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Morocco's Green Energy Opportunity

Laura El-Katiri

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Abstract

Morocco's energy landscape has been changing rapidly over the past decades. Alongside its own population growth, rising access rates to electricity as well as high rates of rural-urban migration and rising living standards, Morocco's domestic energy needs have risen sharply since the early 1990s. This policy paper explores Morocco's long-term energy options, focusing on "green" energy solutions that lie within Morocco's natural competitive advantage. Using Morocco's strategic assets – its strategic geographic location at the interception of Europe, North and West Africa and the Middle East; its political stability and its long-lasting, well-established relations with neighbouring Europe; its domestic market size, which is one of Africa's largest markets for energy; and its abundance in its still under-utilised renewable energy resources solar and wind power – Morocco can benefit from a domestic clean energy transition. To maximise its use of these resources and to take up the vast opportunity Morocco faces in green energy – in particular in Concentrated Solar Power (CSP) – Morocco will need to add further policy focus on the area, and work actively to secure finance options, including from external sources. COP22 in Marrakech in November 2016 will in this context offer one important forum to further access to such funding while also working to open up future export markets, in particular Southern Europe.

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Morocco's Green Energy Opportunity

1. Introduction

Morocco's energy landscape has been changing rapidly over the past decades. Population growth, industrialisation and rising living standards that have been accompanied by rising access rates to electricity as well as high rates of rural-urban migration have all contributed to Morocco's growing energy needs. Neighbouring oil and gas-rich Algeria in the east and energy-hungry Europe in the North across the Mediterranean Sea, Morocco has historically traded agricultural products but imported virtually all of its primary energy resources in the absence of significant own oil and gas reserves.

This traditional way of ensuring access to low-cost energy has supported Morocco's socio-economic development model for many decades, but a number of developments have prompted Moroccan policymakers to reconsider the vast role played by fossil fuels in its domestic energy mix, including, first, the rising and cost of oil and oil products from international markets during the 2000s up to mid-2014 when global oil prices collapse, along with the resulting fiscal and exchange rate burden of importing large volumes of oil in particular from international markets; and, secondly, the in parallel falling cost of renewable energy technologies, in particular solar photovoltaic (PV), concentrated solar power (CSP) and wind power, resources Morocco holds plenty of. External funding mechanisms coupled to European and other international incentives in the context of promoting climate-friendly, emissions-reducing energy technologies and the idea of cross-regional electricity trading – such a bringing North African "desert energy" to Southern Europe – that emerged during the 2000s served as important initial building stones to incentivising Morocco to invest in North Africa's first and to date most important set of renewable energy projects.

Using Morocco's strategic assets – its strategic geographic location at the interception of Europe, North and West Africa and the Middle East; its political stability and its long-lasting well-established relations with neighbouring Europe; its domestic market size, which is one of Africa's largest markets for energy; and its abundance in its still under-utilised renewable energy resources solar and wind power – Morocco can benefit from a domestic clean energy transition. In addition to the desired effect of using the country's substantial renewable energy resources to reduce fossil fuel imports and increase domestic energy security through more reliance on domestically produced energy, renewable energy also has potential other, long-term benefits for Morocco, including the creation of a domestic servicing and manufacturing industry that can one day provide valuable jobs for young Moroccans.

To maximise its use of these resources and to take up the vast opportunity Morocco faces in green energy – in particular in Concentrated Solar Power (CSP) – Morocco will need to add further policy focus on the area, and work actively to secure finance options, including from external sources. One key priority area is the opening up of sufficient financing options for Morocco, particularly in the area of CSP at large scale, and in which Morocco has considerable

potential to drive down technology costs globally if it is able to expand its CSP deployment in line with its potential. In this context, forums such as COP22 in Marrakesh in December 2016 present a critical opportunity to help design climate finance mechanisms that provide countries such as Morocco with effective access to finance, in addition to Morocco's inherent interest to negotiate the dismantling of trade barriers inside its main potential trading markets for large-scale clean energy, Europe.

The following study first explores the context for Morocco's energy policy options, and provides an overview of Morocco's changing domestic energy landscape. It then proceeds to explore Morocco's green energy opportunities, including through utility-style, off-grid and rooftop applications. After this, policy priorities for the coming years are identified.

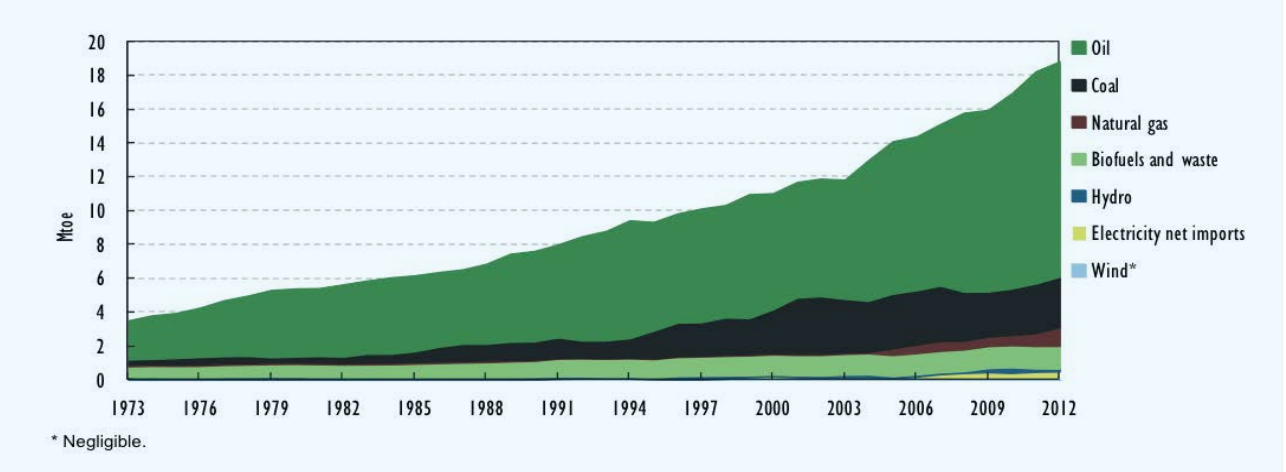
2. Morocco's domestic energy market: a brief background

Understanding Morocco's strategic energy policy choices, it is important to see recent policies in light of the domestic energy market context. This context includes three key challenges: the country's rising energy demand, its historical reliance on fossil fuels, and its related reliance on imported sources of energy.

2.1. Rising domestic energy demand

Morocco is North Africa's fifth largest energy market that has grown considerably in recent years; between 2002 and 2012, total primary energy supply increased by over 50% (Figure 1). Morocco's status as a lower middle-income country reflects its energy profile; with an average per capita rate of energy use, a measure of energy consumed, of around 560 kg of oil equivalent, Morocco is statistically no large consumer of energy. But as with all statistics, reading these averages needs to be done with care. Morocco is characterised by large differences in living standards and energy use patterns between urban centres and the countryside, as well as between its different regions. Large cities such as Casablanca, Marrakech, Rabat and Tangier grow quickly as more of the rural populations migrate into urban areas, while industrial clusters along the Atlantic coast, and touristic areas across both coast sides of Morocco imply vastly different energy needs than those in the countryside.

Figure 1. Total primary energy supply in Morocco, 1973 – 2012

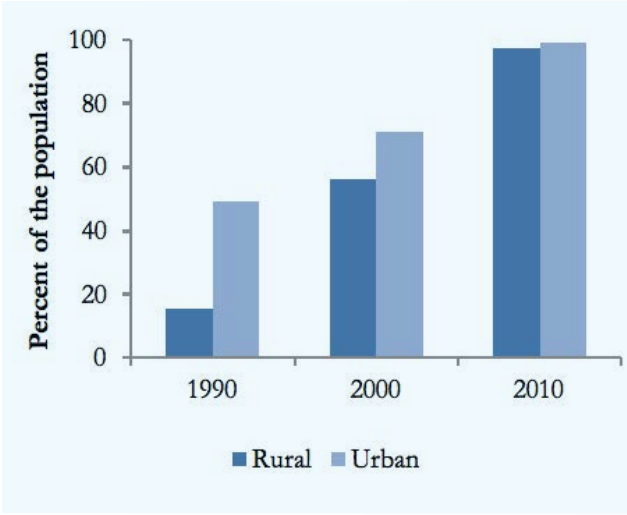


Source: IEA (2014)

Morocco has also witnessed the rapid increase of electricity access throughout the 1990s and 2000s, when the government systematically expanded electricity access across rural areas. Morocco invested over MD24bn ($2.9bn) in the period of 1996 – 2012 into rural electrification, bring access to modern electricity to an estimated 12 million people in more than 39,000 villages, including through the use of off-grid renewable and hybrid sources of energy (El-Katiri, 2014b). The success of the programme meant electricity access across Morocco rose over the same period of time from 22% in 1996 to some 98% of the population by the end of 2012 (Figure 2).

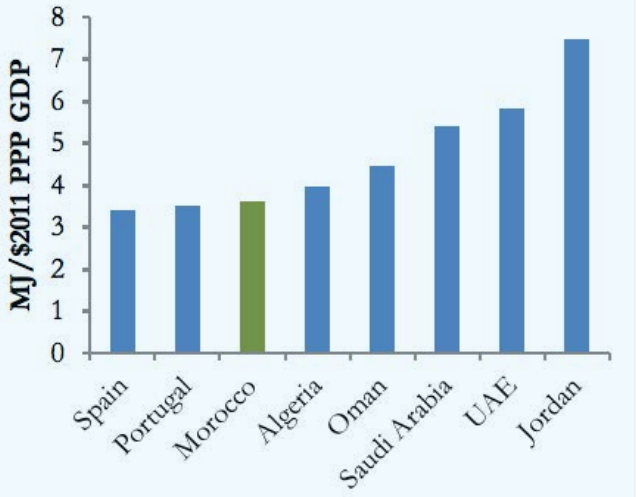
For this reason, combustible sources of energy, traditional biomass, continues to play a role in many rural areas, although basic electricity access is now available in most remote areas. Morocco's rural electrification programme PERG (Programme d'Electrification Rurale Global)[1] is in this context a major success story in rural electrification, including due to its use of renewable technologies – where suitable – to power local off-grid communities (see discussion further down below).

Figure 2. Electrification rates, 1990 – 2010



Source: World Bank (2016)

Figure 3. Energy intensity level of primary energy



Source: World Bank (2016)

Transport and industry account for close to two thirds of Morocco's total final energy consumption, the remainder being residential and commercial sector demand – commercial demand including the agricultural sector (IEA, 2013b). Electricity demand grows fast, at around 8% annually reflecting increasing electricity uptake and rising living standards in the cities in particular (Arab Oil and Gas Directory, 2015).

Morocco's energy intensity, that is the amount of energy used per unit of economic output, is at 3.5 MJ/$2011 PPP GDP comparably low, particularly if compared to regional neighbours in the Middle East and North Africa (Figure 3). This is primarily the result of Morocco's overall low per capita energy consumption, the absence of energy-intensive industries such as those found in neighbouring Algeria, as well as the country's continued reliance on key primary commodity export industries that have comparably low energy needs, in particular agriculture and textile trade. However, having remained fairly static for over two decades, Morocco clearly distinguishes itself from other direct energy-importing neighbours such as Spain and Portugal whose energy

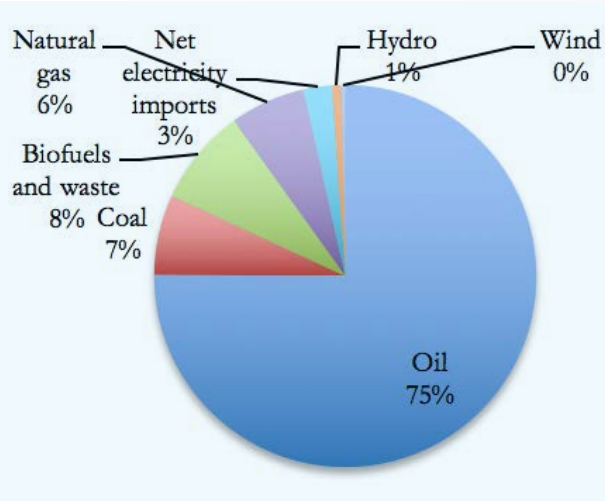
1. An overview over Morocco's rural electrification programme PERG is also available on ONE's website at http://www.one.org.ma/FR/pages/interne.asp?esp=2&id1=6&t1=1

intensity has significantly fallen over the same period of time (IEA, 2013b; World Bank, 2016). Morocco hence has a lot of unused potential to further improve its energy intensity rates by improving energy efficiency.

2.2. Historical reliance on fossil fuels

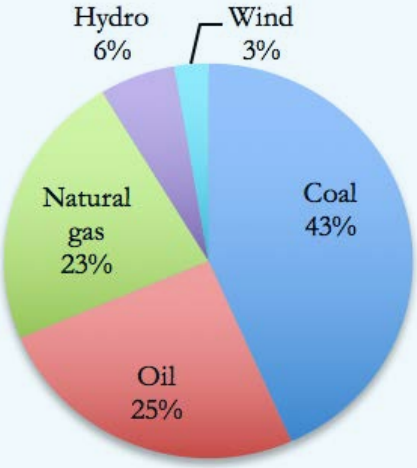
Morocco's domestic energy mix remains heavily dominated by fossil fuels, particularly on oil. Oil supplies over two-thirds of Morocco's primary energy needs, followed by coal (16%), and biomass and waste (7%) (Figure 4). Coal dominates electricity generation with over 40% of total production, followed by oil and natural gas (Figure 5). Another 15% of power production is generated by renewable energy sources, primarily large hydropower owing to Morocco's long-standing reliance on dams to help generate a share of its electricity. Renewable energy sources, primarily solar and wind power, have recently entered Morocco's market, and contribute a rising share of the country's electricity needs. Electricity generation from hydropower has nearly doubled and wind power tripled since 2002 (IEA, 2013b). Most future renewable projects are likely to be either solar or wind-related as Morocco has largely exploited its large hydroelectric potential to capacity.

Figure 4. Morocco's total primary energy supply (TPES), 2012



Source: IEA (2014)

Figure 5. Morocco's electricity generation mix (%), 2012



Source: IEA (2014)

More than one third of all of Morocco's CO_2 emissions originate from the power sector, and over two thirds of emissions are linked to oil, followed by coal – Morocco's two most polluting sources of energy by far (IEA, 2014). Systematically reducing Morocco's reliance on these sources of energy will play a major role in turning the country into a "green" leader regionally, but doing so will also present Morocco with new policy caveats; coal has been part of the government's strategy to expand access to affordable electricity given the continuingly low cost of coal bought from international markets. Morocco just completed a 700MW extension of Jorf Lasfar coal-fired plant, and signed up for two new coal-fired power plants, a 693 MW plant at Safi due to go onstream in 2018 (MEES, 26 September 2014).

Natural gas as a "cleaner" fossil fuel plays only a limited albeit growing role in the electricity sector owing to Morocco's historical lack of access to gas imports; both in view of the comparative

cost of oil on world markets and in view of the high emissions profile of oil within Morocco's energy mix, diversifying the country's energy mix towards a greater share of natural gas could be beneficial in the long-term. Apart from small volumes of in-kind payments for the transiting of Algerian gas to Spain through Morocco, Morocco's government only decided in 2011 to purchase additional volumes of gas directly from Algeria, an agreement whose volume terms could undoubtedly be increased in the future as Morocco is looking for further volumes of cost-effective natural gas.

Box 1. Fiscal effects of Morocco's recent fuel subsidy reform

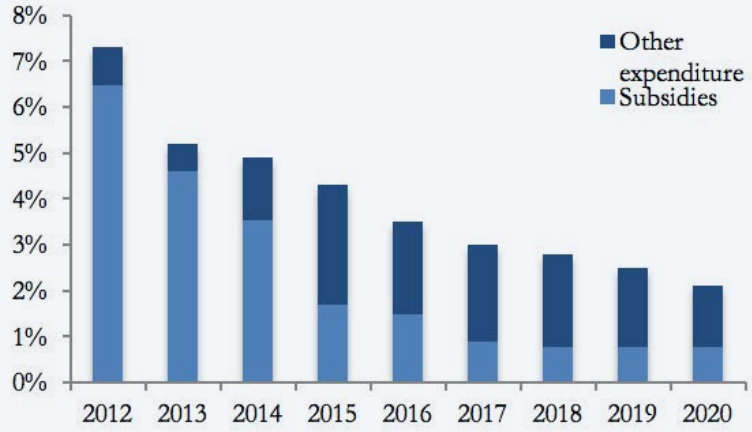
Morocco's historical import dependence for its energy supply has had major fiscal implications. Until 2015, Morocco maintained a system of fairly comprehensive, universal subsidies on energy, alongside food items. Swings on international markets for energy commodity prices have hence affected the budget significantly, leaving public spending to pick up the difference between domestic prices and international market purchasing cost on behalf of consumers. World market prices for oil in particular fluctuate considerably, having been at a historical high in the later part of the 2000s up until mid-2014. This has meant that Morocco's fiscal cost of energy subsidies has not only been record high earlier on this decade, but it has also been fluctuating between the years, considerably complicating prudent fiscal management.

The fiscal cost of Morocco's subsidy system peaked in 2012 at 6.6% of GDP, by which time its subsidy bill had become almost the size of the overall fiscal deficit, larger than the country's total investment budget for the year, and more than the spending on health and education combined (IMF, 2014b; Verme et al, 2014). In addition to the fiscal balance, Morocco's high reliance on energy imports from international markets is also taking a major toll on foreign currency reserves. In 2012, a peak year in terms of government spending on energy imports – largely due to rising world oil prices – Morocco's international reserves declined from an equivalent of eight months' worth of imports of goods and services in 2007 to less than four months (Verme et al, 2014).

Morocco has since progressively reformed its historical price subsidy system for energy. Starting in June 2012 until January 2015, Morocco removed almost all subsidies on oil and oil products not used for power generation – including gasoline for final consumers – in an effort to curb the country's rising fuel subsidies that had increased during the 2000s alongside the rise in global oil prices at the time. Domestic prices have since been linked to international world markets, being adjusted twice monthly by the Ministry of General Affairs and Governance, outside the reach of the Ministries of Energy and of Electricity (Royaume du Maroc, 2013).

In June 2014, authorities ended subsidies for industrial fuel oil used in power generation, replacing it with a programme contract with the public electricity company ONEE, which includes direct transfers for the subsequent four years (MEES, 20 March 2015). The timing of reforms of the pricing of butane (LPG bottles) remains under discussion (IMF, 2016). Morocco's energy pricing reform, alongside the recent fall in world market prices for oil, has contributed to the country's fiscal consolidation in more recent years, including the reduction of the country's total fiscal deficit from 7.3% in 2012 to 4.9% of GDP in 2014 (Figure 6) – a remarkable fiscal savings effect which should in theory free new resources for investment in alternative uses, such as education, health and clean energy.

Figure 6. Morocco's government deficit as % of GDP compared to spending on subsidies and other expenditure



Notes: 2013 actual; 2013 and 2014 second IMF revision; 2015 – 2020 IMF projections
Source: IMF (2016)

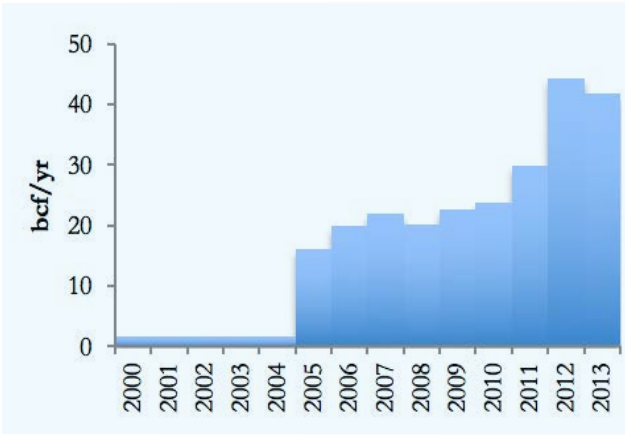
2.3. High dependence on energy imports

Morocco, like Tunisia, is untypical in North Africa in that it holds only very limited own oil and gas resources. Being in the immediate neighbourhood by long-standing energy exporters Algeria, Libya and Egypt, Morocco relies for over 90% of its domestic energy needs on energy imports, all of them fossil fuels as well as electricity from Spain (IEA, 2014). Oil and coal are general imported from international market, prices of which fluctuate, particularly in the case of crude oil and petroleum products, along global price shifts. In 2014, Morocco imported over US$11 bn worth of energy products, about 10% of its nominal GDP that year (MF, 2016a).

Projections for 2015/2016 see a reduction in this trade balance burden owing primarily due to lower world market prices for crude oil and oil products (MF, Ibid); but it is worth bearing in mind that the actual fiscal burden in Dirham is likely to be larger, given import costs are calculated in US dollars, whose strengthening in recent months against the Moroccan Dirham means Morocco's savings in Dirham terms are lower than projections in dollar terms suggest.

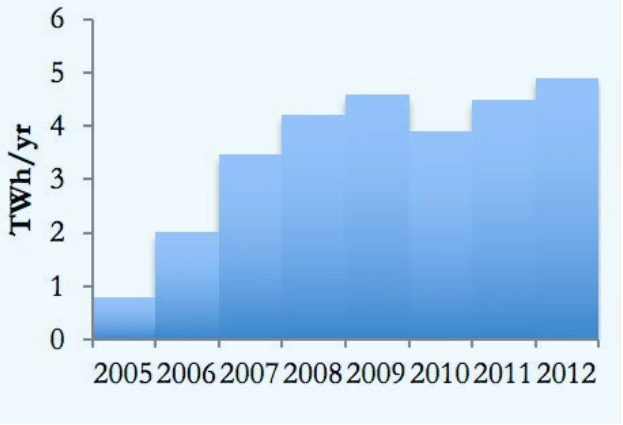
Natural gas. Morocco also imports small volumes of natural gas from neighbouring Algeria, which has allowed Morocco to diversify its electricity generation mix towards cost-effective and less polluting gas. Natural gas first entered Morocco's energy system in 2005 when the country began to be paid in-kind through reverse gas deliveries from Spain for the transit of Algerian gas to Spain via the 12 bcm Gas Maghreb Europe (GME) pipeline that crosses Morocco (Otman and Darbouche, 2010). Since 2011, a sales agreement with Algeria has substantially increased Morocco's intake of natural gas directly from Algeria to around 640 mcm/yr from previously very low initial levels, for the period up to 2021 (Royaume du Maroc, 2013).

Figure 7. Morocco's natural gas consumption



Source: EIA (2016)

Figure 8. Moroccan net imports of electricity from Spain



Source: OECD/IEA (2014)

Natural gas could be another additional source of cleaner energy for Morocco, particularly as a gradual replacement for oil in power generation. Sourcing natural gas at competitive cost has historically been difficult for Morocco; the comparably small size of its domestic market for gas has rendered the initial cost of investing in LNG regasification capacity off its coastline expensive, leaving the option of importing LNG as an additional source of gas on and off the discussion table for more than a decade. The most feasible choice in cost terms would be pipeline gas from neighbouring Algeria, which Morocco has historically been reluctant to rely on bearing in mind the border between the two countries remains closed since 1994.

In its bid to diversify its energy mix, Morocco has announced plans in the past for an own 5 bcm/yr LNG import terminal, starting operation from 2023 in Phase I to supply its domestic market; with options to upgrade Morocco's import capacity in later phases (Ben Hayoun, 2016). The government is currently working on a legal and contractual framework to govern the development of new gas infrastructure including the future LNG terminal, associated pipelines, storage facilities, power plants and storage infrastructure for other products such as LPG (MEES, 19 Jun 2015).

The proposed location for the import terminal at Jorf Lasfar, south of Casablanca, is placed strategically at the Atlantic coastal side of Morocco, a choice that was likely no coincidence. Morocco has signaled preference for long-term contracts, which would render Morocco a likely outlet for US LNG offtakers as nearby Europe is moving towards a higher ratio of sport-market indication, i.e. Henry Hub prices. At the same time, Casablanca is also within reach of Mediterranean cargoes, particularly those heading towards Spain, leaving open the option for Moroccan offtakers to siphon up unwanted cargoes destined towards Southern Europe assuming available arbitrage.

Electricity. Morocco also imports increasing amounts of electricity from neighbouring Spain. Between 2002 and 2012, electricity imports rose by over 250% (IEA, 2013b) as Spain offers Morocco increased supply at reduced cost. Imported electricity from Spain now accounts for around 15% of Morocco's total electricity supply (IEA, 2014) and further capacity additions are underway to increase electricity traffic between Spain and Morocco (Royaume du Maroc, 2013). An electricity interconnection also exists between Morocco and Algeria (Royaume du Maroc, 2013), although the extent of its usage is currently restrained due to political factors.

Box 2. Domestic upstream exploration for oil and natural gas

Morocco has limited own oil and gas resources. In January 2014, Morocco's proven oil reserves stood at 990,000 bl, its natural gas reserves at 1.5 bcm, with an oil and gas production in 2013 of some 160 b/d and 60 mcm (Arab Oil and Gas Directory, 2015). EIA assessments also suggest the presence of potentially up to 68 tcf of risked shale gas in place of which 11 tcf could be technically recoverable; as well as a potential of some 50 billion barrels of oil shale, primarily in the onshore Tadla basin near the Atlas mountains and in the Tindouf basin straddling the territories of both Morocco and Algeria, including the disputed Western Sahara – although with a composite success factor of 20-25% (EIA, 2011).

During 2014/2015, exploration efforts accelerated particularly in the offshore, Atlantic side of Morocco. Morocco's Atlantic side is North Africa's largest exploration province, stretching from Tangier in the North to Laguira in the South, covering an area of over 140,000 sq km (Arab Oil and Gas Directory, 2015). Morocco's brief exploration boom has, however, been followed by stalled exploration success until now. Mostly being high-cost deep water exploration projects, a number of shares in permits have since changed owner, including most recently the sale of 30% of three large deepwater permits by US independent Chevron to state firm Qatar Petroleum in February 2016 (MEES, 12 Feb 2016). Lack of commercial quantities of oil or gas, and falling international prices for oil have since hampered exploration, implying prospects for an own Moroccan hydrocarbon boom, if it materializes, is yet long away.

3. Morocco's green energy opportunity

Morocco's renewable energy potential is undeniably large. Morocco has significant potential for solar energy, with irradiation levels in a range of 2,300kWh/m^2/yr (Figure 9), particular in the south and east of Morocco; while the country's Atlantic coast offers superior wind speeds of above 6 m/s (OECD, 2013: 111; Société D'Investissements Énergétiques, 2016). A study conducted by the Centre du Développement des Energies Renouvelables (CDER) with the GTZ suggests Morocco's wind potential lies at 5,290 TWh/yr (2,645 GW), with a technical potential for 3,264 TWh/yr (1,632 GW) (OECD, ibid; see also IRENA, 2013).

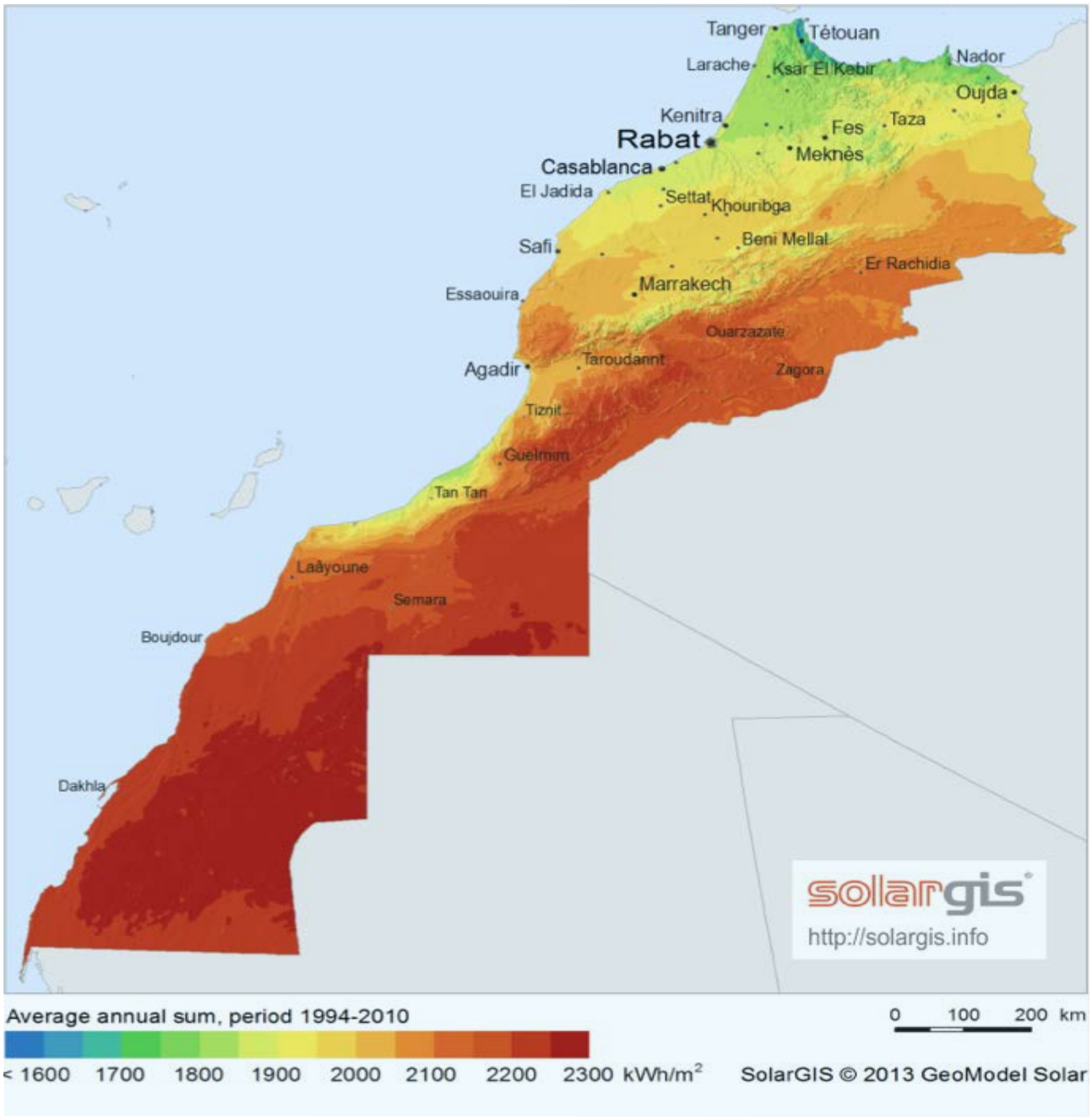
Morocco is also part of a region that, overall, proves to be one of the most conductive areas for the generation of solar power, particularly CSP – both in terms of the resource potential and its geographic conditions, including "abundant sunshine, low precipitation, and plenty of unused flat land close to road networks and transmission grids." (CIF, 2009: 5) Morocco is as part of North Africa also strategically located at the interception of different regional markets between Europe, the Maghreb-Mashreq interception, and Sub-Saharan Africa. Morocco's electricity grid, like that of North African neighbours Algeria and Tunisia already operate to European grid standards synchronously, facilitating electricity trade between the two shores of the Mediterranean.[2] As a result, the Clean Technology Investment Fund's investment plan for North Africa specifically notes that

2. The author thanks Jonathan Walters for pointing this out.

"no other region has such a favorable combination of physical and market advantages for CSP." (CIF, 2009: 3).

A recent technical study by Fraunhofer Institute confirms that North Africa's technical renewable energy potential for the years 2030 to 2050 as a whole exceeds the combined assumed electricity demand of North Africa and Europe by 2050 by a large factor (2016: 8). Data by Fraunhofer further suggests that wind, CSP solar PV combined could cover the entirety of North Africa's electricity needs by this time alone (Fraunhofer, Ibid). Exploiting this potential, according to the study's underlying model, could have significant economic benefits for the entire North Africa region in the long-term.

Figure 9. Global horizontal solar irradiation in Morocco (kWh/m2)



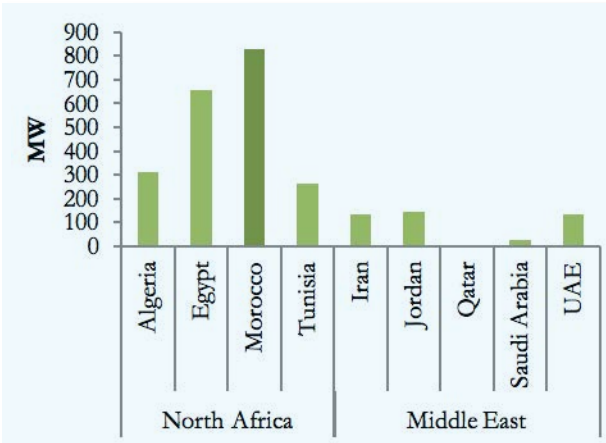
Source: Solargis

Realising this resource potential will depend on political and regulatory framework conditions that are required to optimise the power plan technology mix during this period, suggesting a key role for pro-active energy sector governance now and in the coming years.

3.2. Utility generation

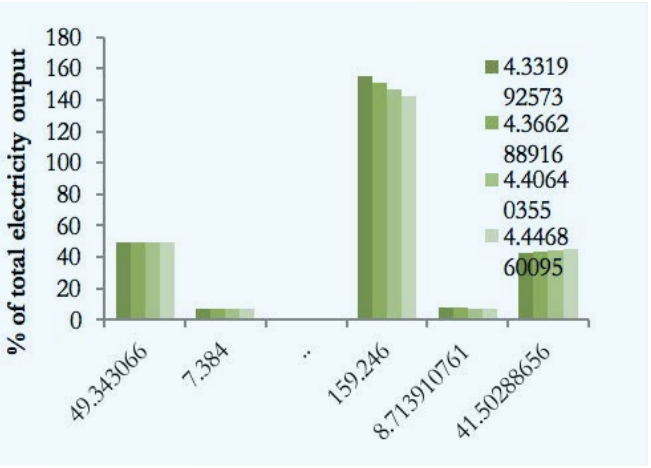
Morocco's options for renewable energy applications are far-reaching. The primary focus area of Moroccan policymaking is utility-style production. Morocco is already harnessing renewable energy and currently leads regionally in terms of installed capacity for non-hydro electricity. By the end of 2015, Morocco had around 800 MW of installed generation capacity for total wind and solar power, the largest in the Middle East and North Africa (**Figure 10**). The launch of Ouazazarte's Nour I CSP plant in early 2016 should add considerably to this capacity, leaving Morocco far ahead as North Africa's single largest producer of wind and solar energy. Morocco's total production of renewable electricity output has subsequently risen sharply in recent years, doubling between 2012 and 2013 (**Figure 11**) alone with a further sharp rise expected for 2015/2016 for which no official data is yet available.

Figure 10. Renewable energy capacity in the Middle East and North Africa, excluding Hydro, 2015



Source: Author based on data from IRENA (2016a)

Figure 11. Renewable electricity output (excl. Hydro) in selected Arab economies



Source: Author based on data from World Bank (2016)

Morocco has ambitious plans to further harness renewable energy sources more systematically, as part of the government's plans to reduce its country's dependency on imported fossil fuels from international markets. Formal plans include the installation of a total of 2GW of wind and 2GW of solar power generation capacity by 2020 – bringing renewable energy capacity in power generation to above 40% of the total energy mix (Ministry Delegate of the Minister of Energy, Mines, Water and Environment, 2014) and further cementing Morocco's regional position as a leading producer of renewable energy in the MENA region. In addition, Morocco's submission to the UNFCCC as part of its INDCs includes the objective to reach 50% of installed electricity generation capacity from renewable sources by 2025 (Kingdom of Morocco/UNFCCC 2015).

More generally speaking, Morocco's National Energy Strategy, adopted in March 2008 sets out renewable energy development and energy efficiency as priorities for Morocco's energy sector to meet the country's fundamental energy objectives: (i) to increase Morocco's energy independence, (ii) to guarantee energy access through secure and affordable energy supply; and (iii) to protect

the environment (Haut-Commissariat Au Plan, 2008). This framework provides ample policy space to expand Morocco's role as a clean energy producer and a frontrunner in terms of national legislation to reduce carbon output, promote "green" energy development and deployment, and reinforce overall a greater orientation towards, environmental and climate friendly activities.

CSP deployment. A particularly important role is in this context played by CSP technology, for which Morocco and North Africa offer a globally highly competitive location (CIF, 2009; Fraunhofer, 2016). Large-scale utility level investment into CSP in Morocco could in this context have significant benefits not only for CSP technology in North Africa, but globally in terms of helping accelerate global CSP deployment, thereby reducing technology costs through manufacturing economies of scale and learning effects. The World Bank's 2009 Clean Technology Fund's investment plan in North Africa specifically acknowledges this potential for significant deployment additions to be of significance beyond the region:

> *"CSP is a technology that is of particular interest to utilities, but with unexploited manufacturing scale economies: CSP could be cheaper relative to PV on a per kWh basis in most cases and is more scalable and more consistent with a centralized and dispatchable generation model. Its adoption and replication by utilities is therefore more assured. CSP is a relatively simple technology with few high-cost materials or proprietary components. If the demand for CSP is scaled up, then equipment costs can fall very substantially, since it has yet to benefit from cost savings that often come from manufacturing scale." (CIF, 2009: 3)*

This reasoning has also played a role in the allocation of significant financial resources through the Clean Technology Fund into CSP in Morocco, though this financing remains below potential in Morocco.[3] Maximising this potential for Morocco will require a further, proactive policy of pursuing precisely this advantage, securing external finance for Morocco to become a demonstration case for CSP applications and cost down-driver for the technology.

Current plans. In addition to the first phase of the Noor-Ouarzazate concentrated solar power (CSP) plant in February 2016, another two phases are planned for the time to 2018, by when the plant will have 500 MW generating capacity, making it the world's largest CSP plant, and is expected to supply electricity to 1.1 million Moroccans. Noor is also a significant step to help achieve Morocco's pledged climate goals, expected to cut Morocco's carbon emissions by as much as 760,000 tons per year (IISD, 4 February 2016). Contributing significantly to the $2bn investment in renewables in Morocco in 2015 alone, projects such as Noor have also helped raise Morocco's global ranking as an attractive destination for renewables-oriented investment, climbing into the world's top-15 in a recent ranking by Ernst & Young (L'Economiste, 1 March 2016).

Other plans include solar projects in Ain Beni Mahtar, Laayoune, Boujdour and Tarfaya, due to come progressively on stream between 2016 and 2020. Once completed, the solar energy program will mean annual savings of 1 million tons of oil and will prevent the emission of 3.7 million tons/year of CO2 (Arab Oil and Gas Directory, 2015). Phase II of ONEE's 1GW Integrated Wind Energy Program, which aims to ramp up Morocco's total wind capacity to 2GW in 2020, involves five more wind installations, located in Midelt (150MW); Tiskrad at Tarfaya (300MW); Tangier II (100MW); Jbel Lahdid (100MW) at Essaouira, and Boujdour (200MW). New capacity from

3. The investment plan is available at CIF (2009). For a database with CIF CSP projects in North Africa, see CIF (2016).

here is expected to go online between 2016 and 2020 (MEES, 19 Sep 2014).

3.3. Rooftop schemes

Another potent, though not yet overly explored area of renewable energy deployment in Morocco, is the use of solar PV for rooftop installations – both for the purpose of electricity generation and for solar water heating. Morocco's solar resources are plentiful and suitable for solar PV, and the technology for rooftop installations is easily accessible, making schemes for the promotion of rooftop solar programmes, as used for instance in Europe (see Box 3 with background about the German model). Such schemes could be transferrable to Morocco's context, for use in both urban and rural areas. Financial aid schemes such as government loans and technological assistance to rural communities could make the initial investment feasible for Morocco's middle class, making the scheme feasible in quantitative terms.

Widespread home ownership in Morocco, including among lower income households and in rural areas, means incentive structures for feed-in-tariffs (FIT) could be high – with a loan scheme at hand and guaranteed FITs for households feeding surplus electricity production back into the grid, and in view of Morocco's considerably higher solar irradiation intensity than in Germany, rooftop solar in Morocco could make long-term economic sense for many Moroccan households. Lower income homes, in turn, could be incentivised to install rooftop solar panels with the help of loans structured to account for their lower income – with realistic prospects for households to recover their initial investment eventually over time through FIT premiums and the lower cost of electricity.

Morocco's electricity tariffs are high in the context of the Middle East and North Africa, at 2013 rates of US$0.122/kWh for intermediate consumption and US$0.167/kWh for higher consumption brackets comparable to lower-cost European electricity.[4] At this rate, savings made in electricity bills through lessened grid consumption and the sale of surplus electricity generated into the grid, this could provide a viable alternative even to low-income Moroccan households to the current model; while a high uptake rate of PV rooftop installations can, as in the German case, contribute significantly towards national goals such as articulated through Morocco's INDCs to the UNFCCC in December 2015 of boosting the country's renewable energy capacity to 50% of the country's electricity mix by 2025.[5]

Box 3. Rooftop solar photovoltaic (PV) electricity in Germany

Germany has in recent years systematically promoted the installation of solar PV capacity, both ground-mounted utility-style (*Freiflächenanlagen*) and rooftop schemes (*Dachflächenanlagen*). In 2015, Germany installed about 1,5 GW of new PV capacity, corresponding to about 2% of new installations worldwide; under the German Renewable Energy Act 2014, the federal government has set down an annual target of 2.5 GW. Total PV-generated power contributed around 7.5% to Germany's total electricity generation in 2015, through Fraunhofer Institute estimates that on

4. For a cross-regional comparison of electricity tariffs in the Middle East and North Africa, see RCREEE (2013). Morocco's current electricity tariffs can be determined through Morocco's utility tariff law, available at http://81.192.52.100/BO/AR/2014/BO_6275-bis_Ar.pdf (accessed August 2016).

5. Morocco's INDC can be accessed via the UNFCCC's website at http://www4.unfccc.int/submissions/INDC/Published%20Documents/Morocco/1/Morocco%20INDC%20submitted%20to%20UNFCCC%20-%205%20june%202015.pdf.

sunny weekdays, PV power can cover some 35% of momentary electricity demand; and up 50% on weekends and holidays (Fraunhofer ISE, 2016).

A large share of Germany's PV capacity is actually rooftop-based, making private households critical to the deployment of solar power in the country; in 2014, an estimated 1,400 MW of PV capacity was installed on German rooftops versus just 500 MW of new capacity installed on the ground. This is no new trend – private rooftop schemes were from relatively at the beginning of Germany's solar power drive targeted as a key agent for the deployment of PV panels. Private households hence became investors in their own electricity supply, with considerable effort having been spent in explaining to the public the benefits of installing rooftop panels.

A series of policies have been put in place to support this deployment: with initial government loans and guarantees to incentivise home-owners to invest in PB panels, home-owners were also informed about the potential for their investments to run even after a period of time given lower use of electricity from the grid and the potential to feed in excess generation from their rooftop panels back into the grid itself. Feed-in-tariffs (FITs) that paid private rooftop solar producers a premium for electricity fed into the grid made solar panels commercially attractive for many homeowners; the average own use of solar power generated by rooftop PV installations in Germany

only amounts to some 30% of total electricity generation (BMWi, 2014); while households also save electricity costs for the electricity they did subsequently no consume from the public grid.

As a result of the rapid deployment of PV cells across German rooftops, costs for rooftop panels fell rapidly, by over 60% between 2009 and 2012 alone (BMWi, 2014). Germany manufactures PV panels, so both local businesses and national innovative capacity benefited from the programme as did private households. In 2014, the German Ministry of Economy reports German PV modules are now only around 12% more expensive than Chinese manufactured ones – effectively proving the point that under sufficient deployment and innovative work, even a high-cost labour market such as Germany can economically supply itself with PV panels. Many business have meanwhile invested in own rooftop programmes to benefit themselves from the commercial attractiveness of PV rooftop panels in Germany.

Sources: BMWi, 2014; Fraunhofer ISE, 2016.

3.4. Off-grid opportunities

Solar and small-scale hydropower offers tremendous potential in Morocco to address electricity access in remote off-grid areas. Morocco's rural electrification programme PERG (Programme d'Electrification Rurale Global) has since the 1990s shown tremendous results in providing rural communities that could not be connected to the country's main grids with access to electricity (El-Katiri, 2014a, b). PERG has operated on the basis of chosing local solutions based on local contexts: the programme reviewed local conditions to assess the viability of alternative solutions such as photovoltaic generators, small hydro turbines, wind turbines, diesel generators, and hybrid systems. Over a period of 15 years, more than 35,000 villages and some 1.9 million rural households were electrified, lifting rural electrification rates to from as low as 18% in 1996 to 97 per cent by 2009 (Agence Française de Développement, 2013).

Solar, wind and hydro power offer real advantages to rural communities over exclusive reliance on conventional fuels, because the energy source itself is independent from access to transport roads, and hence outside help. Work accompanying similar schemes in Jordan revealed that many rural communities welcomed the introduction of cleaner and supposedly low-maintenance PV generators, which avoided the running costs associated with diesel fuel (Al-Soud and Hrayshat 2004: 593).

An additional benefit of renewable energy off-grid systems is that installation and maintenance can be trained among a local stock of people, helping locals learn new skills, and help maintain their local communities. For sure, variable renewables such as wind and solar power have limitations, most importantly their lack of 24-hour coverage. Hybrid systems using diesel generators as a backup solution has been one main response in the framework of PERG – using solar and wind power when possible while relying on conventional fuels when necessary. For rural communities in particular, there would also be plenty of potential for R&D within Morocco to explore more economic forms of electricity storage, including village-based mini-grids that run on the basis of concentrated solar power (CSP).

4. Future policy priorities

4.1. Institutional capacity and job creation

Despite looking back at a relatively brief history of "green" economic planning, Morocco has some significant institutional capacity to support a clean energy transition. The Office National de l'Eau et de l'Electricite (ONEE) has been active for many years in organising and coordinating national efforts towards exploring and demonstrating renewable energy projects, notably Morocco's highly cost-effective wind farms as well as various solar initiatives, including with international credit banks and European Union initiatives. Part of this has been structural reform of Morocco's utility sector, as discussed by Amegroud (2015). To the end of increasing Morocco's capacity to benefit from renewable energy sources, three dedicated state agencies have been created:

- Agence marocaine de l'énergie solaire (MASEN);
- Agence Nationale pour le Développement des Energies Renouvelables et de l'Efficacité Energétique (ADEREE); and
- Société d'Investissements Energétiques (SIE);

Key to leveraging on Morocco's green potential within the institutional landscape in Morocco now will be the distribution of clear mandates, as well as a responsive mechanism of consulting, managing and implementing a legislative environment that proves conductive to the creation of innovative industries and R&D. A critical role within this framework will undoubtedly be played by the private sector, ranging from manufacturing to financing of project, installation, operation but also technology research. Managing this complex transition will require many institutions to work together transparently, ensuring credible investment decisions and accountability in the way public funds and foreign investment are channelled into new projects.

Individual household-based projects such as rooftop schemes and rural village-based electrification programmes require a second tier of regulatory oversight, including a transparent and credible

process from the perspective of individual households in their money transfer and, where relevant, the application of feed-in-tariffs. In addition to the creation of new government bodies and agencies, this process will need to include capacity building inside existing government entities. This is no easy task, and ensuring progressive preparation and an action agenda will prove critical to turning Morocco's vast green energy potential into a functioning market.

Diversifying into renewable energy technologies and associated R&D could also help promote Morocco as a "green" energy hub in the region – with potential for collaborative links both with Europe in the North and Sub-Saharan Africa in South. To promote and coordinate local R&D activity, Morocco established in 2011 a separate institution, the Institut de Recherche en Energie Solaire et en Energies Nouvelles (IRESEN). Separately, the Centre de Competence Changement Climatique du Maroc (4C Maroc) was more recently as a further specialised institution aimed to be a capacity-building and information sharing platform to forge Morocco's climate plans – there is potential here for collaboration with neighbouring countries. This institutional landscape focused on clean energy and climate change mitigation is already now unique in both North and Sub-Saharan Africa, though it will now need to be followed up by capacity building and action plans.

Morocco's demography is generally favourable to the aim of using renewable energy for local value chain and job creation. Its population of more than 33.8 million is young, with some 45% under the age of 25 (Haut-Commissariat Au Plan, 2016). Research and development (R&D) activities would hence be as feasible on practical grounds as would be, in principle, industrial-style manufacturing given the availability of both high-skilled and low-skilled Moroccan labour force to supply both industry strands. Spill-overs from systematic renewables deployment could also be expected for related sectors in Morocco such as construction, transportation, research and service industries (Marktanner and Salman, 2011; El-Katiri, 2014a).

Estimates by IRENA suggest the entire North Africa region could have the potential for around 16,000 jobs in renewable energy (2016: 11), a positive outlook given the comparably low new local job creation potential for conventional energy sources. An earlier World Bank study put the job creation potential significantly higher, at around 50,000 new local jobs for manufacturing components by 2025 in CSP component production alone between the five MENA economies Morocco, Algeria, Egypt, Tunisia and Jordan by 2025 in CSP component production alone (World Bank/ESMAP, 2011).

4.2. Access to external funding

Financing investments in renewable energy technologies requires systematic efforts by governments owing to the unusual cost structure of renewable energy projects – particularly its typically high initial capital costs. In the case of CSP, a technology of particular interest for scaling-up in Morocco, additional considerations include the comparably higher cost of CSP relative to existing technologies, whereby the long-term benefit of utility-style deployment in Morocco and North Africa will bring about technology cost decreases over time, but not for the immediate benefit of projects requiring funding today. Mobilising adequate financing mechanisms is hence a key element in taking up Morocco's opportunity in scaling up its renewable energy investments. Clean energy developments in Morocco may also benefit substantially from external funding options, including international finance institutional provisions as well as potential funds created in future rounds of negotiations as part of the UNFCCC climate-related clean development pledges. The Clean Development Mechanism (CDM) is one potential source of financing. The

CDM was designed under Article 12 of the Kyoto Protocol to assist specifically developing countries in emissions-reducing projects that are counted towards these countries' set Kyoto targets. It is also the main source of funding for the Kyoto Protocol's Adaptation Fund (AF) aimed to assist countries that are particularly vulnerable to the negative effects of climate change (UNFCCC, 2014). Problematic alone is that the CDM alone only covers a share of the total investment required – around 10% - and requires specific expertise (Hafner and Tagliapietra, 2013).

Past examples illustrate this funding route for Morocco. The European Bank For Reconstruction and Development (EBRD) launched a large program in November 2015 providing $250mn to private sector companies developing renewable energy projects in in Morocco, Egypt, Tunisia and Jordan (MEES, 13 Nov. 2015). The money is provided in the form of debt and equity funding for mainly wind and solar power projects. Morocco's proposed 120MW Khalladi wind farm near Tangier is expected to be the first project funded under the scheme. In response to a number of reforms to domestic electricity market regulation, the EBRD further asserted support for "a number of new business models, from direct agreements between large developers and corporate consumers to small-scale generation in communities" in Morocco and its neighbouring countries (MEES, Ibid).
Three other projects have been part-funded through the CDM: photovoltaic kits used for rural electrification in 2006; a biomass plant in Melloussa and the Jbel Sendouq-Khalladi wind farm project, both in 2012.[6] On the other hand, the over US$3 bn Noor project has been financed with the combined assistance of the African Development Bank (AfDB), the World Bank's Climate Investment Funds (CIF), as well as other World Bank financing channels and European financing institutions with specific means dedicated to helping developing countries fuel low-carbon growth initiatives, including the French Development Agency (IISD, ibid; Arab Oil and Gas Directory, 2015). The World Bank also offered financial backing for Morocco's 350MW Noor 2 and 3 concentrated solar projects (around $519mn) and the 100MW Tafilalt solar PV plant ($26mn) (MEES, 13 Nov. 2015).

A major potential source of finance for Morocco's green energy programme, alongside other clean energy transitional measures will be the Green Climate Fund (GCF) as established by the parties to the UNFCCC at COP 16 in Cancun in 2010. The last meeting, COP 21 in Paris recognized the importance of adequate and predictable financial resources for the implementation of developing countries' climate mitigation and adaptation programmes (UNFCCC, 2016a). Importantly, the meeting also emphasized a range of climate-related activities that could further help broaden Morocco's commitment to greener development, including tackling deforestation and forest degradation, conservation management, and encouraging the coordination of support from private, public, bilateral and multilateral resources (UNFCCC, Ibid).

The Gulf region could be another potential source of finance, both as part of dedicated development aid networks across the two regions and as part of more systematic collaboration on the technical side between the Gulf economies and Morocco. Morocco's close political relations with countries such as Saudi Arabia and the UAE could help provide the basis for future collaboration, particularly since both Gulf partners are themselves looking into diversifying their own energy mix towards renewable energy while also broadening their investment portfolios. For instance, cross-regional aid into Morocco could similarly be directed into clean energy projects, thereby contributing towards Morocco's energy transition and forging non-oil relations between

6. CDM projects can be accessed at the CDM's website at http://cdm.unfccc.int/Projects/projsearch.html.

the Kingdoms of Morocco and the Arab Gulf. In September 2013, the UAE pledged to provide Morocco with $100mn to support the building of further solar and wind plants in remote areas as part of the country's rural electrification efforts, a model case for future engagement in this way (MEES, 4 Oct 2013).

Renewable energy projects in Morocco could also become an investment opportunity. UAE firm TAQA, for instance, has been involved in the extension of Morocco's Jorf Lasfar's coal plant (MEES, 19 September 2014) – similar investments could be forged in renewable energy plants to feed into the strategy of many Gulf-based investment funds to diversify their investment portfolio into clean energy (Walters and El-Katiri, 2015).

4.3. Trading clean energy with Europe

Much has been said and written about North Africa's trading relationship with Europe in the case of renewable energy. The 1990s and 2000s marked enthusiastic beginnings to the idea of "clean desert power", when projects ranging from the Mediterranean Solar Plan to Desertec emerged and expectations rose dramatically for North Africa to soon play a critical role in helping Europe fulfil its members' clean energy pledges. About a decade later, a much more sober picture has emerged; Desertec has been dismantled, leaving many Europeans question the economics of North African solar power, while initiatives such as the Mediterranean solar plan have made little tangible progress.

Box 4. Past initiatives: Desertec and the Mediterranean Solar Plan (MSP)

Desertec Industrial Initiative (Dii) was created in 2009 by a group of European energy companies with the aim to produce solar and wind energy in North Africa to cover 15% of Europe's electricity needs by 2050 (Dii, 2012; Desertec Foundation, 2009). The initiative was accompanied by a separate foundation that grew out of a network of scientists, politicians and economists keen to pursue a Euro-Mediterranean renewable energy solution (OECD, 2013: 33). The overly ambitious project – some have later on called it "too expensive and utopian" (EurActive, 31 May 2013) or simply "green gigantism" (Fuchs, 2008) – has since been largely shelved owing to a combination of lacking access to financing, and changing policy frameworks in Europe including Germany's own ambitious renewable energy programme given the majority of industrial stakeholders inside Desertec were German companies (e.g. Forbes, 19 Nov. 2012; Handelsblatt, 14 Oct. 2014).

The Mediterranean Solar Plan (MSP) was initially part of the Union for the Mediterranean (UfM)'s activities centring around energy, security of supply and environmental issues across the Mediterranean, launched in July 2008 building on the "acquis" of the previously pursued Barcelona Process (EU, 2010; Jablonski, 2012). The original objective was for the UfM to "support the deployment of alternative energy sources" across the Mediterranean Sea; the creation of a total of 20 GW of new generation capacity from renewable resources was supposed to be encouraged by the European Union, through measures ranging from the support of R&D activities, the creation of appropriate financing mechanisms, to the expansion of cross-Mediterranean electricity interconnections under Art. 9 of the EU Directive on the Promotion of the Use of Energy from Renewable Resources at the time (EU, 2010). The MSP at the time included not only North Africa and Southern European countries, but also the East Mediterranean, including Egypt, Lebanon, Syria, Turkey and the Palestinian Territories.

Despite past difficulties, the reality remains that North African – including Moroccan – wind and solar power offers competitive advantages over those found in Europe. The OECD confirms that solar intensity in most of the countries in the MENA region is above that in France (OECD, 2013: 46). According to DLR data, Morocco's technical potential for solar thermal electricity generation exceeds with around 20,151 TWh/yr[7] the technical potential of Spain by a factor of twelve, and of Portugal by a factor of 46; Morocco's economic potential at a DNI > 2,000 kWh/m^2/yr is with 20,146 TWh/yr almost as high as its technical potential (DLR, 2005). And Morocco's direct normal irradiance (NDI) rates are around 18% higher than those of Spain (DLR, Ibid), providing Morocco with an economic advantage over Southern Europe with regards to CSP potential in particular.

A recent technical model by Fraunhofer Institute confirms that, in addition to fulfilling North Africa's entire own electricity demand by 2050, the region's overall renewable energy potential is so large that additional electricity exports to Europe would be very feasible (Fraunhofer, 2016: 8). The study notes in particular that:

> *"Wind power has the lowest generation costs at favourable locations, but also PV and CSP can be installed economically within this time frame. In 2050, the electricity production costs for the generation potential of 2,000 TWh / a for wind power are € 50 / MWh, for PV below 48 € / MWh and for CSP under € 56 / MWh" (Fraunhofer, Ibid)*

One factor the Faunhofer study identifies for the exploitation of Morocco's trading advantage in particular is the expansion of the country's grid capacity by 2030, in line with the development of an inter-continental European and North African transmission infrastructure that takes into account grid protection and allows for safe and efficient energy exchanges (Fraunhofer, 2016: 15, 18). Key elements among the challenges under past projects for Euro-Mediterranean electricity trade is the dominance of regional approaches – the P5+5, the "EU-Southern Mediterranean Energy Community or the general "regionalisation" of cross-Mediterranean energy relations (Ben Abdallah et al, 2013) – the result of which has in the past been modest progress, particularly in exploiting the vast potential of transporting green energy from North Africa to Southern Europe (e.g. Taliapietra and Zachmann, 2016).

To facilitate trade, Morocco not only need clean investment finance, but also, and perhaps foremostly, equal-level market access to European utility markets. This is currently not the case, as the continuation of European policies such as subsidies for their domestic renewable energy producers protect European markets from potentially lower-cost competition from external markets such as North Africa. In the coming decade, exploring options for Europe to open its market to North African clean energy as part of its commitment to, for example, the principles of the UNFCCC and the Paris Agreement's provisions to lower the EU's greenhouse gas emissions footprint, could provide a major investment incentive into clean energy in North Africa – with or without the need for additional financial loans and aid packages. Furthering such investment systematically in the future could hence benefit both European and Moroccan climate and clean energy pledges.[8]

Morocco would also offer itself within the North African context as a key trade partner with Europe, owing to its political stability. Having been largely spared by the political upheaval other

7. DLR 2005 evaluation data, based on DNI > 1,800 kWh/m2/yr

8. The author thanks Jonathan Walters for making this point in response to an earlier draft of this paper.

parts of North Africa have experienced since the onset of political uprisings, the Arab Spring in Tunisia and later Egypt and Libya, Morocco also holds politically close relations with European member states. Trade agreements with Europe exist in other areas such as agricultural products and textiles, which are based on principally the same logic future agreements on solar energy could be based: lower cost production in Morocco, traded into the European Union to reduce costs for European customers as well.

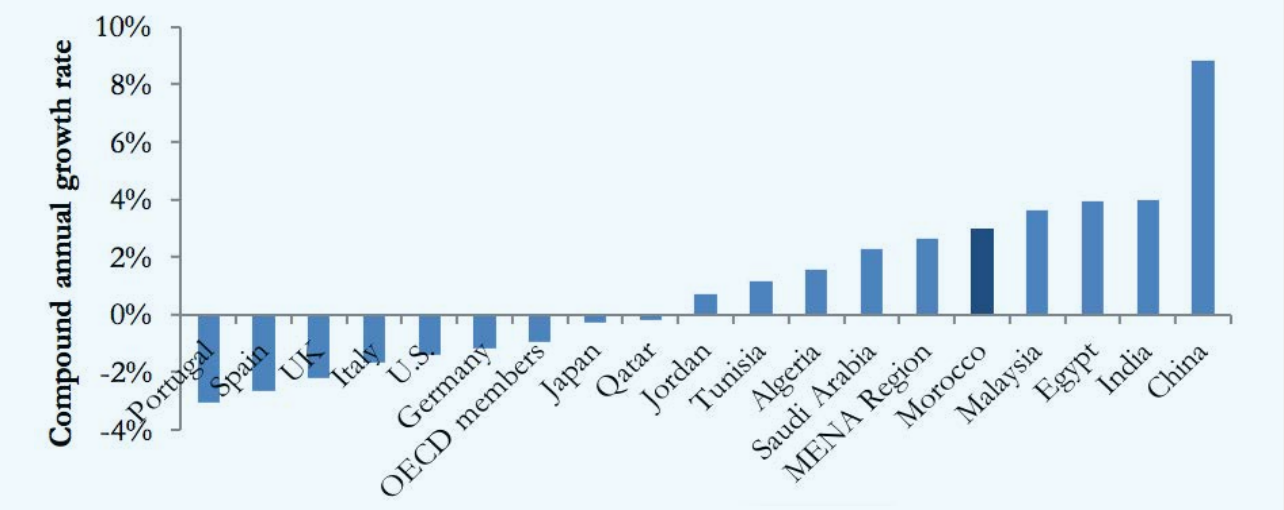
4.4. Climate change adaptation and the UNFCCC

Morocco is vulnerable to climate change induced changes to weather, precipitation, desertification as well as urban air and water pollution. IEA data suggests "a clear progression of the semi- arid climate towards the north", a trend which the agency sees will worsen in Morocco throughout the 21st century (IEA, 2014: 27; see also Ministry Delegate of the Minister of Energy, Mines, Water and Environment, 2014; Department of Energy, 2009). Overall rainfall in Morocco has been reduced in recent years by between 3-30%, in line with more frequent droughts, hitting particularly the country's agricultural sector (IEA, Ibid). The Department of Energy foresees an increased frequency of droughts in the southern and eastern provinces in the future, along with greater risk for thunderstorms and reduced snow in the Atlas mountains (Department of Energy, 2009). In addition, climate-oriented policy action offers Morocco the opportunity to seek access to finance for green technologies via mechanisms such as climate funds.

Morocco ratified the 1992 United Nations Framework Convention (UNFCCC) in 1995 and the Kyoto Protocol in 2002. It also hosted the seventh session of the Conference of the Parties (COP 7) in Marrakech in 2001, which enacted the Kyoto Protocol. In preparation of the previous round of negotiations, COP 21 in Paris in December 2015, Morocco was the first Arab country to submit its INDCs (or Intended Nationally Determined Contributions). Morocco's role in hosting the next session, COP 22, in November/December 2016 in Marrakesh will undoubtedly be another opportunity to strengthen its role in contributing towards positive and constructive global climate change negotiations and the enactment of green, environmental and climate-friendly policies, including domestically.

Morocco's fossil fuel-based energy mix coupled to rising energy and electricity consumption, has meant that the country's carbon footprint has been growing rapidly in recent years (Figure 12). Albeit with around 1.74 metric ton per capita still at the lower range – which largely reflects Morocco's comparably low levels of electricity consumption on a per capita basis. Morocco epitomises the challenged faced by middle-income developing countries in positioning themselves within global climate negotiations in a way that does equal justice to climate change concerns and domestic development objectives, including universal access to affordable energy.

Figure 12. Compound annual growth rate in CO2 emissions in selected countries, 2002 -2011



Source: Author, based on World Bank (2016)

Morocco therefore has a very pragmatic interest in positive negotiations progress at the coming COP meetings. In its INDCs submitted, Morocco states the need for "a legally-binding agreement under the auspices of the UNFCCC" as part of the country's ability to access sources of finance for its ambitious climate and renewable energy goals; around three-quarters out of the estimated total of $45 bn investment needs linked to Morocco's climate objectives will depend on access to external climate finance mechanisms such as the Green Climate Fund (Royaume du Maroc/ UNFCCC, 2015). Being President of COP 22 in December 2016 in Marrakesh will provide a key opportunity to help translate last year's initial agreement into positive, quantifiable action for other developing countries as well.

5. Conclusions

Morocco's renewable energy resources provide the country with plenty of potential to explore a future energy route that differs from that chosen in the past; in particular, involving a systematic turn away from just fossil fuels towards a more diversified energy mix, but also a potential regional front-runner role in demonstrating economically clean energy technologies – including renewable energy systems, but also regulatory approaches that incentivise clean self-generation and an overall more eco-friendly, more efficient way to consume energy.
The challenges Morocco hereby faces have been 's summarised by policymakers back in 2009 accurately:

> *"The real challenge lies in the ability to find the right balance between development requirements and the desire to reduce greenhouse gases emissions and ensure a rational exploitation of natural resources. Hence the need to foster a dynamic growth of green and adopting appropriate metrics." (Department of Energy, 2009: 5)*

Many of the obstacles to the full exploitation of Morocco's opportunities are known; they include regulatory hurdles and familiar issues related to red-tape and transparency, which keeps particularly small-scale investors and the residential sector from driving more of the many opportunities Morocco's market has to offer. While public infrastructure and services remain in some cases poor, Moroccan labour costs compare to those of Southern European neighbouring countries with functioning bureaucracies that are also located within the Euro-area. To attract more European investment, even more so at times of financial crisis, Morocco will need to make institutional efforts to compete on a more equal basis for investors. The positive element in this context is that many of these factors are in policymakers' hands.

The 22nd session of the Conference of the Parties (COP 22) to the UNFCCC in Marrakesh in November 2016 could be an important opportunity for Morocco to demonstrate its regional lead position in driving renewable energy deployment and in promoting the preconditions for a regional and global energy transition towards cleaner energy. Morocco's own position within this framework is unique, because in driving the meeting's agenda, Morocco's experience could also fortify the case for the complementarity of energy access, socio-economic development and clean energy provision under competitive frameworks that are attractive to investors and benefit consumers. Having this message come from a country that itself spent the past twenty years providing all of its population with access to modern energy technologies could provide a highly credible call to the COP process, while Morocco could also play a role in facilitating the design of a global climate agreement.

Making use of the opportunity Morocco faces in positioning itself as an energy-trading hub between Europe and North Africa will likewise require strategic long-term planning and negotiation. The potentially most important factor creating the right conditions for clean electricity trade between North Africa and the European market would be the removal of European barriers to such trade, in particular protectionist measures such as subsidies for renewable energy inside the European market. Rather than offering Morocco direct climate finance in the form of loans or development aid, Europe could initiate large potential investments into Moroccan CSP simply on the basis of removing trade barriers – a powerful tool which both sides should explore more attentively. COP22, but also future meetings between Morocco and the EU could be used to specifically target this point – deemed to be a major potential investment incentive into clean energy in Morocco, particularly in CSP.

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