The World Bank

The African Development Bank

CTF Trust Fund Committee

Joint AfDB-WB Submission Document

Morocco: Noor 2&3 Concentrated Solar Power Project

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Abbreviations

AfDB	African Development Bank
CCGT	Combined Cycle Gas-fired Turbine
CSP	Concentrated solar power
CTF	Clean Technology Fund
CO_2	Carbon dioxide
DNI	direct normal irradiance
EIB	European International Bank
ESIA	Environmental and Social Impact Assessment
ESIAF	Environmental and Social Impact Assessment Framework
GHG	greenhouse gas
GoM	Government of Morocco
IBRD	International Bank for Reconstruction and Development
IFI	international financial institution
IP	Investment Plan
KfW	Kreditanstalt fur Wiederaufbau
LCOE	Levelized cost of energy
LLC	limited liability company
MASEN	Moroccan Agency for Solar Energy
MENA	Middle East and North Africa
NIF	Neighborhood Investment Facility
NO_x	Nitrous oxide
ONEE	Office National de l'Électricité et de l'Eau Potable
PV	photovoltaic
PPP	public-private partnership
SO_2	Sulfur dioxide
SPC	Solar Power Company
WB	World Bank

Weights and measures

GW	gigawatt
KWh	kilowatt-hour
m^2	square meter
Mm^3	thousand cubic megameter
MW	megawatt
TWh	terawatt-hour

Currencies

€	Euros
$	United States Dollars

A. Strategic Context

Global and Regional Context

1. **Climate-friendly development trajectories are in the public interest.** A 2014 report by the IPCC shows that global emissions of greenhouse gases (GHGs) have risen to unprecedented levels despite a growing number of policies to reduce climate change. Emissions grew more quickly between 2000 and 2010 than in each of the three previous decades. According to the Working Group III contribution to the IPCC's Fifth Assessment Report, it would be possible, using a wide array of technological measures and changes in behavior, to limit the increase in global mean temperature to two degrees Celsius above pre-industrial levels. However, only major institutional and technological change will give a better than even chance that global warming will not exceed this threshold.[1]

2. **The Energy Sector is the largest single source of GHG emissions.** In the MENA region, carbon dioxide emissions account for 83 percent of total regional GHG emissions and have increased by approximately 71 percent from 1990 to 2010, mostly resulting from electricity generation and heating (45 percent) and gas flaring (13 percent).

3. **Reduction of GHG emissions is a global public good.** While traditional environmental issues are more amenable to local solutions, reduction of GHG emissions to alleviate human impacts on the climate system has long been recognized as a global public good. Changes to the climate system caused by emissions from all sources in all nations are an inherently global public goods problem.

4. **Historically, energy was perceived in the MENA region as a public good.** Although climate change initiatives garnered attention in some Middle East capitals as part of long-term public policy, energy was and, to a large extent, continues to be viewed in many countries in the region in short- to medium-term economic perspectives. The region has long been recognized for abundance of its energy resources that has made it a global energy supplier. Its energy wealth spurred rapid development of energy-intensive industries in some countries as well as domestic energy consumption growth rates that dwarfed global averages. Much of these developments were caused by domestic policies that identified energy as a public good to be provided by governments, if not for free, then at prices that were, in many cases, far below its market value. These policies involved both implicit and explicit subsidies across different fuel types and electricity at all levels of production (wholesale supply, distribution, and retail). Only Morocco and the Palestinian territories had electricity tariffs that were close to levels in the European Union, though both subsidize electricity, implicitly and explicitly, suggesting that the actual cost of generation may well exceed these already high prices.

5. **Renewable energy development is an economic imperative for net energy exporters.** Traditionally, many countries in the MENA region viewed the cost of energy in terms of subsidized long-run marginal cost of production per unit of energy, not in terms of

[1] Climate Change 2014: Mitigation of Climate Change", the third of three Working Group reports, which, along with a Synthesis Report due in October 2014, constitute the IPCC's Fifth Assessment Report on climate change

the opportunity cost of this unit in the international market. The resulting distortion made fossil-fuel generation a favored incumbent that was difficult to replace with any other form of generation. While net energy exporters in MENA may have been able to support this policy in the past, their rapidly growing population and its attendant substantial increase in domestic energy consumption have made the economic costs of such distortions increasingly evident. As a result, even energy-rich countries like Saudi Arabia, Qatar, Bahrain, and Kuwait began to consider developing renewable sources of electricity generation as an alternative to ever-increasing pressures on the countries' hydrocarbon resources.

6. **Renewable energy development is a tool to ensure energy security for net energy importers.** Net energy importers (e.g., Morocco, Egypt, Tunisia, and Jordan), on the other hand, faced a different problem. While net energy exporters had to contend with the negative implications of the opportunity costs of subsidizing domestic energy consumption, net energy importers had to actually fund the subsidy from the public budget. As domestic consumption increased, so did the fiscal pressure from their domestic pricing policies. Increases in both absolute global oil prices and levels of price volatility since 2000 have made this problem even more acute. Even as some of these net energy importers started to reform their domestic energy pricing strategies to focus more on targeted subsidies and reduce their overall fiscal impact on their national budgets, exposure to price shocks and risks to their energy security (i.e., access to secure energy supplies at affordable prices) only transferred to the broader economy. These risks manifest themselves in much higher costs of energy that raise affordability issues to individual consumers and competitiveness issues to the broader industrial and commercial sectors. Consequently, aggressive renewable energy strategies, as a hedge to exposure to oil price shocks and a key to energy security, seemed reasonable.

Country Context

7. **Morocco is strategically located but energy constrained**. Morocco is strategically located in North Africa with a population of 32.7 million (2013 est.). Its population is relatively young, with over 45 percent under 24 years old, and has a growth rate of 1.04 percent.

8. **Morocco is the largest energy importer in MENA**. Morocco's oil and natural gas reserves stand at 680,000 barrels of oil (bbl) and 1.444 million cubic meters (cu. m.) (2013 est.), respectively, with domestic production standing at 5,057 bbl/day (2012 est.) of oil and 60 million cu. m. (2010 est.) of natural gas. Although the country has some coal reserves, it made the decision in 2000 to close its domestic mines for environmental reasons and currently relies on imported coal. With domestic oil and gas consumption at 123,000 bbl/day (2010 est.) and 560 million cu. m. (2010 est.), respectively, Morocco imports well over 95 percent of its domestic energy needs, making it the largest energy importer in the MENA region. Despite having a per capita energy consumption rate (0.52 tons of oil equivalent (Toe), 2011 est.) that is less than a third of the world average (1.7 Toe, 2011 est.), Morocco's future economic development, which is heavily focused on energy-intensive industries (e.g., chemicals, construction, etc.), building its infrastructure base, and tourism, will likely increase its long-term energy needs. As a result, Morocco is particularly vulnerable to fluctuations in international energy prices and to supply shocks that could range from availability of supply and political externalities (e.g., international embargo on Iranian oil) to logistical issues such as late deliveries, pipeline disruptions, and bad weather.

9. **The increasing fiscal burden of the country's domestic energy pricing policies is adding pressure on the public budget.** Until recently, Morocco, like many countries in the MENA region, followed a domestic energy pricing policy that universally subsidized end-users. Prices were historically fully indexed to market rates until 2000 when energy markets experienced significant increases and volatility. Since then, the Government of the Kingdom of Morocco (GoM) adopted an administrative pricing policy that fixed the domestic costs of energy and covered the difference between this price and cost-recovery rates from the national budget. However, the GoM adopted administrative prices, particularly for electricity, that were close to levels in the European Union, and, as a result, Morocco had one of the lowest subsidy rates in the MENA region. Nonetheless, the fiscal impact of this subsidy policy continued to exert pressure on the national budget and, in 2012, the GoM instituted reforms that aimed to reduce this pressure through a more targeted approach that focused on providing help where it is most needed.

10. **Morocco is at the forefront of climate-friendly policies in the region.** Besides the clear economic rationale behind Morocco's need to diversify its domestic energy use away from fossil fuels, the country has also been at the vanguard of climate-friendly policy supporters. Morocco recognized the public interest in adapting and mitigating the impact of climate change on its population.

11. **Energy security and climate-friendly development policies are key public initiatives.** In 2009, the country adopted a progressive energy sector development plan that committed to increasing the country's share of renewable energy generation to 42 percent of national capacity by 2020. In addition, in 2010, Morocco adopted a 'National Plan Against Global Warming' under which it adopts a two-pronged strategy: (i) to decouple Morocco's economic growth and its greenhouse gas emissions; and (ii) to reduce its vulnerability by adapting to climate change.

Sectoral and Institutional Context

12. **Morocco's power sector is dominated by l'Office National de l'Electricité et de l'Eau Potable (ONEE).** With the exception of renewable energy produced under the framework of Law 57-09, ONEE acts as the single buyer in the sector, owns and manages the entirety of the transmission system, generates 39 percent of the power in the country, and distributes almost 60 percent of the electricity to 4.5 million customers. The balance of the country's 6,910 MWs of generation capacity, which consists predominantly of thermal generation, comes from Independent Power Producers (44 percent) and imports from Spain (15-18 percent).

13. The Moroccan Solar Energy Agency (MASEN) was established by Law 13/09 to develop and manage the 2,000 MW of solar power facilities envisioned under the National Plan Against Climate Change and the Moroccan Solar Plan (MSP). MASEN made the strategic decision to focus a large part of its 2,000 MW program on development of solar plants using CSP technology with thermal storage.[2]

[2] MASEN's first solar complex, originally called the Ouarzazate Solar Complex, was later dubbed the 'Noor' Complex, with the first 160 MW phase (hereinafter referred to as 'Noor I') of the 500 MW complex.

14. While CSP generation presents clear benefits to grid operations and system costs, its relatively higher capital costs, when compared to PV and traditional fossil fuel technologies, have practical financing implications. These costs are expected to decline by 40-50 percent over the next 10 years.[3] Until then, however, governments need to address sustainability of the investment from a financial and fiscal perspective much in the same way as was needed for wind power and PV technologies in early stages of their development.

15. Within this context, the GoM adopted a combination of programs to support its CSP investment in Noor I. The GoM sought and secured concessional financing to cover the entirety of the debt required for construction. The African Development Bank (AfDB) and the World Bank participated in this financing, along with the European Investment Bank (EIB), l'Agence Française de Développement (AFD), Kreditanstalt für Wiederaufbau (KfW), the German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (BMU), and the European Commission under the Ouarzazate I Concentrated Solar Power Project (Noor I Bank Project). A key element of this project is support under the MENA CSP Program provided by the Clean Technology Fund (CTF) that made available US$197 million financing with heavily concessional terms.

16. Moreover, the GoM is expected to provide MASEN annual cash subsidies to cover the difference in the costs of power MASEN has to pay to Noor I's private sector sponsors and the revenue it expects to receive from selling this power to ONEE.

17. As far as the impact of this option on Morocco's economic development is concerned, a 2011 report on the local CSP manufacturing potential in the MENA region found significant potential economic gains from developing a regional industrial base.[4] As MASEN's program matures, it is envisaged that Moroccan industries will be able to provide assembly and production of certain components as well as an increasing percentage of the non-equipment components of the plants.

B. Project Rationale for the Involvement of the Clean Technology Fund

18. On 2 December 2009, the CTF Trust Fund Committee[5] endorsed the Investment Plan (IP) for Concentrated Solar Power (CSP) in the Middle East and North Africa (MENA) Region, which seeks to mobilize US$5.6 billion, including US$750 million from the CTF, to accelerate the deployment of CSP through the CSP expansion programs of Algeria, Egypt, Jordan, Morocco and Tunisia. Specifically, the IP will equip MENA to capitalize on its unique geography to mitigate global climate change through the installation of about 1 gigawatt (GW) of CSP generation capacity, amounting to about 15% of the projected CSP global pipeline and, therefore, doubling global CSP installed capacity compared with the 2009 baseline. The MENA CSP IP aims to act as a demonstrator: the project consists of co-financing nine commercial-scale power plants capable of generating around 1 GW over three to five years and two transmission projects designed to improve the Mediterranean grid and

[3] In fact, the capital costs bid for Noor I were 30 percent lower than the prevailing market price at the start of the procurement process, thus confirming the downward trajectory of future CSP costs.

[4] *See* Ernst& Young and Fraunhofer Institute, *Middle East and North Africa (MENA) Region Assessment of the Local Manufacturing Potential for Concentrated Solar Power (CSP) Projects*, The World Bank and ESMAP (2011) (hereinafter referred to as the "Local Manufacturing Assessment").

[5] The MENA CSP CTF IP was updated in November 2010 and May 2013.

increase exports. The MENA CSP IP had earmarked US$197 million for Morocco's Noor I/Ouarzazate Phase I project, which was channeled by the World Bank and the AfDB. For Noor II & III an additional amount of US$238 million are being made available.

19. Of the countries where the MENA CSP IP is to take place, Morocco proposes the most capacity and is the first to launch the development of a project, namely, the ambitious Noor solar power complex near the town of Ouarzazate, which includes Ouarzazate I/Noor I, as a first phase of 160 MW being implemented, and a second phase consisting in Noor 2 and Noor 3 with 350 MW at the stage of evaluating the technical bids. The Noor Solar Complex is one of the largest planned CSP plants in the world.

20. The World Bank, the AfDB, the European Investment Bank (EIB), the Agence Française de Développement (AFD), the Kreditanstalt fur Wiederaufbau (KfW) and other international financial institutions are involved with MASEN in the competitive selection of one or several qualified and financially robust private partners to establish a public-private partnership (PPP) that would be responsible for preparing and implementing the second phase of the Ouarzazate CSP plant (Noor 2 & 3). This second phase consists of 2 distinct plants: (a) a 200 MW parabolic trough CSP plant (Noor II) and (b) a 150 MW solar tower CSP plant (Noor III). Both plants are to be constructed on lots adjacent to Noor I that have already been acquired by MASEN. Four potential private partners have already been prequalified.

21. Although initially considered, the Ouarzazate/Noor projects will not export electricity in the short to medium run since the European market is not yet ready to absorb renewable energy imports from outside the European Union (EU). Therefore a higher amount of concessional financing is necessary to make the project economically and financially viable, without unduly burdening the State budget. The CTF's allocation to Morocco of US$238 million for the Noor II & III plants needs to be blended with loans and grants from the World Bank, the AfDB, and other financiers so as to reduce government subsidies to an affordable level. The financial analysis of the proposed project indicates that important government subsidies will be required to bridge the incremental cost gap because of the higher generation costs of CSP compared with the power that Noor II & III are shown to be displacing according to Morocco's least cost expansion plan. The main alternative is thereby power plant fueled by LNG.

22. The proposed loan and grant package from multilateral and bilateral donors, especially the CTF's portion, is essential for MASEN to initiate the implementation of Morocco's ambitious solar development plan. The financial support of the World Bank, AfDB, CTF and other financiers will establish MASEN as a solid partner for private developers, allowing the government to scale up solar development and reach its target of installing 2000 MW by 2020.

23. The financial analysis shows that the CTF contribution will lower the CSP levelized cost of electricity (LCOE) by about 10% depending on the assumptions made in the terms and conditions of the loans that would be replaced by the CTF. Beyond its direct financial impact, however, the CTF continues to be instrumental in bringing in other donors. Together, they will strongly reassure private sponsor(s) about Morocco's willingness and capability to subsidize solar electricity over a long period of time. This reassurance will be especially useful in the current political context in the MENA region, and will help keep the equity rate of return required by the sponsor at a reasonable level, as this was the case for Noor I. The

sensitivity analysis with the Boor Solar Complex financial model shows that the project's LCOE could vary moderately by about 12 percent, using a base case of 12 percent return on equity and varying the later by plus minus 5 percent. The required level of equity return is reflective of the sponsor's perception of risk.

24. The project was assessed using CTF investment criteria and that assessment is presented in the Annex. The main points that justify the use of the CTF funds for Noor II and III are highlighted in this section:

25. CO_2 savings are estimated at 240,000 tonnes per year for Noor I (160 MW) and 521,670 tonnes per year for Noor II & III (350 MW), corresponding to 761,670 tonnes per year for the planned 510 MW of CSP at the Noor Solar Complex. Over the 25 year-lifetime of the CSP plants, the cumulative emissions reduction of CO_2 is an estimated 6 million tonnes for the 160 MW first tranche, 13 million for Noor II & III, corresponding to 19 million tonnes for the 510 MW Noor Solar Complex. The full Morocco Solar Plan would reduce emissions by 92 million tonnes. The CTF cost of each tonne of CO_2 saved would amount to approximately US$ 29 for Noor I and US$ 18 for Noor II & III.

26. The potential for saving greenhouse gas emissions will be increased through replication. The proposed project is the second phase of the first site in Morocco's 2,000 MW Solar Plan. The proposed project has high transformational potential. At the country level, it will help develop a sound foundation for the successful implementation of Morocco's 2,000 MW Solar Plan. At the regional level, it is the most ambitious project to involve a PPP, and will serve as a model for the other countries participating in the MENA CSP CTF IP. At the global level, Ouarzazate/Noor I, II & III is one of the largest CSP projects under preparation to date.

27. The development of solar energy will help diversify the energy mix and enhance energy security. Morocco's Solar Plan will also contribute to industrial development, competitiveness and job creation. A study of local manufacturing potential[6] indicates that the full 2,000 MW program could create 11,000 jobs.

28. Public policies and institutional arrangements are very supportive of the Noor Solar Complex project. A renewable energy law was approved in late 2010 and an agency dedicated to solar energy (MASEN) has been created. In addition, both the AfDB and the World Bank are committed to enhancing the policy framework for the sector, supporting reforms to improve the sector's functioning, and promoting the development of renewable energy on a large scale.

C. Project Development Objectives

29. The Project's PDO is to (a) increase the installed and production capacity of the Noor Solar Complex and (b) demonstrate feasibility of innovative tower CSP technology in Morocco.

[6] Ernst & Young et Associés, Fraunhofer Institute for Solar Energy Systems ISE, and Fraunhofer Institute for Systems and Innovation Research ISI. January 2011. *Middle East and North Africa Region: Assessment of the Local Manufacturing Potential for Concentrated Solar Power (CSP) Projects*. The World Bank and the Energy Sector Management Assistance Program.

D. Project Beneficiaries

30. The project has a variety of beneficiaries at local, national and global levels. Moroccans are expected to benefit through the future supply of reliable green energy. Morocco will also be able to increase its energy security, gradually develop a local solar industrial and a research/development base, and develop interior regions of the country. As part of the project design, MASEN is expected to use each bidding process for the plants under the Morocco Solar Plan to encourage development of local manufacturing capacity.

31. Based on the experience with Noor I, MASEN anticipates that procurements equivalent to at least 35% of the Noor II and III's costs would be sourced locally, which should help stimulate development of Morocco's industrial base and create jobs. In the area around Ouarzazate, local authorities and the population will continue benefiting from the economic and social development opportunities that the project can bring, as successfully demonstrated in Noor I, particularly with regard to playing a catalyst role in the development of this semi-desert region.

32. At the regional and even global level, the project is expected to have transformational effects, not only on Morocco and its energy system, but also on the MENA region and Europe. Morocco is expected to significantly contribute to the scale-up of CSP technology with strong learning effect, and to subsequent reductions in the technology's costs, thus achieving wider global benefits. The learning cost curve estimates indicate that the Noor Solar Complex can be expected to reduce the global cost curve for CSP by 3 percent, while the 2,000 MW Morocco Solar Plan, if it relied solely on CSP, would be capable of reducing global CSP costs by 13 percent compared with installed capacity in 2013/24.

33. Morocco's contribution to shifting the global technology cost curve will also contribute to the country's long-term economic viability and making it more attractive regionally and globally. Finally, and as discussed above, other global positive impacts of Noor II & III include avoided greenhouse gases emissions of 521,670 tonnes of CO2 equivalent per year.

E. Project Development Objective (PDO) Results Indicators

34. The PDO level results indicators are:

(a) Generation capacity of renewable energy constructed under the Project (MW);
(b) Private capital mobilized (US$ million);
(c) Tower project operating within 20 percent tested capacity as agreed in the PPA;
(d) Direct project beneficiaries (number), of which are female (%); and
(e) Avoided GHG emissions (tons of CO_2 annually).

F. Project Description

35. The Project will support MASEN's implementation of the second, 350 MW phase of the Noor Solar Complex. This second phase consists of 2 distinct plants: (a) a 200 MW parabolic trough CSP plant (Noor II) and (b) a 150 tower CSP plant (Noor III). Both plants would be constructed on lots adjacent to Noor I that have already been acquired by MASEN.

The Project is presented to the AfDB and the WB respective Boards for approval in advance of the conclusion of the procurement process to select private-sector sponsors to implement Noor II and III. As was the case with the Noor I the AfDB and the WB Project, this is important to provide bidders with sufficient comfort that the full financing for the project had been committed and, in particular, that the critically-important financing from CTF was secured. As discussed further below, the heavily concessional nature of CTF funds is key to reducing the project's financing costs, thus critical to the financial viability of the venture.

36. To support development of Phase II, the Project will consist of two components:

37. **Component 1 – Construction of Noor II and III (US$238 million from CTF, US$100 million from IBRD and US$123 million from AfDB):** As discussed above, until the costs of CSP technology is more in line with levels comparable to traditional technologies, there is a need for support to either reduce the project's overall cost or increase its revenues. Analysis of Noor I's financial structure indicates that the project's levelized cost of energy is highly sensitive to changes in capital costs, the biggest component of the project's total costs. It is estimated that the capital costs bid for at least Noor II (which is based on the same type of technology used for Noor I) would be less than those bid for Noor I.

38. MASEN has prequalified 4 very experienced international consortia for the projects, and a highly competitive bidding process is being anticipated. Three of these consortia are bidding for both Noor II and III, and one consortium is bidding for only Noor III. MASEN has issued the request for technical proposals in December 2013 in a 2-stage bidding process that is designed to award both projects as a package. This approach is expected to incentivize bidders, particularly those bidding for both projects, to optimize their technical design to ensure that MASEN receives the best possible price from both projects together. Furthermore, unlike Noor I, Noor II and III's minimum functional specifications have been optimized to maximize the number of peak-hour generation from the plants. Peak-hour generation yields higher value to MASEN and ONEE because it is expected to displace more expensive generation on the grid from combined-cycle gas turbines using imported liquefied natural gas.

39. Nonetheless, the magnitude of any such savings is not expected to be sufficient to mitigate the incrementally higher plant costs when compared to the system cost of power. As such, support mechanisms (e.g., grants) designed to reduce or buy-down the capital costs would likely be the best tools to bring about the necessary reductions. Noor I's financing package included grants from the EU's Neighborhood Investment Facility (NIF) and BMU. However, the amounts of grants made available were insufficient to cover the incremental capital costs. MASEN hopes to receive some grants for Noor II and III, but, because the plants' project costs and aggregate capacity are expected to be more than double those of Noor I, these are unlikely to be sufficient to cover the full incremental costs.

40. In the absence of additional sources of grant funding to bring down the capital costs, the next step is to attempt to reduce as much as possible the other categories of costs. It is expected that competitive pressures will help reduce project development/owner costs, as well as contingencies and other project costs, to its lowest reasonable levels. This leaves financing costs. As such, Component 1 of the proposed Project will support the formation of a PPP between MASEN and each of the bidders competitively selected to develop the two plants.

Concessional funding of US$238 million from CTF (representing approximately US$680 of CTF support per kW of installed capacity in comparison to US$1,231/kW for Noor I) under this component would partially cover construction of the plants. These funds are expected to be on-lent by MASEN to each of the privately-owned special purpose vehicles (SPVs) formed by the selected bidders to design, construct, own, operate, and maintain the two plants. The balance of the funding required to complete construction is expected to be provided through co-financing arrangements with AFD, AfDB, EIB and KfW, as well by the selected bidders through equity investments.

41. **Component 2 – Cost Mitigation Mechanism (US$ 300 million from IBRD):** While CTF funding under Component 1 is key to reducing the financing costs, it is not expected by itself to reduce the levelized cost of energy from the plants to parity levels with the wholesale cost of power on ONEE's system. As such, as was the case with Noor I, it is envisaged that MASEN will need GoM support to cover the incremental difference between the revenues it receives from ONEE for the sale of power from Noor II and III and MASEN's costs to purchase this power from the competitively-selected private sector sponsors. In the short-term, this support is expected to reduce the level of subsidies needed for electricity generation, thus reducing the fiscal burden on the GoM from its current fossil fuel pricing policy. In order consolidate this support in one component, Component 2 is designed to provide support for the entire Noor Complex (i.e., Noor I, II, and III). It is thus envisaged that similar support provided from IBRD for Noor I under the Ouarzazate I Concentrated Solar Power Project would be restructured.

42. In the short terms the annual subsidies of fossil fuel, which are estimated at US$ 5.5 billion annually dwarf any subsidies for solar power. In the long-term, however, it is expected that the GoM would substantially reduce, if not entirely eliminate, fossil fuel subsidies. Reforms have already begun. In 2013, the GoM began pricing reform at the level of the transport fuels, and in 2014 a new performance contract is being agreed with ONEE, which is to phase out subsidies of heavy fuel oil for power generation.

43. Thus, there is a need for a programmatic approach to provide the envisaged GoM support to MASEN in a manner that preserves MASEN's financial viability and health, while, at the same time, reduces the fiscal burden from this support on public finances. Governments around the world adopted approaches to deal with this issue that included using direct government funding, in the form of capital grants to buy down a project's capital costs to a level that brings its levelized cost of energy (LCOE) in line with system costs (e.g., cost mitigation funding mechanisms adopted in India, Indonesia, and Vietnam), and tax policy (e.g., investment tax credits in the US). Such more permanent solutions should be sought downstream of the Noor Solar Complex project.

44. Some of the most important long-term benefits of CSP are expected to come from the local manufacturing of component. A 2011 assessment[7] by the Fraunhofer Institute and Ernst & Young estimated that realizing 1 GW of installed CSP capacity by 2020 in the MENA region will have a direct and indirect local economic impact of US$2.2 billion, assuming a local manufacturing share of 30.6% by 2025. Should the installed capacity increase to 5 GW

[7] WB/ESMAP. MENA region assessment of the local manufacturing potential for CSP projects. Fraunhofer ISI/ISE and Ernst&Young. 2011

(including 2 GW of exports), the local economic impact would surge to US$14.2 billion, with a local manufacturing share of 56.6%.

45. In May 2013 and as part of the MENA CSP IP program a dedicated Technical Assistance Program was approved in principle and is being submitted along to the CTF trustfund committee along with the submission of the Noor II & III project. The purpose of the Technical Assistance program is to support local manufacturing of CSP components in the region and service provision and to improve market and regulatory frameworks in the participating countries. This is expected to help countries such as Morocco harness the benefits of CSP.

G. Project Financing[8]

Table 1: Noor 2 &3 Financing Scheme
US$ Million

Project Components	Project cost	AfDB Financing	IBRD Financing	CTF Financing	% Financing of CTF
1. Noor II and III Construction (including contingency financing)	2723	123	100	238	8.7 %
2. Financing Support Mechanism	300		300	0	
Total Project Costs	3,023	123	400	238	

H. Lessons Learned and Reflected in the Project Design

46. There were several lessons learned from Noor I's process that MASEN incorporated into the technical design of Noor II and III as well as the structure and approach of the procurement process followed for selection of the private sector sponsors. These lessons include:

- Optimizing the plants' technical design: Noor I was procured on the basis of minimum technical specifications that required 3 hours of thermal storage. Storage is critical in the plant's design as it is the means by which the plant could meet the country's critical evening peak electricity demand when the cost of generation on ONEE's system is highest. The plant design was not optimized to maximize the amount of energy available to meet this peak period. To address this issue, MASEN made the minimum technical specifications of Noor II and III more flexible, specifying instead the minimum amount of peak hour generation needed from the plants. MASEN left it to bidders to propose an optimized plant design to meet this peak hour requirement and offer the optimum size of thermal storage needed subject to utilizing a minimum of three hours of storage. In this way, MASEN anticipates that peak hour generation from Noor II and III would far exceed the amount now expected from Noor I, and, as a result, generate more revenues to MASEN from the sale of power on ONEE's system. This approach leaves bidders flexibility to explore

[8] For confidentiality reasons, as the Noor II and III RFP process is under way, detailed figures are not provided and will instead be presented at the Trust Fund Committee meeting.

innovative approaches to meeting this requirement while minimizing the amount of thermal storage needed, which could also significantly impact the plants' capital costs.

- Accelerating the Schedule to Reach Financial Close and Start of Construction: Because Noor I was the first plant in MASEN's program, the agency did not yet have model procurement documents and legal agreements to use. MASEN developed these documents during the procurement process and the subsequent negotiations that took place with the selected private sector sponsor for Noor I. As a result, Noor I's procurement took some time to complete, and the process to develop and negotiate the related legal agreements that followed award of the project took over a year. For Noor II and III, MASEN expects to include in the procurement documents, which were largely based on those developed for Noor I, almost fully developed legal agreements for bidders to review and comment on during the procurement process. MASEN expects that bidders submit initialed versions of these agreements as part of their final bids. Although some negotiations to finalize the documents may still be needed after award, it is envisaged that the timeframe to reach financial close and start of construction (and disbursements) would be far quicker than experienced on Noor I.

- Accelerating the process of completing the plant-specific environmental and social impact assessment: In Noor I, the plant-specific environmental and social impact assessment was started after award of the project and determination of the exact technology to be used for the plant. This work, which included public consultations and disclosure period, took some time to complete. To accelerate this process, MASEN included in the bidding documents terms of reference for consultants to be hired by bidders to undertake most of the assessment during the procurement process. Bidders are required to submit a draft of the assessment as part of their final bids. Once the selected bidder(s) are identified and awards are announced, the bidders can begin their public consultation process and subsequently disclose the assessment(s), after Bank review, for the requisite disclosure period. This approach is expected to accelerate the timeframe for start of Noor II and III's construction when compared with Noor I's schedule.

I. Implementation

Institutional and Implementation Arrangements

47. MASEN was formed by Law 57-09 to implement the MSP and thus responsible for defining all the technical, safeguards, and fiduciary aspects of Noor II and III. As illustrated in Figure 1, the proposed Project is expected to be implemented through public-private partnerships (PPP) between MASEN and the private sponsors that will form SPVs, which will be the proposed Project's Implementing Entities, to design, construct, own, operate, and maintain Noor II and III. The sponsors are expected to be selected through a 2-stage competitive procurement process that is now in an advanced stage. The first stage involves technical bids to meet MASEN's minimum functional specifications.

48. This allows MASEN the opportunity to evaluate the technical proposals and any innovative approaches offered by bidders to meet the requirements. It also allows more clarity on risk allocations and proposes the draft legal agreements before formulation of the

financial bids. The second stage involves financial offers, focusing on the amount of feed-in tariff per kilowatt hour (kWh) to be paid by MASEN for energy from Noor II and III. In order for bidders to provide financial offers, MASEN needs to provide them during this second stage the terms of the debt financing MASEN will provide the awarded SPV. Because MASEN aims to reach commercial closing (i.e., reaching agreement on all of the commercial issues) contemporaneous with award, MASEN needs to know the final terms of debt financing that will be made available to it from IFIs prior to concluding this second stage bid process.

49. Once selected, the winning bidder(s) are expected to enter, through the SPVs, into a suite of agreements with MASEN to provide the contractual basis for the PPP. The structure of the envisaged PPP is largely based on typical commercially-financed, limited recourse transactions for infrastructure projects. MASEN will enter into a power purchase agreement with the selected bidder(s) to purchase the entirety of Noor II and III's output at the competitively determined feed-in tariff. MASEN will, in turn, enter into a power sales agreement to sell this power to ONEE at the regulated high-voltage system tariff.

50. MASEN is expected to enter into a supply agreement with the SPV to provide water, and provide the common infrastructure facilities to be used by the plants. MASEN is also expected to take a minority equity interest in the SPVs (up to twenty-five (25) percent) and special purpose vehicles formed to operate and maintain the plants. The agency's participation in the day-to-day activities of these vehicles is expected to be limited to the typical role of a minority shareholder. Nonetheless, MASEN expects that its participation will give it more insight into operating these types of business enterprises and to increase its capacity to design subsequent projects to implement the remaining projects in its 2,000 MW mandate. The shareholding of MASEN is also expected to raise investor confidence.

51. Consistent with the approach followed in Noor I, MASEN is expected to enter into a lending arrangement with the SPVs to pass to them the proceeds of the IFI financing made available to MASEN for Noor II and III. These proceeds are expected to comprise the bulk of the debt financing of the projects and cover up to eighty (80) percent of Noor II and III's costs. The amount of debt financing will depend on the final structure of the capital grant offered under Component 2 of the proposed Project, and how it will be accounted for at the SPV level. The remaining twenty (20) percent of Noor II and III's costs will be covered by commercial equity provided by the SPVs' shareholders.

Results Monitoring and Evaluation

52. MASEN will regularly monitor implementation of Noor II and III by the SPV(s) in accordance with the agreed contractual obligations that will be put in place prior to effectiveness of the CTF, AfDB and IBRD loans. PDO level results indicators and intermediate indicators will be monitored by MASEN and reported to the World Bank, the African Development Bank and other IFIs in project reports covering a period of one calendar semester. MASEN will submit the project reports to the IFIs forty-five (45) days after the end of each calendar semester. The reports will cover, among other things, financial statements, physical progress, and procurement.

53. The CTF, AfDB and IBRD loan agreements provide for periodic submission of interim unaudited financial reports, supported by a technical audit report prepared by an

independent verification expert. The audit report will particularly focus on (i) achievement of milestones set out in the relevant engineering, procurement, and construction (EPC) contract and (ii) compliance with the contract's pricing provisions.

Sustainability

54. The GoM considers this project as being critical for the development of its economy, and, as described above, it is an integral part of Morocco's Solar Plan and its strategy of combatting climate change. The costs the program imposes initially and the risk that a failure of the program to generate its potential wider benefits may entail are well known.

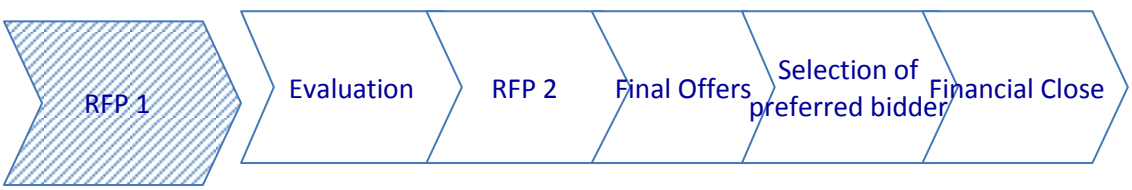
55. The sustainability of the project itself ensured with the help of the dedicated agency staffed with top professionals to develop the Morocco Solar Plan, namely MASEN, and its association with a financially strong and technically capable private developer to develop the Noor Solar Complex. This partnership will ensure that the plant will be constructed, operated and maintained according to industry standards. The experience of Noor I seems to indicate that this institutional framework is working.

56. MASEN's Law and the conventions signed or to be signed between the GoM and MASEN provide for the GoM to support for not only the Noor Solar Complex of 500 MW but also the complete 2,000 MW program. MASEN buys high cost CSP production and sells it to ONEE at a price equivalent to the currently lower coal generation cost; however the gap between the two prices is covered by law by GoM, which guarantees financial sustainability of the Morocco Solar Plan, on a project-by-project basis. As solar energy develops, along with other renewables, the State budget to cover subsidies for fossil fuels will decline, as the economy becomes less dependent on imported fossil fuels, freeing additional financial resources to subsidize solar energy if still needed. Indeed, for Noor I – and as long as heavy fuel oil continues to be subsidized – there is an annual net reduction of subsidies in the order of US$10 million annually due to the operation of Noor I when compared with its alternative, which is plant operated by heavy fuel oil.

Schedule

57. MASEN has issued the request for technical proposals in December 2013 (first stage) in a 2-stage bidding process that is designed to award both projects either as a package or individually. The second stage bid is scheduled to be issued in June 2014 with objective to reach the financial close towards the end of 2014 or early 2015. It is estimated that the construction will take 25 to 30 months, with commissioning expected in 2017.

Figure 2: Project Preparation Schedule



December 2013	May 2014	June 2014	August 2014	Oct. 2014	End 2014/Early 2015

Note: RFP1 : First Phase of Request for Proposal; RFP2 : Second Phase of Request for Proposal

J. Donor Coordination

58. Several donors are active in the Moroccan energy sector, through both grants and loans. Besides the AfDB and the World Bank, the Agence Française de Développement (AFD), Kreditanstalt fur Wiederaufbau (KfW), the European Investment Bank (EIB) and the European Commission (EC) are involved. Coordination currently takes place through regular project-specific meetings of donors and executing agencies. These meetings are an opportunity to coordinate these parties' actions with the actions of other institutions.

59. The Noor Solar Complex project has raised strong interest and support from international financial institutions and other stakeholders. The project will be co-financed by the the AfDB, the World Bank, the CTF, AFD, KfW, the EIB, and the EC's Neighborhood Investment Facility (NIF). These institutions initially raised around US$1 billion (€0.75 billion) for the first phase, consisting in Noor I 160 MW (gross). The second phase is being evaluated and consists of 2 distinct plants: (a) a 200 MW parabolic trough CSP plant (Noor II) and (b) a 150 tower CSP plant (Noor III). All preparation missions of donors have been undertaken jointly. Collaboration among donors will be intensified during project implementation, especially in the period to effectiveness of the loans, as there will be numerous and complex effectiveness conditions.

K. Key Risks and Risk Management

Table 2: Risk Ratings Summary

Risk Category	Rating
Stakeholder Risk	Moderate
Implementing Agency Risk	
- Capacity	Moderate
- Governance	Low
Project Risk	
- Design	Moderate
- Social and Environmental	Moderate
- Program and Donor	Moderate
- Delivery Monitoring and Sustainability	Moderate
- Technological	High
- Affordability	High
Overall Implementation Risk	**High**

Overall Risk Rating Explanation

60. Given its inherent technological and financial risks, the Project is considered high risk both for project preparation and implementation. While the sum of individual risk ratings may indicate a lower overall rating, the importance of the risks pertaining to sector viability, project financials (affordability), and technology suggests an overall high risk rating.

L. Economic and Financial Analysis

61. A CSP plant will have both capacity and energy benefits, particularly when the CSP facility uses thermal storage to better match its output to the daily and seasonal load curve. ONEE determined that, although Noor II and III displace some fuel oil and coal-fired generation in the early and later years of operations, the plants largely displace combined-cycle, gas-fired turbine (CCGTs) generation using imported liquefied natural gas. This is consistent with MASEN's intention to maximize Noor II and III's contributions to meet Morocco's evening peak load where CCGTs typically operate.

62. When compared to the notional least-cost expansion option, Noor II and III have a negative opportunity cost to the GoM that is estimated to be approximately US$ 517 million, using a discount rate at the GoM's five (5) percent real opportunity cost of capital (see Table 4). This figure is based on the return associated with the last GoM bond issuance. The fact that the least-cost notional alternative is a low-emission, gas-fired plant also means that the incremental greenhouse gas benefits from Noor II and III, when compared to this notional plant, is not as large as for Noor I, for example, which largely displaced least-cost alternatives using the higher carbon emitting fuel oil. Accordingly, an economic analysis of Noor II and

III determined that the projects would be economic at an avoided cost of carbon emissions of US$106/ton.

Table 3 – Summary of the Economic Analysis

		Govt. Opportunity Cost	ONEE
Discount rate		5%	10%
ERR	[ ]	-0.07%	-0.07%
ERR+local	[ ]	0.18%	0.18%
ERR+local+GHG@30$/t	[ ]	1.72%	1.72%
Switching value, GHG	[$/ton]	106	247
NPV			
Costs			
Capital Cost	$USm	-1873	-1749
Fixed O&M	$USm	-511	-300
Benefits			
Avoided Gas Cost	$USm	988	504
Capacity Credit	$USm	249	198
Avoided Oil & Coal	$USm	414	342
NPV (before environmental benefits)	$USm	-733	-1005
Local Environmental Benefits	$USm	25	13
GHG Emissions @$30/ton	$USm	191	110
NPV (including environment)	$USm	-517	-883

63. Nonetheless, this conclusion is highly sensitive to the projects' capital costs estimate and the discount rate. A ten (10) to fifteen (15) percent reduction in capital costs, which would not be unusual based on the Noor I experience where the awarded capital costs were thirty (30) percent lower than the appraised value, would reduce the avoided cost of carbon to US$64/ton, well within the range of other renewable energy generation's avoided costs.

64. Furthermore, these valuations do not take into account the potential local manufacturing economic impacts that could accrue from MASEN's program and CSP developments in the country. Using a decision-based bottom-up analysis based on a detailed survey of the local manufacturing potential in Morocco, the Fraunhofer Institute (2014) estimates that the cumulated economic impact of the CSP program with only 450 MW of CSP installed by 2020 alone would lead to direct economic benefits of US$603 million, and additional indirect economic benefits of US$474 million, equivalent to a total of US$1,076 million. By 2025, the combined direct and indirect macro-economic benefits would be about US$1.8 billion, considering 700 MW of CSP installed. If Morocco were to install 2.3 GW of CSP by 2025, the economic benefits would increase significantly due to the local manufacturing impact rising to US$2.2 billion by 2020 (with an installed capacity of 1 GW), and US$5.3 billion by 2025.

65. To realize the full benefits of the program, additional mitigation measures can be put in place to render a positive outcome more likely. Among these the GoM is putting in place a dedicated R&D policy and establishing a Climate Innovation Center, which is to support local

manufacturers in Morocco. In parallel a CTF-sponsored US$10 million grant is being prepared to support local manufacturers in MENA by facilitating licensing of component manufacturing and providing small grants for business line development on a competitive basis (approval estimated in June 2014).

66. In order to better understand the future benefits of global subsidy investments in CSP during the early years of the technology's development, an analysis was undertaken of the hypothetical scenario of selling CSP capacity from the MENA region to Europe starting from 2020. Using a conservative range of carbon prices estimated by the US Interagency Working Group on the Social Cost of Carbon (IWGSCC) and European gas price forecasts of the World Energy Outlook, the baseline estimate of the future economic rate of return from CSP projects was 6.9 percent using a 2030 carbon price of US$57/ton of CO2. In 2015, the net subsidy required for CSP is 2.1 US¢/kWh – being the difference between CSP at 13.8US¢/kWh and CCGT at 11.8 US¢/kWh. But by 2030, the cost of CSP has fallen (from 12.9 to 7.3 US¢/kWh), as has the economic cost of gas for the CCGT (as per the WEO 450 ppm scenario): at the same time, the cost of carbon has increased.

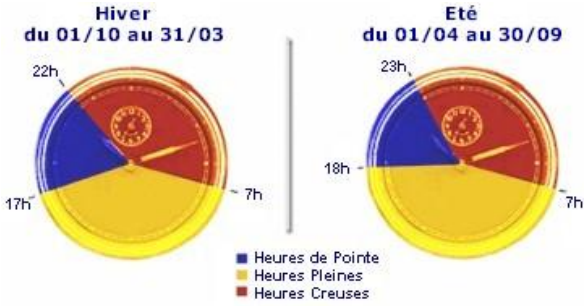
67. The analysis shows that the global investment in CSP in the short-term - to cover the incremental costs and subsidies required for the projects built today, such as Noor II and III - bring a long-run (real) rate of economic return of around 7%. This is because in the future, the costs of carbon, gas, and fossil fuels in general are expected to increase, while the cost of CSP is expected to decline - at which point CSP becomes less costly than the fossil fuel alternative - but this result is achieved only by the short-term subsidy investment support. In other words, provided the global community supports not just Noor II and III, but a further 10,000 MW in the next few years, then the global community's economic return on that support will be substantial.

68. The financial impact on the GoM from Noor II and III is expected to be significantly less than the projected economic impact. Construction of Noor II and III is expected to cost approximately US$2 billion. These costs are to be funded through a financing plan with a 80:20 debt to equity ratio. The entirety of the debt will be provided by MASEN from the proceeds of concessionary loans made available to the agency by WB, KfW, AfDB, EIB, and AFD, and on-lent by MASEN, as the projects' sole lender, to the competitively-selected SPVs that will design, construct, own, operate, and maintain the plants. The remaining balance of the projects' costs (i.e., approximately US$ 400 million) will be covered by equity, the bulk of which will be provided by the competitively-selected sponsors that will own the majority of the SPVs' shares. MASEN is expected to participate in the SPVs' shareholding and provide up to 25 percent of their equity requirements through grants made available to MASEN by the European Union's Neighborhood Investment Facility (NIF).

69. The levelized cost of energy (LCOE) that the SPV(s) will offer will be determined as part of the procurement process, for which the LCOE is a key selection criteria. Masen will pay the SPV the LCOE per kWh produced. On the other hand, the SPV will make payments to MASEN covering the repayment of SPVs' loans to MASEN, returns on the SPVs' shareholder equity and the plants' fixed and variable operating costs. MASEN will use the cash it receives as repayment of its loans to the SPVs to service its debt to the AfDB, the WB and other donors.

70. MASEN would partially cover these LCOE costs from the sale of plants' output to ONEE under a 25-year power purchase agreement using its own net high voltage tariff. The figure below shows the different summer and winter tariffs that ONEE provides.

Figure 3 – Time of Use Aspect of HV/VHV ONEE Tariff

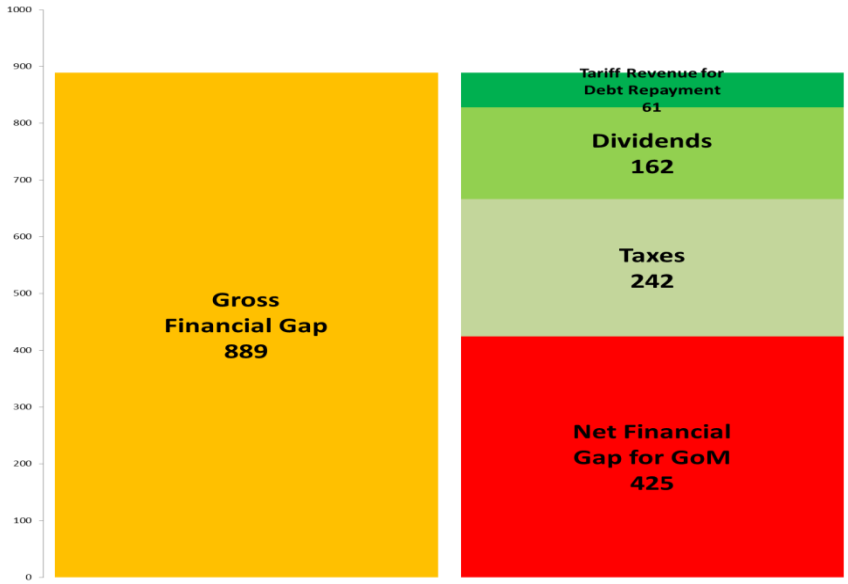


71. Although this regulated system cost is expected to escalate year-to-year faster than the anticipated escalation of Noor II and III's costs, revenue from MASEN's sales to ONEE are expected to be insufficient to cover MASEN's purchase costs from the SPVs. The net present value (NPV) of the resulting revenue gap at MASEN's level is estimated to be around US$930 million over the 25-year life of the power purchase transactions, which the GoM is expected to cover. As IBRD's Cost Mitigation Mechanism is expected to lower this amount by approx. US$40 million, the financial gap (defined as the revenue gap minus the cost mitigation mechanism value for Noor II and III) is estimated to be US$890 million.

72. However, the net financial burden to the GoM from this revenue gap is expected to be far less than the estimate gross total amount of the gap above. Noor II and III are expected to generate cash to the GoM and MASEN through a variety of sources that will help off-set the bulk of the revenue gap. First, the SPVs are expected to pay corporate income tax on their earnings and value added tax on certain goods and services. These taxes are expected to generate an annual cash stream to the GoM whose NPV amount to US$ 242 million over the 25-year life of the agreements with the SPVs. Second, MASEN's equity investment in the SPVs, which is expected to be funded from NIF grants, is projected to yield a return in the amount of US$ 162 million over 25 years. MASEN is expected to use this return to cover part of its revenue gap, thus reducing the financial burden that the GoM has to carry.

73. Third, the estimated LCOE from Noor II and III is based on full amortization of all the projects' debt over the 25-year life of the PPAs. This is expected to generate excess cash to MASEN from accelerating the amortization of the 40-50 year CTF loans provided by the WB and the AfDB. Furthermore, MASEN is expected to charge a fixed interest rate in its loan agreement(s) with the SPVs that includes a margin to cover MASEN's exposure to fluctuations in the variable interest rates charged by the WB, the AfDB and other donors for their loans. This margin is expected to generate excess cash in the early years of Noor II and III's operations until interest rates are projected to increase to a level that would absorb the margin. MASEN is expected to use all of this excess cash (whose NPV is estimated to be US$61 million) to cover its revenue gap. Consequently, the net financial burden to the GoM from MASEN's revenue gap decreases from a gross NPV amount of US$890 million to a net amount of approximately US$425 million (see Figure 4).

Figure 4 – Gross and Net Financial Costs of MASEN's Revenue Gap
(NPV in US$ Million)



74. The GoM has committed to ensuring MASEN's financial viability in a General Convention signed between the GoM and MASEN at the time the agency was established. Furthermore, the GoM is expected to enter into a Specific Convention with MASEN that covers the government's particular support to each of Noor II and III once the procurement process concludes and the amount of this support can be more accurately determined. At this stage, it is anticipated that this support will come in the form of periodic transfers to MASEN to meet its cash obligations. The purpose of Component 2 is to reduce the cost to the Go M to financing these payments.

M. Technical Analysis

75. Noor II and III are expected to need up to 230,000 cubic meter (m^3) and 125,000 m^3 of water, respectively, from the reservoir behind the Mansour El Dahbi dam, which is in the aggregate less than a quarter of Noor I's water consumption and, when combined with Noor I's consumption, represents less than one percent of the dam's Regular Annual Volume and half a percent of the overall water resources available in the region once the new Tiouin dam's construction is completed. Water is expected to be supplied from the reservoir to the site through a 10 km pipeline that is currently under construction as part of the Noor I process.

76. The plants' electrical output will be evacuated to the grid on a new 225 kV line connecting the existing substations at Ouarzazate and Tazarte. ONEE will construct this line and is in the process of procuring a contractor for the work using financing under a separate project with funding from AFD. Once completed, the line will reinforce an existing 225 kV between the same substations and increase flexibility on the grid by creating a stronger loop in the area among the Ouarzazate, Errachidia, Tarzate, and Khenifra substations.

77. Front-End Engineering and Design (FEED) to meet MASEN's minimum technical specifications will be carried by the awarded bidders who will construct, own, and operate

Noor II and III. Both Noor II and III plants will be of solar stand-alone configuration and will be designed, manufactured , installed, erected, operated and maintained in such a way that they will achieve high availability and reliability with minimum generation costs. Noor II and III's specifications request the power plants to be optimized to maximize peak-hour generation in order to displace combined-cycle gas turbines fuelled by expensive imported LNG. The plants will follow environmentally sound practices and comply with the recommendations of the Framework Environmental and Social Impact Assessment study ("FESIA"). Fuel and water consumption will be minimized for both plants. Fuel-burning equipment will be used only for auxiliary support functions (i.e. plant start-up and safe operation).

78. As previously described, the proposed project includes the construction of two large-scale CSP plants: a parabolic trough plant (Noor II) and a solar tower power plant (Noor III). With regard to Noor II, the parabolic trough choice is considered a proven and fully commercial technology for energy production, and the project presents no unusual construction or operational challenges for a power plant of that size. Parabolic trough is the CSP technology with the most commercial operating experience. At the end of 2013, around 3400 MW of installed CSP capacity used the parabolic trough technology and accounted for most of today's installed CSP capacity. Noor II's Minimum Functional Specifications (MFS) have been prepared by MASEN with the assistance of highly qualified consultants, incorporating international best practices and the lessons learned from Noor I procurement process. The technical specifications have also been reviewed and commented by the donors' technical experts in order to ensure that all relevant construction and operational risks are adequately addressed.

79. On the other hand, the solar tower technology selected for Noor III is still an evolving technology in its first commercial stages. Solar tower has also higher capital costs than parabolic trough, and the operational experience is much more limited due to the reduced number of projects under construction and operation. There is a higher risk of delay in the commissioning of a solar tower when compared to parabolic trough, due to the scaling-up challenges and the continuous technical improvements and cost optimizations that are being incorporated in the newer plants. The team acknowledges this risk and will closely follow the performance of the mentioned solar towers and monitor the procurement and construction of Noor III in order to minimize potential delays.

80. However, solar tower also has important benefits that make it very attractive and potentially better than other CSP technologies: (i) higher conversion efficiency from solar thermal energy to electricity since they can achieve very high temperatures with manageable losses by using molten salt as a heat transfer fluid. This allows higher operating temperatures and steam cycle efficiency, and reduce the cost of thermal energy storage by allowing a higher temperature differential (ii) molten salt towers have lower water consumption requirements; (iii) greater potential for cost reduction and local manufacturing. These advantages are driving the increasing share of solar tower projects planned worldwide and according to several expert sources, solar towers might become the technology of choice in the future.

N. Financial Management

81. As part of the Noor I process, MASEN established an accounting and financial management system satisfactory to the Bank. This system is based on rules applicable to commercial law of the Kingdom of Morocco. MASEN's financial statements are submitted annually to an independent external audit. Similar to the approach adopted for Noor I, interim unaudited financial report, which will cover all the activities and sources of funds of the project, will be prepared for the Project twice a year by MASEN and transmitted to the World Bank and the AfDB forty-five (45) days after the end of each period. The external annual audit report of the Project's accounts and the management letter covering recommendations to improve the internal controls and the accounting system will be transmitted by MASEN to the IFIs no later than six (6) months after the end of each exercise. Moreover, the annual audit report of the Project's accounts will be carried out in accordance with the AfDB guidelines by an acceptable auditor and according to terms of references acceptable to the AfDB.

82. The SPVs, which will be the Project's Implementing Entities, will not be identified until after conclusion of the procurement process and award of Noor II and III. As such, appraisal of their accounting and management system is not possible until then. However, consistent with the approach adopted in Noor I, the CTF, AfDB and IBRD loan agreements require, as a condition to effectiveness of the agreements, that the SPVs adopt an accounting and management system acceptable to the WB and AfDB. It is envisaged that this system would provide for preparation of annual financial statements and periodic expenditure reports by component, category, and source of funding. It is further envisaged that the SPVs will be audited annually by an independent external auditor acceptable to the WB and AfDB. MASEN is expected to reflect these requirements in the conditions to effectiveness of the PPA(s), the financing agreement(s) governing the on-lending arrangements of IFI funds, or other similar contracts entered into with the SPVs.

O. Procurement

83. The Project's procurement consists of the competitive selection of private sector sponsor(s) for a Design, Build, Own, Operate, and Transfer (DBOOT) public-private partnership (PPP) arrangement. Procurement will be for the selection of private project sponsor(s) or independent power producer (s) that, in partnership with MASEN, will constitute the SPC(s). This selection will use international competitive bidding, preceded by pre-qualification. In accordance with the WB and AfDB's policies, because the project sponsor will be selected under open competitive bidding procedures acceptable to the AfDB, it will then be free, alone or as a shareholder in the SPC, to procure the goods, works, and services required for the facility from eligible sources, using its own procedures. As a result, the Project's procurement plan is limited to 1-2 PPAs for the purchase of power from SPVs formed by the selected sponsor(s) to construct, own, and operate Noor II and III for the term of the agreements.

84. The procurement process is currently in an advanced stage. MASEN adopted a procurement approach that includes a prequalification phase and a 2-stage bidding process. On January 23, 2013, MASEN issued an invitation for prequalification that provided a short description of Noor II and III, and enumerated the requirements for prequalification. Four

highly qualified consortia were invited to participate in the next bidding stage, 3 of which qualified to bid for both Noor II and III, and 1 qualified to bid for Noor III only. On December 12, 2013, MASEN issued the request for proposal (RfP) in the first stage of the bidding process to invite technical bids. The RfP provided minimum functional specifications to set the parameters for the technical design, but otherwise left bidders flexibility to propose the most optimum design to meet MASEN's requirements. For those bidders prequalified for both Noor II and III, the RfP provided flexibility to propose a design that provided for two separate projects or one that is optimized to combine them in the most cost-effective manner.

85. The RfP also invited bidders to submit proposals for Industrial Integration, consistent with MASEN's mandate to promote local industrial development. The bidding documents invited bidders to proposed either direct or indirect investments that are equivalent to at least 35% of Noor II and/or III's costs, as applicable. Direct measures comprise expenditures on construction of the projects (e.g., civil works, earth movement, construction materials, and other services from companies incorporated in Morocco). Indirect measures comprise investments in, for example, maintenance facilities and research and development centers. However, the RfP made clear that "Bidder's proposal of any such investment in the first stage of the Tender Procedure is discretionary and voluntary." The RfP further provided that "the nature and level of the investment, as reflected in the Industrial Integration Proposal, is left to the complete discretion of the Bidder." Once a bidder voluntarily proposes some investments in the first stage of bidding, it is expected to commit to such proposal in the second stage of the process.

86. Final bids are due in the latter end of 2014, and award is expected to be made to the lowest evaluated combined financial bid for Noor II and III. MASEN expects to reach commercial closing (e.g., signature of the PPAs, on-lending agreement(s) that will govern pass-through of the African Development Bank, the World Bank and other IFI's funds from MASEN to the SPV(s), and other project-related documentation) for both Noor II and III contemporaneously with award of the projects to selected sponsors. As such, it is critical to ensure that the requisite debt financing from the African Development Bank, the World Bank and other IFIs is approved prior to conclusion of the second stage of the bidding process. Aside from the credibility this provides in such a key element of the projects' financing structure, such approvals would ensure that the necessary terms and conditions of financing are known and can be reflected in the documents to be signed by bidders at the time of award.

P. Social Assessment

87. As part of the process for Noor I's development, MASEN prepared and disclosed a Framework Environmental and Social Impact Assessment (FESIA) that is in line with the AfDB's and WB's safeguards policies. The FESIA described the process whereby MASEN acquired the site for the entire Noor Solar Complex (including Noor I, II, and III) that consisted of 2,500 hectare (ha) of 64,000 ha collective land owned by the Aït Oukrour Toundout community. The acquisition was carried out following Moroccan standard procedures for similar types of voluntary land transactions between a local community and a public agency. These procedures included (i) an expert commission's determination of the land acquisition price; (ii) issuance of the required public authorizations and consents; (iii) signature of notarized decisions regarding the land acquisition; and (iv) transfer of property rights. The FESIA was updated, as part of the preparation process for the proposed Project, to

reflect the latest available information, and is to be re-disclosed in May, 2014. Land acquisition was undertaken in a willing buyer – willing seller basis.

88. Compensation for MASEN's acquisition of collective land for the Noor Solar Complex, which includes Noor I, II, and III, is required by law to be administered by DAR for the benefit of the communities involved. The communities identify development projects, and, working with DAR and local authorities, implement them using the compensation proceeds. This process takes time as (i) communities internally agree on the list of projects to pursue, (ii) the list is agreed with local authorities and DAR, (iii) any requisite project procurements take place, and (iv) construction is completed. As such, MASEN agreed, as part of the Noor I process, to prepare a Social Development Plan to periodically inform AfDB and WB of the status of this process and to ensure that the benefits the communities expect are realized within a reasonable timeframe. It is expected that AfDB and WB would continue to use this plan to supervise implementation of the effort for Noor II and III as well.

89. As discussed further below, it is expected that site-specific environmental and social impact assessments (SESIA) be carried out by the selected private sector sponsors of Noor II and III. The SESIAs will follow the requirements of the FESIA, and include a public consultation process in compliance with AfDB and WB guidelines. It is expected that, once the SESIA's are reviewed by AfDB and WB and found in compliance with AfDB and WB policies, the documents would be publicly disclosed one hundred and twenty (120) days prior to start of the plants' construction. This disclosure requirement is currently reflected in the draft legal agreements expected to be entered into between MASEN and the private sector sponsors as part of Noor II and III's contractual framework.

90. In addition, Noor II and III are expected to have associated facilities that the plants will need for their operations. Many of these facilities are shared with Noor I. AfDB and WB are working with MASEN to ensure compliance with AfDB's and WB's policies with respect to these Associated Facilities.

Q. Environmental Assessment

91. The updated scope of the FESIA covers all of the Noor Complex's site and the different technologies (CSP parabolic trough, CSP Solar Tower) under consideration by MASEN. The updated FESIA will be prepared in a participatory manner including all stakeholders' consultation and disclosure. It will includes a description of: (i) the legal and regulatory framework applicable to the project, (ii) alternative options considered, (iii) a state of the environment in the project location and surrounding region, (iv) potential impacts and associated compensation measures to be considered, and (v) a Framework Environmental and Social Management Plan (FESMP). The FESMP will include institutional settings, general mitigations measures and monitoring plan for the potential impacts expected from project activities during construction and operation stages.

92. The updated FESIA will guide the preparation, adoption and monitoring of a Specific Environmental and Social Impact Assessment (SESIA) to be carried out by the bidders and their respective SPVs competitively selected to implement Noor II and III, once their initial designs are determined. The ESIAs shall include a detailed Environmental and Social Management Plan in accordance with the provision of the updated FESIA, including the

processes, rules and standards defined in the FESIA, and will be subject to the AfDB's and WB's review and concurrence before its final approval and implementation by MASEN and the relevant SPVs.

93. Accordingly, the SPVs will be responsible for preparing the ESIA(s) that will include a detailed Environmental and Social Management Plan (ESMP) for the plants. After the ESIA(s) are approved, the SPVs are expected to contract environmental and social safeguards coordinators that will have direct responsibility for implementing the agreed environmental, health and safety measures at the plants' site during construction and operation. These coordinators will, inter alia, prepare a monthly Health, Safety and Environment report during the construction and operation phases of Noor II and Noor III, and MASEN is provide this information of the AfDB's and the WB's review during the supervision phase of the proposed Project.

94. ESIAs for associated facilities (including but not limited to transmission lines) will be carried out by various entities, including but not limited to ONEE, responsible for completing these facilities. These entities are expected to prepare environmental and social assessments for their respective associated facilities and implementing the related environmental and social management plans (ESMP). Both environmental and social assessments and environmental and social management plans shall be forwarded to the AfDB and the WB for review and concurrence by MASEN and subsequently publicly disclosed.

95. MASEN has already established a department within its organization to monitor development and implementation of the safeguards aspects of the Noor Complex, including Noor I, II, and III. MASEN is expected to ensure that staff in this department receives adequate training and possess the relevant expertise to supervise implementation by the SPVs of all relevant environment and social impact mitigation measures, including occupational, health and safety guidelines, that are mainstreamed into the projects' design in accordance with the provisions of the updated FESIA.

Annex 1: Clean Technology Fund Morocco: Noor II and III CSP Project

Key Indicators	CTF/World Bank Project Noor II and III	Scaled-up phase Morocco's Solar Plan by 2020
Installed solar capacity for power generation (MW)	350 MW	2,000 MW
Power generation (GWh per year)	1,156 GWh	6,606 GWh
Avoided CO_{2eq} - tons per year - lifetime (tons/25 years)	521,670 13 million	3.7 million tons per year
Financing leveraged through CTF financing (US$ million)	US$ 2,785 million Breakdown of financing: - US$ 300 million to be provided by IBRD for cost mitigation mechanism; - Debt: US$ 1,988 million (80%), to be provided by AfDB , KfW, EIB, IBRD, and AFD; - Private equity: US$ 497 million (20%), including from NIF.	US$ 9 billion
CTF leverage ratio	1:11.7	1:37.8
Cost effectiveness - CTF cost effectiveness [$\$_{CTF}/tCO_{2eq}$ avoided over lifetime of the project] - Total project cost effectiveness [$\$_{Total\ Project}/tCO_{2eq}$ avoided over lifetime of the project]	US$ 18.3 US$ 155 [9]	US$ 2.57 US$ 97.3 (See footnote [10])
Environmental co-benefits in terms of avoided local pollution (US$ million)	25	n/a
Other co-benefits	- Improved energy security from increased penetration of solar renewable energy in the energy mix: 4.3-5% of current installed capacity. Solar target is 14% in 2020. - Reduced imports of electricity. - Increased employment from development of local industry. - Cost reduction in concentrated solar power technologies. - The regional Technical Assistance program that is being developed in parallel will be used to help support gender equity.	

[9] The calculation of Total Project cost effectiveness considers total EPC cost of US$2,015 million, therefore excludes viability gap financing and contingency.

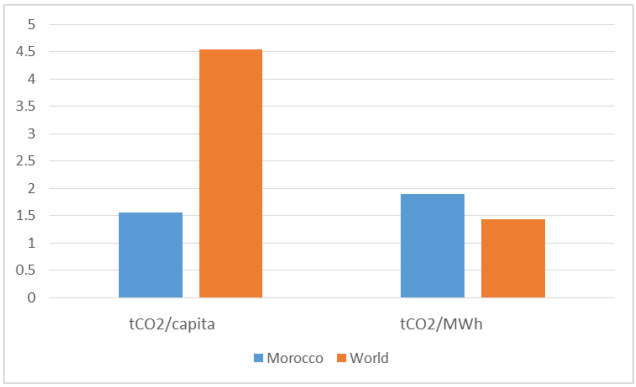
[10] The calculation of CTF and Total Project cost effectiveness assumes 3.7 million tons CO2eq over 25 years.

I. Introduction

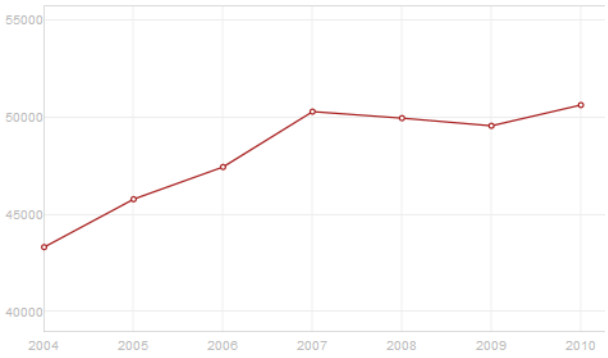
Background: country and sector context

1. Morocco is experiencing strong real GDP growth. This raises challenges of long-run energy security and management of the country's increasing GHG emissions (see Figure 1 (b)), given both that Morocco imports nearly all its energy needs (97%, excluding non-commercial forms of energy). Power generation in Morocco is dominated by thermal generation (installed capacity in 2012: coal 37%; fuel and gasoil 18%; and natural gas 19%), which makes Morocco a CO_2 intensive country, with CO_2 emissions per kWh generated, 30% higher than the world average despite a low total CO_2 per capita (see Figure 1 (a)). Improving energy security and climate change mitigation are therefore two key objectives of the country's energy policy. This should be done without jeopardizing energy access for all citizens and businesses, and at the lowest cost possible.

Figure 1 - Morocco: CO_2 Emission Intensity (2011) and Emission Trend (2004-2010)



a) **Morocco CO2 emissions intensity (kt, source WDI)**



b) **Morocco CO2 emissions**

Source: based on IEA statistics (2011)

2. Morocco has physical attributes that make it particularly promising for scale-up of solar technologies with particular focus on concentrated solar power (CSP): abundant sunshine, low humidity and plenty of unused flat land close to road networks and transmission grids. These attributes, together with access to EU electricity markets (at least in the medium-long term) through the existing interconnection with Spain, makes Morocco one of the most suitable places globally to get cost reduction for CSP and accelerate global CSP deployment

Morocco and the CTF MENA CSP Investment Plan

3. The World Bank Group and the AfDB, together with other donors, such as the EIB, AFD, KfW/BMU, and the EC have worked together to accelerate CSP deployment in the region. A significant part of this initiative is the CTF's MENA CSP Investment Plan (MENA CSP IP), which was endorsed in December 2009, updated in November 2010, and revised in May 2013. The MENA CSP IP aims to mobilize nearly US$ 5 billion (including US$660 million from the CTF) to accelerate the deployment of CSP projects in Morocco, Egypt, Tunisia, and Jordan.

4. In addition to US$197 million CTF funding destined to the development of Noor I (formerly known as "Ouarzazate"), the MENA CSP IP has earmarked US$ 218 million CTF funding to support the development of Noor II and III, to be channeled by the World Bank and the African Development Bank (AfDB). Additional US$ 20 million are requested for Noor II and III, as bidders' technical proposals lead to the conclusion that most likely these two new plants will end up installing a capacity 50 MW larger than originally targeted (see table below with 300 MW planned as per the 2013 Investment Plan Update). While Noor I received a capital subsidy of US$1230/kW installed, under the last Investment Plan (IP) Update a markedly lower subsidy per kW installed was proposed, namely US$727/kW corresponding to a reduction of the subsidy of 41 percent. With the addition of 50 MW to the plant the subsidy would fall further to US$623/kW installed or by a total of 49 percent.

5. While some decrease in the amount of CTF financing can be justified as the costs of Noor I were by about 30 percent lower than expected, it should be noted that even with the currently proposed subsidy, Morocco will bear US$890 million of the incremental costs of the project that remains once all concessional financing has been taken into account. The addition of US$20 million to the overall CTF funding envelope for this project would allow for the subsidy to be slightly increased to US$680/kW corresponding to a reduction in subsidy of 44 percent compared with Noor I. These additional CTF funds would come from the endorsed MENA CSP IP.

Table 1- MENA CSP CTF Indicative Financing Plan—May 2013 Update (in US$ million)[11]

Country	**Projects / Capacity (MW)**	**CTF Financing (US$ million)**
Morocco ,	Noor I (formerly "Ouarzazate") 160	197
	Noor II and III 300	218
Egypt	Kom Ombo 100	123
Tunisia	Akarit 50 (possibility to increase to 100)	62 (US$123 million for 100 MW)
Jordan	IFC Up to 100 MW (including Concentrated PV)	50
Total Projects	550	453
Technical Assistance	NA	10
Total		**660**

[11] An update of the MENA CSP IP will be submitted for consideration of the CTF Trust Fund Committee in June 2014. The update note will reflect the revised amount of US$238 million CTF co-financing required for 350MW solar CSP capacity under the proposed Noor II and III project. This represents an increase in both CTF funding and MW installed as compared with the MENA CSP IP revision of May 2013, which provided a tentative allocation of US$218 million for 300MW total installed capacity.

Project Description

6. Similarly to the Noor I first phase process, the World Bank, the AfDB and other IFIs are involved with MASEN in the competitive selection of qualified and financially robust private partners to establish a PPP, which would be responsible for the preparation and implementation of the second phase of the Noor CSP complex. This second phase consists of 2 distinct plants: (a) a 150-200 MW parabolic trough CSP plant (Noor II) and (b) a 100-150 tower CSP plant (Noor III).

7. MASEN has already prequalified 4 highly experienced international consortia for the projects. Three of these consortia are bidding for both projects, and one consortium is bidding for only one. MASEN has issued the request for technical proposals in December 2013 in a 2-stage bidding process that is designed to award both projects as a package. This approach is expected to incentivize bidders, particularly those bidding for both projects, to optimize their technical design to ensure that MASEN receives the best possible price from both projects together.

8. Furthermore, unlike Noor I, Noor II and III's minimum functional specifications have been optimized to maximize the number of peak-hour generation from the plants. Thus, the impact of the plants on reductions of fossil fuel used to meet peak generation demand in Morocco is expected to be higher than in Noor I. Both projects will provide a Thermal Energy Storage (TES) Capacity of at least 3 hours (this is Noor I TES Capacity) Based on the preliminary technical studies and the recent comparable project of Noor I and others in the MENA region and worldwide, the total project cost for the construction of the second phase would be US$2,015 million (US$1.07 billion for Noor II and US$0.94 billion for Noor III[12]). Considering 350 MW total installed capacity for Noor II and III, the unit cost per MW installed would be 5,760 US$/MW.

Table 1 - EPC Cost Breakdown (US$ million)

Description	**Noor II and III**
Civil works, Buildings	113
Solar Field	532
HTF system (only for Noor II)	139
Solar Receiver Subsystem (only for Noor III)	149
Thermal Energy Storage System	211
Power Block including Steam Generator	317
Others: Land, Project and Construction Management, Engineering	118
Total CAPEX	**1,580**
EPC margin/Contingency[13] on CAPEX	435
Total EPC Cost	**2,015**

[12] EPC margin/contingency on capex : 25% for Noor II, 30% for Noor III
[13] Contingencies : 25% of Capex for Noor II, 30% for Noor III

II. Assessment of the Proposed Project with CTF Investment Criteria

Potential for GHG Emission Savings

Emission reduction potential of investment. Absent any further development of renewable resources, GHG emissions from power generation have been forecasted by the GoM to increase from an estimated 16 million tons per year in 2007 to an estimated 36 million tons by 2020 – an increase of 20 million tons. Using the underlying fuel savings estimated by ONEE and the typical CO_2 emission rates of the different types of power plants[14], the CO_2 saving for the Project are estimated at 522,000 tons per year. This estimate is based on 350MW of solar CSP installed capacity with 37.7% capacity factor (including storage) producing 1,156 GWh solar power on an annual basis. As stated in the Economic Analysis, Noor II and III are indeed not part of ONEE's least cost plan, and must be forced into the solution. Figure A6.1 and table A6.3 of shows the generation that is displaced when Noor II and III are forced in. In the first few years significant amounts of fuel oil are displaced, but subsequently LNG-CCGT accounts for most of the displaced energy – consistent with the announced MASEN strategy of contributing to the evening peak load where CCGTs would normally operate. In other words, Noor II&III replaces mainly natural gas, leading to a weighted average emission factor of 452 kg CO2/MWhOver the 25 year-lifetime of a CSP plant, the cumulative emissions reduction of CO_2 is estimated at 13.04 million for Noor II and III.

9. **CSP Technology Development Status.** The proposed project includes the construction of two large-scale CSP plants: a parabolic trough plant (Noor II) and a solar tower power plant (Noor III). With regard to Noor II, the parabolic trough choice is considered a proven and fully commercial technology for energy production, and the project presents no unusual construction or operational challenges for a power plant of that size. Parabolic trough is the CSP technology with the most commercial operating experience. At the end of 2013, around 3400 MW of installed CSP capacity used the parabolic trough technology and accounted for most of todays installed CSP capacity. Noor II's Minimum Functional Specifications (MFS) have been prepared by MASEN with the assistance of highly qualified consultants, incorporating international best practices and the lessons learned from Noor I procurement process. The technical specifications have also been reviewed and commented by the donors' technical experts in order to ensure that all relevant construction and operational risks are adequately addressed.

10. The solar tower technology selected for Noor III is in its first commercial stages. Solar tower has also higher capital costs than parabolic trough, and the operational experience is much more limited due to the reduced number of projects under construction and operation. The total capacity in operation has recently increased to almost 500 MW with the commissioning of Ivanpah by Brightsource in California. Ivanpah, together with the Crescent Dunes in Nevada (currently under commissioning) show that it is possible to build and operate large-large scale solar towers using different technologies (molten salt or direct steam as working fluid). However, the construction and commissioning of both projects have taken longer than initially planned. There is a higher risk of delay in the commissioning of a solar tower when compared to parabolic trough, due to the scaling-up challenges and the continuous technical improvements and cost optimizations that are being incorporated in the newer plants. The team acknowledges this risk and will closely follow the performance of the

[14] 987 kg/MWh for coal, 592 kg/MWh for oil and 406 kg/MWh for gas (combined cycle)

mentioned solar towers and monitor the procurement and construction of Noor III in order to minimize potential delays.

Cost-effectiveness

11. The cost effectiveness is 18.4 US$/tCO2 for CTF funding and 155 US$/tCO2 considering total funding for the project.

Marginal abatement cost

12. **Marginal abatement cost.** In October 2013, the CTF Trust Fund Committee suggested providing information on the estimated marginal abatement cost (MAC) for projects for which the marginal abatement cost is likely to exceed US$100 per ton of CO2eq. This decision draws from the CTF criteria which specifies that CTF co-financing will not be available for investments in which the marginal cost of reducing a ton of CO2eq exceeds US$200, which reflects the lower-end estimate of the incentive needed to achieve the objectives of the BLUE Map Scenario as indicated in the *International Energy Agency's Energy Technology Perspectives 2008 Report*.

13. Preliminary calculations confirm that the MAC for the project will not exceed the aforementioned US$200 threshold value per ton of CO2eq. These computations overestimate the MAC as the Net Present Value (NPV) is computed without accounting for local co-benefits (jobs creation, reduced local pollution etc.) and knowledge spillovers. Moreover, the project is part of a wider strategy of Morocco to build large scale CSP, which is expected to reduce emissions at a lower MAC than each of its projects evaluated separately.

14. The marginal abatement cost is computed as the project's NPV divided by lifetime CO2eq (LCO2) avoided emissions:

$$MAC = \frac{NPV}{LCO2},$$

where NPV stands for Net Present Value and LCO2 stands for Lifetime CO2eq emissions.

15. The MAC is between US$23 and US$78 per ton of CO2eq, depending on the discount rate used. For the 5% discount rate that reflects Morocco's opportunity cost of capital, which is the base case for the economic analysis, the MAC is US$57 per ton CO2eq. Even at the ONEE discount rate of 10%, the MAC is US$78 per ton CO2eq.

Table 3: Marginal Abatement Costs (MAC) using different discount rates

			Stern Report	Govt. Opportunity Cost	ONEE
	Discount rate		1.4%	5%	10%
1	Lifetime avoided GHG emissions	mtCO2eq	12.8	12.8	12.8
2	NPV	US$ m	-293	-733	-1005
3	Marginal Abatement Cost	US$/ton CO2eq	23	57	78

Source from Economic and Financial Analysis

16. **Expected Cost Reduction of Solar Technologies.** CSP is considered to be a proven technology that is at the point of exiting the early stage of its cost reduction curve. Cost reductions are expected due to: (i) technical improvements, as lessons are learned from installed plants and parallel R&D efforts identify performance improvements; (ii) increasingly larger-scale installed plant size, that allows for more efficient and more cost effective components to be used; and (iii) volume production that allows fixed costs of investments in production efficiency to be spread over larger production runs.

17. Learning cost curve effects are commonly measured using the "Progress Ratio," which is defined as the rate at which costs decline for every doubling of cumulative installation. As shown in the following table there is a median Progress Ratio (PR) value of approximately 0.82 for Wind and PV. The projections for CSP have been more conservative compared to the historical evidence from other industries (see table 4).

Table 4: Median Progress Ratio (PR) value for Wind, PV and CSP and Cost Reduction per Doubling of Capacity

Source	Progress ratio	Cost Reduction per doubling
Related industry precedents		
Sargent and Lundy (2003) quoting PV	0.82	18.0%
Sargent and Lundy (2003) quoting wind 1980 - 1995	0.82	18.0%
GEF (2005) quoting PV to 2000	0.8	20.0%
Hinkley et al (2011) quoting Hayward etal on PV	0.8	20.0%
Hinkley et al (2011) quoting Hayward etal on wind	0.85	15.0%
GEF (2005) quoting IEA, median over range of industries	0.82	18.0%
CSP near term projections		
Sargent and Lundy (2003) Low	0.85	15.0%
Sargent and Lundy (2003) High	0.96	4.0%
Richter et al (2009) current estimate for CSP	0.9	10.0%
GEF (2005) quoting 1999Enermodal study for CSP low	0.85	15.0%
GEF (2005) quoting 1999Enermodal study for CSP high	0.92	8.0%
GEF (2005) quoting DLR 2004 Athene study for CSP - solar field 0.9, storage 0.88, power cycle 0.94 gives overall	0.9	10.0%
IEA (2010A) roadmap for CSP	0.9	10.0%
Hinkley et al (2011) analysing CSP to date	0.85	15.0%

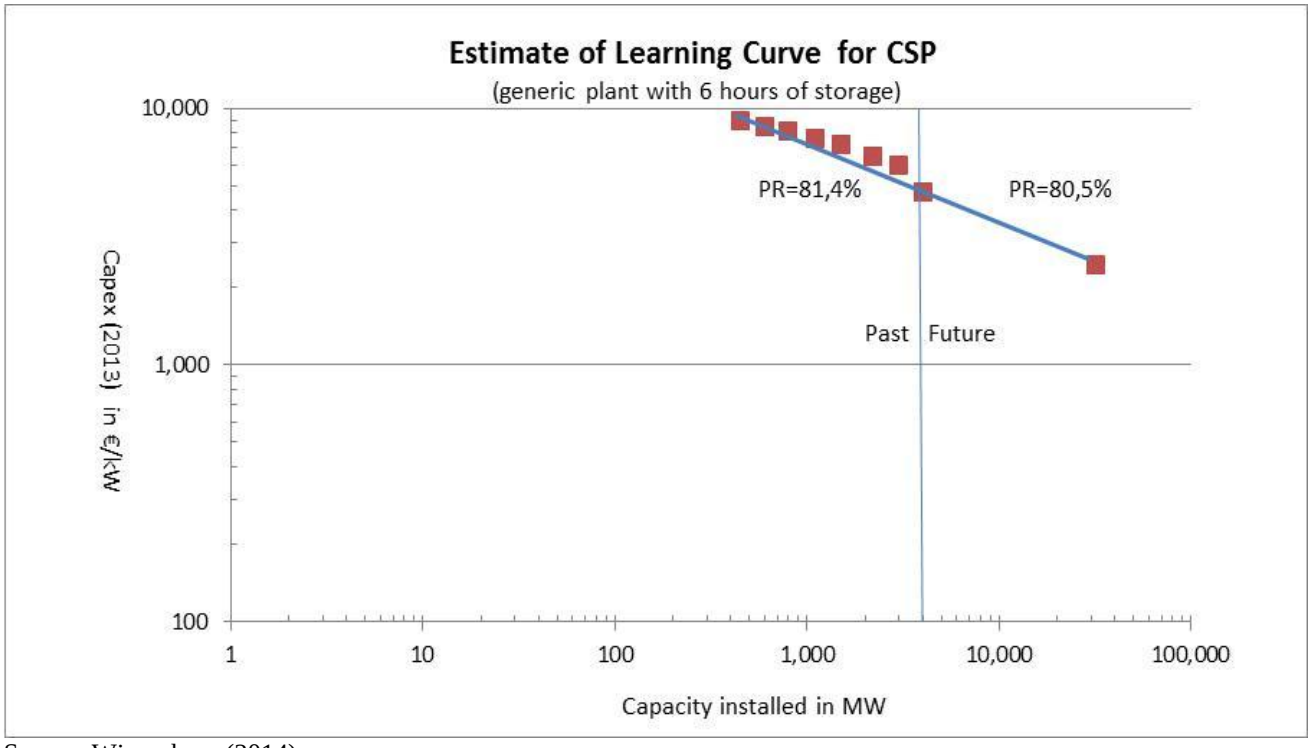
Source: IT Power, Realising the Potential for Concentrating Solar Power in Australia, Australia, May 2012.

18. It is apparent that the CSP industry behavior since the restart of 2006 has not stabilized well enough to show a clear conclusion for only 8 years of experience. Furthermore, the existence of different technologies (Parabolic trough, Central receiver and Fresnel) with or without storage makes it still more difficult to have a consistent data base for creating one learning curve for all CSP technologies.

19. On the other hand, the changes in the Spanish regulation over the last two years have had a direct impact in the cost learning curves for CSP. Before the year 2012, the old feed-in tariff structure in Spain dis incentivized any cost reduction and held the cost of CSP plants at a very high level over several years. Today, the prevailing tender process for CSP projects, more competition and the existences of a global market for CSP offer more incentives for cost reductions and innovation. For this reason, a two-phase learning curve approach for CSP has been used: phase from 2006-2013 with PR = 81.4%; and phase from 2014 on with PR = 80.5%. The progress ratio (PR) is a parameter that expresses the rate at which costs decline for every doubling of cumulative installation. For example, a progress ratio of 80% equals a learning rate (LR) of 20% and thus a 20% cost decrease for each doubling of the cumulative capacity. Both terms are used in the literature.

20. The learning cost curve estimate above would indicate that the Noor Complex can be expected to reduce the global cost curve for CSP by 3 percent, while the 2000 MW Morocco Solar Plan, if it relied solely on CSP, would be capable of reducing global CSP costs by 13 percent.

Figure 2 - Learning Cost Curve for a generic plant with 6 hours of storage



Source: Wiesenberg (2014).

Demonstration Potential at Scale

21. *Scope of avoided GHG emissions through replication.* The country program calls for the installation of 2,000 MW of solar installed capacity by 2020. This would lead to an important increase of emission reductions. If the numbers were extrapolated for the capacity additions, the potential of GHG emission savings for the government's target would reach over 3 million tons of CO_2 emission reductions per year in 2020. The proposed Project is expected to help bring down the global costs of CSP technology by increasing demand for related equipment and creating manufacturing economies of scale and learning effects from replication

22. *Transformation potential.* The proposed project has high transformational potential at the country, regional and even global level:

- *At the country level,* the project will help in building, after Noor I, a sound foundation for a successful implementation of the solar plan and installation of 2,000 MW of solar generation capacity by 2020: (a) a successful completion of the transactions under Noor I has established MASEN as a solid partner to private developers interested in CSP/solar development - this transformation is essential as the program requires funds well beyond the public sector financing capability and the country's capacity to raise debt; (b) the experience of Noor I has built MASEN's capability (learning by doing) to prepare, manage and implement complex projects and competitively select strong private partners to achieve its ambitious solar development target; (c) the contractual arrangements developed during the selection of the partner for Noor I has set the standards for future transactions as they have adequately addressed possible conflicts of interest by adequately ring fencing the different functions entrusted by the government to MASEN; (d) successful construction of Noor I, II and III will build the foundation for achieving the government target, provide confidence to manufacturers and developers in the country's solar market leading to more investments locally and cost reduction.
- *At the regional level,* the Noor complex project is the most ambitious solar project and more importantly the only one involving private sector to date. Its success will provide other countries in the region with confidence to consider PPP as a reliable mean to raise the sizeable funds required for the development of CSP at the regional level. The financial close of the PPP has reinforced interest of international developers in the development of local capacity in manufacturing and support services triggered by the MENA CSP IP. Furthermore, Morocco's ambitious solar program has been followed by the disclosure of ambitious development targets in many countries of the region.
- *At the global level,* Noor is one of the largest CSP project announced to date. It is particularly important because it attracted the developers' attention to the solar potential in the MENA region. The successful completion of the transactions under Noor I project have shown that mitigation of institutional and market risks are possible through adequate contractual arrangements, even in developing countries. Noor II and III will contribute to achieving the target envisaged under the MENA CSP IP, and to localizing manufacturing capacity in the region to reduce cost and contribute to local value creation.

23. In order to enhance and complement the transformational impact that the project helps to bring about in its own right, a technical assistance program is being made available in

parallel, which is targeting the improvement of local manufacturing capabilities in MENA, including Morocco, and the improvement of the administrative and legal framework in MENA to help put in place CSP projects.

Development Impact

24. **Improved reliability.** The development of solar energy will have significant benefits in terms of the reliability and security of electricity supply to Moroccan consumers, which is a high development priority for the Government. CSP is a technology that is of particular interest to utilities as it is more predictable than most renewable energy options and is closest to economically viable energy storage, and therefore easy to integrate into conventional electricity systems.

25. **Improved energy security.** Further development of renewable resources will increase energy security in a country that imports 15 to 18% of its electricity from Spain and is overall 97% dependent on imports. Diversity will also strengthen the resilience of the power sector to future shocks such as fuel price spikes or increased variability of hydro power generation due to climate change. While Noor production will initially be for local consumption, a growing share of the electricity produced under Morocco's Solar Plan will be exported to Europe over the medium term. In the longer-term, this share is expected to peak, and to decline when the CSP costs go down, therefore making the technology more affordable to serve local markets.

26. **Development of local industry.** Scale-up of solar development will support industrial infrastructure and strengthen the foundation for sustainable development. The Government also intends to promote local manufacturing to increase local content of the solar program. The development of the solar sub-sector in Morocco would further strengthen the country's role as a leader in renewable energy development in the region. In this context, the Ministry of Energy and the Ministry of Industry are jointly developing an integrated "Offre Industrielle" for green energy development, which essentially consists of incentives and specialized training aimed at attracting local and foreign investments in the renewable sector.

27. The development of this project through a PPP is also a clear commitment of the government to involving the private sector in the solar program. This will provide confidence not only to foreign investors but also to Moroccan private companies to increase their involvement and invest in goods and services to contribute to increased local industrial integration and job creation.

28. To support the MENA CSP IP and assess derived economic benefits, a study commissioned by the World Bank (Fraunhofer Institute, 2014) analyzed the potential or local manufacturing of CSP components across the five countries of the MENA CSP IP, namely Algeria, Egypt, Jordan, Morocco and Tunisia, and evaluated the potential economic benefits in particular with respect to the labor and the foreign trade impact. Below are the results for Morocco:

- ***Average share of local manufacturing in the CSP value chain:*** Assuming 1,000 MW CSP capacity installed by 2020 and 2,300 MW in 2025, the total potential of local content of CSP plants will increase constantly and could reach 45% in 2020 and up to 52% in 2025.

- ***The economic impact on GDP:*** Beyond electricity production, the economic impact of CSP development in Morocco is a function of local content and size of installed CSP capacity. If 2.3 GW of CSP is installed until 2025, then the economic benefit would be 5,2 bn US$. Almost 3 bn US$ comes from the construction and operation of power plants whereas more than 2 bn US$ comes from the component manufacturing in the supply chain.
- ***Labor impact:*** Over the period 2010-20**,** the cumulated total jobs of full-time equivalent for construction, manufacturing and O&M of CSP plants for 1 GW will reach over 24,000. In the long-term, between 26,000 and 73,000 FTE jobs can be created cumulatively in Morocco. In 2020, between 2000 and 5000 people would be working in the CSP industry and in 2025, between 2000 and 10000 people could potentially be employed.
- ***Foreign trade impact:*** Additional impacts on job creation and growth of GDP could come from export of CSP components.

29. **Environmental Benefits.** With respect to environmental benefits, the generated power in Noor II and III is expected to replace mainly natural gas generation in CCGTs, except for the first few years when there is also some displacement of coal and fuel oil The local environmental benefits are estimated in US$ 25 Million (when discounted at the Government opportunity cost of capital, 5%).

30. These estimates of avoided local externalities associated with fossil fuel combustion are subject to some uncertainty because there are no Morocco-specific health damage studies available, and therefore they are based on the average values from two studies (i) using the benefit transfer method, extrapolating values from the EU studies to Morocco by adjusting for per capita PPP GDP, and (ii) based on the (lower) damage cost estimates in the Six Cities study. The average damage cost is taken as 539$/ton NOx (which is escalated at the assumed rate of per capita GDP growth), resulting in a levelized damage cost of 0.19 USc/kWh,

31. **Gender.** Among the PDO level results indicators, the direct project beneficiaries (number) will be measured, and particularly the percentage which are female. This a core sector indicator. To that effect, it will be assumed that electricity customers are actually households whose gender makeup is similar to the national average of males to females in the population. So, the national average of males to females should be indicative of the gender breakdown of project beneficiaries. The MENA CSP Technical Assistance program that is being presented to the CTF in parallel will include gender-specific interventions.

Implementation Potential

32. **Public policies and the institutional set-up** in Morocco are very supportive for this project. The Government has in recent years undertaken a substantial effort to promote renewable energy, establish an adequate legal framework, set up a dedicated agency for energy efficiency and renewable energy development, and set up an institution specifically dedicated to implementing the Solar Plan (MASEN). The implementation of the solar program was entrusted to the Moroccan Agency for Solar Energy (MASEN), a fully state-owned limited liability company created on 26 March, 2010 to develop at least 2,000 MW of solar power capacity by 2020. MASEN is governed by a Board of Directors (the Directoire) and an oversight council (the Conseil de Surveillance).

33. The commitment of Morocco to a low carbon growth is evidenced by its high level participation in the recent Conferences of Parties (COPs) to the United Nations Framework Convention on Climate Change (UNFCCC) and in line with the Cancun and Durban COPs, with an explicit commitment to climate change mitigation. In preparation for the COP meetings, the Government of Morocco (GoM) released a National Action Plan against Global Warming, which lists adaptation and mitigation measures either already implemented or under consideration across a range of sectors.

34. To achieve these objectives, the key elements of Morocco's energy strategy are: (a) diversification and optimization of the energy mix using reliable and competitive energy technologies, in order to reduce the share of oil to 40% in primary energy consumption by 2030; (b) development of the national renewable energy potential by increasing the RE power generation capacity to 42% of installed capacity by 2020; (c) improvements in energy efficiency to induce energy savings of 15% from the "business as usual' scenario by 2020 and 25% by 2030; (d) development of indigenous energy resources by intensifying hydrocarbon exploration activities and developing conventional and non-conventional oil sources; and (e) integration into the regional energy market, through enhanced cooperation and trade with Maghreb and EU countries.

35. Morocco's Solar Plan, launched in November 2009, is the cornerstone of the country's renewable energy and climate change mitigation strategy. This US$ 9 billion plan calls for the commissioning of five solar power generation plants by 2020 for a total capacity of 2,000 MW, starting with the ambitious Noor complex project structured as a public-private partnership (PPP). In addition to fostering low-carbon development of the energy sector and enhancing energy security, the implementation of this plan will stimulate large investments and enhance Morocco's competitiveness. This is an integrated plan in the sense that it calls for local manufacturing, as well as related training, education and research activities, therefore boosting economic growth and contributing to job creation.

36. A renewable law 13-09 was approved in 2010. It provides a legal framework for the creation and operation of facilities producing electricity from renewable energy sources. It allows public and private corporations to compete with ONEE, the publicly owned utility, in the production of electricity from renewable energy and have access to the electricity transmission system operated by ONEE

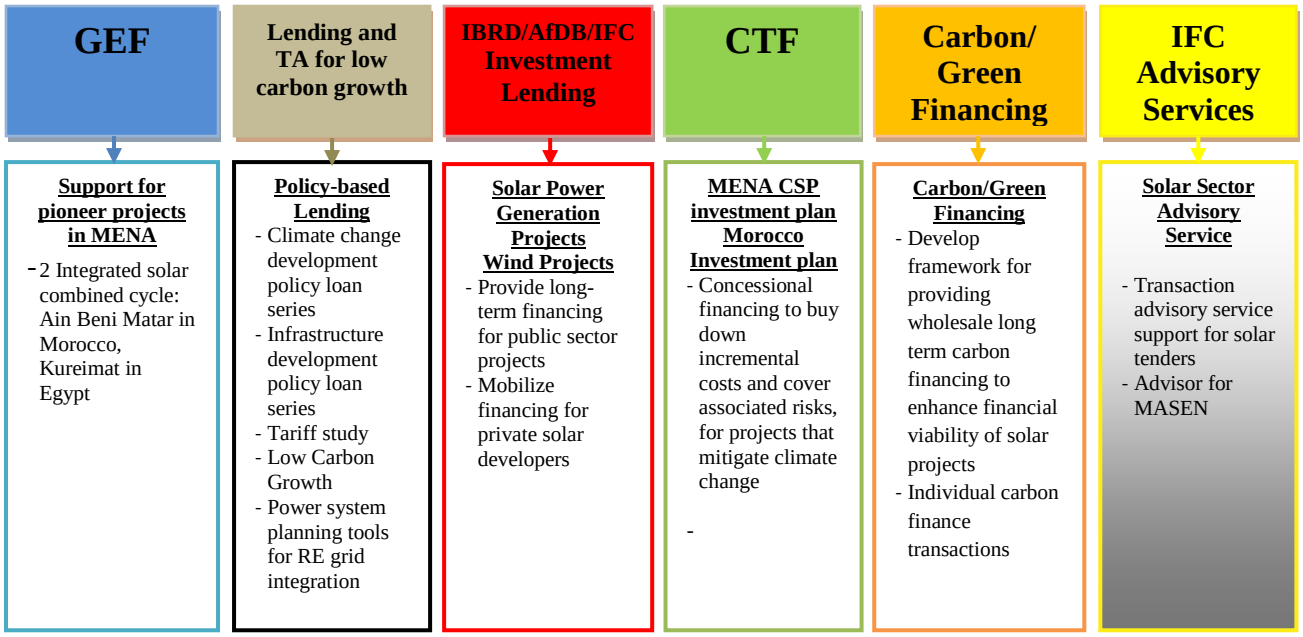
37. The Government is also undertaking extensive efforts to implement cost-reflective energy pricing and is launching energy conservation programs that will ease the transition to cost-reflective pricing by keeping consumer electricity expenditures steady.

38. **Sustainability of Transformation.** In addition, the World Bank and the African Development Bank are engaged with the Government to enhance the overall sector policy framework and advance reforms aimed at improving the sector's commercial environment and financial sustainability.

39. **Leverage of domestic public and private sector resources, carbon finance, GEF, bilateral and multilateral co-financing**. As illustrated below, the World Bank and the AfDB

are leveraging a set of actions aimed at building capacity within Morocco and providing the adequate incentives for policy reforms enabling a higher penetration for renewable energy.

Figure 3: Utilizing different instruments to make a transformational impact



40. IFI and Donor Coordination: Given the importance of solar energy in Morocco's development agenda and its significance to mitigating climate change, a number of IFIs and donors are assisting the GoM implement its national solar plan. There is already considerable coordination as well as collaboration of these efforts. This is exemplified by the various sources of financing announced for Noor II & III.

41. **Leverage:** The CTF is leveraging an additional US$ 1374 million from KfW, IBRD, EIB, AfDB, NIF and AFD. The financial leverage ratio is 1 to 5.77

CTF Additionality

42. The CTF and AfDB/World Bank loans are critical to enhancing the financial viability of the project. In the absence of the CTF funds, the resulting cost increase due to the higher generation cost of CSP compared to coal (with the future of electricity exports still uncertain for Noor II and III) would place pressure on fiscal subsidies or burden electricity consumers in the unlikely case where additional costs could be passed on to consumers. Furthermore, the CTF funds will also enable MASEN to take greater calculated risks and look to achieving breakthroughs, where boundaries are being pushed in terms of development that go beyond what many private companies would be willing to undertake.

43. The direct impact of CTF is expected to be important and it is expected to weight around 10-15% of the total concessional debt. If the CTF debt were to be on commercial terms (7%), the repackaged IFI rate would have increased twofold from 1% to 2.6%.

Implementation Readiness

44. MASEN has already prequalified 4 highly experienced international consortia for the projects. Three of these consortia are bidding for both projects, and one consortium is bidding for only 1.

45. MASEN has issued the request for technical proposals in December 2013 in a 2-stage bidding process that is designed to award both projects as a package financial closure is expected to occur in April 2015. Plant construction would then begin in and the plant would be commissioned in the second half of 2017.