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Financing Distributed Renewable Energy Deployment

An investigation of financing mechanisms in Morocco, Tunisia, Jordan and Egypt

Matthew Alison

Supervisors:

Lars Strupeit

Prof. Lena Neij

Dr. Tareq Emtairah - RCREEE

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Published in 2014 by IIIEE, Lund University, P.O. Box 196, S-221 00 LUND, Sweden,
Tel: +46 – 46 222 02 00, Fax: +46 – 46 222 02 10, e-mail: iiiee@iiiee.lu.se.

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Matt

Abstract

The current market of financing mechanisms to support distributed solar energy within the Middle East and Northern Africa (MENA) region is infant and as such has not been described or analysed appropriately. Within Morocco, Tunisia, Jordan and Egypt this research firstly identified and described the contextual background of these four countries and how they impact on financing mechanism deployment and use, using four key contextual descriptors. Secondly, the paper then describes the current financing mechanisms that are offered by public and private institutions to enable greater solar energy technology diffusion. Then, utilising data attained from literature and on-site interviews the paper evaluates how these mechanisms are designed, implemented and adopted by the consumer within the setting of the national contexts.

It was found that the design and implementation features of the identified financial mechanisms in combination with the contextual background had a significant impact on the use of the mechanisms by the targeted consumer. The most utilised financial mechanisms were found in Jordan and Tunisia which both had an appropriate policy context in place that were conducive to financing mechanism deployment and use. Also, collaboration in the design and implementation of the financing mechanisms was found to be a major factor in the success (use) of the financing mechanisms. Additionally, financial mechanisms that were underutilised had obvious design and implementation issues that could be rectified by the relevant actors and improve use.

Keywords: Renewable energy; financing mechanisms; solar energy;

Executive Summary

The latest International Panel on Climate Change report and the International Energy Agency expound that the importance of a global energy transition to cleaner, low carbon sources is crucial to avoid significant climate change impacts (IPCC, 2014; IEA, 2013). The reality of the shift is complex and will take a range of stakeholders, policies and financing mechanisms to work congruently with each other if the shift is to occur rapidly and effectively. Addressing issues such as energy security, climate change, energy poverty, sustainable development and economic growth in developing countries brings policy makers face-to-face with two very complex fields: finance and renewable energy (RE). Designing smart policies and financing mechanisms to trigger investment into RE can address these overlapping challenges (IRENA, 2012). Developing countries in particular have a unique opportunity to build additional capacity and meet their growing energy demand in ways consistent with low-carbon and climate resilient development (Buchner & Heller, 2012). The Middle East and Northern Africa (MENA) region is one such region that has the incentive, the potential and the resources to commit to such an energy transition.

Distributed solar energy technology (Solar PV and solar hot water) has the potential to positively impact many of the regions energy and development issues however deployment is currently considered poor. One of the key elements to successful distributed solar energy technology deployment is the establishment of appropriate financing mechanisms that enable financial barriers to be overcome (Buchner & Heller, 2012; Eckhart, Stone, & Rutledge, 2005; Green Climate Fund, 2013; International Renewable Energy Agency, 2012; Justice, 2009; Nelson et al., 2014). These include concessional loans, equity investments, grants and subsidies. Appropriate finance is currently considered poorly implemented throughout the MENA region even though in recent years financing mechanisms to address financial barriers to distributed solar energy deployment have been established in some of the regions countries (Regional Centre for Renewable Energy and Energy Efficiency, 2013a). These have not been characterised and assessed and therefore any issues in deployment and use of these mechanisms has not been determined. The objective of this research is to address this knowledge gap through an ex-post evaluation of financing mechanisms focused on solar energy technology deployment in Morocco, Tunisia, Jordan and Egypt.

The research questions posed are thus:

1. How do the national contexts of Morocco, Tunisia, Jordan and Egypt provide a conducive environment for the deployment and use of financing mechanisms for distributed solar energy?

1. What are the design and implementation features of the identified financing mechanisms and to what degree have target consumers adopted the identified mechanisms? How have these features affected adoption by consumers in the setting of the national context?

Methodology

In order to perform an evaluation and answer these questions, a framework utilised by the United Nations Environment Program (UNEP) and Sustainable Energy Finance Alliance (SEF) was used as inspiration. This framework has been utilised previously to evaluate public finance mechanisms in a range of contexts and enables a step-wise approach to be taken to the point of evaluation. Step 1 of the framework involves identifying and describing key contextual areas that will have an impact on financing mechanism deployment and/or use and

is used to answer *Research Question 1*. This paper has used four context descriptors in order to identify these key areas.

1. The **overall potential** of the solar energy market based on electricity tariff rates, energy imports, energy demand and solar irradiation.
2. **Policy framework** – including renewable energy laws and regulatory instruments focused for distributed solar energy, namely net-metering schemes.
3. **Consumer Financing Market** – focused on any obvious borrowing market characteristics of the focus country's that influence the deployment or potential use of financing mechanisms
4. **Main actor collaboration** – An overview of the main actors of the solar energy market is provided including key public sector, industry, commercial and private organizations directly involved in the deployment of solar energy technology (including dynamics between key players) (United Nations Environment Programme, 2011). These actors often play key roles in initiating financial mechanisms targeted at specific market segments to support national, sector or industry goals.

Step 2 and 3 of the UNEP framework will be used to answer Research Question 2. Firstly, financing mechanisms within each focus country have been identified that focus on the deployment of distributed solar energy. These include concessional loans, capital grants and subsidies, equity and quasi equity. To guide data gathering, the methodology has developed and defined a common set of criteria to characterise the financing mechanisms in design, implementation and market impact. These are presented in Table 1 below.

Table 1: Mechanism criteria for characterisation

	Criteria
Design	Appropriate for the target consumer
	Appropriate for the target technology
	Clarity of purpose and explanation of benefits and risks of utilisation
	Targets
Implementation	Administrative procedure
	Fund disbursement
	Technical/financing/administrative capacity
Market Impact	Barriers addressed
	Utilisation of the mechanism by target consumers

Utilising a defined set of indicators for each type of financial mechanism, an assessment has been performed of the financing mechanisms comparing each against the defined criteria. A simple 'high' 'average' and 'low' assessment rating has been given to each criterion of each

financing mechanism based on specified indicators. The purpose of this assessment is not to rank the various financing mechanisms but rather identify leading practices in the design and delivery of the identified financing mechanisms.

Main findings

With regards to *research question 1* results show that, firstly, all countries in the study are suitable for solar energy deployment based on abundant solar irradiation, high reliance on energy imports and increasing energy demand. However, the highly subsidised electricity rates that Egypt offers will hinder the solar market as it will be difficult for solar energy to reach grid parity and be economically viable for households, small and medium enterprises (SMEs) and industry with these subsidies in place.

In terms of the *policy framework*, all focus countries have laws and regulations in place specifically focused on RE deployment and are considered to be long term and stable. The Tunisian and Jordanian laws have a focus on distributed renewable energy while the Moroccan and Egyptian laws are more focused on larger scale or utility scale solar energy. Net-metering schemes have been implemented in Tunisia, Jordan and Egypt to support distributed solar PV deployment while Morocco enables larger projects on the medium and high voltage networks (up to 50MW) to sell any excess electricity generation back to the electricity regulator under a power purchase agreement (PPA). This legal and regulatory focus to encourage distributed energy systems provides a favourable environment in which financing mechanisms can be launched as they can be focused on sectors that are able to take advantage of regulatory programs and potentially increase the use of the mechanism.

The *consumer financing markets* of all countries are well established and offer financing products to all sectors (households, SMEs, commercial, tertiary and industrial enterprises). However, the consumer financing market characteristics differ across countries and impact on the deployment of financing mechanisms as well as the use of financing mechanisms. For example, within Jordan religion plays a large part in the borrowing market and financial products used. This has meant the role Islamic banks play in the market is much larger than other country markets. This influences the use of typical financial mechanisms such as loans as well as the decision of financial institutions to deploy additional financing mechanisms. In Tunisia, SMEs face significant risk aversion of financial institutions when attaining finance for projects which could impact on the deployment of financial mechanisms offered to this sector. Contrastingly, financial institutions in Morocco show good penetration of the SME market offering a conducive environment for further mechanisms focusing on renewable energy to be deployed to this large sector.

Main actor collaboration in solar markets varied significantly across the focus countries. Within Morocco, it was observed that a culture of collaboration between all government organisations involved in the solar energy sector as well as with commercial banks was high. This culture of collaboration can spill over to the financing mechanisms offered to support the solar energy market. Within Jordan there was a lack of collaboration between government organisations and commercial organisations. This is not conducive to financial mechanism deployment as financial institutions, namely commercial banks, are not inclined to offer products focused on the infant solar market without the support or guidance of government organisations. However, this was largely negated by the active involvement of development banks such as Agence Francaise de Developpment (AFD – French Development Bank) and the agreements with commercial banks to deploy financial products focused on the distributed solar market at subsidised rates. Tunisia showed high collaboration between government organisations, private commercial banks and electricity utility's involved in the solar sector. This is beneficial to financial mechanism deployment as financial products can be implemented focused on the

solar energy sector with the support of all key actors. Within Egypt, collaboration was also observed between solar industry organisations, public offices, commercial banks and sector organisations. This shows a conducive environment to the deployment of financial mechanisms focused on the solar energy sector as is shown by the implementation of the Green Hotels mechanism.

With regards to *research question 2* it was found that there are a total of thirteen financing mechanisms offered at present across Morocco, Tunisia, Jordan and Egypt. These included concessional loans, grants and subsidies, equity and quasi equity mechanisms. Concessional loans were the most prevalent financing mechanism across the countries indicating the importance of commercial banks in the distributed solar energy sector.

In regards to the **design** of identified mechanisms, most performed well in relation to the *appropriateness for target consumer* criterion. This indicates that most organisations understand how to initially attract target consumers. This is somewhat helped by the backing of central banks and development banks which enable 'soft' terms to be offered. However, collateral requirements were high for some banks and prohibited consumer use of the financing mechanism. In regards the *appropriateness for target technology*, a majority of financing mechanisms offered loan terms that were in line with technology payback periods and amounts that could cover technology costs. The *clarity* of the purpose and explanation of the benefits of the mechanism was lacking within some financing mechanisms. With the exception of the Tunisian PROSOL mechanisms, all other mechanisms lacked any solid *targets* such as amount to be deployed or number of systems to be funded.

In regards to the **implementation** of the identified mechanisms, the *administrative procedure* was an issue across some of the offered mechanisms. Streamlining administrative procedures and reducing the reporting steps could facilitate quick approvals and increase use. The *internal technical capacity* of many commercial banks was low, and impacted on the approval of loans for renewable energy technology (RET). Offering technical assistance in combination with credit lines could alleviate this. The timing of *disbursement of funds* is as an issue and while some organisations disbursed funds according to project progress, others only paid funds once the project had been complete. Late disbursement of funds has been revealed as one of the reasons for a lack of adoption of financial mechanisms.

In regards to **market impact**, with the exception of the Tunisian financing mechanisms, there was a lack of *utilisation* across all other financing mechanisms. Contextual factors as well as design and implementation issues discussed have an impact on the limited use of financing mechanisms.

Recommendations

In order to increase the adoption of financing mechanisms, the following recommendations are proposed. Firstly, in regards to specific design and implementation features, improving the technical capacity of staff in financing institutions will ensure more informed assessment of risk associated with renewable energy projects. This could help in lowering collateral requirements for projects, increase the number of potential consumers and therefore increase the use and diffusion of solar energy technology. Increased interaction between financial institution and solar industry organisations could be part of such a capacity building process. Also, the streamlining of administrative procedures to reduce transaction costs on both sides will encourage higher use of mechanisms. Additionally, the timing of the disbursement of funds should not be at the end of a project but instead in stages in line with project stages. This could have a significant impact on the attractiveness of the mechanism to the end

consumer while also giving the financier greater control over use of the funds and security that the project will achieve the desired savings and increase likelihood of payback of the principal.

Secondly, collaboration is essential between public sector, financing sector, industry organisations and private sector in the design and implementation of financing mechanisms. Collaboration ensures that all technical, financing, target market and policy factors are covered in the design and implementation of the mechanism. The technical aspects such as approving installers to take part in a mechanism could be covered by solar industry organisations. As the solar markets are relatively infant, such measures for quality management are likely to contribute to higher project quality, increased savings for the consumer and a reduction in the perceived risk of financing organisations towards RET. Also, industry associations, such as the Egyptian Hotels Association, play an important role in providing information on important target sub-sectors, in this case the hotel sector. Collaboration across solar industry associations, interest organisations representing specific adopter groups and financing organisations would facilitate better-tailored design and implementation of financing mechanisms and increase adoption.

Lastly, the financial ideology of Islamic banks is well suited to developing renewable energy markets as the focus is on ethical, moral and social considerations and the belief that money should be used to create social value rather than just wealth. The financial products offered are also appropriate for RET investments. For example, the ***Ijara*** (Lease-to-own) product would be suited very well to households, SMEs, and commercial organisations. Lease-to-own models have proven very successful in both developed and developing country contexts to increase the diffusion of solar energy technology. Within Jordan this would be particularly viable as Islamic banking is already well established. This would overcome the issue of religious constraints on consumers entering the standard borrowing market. ***Mudarabah*** (Profit and Loss sharing) and the ***Musharkah*** (Joint venture) products are well suited to project developers and larger industrial projects that can take advantage of net metering and PPAs such is the case in Morocco, Tunisia and Jordan. It is highly recommended that Islamic banks become involved in the distributed renewable energy markets through their standard financing products.

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Abbreviations

ADEREE - L'agence Nationale pour le Développement des Energies Renouvelables et de l'Efficacité Energetique

AFD – French Development Bank

EGP – Egyptian Pound

EUR - Euro

FIT – Feed-in-tariff

IPP – Independent Power Producer

JEDCO – Jordan Enterprise Development Corporation

JOD – Jordanian Dinar

kFW - KfW Bankengruppe

kW – Kilo watt

kWp – Kilo watt peak

kV – Kilo volt

MAD – Moroccan Dirham

MENA – Middle East and North Africa

MW – Mega watt

NBE – National Bank of Egypt

ONE - l'Office National de l'Electricité

PPA – Power purchase agreement

PV – Photovoltaic

RCREEE – Regional Centre for Renewable Energy and Energy Efficiency

RE – Renewable Energy

RET – Renewable energy technology

SHW – Solar hot water

SME – Small and medium enterprises

STEG – Tunisian Company of Electricity and Gas

TND – Tunisian Dinar

USD – United States Dollar

W – Watt

Exchange rates

The following exchange rates were used to convert local currencies to Euro's in order to make comparisons and reading easy. They were taken from XE.com on Friday 5th September

1 Euro (EUR):

= 11.12 Moroccan Dirham (MAD)

= 0.92 Jordanian Dinar (JOD)

= 2.27 Tunisian Dinar (TND)

= 9.26 Egyptian Pound (EGP)

= 1.29 US Dollars (USD)

1. Introduction

Distributed solar photovoltaic (Solar PV) and solar hot water (SHW) technologies are suited very well for industrial, small and medium enterprises (SME) and household sectors within the MENA region. These technologies offer a unique opportunity to, in part, address energy security, energy poverty, sustainable development and economic growth issues facing many countries in the region. The deployment and use of financing mechanisms is a key to enable substantial diffusion of these technologies and achieve national energy and development goals.

Figure 1: The Middle East and North Africa Region (Source: Economist Intelligence Unit, 2011)

1.1 The need for an energy transition in the MENA region

It has been recognised in recent years that the generation of electricity from fossil fuel sources comes with certain negative environmental and social impacts and challenges. Increased climate change impacts from fossil fuel use, declining secure sources of fossil fuels and increasing energy demand in developing and industrialised countries all drive the case that adoption of alternate forms of energy is required. Renewable energy is infinite and an important resource for many rapidly developing countries to utilise in order to increase energy diversity and security, alleviate energy poverty and meet environmental and climate change goals (Nelson et al., 2014). Many MENA region countries are looking to renewable energy to help address some of these issues.

1.1.1 MENA region is highly vulnerable to climate change impacts

Climate change is an issue that will have significant impacts throughout the world. The MENA region is especially susceptible to climate variations. Based on the 2007 Intergovernmental Panel on Climate Change (IPCC) assessment, most of the MENA region is expected to become hotter and drier as a result of climate change and is extremely vulnerable to climate variations (Drine, 2011). Significant impacts will be seen in the important agricultural sector leading to possible food shortages as well as adding stress to an already water poor region(Drine, 2011; World Bank, 2013) Investment in low carbon technology by all countries is crucial to mitigating the harmful impacts of increased CO_2 concentrations.

1.1.2 Energy security is a high priority

Volatile oil prices, a dependence on imported energy, a culture of high energy subsidies and a unpredictable political situation in the region make energy security a top priority for many of the regions countries. The price of oil has increased over the last five years from around US$60 per barrel in 2009 to about US$107 per barrel in 2013[1]. This is in part due to tensions within the region coupled with decreasing investment into the oil industry and declining oil resources (Arian, 2013). Although there are some gas reserves, oil is the major source of energy for countries within the region (International Renewable Energy Agency, Directorate of Energy & Climate Change, & Renewable Energy Policy Network for the 21st Century, 2013). The continued high and volatile prices of fuels are straining the finances of many net-importing countries such as Morocco, Tunisia and Jordan (World Bank, 2013). Economic losses incurred by rising fossil fuel consumption in the MENA region are visible in net importing countries such as Jordan in which imported energy sources (96% of total energy sources) accounted for 40% of the countries budget (Elsagheer, 2013; International Renewable Energy Agency et al., 2013; US Energy Information Administration, 2014b). Volatile political situations in exporting countries such as Egypt and Syria also disrupt energy supply. The Arab Gas Pipeline has been attacked on several occasions causing cuts to supply and forcing importing countries to utilize expensive diesel fuels for electricity production in order to sustain their industries[2] (US Energy Information Administration, 2014b). The development of renewable energy capacity in these countries will be crucial over the coming years to ensure their energy security and reduce the economic burden that the use of imported hydrocarbon fuels is placing on their economies.

1.1.3 Rising energy demand needs to be addressed

The causal relationship between Gross Domestic Product (GDP) growth and increasing energy consumption has been established in multiple publications (Al-Iriani, 2006; Asafu-adjaye, 2000; Kraft & Kraft, 1978; C.-C. Lee, 2005; Soytas & Sari, 2003)This relationship was specifically shown in MENA region countries by Bououiyour & Selmi (2013). Demand for electric power in the MENA region is accelerating rapidly and is expected to grow at around 7% per year over the next 10 years. This will add pressure on already stressed existing energy infrastructure and create a relatively high demand for new investments (World Bank, 2013). The increasing demand has been driven by population growth, economic development and industrialization and the related increases in demand for liquid fuels and electricity for domestic use in electric devices, heating and cooling. (Economist Intellignece Unit, 2011; Griffiths, 2013; International Renewable Energy Agency et al., 2013). Currently the residential and commercial sectors in the Middle East make up the largest energy users. Up to 54% of energy use came from the residential sector and another 29% from the commercial sector (Hormann, Kuntze, & Dib, 2011). Over the next 30 years it is estimated that total investments needed in the energy sector within the region will be over US$30 billion a year (World Bank, 2013;International Finance Corporation, 2012).

1.1.4 Potential for distributed solar energy in the region

The solar power potential, declining costs of renewable energy technology combined with policy changes in many of the regions countries all show the potential to launch significant renewable energy programs throughout the region (Aanesen, Heck, & Pinner, 2011, 2012; Clean Energy Pipeline, 2013; Griffiths, 2013; International Finance Corporation, 2012; International Renewable Energy Agency et al., 2013; International Renewable Energy

[1]All prices are nominal for the year

[2] 39% of Jordan's primary energy supply comes from the AGP presenting major issues if cut off.

Agency, League of Arab States, & Regional Centre For Renewable Energy and Energy Efficiency, 2014)

The high potential for solar power in the region is obvious with high insolation, low humidity and extended available flat areas near road networks and transmission grids (Abdo and El-Shimy 2013; Parajuli et al. 2013). On top of macro-factors such as the increasing energy demand and need for energy security, solar photovoltaic (solar PV) has now become cost competitive (at point of consumption) against conventional (unsubsidized) power generation in some MENA region countries due to a dramatic drop in solar equipment costs, and further reductions in balance of system (BOS) costs (Aanesen et al., 2012; Griffiths, 2013).

The location of the MENA region within the 'Sun Belt' means it has high solar potential compared to other regions around the world. In a study by Betak, Suri, Cebecauer, & Skoczek (2010) the solar PV potential of the MENA region compared to the European Union (EU) was significant. The study found that countries such as Jordan and Egypt had the highest irraditon with means of 2300kWh/m^2 and 2080 kWh/m^2 respectively[3]. Of the top 20 ranked countries for potentail solar power production, fourteen were within the MENA region.

Generation is most valuable when electricity demand is highest (Burke, 2014). In other energy markets under the most extreme demand conditions, solar has reduced the peak demand seen by retailers and wholesale energy markets (Burke, 2014). In MENA economies the expected production curve of distributed solar power fits in very well with peak demand for electricity. Peak hours are in the afternoon hours in summer, when air conditioning use in high-income economies of the region leads to surging electricity demand (El-katiri, 2014).

Renewable energy targets have been established within MENA region countries in order to encourage and drive the sector performance. Table 2 below shows renewable energy targets adopted by focus countries. This shows the commitment to implement policies that encourage the adoption of renewable energy technologies. The establishment of policies to encourage the diffusion of distributed solar energy has also been encouraging. A detailed outline of specific policies in place in the focus countries is presented later in Chapter 4.

Table 2: Renewable energy targets as a percentage of total energy (RCREEE, 2012)

Country	Current RE mix	RE Target	Target Year
Morocco	32%	42%	2020
Jordan	0.5%	10%	2020
Egypt	11.6%	20%	2020
Tunisia	6%	30%	2030

The economics of solar PV versus alternative forms of power generation is the factor most likely to drive rapid market adoption (Griffiths, 2013). The declining costs of renewable

[3] Using annual DNI potential per country

energy technologies over recent years has made the technology accessible to more households, commercial, tertiary and industrial enterprises on a small and medium scale than ever before. Solar panel costs have declined over the last five years to a level of €0.57 c/watt in 2013 when in 2008 they were approximately €2.70/W (Bloomberg New Energy Finance, 2013 and Bazilian et al., 2013). Since 2004 system prices have fallen steadily as installers achieved lower installation and maintenance costs due to better racking systems, and falling balance of system (BOS) costs (Bazilian et al., 2013). Installed costs in countries such as Jordan are around €1,420 per kWp and in Tunisia about €2300 for a 1 kWp for household PV systems (Soften, 2014; Piladelphia, 2014).

According to Bloomberg New Energy Finance the 2012 levelised cost of electricity[4] (LCOE) for solar PV ranged from €0.08/kWh to €0.19/kWh (Bazilian et al., 2013). A study by Tsoutsos et al. (2013), "Photovoltaics competitiveness in Middle East and North Africa countries the European project PV parity" calculated the LCOE for focus MENA region countries. The PV LCOE for Morocco , Jordan and Egypt was approximately €0.10/kWh while Tunisia was slighlty higher at €0.12/kWh. This data is supported by Griffiths (2013) who calculated a similar avaerage LCOE for MENA region countries. Major driving forces for reducing the LCOE are the high PV learning rate (reducing production and install costs), a reduction in module prices, and high annual growth rate of PV industry leading to increased supply and competition amongst producers (Breyer, Gerlach, Schäfer, & Schmid, 2010).

A low LCOE however does not necessarily mean solar energy will be used. Due to price distorting subsidies on fossil fuel energy sources, the retail price (grid parity) is unnaturally low. Highly subsidised fossil fuel electricity prices are a culture throughout the region (El-katiri, 2014; International Monetary Fund, 2013a) and therefore many RE technologies find it difficult to compete on financing terms. However, solar PV is getting very close to grid parity in Morocco and Tunisia where electricty subsisides are lower than other countires in the region and with continued drops in module prices and fast local learning curves related to the provision of solar PV, other countries could soon follow (Breyer, Gerlach, Beckel, & Schmid, 2010; El-katiri, 2014). The uptake of solar PV in maintstream markets requires more than cost effectiveness from the perspesctive of levelised cost of electricity generation and grod parity (Yang, 2010). Other market barriers such as up front capital investments and regulatory barriers need to be addressed before significant market deployment can take place.

1.1.5 Current deployment of distributed solar energy technology in MENA

Despite abundant regional solar resources little distributed solar energy capacity has been deployed in the MENA region (Regional Centre for Renewable Energy and Energy Efficiency, 2013b, 2013c, 2013d, 2013e). This is due to factors such as entrenched reliance on hydrocarbon fuels for power generation, disincentives created by heavily subsidized electricity prices, and lack of renewable energy policies such as feed-in tariffs or net metering and limited offerings of financing mechanisms to address the high up front capital costs (Breyer, Gerlach, Schäfer, et al., 2010; Griffiths, 2013).

[4] The LCOE is defined as the "cost per unit of electricity delivered (€/kWh), averaged over the lifetime (a quantity yet to be defined) of the generating system, and includes the capital costs (depreciation, financing costs, etc.), BOS costs, as well as the operating and maintenance costs (including insurance, etc.) of the system. The LCOE is dependent on the total amount of electricity generated and therefore on the insolation at the location of use as well as on the performance of the system" (ECN, 2012)

While large-scale renewables are receiving a lot of attention in the region[5], smaller, decentralized sources of renewable energy such as solar PV and solar hot water have received little investment. The residential sector of the Middle East accounts for 54% of final energy usage making it the largest energy consumer in the region (Hormann et al., 2011). A majority of this energy is produced from fossil fuel sources presenting an opportunity for smaller to medium sized distributed solar to meet part of a nation's social and climate goals by addressing energy issues, climate issues and employment issues. While there have been programs aimed at rural electrification using off grid solar PV such as Morocco's Global Rural Electrification (PERG) program and Rural Electrification Program in Tunisia (Masse, 2010), this represents a very small section of the total potential of the distributed renewable energy market in the region.

1.1.6 Barriers to distributed solar energy

The market gap in distributed solar energy has occurred in part due to a lack of/inadequate policy measures in place and also a lack of/underutilization of appropriate financing mechanisms that help to overcome barriers associated with RE installs for self-consumption. This section will outline the current issues facing distributed solar PV and solar hot water (SHW) installations within the region and develop the topic area of financing mechanisms used to address these issues.

The dissemination of solar PV and SHW in developing countries faces a multitude of financing, technical, institutional and policy barriers as outlined in Table 3 (Barua, Urmee, Kumar, & Bhattacharya, 2001; Painuly & Wohlgemuth, 2008). Renewable energy is characterized by high up front capital costs, risk aversion of financing institutions, and political and regulatory barriers (International Renewable Energy Agency, 2012). By working within the regulatory context, appropriately designed financing mechanisms seek to overcome these barriers and enable greater renewable energy deployment (International Renewable Energy Agency, 2012). Within the scope of this thesis, the author will focus only on financing barriers impacting distributed/self consumption solar PV and SHW deployment as well as relevant contextual policy barriers that directly impact these financing barriers.

Table 3: Barriers to Distributed Solar Deployment (Painuly & Wohlgemuth, 2008)

Barrier	***Description***
Market Barriers	- Lack of broad information/awareness by decision makers - Subsidies for conventional energies create market distortion - Limited technology transfer and capacity building
Regulatory/Administrative Barriers	- Lack of adequate institutional and regulatory framework

[5] Total investment in renewables in the region has also increased from €366 million in 2009 to €2,217 million in 2012. (International Renewable Energy Agency et al., 2013).

	- Absence of systematic policy support
Financing Barriers	- High up front capital costs - Lack of adequate financing mechanisms - Risk aversion of investors and financing institutions
Other Barriers	- Lack of adequate transmission and distribution grids needed to properly integrate RE systems into the electrical grid - Social acceptance of RE technology is still low - Sensitive political environments

Financing mechanisms can overcome the high up front costs of solar energy technology

Even with technology costs falling dramatically high initial capital costs and lengthy payback periods have been identified as the most significant barriers that limit the diffusion of solar photovoltaic (PV) systems and solar thermal systems (Alafita & Pearce, 2014; Barua et al., 2001; El-katiri, 2014; Goldman, Mckenna, & Murphy, 2005; Margolis & Zuboy, 2006; Noll, Dawes, & Rai, 2014) This is amplified in developing countries such as the MENA region where incomes are lower and access to capital may be more difficult (El-katiri, 2014; Regional Centre for Renewable Energy and Energy Efficiency, 2013a). For this reason appropriately designed financing mechanisms that are tailored to specific consumers' needs are crucial to ensuring the deployment of renewable energy technology (RET) is both accessible to a households, SMEs, commercial and industrial sectors and is sustainable (i.e. long term deployment can take place). Without adequate financing, the adoption of distributed solar energy technology has been difficult due to the high up front costs that prohibit much of the middle-low income population from accessing the technology.

Risk aversion if financing institutions towards renewable energy projects

Limited access to low-cost financing is an impediment to high-velocity technological diffusion of solar PV technology for distributed grid-connected uses (Alafita & Pearce, 2014). There is a general lack of renewable energy finance experience within commercial financing institutions (J. Maclean, 2008). Knowledge and capacity among potential renewable energy financiers is often limited, resulting in increased perceived risk of projects and consequent elevated financing costs (International Renewable Energy Agency, 2012). High perceived and real end-user credit risks, inability for renewable energy equipment to be used as collateral and difficulties creating creditworthy financing structures all discourage commercial financing institutions from entering this market. Despite renewable energy policy implementation in many countries, financing institutions and private investors are still risk averse to renewable energy projects (El-katiri, 2014). Even in developed markets such as the US, commercial lending organizations generally have concerns with the stability of the market and solid incentives, the newness of the technology and a lack of technical knowledge of the systems (ICF International, 2013). Many financing institutions lack the technical capacity to approve loans for renewable energy projects. Without understanding the technical aspects such as the quality of solar PV panels or location of RE projects they are unable to determine if the project holds acceptable risk and may not approve favourable projects or may even approve unfavourable projects.

Distributed solar energy projects payback in a different form to normal investments. The payback is not shown through cash back but instead on money saved through the electricity bill. This requires financing institutions have a different mind-set when establishing the cash flows of a particular renewable energy investment. For these reasons there has been a significant lack of private financing mechanism offerings in the MENA region (El-katiri, 2014). Certain financing mechanisms such as guarantee funds and risk sharing mechanisms can be utilized to help quell the risk aversion of these financing institutions.

The barriers described above are able to be overcome with adequate and innovative financing mechanisms however for small clients, such as rural households or even urban middle class residential investors, credits covering the costs for small-scale renewables applications such as rooftop installations may not exist at all (El-katiri, 2014).

1.1.7 Problem Definition

Distributed solar energy technology (Solar PV and solar hot water) has the potential to positively impact many of the regions energy and development issues however deployment is currently considered poor. One of the key elements to successful distributed solar energy technology deployment is the establishment of appropriate financing mechanisms that enable financial barriers to be overcome (Buchner & Heller, 2012; Eckhart et al., 2005; Green Climate Fund, 2013; International Renewable Energy Agency, 2012; Justice, 2009; Nelson et al., 2014). In recent years financing mechanisms to address financial barriers to distributed solar energy deployment have been established in some MENA countries however finance is currently considered poorly implemented throughout the MENA region (Regional Centre for Renewable Energy and Energy Efficiency, 2013a). Currently deployed financial mechanisms have not been characterised and assessed and therefore any issues in deployment and use of these mechanisms has not been determined. This research will address this knowledge gap.

1.2 Objective and research questions

Aim and Objectives of this paper:

The aim of this paper is to contribute to the knowledge of renewable energy finance mechanisms available within the MENA by providing details of the significant contextual factors of four focus countries and the financing mechanisms that operate within. The objective of this paper was to perform an ex-post evaluation of these mechanisms and the contextual framework in which these operate in the four focus countries.

The *research questions* of this thesis are thus:

1. How do national contexts of Morocco, Tunisia, Jordan and Egypt provide a conducive environment for the deployment and use of financial mechanisms?

2. What are the design and implementation features of the identified financing mechanisms and to what degree have target consumers adopted the identified mechanisms? How have these features affected adoption by consumers in the setting of the national context?

1.3 Methodology

In order to answer the above research questions a framework utilised by the United Nations Environment Program to evaluate public finance mechanisms has been adopted by the author to evaluate financing mechanisms found within focus countries Morocco, Tunisia, Jordan and Egypt. This framework was used to evaluate the context, design, implementation

and adoption of the identified mechanisms. To gather data for use in the analytical framework a combination of literature and on site interviews within the stated countries has been performed. Both the framework and research methodology are developed further in Chapter 2.

1.4 Scope

Countries

The focus countries for this thesis are Morocco, Tunisia, Jordan and Egypt. These countries were determined by the author and RCREEE. All four countries ranked as the highest of all RCREEE member countries in the category of Finance and Investment in the last AFEX report produced in 2013. This ranking was based on three key factors of financing support, macro investment conditions and RE investment conditions. These countries therefore show the most promise in having established financing mechanisms that promote the deployment of renewable energy technology.

Technologies

Solar PV and SHW have the highest potential for distributed renewable energy deployment within the region (RCREEE, 2013). While some financial mechanisms can be utilised for other technologies, solar PV and solar hot water provide an interesting case to enable the evaluation of the financial mechanism design, implementation and market impact[6]. Solar PV and solar hot water present very similar characteristics in terms of their high up front capital cost and their payback time, generally through savings on the consumers' electricity bill.

Financing mechanisms

A financing mechanism is defined as any method through which capital funding is made available (IEA, 2011; PWC, 2011) The following financing mechanisms will be included in the paper for analysis:

- Concessional loans
- Equity investments (including quasi-equity)
- Grants and subsidies

Criteria for the inclusion of a financial mechanism in this study has been:

- Mechanism must specifically be focused on distributed renewable energy primarily for self-consumption. This must be implicitly stated either in an interview or via communication material such as website, brochure or pamphlet.
- Mechanisms must have specific eligibility criteria that potential consumers must meet in order to gain access to the mechanism
- Mechanisms must be an offer to the final consumer. This means guarantees and insurance products used by commercial lenders are not assessed.

Consumers are classified broadly as any person or entity that engage with an organisation offering a financial mechanism for distributed solar energy. Included consumers in this paper are:

[6] Within this project, limited data on other renewable energy technologies was attained however will not be presented or analysed due to scope of the project.

- Households
- Small and medium enterprises (SMEs)
- Commercial institutions
- Industrial institutions
- Tertiary institutions such as hotels, hospitals, universities and schools.

The financial mechanisms analysed in this thesis focus on distributed energy projects. Definitions of distributed energy differ greatly from the size of the system, the location of generation, the purpose of use, ownership (Ackermann, 2001). While there is no generally accepted definition of distributed energy for the purpose of this paper the definition presented by Ackermann (2001) and adopted by the International Energy Agency will be used:

> "The purpose of distributed generation is to provide a source of active electric power. Distributed generation is defined as the installation and operation of electric power generation units connected directly to the distribution network or connected to the network on the customer side of the network/meter".

1.5 Limitations

As the focus of this thesis is within countries where English is not the primary language spoken, there were limitations within interviews. Within Morocco a majority of interviews were conducted in French, however the author was able to have at interviews a native French speaker who was conducting research in parallel for RCREEE. Many documents within the focus countries are written in either Arabic or French. With help from RCREEE in translations and Google translate this limitation was mainly overcome.

The travel schedule to conduct interviews was quick as all interviews had to be conducted before Ramadan in June. This meant that it was only possible to spend a week within each country. As such follow up interviews were difficult to schedule and if any interviews were postponed it was difficult to reschedule within the time frame. However, information through follow up e-mails was obtained. Some informants declined to be interviewed, as they were unable to schedule within the times available.

1.6 Ethical considerations

Ethical considerations are an important element to take into account when performing any research. Relevant considerations for this research included:

- Requesting if the interviewee would consent to be recorded during the interview
- Checking with the source any information that was considered to be sensitive before adding it to the thesis.
- Maintaining anonymity of any interviewees or sources that request this
- Remaining objective in the presentation of the results, findings and any recommendations.

1.7 Audience

The intended target audience for this research are intergovernmental organisations, developing country financing institutions, government departments and policy makers. Intergovernmental organisations such as the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE) could find the research useful to advise policy makers and financing institutions on the best practice to achieve high use of financing mechanisms for distributed RET diffusion.

The financing institutions researched could find the evaluation of their mechanism design and implementation useful in order to make any changes and encourage greater use by consumers. For financing institutions that are considering establishing a financing mechanism focused on renewable energy this research will enable good practice and poor practice to be viewed and ensure the mechanism is designed and implemented in a way that gives the best chance for utilisation.

This research could be of value to government departments and policy makers as it shows the two important elements to successful financing mechanism implementation. Firstly, that the right policy context is crucial to encourage supply and use of financing mechanisms and secondly that collaboration with the private sector to ensure mechanisms are designed in line with national regulations and in a way to support national objectives, offers the best chance of success for the mechanisms utilisation.

1.8 Disposition

Chapter 1 – Introduction and problem definition - This chapter presents the nature of the problem addressed in this research. It briefly describes the methodology used to collect data to address the research questions. The content provided identifies research limitations, provides a thesis outline and describes the audience, for which this research may be useful.

In Chapter 2 – Presentation of analytical framework and research methodology - This chapter presents the research methodology used to obtain and analyse data as well as the analytical framework used by the author to evaluate the design and implementation of financing mechanisms within the focus countries as well as certain contextual aspects that influence these mechanisms. The methodology and analytical framework will enable conclusions about factors that impact the use of these mechanisms to be drawn.

Chapter 3 – Presentation of literature on financing mechanisms for distributed solar energy - This chapter firstly shows the impact that policy context can have on financing mechanisms. It then presents financing mechanisms implemented to encourage the diffusion solar PV and SHW and overcome financing barriers in contexts throughout the world. As the MENA region has a mainly Muslim population an overview of the emergence of financial products offered by the Islamic banking sector will also be presented.

Chapter 4 – Presentation of focus country contexts and analysis of descriptors impacting financing mechanisms - This chapter presents the focus country contexts and an analysis of the main descriptors that impact on financing mechanism supply and use presented in Chapter 1.

Chapter 5 – Analysis of identified financing mechanisms – This chapter analyses the identified financing mechanisms using the criteria and indicators established in Chapter 2.

Chapter 6 – Discusses the main findings of the analysis - This chapter discusses the main findings from chapter 4 and chapter 5 particularly in regards to use of the financial mechanisms. It also discusses potential changes to be made to the framework used and analytical approach. The main research contributions of this work and any areas that require further study as a result of this research are also highlighted in this chapter.

Chapter 7 provides conclusions determined from this research.

2 Evaluation method for financing mechanisms

This section will present the research methodology and the analytical framework used by the author to evaluate the design and implementation of financing mechanisms within the focus countries as well as certain contextual aspects that influence these mechanisms. This will enable conclusions about factors that impact the use of these mechanisms to be drawn.

This thesis will evaluate current financing mechanisms identified in four focus countries. Evaluations are essential for the verification of results and the impact of instruments of GHG emissions reduction and the development of energy systems (Neij & Åstrand, 2006). The crucial element within policy evaluations is the feedback function to policy and mechanism implementers (Neij & Åstrand, 2006). This feedback function is a link between policy programs (in this case financing mechanisms), the outcome and the impact of these programs and the problems and needs of the environment and society.

Policies and financing mechanisms can either be studied from an ex-post perspective or an ex-ante view. The ex-ante perspective defines evaluation as "forward-looking assessment of the likely future effects of new policies or proposals" (Guedes Vaz, Martin, Wilkinson, & Newcombe, 2001). While the ex-post perspective enables a review of a policy or mechanism already in place and under use. RE finance practitioners should always be prepared to revise the approach according to the best emerging information and research. Therefore, assessment is a critical component of finance strategy (IRENA 2012).

2.1 Analytical framework

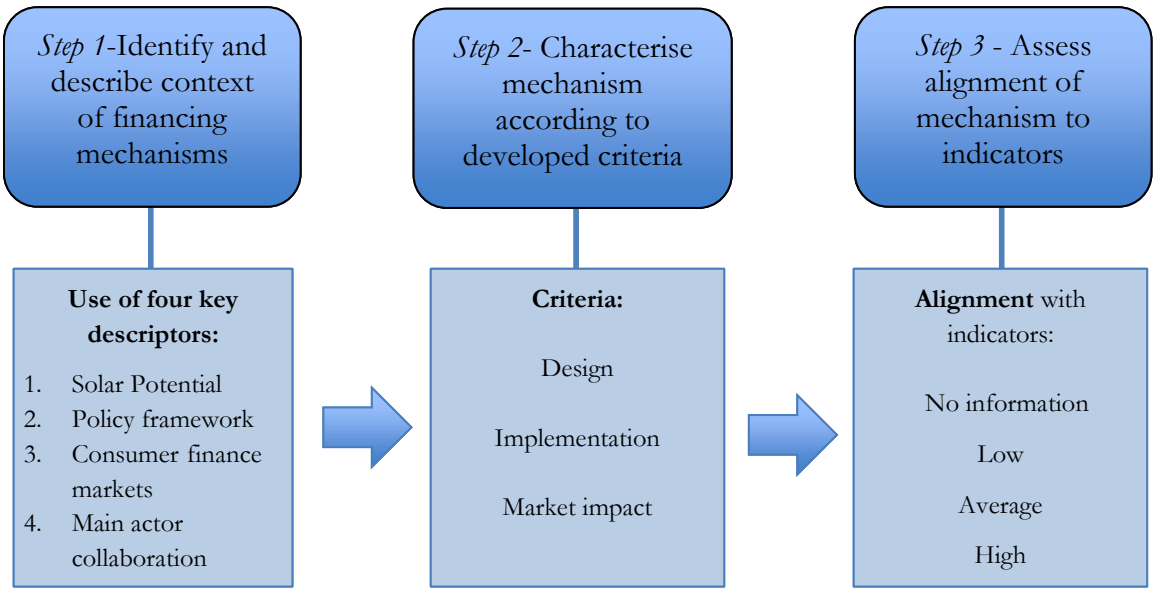
This thesis will evaluate the current financing mechanisms within focus countries in the MENA region from an ex-post perspective using defined methodology and criteria outlined in this section. In order to reach the stated objective and answer the research questions presented, a structured process of data collection and analysis was followed. Each step was designed to address one or more of the research questions of the paper.

In order to evaluate[7] the identified financing mechanisms and answer the research questions, the thesis adopted a framework developed by United Nations Environment Program and Sustainable Energy Finance Alliance (SEF), presented in Figure 2. The framework was used in a report "Evaluating Clean Energy Public Finance Mechanisms" (United Nations Environment Programme, 2011) in which a methodology to evaluate and identify leading practices in the design and delivery of clean energy public finance mechanisms was developed. This thesis has used the methodological steps in a similar way, however, the evaluation criteria has been adapted based on literature of commercial financing mechanisms and data availability[8]. Any elements that have been directly utilised from the report have been referenced. All other elements are the author's own adaption of the framework.

[7] It is important to note here before explaining the framework the difference between assessment and evaluation. An assessment focuses on learning, teaching and outcomes whereas an evaluation focuses on an overall performance. As such this framework includes both an overall evaluation of the mechanism performance and an assessment of each mechanisms various elements that adds to the overall evaluation. Both terms will be used in the explanation of the framework

[8] This is based on the authors previous experience with organisations in the region and the data that is able to obtained publicly.

The framework presented in this section was chosen as it enables an assessment of a number of key factors that impact the success of financing mechanisms and allow an overall evaluation and final recommendations to be provided. The framework is designed to evaluate the performance of the various financing mechanisms and their suitability to be replicated in other contexts throughout the MENA region (United Nations Environment Programme, 2011).



2.1.1 Step 1: Context

Figure 2: UNEP & SEF Alliance Framework for Evaluating Clean Energy Public Financing Mechanisms

Step 1 of the framework involves identifying and describing key contextual areas that will have an impact on financing mechanism deployment and/or use and was used to answer *Research Question 1*. Financing mechanisms are designed to meet specific requirements and reflect national circumstances within which they operate (United Nations Environment Programme, 2011). Therefore the design of a financing program should begin with an understanding of the local context (International Renewable Energy Agency, 2012; United Nations Environment Programme, 2011). With a solid contextual base conducive to solar energy technology and financial mechanism deployment and use, other barriers can then be addressed such as the high up front costs of technologies for SHW and solar PV.

Within this paper four descriptors will be taken into account in order to give an overall picture of the contextual situation the financing mechanisms are operating within. Some of these have been used in the same way as the UNEP framework while others were discussed with RCREEE as being important for the study.

1. The **overall potential of the solar energy market** based on electricity tariff rates, energy imports (including details of any underlying natural resources such as natural gas and oil reserves), energy demand and solar irradiation, will be determined as either having high initial potential, medium potential or low potential (United Nations Environment Programme, 2011). This initially determines if solar energy is a viable option to pursue within the country. If it is determined to be 'low', it would

be unlikely that institutions would offer financing mechanisms targeting solar energy technology.

2. **Policy framework** – The policy framework may influence the relative impact of the financing mechanism and the extent to which the financing mechanism is supported or hindered by the framework (United Nations Environment Programme, 2011). To investigate this element two areas have been identified – Firstly, the *renewable energy laws*. Have these been established and are they long term and up to date with current trends? Is there a focus on distributed solar energy? This will impact financier's decisions to offer renewable energy programs, as solid long-term laws and policies directly related to distributed solar energy provide confidence to financiers that they can develop mechanisms in line with current laws and will encourage long term financing mechanism deployment. On the other hand, short-term, volatile policies and laws increase the risk of renewable energy projects and discourage deployment of financing mechanisms. Secondly, *regulatory instruments* for distributed solar energy – Regulatory instruments that specifically target distributed solar energy can have a large impact on demand for solar PV and SHW and therefore demand for financial products tailored for these technologies. While there are a number of regulatory instruments[9], net metering and feed-in-tariffs have been successful across a number of contexts to encourage investment in distributed solar PV technology as this enables greater financial benefits to be attained by the consumer. Thus, this work will determine if there is a feed-in-tariff or net metering scheme in place directly focused on distributed energy markets to encourage the uptake of solar PV.
3. **Consumer Financing Markets** – One of the greatest obstacles to renewable energy deployment is the absence of well-developed financing intermediaries and the consequent financing difficulties that projects in developing countries face (Painuly & Wohlgemuth, 2008; The World Bank & Climate Investment Funds, 2012) As such this paper will pose a broad question in this descriptor. Are there obvious borrowing market characteristics of the focus country's that influence the deployment or potential use of financing mechanisms?
4. **Main actor collaboration** – An overview of the main actors of the solar energy market is provided including key public sector, industry, commercial and private organizations directly involved in the deployment of solar energy technology (including dynamics between key players) (United Nations Environment Programme, 2011). These actors often play key roles in initiating financial mechanisms targeted at specific market segments to support national, sector or industry goals.

2.1.2 Step 2: Identification and characterisation of mechanisms

Step 2 of the UNEP framework will be used to answer *Research Question 2*. The methodology has developed and defined a common set of criteria to characterise and assess the performance of the financing mechanisms in design, implementation and market impact. These are presented in Table 1 below. A majority of the criteria is qualitative, however, some data made available through interviews allowed certain quantitative criteria to assessed such as 'use' through number of modules deployed. These criteria were chosen by the author and agreed upon with RCREEE to determine which design and implementation features allow the studied mechanisms to have the best chance of use and therefore market impact.

[9] Regulatory instruments to support solar include technical specifications, tax breaks for solar equipment, green certificate incentives etc.

The following Table 4 shows the criteria and how data for this indicator will be ascertained. A description of the importance of each metric and why it has been used is provided below.

Table 4: Characterisation criteria for financing mechanisms

	Criteria	*Information Source*
Design	Appropriate for the target consumer	- Mechanism criteria - Interviews
	Appropriate for the target technology	- Mechanism criteria - Interviews
	Clarity of purpose and explanation of benefits and risks of utilisation	- Mechanism criteria - Interviews
	Targets of the mechanism	- Mechanism criteria - Interviews
Implementation	Administrative procedure	- Mechanism criteria - Interviews
	Timing of fund disbursement	- Mechanism criteria - Interviews
	Internal technical/financing/administrative capacity	- Mechanism criteria - Interviews
Market Impact	Financial barriers addressed	- Mechanism criteria - Interviews
	Utilisation of mechanism by target consumer	- Assessments - Interviews

Design Criteria

The design of a financing mechanism has a large influence on its' success. The objective is to design a financing product that is attractive, to the target consumer. A product that is easy to use with reasonable security terms, and where the terms, tenors and payments are matched with the target RE project savings benefit streams so that loans can be self-amortizing through savings (J. Maclean, 2008).

Appropriateness for target consumer – Design of a financing product starts with assessment and selection of the target market. Choice of target market should be based on matching the financing institutions interests and capacities with the market need, where the RE project economics are strong, and the financing institution is knowledgeable of the sector's credit characteristics and can assemble adequate security for the contemplated transactions (J. Maclean, 2008). The target consumer could be small and medium enterprises, households or large commercial and industrial enterprises. The ease of access to the mechanism therefore has to reflect the target consumer through its terms and communication technique.

Mechanisms have failed as a result of criteria that were too difficult for the target consumer to meet. For example, if the interest rate is too high or collateral requirements too heavy for customers, the mechanism will fail in the early stages to achieve its objectives, as it will not be demanded by the target consumer.

Appropriate for target technology – Renewable energy finance can be different for various types of renewable energy technology (Kfw Bankengruppe, 2005). Each mechanism generally has a target technology whether explicitly stated or not. In this paper the target technology will be either solar PV or SHW PV. As such, the terms of the mechanism, such as a loan, will usually reflect the lifecycle of the technology and the appealing characteristics. If the mechanism is in the form of a loan for solar PV modules, the length of payback period will be in line with the payback period from the savings made on the electricity bill from the solar PV installation.

Clarity of purpose and benefits and risks – The clarity with which the operation of financial mechanism is described to potential beneficiaries is important to gain the trust of potential users of the mechanism. Beneficiaries need to understand the benefits, risks and requirements of the mechanism before they will utilise a nominated financial mechanism.

Targets – Having specific, stated targets for a mechanism is important to drive performance and use. These targets could be amount of money lent in the case of a loan or number of units of a particular technology deployed as a result of the mechanism. Targets are often linked to the context. For example, if the national policy is encouraging the use of solar PV then a mechanism deployed by a government institution may have a target number of solar PV modules that they would like to be funded for installation through use of a grant.

Implementation Criteria

While the design is important, without appropriate implementation the mechanism will fail to meet many of its objectives. The following criteria are important, as they can potentially be a significant hindrance to the success of the mechanism of they are not implemented appropriately.

Administrative procedure – The success of a mechanism can be traced back to the length of the application and approval process (United Nations Environment Programme, 2011). If the administrative burden is too high for either the implementing party or the consumer, it is unlikely the mechanisms will be utilized and will eventually fail.

Disbursement – The disbursement of funds can impact how useful the mechanism is in overcoming the high up front cost barrier. For example, a solar PV project, if the funds are distributed at the end of the project without any prior agreement then a majority of the risk is on the project developer (i.e. Household or SME). This does not overcome the high up front capital cost barrier presented by both solar PV projects and SHW projects. Funds should preferably be disbursed in stages. For example, at the start to purchase the equipment, before installation and on final commissioning. This gives the project developer adequate funding throughout to complete the project and also gives the funding party assurance that the money is being used for its specific purpose and is able to monitor progress of the project.

Internal Capacity – The internal capacity of implementing party's is crucial for the success of the mechanism. Knowledge of renewable energy technology is important for financing institutions to understand if they are to approve RE projects. Banks often do not understand RE technologies and are unwilling to approve financing due to an inability to appropriately assess the risk of the project (IRENA, 2012). Internal technical knowledge of system design and potential benefits or risks associated with different projects is crucial to appropriately

assess this risk. The economic knowledge of system paybacks is also important for financial institutions to understand. For example, distributed solar PV projects are generally not cash generating in the classical sense of the term. They generate cash through savings made on the electricity bill of users. As such financing institutions must apply a different mind-set to the benefits and cash flows generated for such projects.

Market Impact Criteria

The design and implementation of a mechanism has the end goal of having an impact in the RE market. The barriers the mechanism is designed to address need to be overcome and the amount of technology diffusion that occurs as a result of the mechanism implementation can be measured against any targets.

Barriers Addressed – Each mechanism is established in order to address a particular barrier. For example, if the mechanism has been implemented to overcome high up-front capital costs of installing RE technology the measure will need to determine if the mechanisms has in fact allowed the high cost to be disbursed in such a way that it is no longer a barrier and beneficiaries are able to adopt RE technology more readily. Barriers addressed have been measured by the amount of available finance for each project compared to the average sized installation[10] of the target consumer.

Use – High use of a supplied mechanism is the desired result of all financing institutions, government and industry originations. Higher use means that more solar energy technology is being diffused and will enable environmental, social and energy issues to be addressed. The 'use' may be determined in terms of amount used out of a fund, the number of beneficiaries or the amount of technology deployed.

2.1.3 Step 3: Mechanism assessment with indicators

Step 3 of the UNEP framework will be used to answer *part b* of *Research Question 2*. An assessment has been performed of the mechanisms comparing each against the defined criteria and the context within which it is operating. The purpose of this assessment is to identify leading and poor practices in the design and delivery of the identified mechanisms. Due to the broad range of mechanisms and differing contexts, a numbered ranking of the mechanisms is not possible and will not be provided. Results have been grouped into mechanism categories (i.e. Credit lines, equity, grants and subsidies etc.) in 5.2 Analysis of Financing Mechanisms. The assessment system is used to identify some of the key attributes of financing mechanisms and offers an insight into the current mix of mechanisms offered in the region. If there are any obvious pitfalls or examples of good practice, these have been identified and relevant recommendations provided.

The criteria established to assess the mechanisms is slightly different for each type of mechanism (i.e. loans, equity, grants all have different criteria). A full list of criteria relating to each mechanism category can be found in Appendix 7.1. An example of 'Loans' is provided below in Table 5 to allow the reader see the criteria used to evaluate loan mechanisms in the focus countries.

[10] Average sized installations and costs were determined from interviews with implementers as well as installers

Table 5: Criteria and measurements for evaluation of loans

	3 = High	2 = Average	1 = Low
	Loans		
	Design		
Appropriate for target customer	• The interest rate is below or equal to the commercial bank prime lending rate of given country • The mechanism terms are medium to long term • Grace period on loan is available • Collateral requirements are low • Ceiling of loan is appropriate to cover majority of target customer project costs • Technical assistance is available through the mechanism	• Interest rate is equal to commercial bank prime lending rate • Mechanism terms are short to medium term • No grace period • Collateral requirements are similar to other bank lending products • Ceiling of loan does not cover a majority of target consumer project costs • No technical assistance is available through the mechanism	• Interest rate is above commercial bank prime lending rate • Mechanisms terms are very short • No grace period • Collateral requirements are large • Ceiling of loan covers a small amount of project costs of target consumer • No technical assistance available through mechanism
Appropriate for target technology	• Identification of barriers targeted by mechanism reflect barriers to target technology adoption • Repayment terms are in line with savings/payback of technology	• Identification of barriers targeted by mechanism reflect barriers to technology • Repayment terms are appropriate but not in line with projected technology savings/payback	• No barriers identified or targeted by mechanism • Repayment terms are not appropriate for technology and not in line with projected savings/payback of technology
Clarity of design and understanding	• User guidelines are available and they are clear in the operation of the mechanism and the benefits and risks of utilisation	• User guidelines are available however they are unclear and do not identify appropriately the operation of the mechanism and the benefits and risks of utilisation	• User guidelines are not available
Targets for mechanism	• Targets are established and in line with national policy	• Targets are set but are arbitrary and not linked to any larger goals	• No targets set
	Implementation		
Administrative procedure	• Application process is straightforward and requires minimal documentation and few steps • Time taken to approve applications is fast (<2 weeks) • Applications can be dealt with internally	• Application process is straightforward and requires minimal documentation and few steps •Time taken to approve application is medium (>2 but < 4 weeks) • Applications are dealt with externally by a third party	• Application process is long and complicated with many steps and forms required • Time taken to approve is > 4weeks • Applications must be dealt with externally by a third party
Disbursement is appropriate for target consumer	• Fund disbursement is related to the stage of a project	• Funds disbursed in lump sum at start of project	• Funds disbursed in lump sum at the end of the project
Internal Capacity is appropriate to approve loans	• Good internal knowledge of economic and technical aspects of target technology • Administrative capacity is adequate to deal with applications and loan approvals	• Average internal knowledge of economic and technical aspects of target technology • Administrative capacity is adequate to deal with applications and loan approvals	• Poor knowledge of both technical aspects and economic aspects of target technology • Administrative capacity is not adequate to deal with applications and loan approvals
	Market Impact		
Barriers have been addressed	• Barriers identified have been addressed	• Barriers identified have been somewhat addressed	• No barriers identified or addressed or barriers identified were not addressed
Use of Mechanism	• High use of the mechanism determined by amount loaned compared to any targets or customers served	• Average use of the mechanism determined by amount loaned compared to any targets or customers served	• Low use of the mechanism determined by amount loaned compared to any targets or customers served

2.1.4 Methods for Data Collection

In order to attain sufficient data to address all the elements within the framework and perform a comprehensive evaluation on identified mechanisms a variety of sources were used.

Data was collected by:

- conducting a literature review;
- web search and;
- semi-structured interviews with key stakeholders in order to identify, group and assess mechanisms within the focus countries.

Background research and mechanism identification

Background research on various financing mechanisms that could potentially be used for the deployment of renewable energy in the MENA region has been carried out through online searches and library resources. Initial key words for the search included, "green financing", "renewable energy financing", "MENA region renewable energy", "financing mechanisms". Searches have been conducted in both academic databases and as well as the Google search engine and Google Scholar. A majority of the academic literature search has been conducted in Lund University's academic literature databases. A general overview of these mechanisms is presented in Chapter 3, including a description of how they have been applied in other regional contexts. This is done in order to understand what mechanisms may be found in other regions and how they may be translated into the MENA region context.

Web searches were focused on major financing institutions and government organizations within the focus countries in order to identify current mechanisms in use within the focus countries. A list of national banks and government organisations focusing on renewable energy deployment were then identified. Previous on-site research conducted by the author provided the necessary information about financing institutions in Jordan. .

In order to facilitate a comprehensive analysis of the collected data (see section ??), each set of national information was organized in a matrix including type of mechanism, key features of the mechanism and the institution implementing the mechanism.

Primary Data collection

In order to answer the research questions, up-to-date first hand data was attained through interviews targeting both the implementing parties and beneficiaries of the mechanisms. These were conducted on site in Morocco, Tunisia, Jordan and Egypt. Interviews were semi-structured with questions aiming to collect qualitative information about the mechanisms' performance and any issues stakeholders have found with the use of the mechanism. Questions about barriers, design features, operation, administrative procedures, mechanism use etc. have been used to gain an in depth understanding of the mechanisms' performance and any potential issues/barriers encountered. Interviews with thirty-one stakeholders were conducted, including Ministries of Energy and Renewable Energy in each country, central banks, commercial banks, project developers, and industry associations. A comprehensive list of interviews conducted and sample interview questions asked can be found in 7.8 and 7.9.

3 Financing Mechanisms for Renewable Energy

This section will summarise the portfolio of available mechanisms implemented to encourage the diffusion of solar PV and SHW and overcome the financial barriers identified in 1.1.6. As a starting point the section will show the impact that policy context can have on financing mechanisms supply and use. While there are many brands of banks[11], the establishment of Islamic banking throughout the world in recent years has enabled the offer of interesting products that could be used for RE deployment. As the MENA region has a mainly Muslim population these banks could play a significant role in the development of the RE sector. As such, an overview of the emergence and products offered by the Islamic banking sector will also be presented at the end of this section.

In the broader context, financing has been identified internationally as a key issue in achieving renewable energy development (Churchill & Saunders, 1989; Painuly & Wohlgemuth, 2008; The World Bank & Climate Investment Funds, 2012). Some of the earliest studies on energy sector financing in developing countries point to the importance of the private financing sector in supporting RE deployment (Churchill & Saunders, 1989). The issue, as Justice (2009) points out, is that the finance sector approaches renewable energy in the same manner as other investments, however, as renewable energy has differing characteristics such as new policy and regulation, these investments require an additional level of understanding. This was also identified early in the development of renewable energy policy when Wiser & Pickle (1998) identified that the misunderstanding of financing processes for renewable energy was one of the key reasons RE policies were not more effective in their design and implementation.

The characteristics of solar PV and SHW that are essential considerations in the finance of end use applications include:

- *The geographic location*: the amount of direct sunlight reaching the location per year impacts on the amount of energy produced from the system and resultant energy savings.
- *The facility design and cost:* these include the cost of PV modules, the balance-of-system (BOS) equipment[12], services such as operation and maintenance, procurement and installation.
- *System efficiency:* the key operational characteristic of a PV system as it determines the output of the solar irradiation hitting the panel and impacts on energy used for self consumption as opposed to grid use. This determines the payback period of the system
- *The useful lifetime* determines the amount of time a financier can allow for repayment or lease (generally warranties are given by installers for 10-25 years assuring the owner of 80% to 90% of the modules rated output)
- *Regulatory treatment:* Net-metering and feed in tariffs will directly impact the payback time of the system and so influence the financier's decision to fund and terms of finance.
  (Eckhart et al., 2005; US Energy Information Administration, 2013b)

[11] Commercial banks, retail banks, investment banks, central banks, credit unions, online banks, savings and loans are all different forms of banks performing different operations.

[12] Balance-of-system equipment includes batteries, controllers, inverters, switches fuses etc.

3.1 Policy context significantly impacts financing mechanisms

Financing mechanisms are only as effective as the regulations and policies they operate within as they are merely acting within a specific policy and regulatory environment (J. Maclean, 2008). In one of the earlier analysis of energy sector financing in developing countries, Churchill & Saunders (1989) identified that a proper policy framework is necessary to encourage private sector financing involvement. The lack of supportive, long term consistent or stable RE policy regimes constitute a formidable barrier to investment in many developing countries (International Renewable Energy Agency, 2012). The economic benefits of the project is directly linked to the policy regime that it is operating within and based on that regime remaining in place for the duration of the project. As such banks and equity investors complete detailed risk assessment prior to authorizing an investment or loan. This will generally include an analysis of the duration of the regime, its legal basis, its ability to be amended (Justice, 2009). For example, policies such as feed-in tariffs or net metering will impact on a customer's payback length of a solar home system. Banks looking to lend to households will take this into account and will need to be able to determine if the FIT will still be available in the long term for customers to be able to finance their loans.

Buchner and Heller (2012) promote the importance of policy to unlock 'reactive' investment. They discuss how feed in tariffs, direct subsidies and grants for up front capital costs as well as carbon taxes and cap and trade systems are able to alter the balance of costs and returns between carbon and non-carbon investments and in turn change private behaviour. Politics and the energy market structure are two key elements which indirectly affect the possibility of financing of RE (Kfw Bankengruppe, 2005). In sum, nations require a solid, predictable policy and regulatory environment in order for financing mechanisms to be successful in achieving their goals and enable them to overcome financing barriers.

3.2 Financing mechanisms used for the deployment of distributed solar energy

This section will describe the main financing mechanisms used in the deployment of solar energy, the barrier that the mechanism attempting to overcome, how it does this and examples of where the particular mechanism has been deployed. Appropriate financing of renewable energy involves lowering the cost of capital (debt and equity) to a level that is attractive to the end user or allowing the payment of the capital cost to be spread over a period of time that makes the technology attractive to adopt, such as through lease-to-own agreements.

3.2.1 Loans and lines of credit for solar energy systems

Debt is one side of the cost of capital and needs to be kept as low as possible in order to make RE technology available to consumers. Loans usually entail an interest rate (either fixed or variable), the loan term (number of years to payback the loan) and a repayment schedule that is generally monthly, quarterly or yearly. Loans and credit enable the initial up front cost to be distributed into manageable repayments over a period of time. They are the most common financing vehicle used to directly finance the energy end user (J. Maclean, 2008; United Nations Industrial Development Organisation, n.d.)

Loans have been a successful tool used to address the high up front cost of many renewable energy technologies, particularly for SMEs and households looking to install technologies

such as solar hot water and solar PV systems. The importance of concessional debt[13] in developing countries is established by Nelson et al. (2014) as a more cost-effective method of catalysing investment in RET than other forms of support. They posit that while the exact benefits vary, by subsidizing the cost of debt, many countries could provide the same level of incentive with less total support and at a lower cost than other financing, such as grants (Nelson et al., 2014).

Effective credit lines and loan mechanisms in developing countries need to address three major barriers:

- Cost (interest rate);
- Collateral requirements;
- Loan term (in line with savings)

The interest rate is the biggest factor in making credit mechanisms attractive to potential beneficiaries as it directly impacts on the cost of capital (Eckhart et al., 2005; Kubert & Sinclair, 2009; U.S. Department of Energy, 1999). High cost debt can significantly increase the cost of renewable energy in rapidly developing countries and by lowering the cost of debt, greater financing engineering will enable a reduction in costs and improve the effectiveness of existing renewable energy polices (Nelson & Shrimali, 2014).

Requiring a collateral commitment is a risk minimizing strategy employed by financing agencies. The requirements are determined by lenders depending if the party receiving the loan has little or poor credit history however often in developing countries the collateral that can be provided by borrowers is not adequate and therefore they are unable to gain access to credits (International Energy Agency, 2002; Kapadia & Hande, 2004; Murphy & Edwards, 2003). Many lenders require borrowers to pledge hard or liquid asset collateral equal to a multiple (sometimes up to 150%) of the loan amount (J. Maclean, 2008). These high requirements are often amplified by the fact that lenders are unfamiliar with the technology and therefore perceive the risk to be higher (ICF International, 2013; Murphy & Edwards, 2003). The solar energy system may sometimes be used as collateral however only if the financing institution can make use of it in the case of default (International Energy Agency, 2002). High collateral requirements are often the largest barrier to renewable energy finance for households and SMEs in developing countries and may limit mass-scale penetration of energy loans (Kfw Bankengruppe, 2005; J. C. Maclean & Siegel, 2007; Morris, Winiecki, Chowdhary, & Cortiglia, 2007). Linking borrowers with guarantee programs is one way to handle the risk of non-payment and lack of appropriate collateral from borrowers (J. C. Maclean & Siegel, 2007).

A short loan period can be a significant impediment to use as when combined with the rate of interest, the loan length impacts the size of periodic repayments (Kfw Bankengruppe, 2005; Shrimali, Nelson, Goel, Konda, & Kumar, 2013). A longer loan length results in lower regular repayments however also increases the total amount of interest paid (Eckhart et al., 2005). Depending on the borrowers financing situation lower (monthly) repayments may be more attractive and affordable even though they pay higher interest over the course of the loan. Maclean & Siegel (2007) focus on the importance of loans to deliver energy equipment to households by paying over time with monthly or periodic payments that are affordable. Ideally repayments should be in line with expected savings from the installed system and no

[13] Concessional Debt involves lending extended by creditors at terms that are below market terms with the aim of achieving a certain goal (Dippelsman & Kitili, 2004)

longer than the shortest individual lifetime of a system component (International Energy Agency, 2002).

Concessional or 'Soft' loans involve the relaxing of the terms (lower interest rate, low/no collateral requirements, longer length and a grace period during which no repayments need to be made) and have been utilized effectively in developing countries for both rural and urban households that may be unable to afford the up front capital cost (Eckhart et al., 2005). There are a number of examples that exist for solar energy technology. The Indian Renewable Energy Deployment Agency has initiated a successful concessional loan focusing on solar PV. It attracts a concessional rate of 5% with no collateral requirements and 10 year term with a 2 year grace period (Eckhart et al., 2005). It is important to note that the loaned amount should not cover the entire cost of the system as equity from the borrower ensures some responsibility and ownership (International Energy Agency, 2002).

3.2.2 Equity funds

In addition to debt financing by banks and other finance institutions, RE projects and companies also require equity financing. Besides small amounts of equity provided by households as down payments for solar home systems, private and government organisations also provide equity in projects and renewable energy companies on concessional terms in order to lower the cost of capital (J. Maclean, 2008). Equity investments take an ownership stake in the project or the company (IRENA, 2012). They can either be a pure equity purchase or quasi-equity. Pure equity investors provide capital in a project in return for a share of the equity of the project. Generally, equity investors are willing to take on a higher risk but in exchange for higher returns (Shrimali et al., 2013). Quasi equity or subordinated debt has traits of both debt and equity. Quasi-equity shares the risk and reward of the investment between the investor and the investee by allowing the investor to take a share of future revenue streams. Unlike a loan, this investment is truly 'at risk' i.e. should the company not achieve the expected financing performance, a lower – possibly zero – financing return to the investor is payable (Cheng, 2008). Quasi equity is cheaper than pure equity and therfore popular for RE companies to finance the additional finance 'gap' as well as allowing them to preserve controlling ownership interest in their project or company (J. Maclean, 2008).

In emerging markets experience has shown that there is a substantial potential for the use of equity. However, RET has shown only limited success in attracting these funds through standard private sources. Equity investors seek a required return on equity (ROE)[14] that is often too high for RE project developers and companies in developing countries to attain (Shrimali et al., 2013). The required return for private investors consistent with alternative assets classes with similar risk profiles is typically a 14 – 20% internal rate of return (IRR) (Kfw Bankengruppe, 2005; Shrimali et al., 2013). Within a developing market the ROE is generally higher as investors view the country risk[15] as higher as well as the company risk due to a lack of performance history.

A number of authors have highlighted the issues with the standard Capital Asset Pricing Model[16] that investors use to price required returns on equity in developing economies.

[14] The ROE in the project can be different from the actual return. The ROE is simply the minimum return the investor is willing to accept. The actual return is typically higher than the ROE.

[15] Country risk includes political risk, exchange rate risk, economic risk and sovereign risk.

[16] Capital Asset Pricing Model is used to describe the relationship between risk and expected return

Cheung et al. (1993) and Mobarek & Mollah (2004) both showed that the model is not applicable to developing Asian markets as investors overstated the market risk. Donovan and Nuñez (2012) also found that in a portfolio of renewable energy firms in emerging markets, a near average market risk was ascertained. In contrast, Henriques & Sadorsky (2008) established much higher levels of risk for renewable energy companies in developing countries.

There are now a number of equity providers supporting the growth of renewable energy companies and projects in the world's developing markets. Funds in developing regions such as the Emerging Energy and Environment fund in Latin America, Inspired Evolution Investment Management in southern Africa, Armstrong Asset Management, Frontier Investment Management and the MGM Sustainable Energy fund pursue investments strategies that enable regional development of renewable energy projects and companies (EEEF, 2014; Evolution One, 2014; Armstrong Asset Management 2014; Frontier Investment, 2014). These funds are involved in different stages of the company lifecycle and focus on various sized projects however all have similar general stipulations for their investments. Firstly, they all solely engage in emerging markets and focus on not just financing returns but have an emphasis on economic returns (Employment, living standards, energy security) as well. Within all of these funds it is stipulated that a clear exit strategy for investment projects is a high priority (EEEF, 2014 & Evolution One, 2014 & Armstrong Asset Management 2014, Frontier Investment, 2014). The investment horizon for these funds is typically medium to long term (4-10 years)(Global Energy Efficiency and Renewable Energy Fund, 2014; Inspired Evolution Investment Management, 2014). Required returns can differ from low such as 10% of Armstrong Asset Management to three times of the initial investment capital as required by Inspired Evolution Management.

By investing equity in renewable energy companies and projects that present solid risk-adjusted returns as well as social and environmental strategic goals, these funds are enabling renewable energy companies that previously may not have been able to operate to grow and deliver renewable energy products and services to their populations. The Inspired Evolution Fund also provides finance to business segments and green field regions that have been insufficiently serviced by existing financing institutions. They have seen an opportunity as the clean energy and resource efficiency market segment has often been categorized as un-bankable without subsidies and long-term supply and product/service off-take agreements (Inspired Evolution Investment Management, 2013). These organisations have become integral in the development of sectors that ordinarily may face prohibitively costly equity or may not even be able to access equity financing.

3.2.3 Loan Guarantees and risk sharing mechanisms

Low cost loans programs are often tied to support mechanisms such as project validation or risk guarantees making it easier for borrowers to secure additional low cost debt from commercial lenders (International Renewable Energy Agency, 2012; Nelson et al., 2014; Razavi, 2012). Within developing countries SMEs contribute to a large share of employment and GDP however expanding SME finance has been a major challenge as financing institutions see the sector as too risky (Saadani, Arvai, & Rocha, 2010). This is amplified by the risk perception of renewable energy technology from financing institutions. Micro enterprises are generally able to receive funding from micro finance institutions (MFIs) however SMEs are caught in a funding 'gap'. This problem is significant in the MENA region where about 33% of SMEs report having difficulties accessing finance, compared to 25% on average in other emerging regions (Saadani et al., 2010).

Guarantees lower the financing risk a lender takes, as if the borrower defaults, the defaulted amount is at least partially paid by the guarantee fund. In principle, guarantees can leverage additional investment per unit spent better than either grants or direct loans (UNEP SEF Alliance, 2010). Public financing institutions or other government development agencies may offer credit guarantee programs to support renewable energy financing. When the terms are attractive, these can be accessed by the commercial financing institutions to share risks and can be a very effective tool to support expanded renewable energy lending. (J. Maclean, 2008).

3.2.4 Capital grants and subsidies

Capital grants do not have to be repaid and are often used to reduce the capital costs of energy systems (J. C. Maclean & Siegel, 2007). They are generally used in early stages of technology deployment when the market is infant and can play a significant role in increasing deployment of small, customer-sited projects (Sawin et al., 2011; Wiser and Pickle, 1997). Grants and subsidies are usually implemented by government and industry organisations and include a statement of the work that will be performed using the money, including restrictions on how the money can be spent and the time frame during which it can be spent (Coughlin & Cory, 2009). Grants can either cover the full cost of the system or partially cover the costs (Eckhart et al., 2005).

Grant/capital subsidy schemes can be found in many different sectors in both industrialised and developing countries and benefit renewable energy in a number of ways (Asia-Pacific Economic Cooperation, 2013). By providing up front capital they are able to reduce the financing risks to the consumer associated with renewable energy projects and enable faster market growth They also generally present a low administrative burden as once the level has been set the processing should be relatively simple (Kubert & Sinclair, 2009). Subsidy levels are ideally based on the market cost of a technology and the desired support of that technology but as with any other subsidy they are market distorting and economically inefficient and should be phased out over time as the technologies become more established and cost competitive. (International Energy Agency, Organisation of the Petroleum Exporting Countries, Organisation for Economic Co-operation and Development, & The World Bank, 2010; Kubert & Sinclair, 2009)

3.2.5 Leasing-to-own arrangements

Lease-to-own business models for the purchase of solar energy equipment have been successful in overcoming the high up front cost barrier associated with equipment and install (Kubert & Sinclair, 2009; Liu, O'Rear, Tyner, & Pekny, 2014; J. Maclean, 2008; Rai & Sigrin, 2013; Tongsopit, Sugiyama, & Chunhachoti-ananta, 2013). Leasing allows residents to finance capital equipment for the solar PV system over a contractual period in which the lessee enters into a contract with the lessor establishing monthly payments for the solar system (Liu et al., 2014). The length of the contract can be negotiated but is usually for 5-10 years (depending on the technology) after which the lessor becomes the owner of the system. Maintenance of the system is usually included within the lease (Pode, 2013). Benefits of a lease program for the lessee include: installation without large up front costs; no operation and maintenance costs if these are included in the service contract; lower technology risk as if the system does not perform to the contractual agreement the lessee can stop making payments (A. Lee, 2013). Benefits for the lessor include: improved regular cash flow; a higher margin as they deal with the transaction costs; purchasing solar PV at a lower cost (A. Lee, 2013).

Leasing-to-ownership models have been successfully used in a number of developing and developed countries to increase solar energy deployment. Leasing offers immediate savings and low risk for the consumer as the leaser generally maintains the system and ensures it is operating to its prescribed potential in order to continue to receive lease payments. By performing a cost-benefit analysis, Liu et al., (2014) showed that leasing can be a more cost competitive option over the life of the system than loan financing[17]. Rai & Sigrin (2013) have found lease programs have been very successful at opening up the solar PV market to consumers with a tight cash flow – a potentially very large market segment particularly in developing countries and middle-low income areas. In developing countries both rural off-grid and urban on-grid populations have been served well by solar leasing programs. This has been established in Bangladesh and the Dominican Republic where customers are offered systems tailored to their individual needs. In the case of the Dominican Republic, customers take care of the maintenance them selves (Northrop, Riggs, & Raymond, 1996).

3.2.6 Combinations in the MENA region

The MENA region has been earmarked by numerous bilateral funds and development banks as a region that holds great potential for the development of solar energy markets. As such, there have already been a number of programs initiated and completed with the goal of solar energy diffusion. Two such successful programs are presented in this section.

PERG Rural Electrification Program Morocco

Noting the slow progress of nation wide electrification in Morocco in the early 1990s, the Moroccan government launched the Global Rural Electrification Program (PERG) in 1996. In 1995 over 80% of villagers lived without electricity (Islamic Development Bank, 2013). The program incorporated both grid extensions as well as the provision of solar energy units for communities in which grid extensions were not economically or technically viable (George, 2002; Masse, 2010). By the end of 2008, 3,653 villages were supplied with electricity using 'family' sized solar PV kits (Masse, 2010).

In June 2002, the natioanal electricty provider (ONEE) enetered into a fee-for-service[18] partnership with a renewable energy servces company (RESCO) to electrify rural housholds using solar PV systems. Under this scheme, cutomers pay an initial connection fee and monthly service fee. A direct subsidy, amounting to 66% of the total cost, is also provided by ONEE to consumers to fund the upfront equipment cost and make the installation and maintenace costs affordable to rural villagers. The private operator contributes 24% of the project cost which is then paid back through collection of monthly fees from customers. Customers pay 10% of the initial financing through connection fees. (George, 2002; Masse, 2010).

The program has been successful due to funding of the high up-front system costs enabling poorer rural villagers access to these systems, as well as the design of the fee-for-service model which enabled indsutry development to occur while ensuring the ongoing costs were viable for customers. The program is now up to Stage V with a focus on connecting the remaining households and villages.

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[17] Leasing is economical for the lessees as long as the combination of monthly leasing fees and the costs of grid electricity consumption are lower than the costs if all electricity demands were being completely met by the grid (Liu et al., 2014)

[18] Fee for service - charging a flat monthly fee for the use of a solar home system that is owned and maintained by a service company. This is usually prepaid in the case of solar home systems and affords the user a certain amount of energy use (kWhs) per month (Eckhart et al., 2005).

Tunisian PROSOL

The UNEP/Italy PROSOL program is aimed at supporting domestic financing institutions in Tunisia in order to accelerate the deployment of solar heaters among private households. The well-designed program combines an up front capital subsidy with a credit line both of which are paid to the installing contractor who passes the savings on to the end user. It focuses on the removal of two major barriers to the final consumer: the high initial capital cost and the high payback time in comparison with other conventional technologies. To address this the mechanism is able to combine two financing mechanisms:

- A government grant for each purchase of SWH through the National Fund for Energy Conservation created for this purpose in 2005 which improves the recovery time for the end user
- The providing of credit to the consumer via Attijari Bank, repayable over a period of five years, with payment ensured through the electricity bill of the Tunisian Company of Electricity and Gas (STEG) (Baccouche, 2014).

The results show that the scheme was very successful in the diffusion of solar hot water systems throughout the target region. The rate of installed solar water heaters has increased from 7,000m^2 in 2004 to a rate of installation of 80,000 m^2 per year since 2008 (Baccouche, 2014).

3.3 The potential of Islamic banking in the renewable energy sector

Islamic financing transactions are guided by ethical, moral and social considerations and the belief that money should be used to create social value rather than just wealth (Ali, 2011; Ferruelo, 2012). This fits well with engagement in the early stages of renewable energy markets. The Mit Ghamr Local Savings Bank was first Islamic bank was established in the 1960's in Egypt (Botiș, 2013). Since then Islamic banking has become well established in the Arab region and around the world where there are high Muslim populations (Goaied & Sassi, 2011; Iqbal & Mirakhour, 1999). Islamic banks now have global assets close to US$1.7 trillion in 2013 and an annual growth rate of 17.6% over the last four years and have 38 million customers globally (Ernst and Young, 2013).

Islamic banks offer banking financing and services in accordance with the Shari'a or Islamic principles in all transactions and products it provides a client whether investment deposits, investment certificates or savings accounts (Abu Dhabi Islamic Bank, 2014). The main principle is the prohibition of Riba or interest. Modern theory of finance into Islamic banking, i.e., the notion that the prohibition against Riba meant the elimination of all fixed-fee debt contracts and that an Islamic financing system would have to be primarily equity-based has led to the development of a model for an Islamic bank conducting business on a profit/loss-sharing principle (Iqbal & Mirakhour, 1999). The main products offered by Islamic Banks are summarised in Table 6 below:

Table 6: Islamic Banking Products (Abu Dhabi Islamic Bank, 2014; Botiş, 2013)

Product	Description
Mudarabah (Profit and Loss sharing)	Partnership between the 'Capital Provider' and 'Entrepreneur' whereby the provider receives a share of the profit against his capital and the entrepreneur receives a share of the profit against his labour and management *Unrestricted* – Entrepreneur has the freedom of action without consultation with the Capital provider *Restricted* – Capital Provider imposes certain conditions of the Entrepreneur to secure his capital.
Wakala (Agency)	Used to invest deposits where the client gives the bank authorisation to invest his money in Islamic activities for a certain percentage of capital to be deducted from the realised profit.
Murabaha	Defined as "a sale at the original price plus profit". In Murabaha, the bank buys and owns the commodities identified by the customer, including consumer goods and production assets according to specifications determined by the customer. After assuming ownership, the bank sells these goods to the client for a price including the purchase cost plus a determined profit against the efforts exerted for the purchase and the expenses borne by the bank. The commodity is then delivered to the customer with the required specifications. The client shall pay for the commodity in periodic instalments, subject to the contract of sale. "Murabaha sale" is also offered to companies by providing local or foreign raw materials, equipment's and machinery with the aim of establishing and expanding production lines. It is very similar to leasing agreements.
Musharkah (Joint venture)	Under "Musharkah Financing" the client requests financing for a particular project where the bank shares the anticipated profits or losses of the project with the client. The Musharakah contract is done according to a previously arranged, mutually agreed upon set of distribution rules and principles, in compliance with Shari'a. Unlike the case of loans, in Musharkah Financing there are no interest rates.
Ijara (Lease-to-own)	A Lease is defined as a contract that allows the customer to lease a particular asset, utilize it for a specific period of time after which it's finally to be owned. This financing lease is adopted as a result of the customer's inability to buy a particular asset in cash. Ijara finance, which is a Lease with Promise of Ownership, is a financing method that distinguishes Islamic Banks from conventional Banks , through specialized companies and for helping those who cannot afford to purchase assets

The prohibition of Riba makes conventional banking an inadequate financing intermediary in an Islamic economy and also excludes all speculative activities related to interest rate expectations (Ali, 2011; Goaied & Sassi, 2011). The viability and feasibility of noninterest-based financing transactions, instruments, institutions and systems as well as the legitimacy

of academic research in this area are no longer questioned and will be utilised more in states that are a majority Islamic (Iqbal & Mirakhour, 1999).

The Islamic Banking sector is becoming more prevalent in the renewable energy investments. The sector has realised the benefits of investing in renewable energy particularly in areas such as the MENA region due to the great RE output potential (Business Islamica, 2013). In 2012, Islamic Banking saw the release of a green financing certificates program for the financing of climate change investments and renewable energy projects. The Climate Bonds Initiative, the Clean Energy Business Council and the Gulf Bond Sukuk Association launched the Green Sukuk[19] Working Group to enable the market and develop the best practices to promote the issuance of green financing certificates (Kidney, 2012). The Islamic Development Bank has also been involved in the RE sector, contributing US$1 billion between 2010 and 2012 with Morocco, Egypt and Tunisia all receiving significant contributions to their respective renewable energy sectors (Islamic Development Bank, 2013). More recently the Islamic Development Bank has undertaken an initiative called "Renewable Energy for Poverty Reduction". The initiative will contribute US$180 million to fund projects over the next three years to improve access to electricity in Africa's rural areas (Farge, 2014; Islamic Solidarity Fund for Development, 2014).

There is great potential for Islamic banks to be involved in the renewable energy sector in developing countries given their financing models and their focus on social value not just profit however there is very little literature on this topic. The financing products shown in Table 6 could potentially be used for smaller distributed scale renewable energy equipment. The lease-to-own (Ijara) product would be well suited to residential and SME customers looking to install solar energy technology. The value based investment decisions surrounding Islamic Banking are also more appropriate for renewable energy particularly in emerging markets where returns may not be as substantial.

[19] Sukuk commonly refers to the Islamic equivalent of bonds. However, as opposed to conventional bonds, which merely confer ownership of a debt, Sukuk grants the investor a share of an asset, along with the commensurate cash flows and risk. As such, Sukuk securities adhere to Islamic laws sometimes referred to as Shari'ah principles, which prohibit the charging or payment of interest (Islamic Development Bank, 2010)

4 Focus countries contexts

In order to answer *Research Question 1* the following data has been attained through both literature and on site interviews with appropriate stakeholders. This chapter will present the four focus-country contexts and will provide a summary using the four descriptors outlined in Chapter 2.

4.1 Morocco

Morocco is characterized by high electricity tariff levels[20], high-energy imports and an ambitious renewable energy strategy. Table 7 below gives an overview of relevant data on Morocco utilized for the contextual description in this section.

Table 7: Morocco country profile

Country Indicators	*Value/Description*
Population (2013)	33.01 million
Religion[1]	Muslim 99%, Christian 1%
Forecast population increase to 2010-2020[2]	11.04%
GDP (2013)	$104.4 billion (World Bank Data)
Forecast GDP growth[3]	1.7% 2014, 3.3% 2015
Income level	Lower middle income
Electricity consumption	25 TWh (2011)
Renewable Energy Targets	42% by 2020
Market structure	Single Buyer model
Subsidies[4]	Low
Tariffs Levels[5]	High (US$0.12/kWh)
Feed-in-tariff/Net Metering for distributed solar energy	None
Commercial Bank Prime Lending Rate[6]	6.32%
Energy Imports[7]	96%
Major laws	Law 13-09 Renewable energy Law

1 CIA World Factbook - https://www.cia.gov/library/publications/the-world-factbook/geos/ts.html

2 Data from http://esa.un.org/unpd/wpp/unpp/panel_population.htm (United Nations Department of Economic and Social Affairs)

3 Projected by Africa Economic Outlook - http://www.africaneconomicoutlook.org/en/countries/north-africa/morocco/

4 Relative to other countries within the region based on IMF 2014 report 'Energy Subsidies in MENA' - (International Monetary Fund, 2014)

5 Relative to other RCREEE member states and based on estimated regional average household consumption of 271 kWh/month (RCREEE Electricity Tariff Brochure, 2013)

6 CIA World Factbook as of 31 December 2013 (Central Intelligence Agency, 2014)

7 From World Bank Data 2011 (World Bank, 2014b)

[20] Relative to other RCREEE member states and based on estimated regional average household consumption of 271 kWh/month (RCREEE Electricity Tariff Brochure, 2013)

4.1.1 Market and context

Current Energy Sector

Morocco is a country with limited conventional energy resources. The country produces marginal amounts of crude oil, natural gas and refined petroleum products which are consumed domestically (US Energy Information Administration, 2014c). Morocco spends approximately US$3 billion a year on fuel and electricity imports reflecting its energy import dependency of approximately (96% of net energy use) (US Energy Information Administration, 2014c; World Bank, 2014b)

Energy demand growth of 6.5% per annum has been recorded and electricity consumption has been increasing over the last decade reaching 25.14 TWh in 2011 compared to 14.35 TWh in 2001 (IEA, 2014; Norton Fulbright Rose, 2012). Morocco has an installed electricity capacity of 6.4 TW of which 68% is centralised fossil fuel capacity (Regional Centre for Renewable Energy and Energy Efficiency, 2013d; US Energy Information Administration, 2013c). Combined with increased electricity demand this has led to a steady increase in CO_2 emissions from fossil fuels, from 33.75 million metric tons in 2001 to 42.7 million metric tons in 2011 (US Energy Information Administration, 2014c). Given the forecast GDP growth of the country as well as the increasing population, energy demand looks to also increase significantly. The Moroccan transmission and distribution company (ONEE) has reported growing strain on the national transmission network increasing technical electricity transmission losses of about 5% (World Bank Group, 2013). Morocco will need to address this increasing demand and associated budget impacts from imports by developing alternate forms of electricity supply.

Renewable Energy

Morocco has been the leader in the MENA region in its pursuit of a low carbon energy transition. The last AFEX report in Renewable energy ranked Morocco highest in all four categories for Market Structure, Policy Framework, Institutional Capacity and Finance and Investment (Regional Centre for Renewable Energy and Energy Efficiency, 2013a). The government has set a renewable energy target of 42% by 2020, the highest of any of the MENA region countries. Currently Morocco's energy production has a total installed capacity of 6,723 MW and of this 32% is produced from renewable energy sources (including hydro) (Regional Centre for Renewable Energy and Energy Efficiency, 2013d). In order to meet their targets Morocco is looking to install 2000MW of solar, 2000MW of wind power and 2000 MW of hydro power (Regional Centre for Renewable Energy and Energy Efficiency, 2013d). Within the new targets solar power and wind power make up the largest proportion of investment. The Moroccan Solar Plan was launched in 2009 and aims at to:

- Strengthen the security of supply of energy through the diversification of sources and resources
- Optimize the energy balance
- Build 200MW of solar capacity by 2020
- Provide access to energy for the general population at an affordable and competitive price
- Achieve sustainable development through the promotion of renewable energy
- Protect the environment and reduce of GHG emissions
- Strengthen regional integration through the opening up to Euro-Mediterranean energy markets and harmonizing energy legislation.

(Moroccan Agency for Solar Energy, 2014)

Current distributed solar energy

While solar PV certainly shows potential the distributed solar PV market is currently very small and underutilized potential for mid-size solar energy projects has been reported. (Personal correspondence, ADEREE, 27/05/14; World Bank Group, 2013). Small and medium sized distributed projects are able to partially match load profiles in particular regions and enable quality power to be supplied to some of the locations with the highest solar energy instead of investing in additional costly grid investments (World Bank Group, 2013). The fact that the low voltage grid is not 'open' for solar PV installs discourages use of the technology by SMEs and households. The low voltage network is to be opened up under the "PV for All" strategy to be launched in 2015 and could have a significant impact on the market (Personal correspondence, SIE, 27/05/14).

The solar hot water market is more developed. Under the PROMASOL mechanism the market for SHW increased from 5,000m^2 per year in 1998 to 42,000 m^2 per year in 2008 and a total installed fleet of 350,000 m^2 in 2012 (International Renewable Energy Agency et al., 2013). This is now being transferred to the *Shemsi* program however at the time of writing, this program was not operational and details were not available as to the final design of the program (Personal Communication, ADEREE, 2014). The program does have ambitious targets however to install 1.7 million m^2 of SWH by 2020 (Ettaik, 2012). There are currently 2 manufacturers, 50 retailers and approximately 200 solar hot water installers operating in Morocco indicating a well served market (International Renewable Energy Agency et al., 2013).

Renewable Energy Law and regulations

The Renewable Energy Law No 13-09 of February 2010 introduced competition in power generation by allowing the private sector to sell their generated electricity directly to consumers through the Medium Voltage and High Voltage grid. This legal provision, however, has not had any major effects yet because some of its implementation Decrees have not been approved (World Bank Group, 2013). Some key points from the law relating to renewable energy deployment include:

- The raising of the ceiling for self-generation by industrial sites from 10MW to 50MW. This law is principally focused on wind energy however applies to all renewable energy including solar PV.
- Any power producer from renewable energy sources has the right to be connected to the medium, high or very high voltage national electricity grid. This production should be for the exclusive use of the producer and electricity surplus should necessarily be sold to the national electricity regulator, ONE. The purchase tariff is defined by a Power Purchase Agreement to be signed between the operator and the national utility.
- There are no conditions on production of <20kW
- For projects >20kW but <2MW a preliminary statement regime must be provided. The preliminary statement requires an administrative form to be submitted in order to granted access to the grid.
- For projects >2MW an authorization regime must be followed. These projects will only be implemented if they are proposed by ADEREE (International Energy Agency, 2013; Malek, Lapierre, & Currie, 2012)

The low voltage (household) network for small self-consumption projects currently has no regulations in place that encourage solar PV installations. A net-metering scheme is being developed under the guidance of ADEREE however the terms and details of the scheme are

unknown. Under the guidance of SIE, "PV for All" is to be launched in 2015 to encourage the uptake of household PV systems however details are still to be determined on the program design and implementation (Personal correspondence, SIE, 27/05/14)

Consumer Finance Market

Morocco has a diversified financing system that has grown rapidly over the past decade (World Bank, 2014a). It is considered large and has been able to penetrate the SME and low-income household market by offering smart lending and financing products (World Bank, 2014a). Major international and local banks have significant operations and offer lending mechanisms to promote SMEs, households and agricultural enterprises (BMCE, 2014; HSBC, 2014; Credit Agricole, 2014; International Finance, 2014).

In 2010, Morocco began allowing conventional banks to offer a limited set of Islamic financing services and in June 2014 the lower house of parliament passed a law to allow local and foreign banking institutions to set up Islamic banking branches in Morocco (Moqana, 2014). This has the potential to change the banking and lending landscape significantly considering 99% of the Moroccan population is Muslim.

4.1.2 Key actors in the deployment of Renewable energy technology

In the pursuit of a significant shift in the energy mix, the Renewable Energy Law enabled the establishment of some key organizations will ensure the on-going investment and development of the renewable energy sector in the country.

Ministry for Energy Mines and the Environment

The Ministry of Energy Mines and the Environment introduces the laws and regulations that impact on the renewable energy sector. These laws include the Renewable Energy Law 13-09 briefly presented above.

L'agence Nationale pour le Développement des Energies Renouvelables et de l'Efficacité Energetique (ADEREE)

ADEREE is responsible for the implementation of Morocco's national plan for renewable energy. They are responsible for the development of programs for renewable energy and energy efficiency within the framework of the renewable energy strategy. In terms of financing involvement in promotion of the sector they play a key role by partnering with local and international financing institutions and offering support to programs such as Credit Agricoles' ECOTAQA program (Agence Nationale pour le Developpement des Energies Renouvelables et de L'efficacite Energetique, 2014). Focusing more on the technical assistance of program implementation, they engage in energy audits and product knowledge for programs such as ECOTAQA.

l'Office National de l'Electricité (ONE)

ONE is the single buyer of electricity in the country as well as being the major single producer (about 45% of total production). They are heavily involved in the establishment of mostly large-scale renewable energy projects. They have signed power purchase agreements with MASEN for the purchase of solar power from projects that fall under the Moroccan Solar Plan.

Société d'Investissements Energetiques (SIE)

Created in 2010, SIE is the major equity investor for Morocco's renewable energy sector. SIE takes a minority shareholding in project companies as either an active role in the governance of the company or as a passive investor but allowing the company greater access to capital through lower interest loans from financing institutions. They also have a clear timeframe, target return on investment (ROI) and exit strategy for all investments made. They state that they only invest in profitable projects.

MASEN

MASEN is responsible for implementing the National Solar Plan. This plan is focused mainly on large-scale solar PV and CSP projects and aims to have 2000MW of solar power installed by 2020 at a cost of US$9 billion. MASEN works very closely with SIE and ONE in regards to financing and power purchase agreements.

4.2 Tunisia

Tunisia is characterized by relatively high electricity tariff levels and a successful distributed renewable energy strategy despite having relatively low energy imports. Table 8 below gives an overview of relevant data on Tunisia utilized for the contextual description in this section.

Table 8: Tunisia country profile

Country Indicators	*Value/Description*
Population (2013)	10.89 million
Religious Population[1]	Sunni Muslim 99%, Other 1%
Forecast population increase to 2010-2020[2]	10.8%
GDP (2013)	US$47.13 billion
Forecast GDP growth per capita[3]	2.2% 2014, 3.5% 2015
Income level	Upper middle income
Electricity consumption	12.94 TWh (2011)
CO2 emissions per capita	2.5 tons (2010)
Renewable energy targets	25% by 2030
Major technologies targeted	Solar PV, SHW and Bio-mass
Market structure	Free Market (STEG still hold majority of market)
Subsidies[4]	Low
Tariffs[5]	High (US$0.10/kWh)
Commercial bank prime lending rate[6]	7.31%
Feed-in-tariff/Net Metering	Net metering
Energy Imports[7]	17%
Major laws	Law 2009-07 "Framework Conditions for Renewable Energy

1 CIA World Factbook - https://www.cia.gov/library/publications/the-world-factbook/geos/ts.html

2 Data from http://esa.un.org/unpd/wpp/unpp/panel_population.htm (United Nations Department of Economic and Social Affairs)

3 Projected by Africa Economic Outlook - http://www.africaneconomicoutlook.org/en/countries/north-africa/tunisia

4 Relative to other countries within the region based on IMF 2014 report 'Energy Subsidies in MENA' - (International Monetary Fund, 2014)

5 Relative to other RCREEE member states and based on estimated regional average household consumption of 271 kWh/month (RCREEE Electricity Tariff Brochure, 2013)

6 CIA World Factbook as of 31 December 2013 (Central Intelligence Agency, 2014)

7 From World Bank Data 2011 (World Bank, 2014b)

4.2.1 Market and Context

Current Energy Sector

Tunisia is a relatively small hydrocarbon producer with oil production totalling about 67,000 bbl/d in 2012 (US Energy Information Administration, 2013a). While this covers some of the nations energy consumption it is not enough given the increase in population and economic growth. While in comparison to Jordan and Morocco energy imports are low at 20.7% of net energy used in 2011 (World Bank, 2014) being a net importer still places stresses on the government budget as well as energy security risk considering the political situation in the region. Currently more than 95% of electricity generation comes from fossil fuelled power stations, increasing CO_2 emissions of the country (US Energy Information Administration, 2013a).

Renewable Energy

Despite Tunisia's recent political turmoil the country is still pursuing renewable energy targets and an energy strategy that is in line with regional and global trends. Within the latest AFEX report, the country performed relatively well in the categories of Finance and Investment, and Institutional capacity however received a very low score in regards to both Policy Framework and Market Structure (Regional Centre for Renewable Energy and Energy Efficiency, 2013a).

Tunisia is pursuing a renewable energy target of 40% of total energy mix by 2030 with a focus on solar and wind technologies. Currently the mix of renewables is very low at 6% of total current installed capacity coming from renewable energy sources (Regional Centre for Renewable Energy and Energy Efficiency, 2013e). The ambitious targets are likely to be mainly achieved by wind power and solar PV (International Renewable Energy Agency et al., 2013). The long-term target for solar is to install approximately 1.5GW by 2030 which is a significant increase from 2012s installed capacity of 7.2MW (Regional Centre for Renewable Energy and Energy Efficiency, 2013e). Of this about one-third will come from small scale rooftop systems on the net metering scheme with the rest coming from larger scale feed in tariff projects and independent power producer (IPP) projects (Personal Communication, ANME, 2014).

Laws and Regulations

The introduction of Law 2009-07 on Energy Efficiency: Renewable Energy Provisions in 2009 has been a move forward in the drive for renewable energy deployment in the country. The three principal goals of the law are energy saving, the promotion of renewable energy and the substitution of forms of energy previously used wherever this offers technical, economic and ecological benefits (IEA, 2013). One of the key aspects of the law is to allow companies producing electricity from RE sources to sell their production to the national electricity distributor, Societe Tunisienne de l'Electricite et du Gaz (STEG) and transport it through the national grid. Electricity production from RE sources still should not exceed 30% of total annual production, and its purchase price will be fixed annually by the Ministry of Industry and Small and Medium Enterprises (IEA, 2013). STEG is to purchase, according

to a PPA validated by the Regulatory Authority, the full energy production from low energy-consuming technologies (IEA, 2013). The market and ANME is moving in a deregulated direction and putting pressure on opening up the market for third party sales of RE to break the monopoly of STEG (Personal Correspondence, ANME, 05/06/14).

In December 2009 the government presented the first national Tunisian Solar Plan to cover the period 2010 to 2016. The objective of this plan is to increase the share of renewable energy sources from just under 1% to 4.3% in 2014 (United Nations Environment Program, 2014). The plan includes the use of solar PV and SHW systems and solar concentrated power (SCP) units for electricity generation. In order to kick start the plan a significant sum of approximately US$2.5 billion[21] will be spent by 2016 on 40 renewable energy projects, with approximately 70% of the funding coming from the private sector and 40% of the funding going towards energy export infrastructure development (Ernst and Young, 2014).

Current distributed solar energy sector

Tunisia has very high solar insolation with annual average global solar radiation ranges from 1600kWh/m2/year in the north to 2600kWh/m2/year in the south. This makes it an ideal area for solar energy technology (El Ouderni, Maatallah, El Alimi, & Ben Nassrallah, 2012).

The SHW market has developed significantly over the last few years and has now reached an installation rate of 80,000m^2 per year (Baccouche, 2014). There are currently 10 manufacturers, 49 retailers and 1,150 installers operating in the SHW market (International Renewable Energy Agency et al., 2013). The solar PV sector is relatively infant and underdeveloped. New mechanisms designed to increase solar PV diffusion have however been initiated such at the PROSOL Elec scheme. With a burgeoning solar thermal market already established, the solar PV market has great potential to increase given the number of retailers and installers already involved in the market. Current targets for distributed solar PV are ambitious with 60MW by 2016, 160MW by 2020 and 390MW by 2030 to be installed within the household, industrial and tertiary sector (Personal correspondence, ANME, 05/06/14).

The private sector for small-scale household and SME installations of both SHW and solar PV is fairly well established. While the SHW market has been established for a number of years since the success of the PROSOL program the solar PV market is only now beginning to gain some traction. PV installers that are operating within the market are very enthusiastic about the potential considering the launch of the PROSOL Elec scheme that promises to be as successful in launching solar PV as the PROSOL Residential scheme was for SHW. Private sector operators play a key role in both of these schemes through the communication of the benefits, paybacks, feasibility studies and financing education of their clients. Most operators that were interviewed or researched have a clear understanding of the process and offer a guide on their websites for customers that wish to take part in either scheme.

Consumer Financing Market

While relatively small, the Tunisian financing system is well established. The financing sector is dominated by the banking sector, where state ownership remains considerable. The state has majority holdings in three of the country's major commercial banks, as well as controlling micro-financing operations, development banks, and insurance companies (The Tunisian

[21] Approximately $175 million will be from the National Fund, $530 million from the public sector, $1,660 million from private sector funds and $24 million from international co-operation.

International Monetary Fund, 2012). A small Tunisian stock exchange exists as well as major banks, both local and international, operating throughout the country.

An issue of accessing credit by small firms has been shown by Fhima & Bouabidi (2011), Adair & Fhima (2014) and Bouabidi & Rajhi (2009) when they determined that credit rationing[22] exists in Tunisia. The decision to ration credit is particularly affected by the firm size and the inability to provide sufficient collateral. Additionally, results show that the smallest firms are more exposed to the rationing problem, especially for medium and long-term debts (Fhima & Bouabidi, 2011). This can severely hamper SMEs ability to gain access to credit for distributed RE projects as banks may refuse to grant financing credit to profitable RE projects (Fhima & Bouabidi, 2011).

Islamic finance is permitted in Tunisia however is a very small sector making up only 2.5% if the financing landscape (Vizcaino, 2013). Reports suggest that the sector could increase its market share significantly over the next five years as consumers become more familiar with Islamic financing products and the industry is promoted further by the current Islamic banking sector (Vizcaino, 2013).

Fonds de Transition Energetique (FTE) *(Previously- National Fund for Energy Management)*

The National Fund for Energy Management (previously FNME and now FTE) was established in 2006. The fund is administered by ANME and has a board of representatives from a diverse range of authorities and ministries (Personal Correspondence, ANME, 05/06/14). The Ministry of Industry however takes the final decision on the use of the funds resources. According to Article 2 of Law 2005-82 the fund is to be financed by the following:

- tax on first license registration of touristic cars
- VAT tax and customs duties on air conditioning equipment and commodities
- Revenue derived from non-compliant companies or individuals as stated in Law 2009-07 on Energy Efficiency.

(IEA, 2013)

These three financing streams ensure a fairly stable revenue base to implement energy programs such as the Tunisian Solar Plan (TSP). Approximately €17.5 million per year is contributed the fund as a result of these revenue streams (Personal Correspondence, ANME, 05/06/14). The structure and use of the fund could also change and be used for opening new credit lines, interest rate subsidies, guarantees, equity etc. (Personal Correspondence, ANME, 05/06/14). While there is no new decree applied yet for the future use of the fund for RE programs, ANME is confident in the potential to fund distributed solar energy programs (Personal Correspondence, ANME, 05/06/14).

[22] Credit Rationing was a theory developed by Stiglitz and Weiss (1979) to explain the situation in which lenders limit the supply of additional credit to borrowers who demand funds even if the borrowers are willing to accept higher interst rates.

4.2.2 Key actors in the deployment of Renewable energy technology

Agence Nationale pour la Msîtrise de l'Energie (ANME)

The Agence Nationale pour la maîtrise de l'Energie (National Agency for Energy Conservation) was created in 1985 under the Ministry of Energy. ANME has a broad scope of intervention when it comes to renewable energy and energy efficiency as their mission is to implement state policy in the field of energy efficiency through study and the promotion of energy efficiency, renewable energy and alternative energy (ANME, 2014). Within the scope of renewable energy they participate by means of the following avenues:

- Conducting prospective and strategic studies in areas of greenhouse gas mitigation related to energy consumption
- The management of the National Fund for Energy Management, which is a unified incentive mechanism to support the actions of energy efficiency measures, ensuring their implementation and long term sustainability
- The proposal of the legal and regulatory measures within the energy management framework
- The granting of tax and financing incentives
- Supporting the development and influence of the industry and encouraging investment in this sector.

(ANME, 2014)

ANME works in conjunction with many different stakeholders from oil and gas companies, to renewable energy providers and the national electricity company STEG.

Société Tunisienne de l'Electricité et du Gaz (STEG)

STEG is the publicly owned Tunisian Company of Electricity and Gas. STEG's main roles are to electrify the country, develop the natural gas network, upgrades and maintenance of the electrification and gas infrastructure (STEG, 2014). Within STEG a new subsidiary was formed in 2010 called STEG Energies Renouvelables (STEG-RE). STEG RE is covered under private law and has a capital of EUR 2.2 million (TND 5 million)(STEG, 2012). They have shareholders from a range of economic areas including engineering and consulting firms (25%), industrial companies (24%), banks (10%) institutions (6%) and STEG (35%) (STEG, 2012). Their main objective is to "contribute to the leadership and the development of the Tunisian Solar Plan." The company sees its main area of intervention in the development of public-private partnerships in the renewable energy and energy efficiency sector as well as study, construction, operation and maintenance of RE and co-gen systems. STEG is a key stakeholder in both the PROSOL and PROSOL Elec mechanisms (see Appendix) as they are responsible for the technical review and approvals of both programs. They also schedule the loan repayments to the bank as a percentage of the energy savings from the installed solar energy systems (STEG-ER, 2013). Through its three divisions in wind, solar and cogeneration, STEG RE sees itself as a key player in the achievement of Tunisia's renewable energy target (STEG-ER, 2013).

Attijari Bank Tunisia

The Attijari bank offers credit lines for both the PROSOL residential and PROSOL Elec schemes. These lines of credit are a key element to the success of the schemes (Personal correspondence, ANME, 05/06/14). Without them the up front cost of SHW and solar PV systems would still be too great for many residents. Attijari Bank was able to become the

supplier of these credit lines after a tender process for the program between banks. While the project is not very profitable for the bank the real benefits come from being involved in the promotion of the renewable energy technology throughout the country (Personal correspondence, Attijari Bank, 03/06/14). This promotion is seen as crucial to the banks brand and strategy for the future (Personal correspondence, Attijari Bank, 03/06/14).

4.3 Jordan

Jordan is characterized by relatively high and increasing electricity tariff levels for commercial, industry and high consumption households, high-energy imports and a new renewable energy strategy that includes a focus on distributed solar energy diffusion. Table 9 below gives an overview of relevant data on Jordan utilized for the contextual description in this section.

Table 9: Jordan country profile

Country Indicators	*Value/Description*
Population (2013)	6.459 million
Religious Population[1]	Muslim 97.2%, Christian 2.2%, Other 0.6%
Forecast population increase to 2010-2020[2]	25%
GDP (2013)	US$33.68 billion
Forecast GDP growth[3]	3.1% 2014, 2.9% 2015
Income level	Upper middle income
Electricity consumption	14.27 TWh
CO_2 emissions per capita	3.4 metric tonnes per year
Renewable Energy Targets	10% by 2020
Major technologies targeted	Solar PV and Wind
Market structure	Single buyer model
Subsidies[4]	Medium
Tariffs[5]	High (increasing into 2017)
Commercial bank prime lending rate[6]	8.9%
Feed-in-tariff/Net Metering for distributed solar	Net Metering
Energy Imports	96%
Major laws	General Electricity Law

1 CIA World Factbook - https://www.cia.gov/library/publications/the-world-factbook/geos/ts.html

2 Data from http://esa.un.org/unpd/wpp/unpp/panel_population.htm (United Nations Department of Economic and Social Affairs)

3 Data from: http://ieconomics.com/jordan-gdp-annual-growth-rate-forecast

4 Relative to other countries within the region based on IMF 2014 report 'Energy Subsidies in MENA' - (International Monetary Fund, 2014)

5 Relative to other RCREEE member states and based on estimated regional average household consumption of 271 kWh/month (RCREEE Electricity Tariff Brochure, 2013)

6 CIA World Factbook as of 31 December 2013 (Central Intelligence Agency, 2014)

7 From World Bank Data 2011 (World Bank, 2014b)

4.3.1 Market and Context

Current Energy Sector

The total electricity consumption in Jordan reached 14.27 TWh in 2012 which translates to the highest energy consumer per capita of the focus countries and the highest CO_2 emitter per capita as 99% is generated form fossil fuels (The Hashemite Kingdom of Jordan National Electric Power Company, 2012; The World Bank, 2014) Electricity demand mainly came from households (43%) followed by the industrial (24.25%) and commercial (17%) sectors (NEPCO, 2012). According to the Electrical Regulatory Commission the electricity demand is set to increase by 250%[23] in 2025 based on the 2012 demand level (Electricity Regulatory Commission, 2013).

Jordan does not have access to any significant fossil fuel reserves (Adam Smith International, 2013), and the country instead imports about 96% of its total energy consumption sources (Clean Energy Pipeline, 2013). At this point in time a majority of Jordan is heavily reliant on gas imports from Egypt via the Arab Gas Pipeline. A volatile situation in Egypt as well as other major oil trading partners has resulted in more frequent power shortages and blackouts and forced Jordan to occasionally operate its power plants on highly expensive imported diesel.

The domestic, commercial and industrial electricity sector has until recently enjoyed heavily subsidized tariff rates. Recently however Jordan has requested financing assistance from the International Monetary Fund (IMF). In order to receive the funding (US$2 billion) the IMF mandated that significant subsidy reform must take place as these have been the biggest burden on public debt since 2011 making up approximately 40% (Al-Daameh, 2014; International Monetary Fund, 2013b). As such Jordan will now eliminate all electricity subsidies by 2017 pushing domestic, commercial and industrial electricity tariffs higher.

Renewable Energy

The Ministry of Energy and Mineral Resources (MEMR) has set a renewable energy target of 7% of Jordan's energy mix by 2015 and 10% by 2020 (Electricity Regulatory Commission, 2013). Large scale solar and wind as well as small-scale renewable energy are incorporated into the plan to reach this target.

Renewable energy Law and Regulations

MEMR introduced Law No. (13) of 2012 Renewable Energy and Energy Efficiency Law (here and after called Law No. 13) to support grid connected distributed solar energy. Article 10 of the Law includes the introduction of a net metering[24] supporting regulation for renewable energy as well as an electricity wheeling[25] regulation introduced in early 2014 to support Jordan's renewable energy policy framework.

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[23] This does not take into account a significant refugee influx from Syria in recent times which could increase this figure significantly due to increased population growth.

[24] Energy Net-Metering: Difference between electrical energy exported from the User's Renewable Energy System in kilo Watt hour (kWh) and electrical energy by the imported from the Distributor's network in kWh. – (ERC Directive, 2012)

[25] Electric wheeling is a methodology under which electric power can be generated off site and delivered via the transmission and/or distribution lines and its associated facilities to a specific customer and be used to offset the electric power provided by the electrical company to the same customer during the billing period (Electricity Regulatory Commission, 2013).

> "Article 10a - Any person, including small Renewable Energy Facilities and homes that have Renewable Energy Systems for the generation of electrical power, may sell the generated electrical power to the Bulk Supply Licensees and to the Retail Supply Licensees." (Law No. 13)

This law has opened up the low voltage[26] and medium voltage[27] distribution network for consumers to install renewable energy systems. Under the net metering directive, any customer can sell excess electricity production to the electricity network at a preferential rate of US$0.17/kWh and is applicable small projects under 5MW. The Electric Wheeling Directive allows the customer to install RE for electric power generation in a different location to their primary energy consumption and connect to the electric grid. This also enables the consumer to take advantage of the net-metering system if they do not have enough area to install a system on-site. The net metering regulations are considered to be stable regulations to encourage the deployment of solar PV and enable better financing support to be offered to prospective consumers however they are confusing regulations that require more clarity so as industrial and SMEs are able to take advantage of the benefits (Multiple Stakeholder interviews and workshop engagement Jordan, 2014).

Article 12 also establishes the Jordan Renewable Energy and Energy Efficiency Fund (JREEEF). The aim of this fund is to, "provide the necessary funding for the exploitation of RE sources and the rationalization of energy consumption including small Renewable Energy facilities." Financing for the fund will come from the general budget, any revenues the fund may make on investments, bi-lateral and multi-lateral aid and the sale of Certified Emissions Reductions Credits under the Clean Development Mechanism[28].

Current distributed solar energy sector

Jordan has high potential for solar energy with a 90% desert climate and an average of 330 sunny days every year. The irradiation in the country ranges from 2200 kWh/m2 – 2550 kWh/m2, with the southern part of Jordan getting more direct sunlight on a regular basis. A study by German Aerospace Centre suggests that the economic potential of PV in Jordan is 4.5 TWh/year. Currently Jordan has 1.6MW of distributed solar PV installed and 350 MWth of solar hot water installed through both public and private developments as well as increasing the share of decentralized renewable energy sources (Regional Centre for Renewable Energy and Energy Efficiency, 2013c). Estimates of suppliers of solar PV technology range from 150-300+ however only about 50 are actually in full operation (Personal correspondence, Shamsi, 2014).

The solar hot water market in 2012 had a total capacity of 350MWth and a total collector area of 500,000 m^2. The market is served by 3 manufacturers, 10 retailers and 13 installers (International Renewable Energy Agency et al., 2013). Considering the potential for solar thermal within the country and the lower cost for install compared to solar PV, the author considers this market to be underserved.

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[26] Low voltage: Voltage that does not exceed the nominal level of (1) kilo volt

[27] Medium voltage: Voltage that exceeds the nominal level of (1) kV but does not exceed the nominal level of (33) kV

[28] The Clean Development Mechanism (CDM), defined in Article 12 of the Kyoto Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one tonne of CO2, which can be counted towards meeting Kyoto targets (UNFCCC, 2014)

Financing System

The banking system in Jordan is one of the smallest in the Middle East in terms of total assets. However, it is considered 'overbanked' with 23 banks serving the market made up of local, Islamic and foreign banks (Jordan Investment Corporation, 2009). The banking system is unique as Jordan has two banking systems; the conventional banking system (commercial banks) and the Islamic banking system. In a study performed by Dutta & Magableh (2006), it was determined that the main barrier for Jordanians in obtaining credit were religious barriers. The most important factor encouraging Islamic banking in Jordan is the fact that a majority of the population are Muslims, most of whom are would seek to obtain competitive financing services that conform to their religious beliefs (Saleh & Zeitun, 2007). The country was thus well-placed and ready to adopt the Islamic banking concept and develop it further (Saleh & Zeitun, 2007).

Generally speaking commercial Jordanian banks have a modest risk profile and offer mostly basic financing instruments (World Bank, 2013). This has been an issue in the past for renewable energy projects as the banks lacked technical knowledge and RE projects attracted a higher rate of interest due to the perceived risk by the banks (Personal Communication, Central Bank of Jordan, 2014). AFD also communicated that there is a gap between very small companies who are financed by microfinance institutions and large companies (Personal Communication, AFD, 2014). Both JEDCO and AFD confirmed that SMEs have issues attaining finance for projects as banks seem reluctant to lend to SMEs. This could be due to a lack of technical knowledge for RE projects or higher risk association with SMEs (Personal Communication, AFD, 2014; Personal communication, JEDCO, 2014)

4.3.2 Key actors in the deployment of Renewable energy technology

Ministry of Energy and Mineral Resources (MEMR)

The Ministry of Energy and Mineral Resources determines all laws to be enacted by the responsible parties. In 2012 they instigated the Law no. 13 – The Renewable Energy and Energy Efficiency Law. The MEMR is also responsible for the Jordan Renewable Energy and Energy Efficiency Fund under Article 13 of the Law. The Ministry overseas how this fund will be utilized in regards to which RE programs will receive funding. At the time of writing however this fund was not in full operation and had not been utilised for any renewable energy or energy efficiency programs (Personal Correspondence, Ministry for Energy, 2014).

Electricity Regulatory Commission (ERC)

The Electricity Regulatory Commission is responsible for the execution of the Renewable Energy and Energy Efficiency Law through the Directive Governing the Sale of Electrical Energy Generated from Renewable Energy Systems. Within this information on the net-metering and wheeling charges, technical requirements, viable sources of RE and the distributor and user responsibilities are determined.

Industry organizations - EDAMA and Network for Jordanian Industrial Sustainability

Industry organizations such as EDAMA (Arabic for sustainability) and the Network for Jordanian Industrial Sustainability are crucial to Jordan's renewable energy future as they are able to inform, train, organize and educate the industry and the public about the solar energy

sector (Personal correspondence, EDAMA, 06/04/14; Personal Correspondence Network for Jordanian Industrial Sustainability, 2014). Perhaps their most important role however is to be a common voice for their members in the industry and influence policy makers' decisions for the betterment of the solar industry (Personal correspondence, EDAMA, 06/04/14).

4.4 Egypt

Egypt is characterized by relatively low electricity tariff levels due to high subsidies, low energy imports, significant natural gas reserves, and a renewable energy strategy that focuses on large-scale wind power. Table 9 below gives an overview of relevant data on Egypt utilized for the contextual description in this section.

Table 10: Egypt country profile

Country Indicators	*Value/Description*
Population (2013)	82.06 million
Religious population[1]	Muslim 90%, Christian 10%
Forecast population increase to 2010-2020[2]	16.6%
GDP (2013)	US$272.0 billion
Forecast GDP growth[3]	0.9% 2014, 1% 2015
Income level	Lower middle income
Electricity consumption	129.44 TWh
CO_2 per capita	2.6 metric tons (2010)
Renewable Energy Targets	20% by 2020
Major technologies targeted	Solar PV and Wind
Market structure	Single Buyer model
Subsidies[4]	High
Tariffs[5]	Low
Major Consumer	Residential
Commercial bank prime lending rate[6]	11%
Feed-in-tariff/Net metering	Net-metering (Newly implemented)
Energy Imports[7]	Net-exporter
Major laws	Law 102-1986

1 CIA World Factbook - https://www.cia.gov/library/publications/the-world-factbook/geos/ts.html

2 Data from http://esa.un.org/unpd/wpp/unpp/panel_population.htm (United Nations Department of Economic and Social Affairs)

3 Data from: http://ieconomics.com/egypt-gdp-annual-growth-rate-forecast

4 Relative to other countries within the region based on IMF 2014 report 'Energy Subsidies in MENA' - (International Monetary Fund, 2014)

5 Relative to other RCREEE member states and based on estimated regional average household consumption of 271 kWh/month (RCREEE Electricity Tariff Brochure, 2013)

6 CIA World Factbook as of 31 December 2013 (Central Intelligence Agency, 2014)

7 From World Bank Data 2011 (World Bank, 2014b)

4.4.1 Market and Context

Current Energy Sector

Egypt is the only focus country that has significant oil and gas reserves. With 4.4 billion barrels of proven oil reserves and a daily output of 662,000 barrels, Egypt is the World's 26th top oil producer (US Energy Information Administration, 2014a). More than 90% of its energy needs are provided by oil and natural gas making it the largest oil and natural gas consumer in Africa (US Energy Information Administration, 2014a). The country has significant natural gas reserves amounting to 77 trillion cubic feet (third highest in Africa) and over 80% of the electricity generation is sourced from natural gas meaning a majority is consumed domestically. Overall about 88.4% of current installed electricity capacity is from fossil fuel sources (Regional Centre for Renewable Energy and Energy Efficiency, 2013b). The rest is exported to neighbouring countries such as Jordan via the Arab Gas Pipeline (AGP) (EIA, 2012; IRENA, 2012).

Despite these fossil fuel resources, a rapid increase in energy demand driven by an increasing population and economic growth has meant that Egypt has now become a net importer of energy. From International Energy Agency figures, natural gas consumption has increased by an average of 11% per year from 2001 to 2011 (International Energy Agency, 2014). Rising power demand, natural gas supply shortages, ageing infrastructure, and inadequate generation and transmission capacity have led to frequent blackouts in Egypt particularly during the summer months of peak electricity demand for air conditioning (US Energy Information Administration, 2014a).

The Egyptian electricity market is dominated by the Egyptian Electricity Holding Company, which is state owned and comprises sixteen affiliated companies including production, distribution and transmission companies (Reegle, 2012). The holding company owns over 90% of Egypt's generating capacity and the distribution and transmission also remain under the state owned monopoly. Private generation of electricity was authorized by the 1996 Law No. 100 however IPPs are still few and account for only 7% of the total produced power, none of which is renewable energy (RCREEE, 2012). The regulation of the electricity market is handled by the Egyptian Electric Utility and Consumer Protection Regulatory Agency (EgyptEra).

Renewable Energy

Despite some of largest oil and gas reserves in Africa, Egypt is pursuing a significant renewable energy strategy and aims to have 20% of their national electricity mix supplied by renewable energy sources by 2020. Of this, wind will account for 12%, hydro 6% and solar 2% (NREA, 2013). Current installed capacity makes up about 11.6% of the total energy mix with a majority of this being large scale hydro power (2800MW) (Regional Centre for Renewable Energy and Energy Efficiency, 2013b). Despite the solar power potential, solar PV has had a very small influence on the renewable energy market thus far. Only about 15MW of capacity has been installed and mostly for small-scale decentralised, off-grid projects. Due to high subsidies on fossil fuels there is very little incentive for households and businesses to look to solar PV for self-consumption purposes. However, the drop in prices of solar PV technology has meant that New and Renewable Energy Authority (NREA) will revise its strategy to reach its renewable energy targets by 2020 and make solar a bigger share of the target (Personal Communication, NREA, 2014). The Egyptian Solar Plan, approved in July 2012, has set a target of 700MW installed capacity of solar PV by 2027 (International Renewable Energy Agency et al., 2013).

Renewable Energy Law

The current relevant legal framework for renewable energy deployment is relatively old compared to other focus countries and is stated under Law 102-1986. In regards to RE the law states the functions and competences of the New and Renewable Energy Agency. A new electricity law is excepted to be developed in the near future that will initiate significant changes in the legal framework relevant to renewable energy technology (EgyptERA, 2011). The electricity regulatory body, EgyptERA, has recently developed a document on the technical requirements for connecting small-scale solar PV systems to low voltage distribution networks (Egyptian Electric Utility and Consumer Protection Regulatory Agency, 2014). This has been approved by the board of directors which is enough to make these requirements law (Personal Communication, EgyptERA, 2014).

In order to increase the private sector's contribution in solar energy projects two key policies have been implemented. As of June 2012, third party sales are allowed to take place. Investors are allowed to build and operate RE power plants to satisfy their electricity needs or to sell electricity to other consumers through the national grid(NREA, 2013). Secondly, in January 2013, the EgyptEra board approved the a net metering system to encourage the implementation of solar PV roof top systems (NREA, 2013)

Current distributed solar energy sector

Egypt receives between 2,000 and 3,200 kWh/m2/year of solar radiation and when combined with favourable topography and climate, there is significant potential for distributed solar energy to be developed in the country (Croker, 2013). Currently the main solar PV market has been decentralized small scale off grid PV systems amounting to about 15MW of installed capacity (RCREEE, 2013). ONERA, one of the largest installers in the country, has performed many off grid installations but communicated the urban on-grid market is very small (Personal Correspondence, ONERA, 2014). The future market for solar PV appears to be to deal with regular 'black outs' that occur in Cairo and surrounding cities due to heavy demand and lack of capacity (Personal Correspondence, ONERA, 2014). Companies such as ONERA offer new systems that deal with this issue, with a focus market of high-income villas. ONERA has been pressing for new financing mechanisms to enable greater uptake of solar PV systems. The market is not very well developed with only nine solar PV companies being a member of the main industry organization, Solar Energy Development Association (SEDA, 2014).

The SHW market in Egypt is more advanced and has a total installed fleet of 750,000 m^2. The industry consists of 4 manufacturers and 14 retailers however only 5 installers indicating that the market is significantly under served (International Renewable Energy Agency et al., 2013). Currently there is cooperation with the tourism sector to spread the utilization of RE applications in tourist communities, including increasing the use of solar heaters in Hotels and Tourist Villages (NREA, 2013).

Consumer Finance Market

The banking and financing sector is amongst the oldest and largest in the region and is steadily moving towards becoming the biggest financing centre in the region (Egypt State Information Service, 2009). The banking sector plays a crucial role in the development process of Egypt and consists of mainly local and international commercial banks. It also includes specialized banks and financing institutions operating in the fields of investment and credit for industry, agriculture, housing and rural development (State Information Service, 2009). In 2013 the Central Bank of Egypt finished the implementation of the banking reform

program that lasted for eight years aimed at "raising the efficiency and soundness of the Egyptian banking sector, and enhancing its competiveness and ability for risk management" including the implementation of Basel II[29] standards and a commitment to the Basel III standards in 2019 (Central Bank Egypt, 2014).

Egyptian banks have extended their lending activity during the 2012/13 financing year (FY). One of the major increases in lending came from the household sector which accounted for around 66.5% of the increase in local currency loans and made up 9.5% of total banking sector credit (Central Bank of Egypt, 2014). Private business loans also increased by 4.5% and make up approximately 27.5% of total credit in the 2012/13 FY.

The Islamic banking sector in Egypt began in the 1970's however has struggled to attain a significant market share in the banking sector and accounts for only 2-5% of the Egyptian market (Abu Dhabi Islamic Bank, 2014; Abdelazim, 2014). A recent Gallup Poll[30] indicated that the main cause of this was a lack of understanding of Islamic banking products. However, the poll also revealed that 45% of respondents would prefer a more expensive loan from an Islamic bank than a cheaper loan for a conventional bank (Demirguc-Kunt, Klappers, Randall, & Sonnenshein, 2013).

4.4.2 Key actors in the deployment of Renewable energy technology

Egyptian Electric Utility and Consumer Protection Regualtory Agency (Egypt Era)

EgyptERA was established in 1997 following the presidential Decree No. 326 and in 2000 the major activities and authorities were defined under Decree No. 339. Their major role is to design and improve electricity regulation (Personal Communication, EgyptERA, 2014). This will entail determining the regulations renewable energy operators will need to abide by. In regards to the major activities that will impact renewable energy development and deployment, the following key activities are relevant:

- Ensuring that all activities of electric power generation, transmission, distribution, and sale, are carried out in compliance with the laws and regulations in effect in the Arab Republic of Egypt, especially those relating to environmental protection
- Issuing licenses for the construction, management, operation, and maintenance of the electric power generation, transmission, distribution, and sale projects.

New and Renewable Energy Agency (NREA)

The New and Renewable Energy Agency was established under Law 102-1986. The Agency is responsible for assessing RE resources, planning the development of its investments, allocation of land for wind and solar projects, preparing technical environmental and economic feasibility studies and the implementation of policies to encourage the use of renewable energy (NREA, 2013). The agency has been the key to the implementation of the net-metering scheme in early 2013 as well as the regulations of third party sales for IPPs (NREA, 2013)

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[29] Basel II – Published in 2004 to establish an international standard for banking regulators to control how much capital banks need to put aside to guard against the types of financing and operational risk faced. The intention is to guard against large financing shocks (Bank for International Settlements, 2014)

[30] Gallup Poll – A U.S. based consultancy that produces polls and reports on politics and economy.

Solar Energy Development Association (SEDA)

SEDA is a not-for-profit industry association whose mission is to enhance the use of solar energy applications for heat and power in the market place as well as facilitate active collaboration among key stakeholders to actively research and promote national market development campaigns and capacity building mechanisms that display social, economic and environmental benefits (SEDA, 2014). They look to accomplish this mission through ensuring a sound financing concept and funding strategy, implementation of national sector programs, as well as providing training, awareness and lobbying power to the solar industry (SEDA, 2014).

4.5 Summary of focus country contexts

The contexts in which the mechanisms operate have a large impact on the mechanism offering, design and ultimate success. Based on the previous description of each country's market, context and key actors, the following presents a summary of each country's context based on the descriptors presented in 2.1.1. The aim is to show the potential impacts that the contexts can have on the financing mechanisms offered (presented in Chapter 5: Analysis of financing mechanisms). As an overview, Table 11 below has been provided as a comparison of the main elements impacting both on the supply and use of financing mechanisms.

Table 11: Contextual overview comparison

	Morocco	**Tunisia**	**Jordan**	**Egypt**
Overall potential for distributed solar energy deployment	High	High	High	Medium
Laws to support distributed solar energy	*Law 13-09 Renewable energy Law* Well established and long term focus A focus on industrial enterprises for self generation	*Law 2009-07 on Energy Efficiency: Renewable Energy Provisions* Focus up to 2016 Focus on both distributed solar PV and SHW systems	*Law 13 Renewable Energy and Energy Efficiency Law* Long term focus Includes specific articles on small scale distributed RE generation	*Law 102-1986* Out dated and does not take into current trends in RET costs
Net-metering to support distributed solar energy	Enterprises able to sell excess generation to the gird after a PPA signed with ONE. Only for the medium and high voltage grid.	Net-metering has been established Producers able to sell up to 30% of over production to STEG.	Net-metering and wheeling regulations are established Enable all over production to be sold to grid	New net-metering regulations in place as of 2014

Consumer Financing Market	Well established and with good penetration of SME and household market	Small but well established Issue with credit-rationing to SMEs	Small and simple financing products offered Islamic banking plays a significant role	Well established Islamic banking established however small market share
Public and commercial actor collaboration in the RE sector	High	High	Low	Medium

4.5.1 Morocco

Based on Morocco's dependence on energy imports, high solar irradiation, high use of fossil fuel for electricity generation, increasing energy demand and high electricity tariffs, the country is very suitable to pursuing distributed solar energy deployment strategy (See 4.1.1 for full description). So far the distributed solar energy market has not been addressed appropriately by either public sector regulators or private sector actors. The distributed solar PV market could also lessen the strain on the national transmission network and reduce the need for high cost transmission upgrades by decreasing the peak demand load as pointed out in 1.1.4 and 4.1.1.

The current policy framework is considered long term and predictable as can be seen by the Moroccan Solar Plan and the current Renewable Energy Law No. 13-09. The regulation to increase the capacity allowed for self-production from 10MW to 50MW enables large scale enterprises to invest in renewable energy technology to offset some of their electricity consumption form the national grid. While this was mainly intended for wind it gives enterprises that are not necessarily located in prime areas for wind power the opportunity to install solar PV as an alternative and still be rewarded with electricity savings. There is currently no regulation in place to support distributed solar PV for the low voltage (<1kV) network. However, a net-metering scheme has been proposed along with the initiative 'PV for All' to encourage the diffusion of small-scale (mainly residential) uptake of solar PV. With the current focus on larger industrial enterprises for renewable energy self-production, this too is where financing institutions should focus their current efforts in providing appropriate financing mechanisms.

The large diversified nature of the Moroccan banking sector and apparent ability to penetrate the SME and household markets provides favourable conditions for the launch of financing mechanisms focused on small scale distributed solar energy. The recent passing of laws to allow Islamic banks to become established offers a great opportunity for these banks to offer RE financing products tailored to the largely Muslim population. BMCE is one such bank that is already establishing an Islamic subsidiary (Yaakoubi, 2014). BMCEs current plans to become more established in the RE sector could significantly widen their demand base for a RE financing products.

The current close collaboration between Morocco's agencies in establishing policies, programs and investments is something that was not found in any other focus country. Examples include the SIE directly investing in MASEN (25% shareholding) as well as ADEREE collaborating with Credit Agricole on the ECOTAQA mechanism. These

institutional structures have strong synergies between them and cover the technical, institutional, regulatory and financing aspects of renewable energy programs. This continued collaboration should ensure that future financing mechanisms are well designed and in line national regulations, policies and goals.

4.5.2 Tunisia

As detailed in 4.2.1, Tunisia's dependence on fossil fuels (imported and local) for electricity production, high electricity tariff rates and high solar irradiation make solar PV and SHW attractive in the pursuance of a low carbon energy system.

The direct focus of Law 2009-07 on energy efficiency indicates the commitment of the government to establishing distributed solar energy as a key technology to help reach energy goals. Solid energy targets and regulations such as the net-metering and wheeling schemes mean that financing institutions can have confidence that the market for distributed solar PV will be strong and grow into the future. The only drawback is that the purchase price of any excess electricity is subject to change annually. This means planning the future income/savings from projects is difficult over the medium to long term and could hamper any independent mechanisms that commercial banks or other financing institutions design and offer the market.

The inclusion of the PROSOL mechanism within the energy efficiency law shows the commitment to make distributed solar energy a key aspect of reaching RE targets. Added to this, the committal by ANME to achieve the 40% RE target with one third small scale rooftop systems gives more confidence to financing institutions that there will be growing demand for distributed solar energy systems and they can supply mechanisms that are in line with this national target to help diffuse more distributed solar systems. There seems to be a shorter-term focus up to 2016 of most programs and laws. This could pose an issue for financing institutions needing a long-term commitment however is a minimal problem considering the well-established nature of a majority of the laws and regulations.

The financing and banking market of Tunisia is relatively small however is well established as described in 4.2.1. The issue of risk aversion and credit rationing to SMEs could hamper the offering of financing products tailored to distributed solar energy by commercial banks. The success of the PROSOL mechanisms due to the close collaboration of Attijari Bank and public sector actor's means that it may also be difficult for banks other than Attijari to enter the distributed solar energy market as these mechanisms will be the primary source of technology diffusion. The Islamic banking sector makes up only a small share of the banking market however these banks could play a significant role in the solar energy market by offering attractive leasing terms on solar energy equipment rather than fixed interest.

The collaboration between ANME, STEG and commercial banks is impressive and shows that private and public sectors are able to negotiate and work towards a common goal. The success of the PROSOL scheme is testament to this and shows how close collaboration can lead to the deployment of a very successful mechanism. The funding of these schemes through the National Fund for Energy Management has ensured a stable revenue base with which to utilize and implement any future financing mechanisms. The future use of the fund is directly aimed at enabling the development of new financing mechanisms to support renewable energy deployment. This will give commercial banks the confidence to take some initiative and develop mechanisms that may be designed in collaboration with ANME and the FTE.

4.5.3 Jordan

Jordan's heavy dependence on energy imports, a volatile situation in Egypt, increasing energy demand, high and increasing tariff rates and high solar irradiation throughout the country makes solar PV and SHW attractive options and could play an integral part in Jordan's shift to a low carbon economy. RE targets, while not as ambitious as other states, offer a long-term commitment of Jordan to addressing its energy issues.

The 2012 introduction of the Renewable Energy and Energy Efficiency Law gives financing institutions confidence in the distributed solar PV market. The energy wheeling regulation and the net-metering scheme, encourage the uptake of distributed solar PV by households, SMEs and the industrial and tertiary sectors. Financing institutions will be able to design financing mechanisms in line with these national regulations, a crucial element to increasing financing mechanism use.

The Jordanian banking and financing sector is well established however is very small and only offers simple financing products as discussed in 4.3.1. One of the distinguishing features of the financial system is the established nature of Islamic banks. As discussed in 3.3, these banks offer financing products well suited to RE deployment however none of these banks offered any financing products aimed at the renewable energy sector within Jordan. Jordan Ahli bank is a standard commercial bank and offers an interest free loan on renewable energy equipment in an attempt to attract Islamic customers. The commercial banking sector is risk averse to SMEs and does not have the technical capacity to approve loans for renewable energy as pointed by AFD. This is not conducive to the supply of financing mechanisms focused on distributed solar energy as most of the customers looking to install the technology are either SMEs or households (Personal Correspondence, Shamsi, 2014).

A lack of collaboration between key organizations could severely hamper the implementation of appropriate financing mechanisms. The key actors in the deployment of RE technology, seem to work autonomously without much collaboration. This was observed through many meetings and having questions asked of me as to what other organizations were developing in the way of financing mechanism and regulations. Within interviews multiple actors queried about other institutions programs and regulations. There did not seem to be any knowledge transfer between major institutions. This has been highlighted with the proposed Jordan Renewable Energy and Energy Efficiency Fund (JREEEF) fund, which has been developed to support RE and EE initiatives however it is still unknown within Jordan how it will be funded or how the funds will potentially be used. The lack of collaboration is not conducive to financial mechanism deployment as key actors are unable to present their opinions about the design and use of financing mechanisms. This could be a reason why JREEEF has not launched any significant financing schemes to support RET.

4.5.4 Egypt

Even through solar irradiation in Egypt is significant and well above the global average, the nation has significant gas reserves, highly subsidised electricity tariffs and an undeveloped solar energy market. This makes solar energy a less attractive option particularly for smaller distributed systems. With such low tariff rates, the payback time from the savings would be significant and probably prohibitive as an investment decision be it household or business. The inadequate generation and transmission capacity however make solar PV systems a good option to reduce system load and enable power to be maintained for some devices during blackouts.

The out-dated legal framework (Law 102-1986) could hinder the development of further regulations that support distributed renewable energy. The technical requirements document for connecting small scale solar PV to the low voltage network is certainly a step in the right direction as is the introduction of a net-metering scheme. However, due to the infancy of this, appropriate financing mechanisms may struggle to be designed in a way that supports this sector until the regulations become more widely known and utilized. As NREA stated, "first the regulations need to be in place, then we can start thinking about financing mechanisms" (Personal Correspondence, NREA, 2014).

The Egyptian financing market is one of the largest in the region. Commercial financing institutions have been increasing their lending activities to SMEs and households in resent years indicating they are accustomed to the risk profile they present (see 4.4.1). This could be beneficial as the solar energy market becomes further established and these sectors seek financial assistance for projects. The lack of knowledge of Islamic banking in the country is surprising and the sector could potentially play a much larger role in the current niche RE market through Ijara (lease-to-own agreements).

The key actors in the industry, while all supportive of the distributed solar PV and SHW markets have differing expectations. SEDA is very optimistic about the market however NREA and EgyptEra are more conservative about the role they see the small scale distributed market playing in the countries energy mix. There is obvious collaboration between actors as SEDA pointed out that they engage with sector associations as well as government organisations and financial institutions. SEDAs collaboration with these sectors is important to financial mechanism deployment as it enables communication of the benefits of solar technology and the technical aspects with other sectors (particularly government and commercial banks), increasing the likelihood of the deployment of financial mechanisms.

5 Analysis of financing mechanisms

This section will address *research question 2* by firstly identifying and characterising currently implemented financing mechanisms in Morocco, Tunisia, Jordan and Egypt. An analysis has then been performed to assess the design, implementation and market impact of each mechanism utilising the defined criteria and related indicators shown as step three of the UNEP framework. Step three of the UNEP framework firstly assesses the alignment of the mechanisms to indicators allowing an overall evaluation

5.1 Identification and characterisation of mechanisms

A short description of each mechanism identified in the focus countries will be provided however for full details see on terms, requirements and use of each mechanism see Appendix 7.3.

5.1.1 Loans

BMCE EnergiCo *(Morocco)* – The EnergiCo mechanism was developed by the BMCE Sustainable Development Department. It has no financial backing by a development bank or government organisation although it started as a collaboration with ADEREE. It offers a low interest fixed (5.7%) or variable (5.2%) loan on medium terms (5-7 years) for the acquisition of equipment to reduce energy consumption. Funds are paid to the consumer at the end of the project once the final invoice has been presented. It is targeted at corporate and industrial customers to enable them to improve their energy performance in a sustainable and profitable manner.

Credit Agricole EcoTaqa *(Morocco)* – The EcoTaqa mechanism is a collaboration with Credit Agricole, the Ministry for Agriculture and ADEREE. The mechanism provides energy audits, advice and credit for RE and EE activities in the agricultural sector with an aim to reduce energy consumption by 20% on participating farms. The mechanism offers short and medium term loans at low fixed interest rates (5-5.8%) for audits and recommendations that are determined by the audit. Large agricultural enterprises are targeted but so far only twelve projects have been funded under the mechanism.

PROSOL mechanisms *(Tunisia)* – Although the PROSOL Residential (SHW) and the PROSOL Elec (Solar PV) offer slightly different amounts due to differing technologies, they both are targeted as residential households and operate through the same process and with the same actors involved. A capital subsidy is provided by ANME, Attijari Bank provides credit and STEG then recovers the credit through the energy savings on the residential electricity bill and pays Attijari the monthly or bi-monthly repayments. As assurance for repayment, if a consumer does not meet the repayments, STEG is able to disconnect the power to the household. Both the credit and subsidy is paid directly to the installer who offers discounted prices to customers. Unfortunately, while the mechanism is designed very well, the administrative procedure for the approval of projects has been slow taking over 4 weeks and over 2 months to pay installers the grant funds.

PROSOL Tertiary *(Tunisia)* – The PROSOL Tertiary mechanism operates in much the same way as the PROSOL Residential mechanism. The focus is on tertiary institutions including hotels, schools and universities. The bank offers a credit subsidy of 2 basis points to the project implementer. This is repaid through normal direct bank channels, as STEG is unable to disconnect power to tertiary institutions. ANME and UNEP then offer grants for the cost of feasibility studies (70%), capital costs (55%) and on-going maintenance costs

(€2.62/m2 /year). This is funded through the Fonds de Transition Energetique (FTE) described above in 4.2.1.

Cairo Amman Bank Green Lending Program *(Jordan)* – The Green Lending program is targeted at households and SMEs to encourage the uptake of RET, but mainly focused on solar PV. A credit line from either AFD or the Central Bank of Jordan is used to offer concessional interest (6.5%) fixed for 10 years on renewable energy technology. Funds are disbursed at different stages of the project.

Capital Bank Green Lending Program *(Jordan)* – This loan uses the same credit line as Cairo Amman Bank however targets larger corporate customers and SMEs. They offer an interest rate of between 6.5% and 7.5%. Use of this mechanism has been very low by target consumers.

Ahli Bank Go Green Loan *(Jordan)* – The Go Green Loan offers loans of up to €10,924 for households and €49,165 for SMEs to implement renewable energy technology. It offers a 0% interest rate however requires a 55% debt burden rate and a salary transfer for retail customers. Approved RE suppliers are to be used from a list on the bank's website.

National Bank of Egypt /SEDA/Egyptian Hotels Association/Egypt Ministry for Tourism Green Hotels Program *(Egypt)* – A concessional loan focused on the hotel industry with the goal to reduce energy consumption and promote green tourism. National Bank of Egypt offers the loan at an interest rate of 6-7% repaid over 7 years. The mechanism has only recently been launched and has been modelled from the PROSOL Tunisia programs with a focus currently on solar hot water heaters.

5.1.2 Grants and capital subsidies

Jordan Chamber of Industry Factories Support Program *(Jordan)* – The Jordan Chamber of industry offers a non-refundable capital subsidy for small industrial enterprises to install either solar PV or SHW. The objective is to install small projects in order to familiarise industry with the technology. The subsidy is paid at the end of the project once an on site inspection has taken place and covers up to 35% of product costs if foreign and up to 50% if product is Jordanian.

Higher Council for Science and Technology Industrial Research and Development Fund (IRDF) *(Jordan)* – The IRDF aims to provide a bridge between industry and academia in order to increase competitiveness of local industry. An industrial organisation is able to attain a grant of up to €32,792 for implementing a solar PV project in partnership with an academic institution.

5.1.3 Equity and quasi equity

Société D'Investissements Énergétiques (SIE) *(Morocco)* – Provides equity investments into profitable renewable energy companies. The objective is to help companies within the sector grow. SIE takes a minority stake in companies involved in concrete and profitable projects and who are able to demonstrate their industrial feasibility. These can be either existing companies or new companies. The term of investment is usually 7-10 years.

Jordan Enterprise Development Corporation (JEDCO) Governorates Development Fund (GDF) *(Jordan)* – The aim of the fund is to stimulate investments and job creation outside Amman. The GDF offers equity, quasi equity and convertible bonds, however quasi equity is the most popular instrument for funding. A loan is provided of up to 80% of the

total cost of project and instead of being repaid the principal plus interest, JEDCO grosses 10% of the project net profit. Any industrial enterprise or SME is eligible with a minimum investment requirement of €54,656 (50,000JOD) and total project cost of minimum €109,302 (100,000JOD). Solar PV has been targeted however it is open to all forms of RE. One of the main focuses is on economic value (employment, industry development, environmental protection) and not just financial value.

5.2 Assessment of financing mechanisms

The following section will address Research Question 2, namely *What are the design and implementation features of the identified mechanisms and to what degree have they been adopted by target consumers?* Due to the number of mechanisms and indicators for assessment, only elements of interest (high and low scores) have been chosen to examine in the main text to highlight relatively good practices and relatively poor practices compared to defined criteria. A full assessment of each mechanism is available in the Appendix 7.3. For ease of viewing all figures have been split up according to country of operation however will be discussed together.

5.2.1 Concessional Loans

Loans and credit lines are the most prevalent financing mechanism offered throughout the focus countries. Commercial banks are an avenue used by both development banks and central banks to distribute funds via 'soft' of concessional loans.

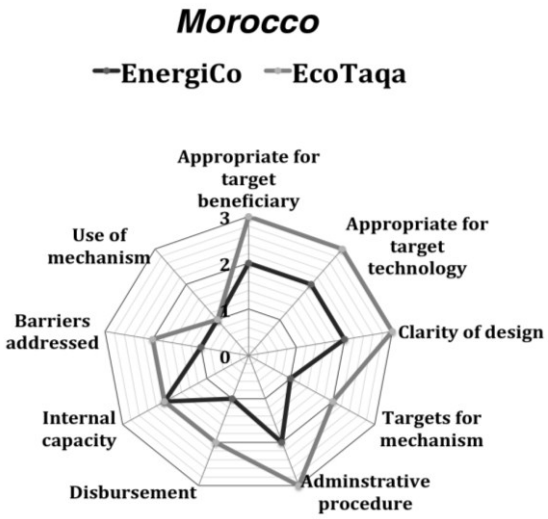

Figure 3: Morocco loan assessment indicators

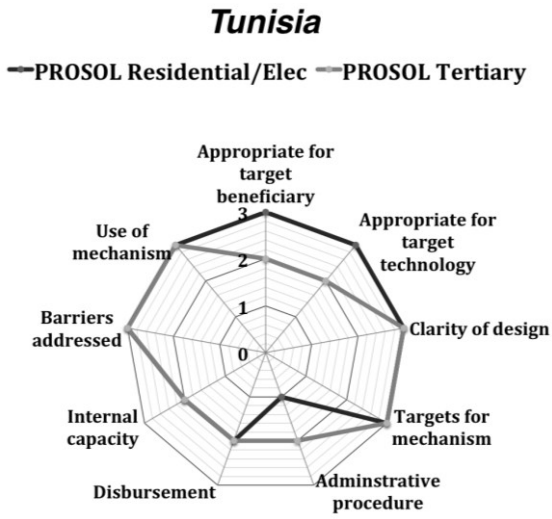

Figure 4: Tunisia loan assessment indicators

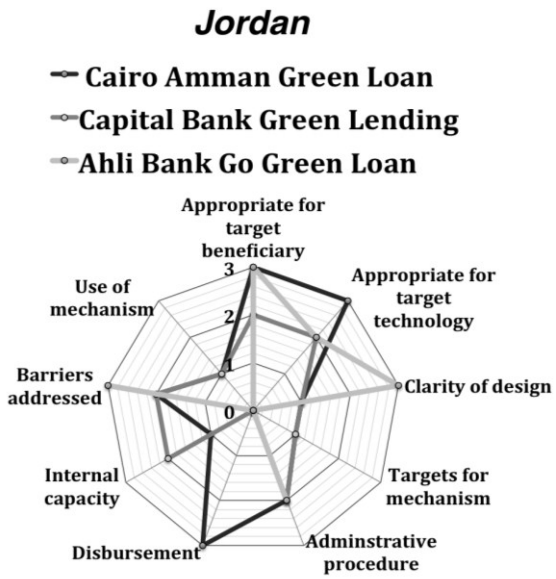

Figure 5: Jordan loan assessment indicators

Figure 6: Egypt loan assessment indicators

In terms of *appropriateness for the target customer*, all mechanisms performed well in this criterion and were assessed as either 'high' or 'average'. The interest rates are all below the commercial bank prime lending rate as they have been 'softened' (subsidised) by either a government organisation in the case of the Credit Agricole EcoTaqa mechanism, or a development bank in the case of the Jordanian banks. The loan length was also appropriate across all mechanisms ranging from the medium term of five years, as was the case for the PROSOL Elec mechanism, to thirteen years for the BMCE EnergiCo mechanism. The length is related to the typical size projects of target consumers. For example, the PROSOL Elec program targets smaller residential installs that can also take advantage of the net-metering scheme and so require a shorter payback period, while the BMCE mechanism targets larger commercial and industrial installs, which require a longer-term loan. Some mechanisms offer more favourable terms such as fixed interest rates and grace periods. This was the case for the Cairo Amman mechanism which offers a grace period of 1-3 years as well as fixed interest rate for 10 years. The fixed interest rate reduces the interest rate risk making it more attractive for potential consumers such as larger commercial enterprises that may be engaging in a larger project and value some certainty in their interest repayments. They therefore received a 'high' assessment rating for this criterion.

Within this same criterion, some mechanisms imposed higher collateral requirements often making them inaccessible to the target consumer. While the exact requirements were unable to be attained information from interviews was ample to determine any issues. BMCE noted this as one of the reasons the mechanism had not been as successful as hoped (Personal correspondence, BMCE, 28/05/14). The issue with high collateral requirements was also underscored by AFD Jordan when they discussed the feedback they received from clients of Capital Bank and Cairo Amman Bank. While the banks offer very attractive terms and rates, the collateral requirements were often too high and therefore limited the use of the mechanism (Personal Correspondence, AFD Jordan, 2014).

Appropriateness for target technology is important as the mechanism needs to firstly relate to the high up front cost barrier and also tailor the loan repayments in line with expected payback of the technology from the savings made on the electricity bill. Mechanisms performed well in this criterion and assessment ratings were either 'Average' or 'High'. Most mechanisms identified the high up-front cost barriers of the target technology as the main barrier to overcome which is in line with the literature. However, only some stated that they tailored the loan payback in line with the expected savings from the technology. The Cairo Amman Bank mechanism emphasised that they tailored the loan terms to the expected savings the consumer was expected to make based on the attained electricity bills. This was generally 4-5 years. Also, The PROSOL Residential and PROSOL Elec. mechanisms directly linked savings made on the electricity bill from the technology to repayments on the loaned amount. Alternatively, the BMCE mechanism followed standard bank repayment standards without any link to the payback of the technology.

Clarity of design and understanding for the target beneficiary is an important indicator as once the initial hurdle of attractiveness is overcome for the end user, they must then be able to understand how the mechanism operates and what the potential benefits and risks are. Mechanism assessments ranged from 'low' to 'high' for this criterion. To illustrate, while it is known that Cairo Amman Bank and Capital Bank Jordan offer green loan program there are no user guidelines available on either the website or from the bank to enable potential users to understand the mechanism and therefore received a 'low' rating. In contrast, the Ahli

Bank Go Green loan has a clear website outlining the eligibility requirements for potential users, the terms and the benefits of the loan. A list of approved installers is also provided reducing the technical barriers to consumers and bank staff.

Targets are important in order to firstly drive the use internally of the mechanisms and also enable evaluations of the mechanism performance. Of all the loan mechanisms only the EcoTaqa mechanism and the PROSOL mechanisms have well defined targets. Having solid targets means the mechanism is encouraged internally of the offering organisation and will potentially be promoted and utilised more frequently externally. Only the PROSOL mechanism had targets in place that were directly related to national policy targets.

The *administrative procedure* should be quick and involve only a few steps for the consumer to reduce transaction costs and improve attractiveness of the mechanism. This was the case across most mechanisms and assessment ratings were mostly 'average' and 'high'. From interview data it generally took a maximum of two weeks to review any loan applications. The exceptions were the PROSOL schemes. They performed very well according to all other criteria however the administrative procedures in order to attain credit takes at least two months and according to one installer can take up to six months. This has meant installers are under additional financial pressure from the high upfront costs of systems and discounted projects costs offered to the consumer according to the credit they will receive from STEG (Personal correspondence, SOFTEN, 03/06/14). Administrative procedures for investigating cases of subsidy and credit are slow and heavily penalize operators in the sector, given the long payment delays. This is due to the procedure for obtaining the grant of ANME that includes a visit from an agent of STEG responsible for taking pictures of PV equipment to validate the compliance of the installation. This step is seen as an unnecessary constraint for the installer who requires faster cash flow to keep up with demand (Personal correspondence, SOFTEN, 03/06/14).

The timing of fund *disbursement* is important as it may contradict the initial goal of the mechanism that is to reduce the high up front cost of the technology. Assessment ratings ranged from 'low' to 'high' in this criterion. The BMCE EnergiCo mechanism provides the loan to the client once the final invoice has been presented and paid in full. This does not initially help with the high upfront costs that are inherent in renewable energy projects. As the BMCE loan is also targeted at larger commercial enterprises, the size of the initial investment would be substantial. This could deter potential users of the mechanism as they are unsure if the project will gain final approval. In comparison, the Cairo Amman Bank mechanism pays the approved loan amount in instalments depending on the project phase. Part is paid to cover the initial purchase of the equipment, a portion for the mounting and installation and the final payment of the loan is made upon commissioning and final approval of the system (Personal correspondence, Cairo Amman Bank, 10/06/14). This covers the high up front cost of the system for the end user in manageable instalments and also addresses some of the risk for Cairo Amman Bank who can review the progress of the project as well as make sure the final install is completed appropriately and the projected savings are realised.

Internal capacity is important as it determines if loans can be administered effectively. Internal capacity can involve technical, administrative and financial capacity. It was considered to be 'Average' or 'High' among most mechanism implementers with the exception of Cairo Amman Bank and Capital Bank. This was firstly indicated by the Cairo Amman representative who acknowledged a lack of adequate technical knowledge and was confirmed by AFD who see this as an issue with both banks however is to be resolved by offering

technical assistance (Personal correspondence, Cairo Amman Bank, 10/06/14; Personal Correspondence, AFD Jordan, 2014). A lack of technical capacity could lead to poor projects being approved and alternately good projects being dismissed due to poor knowledge of the project feasibility.

Identified *barriers* need to be addressed if the mechanism is to be attractive to potential consumers and utilised. The high upfront cost barrier was predominantly addressed by mechanisms. The PROSOL Residential and PROSOL Elec mechanisms addressed this well through a loan and grant that reduced the up-front cost of the systems to almost nothing. On the other hand the disbursement of funds after completion of the project by the BMCE mechanism does not address the high up front cost barrier.

The final objective of all mechanisms is to be utilised to their potential. With the exception of the PROSOL mechanisms, the use of all loan mechanisms across the focus countries was considered to be 'low.' The PROSOL schemes have been very successful in diffusion of technology. The PROSOL Residential solar hot water scheme has achieved an average of 80,000m^2 per year of solar water installs since 2008 (Bahri, 2014). The PROSOL Tertiary scheme is still new to the market however between 2010 and 2013, 51 hotels have signed agreements with PROSOL and 4,993 m^2 has been installed. The EnergiCo mechanism had only served "a few customers" since being launched (Personal correspondence, BMCE, 28/05/14) and the EcoTaqa mechanism has only seen twleve beneficiaries use the mechanism since being launched (Personal Correspondence, Credit Agricole, 2014). Both the Cairo Amman Bank and the Capital Bank mechanisms had very low use considering out of the US$53 million credit line offered by AFD, only a combined US$5.7 million had been used by the two banks. The 'Green Hotels' program is in its early stages therefore use has been limited as it becomes established.

5.2.2 Grants and Subsidies

Grants and subsidies are used to overcome the initial high up front capital cost barrier presented by solar energy projects. They are used particularly by government or industry organisations as a way to 'kick start' the RE industry or to make industry more competitive and efficient as in the case of the Jordan Chamber of Industry mechanism.

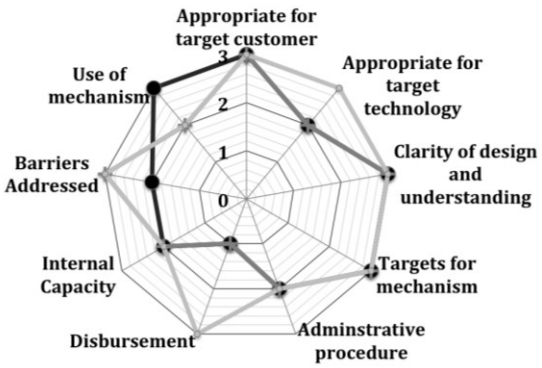

Figure 3: Tunisia grant assessment indicators

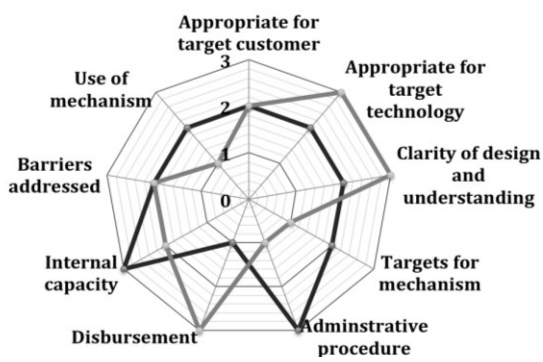

Figure 4: Jordan grant assessment indicators

In regards to *appropriateness for the target customer*, the amount offered has the largest impact on this criterion and should cover a significant part of the capital cost to be attractive to consumers. All mechanisms have specific target consumers and offer amounts that would cover a significant proportion of the typical size project costs. For example, the Jordan Chamber of Industry Factories Support program offers a capital subsidy of maximum €8,216 to cover 50% of a small industrial install. The install costs are about €1,400 per kW[31] and so this amount could cover 50% of a project size of a 12kW system which is enough to offset much of the electricity of a small enterprise. For SHW, the grant covers up to €5,464 of the project cost. Considering the average size of SHW installs under this mechanism is 2-5m^2 the amount adequately covers this. This is also illustrated by the PROSOL Tertiary grant which covers a majority of the feasibility audit costs (70%), the capital costs (55%) as well as the on-going maintenance costs (€2.6/m^2/yr).

With the exception of the IRDF, all mechanisms have *targets* that are specific to their target technology. The PROSOL targets are specifically set to national policy while the Chamber of Industry targets are based more on industry efficiency. The IRDF does not have any targets for renewable energy deployment and could impact on its internal use for renewable energy and could be a factor in low use of the mechanism.

As pointed out in 3.2.4, once the grant level is set the *administrative procedure* should be very straightforward. The administrative procedure for the IRDF includes multiple proposals, agreements, progress and evaluation reports hence the 'low' rating. While it is good practice to place requirements on project updates, the multiple detailed project update reports required by the IRDF seems to be too many steps compared to other grant mechanisms. A signed agreement between the academic and participant, outlining the roles and responsibilities is required and could also add to length of proposal procedures while these are negotiated. Renewable energy installs are generally a simple procedure once they have been deemed technically feasible. Adding time and confusion to the procedure will not attract potential consumers to the mechanism. On the other hand, the Factories Support Program only requires an application letter stating which program applied for, two quotes from installers and justification letter including expected payback period. Approvals are generally given in under a week illustrating the straightforward procedure.

The *disbursement of funds* in stages or at the start of the project is important for overcoming the high up front cost barrier. The IRDF distributes the disbursement into three payments: 40% when the agreement is signed; 30% when 70% of the project is complete (must submit a progress report for evaluation); and 30% when final report it received and the evaluation of the project is complete. This stepwise approach ensures funds are utilised for specific purposes according to the stage of the project, such as equipment purchase and then installation costs. In comparison the Chamber of Industry subsidy is a lump sum payment at the end of the project. This does not deal with the high up front cost that both SHW and solar PV present to potential users. However as there are specific criteria and documents required to be submitted before the project goes ahead, the risk of not receiving payment from the Chamber of Industry is low and there has not been an instance of non-payment yet.

[31] System costs acquired from Jordanian installer Shamsi.

The *internal capacity* and knowledge of renewable energy was deemed 'average' to 'high' across the mechanisms based on administrative capacity within the organisations and the obvious technical knowledge of all implementing organisations. This is positive for future re-design of the mechanisms and also for the launch of other mechanisms from these organisations.

With the exception of the PROSOL mechanisms, *use of grant and subsidy* mechanisms was 'average' or 'low'. The Jordan Chamber of Industry Subsidy has used €49,296 out of a €158,855 budget indicating some use. The IRDF fund however has not been successful in attracting beneficiaries to utilise the fund for renewable energy projects.

5.2.3 Equity and quasi-equity

Both Morocco and Jordan have established similar entities that offer equity products to new and established companies focused on renewable energy projects namely Societe D'Invetissements Énergétiques (SIE) and the Jordan Enterprise Development Corporations (JEDCO).

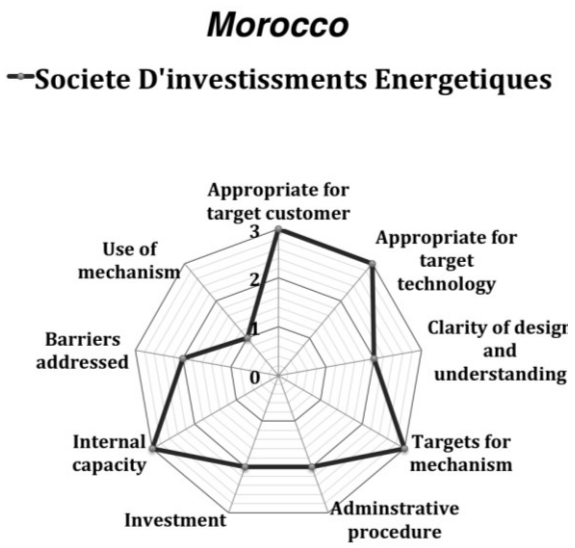

Figure 5: Morocco Equity fund assessment indicators

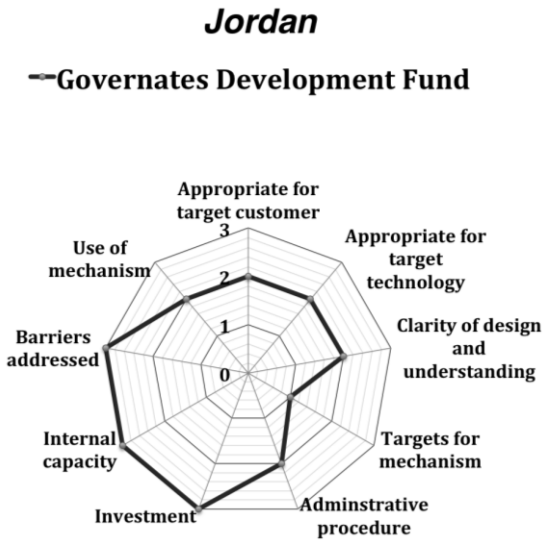

Figure 6: Jordan equity fund assessment indicators

To be *appropriate in design for the target customer,* equity stakes should enable access to lower cost finance from other institutions such as debt from banks and also overcome barriers associated with the high cost of equity. Both mechanisms meet the criteria well. To illustrate, SIE is a government-funded organisation and is well trusted by banks and other financing institutions. This allows beneficiaries to attain lower cost debt as financing institutions see SIE involved as an active shareholding and lower their risk profile of the company accordingly (Personal correspondence, SIE, 27/05/14). This allows the cost of capital to be reduced significantly for project companies. The quasi-equity element of the JEDCO Governorates Development Fund allows up to 80% of the investment in the project to be financed by JEDCO and they only require a 10% return on any profits made. This significantly reduces the cost of equity for start up RE companies and solar projects. The only drawback of the JEDCO mechanism is appropriate technical and management assistance is not offered. This is important particularly for new start up companies and projects.

Investment terms should have a low required return on investment (ROI) or IRR for the given stage of development to make it attractive to consumers. The JEDCO mechanism meets this criteria well as it only requires a 10% return for an 80% equity holding at any stage of company/project development. The IRR for the project company is therefore very high as they are only required to invest 20% equity and gain most of any net profits made (Personal correspondence, JEDCO, 12/06/14). The SIE IRR terms are also desirable and are dependent on the stage of development the project has reached and its role it will play in the sector. If the project is in the first development phase they will require an IRR above 12%. If the project is close to financing close the required IRR is 10-12% and for finalised projects the SIE required IRR is less than 10% (Personal Correspondence, SIEM, 2014). A lower required IRR indicates a lower cost of capital is able to be attained as the general IRR rule implies that only projects with IRR higher than the cost of capital should be undertaken.

In regards to the *barriers addressed* criterion, a major barrier for new solar PV companies and projects is to raise enough capital at a fair price to be profitable. The SIE mechanism enables this to occur as they no only provide low cost equity but also enable companies to gain low cost debt from other sources and therefore lower there overall cost of capital. A lack of performance history of some companies is a significant barrier particular in infant solar markets. The JEDCO mechanism finances start up companies with a lack of performance history with very cheap quasi equity offers.

The *use* of both the SIE equity fund and the JEDCO Governorates Development Fund was considered to be 'low' or 'average' respectively. The SIE fund has recorded no use so far for small-scale distributed companies however the 'PV for all' scheme will be launched very soon. The Governorates Development Fund has not been heavily used for RE deployment as this has not been a priority for industry. With increasing electricity prices, energy efficiency is becoming a high priority and JEDCO expects far more use for renewable energy technology.

6 Discussion

This section will present a discussion of the analysis and interesting findings from the previous chapters. In particular, 6.1.1 addresses the second part of Research Question 2, how have the design and implementation features affected adoption by consumers in the setting of national context? Also, the implications and significance of the research, the applicability of the methodology chosen and recommendations for further study will be presented.

6.1 Discussion of findings and results

Research Question 1 was firstly answered by describing the national contexts of the four focus countries. Using four defined descriptors, the influence that these contexts have on the deployment and/or use of financial mechanisms has been discussed. Research question 2 was addressed by firstly identifying the financing mechanisms in the focus countries and then applying a defined criteria to assess the design, implementation and market impact of the mechanisms to determine design and implementation features of these mechanisms. The methodological process and assessment techniques have revealed some unexpected findings, in particular in relation to the 'Use' of the mechanisms. It was also identified that the perceived risk of commercial bank institutions towards renewable energy projects is high and needs to be addressed to encourage greater supply of appropriately designed financing mechanisms.

6.1.1 The adoption of financing mechanisms was generally 'Low'

It was found that use of all financing mechanisms was 'Low' or 'Average' with the exception of the PROSOL mechanisms. The use of the presented financing mechanisms by consumers is in part dictated by the context and characteristics of the market in which they operate as well as mechanism design and implementation. This section will highlight some key findings relating to the use of the presented financing mechanisms.

The countries in which there is specific policy support for distributed solar PV and SHW have the greatest number of financing mechanisms to encourage uptake of distributed solar and therefore the greatest chance of utilisation. Jordan and Tunisia have established regulations such as the net-metering scheme to encourage solar PV adoption in the residential and SME/industrial sector. They also have the highest number of mechanisms (six and three respectively) available serving these sectors. Tunisia's combination of credit and subsidies is viewed as a package that could be split into more financing mechanisms. Morocco allows sales of excess electricity to the grid operator however this is focused primarily on larger industrial enterprises on the medium and high voltage network and therefore counts out the broader market (households, SMEs, commercial). Egypt has only just implemented regulation to encourage distributed solar PV uptake and therefore only one financing mechanism is offered to the hotel industry, a very specific market segment. Establishing regulations such as net-metering or feed-in-tariffs encourages households, SMEs, industrial and commercial enterprises to investigate options for installation and enables greater initial demand for mechanisms focused on distributed solar energy.

The use of the mechanism relies on the initial design of the mechanism to be attractive and appropriate for the target customer and technology. *Collaboration* between industry organisations, commercial banks, public utilities and public policy actors offers the best chance for a mechanism to be designed in such a way to reflect national goals and circumstances and meet target consumer demands. This was the case in all Tunisian PROSOL mechanisms and the EcoTaqa mechanism in Morocco in which public and private

sector actor collaboration was high. Even though the EcoTaqa mechanism recorded low use this was attributed to the fact that large farmers generally ask for a global loan to finance several actions and not just RE (e.g. new machinery, land acquisition etc.). Therefore the loan is not always detected under the EcoTaqa mechanism although RE may be a focal point of the loan use. Jordan has a range of mechanisms that are underutilised by their target consumers considering the terms they are offering. A lack of technical knowledge appears to be an issue with these banks. The partnership of Capital Bank and Cairo Amman bank with AFD is a good step however an additional partnership with industry organizations such as EDAMA will help the promotion of the programs as well as the transfer of technical knowledge between the solar industry and financing institutions and allow banks to be more comfortable in approving loans for solar energy projects. The Egyptian 'Green Hotels' mechanism is a collaboration with the Ministry of Tourism, National Bank of Egypt, Egypt Hotels Association and SEDA. This gives the mechanism the best chance to be designed effectively and increase utilization as all technical, financing and target market details are covered by these four organisations.

Within Jordan, the borrowing market is largely impacted by religious beliefs. Islam prohibits Riba (interest) and so fixed fee debt contracts are unable to be used by Islamic customers. One of the target beneficiaries of the Cairo Amman Bank and Capital Bank mechanism are households, however, as 95% of the Jordanian population is Muslim this could reduce demand for the mechanism due to religious beliefs. AFD Jordan confirmed this as they stated "this is one of the reasons explaining the difficulties encountered by the Green Credit Line" (Personal Communication, AFD Jordan, 2014). A more appropriate mechanism would offer Ijara (leasing-to-own) terms on solar energy equipment in the same way Islamic banks offer this option for machinery and real estate according to regulations of Sharia arrangements. While this was not mentioned in the interview with JEDCO, the equity structure of the Governorates Development Fund is in line with Islamic banking products such as Mudarabah (Profit and loss sharing) and Musharkah (Joint Venture) and could be offered as a good alternative to conventional banking for SMEs. Islamic banks could play a significant role in the dissemination of RE throughout the region and have a unique opportunity to enter this currently niche market by focusing their standard products on RET.

There is a significant nexus between elements raised in chapter 5.2 and the potential utilisation of these mechanisms. All commercial banks interviewed as well as the organisations offering credit lines (Central Bank of Jordan and AFD Jordan) reported underutilisation of mechanisms. The collateral requirements of commercial banks were heavy and confusing. This was the case in both Morocco and Jordan. While the exact details of collateral requirements were unable to be attained, it was discussed in several interviews as an issue with the mechanism adoption.

The disbursement of funds could play a role in underutilisation of certain mechanisms. The Jordanian Chamber of Industry has disbursed €49,296 out of a €158,855 budget. This could be attributed to the disbursement of funds at the end of the project as it does not enable the high up front cost barrier to be overcome and may limit attractiveness to potential beneficiaries. To make it more attractive a possibility would be to offer the subsidy in stages at the beginning of the project and the remainder after the project has been completed and approved by the Chamber of Industry. The BMCE EnergiCo mechanism also disburses funds at the end of the project once the invoice has been presented. As the focus is on larger corporate clients, the installs are likely to be large and the up front costs significant. Providing funds at the end of the project does not address the high up front capital cost of solar energy deployment and could be a significant factor in underutilisation.

The technical capacity of mechanism implementers is important to achieving maximum utilization of the mechanism as it reduces the administrative time for approvals and also reduces the perceived risk of financing institutions towards solar projects. The Capital Bank and Cairo Amman Bank mechanisms are possible due to the AFD credit line (See 7.3.5 and 7.3.6 for details). This has been significantly underutilised, as indicated by AFD only US$5.7 million out of US$53 million has been utilised by the two banks over several years since the launch of the credit line. The technical capacity of these two banks was deemed to be 'Low' and this was confirmed in an interview with AFD. This lack of technical capacity and understanding of risk of RE projects has meant that these banks ask for significant collateral from customers. Feedback from the clients is that banks offer very attractive terms and rates but also ask for significant collateral (Personal Correspondence, AFD Jordan, 2014). The new technical assistance package offered by AFD Jordan is hoped to address this issue and offer assistance on both the technical aspects and financing analysis of projects. Cairo Amman Bank confirmed that this will help significantly in enabling project approval and attractiveness as customers will have a list of approved technology and installers (Personal correspondence, Cairo Amman Bank, 10/06/14). This will cut down on the transaction costs for customers researching appropriate technology and installers and reduce the administration time and technology risk for the involved banks.

A quick and easy administrative procedure is very important to a mechanisms use. The IRDF fund has rarely been utilised for solar PV installations however the implementers would like it to be more available for this purpose. The administrative procedure of the fund however is far too complex and administratively intensive. Reducing the steps involved in attaining funding could significantly enhance the usability of the mechanism. On the other hand, the PROSOL mechanism in Tunisia offers a straightforward mechanism in which customers do not have to deal directly with the bank. Placing this administrative and technical burden on STEG and the installers makes the mechanism far more attractive and increases use by the target beneficiaries. The average customer lacks appropriate financing and technical knowledge and therefore this ease of use for the end consumer appears to be a key element to the high use of the mechanism and subsequent technology diffusion.

There are other factors that could potentially impact on the use of the mechanism that were met during the research however were not analysed within this paper. The consumer awareness and attitude towards solar energy technology was considered to be low across three of the focus countries. This was discussed in interviews with developers and industry organisations in Jordan, Tunisia and Egypt. Consumer awareness and attitude towards renewable energy technology could play a major role in a lack of demand for the technology and therefore a lack of demand for any financing mechanisms used to diffuse RET. The environmental culture of Jordanian consumers, for example, was discussed in multiple interviews as being very low. It was also noted that there was a lack of appropriate promotion of mechanisms both internally and externally. Websites of Capital Bank and Cairo Amman Bank only offered news articles on the credit lines they were offering however no specific link to the loan mechanisms. Jordan Ahli Bank has a web page presenting the 'Go Green Loan' including minimum requirements for access, the standard terms of the loan as well as an approved list of suppliers. The feedback from consumers of the Jordan Chamber of Industry fund has been positive indicating the low use could also be a lack of appropriate promotion of the mechanism. The Chamber of Industry had said, "[They] had only promoted it for one cycle." (Personal correspondence, Jordan Chamber of Industry, 09/06/14). The promotion of the Credit Agricole mechanism internally appeared to be low as, one branch manager was unaware of the EcoTaqa mechanism offered.

6.1.2 Perceived risk of RE investments is high

The perceived risk of financing institutions for renewable energy projects remains high in most of the focus countries (Personal Correspondence, AFD Jordan & Cairo Amman Bank & BMCE, 2014). This seems to be compounded by two factors: the infant nature of the markets and the risk profiles of customers. This leads to unfavourable requirements from financing institutions.

Within Jordan, households and SMEs are still considered risky borrowers and without the subsidized rates offered by banks such as the Central Bank of Jordan or AFD, loan programs may not exist. As mentioned above the high risk placed on these consumers may be because a lack of internal technical knowledge of solar PV projects and therefore an increased risk premium attached to projects. Technical assistance has recently been offered by AFD to both Capital Bank and Cairo Amman Bank which should enable greater ability to assess projects technical capability and improve their ability to approve viable projects (Personal correspondence, Cairo Amman Bank, 10/06/14; Personal Correspondence, AFD Jordan, 2014).

The BMCE program would like to upscale the EnergiCo program and provide larger scale enterprises with long-term loans (17-20 years) for renewable energy projects (Personal correspondence, BMCE, 28/05/14). While BMCE stated that they "trust these large investments and treat them as others", they also communicated that these projects would attract a high IR on a case-by-case basis (Personal correspondence, BMCE, 28/05/14). This interest rate risk premium attached to projects could make them unattractive to potential consumers.

Risk sharing mechanisms can be very successful in encouraging financial institutions to deploy renewable energy technology however mechanisms offered by both government institutions and development banks have been underutilized and require further communication. The mechanisms offered within Morocco offer very favourable terms and while BMCE Bank had linked their EnergiCo mechanism to a guarantee and loan matching mechanism. This link has the potential to significantly increase the attractiveness and use of the mechanism however was not communicated well. Guarantee schemes have been shown to significantly leverage investments. For instance, within Jordan, the Jordan Loan Guarantee Corporation reports that its outstanding guarantee portfolio is more than four times the value of its shareholder equity and that it could increase this ratio to 8:1 without any problem. The impact of guarantee schemes has been shown by Brown & Jacobs (2011) who report a leverage rate of six to ten for loan guarantees. UNEP (2009) reports that the partial credit guarantee scheme operated by the International Finance Corporation in seven countries, achieved a leverage rate of 12 times to 15 times illustrating the impact these schemes can have on the financial markets (Adam Smith International, 2013).

6.2 Significance and implications of the research

The research questions posed were valid as no up-to-date criteria analysis of financing mechanisms in these countries has been performed. Most of the mechanisms are new (implemented within the last 3 years) so this project provided a good opportunity to determine if there were any issues that could hinder their use early in their life cycles. A majority of the research into mechanism design and implementation is generalisable to other nations across the region providing the nation's government has established the appropriate regulatory context to encourage distributed solar energy up take.

The research offers value to a broad range of actors. Individuals, developers, industry organisations, financing institutions and policy makers could use various focus areas of this research. The presentation of mechanisms within the focus countries could be beneficial to individuals, developers and industry organisations to firstly view the alternatives in the market place and secondly to compare and choose the most appropriate mechanism for their requirements.

Policy makers should take note of the importance of the regulatory context to enabling the supply of financing mechanisms. As pointed out in the findings and results, the countries in which the highest number of mechanisms were offered had focused regulatory backing to enable this. It is also worth taking note of the importance of collaboration between the public sector and private sector to the successful design of financing mechanisms. This ensures all areas (financing, institutional, technical) are covered and the mechanism is aligned with national policy goals. All countries should aim for this collaborative effort.

This research has shown there are significant shortfalls in the design and implementation of many financing mechanisms within the focus countries. For example, the technical capabilities and linked collateral requirements could hinder the use of financial mechanisms. This could be useful for financing institutions, development banks and government organisations in order to resolve current technical capability issues and ensure future implementation of financing mechanisms for the deployment of RET addresses this shortfall.

6.3 Applicability of methodology

The overall research methodologies had some strengths however there were some weaknesses in both the contextual descriptors and the assessment criteria and indicators which could be improved in further studies. While there are endless contextual factors that could be taken into account, the methodology enabled a broad contextual base to be determined by firstly outlining that solar energy was an advisable technology to utilise in the focus countries and by describing the potential in each country. This was important as it developed the case for financing institutions to offer mechanisms to support solar energy technology diffusion. The other contextual descriptors allowed a more direct line to be drawn between the context and the financing mechanism design, implementation and use.

The laws and regulatory descriptors were important to understand the commitment of the public sector to renewable energy in general and more specifically distributed solar energy. Without these commitments it is unlikely that private sector actors and financing institutions would offer financing mechanisms to encourage distributed solar energy. The consumer financing market descriptor was challenging to determine which relevant information to include. The consumer borrowing market is influenced by many macroeconomic and micro-economic factors such as the central bank policies and consumer 'trust' in financing institutions. The author was only able to describe obvious borrowing market characteristics that were brought up in literature and interviews and could be seen to have a direct impact on the use of the financing mechanisms analysed.

The main actor collaboration descriptor was a key element to mechanism use and therefore important to include. It was however difficult to determine a 'level' of collaboration and instead the author had to rely on interviews with various industry, private and public sector actors and make a judgment call on how they interacted with each other. It was obvious that collaboration was very low in Jordan as interviewees were interested in the other interviews conducted in the country and what the other organisations were planning and programs they

were establishing. Within the three other focus countries collaboration was obvious through either the actors involved in the mechanism design and implementation such as in Tunisia and Egypt or through the public sector department interaction in Morocco as was pointed out in 4.1.2.

The criteria used to assess each financing mechanism was determined through literature as well as the expected data availability determined from the authors previous experience in the region. While all of the criteria was qualitative in nature, it enabled an in depth view of the features of the mechanisms assessed. The qualitative nature of the data was largely dependent on who the author was able to interview within a short time frame in each country. If a person was contacted that did not have the required information it was difficult within the time frame to establish further interviews. Some of the criteria was difficult to apply such as the appropriate level of funding for the target consumer. This was determined from interviews with banks and estimations of the average size of installation for the target consumer. A greater number of interviews with beneficiaries would have helped to resolve this. The 'internal capacity' was also difficult to determine in some instances and relied on a subjective view of the author to be formed from the interviews performed. This meant that it depended on the person interviewed as to the determination of technical and financing capacity. This does not necessarily reflect the whole organization however as most interviewees were high level and in charge of implementation of the mechanisms the author was able to make sound judgment on this.

The assessment rating of 'high', 'average' and 'low' was simple but worked well for showing good practice and poor practice in relation to other mechanisms. It was difficult to apply to certain criteria such as the 'targets' criterion. This criterion needed a strong, moderate or weak rating. Some elements that became obvious throughout the research and should be included if this system is used again is the internal and external promotion of the mechanism. This would have an impact on the overall use however one would have to take into account marketing literature to determine if this promotion was conducted effectively and was beyond the scope of this thesis.

Collecting primary data in the MENA region involved certain language barriers. The primary languages spoken in Morocco and Tunisia are French and Arabic. The author was able to have access to a translator and colleague from RCREEE for interviews however this still presents issues when asking appropriate questions and understanding the full workings of various mechanisms. The region itself is difficult to arrange meetings in ahead of time and most are organized only a day or two before. With only a week organized in each focus country this potentially meant missing out on important interviews.

6.4 Further study

This research has not been conducted within these countries or the region previously therefore the aim was to offer a broad picture of the financing landscape and offerings for distributed solar energy. As such there are a number of specific areas that should be studied in more depth. The most important in the authors point of view is the role that Islamic banking can have in offering mechanisms to support distributed solar energy diffusion. Islamic banks already have financing products in place (leasing, profit sharing) that have been proven in developed and developing markets as a successful way to increase solar energy technology diffusion. With the emergence of the sector globally and the largely Muslim populations of the focus countries and the MENA region, these banks could play a pivotal role in the transfer to low carbon economies throughout the region.

7 Conclusion

The objective of this research was to perform an assessment of identified financial mechanisms and the contextual framework they operate within. In reaching this objective two research questions were posed:

1. How do the national contexts of Morocco, Tunisia, Jordan and Egypt provide a conducive environment for the deployment and use of financial mechanisms?

2. What are the design and implementation features of identified financing mechanisms and to what degree have target consumers adopted them? How have these features affected adoption by consumers in the setting of the national context?

With regards to *research question 1* this study firstly described the key elements of the national context using four descriptors that impact the deployment and/or use of financing mechanisms. Results show that all countries in the study are suitable for solar energy deployment based on abundant solar irradiation, reliance on energy imports and increasing energy demand. However, the highly subsidised electricity rates that Egypt offers will hinder the solar market as it will be difficult for solar energy to reach grid parity and be economically viable for households, SMEs and industry with these subsidies in place.

In terms of the *policy framework*, all focus countries have laws and regulations in place specifically focused on RE deployment. All laws were considered to have a long-term focus however the Egyptian laws have not been updated since 1986 and therefore may not relate to current trends in renewable energy technology. These laws differ in regards to the focus on distributed RE. Tunisia and Jordan place an emphasis on distributed solar energy in their laws while Morocco and Egypt are mainly focused on larger scale or utility scale solar energy. Countries with a focus on distributed solar energy offer a more conducive environment for financial mechanisms to be deployed that focus on diffusion of distributed solar energy technology. Additional to laws, net metering is an excellent regulatory instrument used to encourage distributed solar PV installs in all sectors. Tunisia, Jordan and Egypt have net metering schemes in place to support small to medium scale solar PV installs while Morocco enables larger projects on the medium and high voltage networks (up to 50MW) to sell any excess electricity generation back to ONE under a PPA agreement. This regulatory focus to encourage distributed energy systems provides a favourable environment in which financing mechanisms can be launched as they can be focused on sectors that are able to take advantage of these regulatory programs and potentially increase the use of the mechanism.

The *consumer financing markets* of all countries are well established and offer financing products to all sectors (households, SMEs, commercial, tertiary and industrial enterprises). However, the consumer financing market characteristics differ across countries. Within Jordan religion plays a large part in the borrowing market and financial products used. This has meant the role Islamic banks play in the market is much larger than other market segments. This influences the use of current typical financial mechanisms such as loans as well as the decision of financial institutions to deploy additional financial mechanisms. In Tunisia, SMEs face significant risk aversion of financial institutions when attaining finance for projects which could impact on the deployment of financial mechanisms offered to this sector. Contrastingly, financial institutions in Morocco show good penetration of the SME market offering a conducive environment for further mechanisms focusing on renewable energy to be deployed to this large sector. Morocco's recent changes in banking laws to allow Islamic banks to operate could also change the commercial banking market significantly. In terms of

size of market, the Egyptian market is one of the largest in the region with a range of local commercial, Islamic and international banks present. A broad range of financial products focused in each sector of the consumer finance market can therfore be found and offers a favourable context for more mechanisms focused on solar energy to be deployed.

Public and commercial actor collaboration in solar markets varied significantly across the focus countries. Morocco had collaboration between all government organisations involved in the solar energy sector as well as with commercial banks. It was observed that there is a culture of collaboration and this can spill over to the financing mechanisms offered to support the solar energy market. Within Jordan there was a lack of collaboration between government organisations and commercial organisations. This is not conducive to financial mechanism deployment as financial institutions, namely commercial banks, are not inclined to offer products focused on infant markets such as solar without the support of government organisations. However, this was negated by the active involvement of development banks such as AFD and the agreements with commercial banks to deploy financial products focused on the distributed solar market at subsidised rates. Tunisia showed high collaboration between government organisations involved in the solar energy sector, private commercial banks and electricity utility's. This is conducive to financial mechanism deployment as financial products can be implemented within the solar energy sector with the support of all key actors. Within Egypt, collaboration was also observed between solar industry organisations, public offices, commercial banks and sector organisations.

With regards to *research question 2* it was found that there are a total of thirteen financing mechanisms offered at present across Morocco, Tunisia, Jordan and Egypt. These included concessional loans, grants and subsidies, equity and quasi equity mechanisms. Concessional loans were the most prevalent financing mechanism across the countries indicating the importance of commercial banks in the distributed solar energy sector.

In regards to the **design** of these mechanisms, most performed well in relation to *appropriateness for target consumer*. This indicates that most organisations understand how to initially attract target consumers. This is somewhat helped by the backing of central banks and development banks which enable 'soft' terms to be offered. However, some mechanisms, such as the BMCE EnergiCo mechanism, imposed collateral requirements that target consumers could not meet and was one factor in the underutilisation of the mechanism. In regards the *appropriateness for target technology*, a majority of mechanisms offered loan terms that were in line with technology payback periods and amounts that could cover technology costs. The *clarity* of the purpose and explanation of the benefits of the mechanism was lacking within some mechanisms such as the Cairo Amman Bank Green Loan and Capital Bank Green Lending programs as well as the JEDCO Governorates Development Fund. With the exception of the PROSOL mechanisms, all other mechanisms lacked any solid *targets* such as amount to be deployed or number of systems to be funded.

In regards to the **implementation**, the *administrative procedure*, while often quick, was an issue across some of the offered mechanisms. For example, The IRDF mechanism, while clearly explained, is a long procedure with many reports to provide throughout a project. This could potentially reduce the attractiveness of the mechanism. Streamlining administrative procedures and reducing the reporting steps could facilitate quick approvals and increased use. The *internal technical capacity* of many commercial banks was low impacting on the approval of loans for RET. In Jordan, offering technical assistance along with the credit lines offered by AFD and Central Bank of Jordan could alleviate this. The time of *disbursement of funds* is as an issue and while some organisations disbursed funds according to project

progress, others, such as the BMCE mechanism only paid funds once the project had been complete. Late disbursement of funds has been revealed as one of the reasons for a lack of adoption of financial mechanisms.

In regards to **market impact**, with the exception of the PROSOL mechanisms, there was a lack of *utilisation* across all other mechanisms. Contextual factors as well as design and implementation issues discussed have an impact on the limited use of financing mechanisms.

In order to increase the adoption of financing mechanisms, the following recommendations are proposed. Firstly, improving the technical capacity of staff of financing institutions will enable them to have a more informed assessment of risk associated with RE projects. This could help in lowering collateral requirements for projects, increase the number of potential consumers and therefore increase the use and diffusion of solar energy technology. Increased interaction between financial institution and solar industry organisations could be part of such a capacity building process.

Secondly, collaboration is essential between public sector, financing sector, industry organisations and private sector in the design and implementation of financing mechanisms. Collaboration ensures that all technical, financing, target market and policy factors are covered in the design and implementation of the mechanism. The technical aspects such as approving installers to take part in a mechanism could be covered by solar industry organisations such as EDAMA (Jordan), SEDA (Egypt), ANME (Tunisia) and ADEREE (Morocco). As the solar markets are relatively infant, such measures for quality management are likely to contribute to higher project quality, increased savings for the consumer and a reduction in the perceived risk of financing organisations towards RET. Within Jordan it is recommended that EDAMA partners with commercial banks to offer technical assistance in order to overcome the risk aversion that Jordanian banks appear to have for RE projects. Also, industry associations, such as the Egyptian Hotels Association, play an important role in providing information on important target sub-sectors, in this case the hotel sector. Collaboration across solar industry associations, interest organisations representing specific adopter groups and financing organisations would facilitate better-tailored design and implementation of financing mechanisms and increase adoption. Public sector actors such as the Ministry for Energy or electricity regulatory bodies should be involved in this process as they can provide detailed information on the current policy framework and national laws as well as any changes that may be made to the policy framework. This allows financing mechanisms to be designed in line with public policy regulations giving consumers and financing institutions confidence that projects can take advantage of any regulatory benefits such as net-metering schemes.

Lastly, the financial ideology of Islamic banks is well suited to developing renewable energy markets as the focus is on ethical, moral and social considerations and the belief that money should be used to create social value rather than just wealth. The financial products offered are also appropriate for RET investments. For example, the ***Ijara*** (Lease-to-own) product would be suited very well to households, SMEs, and commercial organisations. Lease-to-own models have proven very successful in both developed and developing country contexts to increase the diffusion of solar energy technology. Within Jordan this would be particularly viable as Islamic banking is already well established. This would overcome the issue of religious constraints on consumers entering the standard borrowing market. ***Mudarabah*** (Profit and Loss sharing) and the ***Musharkah*** (Joint venture) products are well suited to project developers and larger industrial projects that can take advantage of net metering and PPAs such is the case in Morocco, Tunisia and Jordan. It is highly recommended that Islamic

banks become involved in the distributed renewable energy markets through their standard financing products.

This research has revealed that there is a range of financing mechanisms deployed in the MENA region however these are largely underutilised by the target consumers. While these conclusions are important they have also revealed research gaps that could be pursued in this field. Firstly, the role Islamic banks can play in the distributed renewable energy market in the MENA region should be established. Secondly, further investigation should occur into risk sharing mechanisms and guarantees schemes that can be utilised in conjunction with other financial mechanism offerings as these schemes could leverage additional finance for projects and significantly impact the market. Lastly, additional research focusing on consumer finance market characteristics on both the borrower and lender sides could provide further insight into the influences of deployment of financing mechanisms and the influences of demand for these mechanisms.

Bibliography

Aanesen, K., Heck, S., & Pinner, D. (2012). Solar power : Darkest before dawn. McKinsey & Company.

Abdelazim, M. (2014, January 14). Islamic banking remains unpopular in Egypt : Gallup poll. Daily News Egypt, pp. 14–16.

Abu Dhabi Islamic Bank. (2014). Understanding Islamic Banking. ADIB. Retrieved September 01, 2014, from http://www.adib.eg/understanding-islamic-banking

Ackermann, T. (2001). Distributed generation : a definition. Electric Power Systems Research, (57), 195–204.

Adair, P., & Fhima, F. (2014). Small and Medium-sized Enterprises' Credit Rationing on the Tunisian Bank Credit Market. Journal of Economics and Development Studies, 2(1), 81–97.

Adam Smith International. (2013). Study of mechanisms to incentivize the financial sector to scale up financing of green investment in Jordan Hashemite Kingdom of Jordan.

Agence Nationale pour le Developpement des Energies Renouvelables et de L'efficacite Energetique. (2014). ADEREE – Crédit Agricole du Maroc. Retrieved May 29, 2014, from http://www.aderee.ma/index.php/cooperation/nationale/aderee-credit-agricole

Al-Daameh, M. (2014). Jordan ' s Finance Minister : We will eliminate electricity subsidies by. Asharq Al-Awsat, pp. 2012–2015. Retrieved from http://www.aawsat.net/2014/05/article55332275/print/

Al-Iriani, M. a. (2006). Energy–GDP relationship revisited: An example from GCC countries using panel causality. Energy Policy, 34(17), 3342–3350. doi:10.1016/j.enpol.2005.07.005

Alafita, T., & Pearce, J. M. (2014). Securitization of residential solar photovoltaic assets: Costs, risks and uncertainty. Energy Policy, 67, 488–498. doi:10.1016/j.enpol.2013.12.045

Ali, S. S. (2011). Islamic Banking in the MENA Region (pp. 1–45). The World Bank Islamic Development Bank - Islamic Research and Training Institute.

Arian, R. (2013). A Brief History of Oil Prices and Middle East Tensions: Fear of a Black Gold Shortage. Retrieved June 20, 2014, from http://www.datawatch.ze.com/in-depth/a-brief-history-of-oil-prices-and-middle-east-tensions-fear-of-a-black-gold-shortage/

Asafu-adjaye, J. (2000). The relationship between energy consumption , energy prices and economic growth : time series evidence from Asian developing countries. Energy Ecnomics, 22, 615–625.

Asia-Pacific Economic Cooperation. (2013). APEC Workshop on Best Practices on Financing Renewable Energy. Asia.

Baccouche, A. (2014). The Tunisian Solar Thermal Market: A Change of Scale. Energy Procedia, 48, 1627–1634. doi:10.1016/j.egypro.2014.02.183

Bahri, M. (2014). Présentation Plan Solaire Tunisien - PSM. Agence Nationale lour la de Energie.

Bank for International Settlements. (2014). Basel Committee - Basel II. Retrieved July 15, 2014, from http://www.bis.org/list/bcbs/tid_22/index.htm

Barua, D. C., Urmee, T. P., Kumar, S., & Bhattacharya, S. C. (2001). A photovoltaic solar home system dissemination model. Progress in Photovoltaics: Research and Applications, 9(4), 313–322. doi:10.1002/pip.376

Bazilian, M., Onyeji, I., Liebreich, M., MacGill, I., Chase, J., Shah, J., … Zhengrong, S. (2013). Re-considering the economics of photovoltaic power. Renewable Energy, 53, 329–338. doi:10.1016/j.renene.2012.11.029

Betak, J., Suri, M., Cebecauer, T., & Skoczek, A. (2010). Solar Resource and Photovoltaic Electricity Potential in EU-MENA Region. In Proceedings of the 27th European Photovoltaic Solar Energy Conference and Exhibition (pp. 2–5). Retrieved from http://geomodelsolar.eu

Botiş, S. (2013). Shari'ah Concepts in Islamic Banking. Bulletin of the Transilvania University of Brasov, 6(2), 139–146.

Bouabidi, M., & Rajhi, M. T. (2009). Les Effets de la physionomie du système financier sur le rationnement des PME. Journal of Small Business & Entrepreneurship, 22(2), 181–195. doi:10.1080/08276331.2009.10593449

Bououiyour, J., & Selmi, R. (2013). Electricty consumption and ecnomic growth nexus: Evidence from MENA countires. Munich Personal RePEc Archive, (49136). Retrieved from http://mpra.ub.uni-muenchen.de/50806/1/MPRA_paper_50806.pdf

Breyer, C., Gerlach, A., Beckel, O., & Schmid, J. (2010). Value of solar PV electricity in MENA region. 2010 IEEE International Energy Conference, 558–563. doi:10.1109/ENERGYCON.2010.5771744

Breyer, C., Gerlach, A., Schäfer, D., & Schmid, J. (2010). Fuel-Parity : New Very Large and Sustainable Market Segments for PV Systems. In IEEE EnergyCon 2010.

Brown, J., & Jacobs, M. (2011). public sector climate finance. Overseas Development Institute. Retrieved from http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/7082.pdf

Buchner, B. K., & Heller, T. C. (2012). Effective Green Financing : What have we learned so far ? Climate Policy Initiative. Climate Policy Initiative. Retrieved from www.climatepolicyinitiative.org

Burke, K. B. (2014). The reliability of distributed solar in critical peak demand: A capital value assessment. Renewable Energy, 68, 103–110. doi:10.1016/j.renene.2014.01.042

Business Islamica. (2013). The Islamic Development Bank's board of executive directors approved new finances worth $790 million for projects in member countries. Business Islamica. Retrieved July 08, 2014, from - http://businessislamica.com/home/NewsDetails/7

Central Intelligence Agency. (2014). The World Fact Book: Morocco. Retrieved August 27, 2014, from https://www.cia.gov/library/publications/the-world-factbook/geos/mo.html

Cheng, P. (2008). Quasi-Equity: Case Study in using Revenue Participation Agreements. Venturesome; Charities Aid Foundation.

Churchill, A. A., & Saunders, R. J. (1989). Financing of the Energy Sector in Developing Countries. Retrieved from http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/1989/04/01/000009265_3960928141039/Rendered/PDF/multi_page.pdf

Clean Energy Pipeline. (2013). The Future for Renewable Energy in the MENA Region. Squire Saunders. Retrieved from http://www.squiresanders.com/the-future-for-renewable-energy-in-the-mena-region/

Coughlin, J., & Cory, K. (2009). Solar Photovoltaic Financing : Residential Sector Deployment Solar Photovoltaic Financing : Residential Sector Deployment. National Renewable Energy Laboratory.

Croker, A. (2013). Renewable energy in Egypt: hydro, solar and wind. Norton Rose Fulbright. Retrieved June 04, 2014, from http://www.nortonrosefulbright.com/knowledge/publications/74735/renewable-energy-in-egypt-hydro-solar-and-wind

Demirguc-Kunt, A., Klappers, L., Randall, D., & Sonnenshein, J. (2013). Islamic Banking Remains Niche Market in North Africa: Awareness of Sharia-compliant financial services highest in Tunisia. Gallup World. Retrieved July 25, 2014, from http://www.gallup.com/poll/166583/islamic-banking-remains-niche-market-north-africa.aspx

Dippelsman, R., & Kitili, A. (2004). IMF Committee on Blance of Payments Statisitcs: Concessional Debt. International Monetary Fund.

Drine, I. (2011). WIDER Working Paper No. 2011/96 Climate Variability and Agricultural Productivity in MENA region. WIDER Working Paper.

Dutta, D., & Magableh, I. (2006). A socio-economic study of the borrowing process: the case of microentrepreneurs in Jordan. Applied Economics, 38(14), 1627–1640. doi:10.1080/00036840500427148

Eckhart, M. T., Stone, J. L., & Rutledge, K. (2005). Financing PV Growth. In A. Luque & S. Hegedus (Eds.), Handbook of Photovoltaic Science and Engineering. John Wiley & Sons, Ltd. doi:10.1002/0470014008.ch24

Economist Intellignece Unit. (2011). Securing MENA's electric power supplies to 2020. The Economist.

Egypt State Information Service. (2009). The Banking Sector in Egypt. Retrieved July 15, 2014, from http://www.sis.gov.eg/En/Templates/Articles/tmpArticles.aspx?ArtID=840#.VBHXcBZ0BEd

Egyptian Electric Utility and Consumer Protection Regulatory Agency. (2014). Technical Requirements for Connecting Small Scale PV (ssPV) Systems to Low Voltage Distribution Networks. EgyptERA. Retrieved from http://www.egyptera.org/Downloads/code w dalil/code/ssPV CODE.pdf

El Ouderni, A. R., Maatallah, T., El Alimi, S., & Ben Nassrallah, S. (2012). Experimental assessment of the solar energy potential in the gulf of Tunis, Tunisia. Renewable and Sustainable Energy Reviews, 20, 155–168. doi:10.1016/j.rser.2012.11.016

El-katiri, L. (2014). A Roadmap for Renewable Energy in the Middle East and North Africa. Oxford Institute for Energy Studies.

Electricity Regulatory Commission. (2013). Role and achievements of the Jordanian Electricity Regulatory Commission (ERC) Regarding Renewable Energy Legislations in Jordan General Electricity Law (GEL) – No64 – 2002.

Elsagheer, M. (2013). Energy Situation in Jordan. Ministry of Planning and Internatonal Cooperation.

Ernst and Young. (2013). World Islamic Banking Competetiveness Report 2013-14. Ernst and Young.

Ernst and Young. (2014). Country focus: Tunisia Significant solar potential signals exciting opportunities. Retrieved June 27, 2014, from http://www.ey.com/GL/en/Industries/Power---Utilities/RECAI---Tunisia

Ettaik, Z. (2012). Solar Water Heaters in Morocco: Program Shemsi. Ministere de l'Energie, des Mines, e l'Eau et de l'Environment.

Farge, E. (2014). Islamic Development Bank loans $180 mln for Africa projects. Reuters. Retrieved July 08, 2014, from http://www.reuters.com/article/2014/06/03/islamicfunds-africa-idUSL6N0OK3MK20140603

Ferruelo, E. (2012). Why Socially Responsible Investing And Islamic Finance Is On The Rise. Forbes. Retrieved July 25, 2014, from http://www.forbes.com/sites/ashoka/2012/11/01/why-there-is-high-growth-potential-in-the-nexus-between-socially-responsible-investing-and-islamic-finance/

Fhima, F., & Bouabidi, M. (2011). Credit Rationing in the Bank Credit Market: The Case of Tunisian SMEs. Journal of Small Business & Entrepreneurship, 24(4), 583–602. doi:10.1080/08276331.2011.10593555

George, G. (2002). Electrifying Rural Morocco. Transmissions and Distribution World, 52–55.

Global Energy Efficiency and Renewable Energy Fund. (2014). Investment Strategy. Retrieved July 18, 2014, from http://geeref.com/about/investment-strategy.html

Goaied, M., & Sassi, S. (2011). Financial Development , Islamic Banking and Economic Growth Evidence from MENA Region. International Journal of Business & Management Science, 4(2), 105–128. Retrieved from http://connection.ebscohost.com/c/articles/77695060/financial-development-islamic-banking-economic-growth-evidence-from-mena-region

Goldman, D. P., Mckenna, J., & Murphy, L. (2005). Financing Projects That Use Clean-Energy Technologies : An Overview of Barriers and Opportunities. National Renewable Energy Laboratory.

Green Climate Fund. (2013). Business Model Framework : Financial Instruments (Vol. 4). Green Climate Fund.

Griffiths, S. (2013). Strategic considerations for deployment of solar photovoltaics in the Middle East and North Africa. Energy Strategy Reviews, 2(1), 125–131. doi:10.1016/j.esr.2012.11.001

Henriques, I., & Sadorsky, P. (2008). Oil prices and the stock prices of alternative energy companies. Energy Economics, 30(3), 998–1010. doi:10.1016/j.eneco.2007.11.001

Hormann, M., Kuntze, J. C., & Dib, J. (2011). DELIVERING ON THE ENERGY EFFICIENCY PROMISE IN THE MIDDLE EAST (pp. 1–10). Retrieved from http://www.oliverwyman.com/content/dam/oliver-wyman/global/en/files/archive/2013/Energy_Efficiency_inMiddleEastFINAL.pdf

ICF International. (2013). Rooftop Solar Challenge : Outreach to Local Massachusetts Financial Institutions. Massachusetts Department of Energy Resources (DOER).

Inspired Evolution Investment Management. (2013). Profit with Purpose : Sustainable Value Creation Report 2013. Retrieved from http://inspiredevolution.co.za/wp-content/uploads/2014/03/Evolution-One-Fund-Portfolio-Investments.pdf

Inspired Evolution Investment Management. (2014). Introduction to Inspired Evolution. Retrieved from http://inspiredevolution.co.za/wp-content/uploads/2013/03/IEprofile-17a.pdf

International Energy Agency. (2002). Financing Mechanisms for Solar Home Systems in Developing Countries: The role of financing in the dissemination process. Retrieved from http://www.iea-pvps.org

International Energy Agency. (2013). Morocco - Policies and Measures - Reneewable Energy - Renewable Energy Development Law 13.09. Retrieved June 23, 2014, from http://www.iea.org/policiesandmeasures/pams/morocco/name-24712-en.php?s=dHlwZT1yZSZzdGF0dXM9T2s,&return=PGRpdiBjbGFzcz0ic3ViTWVudSI-PGRpdiBjbGFzcz0iYnJlYWRjcnVtYnMiPjxhIGhyZWY9Ii8iPkludGVybmF0aW9uYWwgRW5lcmd5IEFnZW5jeSZ6d25qOzwvYT4mbmJzcDsmZ3Q7Jm5ic3A7PGEgaHJlZj0iL3BvbGljaWVzYW5kbWVhc3VyZXMvIj5Qb2xpY2llcyBhbmQgTWVhc3VyZXM8L2E-Jm5ic3A7Jmd0OzxhIGhyZWY9Ii9wb2xpY2llc2FuZG1lYXN1cmVzL3JlbmV3YWJsZWVuZXJneS9pbmRleC5waHAiPiZuYnNwO1JlbmV3YWJsZSBFbmVyZ3k8L2E-Jm5ic3A7Jmd0OyZuYnNwO1NlYXJjaCBSZXN1bHQ8L2Rpdj4,

International Energy Agency. (2014). Egypt: Natural Gas. International Energy Agency Statisitcs. Retrieved August 14, 2014, from http://www.iea.org/statistics/statisticssearch/report/?country=EGYPT&product=naturalgas&year=2010

International Energy Agency, Organisation of the Petroleum Exporting Countries, Organisation for Economic Co-operation and Development, & The World Bank. (2010). Analysis of the Scope of Energy Subdsidies and Suggestions for the G-20 Initiative. Retrieved from http://www.oecd.org/env/45575666.pdf

International Finance Corporation. (2012). The Potential of Renewable Energy in MENA (pp. 1–4). World Bank Group.

International Monetary Fund. (2013a). E n e r g y S u b s i d i e s i n h e M i d d l e East E a s t and a n d N o r t Africa : h A f r i c a : Energy Subsidies in t the Middle e s s o n s for f o r Reform R e f o r m Lessons, 1–4.

International Monetary Fund. (2013b). Jordan - Program Note. International Monetary Fund. Retrieved from http://www.imf.org/external/np/country/notes/pdf/jordan.pdf

International Monetary Fund. (2014). Energy Subsidies in the Middle East and North Africa: Lessons for Reform (pp. 1–4). International Monetary Fund.

International Renewable Energy Agency. (2012). Financial Mechanisms and Investment Frameworks for Renewables in Developing Countries.

International Renewable Energy Agency, Directorate of Energy & Climate Change, & Renewable Energy Policy Network for the 21st Century. (2013). Renewables Status Report MENA 2013.

International Renewable Energy Agency, League of Arab States, & Regional Centre For Renewable Energy and Energy Efficiency. (2014). Pan-Arab Renewable Energy Strategy 2030: Roadmap of Actions for implentation.

IPCC. (2014). Summary for Policy Makers, In: Climate Change 2014, Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Cambridge University Press.

Iqbal, Z., & Mirakhour, A. (1999). Progress and Challenges of Islamic Banking. Thunderbird International Business Review, 41(October 1999), 381–405.

Islamic Development Bank. (2013). From darkness to light: rural electricity in Morocco (Vol. 1). Banque Islamique de Development.

Islamic Solidarity Fund for Development. (2014). Islamic Solidarity Fund for Development: FOurth Annual Report. Islamic Solidarity Fund for Development. Retrieved from http://www.isdb.org/irj/go/km/docs/documents/IDBDevelopments/Internet/English/IDB/CM/ISFD/ISFD Annaul Report 1432H.pdf

Jordan Investment Corporation. (2009). Banking and Financial Services (pp. 3–9). Retrieved from http://www.jordaninvestment.com/Portals/0/library/PDF/634464744030645000.pdf

Justice, S. (2009). Private Financing of Renewable Energy - A Guide for Policy Makers. UNEP; SEFI; Blooberg New Energy Finance; CHatham House. Retrieved from http://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy%2C Environment and Development/1209_financeguide.pdf

Kapadia, K., & Hande, H. (2004). Issues and Options: The potential role of microfinance to expand access to energy services (pp. 1–7). Retrieved from http://arcfinance.org/learning-publications.html

Kfw Bankengruppe. (2005). Financing Renewable Energy: Instruments Strategy and Approaches. (KfW Entwicklungsbank, P. Lindlein, & Wolfgang Mostert Associates, Eds.). Kfw Bankengruppe. Retrieved from https://www.kfw-entwicklungsbank.de/Download-Center/PDF-Dokumente-Diskussionsbeiträge/38_AMD_E.pdf

Kidney, S. (2012). Green Sukuk Working Group launched to support finance for climate change investment projects. Climate Bonds Initiative. Retrieved June 18, 2014, from http://www.climatebonds.net/2014/05/green-sukuk-working-group-launched-support-finance-climate-change-investment-projects

Kraft, J., & Kraft, A. (1978). On the relationship between energy and GNP. Journal of Energy and Development, 3(2), 401–03.

Kubert, C., & Sinclair, M. (2009). Distributed Renewable Energy Finance and Policy Toolkit. Clean Energy States Alliance. Retrieved from http://www.cesa.org/assets/Uploads/CESA-renewableenergy-FinancePolicy-toolkit2009.pdf

Lee, A. (2013). Most new residential solar PV projects in California program are not owned by homeowners. US Energy Information Administration. Retrieved July 15, 2014, from http://www.eia.gov/todayinenergy/detail.cfm?id=12991

Lee, C.-C. (2005). Energy consumption and GDP in developing countries: A cointegrated panel analysis. Energy Economics, 27(3), 415–427. doi:10.1016/j.eneco.2005.03.003

Liu, X., O'Rear, E. G., Tyner, W. E., & Pekny, J. F. (2014). Purchasing vs. leasing: A benefit-cost analysis of residential solar PV panel use in California. Renewable Energy, 66, 770–774. doi:10.1016/j.renene.2014.01.026

Maclean, J. (2008). Mainstreaming Environmental Finance Markets – Small-Scale Energy Efficiency and Renewable Energy Finance Mobilizing commercial financail institutions for energy efficiency and small scale renewable energy finance in developing countries: Financail product. In KfW Financial Sector Development Symposium 2008 "Greening the Financial Sector – How to Mainstream Environmental Finance in Developing Countries." KfW Financial Sector Development. Retrieved from http://eefinance.net/images/MacLean KfW Paper on EE-RE Finance Final Nov 21.pdf

Maclean, J. C., & Siegel, J. M. (2007). Financing Mechanisms and Public/Private Risk Sharing Instruments for Financing Small Scale Renewable Energy Equipment and Projects. The Global Environment Facility; The United Nations Environment Program. Retrieved from http://www.unep.org/climatechange/finance/RiskManagement/FinancialRiskManagement/SmallscaleoffgridstandaloneRE/tabid/29724/Default.aspx

Malek, A., Lapierre, A., & Currie, S. (2012). Renewable Energy Morocco. Norton Rose Fulbright. Retrieved July 15, 2014, from http://www.nortonrosefulbright.com/knowledge/publications/66419/renewable-energy-in-morocco#section2

Margolis, R., & Zuboy, J. (2006). Nontechnical Barriers to Solar Energy Use : Review of Recent Literature Nontechnical Barriers to Solar Energy Use : Review of Recent Literature. National Renewable Energy Laboratory. Retrieved from http://www.nrel.gov/docs/fy07osti/40116.pdf

Masse, R. (2010). Financing Rural Electrification Programs in Africa. European Commission. Retrieved from http://www.google.se/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CDgQFjAB&url=http%3A%2F%2Fwww.energyfacilitymonitoring.eu%2Findex.php%2Fen%2Fpublications%2Fproject-publications%2Fdoc_download%2F23-en-financing-rural-electrification-programs-in-africa&ei=QycSVPD_GoK9ygPxxILYAg&usg=AFQjCNEiEYF403tHeBJy3oOrGJFaRebWQQ&sig2=4fEsDEamUJEoGkOfLmWrfQ&bvm=bv.75097201,d.bGQ

Mitchell, C., Sawin, J. L., Pokharel, G. R., Kammen, D., Wang, Z., Jaccard, M., … Hansen, G. (2011). Policy, Financing and Implementation. In D. Jager & A. Boncheva (Eds.), Renewable Energy Sources and Climate Mitigation (pp. 865–950). International Panel on Climate Change. Retrieved from http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch11.pdf

Moqana, L. (2014). Morocco's lower house of parliament approves Islamic banking law. Asharq Al-Awsat. Retrieved July 05, 2014, from http://www.aawsat.net/2014/06/article55333696

Moroccan Agency for Solar Energy. (2014). MASEN - Presentation of Moroccan Solar Plan. Retrieved June 25, 2014, from http://www.masen.org.ma/index.php?Id=42&lang=en#/_

Morris, E., Winiecki, J., Chowdhary, S., & Cortiglia, K. (2007). Using Microfinance to Expand Access to Energy Services : Summary of Findings. SEEP Network. Retrieved from http://www.seepnetwork.org/filebin/pdf/resources/Energy_Summary_FINAL.pdf

Murphy, L. M., & Edwards, P. L. (2003). Bridging the Valley of Death : Transitioning from Public to Private Sector Financing Bridging the Valley of Death : Transitioning from Public to Private Sector Financing. National Renewable Energy Laboratory. Retrieved from http://www.nrel.gov/docs/gen/fy03/34036.pdf

Neij, L., & Åstrand, K. (2006). Outcome indicators for the evaluation of energy policy instruments and technical change. Energy Policy, 34(17), 2662–2676. doi:10.1016/j.enpol.2005.03.012

Nelson, D., Barcklay, R., Buchner, B., Frisari, G., Heller, T. C., Hervé-mignucci, M., & Rompovolo, E. (2014). Finance Mechanisms for Lowering the Cost of Renewable Energy in Rapidly Developing Countries. Climate Policy Initiative. Retrieved from http://climatepolicyinitiative.org/wp-content/uploads/2014/01/Finance-Mechanisms-for-Lowering-the-Cost-of-Clean-Energy-in-Rapidly-Developing-Countries.pdf

Nelson, D., & Shrimali, G. (2014). Finance Mechanisms for Lowering the Cost of Renewable Energy in Rapidly Developing Countries. Clinate Policy Initiative. Retrieved from http://climatepolicyinitiative.org/publication/finance-mechanisms-for-lowering-the-cost-of-renewable-energy-in-rapidly-developing-countries/

Noll, D., Dawes, C., & Rai, V. (2014). Solar Community Organizations and active peer effects in the adoption of residential PV. Energy Policy, 67, 330–343. doi:10.1016/j.enpol.2013.12.050

Northrop, M. F., Riggs, P. W., & Raymond, F. a. (1996). Selling solar: financing household solar energy in the developing world. Energy for Sustainable Development, 3(1), 10–16. doi:10.1016/S0973-0826(08)60176-3

Painuly, J., & Wohlgemuth, N. (2008). Renewable energy financing - what can we learn from experience in developing countries ? Energy Studies Review, 14(2).

Pode, R. (2013). Financing LED solar home systems in developing countries. Renewable and Sustainable Energy Reviews, 25, 596–629. doi:10.1016/j.rser.2013.04.004

Rai, V., & Sigrin, B. (2013). Diffusion of environmentally-friendly energy technologies: buy versus lease differences in residential PV markets. Environmental Research Letters, 8(1), 014022. doi:10.1088/1748-9326/8/1/014022

Razavi, H. (2012). Clean Energy Development in Egypt. Banque Africaine de developpement. Retrieved from http://www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/Cata Energie Anglais.pdf

Regional Centre for Renewable Energy and Energy Efficiency. (2013a). Arab Future Energy Index TM (AFEX) Renewable Energy. Retrieved from http://www.rcreee.org/sites/default/files/reportsstudies_afex_re_report_2012_en.pdf

Regional Centre for Renewable Energy and Energy Efficiency. (2013b). Egypt - 2012 Renewable Energy Country Profile. Retrieved from http://www.rcreee.org/sites/default/files/rcreee_countryprofile_re_egypt_en_2012.pdf

Regional Centre for Renewable Energy and Energy Efficiency. (2013c). Jordan - 2012 Renewable Energy Country Profile. Retrieved from http://www.rcreee.org/sites/default/files/rcreee_countryprofile_re_jordan_en_2012.pdf

Regional Centre for Renewable Energy and Energy Efficiency. (2013d). Morocco - 2012 Renewable Energy Country Profile. Retrieved from http://www.rcreee.org/sites/default/files/rcreee_countryprofile_re_morocco_en_2012.pdf

Regional Centre for Renewable Energy and Energy Efficiency. (2013e). Tunisia - 2012 Renewable Energy Country Profile. Retrieved from http://www.rcreee.org/content/tunisia-renewable-energy-country-profile

Saadani, Y., Arvai, Z., & Rocha, R. (2010). A review of credit guarantee schemes in the Middle East and North Africa. The World Bank. Retrieved from http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-5612

Saleh, A. S., & Zeitun, R. (2007). Islamic Banks in Jordan : Performance and Efficiency Analysis. Review of Islamic Economics, 11(1), 41–62.

Shrimali, G., Nelson, D., Goel, S., Konda, C., & Kumar, R. (2013). Renewable deployment in India: Financing costs and implications for policy. Energy Policy, 62, 28–43. doi:10.1016/j.enpol.2013.07.071

Soytas, U., & Sari, R. (2003). Energy consumption and GDP: causality relationship in G-7 countries and emerging markets. Energy Economics, 25(1), 33–37. doi:10.1016/S0140-9883(02)00009-9

The Tunisian International Monetary Fund. (2012). Economic Structure and Context : Financial System Economic Structure and Context : Key Sectors Copyright of Tunisia Country Monitor is the property of IHS Global Inc . and its content may not be copied or emailed to multiple sites or posted to a listserv, (2011).

The World Bank, & Climate Investment Funds. (2012). Financing renewable energy Options for Developing Financing Instruments Using Public Funds. African Development Bank, Asian Development Bank, European Bank for Reconstruction & Development, Inter-American Development Bank, International Finance Corporation. Retrieved from https://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/SREP_financing_instruments_sk_clean2_FINAL_FOR_PRINTING.pdf

Tongsopit, S., Sugiyama, N., & Chunhachoti-ananta, S. (2013). A Review of Business Models for Distrinuted Solar Power Deployment in the U.S. and Japan: Lessons and Prospects for Thailaind.

Tsoutsos, T., Tournaki, S., Weiss, I., Caneva, S., Arancón, S., Masson, G., … Guilmard, S. (2013). Photovoltaics competitiveness in Middle East and North Africa countries the European project PV PARITY. International Journal of Sustainable Energy, (August 2014), 1–9. doi:10.1080/14786451.2013.863774

U.S. Department of Energy. (1999). The Borrowers Guide to Financing Solar Energy Systems. Retrieved from http://www.nrel.gov/docs/fy99osti/26242.pdf

United Nations Environment Program. (2014). Success Stories: Solar Energy in Tunisia. Green Economy. Retrieved June 14, 2014, from http://www.unep.org/greeneconomy/SuccessStories/SolarenergyinTunisia/tabid/29871/Default.aspx

United Nations Environment Programme. (2011). Evaluating Clean Energy Public Finance Mechanisms. Irbaris. Retrieved from http://www.unep.org/climatechange/ClimateChangeConferences/COP17/Highlights/UNEPSustainableEnergyFinanceAllianceReport/tabid/79177/Default.aspx

United Nations Industrial Development Organisation. (n.d.). Financing options for renewable energy and energy efficiency. In EEU Training Package. Retrieved from https://www.unido.org/fileadmin/media/documents/pdf/EEU_Training_Package/Module19.pdf

US Energy Information Administration. (2013a). Country Analysis: Tunisia. US Energy Information Administration. Retrieved June 28, 2014, from http://www.eia.gov/countries/country-data.cfm?fips=ts

US Energy Information Administration. (2013b). Distributed Generation System Characteristics and Costs in the Buildings Sector. ICF International. Retrieved from http://www.eia.gov/analysis/studies/distribgen/system/pdf/full.pdf

US Energy Information Administration. (2013c). International Energy Statisitcs: Morocco.

US Energy Information Administration. (2014a). Country Analysis Brief: Egypt. U.S. Energy Infiormation Administration. Retrieved May 27, 2014, from http://www.eia.gov/countries/analysisbriefs/Egypt/egypt.pdf

US Energy Information Administration. (2014b). Country Analysis: Jordan. US Energy Information Administration. Retrieved May 24, 2014, from http://www.eia.gov/countries/country-data.cfm?fips=jo

US Energy Information Administration. (2014c). Country Analysis: Morocco. Retrieved May 24, 2014, from http://www.eia.gov/countries/country-data.cfm?fips=mo

Vizcaino, B. (2013). Islamic finance in Tunisia could reach 25-40 pct share -study. Thompson Reuters. Retrieved August 20, 2014, from

http://www.reuters.com/article/2013/06/16/islamic-finance-tunisia-idUSL5N0ES02S20130616

Wiser, R., & Pickle, S. (1998). Financing Investments in Renewable Energy; the impacts of policy design. Rebewable and Sustainabler Energy Reviews, 2(4).

World Bank. (2013). Water Is Focus of Climate Change in Middle East and North Africa. Retrieved June 27, 2014, from http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/0,,contentMDK:21596757~pagePK:146736~piPK:146830~theSitePK:256299,00.html

World Bank. (2014a). INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT PROGRAM DOCUMENT FOR A PROPOSED LOAN IN THE AMOUNT OF EURO 217.6 MILLION (US$300 MILLION EQUIVALENT) TO THE KINGDOM OF MOROCCO FOR A FIRST CAPITAL MARKET DEVELOPMENT AND SMALL AND MEDIUM-SIZED ENTERPRI. World Bank Group. Retrieved from http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/04/10/000333037_20140410124512/Rendered/INDEX/862030PGD0P147010Box385177B00OUO090.txt

World Bank. (2014b). World Bank Data. Retrieved August 25, 2014, from http://data.worldbank.org/indicator/EG.IMP.CONS.ZS/countries/1W-MA-TN-JO-EG?display=graph

World Bank Group. (2013). Project Information Document: Clean and Efficient Energy Morocco (pp. 1–9). Retrieved from http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/MNA/2013/11/12/090224b0820685cb/1_0/Rendered/INDEX/Project0Inform0gy0Project000P143689.txt

Yaakoubi, A. El. (2014). Exclusive - Major Moroccan banks, BMCE, BCP, plan Islamic offshoots. Reuters. Retrieved September 01, 2014, from http://uk.reuters.com/article/2014/03/23/uk-morocco-banking-idUKBREA2M0EM20140323

Legislations

Law No. (13) of 2012 Renewable Energy and Energy Efficiency Law (Law No. 13), Ministry of Energy & Mineral Resources

Appendix

7.1 Criteria for assessment of financing mechanisms

Table 12: Criteria for loan mechanism evaluation

	3 = High	2 = Average	1 = Low
	Loans		
	Design		
Appropriate for target customer	• The interest rate is below or equal to the commercial bank prime lending rate of given country • The mechanism terms are medium to long term • Grace period on loan is available • Collateral requirements are low • Ceiling of loan is appropriate to cover majority of target customer project costs • Technical assistance is available through the mechanism	• Interest rate is equal to commercial bank prime lending rate • Mechanism terms are short to medium term • No grace period • Collateral requirements are similar to other bank lending products • Ceiling of loan does not cover a majority of target consumer project costs • No technical assistance is available through the mechanism	• Interest rate is above commercial bank prime lending rate • Mechanisms terms are very short • No grace period • Collateral requirements are large • Ceiling of loan covers a small amount of project costs of target consumer • No technical assistance available through mechanism
Appropriate for target technology	• Identification of barriers targeted by mechanism reflect barriers to target technology adoption • Repayment terms are in line with savings/payback of technology	• Identification of barriers targeted by mechanism reflect barriers to technology • Repayment terms are appropriate but not in line with projected technology savings/payback	• No barriers identified or targeted by mechanism • Repayment terms are not appropriate for technology and not in line with projected savings/payback of technology
Clarity of design and understanding	• User guidelines are available and they are clear in the operation of the mechanism and the benefits and risks of utilisation	• User guidelines are available however they are unclear and do not identify appropriately the operation of the mechanism and the benefits and risks of utilisation	• User guidelines are not available

Targets for mechanism	• Targets are established and in line with national policy	• Targets are set but are arbitrary and not linked to any larger goals	• No targets set
		Implementation	
Administrative procedure	• Application process is straightforward and requires minimal documentation and few steps • Time taken to approve applications is fast (<2 weeks) • Applications can be dealt with internally	• Application process is straightforward and requires minimal documentation and few steps •Time taken to approve application is medium (>2 but < 4 weeks) • Applications are dealt with externally by a third party	• Application process is long and complicated with many steps and forms required • Time taken to approve is > 4weeks • Applications must be dealt with externally by a third party
Disbursement is appropriate for target consumer	• Fund disbursement is related to the stage of a project	• Funds disbursed in lump sum at start of project	• Funds disbursed in lump sum at the end of the project
Internal Capacity is appropriate to approve loans	• Good internal knowledge of economic and technical aspects of target technology • Administrative capacity is adequate to deal with applications and loan approvals	• Average internal knowledge of economic and technical aspects of target technology • Administrative capacity is adequate to deal with applications and loan approvals	• Poor knowledge of both technical aspects and economic aspects of target technology • Administrative capacity is not adequate to deal with applications and loan approvals
		Market Impact	
Barriers have been addressed	• Barriers identified have been addressed	• Barriers identified have been somewhat addressed	• No barriers identified or addressed or barriers identified were not addressed
Use of Mechanism	• High use of the mechanism determined by amount loaned compared to any targets or customers served	• Average use of the mechanism determined by amount loaned compared to any targets or customers served	• Low use of the mechanism determined by amount loaned compared to any targets or customers served

Notes on the criteria: Average costs and payback periods were determined from interviews with installers in the county. The average install cost in Jordan was €1,400 per kWp and had a payback for larger energy consumers of about 4-7 years. The average install cost in Tunisia €2300 per kWp and paid back 5-7 years with the net metering scheme in place.

Table 13: Criteria for grant and subsidy mechanism evaluation

	3 = High	2 = Average	1 = Low
		Grants and Subsidies	
		Design	
Appropriate for target customer	• Amount covers a significant proportion of target customer size installations • Eligibility requirements reflect target consumer characteristics	•Amount does not meet target customer average size installations • Eligibility requirements reflect target consumer characteristics	• Amount does not meet target customer average size installations • Target consumers are unable to meet eligibility requirements
Appropriate for target technology	• Identification of barriers targeted by mechanism reflect barriers to target technology adoption • Size of grant is large enough to cover a significant proportion of target technology costs	• Identification of barriers targeted by mechanism reflect barriers to target technology adoption • Size of grant is somewhat able to cover target technology costs	• No barriers identified or targeted by the grant • Size of grant covers only a small proportion of target technology costs
Clarity of design and understanding	• User guidelines are available and they are clear in the operation of the mechanism and the benefits and risks of utilisation	• User guidelines are available however they are unclear and do not identify appropriately the operation of the mechanism and the benefits and risks of utilisation	• User guidelines are not available
Targets for mechanism	• Targets are established and in line with national policy	• Targets are set but are arbitrary and not linked to any larger goals	• No targets set
		Implementation	
Administrative procedure	• Application process is straightforward and requires minimal documentation and few steps • Time taken to approve applications is fast (<2 weeks) • Applications can be dealt with internally	• Application process is straightforward and requires minimal documentation and few steps •Time taken to approve application is medium (>2 but < 4 weeks) • Applications are dealt with externally by a third party	• Application process is long and complicated with many steps and forms required • Time taken to approve is > 4weeks • Applications must be dealt with externally by a third party
Disbursement appropriate for target consumer	• Fund disbursement is related to the stage of a project	• Funds disbursed in lump sum at start of project	• Funds disbursed in lump sum at the end of the project

Internal Capacity	• Good internal knowledge of economic and technical aspects of target technology • Administrative capacity is adequate to deal with applications and loan approvals	• Average internal knowledge of economic and technical aspects of target technology • Administrative capacity is adequate to deal with applications and loan approvals	• Poor knowledge of both technical aspects and economic aspects of target technology • Administrative capacity is not adequate to deal with applications and loan approvals
		Market Impact	
Barriers Addressed	• Barriers identified have been addressed	• Barriers identified have been somewhat addressed	• No barriers identified or addressed or barriers identified were not addressed
Use of mechanism	• High use of the mechanism determined by amount granted from fund for renewable energy projects	• Average use of the mechanism determined by amount granted from fund for renewable energy projects	• Low use of the mechanism determined by amount granted from fund for renewable energy projects

Table 14: Criteria for equity mechanism evaluation

	3 = High	**2 = Average**	**1 = Low**
		Equity	
		Design	
Appropriate for target customer	• Investment stake enables greater company expansion and access to other funds • Length of investment is appropriate (medium-long term) with clear exit strategy • Technical and management assistance offered •Investment stake overcomes barriers associated with cost of equity and cost of capital • Eligibility criteria is fair and based on sound investment criteria (Normal due diligence, performance history, management structure etc.)	•Stake does not enable much company expansion or greater access to other funds • Length of investment is unknown but state there is a clear exit strategy • Technical and management assistance not offered •Investment stake can overcome some barriers associated with cost of equity and cost of capital • Eligibility criteria is difficult to meet for target consumers and not based on any investment criteria.	• Stake is too small to enable any expansion or access to other funds • No specified length of investment or exit strategy •Technical and management assistance not offered •Investment stake cannot overcome barriers associated with cost of equity and cost of capital • No specified eligibility criteria

Appropriate for target technology	• Length of investment is appropriate for project size and proposed payback • Investment size distinguishes between mature and less mature technology sectors	• Length of investment is appropriate for project size and proposed payback • Investment size does not distinguish between mature and less mature technology sectors	• Length of investment is not appropriate for project size and proposed payback • Investment size does not distinguish between mature and less mature technology sectors
Clarity of design and understanding	• User guidelines are available and they are clear in the operation of the mechanism and the benefits and risks of utilisation	• User guidelines are available however they are unclear and do not identify appropriately the operation of the mechanism and the benefits and risks of utilisation	• User guidelines are not available and mechanism is very difficult to understand
Targets for mechanism	• Targets are established and in line with national policy	• Targets are set but are arbitrary and not linked to any larger goals	• No targets set
Implementation			
Administrative procedure	• Formalised application procedure • Company analysis based on current RE energy market and company lifecycle situation	• No Formalised application procedure • Company analysis based on current RE energy market and but not company situation	• No clear application procedure • Company analysis not based on current RE energy market and company lifecycle situation
Investment returns	• ROI and/or IRR are low for the stage of development the consumer is in	• ROI and/or IRR are fair for the stage of development the consumer is in	• ROI and/or IRR are high for the stage of development the consumer is in
Internal Capacity	• Good internal knowledge of economic and technical aspects of target technology • Administrative capacity is adequate to deal with applications and loan approvals	• Average internal knowledge of economic and technical aspects of target technology • Administrative capacity is adequate to deal with applications and loan approvals	• Poor knowledge of both technical aspects and economic aspects of target technology • Administrative capacity is not adequate to deal with applications and loan approvals
Market Impact			
Barriers Addressed	• Barriers identified have been addressed	• Barriers identified have been somewhat addressed	• No barriers identified or addressed or barriers identified were not addressed
Use of mechanism	• High use of the mechanism determined by projects/companies invested and/or amount invested from the fund	• Average use of the mechanism determined by projects/companies invested and/or amount invested from the fund	• Low use of the mechanism determined by projects/companies invested and/or amount invested from the fund

7.2 Loan mechanism data

7.2.1 Morocco

Table 15: Morocco loan mechanisms for renewable energy

	BMCE Bank	**Credit Agricole in partnership with ADEREEE and Ministry of Agriculture**
Program	*EnergiCo*	*EcoTaqa*
Barriers targeted	High up front capital costs and technical barriers	High up front capital costs and technical barriers
Target Consumer	Industrial, tourism sectors	Large agricultural enterprises
Target technology	Solar PV, SHW, energy efficiency tech.	Solar PV, SHW and energy efficiency tech
Interest Rate	• 5.7% fixed • 5.2% variable (Reviewed annually)	5-5.8% fixed
Terms	• 5-7 years (medium term)	• Short (<5 years) and medium term • Grace period up to 12 months
Ceiling of loan	Audit determines the level of investment as does the firm specific characteristics	• 70% of audit and/or implementation • Up to €4,504 (50,000 MAD) for audit • Up to €13,493 (150,000 MAD) for recommendations • Client must supply 20% of initial cost
Disbursement	Disbursements of the funds following the presentation of the pro forma invoice. The financed equipment will be mortgaged in favour of the bank.	Disbursement at the end of the project. If the farmer does not have the money to undertake his project, he can ask for an advance from Crédit Agricole du Maroc on the basis of a pre-approval of his project by the ministry of agriculture. This advance is a short-term loan.
Collateral requirements	High - but dependant on the creditworthiness of the client	Low – No collateral requirements
Internal Knowledge of RE tech	Average	High
Guidelines available	Yes – On website	Yes – On website and brochure
Targets set	No	20% energy reduction with clients
Technical assistance	Provided by approved auditor	Provided by bank through a list of approved equipment and audit results
Criteria and Application procedure	Requires an audit report, financing statements and collateral agreement to be documented.	Narrow target consumer market however if criteria is met the application is processed quickly and is easily
Use of mechanism	Small number of customers served	12 projects have been financed under mechanism

7.2.2 Tunisia

Table 16: Tunisia loans and grants

	PROSOL	PROSOL ELEC	PROSOL Tertiary
Loans/credit	Attijari Bank/STEG	Attijari Bank/STEG	Attijari Bank
Grant/subsidy	ANME	ANME	ANME
Target Consumer	Residential sector	Anyone connected to low voltage grid (Generally residential sector)	Tertiary sector including hospitals, universities, hotels, hammams etc.
Target technology	Solar Hot water	Solar PV	Solar Hot Water
Interest Rate	6%	5%	2 basis points below bank prime lending rate
Terms	3-5 years	5 Years	N/A
Collateral requirements	None	None	N/A
Grant amount	20% of capital cost	30% of capital cost 10% capital cost funded by UNEP	70% of cost of studies (FNME) 30% of capital cost (FNME) 25% of capital costs (UNEP) 6 TND/m2/yr on maintenance costs (UNEP)
Ceiling of Grant	€87.46 for 200 Litre capacity and €174 for 300 Litres or more	€1,312 per kWp	• Studies – €30,611.50 • Capital cost €65.60 per m^2
Disbursement	Credit: Paid to installer by STEG after contract has been signed with customer Subsidy: Paid to installer by ANME after contract signed and install complete	Credit: Paid to installer after contract has been signed with customer by STEG Subsidy: Paid to installer after contract signed and install complete by ANME	Credit: Paid once the Subsidies: Paid at time of project implementation and during maintenance
Internal Knowledge of RE tech	Bank: Low ANME: High	Bank: Low ANME: High	Bank: Low ANME: High
Guidelines available	Yes	Yes	Yes
Targets set	750,000m^2 2010-2014	1,500 kW installed (about 1000 households) by 2016	Installation of 4,000m^2 by 2013 Installation of 30,000m^2 by 2016 Installation of 200,000m^2 by 2030
Criteria and Application procedure	Mostly handled by installer and only one contract and one application for credit forms to STEG and ANME	Mostly handled by installer and only one contract and one application for credit forms to STEG and ANME	Detailed feasibility studies and execution documents required to be submitted

7.2.3 Jordan

Table 17: Jordan loan mechanisms for renewable energy

	Central Bank of Jordan (CBJ) - JOD (fixed interest rate of 5.5%)		
	Agence Francaise de Development (AFD) - USD/JOD - 4-4.5% - Minimum drawing of 700 000USD - Technical assistance offered		
	Cairo Amman Bank	**Capital Bank**	**Jordan Ahli Bank**
Program	*Green Loan Program*	*Green Loan Program*	*Go green loan*
Barriers targeted	High up front capital costs and tech capacity	High up front capital costs and tech capacity	High up front capital costs
Target Consumer	SMEs and Households	SMEs and large industry/projects	Households and SMEs
Target technology	Solar PV	Solar PV	Solar PV and SHW
Interest Rate	6.50%	6.5-7.5%	0%
Terms	• Fixed for 10 years • Payback period determined by expected savings and payback on panels • 1-3 year grace period	• 13 years • Grace period up to 3 years	• 48 months • DBR (Debt Burden Rate) up to 55% for salary transfer customers and up to 45% for professionals and self employed customers • Salary transfer is required for retail customers. • No guarantor required
Ceiling of loan	AFD: 5 million USD or equivalent in JOD 700,000 USD floor loan Central Bank: €10.88 million for each client	AFD: 5 million USD or equivalent in JOD 700,000 USD floor loan Central Bank: €10.88 million for each client	Retail: €10,916 SME: €43,661
Collateral requirements	Same as normal bank lending requirements and dependant on customer credit history.	Same as normal bank lending requirements and dependant on customer credit history.	Unknown
Internal Knowledge of Renewable energy technology	Limited - Stated they did not have good knowledge	Limited - Must engage third parties for assessment of projects.	Unknown

Guidelines available	No	No	Yes
Targets set	No	No	No
Criteria and Application procedure	• Last 3 years financing statements needed • Technical and financing feasibility studies conducted	Difficult: Large Projects >2MW: • Financing Audits for last 3 years (by well known company PwC etc.) • Internal financings for last year • Settlement with bank for the last yearFeasibility study •For private sector project - inward letter of credit Small projects <2MW: • Collateral • Technical feasibility conducted by a third party	• Minimum 21 years old; • Valid Identification card for Jordan; • Proof of income; • Additional documents upon request from the bank
Use	Low	Low	Unknown

7.2.4 Egypt

	National Bank of Egypt , SEDA, Egypt Tourism, Egypt Hotels Association
Program	Green Hotels Program
Loans/credit	National Bank of Egypt
Target Consumer	Egyptian Hotels
Target technology	Solar Hot water Heaters
Interest Rate	6-7%
Terms	7 years
Amount	60% of installation cost
Disbursement	After feasibility studies are complete
Collateral requirements	None
Internal Knowledge of RE tech	SEDA: High
Guidelines available	Yes
Targets set	Install 5000 m^2 of SHW
Criteria and Application procedure	1. Application to the program 2. Prefeasibility study provided to PMU for technical validity • Study must cover financing validity, size of project, design draws, descriptive estimates and product must meet specific technical requirements
Use	Currently about 2,350m^2 of SHW in 21 hotels has been installed

7.3 Assessment of loan mechanisms

Table 18: Indicator assessment for loan mechanism evaluation

	EnergiCo	Ecotaqa	PROSOL Resid. Schemes	PROSOL Tertiary	Cairo Amman	Capital Bank	Ahli Bank	Green Hotels
Design								
Appropriate for target consumer	2	3	3	2	3	2	3	2
Appropriate for target technology	2	3	3	2	3	2	2	3
Clarity of design	2	3	3	3	1	1	3	1
Targets for mechanism	1	2	3	3	1	1	0	2
Implementation								
Administrative procedure	2	3	1	2	2	2	2	2
Disbursement	1	2	2	2	3	0	0	2
Internal capacity	2	2	2	2	1	2	0	3
Market Impact								
Barriers addressed	1	2	3	3	2	2	3	2
Use of mechanism	1	1	3	3	1	1	0	1

7.3.1 EnergiCo (BMCE)

Appropriate for target *consumer* – Difficult to ascertain who target beneficiery was; Interest rate appropriate but no grace period and high collateral requirments; Difficlut to understand; Tech assistance available. ***Appropriate for target technology*** – Normal bank payback terms with no link to payback of technology. ***Clarity*** – Guidelines avaialable on website however these are confusing particulalry when linking to guruantee scheme. It was difficlt for customers to understand the requirments and this was a reason for the lack of use (Personal correspondence, BMCE, 28/05/14). ***Administrative procedure*** - Confusing and long admin procedure indicated in interview. The process, time taken for approval and time taken for audit all contirbuted to issues with mechanism *Disbursment* – Funds disbursed at the end of the project once the final invoice has been presented. ***Internal Capacity*** – Deemed average however not certain on this. ***Barriers addressed*** – Due to disbursement and admin time the barriers for the customer have not been addressed. Disbusement at the end does not allow the high up front cost barriers to be addressed and the admin process increases transaction costs for the consumer. ***Use*** – Communicated a lack of use in interview (Personal correspondence, BMCE, 28/05/14). Only a couple of projects established and these were unsuccssful due to the high gurantees demanded by BMCE.

7.3.2 EcoTaqa (Credit Agricole)

Appropriate for target *consumer* – Interst rate is well below market interest rate and a 12 month grace period; No collateral requirments but need to supply 20% of initital cost; Application easy and only need to provide electrcity bills and audit document from nominated auditor organised by Credit Agricole. ***Approprate for target technology*** – Mostly off grid solar installations for water pumping. Up front cost barrier mentioned however no mention of loan repayment in line with savings made from technology (Personal Correspondence, Credit Agricole, 2014). *Clarirty* – There are guilines avaialble and description however these are not very detailed. *Targets* – There are targets of 20% redcution for eahc farm but no overall targets. *Administrative Procedure* – Only need electricty bills and audit documents to be submitted. Nominated auditor organised by Credit Agricole reducing transaction costs in looking for an appropriate auditor. Approval is generally quick (Personal Correspondence, Credit Agricole, 2014). *Disbursement* – At the end of the prject once final approval has been given. However, if the farmer does not have the money to undertake his project, he can ask for an advance from Crédit Agricole du Maroc on the basis of a pre-approval of his project by the ministry of agriculture. This advance is a short-term loan. *Internal Capacity* – Was good with interviewee however when visiting a branch in Casablanca the brnach manager did not know any details about the program. *Barriers Addressed* – Up front cost barriers addressed as are technical barriers. *Use* – So far, only a dozen of project were financed through EcoTaqa mechanism. One of the reasons for this poor number is that big farmers tend to ask for a global loan to finance several actions, part of which are energy efficiency actions and some others are general investment actions (new machinery, buildings, land acquisition, etc.). Therefore, the loan is not always detected as EcoTaqa mechanism (Personal Correspondence, Credit Agricole, 2014).

7.3.3 PROSOL Residential/Elec (ANME/STEG/Attijari Bank)

Appropriate for Target consumer – Interst rate is below commercail bank prime lending rate; Loan term is appropriate (5 years) and is directly related to the expected savings from the technology; No collateral requirements. *Appropriate for target technology* – Target tehcnology is well defined and payback of loan is in line with expected savings from specific technology; High up front cost of technology barrier is expicitly stated as barrier that needs addressing; Loaned amount is high enough to cover a majority of the tehcnology cost. *Clarity* – User

guidelines avaialble on government and installer websites and are very clear as to process and benefits of program; Installers and developers understand the mechanims very well and are able to communacte benfits to customers (Personal correpsondence, Soften, 2014). *Targets* – Clearly defined targets for tehcnology diffusion are in line with national policy and targets. *Administrative procedure* – There are dealys in payment of credit to amount to installers after install; Can take up to six months for payment. *Disbursement* – Payment through the installer means savings are immediately passed on in the quoted amount. Disbursement to the insaller however showed some time delay problems. *Internal Capacity* – The dealy in payments shows there may be some lack of administrative capacity to deal with the number of users; High level of knowledge bout the technology however. *Barriers addressed* – High up front cost barrier appropriately addressed; technical knowledge of customers also adddressed as only accredited suppliers are able to take part in the program. *Use* – High use shown through the technology diffusion that has taken plac in all PROSOL mechanisms.

7.3.4 PROSOL Tertiary

Appropriate for target consumer – Interest rate is two basis points below commercial bank prime lending rate; Mechanism payback is in line with expected savings from the feasability studies; Collateral requirments are uknown and depend on the bank; Technical assistance is high. *Appropriate for target technology* – Payback of loan is not necessarily related to expected savings from technology. *Clarity* – User guidelines are available and are straighforward in explaining the process. *Targets* – Clearly defined technology diffusion targets. *Administrative Procedure* – Long and requires more technical and economic feasability studies to be performed than the residential schemes. This may be validated however due to the size of the projects. *Disbursement* – Unknown *Internal Capacity* – Same as PROSOL residential. *Barriers Addressed* – When used in conjunction with the grants the financing barriers are addressed; Technical barriers are also addressed through the assistance received with the process. *Use* – Already high use and expected to increase and easily reach targets.

7.3.5 Cairo Amman Green Lending Program

Appropriate for target Beneficiery – Interst rate is well below the market rate; Interst rate is fixed for 10 years which negates much of the interst rate risk; Grace period of 1-3 years is granted; Collareral requirements are dependant on the borrower's operations and credit history. *Appropriate for target technology* – Amounts of loan can be significant (up to 10 million JOD for each client; Payback is directly linked to the expected savings and payback on the tehcnology installed. *Clarity* – No guidelines available and not well promoted on website. *Targets* – No targets set. *Administrative procedure* – Hold up getting technical and financial feasability studies completed; Generally a quick application procedure taking about 14 days; require last 3 years financing statements which seems strange as they are targeting households as well as SMEs. *Disbursement* - Disbursed in stages depending on project i.e. at start when equipment needs to be purchased, for installation, on final comissioning. *Internal Capacity* – Lack of good technical knowledge to approve projects (Personal communication Cairo Amman Bank, 2014; Personal Communication, AFD, 2014). *Barriers addressed* – High up front cost barriers addressed sufficiently', tehcnical barriers not addressed *Use* – Low based on AFD figures of use only 5 million USD (out of 53 million USD).

7.3.6 Capital Bank Green Lending Program

Appropriate for target beneficiery – Interest rate is below market rate; Collateral requirements in line with normal industry lending criteria dependant on customer credit worthiness; 13 year terms are appropriately long *Appropriate for target tehcnology* – 13 year terms are long enough for appropriate payback of technology; unknown if payback of loan is tailored to expected

payback of tehcnology *Clarity* – User guidelines not available anywhere. *Targets* – No specified targets for mechanism. *Administrative procedure* –Large Projects >2MW: Financing Audits for last 3 years (by well known company PwC etc.); Internal financings for last year; Settlement with bank for the last year; Feasability study; For private sector project - inward letter of credit; Small projects <2MW: Collateral required and technical feasbility conducted by a third party. *Disbursement* – Unknown. *Internal Capacity* – Low technical capacity as pointed out by AFD (Personal correspondence, AFD, 12/06/14) however financing knowledge of solar tehcnolgy was good. *Barriers addressed* – High up front cost barriers addressed; Tehcnical barriers however are not addressed. *Use* – Low according to AFD figures only 700,000 USD (out of 53 million USD).

7.3.7 Jordan Ahli Bank 'Go Green' Loan

Appropriate for target consumer – Low interst rate (0%); No collateral requirements but high debt burden ratio; requires salary transfer to the bank; no grace period; 100% funding of technology up to €10,915 (10,000 JOD) for retail and €43,662 (40,000 JOD) for SMEs; Obvious technical assitance as list of known installers supplied on website. *Appropriate for target technology* – Loan term is 48 months which is long enough for small scale projects; Ceiling of loan is appropriate for small scale installaions. *Clarity* – Guidelines and technical information available on the website; The costs (fees) are not explained very well however. *Targets* – Unable to establish if there are targets. *Adminstrative procedure* – good link to call centre who know about the loans and can establish a connection with a loan officer. *Disbursement* - Not enough information attained to determine this. *Internal Capacity* - Not enough information attained to determine this. *Barriers addressed* – From information attained both financing and technical barriers have been addressed. *Use* – Unable to determine the use of the mechanism.

7.3.8 Green Hotels Program

(Egypt Tourism/Egypt Hotels Association/SEDA/National Bank of Egypt)

Appropriate for target consumer – Subsidised interest rate below commercial bank prime lending rate; term of 7 years is in the medium to long term; No grace period on the loan; covering 60% of installation cost with no ceiling is appropriate; working with SEDA makes the technical aspcts more feasible. *Appropriate for target technology* – high up front cost barrier targeted and payabck is appropriate; no ceiling of loaned amount but only to cover 60% of costs. *Clarity* – No specific user guidelines available at the time of writing. *Targets* – Specific targets set for the hotels sector; secotr specific and not based on natioanl targets. *Administrative procedure* – Long (13 steps) and requires prefeasibility, feasibility, technical and financing validility however due to the size of the projects targeted these are necessary; maximum of 15 days from request by supplier the prject will start *Disbursement* – Once installation is accepted by PMU, the credit will be directly disbursed into the suppliers/installers account. *Internal capacity* – SEDA has good tehcnical knowledge, Egypt Tourism and Egyptian Hotels Association has good sector knowledge and National Bank of Egypt has good financing knowledge. *Barriers Addressed* – Up front cost barrier some what addressed as loan only covers 60% of install costs. *Use* – Early in the program so unable to determine high use.

7.4 Grants and Subsidies Data

7.4.1 Tunisia

See 7.2.2 Tunisia

7.4.2 Jordan

Table 19: Jordan grants and subsidies for renewable energy

	Jordan Chamber of Industry	**Higher Council for Science and Technology**
Program Name	Factories support program to procure PV	Industrial R&D Fund (IRDF)
Barriers targeted	High up front costs	High up front costs and technical capacity
Target Consumer	Small Industrial enterprises	Industrial sector
Target technology	Solar PV and SHW	Any renewable energy technology
Amount	**PV** - Foreign product - 35% Jordanian product - 50% Ceiling - €8,152 **SHW** - Foreign product - 35% Jordanian product - 50% Ceiling – €5,434	Up to €32,770 (30,000JOD)
Disbursement	At the end of the project once full payment to installer and Chamber of Industry conducts a site visit to make sure install complies with the agreement.	Divided into three payments: • 40% when agreement is signed • 30% when 70% of project is complete (must submit a progress report for evaluation) • 30% when final report received and evaluation of project complete
Internal Knowledge of RE tech	High	Average – Implementers understood the benefits of the technology but not the install/implementation process very well.
Guidelines	No	Yes - Brochure
Targets	To implement pilot projects and show how technologies operate	Bridge the gap between industry and academia in order to increase competitiveness of local industry
Application procedure	• Application letter stating which program applied for • Two quotes from installers • Justification letter including payback period	• Many actors involved and many evaluations needed before grant is approved. • Evaluation/progress reports needed to be completed during at the end of the process also.
Use	Have currently disbursed €49,100 (45,000 JOD) out of €152,000 (140,000 JOD)	No use for solar PV

7.5 Assesment of Grant and Subsidy Mechanims

Table 20: Indicator assessment for grant and subsidy mechanism evaluation

	PROSOL Residential	PROSOL ELEC	PROSOL Tertiary	Chamber of Industry	Higher Council for Science and Technology
Design					
Appropriate for target customer	3	3	3	2	2
Appropriate for target technology	2	2	3	2	3
Clarity of design	3	3	3	2	3
Targets for mechanism	3	3	3	2	1
Implementation					
Administrative procedure	2	2	2	3	1
Disbursement	1	1	3	1	3
Internal Capacity	2	2	2	3	2
Market impact					
Barriers Addressed	2	3	3	2	2
Use of mechanism	3	2	2	2	1

7.5.1 PROSOL Residential

Appropriate for target consumer – Amount is appropriate for residential customers to cover a minority proportion of the capital cost; Eligibility requirements are simple as they only require two standard forms to be filled out to receive the subsidy; any resident is able to access the grant. *Appropriate for target technology* – 20% of the capital cost is a small amount however when linked to the credit scheme this seems appropriate; Up-front cost barrier of SHW identified. *Clarity* – Detailed user guidelines available. *Targets* – Well defined and in line with national policies and targets. *Administrative Procedure* – grant time for approval and disbursement is 15 days however this is often longer as pointed out by Soften (Personal correspondence, SOFTEN, 03/06/14); many applications causing administrative delays and this seems to be a bottleneck in the mechanisms process. *Disbursement* – Disbursed as a lump sum at the end of the project to the installer. *Internal Capacity* – ANME has good technical and financing knowledge of solar energy installs and the target market. *Barriers addressed* – High up front cost is somewhat addressed; the technical barriers are addressed as customers know they are dealing with an accredited installer when using the mechanism and the equipment will be high quality. *Use* – High use of mechanism seen by amount of installs per year (80,000 m^2/year since 2008) (Baccouche, 2014).

7.5.2 PROSOL Elec.

Appropriate for target consumer – Up to 40% (30% from ANME and 10% from Italian Ministry of Environment and Territory) of capital cost is appropriate for residential installs; Eligibility requirements are adequate particularly as they focus on low income groups with lower electricity usage; still energy use must be above 2000 kWh/year to be eligible for a 1kW system and 4000kWh/year for a 2 kW system (this is due to the net metering scheme they have in conjunction with this allowing 30% of overproduction to be sold back to STEG). *Appropriate for target technology* – Mechanism targets high up front capital cost and technical barriers; grant is somewhat able to cover these costs however when linked to the credit mechanism this is appropriate. *Clarity* - User guidelines are available and clear as to how to

apply for subsidy and what eligibility requirements are needed. *Targets* – Well established (1500 kW by 2016) and in line with national RE targets. *Administrative Procedure* – Procedure for investigating cases of subsidy and credit are slow and heavily penalize operators in the sector, given the long payment delays. The procedure for obtaining the grant of ANME includes a visit from an agent of STEG responsible for taking pictures of PV equipment to validate the compliance of the installation. This step is seen as an unnecessary constraint by installers. *Disbursement* – Grant is paid directly to installer at the end of project after an inspection. *Internal Capacity* – Technical knowledge is good however the lack administrative capacity to quickly approve final install makes this a bottleneck in the mechanism. *Barriers addressed* – High up front capital cost and technical barriers are both adequately addressed by the mechanism; the added reduction in transaction costs through ease of use for the end user is also worth noting. *Use* – Use currently seems on track to meet targets however unknown at this early stage.

7.5.3 PROSOL Tertiary

Appropriate for target customer – A majority paid for pre-studies (70%) and capital cost (55% - 30% from ANME and 25% from UNEP); the eligibility requirements match the target segment; Access requires prefeasibility studies to be performed. *Appropriate for target technology* – Size of grant covers a majority the capital cost of technology and the maintenance after the install. *Clarity* – Clear procedures presented and allocation of responsibilities. *Disbursement* – Signature to approve subsidy given once validation of feasibility studies has been approved. *Internal Capacity* – Internal knowledge good however admin capacity to approve large projects is an issue. *Barriers addressed* – Yes up front cost barriers and on-going maintenance cost barriers addressed as well as technical barriers. *Use* – High and very confident in achieving 2016 targets easily.

7.5.4 Factories Support Program (Jordan Chamber of Industry)

Appropriate for target consumer – The amount is very small however as the stated target is small industrial enterprises (Less than 1,056,956 EUR capital volume) this is appropriate; Eligibility requirements state that the company must be less than 250 employees, be a member of SEI and have a capital volume of less than 1,086,956 EUR so matches the SME target consumer; installs so far have installed from 2-5 m^2 and have an average payback of 4 year. *Appropriate for target technology* – High up front cost is targeted and the size of the grant somewhat covers this. *Clarity* – Clarity of guidelines is difficult. *Targets* – Modest about usefulness and targets; Targets are more to produce pilot projects to get SMEs used to the technology. *Administrative procedure* – Application letter stating which program applied for, two quotes from installers, justification letter including expected payback period; approvals are given very quickly in under a week (Personal correspondence, Jordan Chamber of Industry, 09/06/14). *Disbursement* – Lump sum at end of project once Chamber of Industry has conducted a site visit. *Internal capacity* – Good internal knowledge and admin capacity to administer the grant scheme. *Barriers addressed* – up front cost is somewhat addressed; technical barriers not addressed. *Use* – Low use of the mechanism (48,913 EUR out of 152,173 EUR budget).

7.5.5 Industrial Research Scientific Fund (IRDF)

Appropriate for target consumer – Difficult eligibility requirements; the size (32,608 EUR) is appropriate for industrial facilities installations. *Appropriate for target technology* - Barriers identified as technical and high up front cost of solar PV; size of grant is able to cover high up front cost barrier. *Clarity* – Clearly explained how the mechanism should work and how beneficiaries are able to access it; brochure explaining this is available also. *Targets* – No targets have been set. *Administrative procedure* – Long and many steps and actors involved;

many progress reports required and interaction with tertiary sector partner may be difficult for consumer. *Disbursement of funds* – Throughout the project in stages. *Internal Capacity* – Good technical knowledge. *Barriers addressed* – High up front cost barriers addressed; technical barriers also addressed by incorporating tertiary expert in the process (this may also confuse the process). *Use* – Very low use of solar PV or any renewable energy installs.

7.6 Equity fund data

7.6.1 Morocco

Table 21: Morocco equity fund data

	Société d'Investissements Energetiques (SIE)
Program	*PV for All* - Equity investments into profitable renewable energy and energy efficiency companies
Barriers targeted	Risk aversion of local financing institutions to fund projects and companies
Target Consumer	Firms undertaking renewable energy projects within Morocco that may require extra equity investment. State they must be profitable.
Target technology	Solar PV and wind
Amount	Minority stake determined according to the potential presented by the targeted sector: PV - 30% (Less mature sector)
Terms	• 7-10 year investment • Exit terms in line with its commitments and cyclical investment conditions
Internal Knowledge of RE tech	High
Guidelines available	Yes but only very general information.
Targets set	General targets about industry improvement increasing capacity
Application procedure	Must be a profitable company Normal investment due diligence performed before engaging with companies
Investments made	Unknown
Industry development	Renewable energy and energy efficiency industry development is high priority

7.6.2 Jordan

Table 22: Jordan equity fund data for evaluation

	Jordan Enterprise Development Corporation (JEDCO)
Program	*Governorates Development Fund*
Barriers targeted	Lack of investment in new SME projects and risk aversion of financing institutions
Target Consumer	Industrial businesses
Target technology	Any RET
Amount	• No caps on total investment but do not exceed 2.2-2.7 million EUR usually. • Minimum investment of 54,347 EUR • Can be up to 80% of total cost of project

Terms	• 3-8 years • Minimum 2 year grace period
Internal Knowledge of RE technology	Very good – Fund manager understood the economics of renewable energy systems very well as well as the technical aspects
Guidelines available	Yes - On website
Targets set	None
Application procedure and requirements	• Any business or start-up able to apply • No collateral required • Low initial owners contribution requirement (10%) • Minimum local employment requirement (60%)
Use	Very few investments so far for renewable energy
Industry development	Very high priority: • Projects must be economically feasible with high social and economical value added • High ability to create local employment opportunities • Take into consideration economic rate of return

7.7 Assessment of equity mechanisms

Mechanism	**SIE**	**JEDCO**
Design		
Appropriate for target customer	*3*	*2*
Appropriate for target technology	*3*	*2*
Clarity of design and understanding	*2*	*2*
Targets for mechanism	*3*	*1*
Implementation		
Administrative procedure	*2*	*2*
Investment	*2*	*3*
Internal Capacity	*3*	*3*
Market impact		
Barriers Addressed	*2*	*3*
Use of mechanism	*1*	*2*

7.7.1 SIE (Morocco)

Appropriate for target consumer – Stake enables access to other cheaper forms of debt funding as SIE is considered a government organisation and trustworthy with its investments. This reduces the cost of capital for the investee company; Length of 7-10 years is appropriate and a stipulation of a clear exit strategy prior to investment; Technical and management assistance is offered as they take an active shareholding in some companies; Normal due diligence completed on companies and projects before investing. *Appropriate for target technology* – Investment stake depends on sector maturity (PV 30% stake, wind <20% due to maturity of sector). *Clarity* - Broad descriptions of investment eligibility in brochure. *Targets for mechanism* – Broad targets aimed at sector development and "democratising the PV market". *Administrative procedure* – No formalised procedure; normal due diligence performed on potential companies. *Investment returns* –Required IRR is dependant on stage of investment but is fair considering the region and the infancy of the solar PV industry; ROI needs to comply with the demands of the board of directors and partnering investors on the market.

Internal capacity – SIE has good financing understanding of new solar PV companies and projects. *Barriers addressed* – Major barrier for new solar PV companies and projects is to raise enough capital at a fair price to be profitable. SIE enables this to occur. *Use* – No use so far for small scale distributed companies however the 'PV for all' scheme will be launched very soon Has not been heavily used for RE deployment as this has not been a priority for industry. Now it is becoming a high priority and JEDCO expects far more use for RET.

7.7.2 Governorates Development Fund – JEDCO (Jordan)

Appropriate for target consumer - Quasi equity stake is up to 80% of investment and only require 10% return as payment on initial investment; Equity investments only up to 49% as a minority shareholding which is still enough to reduce cost of capital significantly; Length of 3-8 years is a broad range depending on project size and expected ROI; Technical and management assistance are not offered; Terms of investment are enough to overcome equity barriers. Lower than probably even cost of debt making WACC manageable; Eligibility criteria are appropriate and still require no less than 10% owners contribution of project cost. *Appropriate for target technology* - No distinguishing between different technologies however the length of investment is appropriate for suspected project sizes as they are to be a minimum of 50,000JOD and usually up to 2-2.5 million JOD. *Clarity* – Some guidelines available however unclear how this is used for renewable energy projects. *Targets* – No specific targets. *Administrative procedure* – Normal due diligence on companies and owners of companies; No formalised procedure. *Investment returns* – When looking at investing they do not look at very high financing returns but more at economic returns (employment, industry development) for the industry they are investing in; apply low NPV and IRR to potential investments; as they can invest up to 80% and only require 10% return, the IRR on the owners contribution (20%) would be very high and attractive. *Internal capacity* – Very good knowledge of financial and technical aspects of renewable energy installs. *Barriers addressed* – large reduction in cost of capital as the quasi equity element is almost cheaper than a standard commercial bank interest rate; lack of performance history is not an issue as they invest in start up companies. *Use* – Has not been heavily used for RE deployment as this has not been a priority for industry. Now it is becoming a high priority and JEDCO expects far more use for RET.

7.8 Sample interview questions

Financial mechanism implementers

- *Design of the mechanism*
  - Why was this mechanism launched and what is the objective of the mechanism? Which barriers does the mechanism attempt to address. E.g. up front cost barriers.
  - What criteria do beneficiaries have to meet in order gain access to financing?
  - What is the application process for potential beneficiaries?
    - Have you had any feedback from customers on the process?
  - Is the mechanism supported/backed by other financial institutions i.e. Development bank or central bank and if so how do they support this?
  - Are there targets the mechanism must reach? E.g. Number of units financed.
  - Are there available guidelines for customers?
  - What is the average size of install that loans generally get approved for? What is the average size of the loan?
- *Implementation of the mechanism*
  - What is the average length of application through to approval?
  - Are applications handled in house or does a third party deal them with?
  - How is the loan term determined?
  - How are the funds disbursed?
- *Barriers to the mechanism*
  - How does the institution view renewable energy technology in terms of risk profiling?
  - Were there any barriers to establishing the mechanism?
    - Have these been internal or external barriers?
- *How has the mechanism been performing?*
  - How many customers have used the mechanism? From which sector do they come from (i.e. SMEs, households, industrial?)
  - Has the new Net-metering regulation impacted on the demand for the loan to install solar PV systems?
  - Does it need to be changed in any way?
- *Jordan consumer borrowing market*
  - Does the largely Muslim population have an impact on the loan products that are offered? Has this been a reason behind the 0% interest rate offer?
  - What is the risk profile of SMEs and households to Jordan Ahli Bank? Are they considered too risky to lend to? How do you mitigate this risk?

Installers

- Who are your main customers?
  - Residential, industrial, commercial?
- Are the supporting policies relevant (for residential, industry etc) or is something missing according to you? Is there anything else from the regulatory framework you think could enable greater uptake of solar energy systems?
- Have policies changed rapidly? Will they be the same in the coming years? Can you and your customers plan long term?
- What are the remaining challenges and barriers for solar PV installations today?
- Are you working with solar PV installations that can not benefit from any financial help?
- What sort of barriers have you run into during the PROSOL AND PROSOL ELEC programs?

- Have these financing schemes been successful in driving the industry and increasing uptake of new technology?
- Could the industry stand alone without these subsidies and financing schemes?
- What do you think could be improved with the financing mechanisms?

7.9 Interview list

7.9.1 Morocco

Date	Name	Position	Organisation	Department
26/05/14	Nabil Saimi	Senior Executive Advisor Director International Cooperation	MASEN - Morrocan Agency for Solar Energy	
28/05/14	Ghizlaine Nourlil	Senior Project Manager	BMCE Bank	Développment Durable & RSE
28/05/14	Soraya Sebti	Head of Sustainable Development and CSR	BMCE Bank	Sustinable development and CSR
28/05/14	Hircham Amor	Project Manager	BMCE Bank	Project Finance Division
27/05/14	Mohamed El Haouari	Director of Renewable Energy and Energy Efficiency	ADEREE - National Agency for the Development of Renewable Energy and Energy Efficiency	Ministry of Energy, Mines, Water and Environment
	Mokhtar Chemaou	Chargé de Mission	AFD - Agence Francaise de Developpement	
29/05/14	Mariem Dkhil	Director of Financing Direction for Sustainable Development	Credit Agricole	
27/05/14	Ahmed Baroudi	General Manager	SIE - Société D'invessements Énergétiques	

7.9.2 Tunisia

Date	Name	Position	Organisation	Department
	Tahar Achour	President	Chambre Syndicale Nationale des Energies Renouvelables	
3/06/14	Samir Cherif	Chef de division Efficacité Electrique	STEG RE	
3/06/14	Jamel Ghanm	Responsable Attijari Conco (PROSOL ELEC program)	Attijari bank	
03/06/14	Nabil Zidi	Responsable Marketing	Attijari bank	
3/06/14	Omar Ettaieb	Directeur General Adjoint	Soften	

5/06/14	Abdessalem EL Khazen	Deputy Director Renewable Energy Department.	ANME
5/06/14	Abdelkader Baccouche	Ingénieur en Chef, Chef de Service Chef L'Unité. Prosol tertiaire et industrie	ANME

7.9.3 Jordan

Date	Name	Position	Organisation	Department
06/04/14	Eng. Hala Adel Zawati	CEO	EDAMA	
07/04/14	Yaser S. Al-Abbadi	Large Corporate Banking Manager	Capital Bank	
11-Jun	Mohamed Subhi Amaireh	Executive Manager Financing Stabiity Department	Central Bank of Jordan	
10-Jun	Mr Hamdi Issam Katbeh	Account Manager/Small and Medium Management and Palestine Credit	Cairo Amman Bank	
11-Jun	Eng. Ziad Jibril Sabra	Director of Renewable Energy Department	Energy Ministry	
9-Jun	Eng Fadel Labadi	Manager of Industrial Development department	Amann Chamber of industry	
12-Jun	Adi Ghuneim	Head of Financing Support Schemes	Jordan Enterprise Development Corporation (JEDCO)	
11-Jun	Aseel Al-Momani	Investment promotion specialist	Jordan Investment Board	
11-Jun	Elias S. Farraj	Deputy CEO	Jordan Investment Board	
12-Jun	Rima Ras	Director	Industrial Research and Development fund	
12-Jun	Eng. Isam Mustafa	Deputy President Director of Energy Program	National Centre for Research and Development	
12-Jun	Matthew Halle	Project Officer	AFD - Agence Francaise de Developpment	
	Rami Al-Assad	Partner	MANSUR - Shamsi Alsateah for Alternative Solutions	

7.9.4 Egypt

Date	Name	Position	Organisation	Department
17-Jun	Mr. Khaled M Shehata	Planning Engineer	Egyptian Electric Utility and Consumer Protection Regulatory Agency	
18-Jun	Mr M. Madkour		Solar Energy Development Agency	
18-Jun	Mohamad Abdel Hai	General Manager	Onera Systems	
	Engineer Ehab Ismail		New and Renewable Energy Authority	