)

c. Integrating energy efficiency into energy, economic, and environmental planning (e.g. least cost planning, Demand Side Management (DSM), renewable energy resources. ..etc.)

2) Cross cutting activities that facilitate improving energy efficiency at the national levels. This might include:

a. Increasing awareness of energy efficiency of all stakeholders
b. Building capacity in key institutions (regulatory agencies, service providers, industry, financing institutions, research institutions, ..etc)
c. Developing an integrated energy efficiency knowledge management system to provide and facilitate flow of energy efficiency information throughout the economy.

Some of these policy instruments will be further elaborated below.

6.3.2 Policy interventions for Renewable Energy

The Arab strategy for sustainable consumption and production emphasized the importance of promoting the wide use of renewable energy technologies in order to better tap on the renewable energy resources that are underutilized. Opportunities for promoting renewable energy technologies include:

6.3.2.1 Undertake legal and regulatory reforms

National renewable energy policies, strategies and laws should be adopted. This should aim at opening up of the energy sector for competition and private sector participation. Examples are laws and regulations of feed-in-tariff, laws for demand side management, budget allocation for institutions working in the renewable energy field and the inclusion of renewable technologies in various national R&D programmes.

6.3.2.2 Establish national targets for renewable energy

As only six Arab countries have established national targets for renewable energy, it is recommended that the rest should adopt similar targets to promote renewable energy as part of the energy policy framework.

6.3.2.3 Improve the overall investment climate

The aim is to encourage public private partnership. This could include various forms of concessions and management contracts, private independent power producers (IPPs), contracting out operation and maintenance, billing, metering and bill collection and other services. Participation of local and regional private sector should be encouraged and attention should be given to the development of domestic capital market.

6.3.2.4 Develop proper financing schemes

Proper financing schemes should be devised involving governments, private sector (investors, local banks), and international financial institutions. This could also include the creation of a national renewable energy funds such as the ones envisioned in Lebanon, Morocco and Tunisia in order to support early market development. Donors, bilateral and multilateral agencies should explicitly consider renewable energy for development assistance projects. Guarantee funds, and refinancing schemes for local banks should be considered in this respect. Another means is to establish dedicated loan facilities with low interest rates to provide micro-finance for EE and RE Technologies on preferential terms.

6.3.2.5 Make use of the potential for carbon finance in the region.

In many countries of the region, awareness of the Clean Development Mechanism is still relatively low. Only five Arab countries have registered CDM projects. Given the complexity of this instrument, substantial capacity building will be needed among

businesses and other stakeholders. The regulatory framework for the CDM needs to be strengthened; governments could give clear preference to renewable energy CDM projects.

6.3.2.6 Provide financial incentives

A package of financial incentives needs to be developed and offered to promote market development. This should include reducing incentives and other support for fossil fuels and it should develop and implement market-based mechanisms addressing externalities, and enabling EE and RE technologies to compete in the market on a more equal and fair basis. Financial incentives would include, but not limited to, production and investment tax credits, feed-in-tariff, reduced customs duties, low interest loans, loan guarantee programs and similar tools.

6.3.2.7 Develop standards, testing, and certification schemes

There is a need to establish suitable manufacturing standards and specifications and to strictly enforce them. Policy instruments and incentives could be introduced to encourage local manufacturers to upgrade their facilities and enable them to export some of their production to regional markets. By targeting the export market, local manufacturers would have an incentive to improve their production quality and would seek to obtain international certification. The local market would in turn benefit from better quality products, consumer trust and expanded demand.

6.3.2.8 Facilitate technology transfer

This could happen through different schemes, including joint ventures between international technology providers and local firms, and would lead to upgrading and modernizing local manufacturing capabilities. The same cooperation should be enhanced with research institutions to demonstrate and test EE and RE technologies under different national circumstances.

6.3.2.9 Capacity development

Institutional capacity should be strengthened to support the development of comprehensive national EE and RE strategies within national planning processes for sustainable development. This should include strengthening the capacity of the EE and RE agencies at the national levels. It should consider inclusion of renewable energy technologies in the curriculum of schools and universities, and include training of human resources at all levels such as planners, engineers, and technicians for the design, installation and maintenance of renewable systems. Raising awareness and building the capacity of the financial sector is also crucial to overcome the financing barrier. Encouraging the creation of industry associations would play a vital role in market development, networking and matchmaking between manufacturers, installers, importers and consumers. They also catalyze cooperation and public-private partnerships with regulatory agencies and other major players.

6.3.2.10 Develop capacity of research and development

The Arab region research and development in energy efficiency and renewable energy has emerged mainly as a result of collaboration between governments and multilateral organizations such as UNDP, World Bank, USAID, and EU organizations. These mostly donor funded programmes have been successful in creating massive human expertise, and local research capabilities. Energy research centers were established or developed but their impact remained limited with constrained financial support and incentives. Many of these centers have become recently partners to the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) established in 2008 in Cairo by some EU partners. RCREEE provides a platform for the regional exchange on policy issues and technological questions. Some universities in the region have moved faster in terms of providing energy education at the graduate level and in steadily tackling applied energy

research issues that are relevant to their countries. A recent review highlighted the current research focus on energy efficiency and renewable energy in the Arab region[xvii]. The review revealed that research initiatives in the region are not strategically oriented and do not have long-term focus. The published research in the past few years covers work in energy assessment, building energy efficiency, HVAC efficiency, biogas, and solar energy applications. Scarcity of water in many Arab countries has led to emphasis on desalination research using renewable energy. The same review identified some major opportunities of interventions to enhance research in EE and RE in the Arab Region including:

- Promote cooperation among Arab Universities with solid and meaningful partnerships for faculty and student exchange.
- Support long-term interdisciplinary research programs in energy with multiple partners from various countries.
- Mobility grants between Arab countries including GCC countries.
- Research programs that are relevant to the local needs but of global importance.
- More funding on R&D to improve renewable technologies and green buildings and their energy uses

6.3.2.11 Raise public awareness

Low level of awareness and lack of knowledge about costs and other benefits of renewable energy technologies are major barriers to their dissemination. Development of effective public awareness and promotion campaigns making use of all media can be expected to yield substantial results. Such campaigns should provide information on RE concepts, its benefits and its operating requirements. Identification and dissemination of 'success stories' and demonstration projects play a key role in raising awareness and promoting replication. This is crucial to gaining public acceptance and support for renewable energy options.

6.4 Opportunities for Arab-Arab Cooperation in EE and RE

6.4.1 Legal and regulatory reform

National energy efficiency and renewable energy agencies with strong technical skills are required to implement national EE and RE policies. Different institutional arrangements exist in the Arab countries. Some have single agency responsible for both EE and RE, others have different agencies for both EE and RE. These experiences and lessons learned could be exchanged among Arab countries so that needed reforms be realized.

6.4.2 Energy price Reform

Energy demand is price sensitive. Most of the Arab countries have suffered from a long history of heavily subsidized energy Prices. This impaired the economics of energy efficiency and renewable energy projects, helped surge per capita energy consumption and GHG emissions, accelerate depleting natural resources, and worsening macroeconomic performance. Energy prices reform is crucial to improve energy efficiency and promote renewable energy technologies. Different Arab countries have different price reforms experiences; exchanging success and failure stories could be a good learning tool for Arab-Arab cooperation.

6.4.3 Energy Audits

Energy audits are essential for all sectors of the economy (including residential/commercial, industrial sector and transport) to promote better understanding of the current status of end-use energy efficiency. The audits will not only create awareness among energy users but also justify the necessity for the implementation of energy efficiency activities. Energy audits exist in a mandatory form or on a voluntary basis.

Algeria and Tunisia have had experiences in enforcing mandatory audits in different sectors that can be beneficial to other Arab countries. Skilled Arab energy auditors could be used regionally to support improving energy efficiency in the region.

6.4.4 Economic incentives

Economic incentives to promote energy efficiency and renewable resources include measures such as subsidies for energy audits or investment. They aimed at encouraging investment in energy efficient equipment and RE technologies by reducing the investment cost. Some fiscal measures such as tax credits or reduction of custom duties are also used to decrease consumer upfront costs. Feed-in-Tariff in Algeria is a good example of using economic instrument to promote renewable energy technologies. A number of Arab countries such as, Morocco, Tunisia, and Lebanon have had experiences on providing economic incentives, which can be beneficial for other Arab Countries.

6.4.5 Energy efficiency codes and standards

Some Arab countries such as Algeria, Egypt, Syria, Tunisia, and Lebanon have initiated programs for energy efficiency codes and standards of electrical appliances. Those countries can exchange experiences and lessons learned between themselves and with other Arab countries.

6.4.6 Public awareness

Public awareness and promotional campaigns are needed in order to stimulate local demand for energy efficient goods and services and RE technologies. Awareness campaigns and outreach activities should be designed to support the other policy measures. This would aim at enhancing the awareness of major market players of the economic benefits of EE and RE. Further, increasing public awareness of the environmental, health-related and economic benefits of EE and RE would increase demand for these technologies. Many Arab countries such as Algeria, Tunisia, Lebanon and Morocco seem to have prepared and disseminated targeted awareness materials to stakeholder groups in both the supply and demand side of the market. Lessons learned and capacity developed could be further disseminated at the regional level.

7 Urban Planning and resilient Cities

Many Arab cities with their architectural structures, population concentrations, and infrastructure systems are at high risk to potential impacts of climate change. The Arab countries have 34,000 km of coastal lines, nearly fifty percent of which is already inhibited[xviii]. The Arab region is one of the highly urbanized regions of the world. Urbanization rate reaches as high as 90 percent in some Arab countries especially in the Gulf region. Moreover, the past few decades have witnessed large-scale developments and massive urban sprawl such as what is happening in Dubai and in many other GCC cities. In addition, coastal zones host vital economic activities such as agriculture, tourism, industry, power plants, desalination plants, and major infrastructures.

Some of these Arab urban centers have poor infrastructure and will be disastrously impacted by major climate change. At the same time most of these cities lack normal disaster mitigation strategies, not to mention the unexpected and new potential hazards of climate change. Urban vulnerability to climate change includes infrastructure systems, buildings, telecommunications, transport, and energy and water supply systems. The recent extreme weather events such as flash flood and hurricanes in some Arab countries illustrate the devastation that climate changes can have on densely populated coastal urban areas. To reduce climate change risks, new urban planning legislations will have to included climate changes in impact assessments for future urban development. This suggests radical changes to how cities and suburbs are planned and designed. A new paradigm of urban planning can promote concepts such as integrated coastal zone

management, integrated land use and transport planning, urban greenery, and others. With access to up to date climate science, cities can design and implement effective mitigation and adaptation strategies to respond to the unavoidable impacts of climate change. Road systems and land-use decided now will influence energy use for years to come. Promotion of public transport options and careful design of cities is critical for reducing GHG emissions.

Since the mid-1990s, there has been a movement from within the design and architecture sector for "green buildings". Led by the US Green Building Council (USGBC)[xix], this group has set up standards and codes for buildings called LEED (Leadership in Environment, Energy and Design). The USGBC has gone international and also begun a "Neighborhood LEED" program. Green building aims at minimizing ecological footprint of the buildings while maximize economic factors and comfort level for occupants. This is to be achieved, for instant, through conservation of natural resources, energy and water, minimizing pollution, and reducing Greenhouse Gas emissions. At least four Arab countries have initiated efforts to pursue the same movement. They are the UAE, Egypt, Morocco, and Mauritania.

7.1 A proposed pilot initiative for resilient cities

A resilient city is a sustainable network of physical systems and human communities. To meet the climate change challenges, an Arab resilient cities pilot initiative is proposed. Starting with few numbers of Arab Cities (1-4), and benefiting from international experience such as "cities for climate protection campaign" of the I.C.L.E.I[xx], the pilot initiative would bring international lessons learned to the Arab cities, and create a platform for Arab-Arab cooperation in this field. It would test and demonstrate a range of policies and measures to build climate change resilience in the local circumstances of Arab cities, and would disseminate lessons learned, successes and failures. A resilient city action plan would include, and not limited to, the following major activities:

1. Research and education

Research and education are needed to bring current knowledge about potential global climate changes such as temperature rises, sea level rise, storms, flooding and wild fires on the urban designs. The goal here is to increase the pool of human resources and to prompt future engineers, scientists, planners, local administrators, and emergency managers to be prepared for the future climate challenges. Such a program should include support for university education for students in disciplines that can contribute to urban resiliency. It would also include building the capacity of local government officials, municipalities, and civil society organizations on issues of city planning and management and disaster risk reduction and management.

2. Disaster management policies and measures

The objective is to make the Arab cities more climates resilient. A city without resilient physical and human systems will be extremely vulnerable to climate disasters. The initiative would include developing the current legislative and institutional framework of national disaster management including, for instant, enhancing the current disaster management planning practices, improving adaptive capacity of communities, and strengthen regional cooperation on the same areas. It would also include reforming the current legislation of urban planning and land use to integrate climate change considerations. Capacity building would be offered in areas such as emergency preparedness, surveillance and early warning systems, and public health preparedness.

3. Promotion of "green building"

To build on the current experience of some Arab countries of adopting the concepts of "green building", it is proposed to spread the word among other Arab countries through education, technical assistance, and capacity building programs.

4. Public Education

In addition to the physical systems, the public is the second main component of the city. They are the first to be hit by disasters, and their role in disaster management cannot be understated. To enable them to play their role effectively, the public needs to be educated, informed and trained. It is also crucial to involve them in the planning process from its early stages. This requires a long-term collaborative effort to increase knowledge and awareness about resilient city among local communities, media, and other civil society organizations. A regional programme of education of media on issues of climate resilience should be an integral part of this component.

8 R& D and climate technology transfer

The current weak capacity of S&T in the Arab region can be attributed to several main factors. One is an overall lack of interest in science by governments, which devote minimal funds to education and science compared with those set aside for other issues. Another crucial factor is the deteriorating education systems. These factors, along with the inadequate infrastructure and R&D support systems, create an unfavorable environment for research and development. On a global level, the number of scientific publications originating in the Arab world does not exceed 1.1% of world production. According to UNESCO statistics, in terms of the ratio between gross domestic expenditure on R&D (GERD) and GDP investment, Egypt, Jordan, Kuwait, and Saudi Arabia spend the most, devoting about 0.2% of GDP to GERD. The figure for the remainder of the Arab region is as low as less than 0.1%. Expenditure on R&D by Arab countries is at best one-tenth of that spent in industrialized countries. This enormous underfunding of the research and development is major impediment to technology transfer. Non-Arabs produce most of the literatures, on which the IPCC authoritative reports are based. Additionally, the number of Arab scientists contributing to the IPCC reports is very few.

To address this issue, the Sustainable Development Initiative of the Arab Region (SDIAR)[xxi] calls for supporting the development of strategies and national programs for education and illiteracy eradication as a part of the strategy for poverty eradication and also through support to the implementation of the internationally agreed upon objectives on education, including those contained in the Millennium Declaration. Most Arab countries have been implementing national programs to eradicate illiteracy, and reform national education systems. Most R&D units in the Arab countries belong to the government and public sectors, and conduct little contractual research for the industries. Egypt leads the Arab countries in terms of the number of R&D units, followed by Saudi Arabia and Jordan. Governments fund about 75% of these R&D units. Universities trail far behind with only about 19%, the private sector funding the remainder[xxii].

Generally, typical barriers to technology transfer include lack of access to information, market failures, absence of skilled human resources, weak institutional and legislative frameworks, and social constraints. National institutional and legislative frameworks are frequently fragmented. However, these barriers differ by technology and by country. Capacity building and the creation of enabling environments may be needed to accelerate the adoption of mitigation and adaptation technologies in the Arab countries. Another major barrier has been the high cost of technologies and the difficulties faced in accessing finance and the weak capacity to mobilize private-sector capital. Given the magnitude of the investment required, the involvement of the private sector in technology development

and transfer is crucial. This could be realized by establishing innovative public–private partnerships, as well as government incentives to promote private-sector investments.

Role of governments to set an enabling environment for technology development and transfer includes developing and enforcing Intellectual Property Rights (IPR) regimes to encourage technology innovators, and enhance technology transfer, enhancing local capacity for R&D, provision of enough funding for institutional development, establishing suitable research and development platforms, developing appropriate knowledge management systems, and the promotion of cooperation among national R&D centers, industry, universities, and non-governmental and other research entities within a national framework.

Though technology needs are country specific, only five Arab countries have completed technology needs assessments (TNA) supported by the UNFCCC. They are Comoros, Egypt, Jordan, Lebanon, and Tunisia. Results of these TNA revealed some priorities such as protection of coastal zones, technology needs in the waste management sector such as landfill with gas recovery and waste-to-energy. Many technologies identified for mitigation purposes also contribute to adaptation. For example, sustainable agriculture technologies, such as efficient irrigation practices, forestry management activities, energy conservation activities and renewable energy strategies, are beneficial to both adaptation and mitigation.

8.1 Opportunities for enhancing technology transfer in the Arab countries

8.1.1 Legislative and Institutional frameworks

a. Complete the technology needs assessments
b. Develop technology road maps and national action plans.
c. Develop technology transfer frameworks
d. Enhance enabling environments to integrate technology transfer policies at the national levels.

8.1.2 Capacity building

e. Institutional capacity building for technology innovation and adaptation centers
f. Capacity development for creating an enabling system for bridging gap between scientific research and policymaking.
g. Capacity building for systematic observation, meteorology and climatology modeling, and database development and management.
h. Develop adequate knowledge management systems to systematically disseminate the national experiences and lessons learned. In almost all areas, more and better information is available in relation to mitigation technologies than to technologies for adaptation.
i. Raise awareness on the part of the private sector, financial sector, and investors on the opportunities offered by climate technologies.
j. Raise public awareness to overcome negative public perceptions about for example, renewable energy technologies.
k. Capacity building aims at building project-financing skills in government institutions as well as the financial sector.
l. Capacity building of local communities to address climate change as linked with sustainable livelihoods. This can be done through capacity development for local institutions (municipalities, NGOs, etc...).
m. Enhanced assistance to national education systems to consider climate change at the primary, secondary and tertiary levels.

8.1.3 Funding research and technology transfer

n. Funding research and pilot projects within universities and research institutions.
o. Make use of the available financial mechanisms under the UNFCCC such as the CDM, GEF, ODA, and the WB Clean Technology Fund.
p. Promote private sector investment in technology transfer

8.2 Opportunities for Arab-Arab cooperation in technology transfer

a. Adaptation: early warning systems and other observation tools, best available technologies for irrigation and flood and drought control, drought-resistant crops, wetland and/or mangrove restoration, and technologies of protection of coastal zones.
b. Mitigation: Carbon Capture and Storage (CCS), solar and wind power, CNG in transport, CFL and energy efficiency in buildings, technologies of landfill gas recovery, composting, desalination and water saving technologies.
c. Develop regional collaborative R&D initiative that links national programmes and research institutions. This could facilitate transfer of knowledge and technological applications between Arab countries with common problems and opportunities
d. Develop a regional knowledge management platform to enhance information flow.

9 Financing schemes

Financial flows and support for climate technology deployment and diffusion are derived from several different financial resources and vehicles, including ODA, foreign direct investment (FDI), foreign equity investment and Venture Capital, commercial loans, philanthropic sources and export credit agencies. The use and promotion of climate friendly technologies is inhibited financially by a number of factors including the high initial cost, the financial, technological and performance risks, and the scarcity of investment capital. Market penetration of most of these technologies has been very slow due to a lack of proper innovative financing schemes, among other reasons. Furthermore, investors and funding Institutions find it difficult to reimburse their investments due to the specific characters of these projects and their associated risks. The high initial cost of such technologies combined with the risks that the user should undertake create the need of promoting and applying modern financial schemes.

9.1 Available Funding Schemes

The most known funding mechanisms are discussed below.

9.1.1 Governments funding

Governments are playing a critical role in financing climate change programmes. In some Arab countries such as in the GCC, governments are the major financiers for climate change initiatives unilaterally, bilaterally and multilaterally. Unilateral governments funding includes the newly opened King Abdullah University for Science and Technology in Saudi Arabia. It is funding programmes to develop renewable energy and related technologies in partnership with universities in the UK, Italy, the Netherlands and the US. Another example is a bold step towards a knowledge-based economy in Abu Dhabi, which is the US$ 22 billion MASDAR initiative driven by the Abu Dhabi Future Energy Company. It is designed to be a global cooperative platform for engagement in the search for solutions to energy security, climate change and the development of human expertise in sustainability[xxiii]. It will also serve to position Abu Dhabi as a world-class research and development hub for new energy technologies and drive the commercialization and adoption of these technologies in sustainable energy, carbon management and water

conservation. In addition, Doha Bank was planning to launch the Gulf's first carbon credits exchange in 2009 to tap an emerging market for emissions trading[xxiv]

One of the first and most important bilateral programs on climate protection issues in the region was SOLERAS (Solar Energy Research American Saudi). SOLERAS was an early endeavor to which the US Department of Energy and the Saudi Arab National Center for Science and Technology (SANCST) had each committed USD 50 million. SOLERAS was established in 1975 and concluded in 1997[xxv]. One of several projects being carried out under SOLERAS supplied two traditional Saudi Arabian villages, not connected to the central electric grid, with solar energy.

Several Arab countries have also signed agreements with European partners to develop solar energy and other renewables. Qatar is investing $220 million in a low-carbon technology fund in Britain. Jordan is making 2 million square metres of land available to build the world's largest PV plant, costing $400 million, with the help of Solar Ventures of Italy. Egypt in 2009 invested $490 million to build 200 MW wind project in the Red Sea in collaboration with the German development bank (KfW) and the European Investment Bank. Plans are in place to follow this new capacity with a 220 MW farm in the same region in cooperation with the Japanese Aid Agency, then a further 300 MW stage in conjunction with the Spanish government[xxvi].

It is also important to highlight the multilateral initiatives announced during the OPEC Ministers' meeting in 2007. Member countries announced the establishment of a USD 750 million fund for Climate Change. Saudi Arabia paid USD 300 million for the fund while Kuwait, Qatar, and the United Arab Emirates each pledged USD 150 million[xxvii.]

9.1.2 The World Bank Finance

As an implementing agency of the GEF, the World Bank has managed nearly 64 per cent of the funding provided by the GEF in the climate change focal area. Further, the World Bank's initiatives in relation to energy efficiency and renewable energy have nearly 40 per cent of the total Bank commitments in the energy sector. In addition, a number of different carbon funds are hosted by the World Bank to support CDM projects. The World Bank has also established two Climate Investment Funds: the Clean Technology Fund, to promote increased financing for demonstration, deployment and transfer of low-carbon programmes and projects, and the Strategic Climate Fund, which provides financing for the piloting of new approaches to technology development and the support of targeted programmes. It is worth mentioning that Egypt was an early applicant to this fund and secured $300 million of financing allocated to renewable energy and transport.

9.1.3 The Global Environment Facility (GEF)

The Global Environment Facility makes funds available for climate change projects, and also stimulates public and private investors to finance climate change projects. GEF is currently the entity entrusted with the operation of the financial mechanism of the UNFCCC, and as such provides the instruments for the transfer of financial resources from developed to developing countries. The instruments for adaptation funding via the GEF are the GEF Trust Fund, the Least Developed Countries Fund and the Special Climate Change Fund. As of 30 April 2007 these three funds have received allocations and pledges of around USD 200 million in total[xxviii].

Further, a number of public financial institutions have already begun to support climate change projects, including various multilateral and bilateral development banks, the United Nations Development Programme and the United Nations Environment Programme.

9.1.4 Clean Development Mechanism

Although CDM may be considered a policy driver to promote EE and RE, its revenues attained form trading of Certified Emission Reduction Certificates (CERs) would improve the feasibility of EE and RE projects. This can be enough to raise projects above the level of being economically viable. However, in countries where energy prices are subsidized, CERs revenues will not be enough to do so. Thus, renewable energy projects might need further government assistance. Potential sources of finance for CDM projects include multilateral, governmental and private sector carbon funds. Only five Arab countries have participated in the CDM since its inception in 2005, they are Egypt, Morocco, Tunisia, UAE, and Qatar.

9.1.5 Adaptation Fund of the Kyoto protocol

The Adaptation Fund has been established by the Parties to the Kyoto Protocol to finance concrete adaptation projects and programmes in developing countries that are Parties to the Kyoto Protocol. The Fund is financed with 2% of the Certified Emission Reduction (CERs) issued for projects of the Clean Development Mechanism (CDM) and other sources of funding. The fund has recently approved its Operational Policies and Guidelines, which allow eligible Parties, seeking financial resources from the Adaptation Fund, to submit proposals. Three agencies have been identified to manage grants from the adaptation fund. These are the Centre de Suivi Ecologique from Senegal, as well as the United Nations Development Programme (UNDP) and the World Bank. Only Egypt and Mauritania have submitted two project proposals for funding adaptation to sea level rise, flooding, and sand dune encroachment.

9.1.6 Third Party Financing

The funds available from the multilateral sources are much less than the investments needed in developing countries to significantly reduce their greenhouse gas emissions and help them adapt to climate change. Thus it is essential to attract private financing for climate change technology transfer.

Third Party Financing (TPF) is one of the most promising financing schemes especially for the promotion of EE and RE technologies. The general concept of TPF is the funding by an external Energy Service Company (ESCO), using the achieved energy savings to pay for that investment. The user of EE or RE technologies does not have to finance the initial outlay that is required for the realization of the project. In contrast, ESCO fully undertakes the financing, design, development and operation of the project. Instead, the investment is reimbursed by payments related to the performance of the technology installed for a specific time, as specified in the contract. Problems of third party include high initial capital outlay requirements, lack of understanding of energy issues by financial intermediaries, lack of familiarity of investors with energy technologies, need of a reliable energy service company to trust in. The concept of the energy service company (ESCO) to finance EE projects has been implemented in some countries of the region such as in Egypt and Tunisia. However, using the same concept to finance RE projects is still absent in the region.

9.1.7 Build-Operate-Transfer (BOT)

BOT (Build-Operate-Transfer) is a relatively new approach to infrastructure development, which enables direct private sector investment in large-scale projects such as roads, bridges and power plants. The main barriers that often arise in BOT agreements are related to financial uncertainties, technical problems and legal and political disputes. Enabling legislation to make the underlying legal framework attractive for BOT projects is therefore imperative. BOT has now taken different shapes and it is implemented in financing some power projects in Algeria, Egypt, Tunisia, and Morocco. As the energy sector reforms evolve in the region, and with the introduction of Independent Power

Producers (IPP), this is a promising financing scheme for future planned Concentrated Solar Power (CSP) plants in the region.

9.1.8 Venture Capital

Venture capital is so named because it is typically invested or 'ventured' in the start-up stage of a company or technology's development, before products and markets are proven, and the capital provided is therefore at high risk. Venture capital provides investment funding at relatively high risk but often-innovative research that may eventually lead to the development of new companies that produce and market innovative cost-effective sustainable energy technologies. Though this financial mechanism has rarely been used in the region, a bold step is the MASDAR initiative driven by the Abu Dhabi Future Energy Company[xxix]. One key objective of MASDAR is to position Abu Dhabi as a world-class research and development hub for new energy technologies. A related objective is to drive the commercialization and adoption of these and other technologies in sustainable energy, carbon management and water conservation. MASDAR has five business units including a Utility assets and management, which uses various investment models to make strategic investments in companies with promising energy technology. MASDAR Clean Tech Fund expects to invest at least half of its $265 million in renewable power technologies[xxx].

9.2 Opportunities for intervention

9.2.1 Legislative and institutional reforms

As noted earlier, national institutional systems and regulatory and legislative frameworks for technology transfer are frequently fragmented in the Arab countries. Support to enhance enabling environments is still needed to facilitate information flow, technology transfer, and private investment.

9.2.2 Capacity building

Capacity building for financing technology development and transfer is another area, which should be supported in the Arab countries. Initiatives aimed at building project-financing skills in government institutions, can increase the steady flow of bankable technology projects, especially when combined with improved access to private capital markets. Similar initiatives are needed to develop human and institutional capacity in the financial sector.

9.2.3 Adaptation technology needs assessment

Much of the technology needs assessments carried out in the Arab countries has focused on mitigation technologies, a specific assessment of the financial needs related to the development and transfer of technologies for adaptation needs to be conducted in the Arab region.

9.2.4 Mobilizing Arab regional funds resources

More than 10 regional development funds such as Kuwait fund for Arab economic development, Saudi fund for development, and Abu Dhabi Fund for Development have been working actively in the region, they have been playing a crucial role in the socio-economic development of the Arab region as well as other developing countries. The huge capital resources available in these funds have not been tapped yet to meet the challenges of climate change. Shifting some of these resources to climate mitigation and adaptation measures would require high political commitments as well as involving sub-regional economic entities such as GCC in the climate policy debate.

9.2.5 Mobilizing Arab Bank resources

The transition from public funding through subsidies or loans to commercial financing is not easy since the former can usually give better conditions than the latter. For this reason,

using public loans or funds as soon as the commercial banks are able and willing to engage is very important. A support intervention is needed to only finance less profitable projects, which commercial banks do not want to take on. Engagement of entities which are more powerful in the decision making process with regard to planning and financing could be crucial, e.g. Central banks, investment planning and investment promotion agencies.

9.3 Opportunities for Arab-Arab cooperation

Some success stories in the region offer few opportunities for inter-Arab cooperation in financing, these include:

9.3.1 CDM and global carbon market

As mentioned earlier, some Arab countries have been active in the CDM market. They have relatively developed the needed institutional and legislative framework. Large potential for CDM finance are still available and untapped in the region due to lack of the needed capacity. The said countries can exchange their experiences with the rest of the Arab countries. The few number of market intermediaries working in the region need to be mobilized and enabling environment need to be developed.

9.3.2 Venture capital

The relatively new initiative of MASDAR could be a potential hub for developing the Venture Capital market in the region. The huge available capital resources in the region need to be mobilized through information flow, raising awareness, and capacity building.

9.3.3 Special EE and RE funds

To promote energy efficiency and renewable energy, some Arab countries such as Tunisia has implemented a special EE & RE financing mechanism. For instance, through the Fonds National de Maîtrise de l'Energie (National Energy Savings Fund), Tunisia subsidizes: (i) 20 % of all investments undertaken by corporations; (ii) 50 % of energy audit costs; (iii) 20 % of all solar energy investments; (iv) 50 % of investments in RE and EE demonstration initiatives[xxxi].

Another Example is the National Fund for Energy Management (FNME) in Algeria, which contributes to the development of the market of energy efficiency through, granting of credits, loans at zero or reduced rates, and loan guarantees for third parties creditors.

Lebanon seems to have different experience; the Central Bank requires every commercial bank to deposit funds with it as a reserve. It has permitted commercial banks to use a part of these funds at a zero percent interest rate for certain specified purposes. One scheme, based on this, is the zero interest loans for disseminating solar water heating.

Lessons learned from these different financing schemes could be widely exchanged at the regional level.

10 Conclusions

Climate change would have far reaching impacts on the development of the Arab countries. It would add extra burden on those countries in order to be able to achieve the MDGs. Higher temperatures and reduced precipitation will exacerbate the water scarcity and increase the frequency of droughts, which would adversely impact the agriculture production worsening the current situation of food security. The Arab region is projected to have more severe impacts of Sea Level Rise than any other region; global warming could expose 6-25 million people and vital economic activities to coastal flooding. The region is one of the highly urbanized regions of the world. Some of these urban centers have poor infrastructure and will be disastrously impacted by climate change. Though some Arab

countries are highly endowed with oil and gas resources, most of the region is blessed with high potential of renewable energy resources mainly solar and wind that are underutilized.

Financial flows, research and development, technology transfer, and knowledge management are all vital to address the challenges of climate change.

To promote EE and RE, a set of policy, market, and economic barriers needs to be overcome. This paper recommends different policy interventions to overcome such barriers, together with opportunities for Arab-Arab cooperation. The paper also proposes a pilot initiative for resilient cities that would test and demonstrate a range of policies and measures to build climate change resilience in the local circumstances of Arab cities. To foster research, technology transfer, and knowledge management, the paper identifies funding, capacity building and reforming legislative and institutional framework, among others, as priority areas for intervention. Finally, the paper recognizes different policy interventions and opportunities for inter-Arab cooperation to facilitate financial flows. These include, for instant, mobilizing Arab regional funds resources. It also recommends inter-Arab cooperation in areas of carbon market, venture capital and special EE and RE funds.

This paper sets the stage for a multi-stakeholder regional consultation with the aim of finalizing and prioritizing the needed policy interventions, and devising a platform for cooperation.

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