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100% RENEWABLES

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100% RENEWABLE ENERGY: BOOSTING DEVELOPMENT IN MOROCCO

IMPRINT

Authors:
Anna Leidreiter, World Future Council
Filippo Boselli, World Future Council

Reviewer:
Stefan Schurig, World Future Council
Mostafa ElAouazi, Climate Parliament
Prof. Mustapha Ayaita, Chairman of the
Renewable Energy University Network (REUNET)

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EXECUTIVE SUMMARY

In Morocco as well as globally, the energy sector is one of the major drivers of climate change. Additionally, Morocco is also extremely dependent on fossil fuels import which is jeopardizing the country's present and future energy security. In 2011 the country imported 95.6% of its energy demand. Petroleum imports account for 20% of total imports and 50% of the current trade deficit. Further, energy consumption in the Northern African country has risen at an average annual rate of 5.7% from 2002 to 2011 due to economic growth, population rise and increase in per capita energy consumption.

In order to ensure the development of a more sustainable, environmentally responsible and overall more liveable planet, we need to radically transform our energy sector and pave our way towards a cleaner and more just future powered by 100% Renewable Energy. To achieve this transformation, policy makers play an important role. Providing policy makers and the various stakeholders with the opportunity to discuss the tools and best practises to achieve this transformation effectively is therefore crucial. With this in mind, the World Future Council sees its role in connecting the dots between legislators and experts willing to take action and to take leadership on this journey. This report provides an analysis on the current situation of the energy sector of Morocco and derives policy recommendations for a just transition towards a 100% Renewable Energy.

The report builds on a literature review, local expertise as well as on a two-day round table discussion on "100% Renewable Energy: Boosting Development in Morocco" hosted by the World Future Council and Climate Parliament in Rabat in November 2014. This workshop brought together about 30 participants, including parliamentarians, policy makers, members of national energy agencies and utilities as well as technical and academic experts from Morocco. Several international participants provided insights of exemplary energy policies from around the world, offering an opportunity to discuss the feasibility of 100% renewable energy in Morocco.

In this process, four key policy recommendations were identified:

1 Agree on a joined vision & set a 100% RE target

Targets reflect a joined political vision and therefore play a central role in global, national, and local renewable energy policy and strategy. Setting an ambitious, long-term renewable energy target demonstrates political commitment. This can provide both investors and the population as a whole a clearer view of the long-term vision for the region, as well as a better understanding of how they can best fit within it and as such, efficiently streamline various efforts towards a common goal.

2 Embed a strategy for 100% RE into a national economic development plan

A 100% RE strategy must be embedded into a national economic development plan. The energy transition can become a key driver for national economic growth and should form the foundation of a national economic strategy to ensure sustainable, long-term prosperity of Morocco. In order to achieve this objective, six main interventions are needed:

1. Build domestic capacity
2. Support research and education
3. Promote small scale projects which involve local communities
4. Build centres to disseminate information on pioneering projects
5. Explore potentials for job creation
6. Strengthen local and regional actors by reforming law 13-09

3 Increase cooperation across sectors and governance levels

The structural shift that is required to achieve 100% RE will not be able to be tackled by one single stakeholder or by one particular sector. Instead cooperation and synergies across sectors and across different level of society are warranted. Two main types of collaboration were identified.

I. Vertical dialogue: Building alliances between different governance levels
II. Horizontal Dialogue: Promoting cooperation between different stakeholders

4 Designing a coherent and comprehensive 100% RE policy framework

It is essential to design a clear and coherent policy framework able to effectively transform the energy sector such that it can truly benefit the economy and the people of Morocco. This policy framework should present the following key features and draw on two main design processes:

Key features should include:

1. Phase out of fossil fuels subsidies in a socially acceptable way
2. Clear and robust financial support for RE
3. Reliable and stable policy environment supporting RE in the short and long term
4. Promotion of technical and infrastructural changes needed to integrate intermittent RE
5. Policy measures that facilitate higher RE penetration in the transport and heating sector

The design process should be comprised of:
1. A clear and well-structured action plan
2. A learning phase: solutions exist today and decisions should be made based on lesson learnt from pioneers and best practises from around the world

In order to allow for these four key policy recommendations to be effectively implemented, strong and cohesive political will nurtured by an environment of open policy dialogue is needed.

1. INTRODUCTION

Two of the major issues of our times are combating climate change and eradicating poverty and inequality. As we know, they are also closely interconnected. We will never succeed in the latter if we do not succeed in fighting climate change. In Morocco, people are facing an additional challenge: the demand for energy is rising steadily in the Northern African country, in particular the demand for electric power. The causes driving this development include economic growth, advancing industrialisation, greater prosperity and a growing population. At the same time, Morocco possesses virtually no fossil resources of its own and therefore relies on imports for 95% of its fuel supply. These energy imports negatively affect Morocco's trade balance, while energy subsidies are a burden on the national budget. Forecasted demand will cause Morocco's greenhouse gas emissions (GHG), currently still low, to rise considerably.
In Morocco as well as globally, the energy sector is one of the major drivers of climate change. To ensure development in a liveable planet for current and future generations, we need to transform the energy sector to 100% renewable energy. Converting our energy system is more than just replacing fossil fuels with sun and wind etc. as new energy sources. Our dependence upon fossil resources has built a centralized system that lacks diversity and security, excludes people´s participation, threatens the health of our citizens, jeopardizes the stability of the earth's climate, and robs future generations of clean air, clean water, and energy independence.
Turning to 100% renewable energy (RE) today is about a just transition driven by people and their communities in order to strengthen societies and ensure access to sustainable energy services for all. Lifting people from poverty and enabling people to continue to flourish without the threat of unmanageable climate change goes hand in hand with moving to renewable, smart, decentralised energy systems. The transition towards 100% renewable energy (RE) also can be extremely beneficial for Morocco in environmental, economic and social terms. Setting policies which promote a transition towards a 100% renewable energy future can have a variety of wide ranging benefits. However, there are still a number of barriers that hinder or slow down the transition.

To tackle these obstacles, knowledge transfer and exchange between policy makers are vital. Networks between countries actively developing their renewable energy sectors must be established to realize the implementation of a global transition to 100% renewable energies. Despite numerous good practices and successful policy instruments, their lessons learnt not always get through to government leaders and legislators. Dialogue therefore needs to be facilitated so that decision makers can learn from the invaluable experiences of the most successful countries. Platforms are needed for cross-sectorial and multi-stakeholder dialogue in order to develop coherent, comprehensive and robust policy frameworks that can facilitate the transformation.

This report presents some of the insights of the discussions held during a two-day round table organized by the World Future Council and Climate Parliament in November 2014 in Rabat. Further, it builds on available literature and local expertise. It aims at enhancing the debate with parliamentarians and government leaders. The overall goal is to provide policy recommendations on how 100% RE can boost development in Morocco that benefits the people.

The first part of this report briefly describes the main reasons that make renewable energy (RE) not only a prior necessity for Morocco but also a unique source of wide-ranging opportunities. After providing a concise summary of the current energy policy framework in Morocco, this report examines some of the main barriers that are still hindering further RE development in Morocco. In light of these challenges some key policy recommendations are identified. These are considered as essential guidelines not only for the Moroccan government and legislators but for all the parliamentarians, policy makers and stakeholders if they intend to successfully pave the way towards achieving 100% RE in Morocco.

2. WHY 100% RENEWABLE ENERGY IN MOROCCO?

Given Morocco's high dependency on external energy resources and the related threats for its economy as well as the overarching threat of global warming a transition towards 100% renewable energy (RE) is urgently needed. It can also be extremely beneficial for Morocco in environmental, economic and social terms. Setting policies which promote a transition towards a 100% renewable energy future can have a variety of wide ranging benefits. These are briefly summarized in the following paragraphs.

2.1 MITIGATING CLIMATE CHANGE AND ADAPTING TO ITS IMPACTS

The consequences of climate change in Morocco have already created long-term imbalances. Vegetation is disappearing, drinking water is becoming scarce and agricultural productivity decreases. A study by Tekken et al. (2009) outlined the vulnerability to climate change of north-eastern Morocco. The low-lying deltaic plain of the Moulouya River is particularly vulnerable to sea-level rise which will exacerbate coastal erosion and increase the risks of flooding, groundwater salinization and soil degradation. The trend of increasing annual mean temperatures and decreasing precipitation has been observed for the second half of the 20th century in North Africa and it is likely to continue throughout the coming decades, causing overall warmer and drier conditions as well as longer and more frequent droughts. Predictions suggest that precipitation in North Africa is likely to decrease between 10 and 20%, while temperatures are likely to rise between 2 and 3 °C by 2050. In North-Western Africa temperatures could rise even up to 6 °C by the end of the 21st century according to some estimates (Schilling J. et al., 2011).
Low per capita income and large inequalities are considered limiting factors for the adaptive capacity of the country. Climate change exposure, pronounced sensitivity and limited adaptation capacities are all factors which are aggravating Morocco's vulnerability. For examples more frequent droughts will increase stresses on water resources which coupled with predicted increase in population will put at serious risk not only the agricultural sector but the entire economy and stability of the country. In fact, it is important to remember the crucial role that agriculture still plays within the Moroccan economy and how increased aridity and more frequent droughts would put a huge number of Moroccans still highly dependent on income from local agriculture on an extremely vulnerable position. It is estimated that climate change is likely to cause a drop in agricultural production in the 21st century in Morocco of about 15 to 40%. This has the risk to trigger severe shocks in food prices leading to further social inequalities and threaten the country entire social stability (Schilling J. et al., 2011).

The governments' attempts to fight climate change so far focused on the following areas: combating desertification, developing forestry, protecting forests and safeguarding biodiversity (Reifeld & Aidi, 2014). Nonetheless, the energy sector plays a crucial role in this process. Substantial mitigation measures to decrease CO2 emissions will be essential if long term recommended targets are to be responsibly met. The energy sector accounted for about more than half of all greenhouse gas emissions (GHG) emissions in Morocco in 2011 (WRE, 2011). It is evident that if any meaningful reduction in GHG emissions is to be achieved, a major restructuring of the carbon intensive energy sector is necessary. Within this context renewable energy technologies that exist today offer the number one alternative to deliver energy while reducing CO2 emissions.

In light of the above mentioned challenges, many recent studies that have highlighted the risks related to climate change in Morocco also emphasized the importance of prioritizing both mitigation and adaption strategies if the prosperity of future generations is to be safeguarded (Schilling J. et al., 2011, Gommes et al. 2008, Ouraich and Tyner, 2014, Tramblay et al., 2012, Tekken et al., 2009). A decentralised energy system based on 100% renewable energies might be a promising way to combine both mitigation and adaptation, since it contributes to climate mitigation by reduced GHG and helps communities adapt to climate change impacts by reducing vulnerability of the energy system. As regions progress toward 100% RE targets, it is reasonable to expect that risks – including direct physical impacts and damages to the transmission and distribution grid - will generally decrease (Leidreiter et al., 2013).

2.2 PROMOTING ENERGY SECURITY AND RESILIENCE

Renewable Energy (RE) does not only provide an effective solution to meet CO2 reduction targets. Beyond climate change mitigation and adaptation, renewable energy can offer great advantages in terms of energy security and savings on energy imports as well as great opportunities to spend money within the national economy rather than on fuel imports. Morocco is in fact highly dependent on imported energy: in 2011 the country imported 95.6% of its energy demand. Petroleum imports account for 20% of total imports and 50% of the current trade deficit. Imports of electricity in 2012 were close to 5,000 GWh compared with 1,000 GWh in 2005. In fact Morocco spends approximately US$3 billion a year on fuel and electricity imports. This is because, unlike other North African

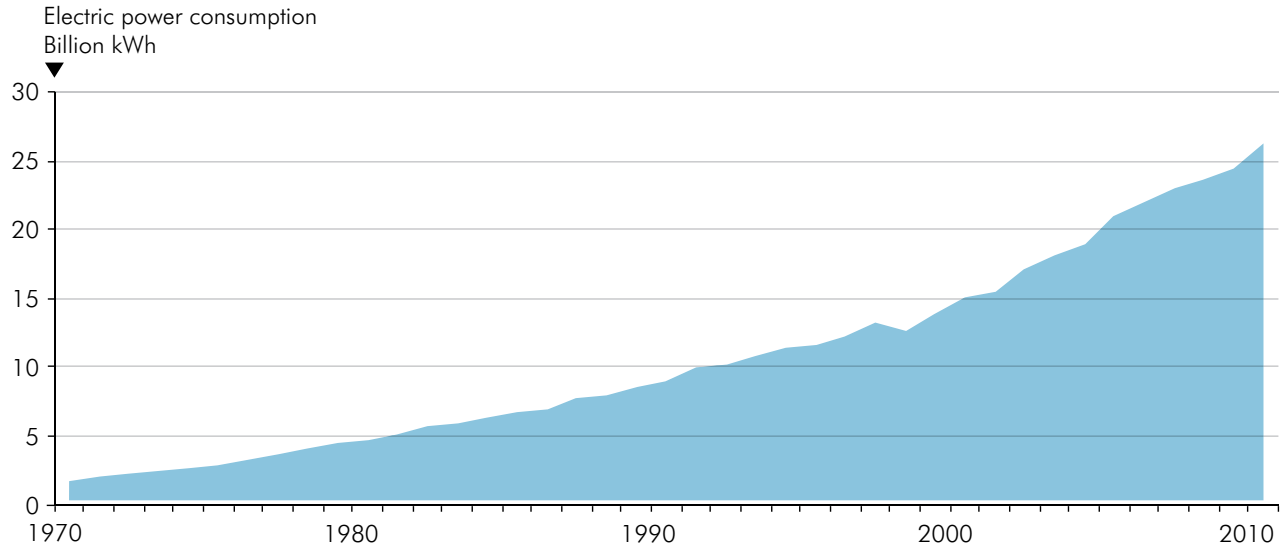


Figure 1: Morocco´s power consumption in Billions of kWh, 1971-2011 (Source: World Bank Data, 2014)

countries, Morocco has very few fossil fuel resources within its borders. Although it has large reserves of unconventional oil shale and some reserves of shale gas, these cannot be exploited given the lack of established specific industrial processes that can competitively produce oil and gas from these unconventional sources (Reegle, 2014).

Furthermore, as shown in Figure 1, Morocco has experienced a considerable growth of electricity demand. Energy consumption has risen at an average annual rate of 5.7% from 2002 to 2011 of due to economic growth, population rise and increase in per capita energy consumption. This increase in consumption was also due to the consistent investments in electrification projects which allowed the country to reach 97 % electricity access rate in 2009 (which is an impressive growth considering that the rural electrification level was only at 18% in 1995) (Reegle, 2014). A rapidly growing energy demand in a country so heavily dependent on imported energy is indeed a critical factor to be considered if future economic stability of the country is to be secured, also bearing in mind the very high volatility of fossil fuel resources such as oil.

As shown in Figure 2, Morocco is highly dependent on only one major fuel, i.e. petroleum. This lack of diversity of the energy mix and dependency on one finite and imported fuel is considered a lack of resilience. On the contrary, the deployment of Renewable Energy (RE) increases the diversity of the energy sources and, through distributed and decentralized generation, contributes to the flexibility of the system and its resistance to central shocks. Larger variety of energy sources used, generation on a considerably larger geographical area, greater number of supply corridors, higher share of energy from domestic inexhaustible sources of energy such as RE offer a crucial added value in terms of energy resilience, autonomy and stability of the Moroccan economy. Lastly it should not be forgotten that while RE resources are by definition inexhaustible, fossil fuel resources are finite and several scientific estimates predict depletion of conventional crude oil in the next 50 years (WEC, 2013).

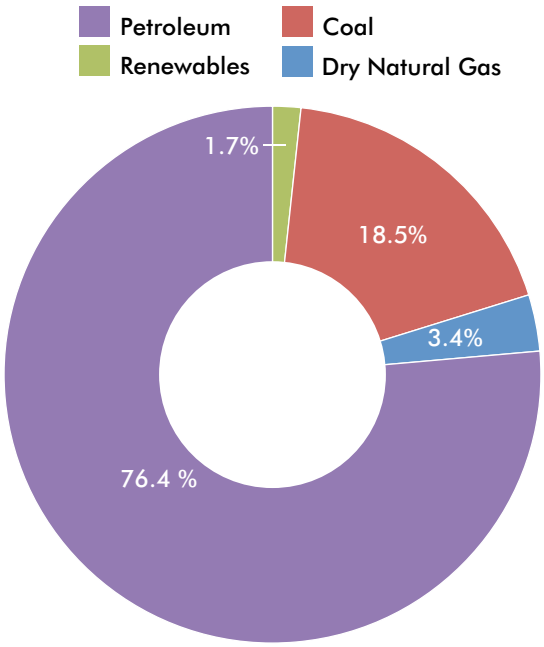


Figure 2: Energy Consumption by Source in Morocco in 2009 (Source: International Energy Statistics 2012)

Potential for Domestic Value Creation	Stage of Development		
	Beginning of Wind and Solar Energy Development	First Projects Realised, Local Industries Suitable for Participating	Many Projects Realised, National Wind and Solar Industry Developing
Life Cycle Phase			
Project Planning	Low	Medium	High
Manufacturing	Low	Medium	Medium / High
Installation	Low	Medium	High
Grid Connection	High	High	High
Operation and Maintenance	Medium	High	High
Decommisioning	Low	Low	Medium
Supporting Processes			
Policy-Making	High	High	High
Financial Services	Low / Medium	Medium	High
Education and Training	Low / Medium	Medium	Medium / High
Research and Development	Low	Low / Medium	Medium
Consulting	Low	Low	Medium

Table 1: The socio-economic benefits of solar and wind energy (Source: IRENA 2014)

2.3 BENEFITING THE LOCAL ECONOMY AND CREATING JOBS

Investing and promoting Renewable Energy can offer major benefits to the local economy as infrastructure investments are localized and much of the revenue remains within the regional domain rather than flowing out to pay for imported fuel resources. Socio-economic effects can be measured along the different segments of the value chain, including project planning, manufacturing, installation, grid connection, operation and maintenance and decommissioning. Further opportunities for value creation exist in the supporting processes such as policy-making, financial services, education, research and development and consulting. The potential however differs as the segments are not necessarily applicable to all markets and countries. Additionally, the potential for domestic value creation depends on the stage of industry development (as shown in Table 1).

A broad range of cross-cutting policy instruments influence the value creation from the deployment of renewable energy. As an example, in Germany the operation of RE facilities is a major source of revenue, 13.8 billion Euros just in 2011 and consistent growth in employment due to the Feed-in Tariff policy framework (BMU, 2012). In 2011, RE made only 12.3% of gross energy consumption in Germany yet the number of jobs within the sector was more than double the number of jobs within the fossil fuel industry in Germany (Morris & Pehnt, 2014). Also, as Hans-Josef Fell presented at the round table, jobs in renewable energy are more than ten times higher than in the nuclear industry in 2014 (as shown in Figure 3).

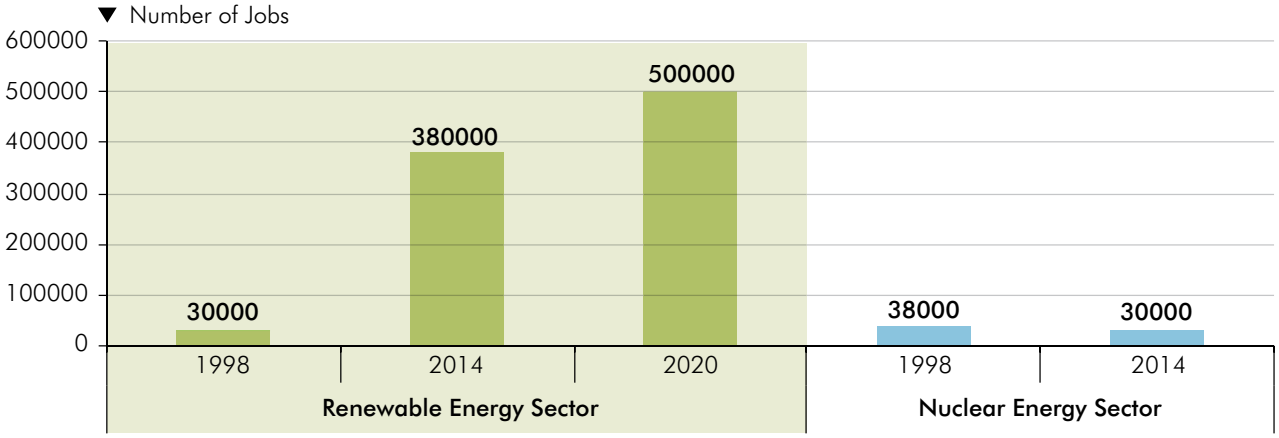


Figure 3: Number of jobs in the renewable and in the nuclear sector in Germany as observed and as projected for 2020 (Source: Hans-Josef Fell, 2014)

According to an IRENA study, renewable energy jobs around the world were about 6.5 million in 2013 (IRENA, 2014). A major American study (Pollin et al., 2009) also demonstrated that spending $1 million on energy efficiency and RE produces a much larger expansion of employment than spending the same amount on fossil fuels (as shown in Figure 4).

One of the key questions for many governments, including Morocco`s policy makers, is where in the value chain of renewable energy the country can create the most jobs. It is clear that in the short term most of the renewable energy technologies such as for example solar panels will be imported from countries which offer the technologies at competitive prices

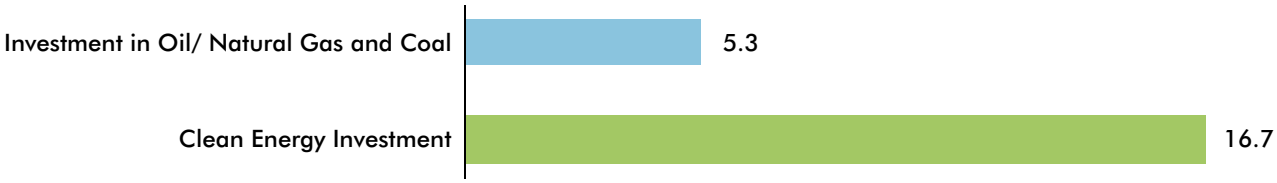


Figure 4: Green investments vs fossil fuels: number of jobs created through $1 million investment (Source: Pollin et al., 2009)

Long term cost savings and creation of added regional value are also major benefits to consider. Instead of covering for imported energy costs, local authorities can invest in local RE infrastructures and industries and as such allowing for significant local added value creation. An example is provided by the islands of Cape Verde where through an investment of 1.3 Billion Euros the country of almost half a million citizens aims at achieving the 100% RE target by 2020. Through this investment it is estimated that up to 14 billion Euros of cumulative macroeconomic savings on imported fuels over 20 years could be achieved (Brito, 2013). These savings can be invested in the region to boost local economic growth, employment, as well as local technological and industry development.

such as China. As such, jobs will not be created immediately on manufacturing but rather on import trading, project management, installation and construction, operation and maintenance. For example, for solar PV technologies, Figure 5 shows the various types of jobs that are created across the value chain. A variety of indirect jobs will also be created which will involve jobs in research and development, in academia, in logistics, in transport, in national agencies for development as well as in consultancy, regulatory and administrative work. In the longer term Morocco will also benefit from developing local industries directly related to the manufacturing of the technologies and its components which will offer great opportunities for domestic as well as export markets. Nevertheless, it should be mentioned that a study by Greenpeace and EPIA

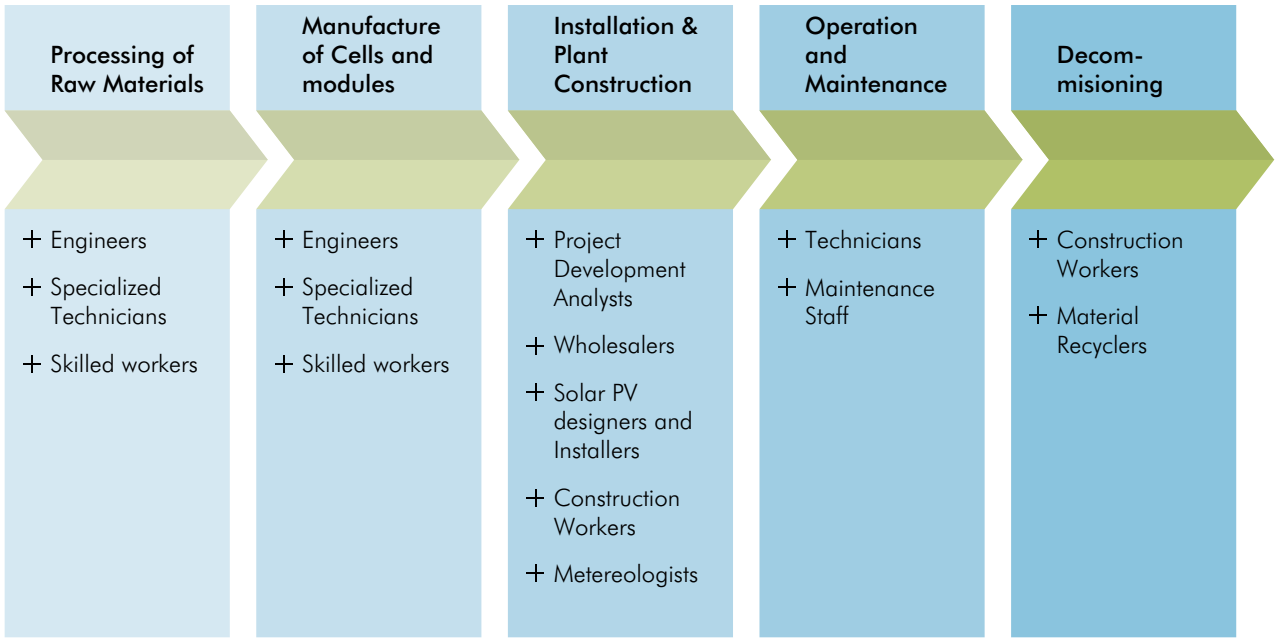


Figure 5: Types of jobs created across the value chain of Solar PV (Source: IRENA, 2011)

estimated that only 18% of jobs related to solar PV derive from manufacturing, as compared to 62% from installation and related activities (IRENA, 2011). Lastly it should also be noted that the majority of the existing studies only look at the impact on the job market related to renewable electricity technologies and still neglect the effects of renewable energy development related to the transport, heating and cooling sector.

In summary, by deciding to promote and invest in local renewable energy, Morocco has huge potential to develop a stronger national economy while demonstrating leadership in paving the way for a sustainable and more prosperous future.

2.4 BOOSTING SOCIAL DEVELOPMENT AND COMMUNITY PARTICIPATION

The decentralized nature of RE offers the unique opportunity for a country like Morocco to develop a small scale, community based energy system where people and communities are not only perceived as consumer but as producers, responsible and in charge of the production of their own energy.

In the two frontrunner countries Germany and Denmark for example, a very large number of energy cooperatives and individuals are driving a transformation within the energy sector by taking collective ownership of the RE infrastructure. In fact, the majority of the owners of the installed RE power capacity in these countries are private individuals (Morris&Pehnt, 2014). As presented by Anna Leidreiter as well as by Hans-Josef Fell during the round table, an open-access energy system enables and strengthens cooperation, and a collective awareness of both the challenges, and the solutions available to overcome them. As local opposition to energy projects can be a major barrier to 100% RE, local and regional involvement of citizens and businesses help policy makers to overcome this hurdle and build public support.

The analyses specifically of the German and Danish case studies prove that participatory decentralized policy approaches achieve the necessary energy transition faster and sustainably. Hereby, the transition to 100% RE is not just a switch from fossil fuel to renewables, but also an opportunity to bring socio-economic development, and enable all stakeholders and citizens to benefit.

In a country like Morocco, the decentralized nature of RE can have enormous benefits particularly for the poorer rural areas as RE technologies can many times offer a secure and reliable energy alternative able to increase the standard of living of rural and less developed communities. For example, as described by Mr. Mohammadi Benhmida during the round table, the instalment of solar panels to provide energy to pump water in a school in a rural area close to the town of El Jadida provided the community with a reliable, locally based and viable solution to supply water by exploiting the abundant solar energy of the region.

Another example for how renewable energy can boost local development was presented from Agadir. The city's ambition to achieve the 100% RE target is mainly driven by its effort to reduce the Municipal energy bill (approximately 10% of its annual budget), reduce dependency on imported fossil fuels, improve air quality, attract investment as well as make a contribution to the Kingdom's ambitious energy targets. The city has established a set of energy targets and established a priority action plan. Supported by ADEREE and its technical and financial partners, the city has mainstreamed energy considerations in municipal and urban planning, and decided to become a model for citizens with regards to sustainable energy management. In order to eventually reach the 100% RE target, the city of Agadir has increasingly called for a regulatory reform, mainly of the Law 13-09 at the national level, to allow for independent energy producers such as municipalities to feed into the national grid low and medium voltage power gained from RE. The expected reform would allow cities to set up mixed-capital companies to produce and sell local power on a larger scale.

2.5 POLLUTING LESS AND BENEFITING HUMAN HEALTH

It is also important to not forget the strict interrelation between pollution and human health. For example, renewable energy technologies emit much lower emissions of air pollutants (such as PM, SO2, NOx, VOCs, etc.) compared to fossil fuel options in terms of grams of pollutants per kWh of energy produced (Sathaye et al., 2011). This can have considerable positive impacts on the quality of air, water and land and consequently on the health of the Moroccan people. For example a recent study demonstrated how air pollution from the combustion of fossil fuels is a determinant cause of asthma and other respiratory diseases among schoolchildren in the city of Mohammedia in Morocco (Houssaini et al., 2007). A recent report on pollution in the Arab countries also described the correlation between mortality and air pollution (Chaaban, 2008). In particular it is estimated that mortality rate increases by 2% due to a corresponding increase of PM10concentrations by 22µg/m3. Keeping this in mind, if we consider that for example in Rabat PM10 levels ranges between 70 and 123µg/m3, this means that between the observed lower and upper level of PM10 pollution there can be an increase in mortality rate of about 4-6% (Chaaban, 2008).

3. RENEWABLE ENERGY IN MOROCCO: WHAT HAS BEEN DONE ALREADY?

The Moroccan government has already initiated policies that reflect many of the merits of renewable energy that were thus far mentioned. To decrease its reliance on energy import, it started to exploit its local renewable energy sources such as wind and solar. In fact, Morocco has an average yearly solar irradiation level greater than 2300 kWh/m²/y, which is up to 30% higher than the best sites in Europe (Reegle, 2014). In addition, Morocco also has about 3,500 km of coastline where winds reach an average speed of up to 11 m/s which is among the highest in the world (3Tier, 2014). It is estimated that Morocco's wind power potential is about 25,000 MW: considering that a 5MW wind turbine is able to deliver the electricity needs for about 1250 homes, this means that potentially wind power alone could provide electricity for more than 6 million houses in Morocco (Dakkina, 2013; Girardet, 2015).

Through a $13 billion worth of investment in the expansion of wind, solar and hydroelectric power generation capacity, and through a series of new energy policies and regulations, the country has committed to achieve a very ambitious target: 42% (or 6,000 MW) of the country entire capacity to generate electricity will need to be provided by renewable energy sources by 2020 (Figure 6). It is important to highlight that this target hence includes only the installed capacity in the country and not the share in the electricity demand.

By setting this target Morocco aims to become a leader in renewable energy in Africa, similarly to what Germany is for Europe. Given the vicinity to Spain, Morocco has great potential to become a dominant leader in exporting clean energy to a major potential importer such as Europe.

In order to promote renewable energy deployment, Morocco has so far adopted a broad strategy that includes three main pillars of action:

1. **the promulgation of actual regulations and laws to favour renewable energy expansion for electricity generation;**
2. **the establishment of institutions with the capacity to manage, supervise and promote renewable energy projects;**
3. **the implementation of projects and major financial investments to build the required renewable energy facilities.**

It should be mentioned that all of these three pillars of action mostly cover the electricity sector and intervene only minimally in other major contributor of CO2 emissions such as the heating/cooling and transport sector. Furthermore, all initiatives follow a top-down approach where decision making processes, investments and projects are managed by the national government or by governmental institutions.

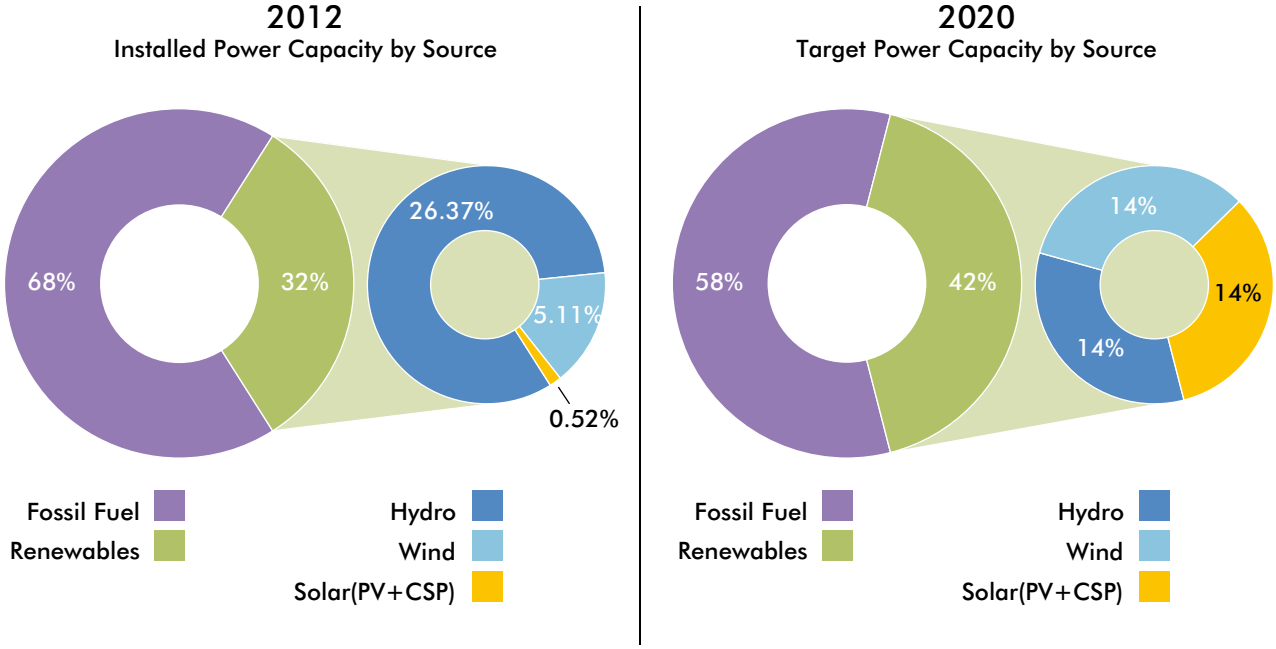


Figure 6: Current installed power capacity in 2012 and renewable power targets for 2020 in Morocco (Source: Rcreee, 2013)

3.1 ACTION 1: PROMOTING RE THROUGH POLICIES AND REGULATIONS

The Moroccan Government has carried out substantial reforms in order to shape a legal, regulatory and institutional framework that would stimulate renewable energy development. The scope of political action focuses primarily on electricity generation and partly on electricity consumption. It concerns exclusively the policy area of energy whereas others like infrastructure development, fiscal, employment and economy policies as well as research and education policies are not aligned yet. This shows that there is no coherent framework that addresses the transformation in the energy sector as a holistic and integrated process. Below is a summary of the main regulations concerning RE that have been introduced in the past few years in Morocco.

Law 13-09

Surely one of the most important steps of the renewable energy policy development in Morocco was the introduction of law 13-09 which was promulgated in 2010 designed to promote and liberalize the renewable energy sector. This law allows electricity to be produced and exported by any private producer as long as they utilize renewable energy sources. Through this policy the Moroccan government opened up the energy market by facilitating new entries and by supporting independent renewable energy producers. The law basically offers medium and large electricity producer the right to input their energy into the national grid which is managed by one operator, i.e. the National Office of Electricity (ONE).While this law has the positive impact of providing independent producers with the right to sell their electricity to the national grid, as such, it also excludes them from building private distribution networks. Nonetheless, there is also a possibility to set up a direct electric distribution lines outside the ONE network but this is only possible if the electricity is to be exported and if the operator has gone through a formal agreement with ONE. Furthermore the law establishes that the authorization for the construction of solar and wind farms needs to be granted by ADEREE (i.e. the "National Agency for the Development of Renewable Energies and Energy Efficiency) which allows development only in designated areas (Currie, 2012; CMS, 2010; Reegle, 2014).

Lastly, according to law 13-09, in order to be entitled to produce electrical energy from renewable sources and export it to the national grid, an operator needs to obtain a permission from the national authorities which can either require a simple prior notification (also known as "preliminary statement") or a proper authorization form depending on the capacity and the nature of its production (e.g. electric or thermal). These are two slightly different processes that need to be undertaken in order to have the right to sell to ONE. First of all the basic requirement is that facilities will be issued a permit only if they have an electricity generating facility greater than 20kW. More specifically preliminary statement agreements are required if the electricity generating capacity of the facility is between 20kW and 2 MW, while authorizations are required for projects with an electricity generating capacity greater than 2MW. ADEREE is in charge of granting this second type of authorization (Currie, 2012; CMS, 2010; Reegle, 2014).

The law does not introduce fixed tariffs but requires that all economic and technical conditions are to be set and negotiated by the producers directly with the grid operator ONE.
There is no feed-in tariff in place in Morocco. Nevertheless there is a scheme called the "EnergiPro" project operated by ONE which very much resembles a feed-in tariff system. This EnergiPro project was launched in 2006 by ONE to promote independent production of electricity from renewable sources. Firstly, it offers producers of renewable energy a fixed rate to distribute their electricity through the large national network controlled by ONE. Secondly, it ensures repurchase by ONE of any surplus electricity produced with a twenty per cent bonus on top of ONE peak, and off-peak day ahead tariffs (Currie, 2012).

Fossil Fuel Subsidy Reform

In 2011, the Moroccan government announced a reform under which fuel prices would be liberalized and the poorer sections of society compensated through cash transfers (Bridle, 2013). In late 2013 and early 2014, important steps were taken to eliminate the effective subsidy on gasoline and fuel oil, as well as to reduce significantly the subsidy on diesel fuel, and in June 2014 to eliminate the subsidy on fuel used for electricity generation. Although there still remains a high level of subsidy in the socially very sensitive area of bottled gas (butane), the measures announced so far will have a far-reaching impact on the budget cost of subsidies and partly on energy consumption. Whereas Morocco indeed provides important leadership in removing fossil fuel subsidies, sensitive subsidies remain and need to be addressed in order to achieve the necessary transition.

Other regulations

Beyond law 13-09, other important laws and regulations were promulgated in the past decade to promote and facilitate renewable energy development. (Currie, 2012; CMS, 2010; Reegle, 2014). Due to the scope of this report, they are only briefly described as follows:

- Decree 1-06-15 introduced in 2006 which requires public institutions to award and fund projects on the base of competitive public bidding.

- Self-Generation law 16-08 was introduced in 2008 to allow major industrial facilities to self-generate their power even up

to an equivalent power output of 50 MW (which is a higher ceiling compared the previous limit of 10MW). In this way large industrial sites are facilitated to produce their own energy locally.

- Law 54-05 allowed public companies to delegate management of their services to private companies particularly with regard to utilities and the transport sector. This measure was intended to promote public-private partnerships aimed at improving management and administration of public bodies as well as stimulate innovation and development.

- Energy Efficiency Law 47-09 introduced in 2011 in order to increase the efficiency of energy consumptions and allow for related cost savings through, for example, the use of solar water heaters, energy saving equipment and low consumptions light bulbs. Morocco's energy strategy aims to save 12% by 2020 and 15% by 2030 of total energy consumption compared to 2011 baseline levels.

- Draft law on Public Private Partnership (PPP) was published in August 2012. PPP is defined as a type of collaboration where public contracting authorities such as the State, regional authorities or other public institutions assign private institutions, through a contract with a private partner, the responsibility to design, finance, construct, rehabilitate, maintain and operate a particular infrastructure required to provide a public service. PPP can offer a cost efficient way to develop and promote development of infrastructure such as renewable energy facilities while distributing risks optimally.

3.2 ACTION 2: ESTABLISHING INSTITUTIONS TO SUPPORT RE

The government has also demonstrated commitment by establishing in the past few years a series of public agencies and institutions which were set up as a means to better organize and structure the promotion of renewable energy development. These include:

- ADEREE, the Agency for the Development of Renewable Energies and Energy Efficiency which is responsible for the development of energy management policies. Among others, the tasks of ADEREE comprise the development and realization of national and regional plans for renewable energy and energy efficiency.

- MASEN, i.e. the Moroccan Agency for Solar Energy which is a public-private venture established in November 2009 when Morocco announced it would install 2 Gigawatts of solar capacity by 2020. MASEN was founded to lead and manage this project.

- SIE (Société d'Investissements Energétiques), which was founded in 2010 as an investment fund for the energy sector in Morocco in order to facilitate diversification of energy resources, promotion of renewable energy and energy efficiency.

- IRESEN the Research Institute for Solar Energy and New Energy was founded in 2009 to promote research, development and innovation of renewable energy technologies around the country. It conducts and finances specific research projects and promotes the building of a network among researchers, projects and universities to strengthen the knowledge capacity around renewable and low carbon technologies.

- REUNET was founded in 2013 as a joint initiative of Moroccan academics, researchers, scientists and Engineers. The Network aims to promote the use of renewable energy in Morocco through Training, Research and Innovation. Its intends to focus its Renewable Energy activities on solar energy, wind and hydro power, biomass and bioenergy, energy efficiency, energy storage, grid integration and power quality. The Network is administered by an Executive Board consisting of 9 Members and a Supervisory Board (National Board of Directors) consisting of 40 Members.

3.3 ACTION 3: INVESTING IN LARGE SCALE RE PROJECTS

Lastly, given the huge potential of renewable energy particularly the abundant indigenous wind and solar resources, Morocco has been at the centre of major investments and large scale renewable energy projects. Many investors, private and public, national and international were involved in these developments (Reegle, 2014). Participants at the round table, including Abdelkrim Touzani from ADEREE, Mustapha Ayaita from REUNET, Khalid Benhamou from Sahara Wind and Zohra Abib from EnR`Afrique presented projects that form the foundation to achieve the 42% RE capacity target.

Solar Energy Projects

The Solar Integrated Projects was launched in 2009 in association with the creation of MASEN the National Solar Energy Agency. The target of this project is to reach a total installed capacity of 2000 MW with the development of large scale Concentrated Solar Power (CSP) and Photovoltaic facilities in 5 different areas covering a total of 10 000 ha for a total final production of 4,500 GWh (18% of current national electricity production). The investment costs for the project amounts to US$9 billion, however the project would lead to savings of 1 million Toe (ton of oil equivalent) and 3.7 million tonnes of CO2 emissions per year. This program will provide 10% of Morocco´s electricity needs by 2020 and prevent the emission of 3.7 million tonnes of CO2 per year. The first phase of the project will have a total capacity of 500MW and will involve the construction of a CSP farm in the area Ouarzazate. The

initial construction is expected to become fully operational in 2015 with a capacity of 160MW. Financing came mostly from the Moroccan government and from other international funding institutions such as the Clean Technology Fund (CTF), African Development Bank (AfDB), the World Bank (WB), and the European Investment Bank (EIB). This project was actually the first one to be financed through a new financing system which allowed an optimal distribution of risks through a blend of public, private and international funding all supervised by the national solar energy agency MASEN. In the future it is expected that technology will be mature enough such that projects will be financed by private investors and local banks. In January 2013, bids were announced to complete this first phase through the construction of two more CSP plants with total capacity of 300 MW (Whitley&Granoff, 2014; Reegle, 2014).

Another major projects known as the PROMASOL project is a United Nations funded initiative with the objective to double solar water heating capacity in only three years. This project allowed cutting carbon emissions by 1.3 million tons since 2002 and it will avoid the emission of 920,000 tons of CO2 per year and create 920 permanent jobs until 2020 (Reegle, 2014).

Wind and hydro energy projects

The Moroccan Integrated Wind Energy Programme was launched in 2010 and included the target of bringing the wind capacity from 280MW in 2010 to 2000MW by 2020 through the construction of major wind farms across five different sites in Morocco. With investment costs estimated at US$3.5 billion this project is expected to deliver an annual production of 6600 GWh, corresponding to 26% of current electricity generation and produce annual savings of 1.5 Toe (tons of oil equivalent) and approximately 5.6 million tonnes of CO2 (Currie, 2012). Lastly it should be mentioned that also hydropower plays a considerable role in the Moroccan energy mix. In 2008 Morocco hydro power delivered 1,360 GWh of electricity (as a reference the same year 298 GWh were produced by wind). Hydro power is planned to deliver 14% of the total electricity capacity of the country by 2020 target which is aimed to be achieved with the construction of two new large hydropower facilities and through the development of several micro-hydropower projects (producing off- grid electricity) (Cirlig, C., 2013).

Discussions on 100% RE in Morocco at the Round Table, hosted by the World Future Council and Climate Parliament in November 2014

4. BARRIERS FOR IMPLEMENTING 100% RENEWABLE ENERGY IN MOROCCO

It is widely acknowledged that all of the above mentioned reforms and investments from the Moroccan government had proven considerable commitment to promote renewable energy and take action against the major challenges that are connected to the energy system in the country. However, many barriers to further progress are still present. These are significantly obstructing further renewable energy development in Morocco.

These major barriers were summarized in Table 2 below. The table is based on the framework of analysis provided by Painuly (2001).

Barriers to renewable energy development in Morocco

Barrier Category	Barrier	Description
1. Economic and financial barriers	Lack of access to capital and credit	Lack of experienced financial institutions banks, investment funds and effective financial instruments able to provide credit and support investments in RE combined with poor credit worthiness, scarcity of capital, restricted entry to capital markets and lack of incentives all contribute to increase risks and uncertainty associated with RE. Particularly in Morocco there is a lack of accessible financial support for small scale projects able to facilitate private consumers to install RE technologies. Most financing is directed to large scale projects.
	High up-front capital costs and high perceived risk	Economic viability affected by high initial capital costs due to lack of confident financial support and high risk perception related to RE. In Morocco major financing for RE development still comes from the government and from international funds rather than from local private investors and regional banks (Whitley&Granoff, 2014).
	Low return on investment, long payback time and short termism	Companies and private lenders tend to prefer investing in assets with high return on investment and require return within a very short period rather than long term savings offered by RE. Within this context, short termism is still a major limiting factor. Furthermore, as RE projects appear to be riskier, Return on Investment (ROI) is also required to be higher in order to compensate for the higher risks.
2. Market failures and imperfections	Heavily subsidized fossil fuels	Subsidies to fossil fuels affect the competitiveness of much less subsidized renewable energy technologies. In 2011 the estimated fossil fuel subsidies budget in Morocco was equivalent to 5.1 per cent of GDP which is extremely high particularly considering that the national budget deficit was 6.8 per cent of GDP in 2011(Bridle et al., 2014).
	Low market penetration, lack of entrepreneurs, skilled workers and RE specialized industry	Costs are driven down and competitiveness is increased when market penetration is large. The still relatively low market penetration of RE compared to well established fossil fuel options still negatively affects the competitiveness of RE. This is also due to a lack of businesses, entrepreneurs, trained or skilled workers as well as specialized industries which are able to promote and expand the market and outreach of RE technologies in Morocco.
	Highly controlled and monopolistic energy sector	Large monopolies within the energy sector in Morocco tend to be locked into fossil fuel-based path dependent processes driven by increasing returns to scale. The large energy firms tend to prefer marketing their existing profitable technologies rather than pushing for the adoption of new and disruptive solutions that may reduce their control over the system and make their current product obsolete. Consequently energy monopolies constitute a major barrier to market diversification and renewable energy development.
	Externalities not considered	Externalities such as environmental pollution and climate change costs, health costs, impacts on energy security, etc. are not internalised by the market and are not evaluated in the cost analysis. This is obviously distorting a fair cost comparison between RE and fossil fuel options.

Barrier Category	Barrier	Description
3. Political, institutional/ governance and regulatory barriers	Current legal and regulatory framework does not facilitate the necessary transformation process	Many laws that were introduced to promote renewable energy such as the 13-09 law are still presenting issues. For example it was claimed that this law tend to facilitate only large scale projects and favour only certain type of investors rather than helping the entry of smaller producers and stimulate the development of more community based, bottom-up energy initiatives. Further, there is a strong need for a coherent strategy across governance levels and policy areas.
	Lack of a clear economic strategy	Lack of a clear, defined, ambitious strategy to integrate RE development into a national economic development plan, lack of involvement of the financial sector/ banks.
	Uncertain and unstable governmental policies, lack of consistency	Uncertainties in future policies, red tape, lack of faith in RE, lack of stable regulations all contribute to weaken the confidence to investors and RE developers.
	Lack of involvement, cross-party cooperation and communication	The lack of coordination, cooperation and synergetic collaboration between the various stakeholders, political groups and ministries does not help forming a common strategic vision for the promotion of renewable energy. Lack of coordinated cross-sectoral communication and an open platform for discussions are also not facilitating the formation of innovative, shared policies. On top of these, clashing interests and divergent views tend to prevail and hinder the formation of a cohesive environment. Parliamentarians are not involved in the law-making.
	Lobbyism	Lobbyism in favour of existing fossil fuel-based energy monopolies does not facilitate promotion of policies in favour of RE.
	Lack of ambitious drive from the leaders	Government leaders tend to adopt gradual solutions and are often hesitant to promote an aspiring, far-reaching vision.
	Lack of transparency	It was pointed out that there is a lack of transparency and clearness over the management of the energy sector. It often unclear how decisions are made and the interests and drivers behind these decisions.
	Lack of information and data	Investments in RE sector are relatively novel and inexperienced. There is a lack of knowledge, data, information, modelling, monitoring and agencies able to assess the potentialities of RE and communicate these information to key decision makers.
4. Cultural, behavioural and educational barriers	Lack of knowledge and understanding of the potential of RE	Lack of understanding of renewable energy among key stakeholders and policy makers who are many often unaware of how RE technology work and what are the main benefits and challenges of RE.
	Lack of acceptance, sensitivity and public apathy	It was pointed out that in Morocco there seems to be a lack of a general culture supporting renewable energy and the added value of such a technology. Social acceptance and public support are very important elements in the need to rapidly scale up RE deployment: undeniably when the public is involved and sensitive to the energy issue people tend to accept the new RE technology better and considerably facilitate the transition.
5. Technical Barriers	General technical challenges related to intermittent nature of most RE	It was suggested that there are still major technical issue relates to the intermittent nature of renewable energies such as wind and solar. Technical complications occur when aiming to ensure large scale reliability of supply with high penetration of intermittent sources.
	Lack of integration of different sectors	So far, renewable energy have only been incorporated in the electricity sector. There is a lack of cross-sectorial approaches that include the heating/ cooling and transport sector.
	Lack of skilled personnel and maintenance capacity	It was pointed out that issues relating to lack of skilled personal and capacity to maintain and appropriately operate renewable energy facilities is an issue also in Morocco.

5. POLICY RECOMMENDATIONS TO IMPLEMENT 100% RE IN MOROCCO

Given the wide range of challenges and barriers there is not only one specific institution or one single action that can solve them all. On the contrary, a holistic, joint and integrated approach will be needed. A series of wide ranging actions able to mobilize a variety of actors and stakeholders will therefore be required. It is useful to organize the variety of solutions in four main areas:

1 Agree on a joined vision and set a 100% RE target

Targets reflect a joined political vision and therefore play a central role in global, national, and local renewable energy policy and strategy. Setting an ambitious, long-term renewable energy target demonstrates political commitment, and can provide both investors and the population as a whole a clearer view of the long-term vision for the region, as well as a better understanding of how they fit within it. Chapter 5.1 outlines how a target can catalyse change by providing an official mandate for action.

2 Embed a strategy for 100% RE into a national economic development plan

A 100% RE strategy must be embedded into a national economic development plan. The energy transition can become a key driver for national economic growth and should form the foundation of a national economic strategy to ensure sustainable, long-term prosperity of Morocco. Chapter 5.2 will outline some tools and recommendations to achieve such a goal.

3 Increase cooperation across sectors and governance levels

A 100% RE strategy requires an inclusive approach which builds on strong alliances and collaboration across sectors and governance levels. Chapter 5.3 will provide some guidelines and recommendations on how to achieve such goal.

4 Design a coherent and comprehensive 100% RE policy framework

A 100% RE strategy requires a coherent policy framework. Chapter 5.4 will provide further details on how to structure a clear and effective policy strategy.

5.1 AGREE ON A JOINED VISION AND SET A 100% RE TARGET

By setting a political target, governments demonstrate a joined vision which plays a central role in global, national, and local 100% RE strategy. Setting an ambitious, long-term renewable energy target demonstrates political commitment, and can provide both investors and the population as a whole a clearer view of the long-term vision for the region, as well as a better understanding of how they fit within it. It catalyses change by providing an official mandate for action.

In fact, identifying and communicating a 100% renewable energy target has a number of additional advantages: it can help engage a wide range of stakeholders; it can ensure a more efficient deployment of both technical and administrative resources, and reduce the risks of duplication and competing policy goals; it can help give key stakeholders (such as utilities, or private investors) the confidence required to make large investments, such as in transmission and distribution grids. By increasing investment certainty, setting ambitious targets can also help attract domestic and international investors, ultimately making it easier to achieve the target. Experience in the European Union and in many other jurisdictions around the world demonstrates that targets can also help build awareness, both among external audiences as well as among the citizens in the local area. This awareness can be essential to building public support among local citizens and businesses to help to achieve the objective (Couture&Leidreiter, 2014).

It is important to highlight that target setting is the first but certainly not the last step to ensure effective implementation. As shown by a number of unmet targets in several jurisdictions around the world, targets need to be credible and achievable. Moreover, targets are more likely to be achieved when they are supported by a stable policy and regulatory framework as well as by a clear, step-by-step roadmap with indicators and regular progress reports.

5.2 EMBED STRATEGY FOR 100% RE INTO A NATIONAL ECONOMIC DEVELOPMENT PLAN

Like many other countries around the world, Morocco faces significant needs to improve living conditions for its people. This includes the urgency to create jobs and build up local trained workforce to assist the transformation. Any renewable energy policy framework must therefore be embedded in a national economic development plan. Morocco will need to develop its own domestic capacity to support the 100% RE target by minimizing its dependency on imported knowledge and fostering the development of the required domestic technology and human capital. In order to achieve this goal, energy policy will need to be better integrated into a larger national economic plan. Morocco stands at the crossroad and has to decide whether it wants to become a manufacturer of RE technology, a knowledge hub for RE implementation or a sees its future in research and development of RE technology. Consequently, the integration of the energy transition in policy areas such as industry, employment, research and education as well as economy will not only benefit the environment but the entire country´s social and economic welfare. Some key proposals that would ensure a transition towards 100% renewable energy that truly adds value to the local economy and create opportunities for new local employment were outlined as follows:

1. Build domestic capacity

First of all, the transition towards 100% RE in Morocco involves a major structural transformation from a centralized, dispatchable, fossil fuel based system to a decentralized, intermittent, renewable energy based system. This major structural shift cannot be achieved by importing human capital and technologies, but by making sure that Morocco builds its own domestic capacity and expertise to support such a transition within its own means. This should be perceived as a unique opportunity for boosting national economic development. By embarking on the journey towards 100% RE, Morocco can simultaneously develop a host of skills and technical knowledge that can be highly valuable domestically, in the MENA region as well as internationally. As shown by Cape Verde as well as El Hierro in the Canary Islands, local research institutes, can become a hub for knowledge sharing and for providing advisory services to other governments and businesses. The local expertise developed in the process of achieving a 100% RE target can therefore be valuable in its own right, and lead to spin-offs in both technological as well as in consulting services.

2. Support research and education.

Several jurisdictions around the world are already demonstrating that renewable energies are ready for the market and for larger scale application. There is no need for miracles, or for major technological breakthroughs – although continued technological improvement and innovation in business models will undoubtedly make the transition easier and faster. In particular adaptation to the local and region conditions are urgently needed. Therefore, the Moroccan energy transition will require development of improved technologies as well dissemination of technical information, development of better knowledge and understanding of what is technically required to make the energy transition possible. Consistent support will need to be delivered to universities and education centres such that they can be equipped with the needed resources to educate, train and sensitize students, specialists and operators to the new renewable energy technologies. In order to do this, it is recommended that research, education and training for building the knowledge and technical potential to achieve the 100% RE target is included within the legislative framework and education policies.

3. Promote small scale projects which involve local communities.

Given its inherently decentralized nature, renewable energy development can offer great opportunities for improved democratic decision-making processes and citizen involvement at the local level. More initiatives and projects should be promoted at the community based level such that local people can take active part and become the drivers of the transition themselves. Currently the approach that seems to predominate in Morocco is a top-down approach involving large scale investments that are almost exclusively managed and decided at the national level.
By learning from pioneers, policy makers can help build positive synergies across the region and build further momentum by providing market access to a wide range of stakeholders. This allows innovative business models to emerge and the competitiveness of jurisdictions to increase. These foster socio-economic value creation and create a fertile ground for additional finance to be leveraged. In other words, the 100% RE target hereby becomes a development policy that supports policy makers to meet non-climate policy priorities.

4. Build centres to disseminate information on pioneering projects.

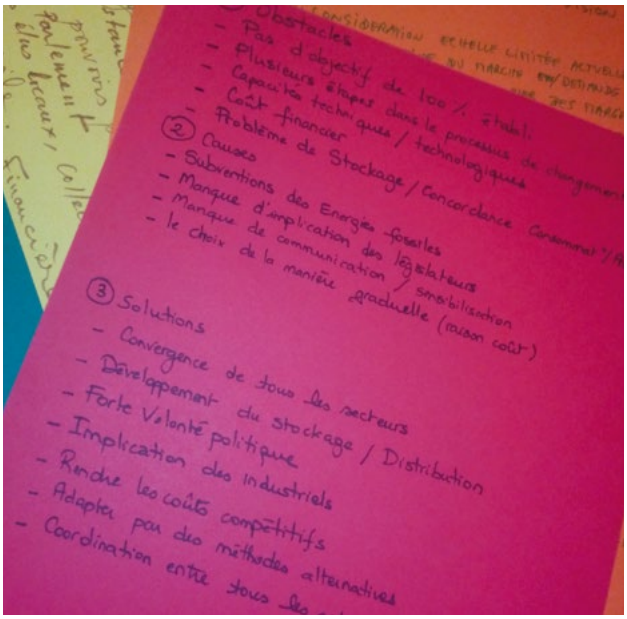
It was suggested that in order to increase outreach and enable more and more communities around Morocco to understand and appreciate the potential for 100%RE, more centres for education around pioneering projects should be established. Educating and informing the public as well as businesses facilitates building public support and acceptance. Local opposition can be a major barrier to 100% RE and is often linked to lack of knowledge about renewable energy. Educating citizens, information sharing and public outreach must therefore be a priority for policy makers. Funding programs need to be developed to enable the establishment of these centres.

5. Explore potential for job creation

In line with the proposal to integrate a 100% RE target in a national economic development plan, it was recommended during the round table that a reliable study on the opportunities of creating new jobs by setting a 100%RE target should be conducted. This would allow policy makers and other stakeholders to understand the potential for local economic benefits in terms of job creation.
As mentioned in section 2.3, renewable energy creates more jobs per unit of energy produced than fossil fuels do. It should be noted that the jobs created and needed to support the RE transition are wide ranging not only in terms of sectors and types of jobs but also in terms of kind of personnel with different formal credential levels and skills. For example, investing in RE means providing opportunities for new jobs in construction, in maintenance and operations, in local manufacturing, in transport, in technology development, in exports, in research and education and so on. Therefore data is needed specifically for the Moroccan context.

6. Strengthen local and regional actors by reforming law 13-09

As described previously, law 13-09 was introduced to liberalize the energy market and facilitate the entry of new renewable energy producers. Nevertheless it was suggested that it still needs to be revised in order to make it more inclusive such that it can facilitate a more participatory, community based energy transition and as such strengthen communities and cities.



Results from working groups at the Round Table, hosted by the World Future Council and Climate Parliament in November 2014.

5.3 INCREASE COOPERATION ACROSS SECTORS AND GOVERNANCE LEVELS

As previously mentioned, the structural shift that is required to achieve 100% RE will not be able to be tackled by one single stakeholder or by one particular sector but instead must be a collaborative effort built upon a multi-stakeholder alliance. It requires a holistic and integrated approach where a variety of players joins efforts to achieve a common target. The 100% RE target can be effectively adopted as a means to catalyse and unite different efforts towards a shared goal. Cooperation and synergies across parties and across different level of society will therefore be crucial. Two main types of collaboration are being fundamental factors to mobilize the required synergies for change.

1. Vertical dialogue: Building alliances between different governance levels

Intensified coordination and collaboration between the international, national, regional and local level is a very important factor to ensure policy coherence and integration. Particularly given the decentralized nature of renewable energy, new actors enter the energy market compared to the centralized fossil resource based system. Establishing multi-stakeholder alliances and deepen the policy dialogue among the different governance levels is therefore recommended.

Concretely, participants at the round table concluded that the International Renewable Energy Agency (IRENA) Morocco would in fact benefit from becoming a member of IRENA, specifically from the knowledge and expertise offered by such international network.

Improved understanding of what platforms are available that can facilitate cooperation across different governance level is indeed crucial. For example, a proposed idea was to increase the engagement with the Arab Parliament to establish platforms to discuss the potential of 100% RE and the needed synergies to achieve such a target. Similarly the Maghreb Union can offer a forum to discuss the possibility of implementing a policy framework to support RE across different North African countries. Bilateral policy dialogue specifically with the neighbouring country Tunisia should be improve and focus around the 100% RE target. It was highlighted that, given the decentralized and intermittency nature of renewable energy, improved collaboration across regions can have great benefits also in technical terms as, for example, one effective way to mitigate intermittency is to connect a large number of intermittent sources across different regions. In this context, cooperation among different national and international governance level becomes extremely important for the successful implementation of 100% RE strategies.

In the national context, the creation of locally based feasibility studies and model regions is recommended in order to improve the understanding of the potential of achieving the 100% RE target in different regions. This region-based approach cannot however stand on its own but needs to be integrated into a larger network for knowledge exchange and alliances formation.

2. Horizontal Dialogue: Promoting cooperation between different stakeholders

There are a number of stakeholders that need to be mobilized in order to achieve a transition which requires contribution from a wide range of actors. It is clear that effective cooperation and policy dialogue between the different stakeholders will therefore be vital. During the roundtable it was discussed how the government, the parliament and civil society must engage in a more effective and result oriented way. First of all it was proposed to establish a committee composed of researchers, scientists and legislators to build capacity for 100% RE and improve the dialogue among the different groups. In fact, it was agreed that there is a need to create platforms for MPs and government staff to come together and openly discuss the technical and financial necessities of 100% RE together with energy experts. These platforms would therefore allow MPs to better understand how they can structure policies and regulations in a more enlightened, consistent and collaborative way.

Moreover, achieving 100% RE requires cooperation of different Ministries, or Departments, that have not had a history of collaborating together. A coherent and robust policy framework builds on the integration of different sectors and policy areas. As Anna Leidreiter presented in the round table, a key component that have supported the success of Cape Verde's strategy is that it offers a complete tax exemption for the first five years of each RE project's operational life, with 50% tax reduction offered for the following five years. The fiscal framework in Cape Verde also involves waiving export duties on certain RE products and components.

Lastly, it was suggested that policy also needs to focus on education and on raising awareness not only on the value of environmental integrity but more specifically on the potential of RE. Debunking myths and misinformation on the potential of RE will be crucial and can be achieved also through a stronger collaboration with the national and international media.

5.4 DESIGNING A COHERENT AND COMPREHENSIVE 100% RE POLICY FRAMEWORK

It is important to design a clear and coherent policy framework able to effectively transform the energy sector such that it can truly benefit the economy and the people of Morocco.

5.4.1 KEY FEATURES

The following features are essential when designing a 100% RE policy framework for Morocco.

1. Fossil fuels subsidies phase out

Participants of the round table concluded that one of the key elements of an enabling policy framework towards 100% RE is the phase out of fossil fuel subsidies in a socially acceptable way. There needs to be strong coordination between phasing out of the current traditional fossil fuel based system and phasing into a new renewable energy based system. Renewable energy will need to gradually, reliably and cost effectively replace the current fossil fuel based technologies without compromising the local economy, dangerously affecting energy prices and the entire country´s energy affordability and reliability. Given that subsidies for fossil fuels tend to be much greater than for renewable energy, they are currently distorting the competitiveness of renewable energy options and hindering further RE penetration into the market. Nevertheless the problem cannot simply be solved by redirecting all the subsidies from fossil fuels to renewable energy technologies. The question is how best fossil fuel subsidies can be reformed such that its potential negative side effects such as rise in energy prices are minimized. Change is not just about eliminating old and harmful technologies but rather about providing a viable, future-just and improved alternative that is able to safeguard the most vulnerable social classes and ensure a new kind of socio-economic prosperity. As pointed out by Tom Moerenhout during his presentation at the round table, there needs to be strong coordination and collaboration among parts with the shared objective of calibrating as fairly as possible the change in subsidies distribution. Subsidies reform needs to be accompanied by concrete measures to mitigate short term negative impacts. For example, gaining widespread understanding and support from the public on the possible implication of a subsidies reform is key to ensure that community consensus is built such that changes can be anticipated and as such better tolerated.
Specifically, the following key factors must be considered when phasing out fossil fuel subsidies:

1. Internal cooperation and coordination
2. Pacing: a gradual approach or a "big bang"
3. Getting the prices right
4. Managing impacts (mitigation measures)
5. Building support for reform

Whereas Morocco indeed provides important leadership in removing fossil fuel subsidies, sensitive subsidies remain and need to be addressed in order to achieve the necessary transition. Participants made the following recommendations during the round table.
Firstly, as the focus has been primarily on the power sector reform, policy makers must incorporate energy efficiency and non-price demand side interventions. Further, as Morocco is mainly powered by imported petroleum products, the subsidy reform has so far focused mainly on oil resources. However, significant subsidies are still provided for other fossil resources such as coal and gas. In this context, policy makers must develop a more holistic reform.
Secondly, in terms of planning, a cross-party and cross-sectorial consensus and political commitment must be built for the phase out of subsidies to ensure a robust and reliable policy framework. This is crucial to create a stable investment environment.
Finally, some recommendations were made with regards to communication. Educating and informing the public as well as businesses facilitates building public support and acceptance as well as a better understanding among consumers. Policy makers should there contextualize the involvement of the World Bank and IMF and stress its leadership in this process. Providing positive messages to maintain support and correct information about subsidy levels is also important as many people are not aware of the actual cost of energy.

2. Financing for the transition

The role of the government is central in directing the country´s future on the right path. Through a robust, reliable and strong and solid policy framework, the government can indeed leverage private investment and attract financial capital from international institutions.

Most importantly, by directing public funding for the promotion of renewable energy technologies rather than fossil fuel options, Morocco could become a world leader gaining international recognition, sustainable economic growth and a more just and prosperous future for its people. Just in 2011, 5% of the country´s GDP was spent by the Moroccan government on fossil fuel subsidies. Redirecting these financial resources towards renewable energy development will be a priority of a robust 100% RE policy.

In order to understand with more precision the economic and financial requirements that will be needed for the energy transition, it is important to appreciate the competitiveness of renewable energy technologies compared to more traditional options. A detailed analysis of the levelized cost of electricity (LCOE) for different technologies in Morocco is necessary in order to better understand the economic consequences on the energy market of using renewable energy technologies. LCOE is the ratio of the total costs of a generic plant (including both capital and operating costs), to the total amount of electricity expected to be generated over the plant's lifetime and provides an estimate of the cost of electricity per kWh produced by different technologies. LCOE estimates can become useful for the government when establishing what level of subsidies and incentives are best in order to compensate for market distortion and ensure competitiveness of RE technologies.

Development banks as well as investment and funding institutions should also be supported by the government`s policy framework such that investors and developers are facilitated to enter the market and as such increase the market penetration of RE.

3. Reliability

It is important to highlight that target setting alone is not sufficient to ensure effective implementation. Targets are more likely to be achieved when they are supported by a stable, reliable and robust policy and regulatory framework as well as by a clear, step-by-step roadmap with indicators and regular progress reports. Investors and project developers need to feel confident that investing in RE will be fully supported by reliable, steady and predictable policies in the short and long term future. Political discontinuity and policy inconsistencies are still creating an unstable ground that is not helping investors to build the trust that is needed in new renewable energy projects. Again, cross-party and cross-sectorial consensus as well as a transparent and participatory governance structure can support this process.

4. Support for relevant technical measures

A policy for 100% RE must facilitate the implementation of the technical and infrastructural changes needed to support an energy system fully powered by renewable energy sources. It will need to delineate and promote clear actions that will enable the country to overcome the major technical hurdles in particular related to the intermittent nature of RE such as wind and solar power. Participants at the roundtable, including Khalid Benhamou from Sahara Wind and Zohra Abib from EnR`Afrique presented project examples that policy makers can already draw valuable lessons from.

In a nutshell, the regulatory framework will need to support 5 major technical requirements:

I. Enlargement & improvement of the network infrastructure

One of the key technical challenges for achieving 100% RE is the intermittency of RE technology. One way to mitigate it consists of connecting a large number of intermittent sources such that the variability of output from these intermittent

sources is smoothed. In simple terms, as an example, when the wind is not blowing on a wind farm in the north of Morocco, it might be blowing very strongly in the south of the country. If the grid is connected to both sources, electrical reliability is enhanced and requirements for storage and back up energy are minimized. A policy that facilitates the construction and management of a large electrical network is therefore recommended.

II. Increased generation flexibility and mix of resources

Greater reliability is provided by using various RE technologies at the same time, such as wind, tidal, solar geothermal and hydroelectric. For example combining wind power with tidal power is suggested to reduce by 37% the cost of extra reserve to balance for intermittency as compared to wind-only scenario (David, 2010). Furthermore small and flexible plants such as biomass thermal plants or combined heat and power plants, are ideal for the integration of variable renewable energy (VRE) and for reducing balancing costs. On the contrary less flexible generating plants such as coal or nuclear plant are less compatible and able to adapt rapidly to changes in output from renewable sources.

III. Demand-side measurement and increase in efficiency

Flexibility can come not only from a more flexible supply side, but also with an improved interaction with the demand side and bi-directional power and information flow (producer to consumer and consumer to producer). Implementation of a smart grid and smart metering systems for demand-response management which are able to shift flexible loads to better match with intermittent sources will be very important. The development of advanced communication technology with smart electricity meters linked to control centres will offer greater flexibility which will require consumer engagements in terms of changes in behavioural patterns, social acceptance and privacy/security issues. Schemes and incentives will be needed to encourage consumer participation with power system operator schemes that require demand-supply smart interaction (Jacobson&Delucchi, 2011).

Lastly, reaching the 100% RE target will also require major increase in energy efficiency and energy savings which will involve demand side interventions such as more energy efficiency lighting systems, more insulated buildings, more efficient cooling and heating technologies and so on.

IV. Improved operational, market and planning methods

Current operational, planning and electricity market procedures, mostly based around dispatachable and predictable energy load patterns, will need to change to facilitate integration of intermittent sources. The nature of regulatory practices greatly affect balancing costs: if system balancing actions are determined close to real time, system balancing costs are minimised, since intermittent output can be forecast with a high degree of accuracy at such timescales. In countries where balancing decisions are made a long period ahead, forecasts of VRE supply is much less accurate and therefore balancing costs are higher. Allowing for improved predictability of intermittent output will also be essential such as improved wind forecasting and accurate prediction models (Sims et al., 2011).

V. Storage

Electrical energy storage can also be used to balance the variable load of intermittent sources. Electricity can be stored when electricity demand is low while production is high such that it can be made available whenever supply does not match demand. Many storage options are available. However, except for pumped hydro storage (which however still requires high upfront capital and it is location dependent) market penetration for many storage technologies is still very low particularly for battery type technologies, hence costs are still very high (Edenhofer et al., 2012). Support from the government to improve and develop cost effective storage technologies is therefore warranted. Secondly, further analysis will be necessary to understand the benefits of storage options compared with other balancing technologies such as increased interconnection, flexible spinning reserves, demand side measures, etc. The question regarding how much intermittent RE can be used before storage becomes the most economic option for further integration is also critical and will require further research (Denholm et al., 2010, David, 2010). Lastly a very efficient form of energy storage is hydro pumped storage such as for example the one adopted in El Hierro in the Canary Islands. Excess renewable energy from intermittent wind energy can be used to pump water into an upper reservoir. When the wind is low, water from the upper reservoir flows downhill to the lower reservoir driving water turbines which produce electricity. In water scarce regions, such as the desert regions in Morocco, this can be integrated with a water resource management strategy which can include a desalination plant. Renewable energy can be used to desalinate the water which is then used within the hydropower system. Improving the integration of renewable energy and water resources can be greatly beneficial and is therefore recommended.

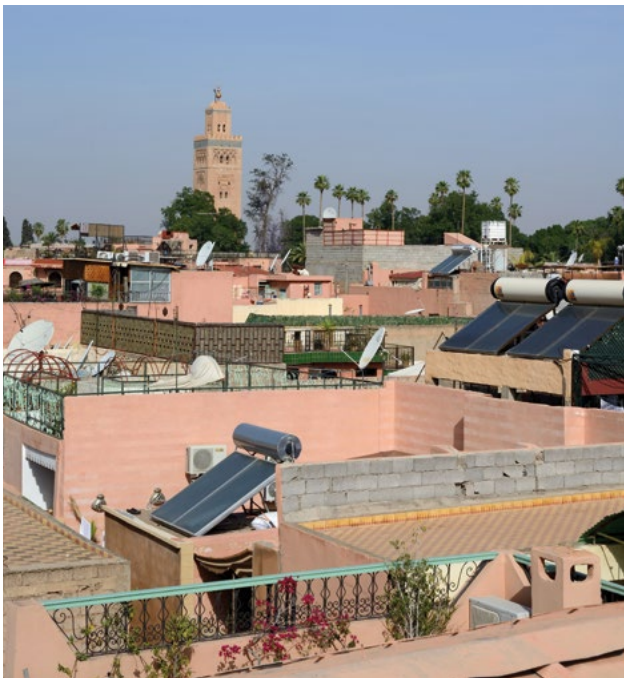
5. Transport and heating sector

While the debates on 100% RE tend to gravitate around the power sector, far too little emphasis has been given to increasing the share of renewable energy sources also in the heating/cooling sector and in the transport sector. Nevertheless, significant expansion of RE in both the transport and heating/cooling sectors will need to become a strategic priority to achieve 100% renewable energy.

Some examples around the world are attempting to solve this issue in various different ways. For example the island of El Hierro already achieved 100% renewable electricity target but it is planning to extend this to the transport sector by replacing the island's 4,500 cars with electric vehicles, in order to further reduce reliance on imported fuels and promote sustainable development on the island. Similarly Costa Rica is trying to go beyond the power sector by encouraging the broader adoption of electric vehicles by offering targeted incentives for the import and sale of EVs as well as for the development of charging infrastructure. Given that transportation represents approximately 44% of final energy consumption, efforts to diversify away from oil are a critical part of Costa Rica's long-term objectives. Combined with its abundant renewable energy resources, the shift to electric mobility in Costa Rica will help gradually transition both its electricity and its transportation system to a greater reliance on local and sustainable energy sources.

Other key example comes from Denmark, where an integrated approach among different sector is planned to deliver the country's entire energy demand with only renewable energy sources by 2050. In order to achieve its 100% objectives, Denmark is relying heavily on a broader electrification of its energy sectors, combining the heating and cooling, transportation and end-use sectors. This will involve, among other aspects, converting greater volumes of the country's abundant wind resources into thermal form (e.g. funnelling more wind power into the district heating system as well as into on-site water heaters) as well as into electric battery storage for the transportation system. Denmark also envisions a significant increase in the use of solar thermal technologies to supply heat directly into the country's district heating systems. Similarly in 2013, the city of Sydney, Australia (Population: 4.6 Million) launched a Green Infrastructure Plan that included an objective to supply 100% of its electricity, heating and cooling needs from renewable energy sources by 2030. In contrast to many other jurisdictions, the Sydney Master Plan puts a strong emphasis on the integrated use of bio- energy sources such as biomass, biogas as well as waste sources from forestry and agriculture, and in particular the use of 'tri-generation' – the integrated production of heating, electricity and cooling. It is expected that tri-generation powered by local waste and bio-energy resources will represent up to 70 % of Sydney's target, with the remaining 30 % largely supplied by local solar PV and wind power projects (Couture&Leidreiter, 2014).

All of these examples from around the world show achieving 100% RE on a sustainable basis will require storing excess power in the form of heat in individual homes and businesses, in both hot water and refrigeration, allocating it to electric vehicles and other forms of storage, as well as offloading it into desalination, water pumping systems, demand response networks, and a host of other flexible loads. This suggests that in order to achieve 100% RE on a stand-alone basis, electricity will need to be managed far more dynamically than in the past, and that electricity demand will need to become increasingly dispatchable. This may involve increasing coordination between the electricity sector and the transport sector through the deployment of electric vehicle charging infrastructure, as seen in Costa Rica, or between the heating and the electricity sectors, as seen in Denmark and in Sydney Australia (Couture&Leidreiter, 2014).



Rooftops in Marrakesh with solar panels

5.4.2 DESIGN PROCESS

In addition to the recommended processes highlighted in section 5.3 regarding cooperation across sectors and governance levels, two more aspects to ensure the creation of a coherent and comprehensive policy framework were identified during the round table.

1. Develop an action plan.

It is crucial to fix a clear action plan which includes detailed steps to undertake in order to achieve the 100% RE target. Targets are more likely to be achieved when they are supported by a stable policy and regulatory framework as well as by a clear, step-by-step roadmap with indicators and regular progress reports.

The action plan should include feasible interventions that can be performed immediately to improve the current policy framework. For example, one first step would be to modify law 13-09 such that it becomes more inclusive and that it can actually

facilitate the development of small scale renewable energy projects. It was suggested that in order to make sure that this action plan is actually delivered, responsibilities should be better clarified from the start and assigned to specific people. For this reason, teams should be assembled across different ministries and parties that are in charge of implementing various steps of the action plan. These teams should also be held responsible and accountable for action and results.

Lastly, as well pointed out by Mustapha Taoumi from IRENA during his presentation at the roundtable, a phased approach is also recommended in order to structure an action plan which is based on a solid understanding of what the needs are and tailor an effective strategy accordingly.

deployment of renewable energy across the country. One of the key lessons here was the need to involve citizens and allow new stakeholders to enter the energy market to leverage investments and ensure acceptance.

As a country with similar development challenges, Cape Verde provides valuable lessons for Moroccan policy makers. The island state faced a significant lack of a local trained workforce to assist with construction and development of key projects to achieve their 100% RE target. In response to this, companies in the country have undertaken a number of training related initiatives in partnership with private sector partners and related research institutes to build the local capacity and train local residents to manage and operate wind parks sustainably in the long-term.

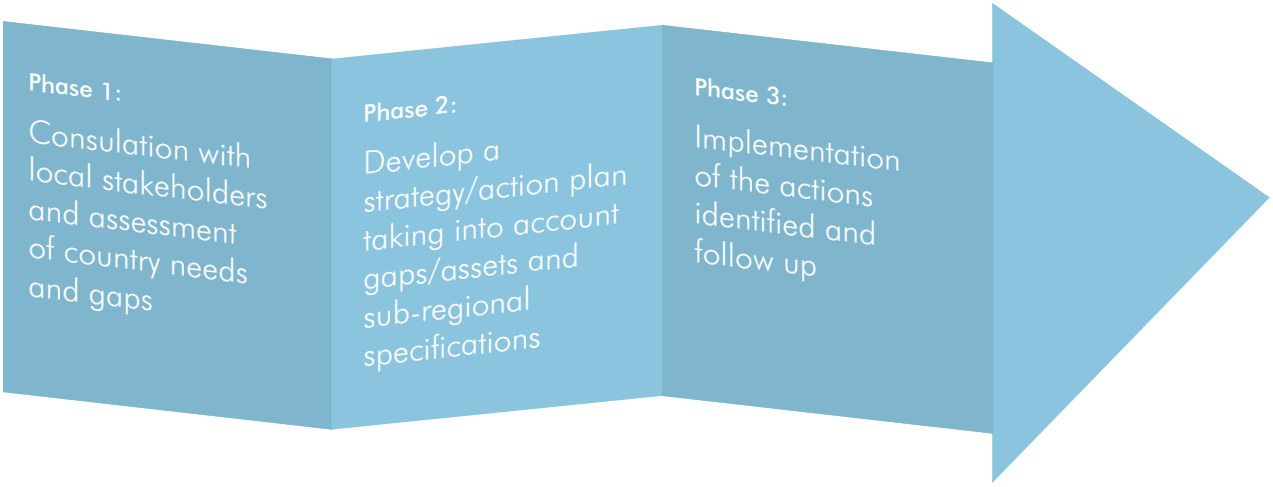


Figure 7: The phased approach as proposed by Mustapha Taoumi from IRENA to ensure actions to promote RE follow a structured process that can deliver effective solutions

2. Learn from pioneers and best practises from around the world

Given that RE is a solution that is still relatively novel in a country like Morocco, it is essential that the political environment remains open to learn from pioneers and from best practises that have proven success in other countries. Policy dialogue goes hand in hand with policy learning and is a prerequisite for a successful future. Capacity building among all stakeholders seems to be one of the major determining factors for maturing further the renewable energy sectors. Platforms and initiatives that can help local policy makers to become familiar with innovative RE policy solutions from around the world are therefore recommended.

For example, Morocco could learn from Tunisia whose government recognizes climate change and commit to climate protection in the national constitution. Best policy examples are also provided by countries like Germany where the Feed in Tariff has demonstrated incredible success in increasing the

Being able to adapt exemplary policy elements from around the world to the Moroccan context can play an invaluable role in speeding up the transition towards 100%RE. An international and multi-stakeholder policy dialogue would help to:

- identify opportunities for harvesting the renewable energy resources across sectors;
- foster a better understanding among legislators, executive branches of local government, energy companies, investors and energy experts on concrete steps to develop the national renewable energy sector;
- identify related investment opportunities, economic stimuli and job implications for the local and national economy; and
- design and formulate a roadmap towards renewable energy development according to a political 100% renewable energy target.

6. CONCLUSIONS

The report outlined solutions and implementation strategies that enable political decision makers at the national, regional and local level in Morocco to spearhead the energy transition. The analysis shows that the importance of policies and regulatory frameworks cannot be overstated. Setting clear policy targets is hereby essential to provide investment security, mobilize stakeholders as well as improve the allocation of resources. This underscores the fact that building political will is essential to catalyse the transformation toward 100% RE.

Continuously building awareness, both among citizens and political decision makers, is arguably a precondition to creating the kind of political will required to sustain and intensify the implementation of 100% RE strategies in the years ahead. Citizens, civil society and the parliament must hold their government accountable for their responsibility to serve the needs of the people and make Morocco a liveable place. Indeed, it is noteworthy that examples around the world suggest that the political momentum is maintained by citizens and civil society. As suggested by legislators at the round table, citizens and the parliament can help creating credibility of the government. This suggests that with the right level of awareness and education, the momentum can be created and sustained through increasing collaboration between stakeholders, including local businesses, media and civil society groups.

In conclusion, in order to facilitate the implementation of the policy recommendations and provide concrete solutions to the major challenges that Morocco is currently facing, the following next steps are necessary:

- **Build capacity on 100% RE specifically for Legislators**
- **Provide platforms for cross-sectorial policy dialogue**
- **Enhance policy dialogue with pioneers to share knowledge**
- **Compile accessible information material on 100% RE to provide facts, data and knowledge**
- **Determine: Who is taking the lead in Morocco to ensure follow up?**

The World Future Council and its partners are committed to support Moroccan policy makers in this endeavour. Policy dialogue goes hand in hand with policy learning and is a prerequisite for a successful future. As stated before, this report aims at enhancing the debate and reach out to other stakeholders to achieve the overall goal boosting development through 100% RE in Morocco. There is only one certainty in this biggest transformation process that humanity has ever faced: The future is not the continuation of the past.

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100% RENEWABLES

Salima Faraji,
Lawyer and Member of Parliament PAM d`Ouja:

"This report is a great opportunity for us in Morocco to learn more about the importance of renewable energy. We as parliamentarians need the knowledge and better coordination with the government in order to ensure positive developments for the Moroccan people."

Prof. Mustapha Ayaita,
Chairman of the Renewable Energy University Network (REUNET):

"Morocco has not only the natural resources to go 100% Renewable Energy but also has many young and motivated people to implement this vision. By establishing education and training programs, we can boost future-just development and achieve 100% Renewable Energy."

Khalid Benhamou,
Managing Director, Sahara Wind:

"Backed by the Atlantic trade winds, the analysis in this report proves again that 100% Renewable Energy is feasible for Morocco. The technology is ready, the private sector is committed to contribute but we need a robust and reliable policy framework to facilitate this transition."