

CLEAN TECHNOLOGY FUND
INVESTMENT PLAN FOR MOROCCO

Update Note

January 2014

MOROCCO

CLEAN TECHNOLOGY FUND INVESTMENT PLAN

Update Note

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ABBREVIATIONS AND ACRONYMS

ADEREE	Agence Nationale pour le Développement des Energies Renouvelables et l'Efficacité Energétique
AfDB	African Development Bank
Cf.	Compare with
CO ₂	Carbon Dioxide
CN	Concept Note
CSP	Concentrated Solar Power
CTF	Clean Technology Fund
EE	Energy Efficiency
EIB	European Investment Bank
ESMP	Environmental and Social Management Plan
EUR	Euro
FDE	Fonds de Développement de l'Energie
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHI	Global Horizontal Irradiation
GoM	Government of Morocco
GW	Gigawatt
HFO	Heavy-fuel Oil
HV	High Voltage
IP	Investment Plan
kWh	Kilowatt-hour
LCOE	Levelized Cost of Electricity
LV	Low Voltage
MASEN	Moroccan Agency for Solar Energy
MENA	Middle East and North Africa
MV	Medium Voltage
MW	Megawatt
ONEE	Office national de l'électricité et de l'eau potable
O&M	Operations and Maintenance
PPP	Public-Private Partnership
PV	Photovoltaic
RES	Renewable Energy Sources
RFP	Request for Proposals
SIE	Société d'Investissements Energétiques
STEP	Stations de transfert d'énergie par pompage
TFC	Trust Fund Committee
US\$	United States dollar
WB	World Bank
WBG	World Bank Group
WEP	Wind Energy Program

EXECUTIVE SUMMARY

1. This note represents the second revision to the original Morocco Clean Technology Fund (CTF) Investment Plan (IP) approved by the CTF Trust Fund Committee (TFC) on October 2009. This note updates the implementation status and proposes modifications to the revised CTF IP for Morocco, which was endorsed by the Trust Fund Committee (TFC) in October 2011 with an envelope of US\$ 150 million. The first revision of the IP (October 2011) focused on Morocco's Wind Energy Program (WEP) and provided support to the associated infrastructure necessary for wind energy generation. CTF resources were to finance (i) transmission infrastructure within wind farms to evacuate electricity, and (ii) pumped-storage to increase the utilization and value of wind-based power. As of January 2014, US\$125 million of CTF funding has been committed by the CTF Trust Fund Committee to the wind program of the Morocco's national utility, Office national de l'électricité et de l'eau potable (ONEE), supported by the African Development Bank (AfDB).

2. The Government of Morocco (GoM) proposes to reallocate the remaining balance of US\$25 million for the Clean and Efficient Energy Project (World Bank). The project will support the first phase of ONEE's solar strategy, which aims at installing 400 MW of solar photovoltaic (PV) technology in several sites near towns across the country located at the end of long transmission lines. The first phase aims to develop 75-100 MW of new solar PV capacity installed in three or four sites to improve the quality of supply in nearby towns, reduce network losses and tap into unexploited solar resources. ONEE's solar strategy is in line with the national energy strategy launched in 2009, which expects 42% (equivalent to about 6,000 MW) of its total energy mix to come from solar, wind and hydroelectric sources by 2020. In view of the expected high penetration of renewable energies, the GoM also proposes to improve the capacity of the power grid operator, ONEE, to manage optimally the grid. Hence, it is proposed to install state-of-the-art software and hardware, i.e. renewables dispatch desk, in the National Dispatch. These proposed activities will be implemented by the World Bank under the Clean and Efficient Energy Project. Despite the reallocation of CTF US\$ 25 million to support the development of mid-size solar PV in a context of declining PV technology prices globally, the objectives of the WEP will still be achieved.

3. Regarding the AfDB's-supported WEP, the process to pre-qualify the companies for the development of the 850 MW wind integrated program under public-private partnerships (PPP) finished in February 2013. Six groups were pre-qualified to move on to the next stage. The request for proposals (RFP) to select a developer is being prepared and is expected to be launched in January 2014.

Table 1: Morocco CTF Indicative Financing Plan Endorsed in October 2011 (US \$150 million)

Financing Source (US\$ million)	Wind Energy Program (AfDB, World Bank)
Fond Hassan II, SIE, ONEE	162.6
EIB	173.01
CTF	150
AfDB/WBG	453.57
Private Investors	209.58

Commercial Banks	1,017.68
Total (US \$ million)	2,166.43

Table 2: Morocco CTF Indicative Financing Plan after Reallocation in January 2014 (US \$150 million)

Financing Source (US \$ million)	Wind Energy Program (AfDB)	Clean and Efficient Energy Project (World Bank)	Total (US \$ million)
Fond Hassan II, SIE, ONEE	162.6	5 ¹	167.6
EIB	173.01	0	173.01
CTF	125	25	150
AfDB	512 ²	0	512
WBG	0	125	125
Private Investors	209.58	0	209.58
Commercial Banks	1,017.68	0	1,017.68
Total (US \$ million)	2,199.87³	155	2,354.87

¹It is estimated that ONEE finances US\$ 5 million for the project.

²EUR 359 million (Exchange rate of June 2012, at the time the project was approved: 1EUR = 1.426 US\$).

³ The difference with the total financing of previous endorsed financing plan is due to the updated exchange rate used in AfDB financing.

INTRODUCTION

4. Electricity demand in Morocco has been increasing rapidly at around 6.5 % per year and it is expected to continue growing at a similar rate. Peak demand has followed a similar trend and experienced an 8% increase in 2012, thus outpacing economic growth. Morocco is largely dependent on imported fossil fuels (97 percent) to satisfy its energy demand, in particular petroleum products which represent 62 percent of the country's energy needs. As a result, Morocco is highly exposed to international oil price fluctuations, which have a strong impact on the country's public finances and balance of payment.

5. To reduce fossil-fuel dependency and enhance energy security, the government has adopted a national target to increase the share of renewables (hydro, wind and solar) in the energy mix to 42% and to reduce energy consumption by 12 to 15 % by 2020. The development of the renewable energy and energy efficiency⁴ potential has become a national priority⁵, which aims to position the country on a green growth path. So far, Morocco has 280 MW of wind energy capacity and 20 MW of Concentrated Solar Power (CSP) in operation. The Moroccan wind and solar plans (2,000 MW of installed capacity each) have been launched to develop the country's vast unexploited wind and solar resources. To achieve these objectives, the government strengthened the regulatory framework by adopting key pieces of legislation, e.g. Renewable Energy law 13-09, and creating specialized institutions, e.g. Moroccan Agency for Solar Energy (MASEN) and the National Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE).

6. The Board of directors of the national utility ONEE, chaired by the Head of government, recently approved ONEE's solar strategy, which complements the large-scale integrated solar program under implementation by MASEN. So far, private and public sectors have committed investments of around US\$ 2 billion to develop the Moroccan wind and solar plans, which have an estimated total cost of US\$ 12.5 billion⁶. The current share of installed renewable energy is 25% due to the large installed hydroelectric capacity⁷, but planned investments in solar and wind energy are expected to be the main driver to reach the 42% target by 2020.

7. In the context of Morocco's energy strategy, the Trust Fund Committee (TFC) of the Clean Technology Fund (CTF) approved an Investment Plan (IP) for Morocco in October 2009 and agreed to allocate US \$150 million to support the country's Energy Development Fund ("Fonds de Développement de l'Énergie" - FDE), with a focus on increasing penetration of renewable energy into Morocco's electricity generating portfolio (wind power in particular),

⁴ Morocco's Renewable Energy Agency, the Agence Nationale pour le Développement des Énergies Renouvelables et de l'Efficacité Énergétique (ADEREE) has launched several energy efficiency programs in the construction, industrial and transport sectors.

⁵ Source: <http://www.mem.gov.ma/publications/StrategieEnergetiqueAout2011.pdf> (visited 10 May 2013). The document outlines the country's strategy as presented during the second edition of "Assises de l'Énergie" held 31 May 2011.

⁶ Source: World Bank.

⁷ Morocco's total installed capacity is 6,377 MW (2011). Installed renewable energy is: hydro (1,306 MW), wind (280 MW) and solar (20 MW). 1,740 MW of wind energy are currently under construction or development, while 160 MW of solar energy (concentrated solar power) are under construction and 300 MW are under development.

and on developing energy conservation measures (industrial energy efficiency and urban transport specifically). Correspondingly, the approved Morocco CTF IP had the following three main components: (i) electricity generation from renewable energy, (ii) energy conservation in the industrial sector, and (iii) energy conservation in the transport sector.

8. The CTF IP for Morocco was first revised in October 2011 to address difficulties in overcoming legal barriers to the on-lending of CTF funding by FDE and reallocate resources to the country's wind power public-private partnership program. Indeed, the GoM considered that the most appropriate way to maximize the impact of CTF resources would be to channel them into the national electricity ONEE's Wind Energy Program (WEP). Under the WEP, Morocco targets the commissioning of 2,000 MW of wind power by 2020 and CTF resources will support necessary associate infrastructure for wind energy generation to leverage private sector funding and crowd-in private resources for wind farm development totaling a capacity of 1,050 MW. As a result of the focus on the WEP, the industrial and transport sectors energy conservation components were removed from the IP.

9. Following the October 2011 IP revision, CTF funds were earmarked to finance (i) wind transmission infrastructure to evacuate electricity generated by wind farms and to increase absorptive capacity of the Moroccan grid and (ii) 350 MW pumped-storage to increase utilization and value of wind electricity, as well as a hydro-power complex with a total capacity of 170 MW (M'Dez El Menzel). Out of the total CTF allocation, the African Development Bank (AfDB) and the World Bank were tasked with the channeling of US \$125 million and US \$25 million respectively.

10. In June 2012, the AfDB approved a loan of US\$ 512 million⁸, in addition to the US \$125 million from the CTF, for ONEE's WEP and rural electrification program. The funds provided by AfDB and the CTF enabled the launch of the WEP (see implementation details further down this note). The US\$ 25 million CTF allocation channeled by the World Bank, however, was not used for the WEP. Instead, Moroccan authorities requested the World Bank to reallocate these funds to support the first phase of ONEE's solar strategy⁹ to improve the quality of supply in rural towns located at the end of transmission lines, reduce network losses and tap into unexploited solar resources using a solar technology with rapidly decreasing capital costs. The first phase aims to develop 75-100 MW of new solar PV capacity installed in three or four sites in the east and southern regions and will pave the way for a larger second phase targeting 200 MW in eight other sites with similar characteristics. Moreover, Moroccan authorities requested support for the grid operator, ONEE, to improve its capacity to adequately manage and optimize the increased flows of renewable energy in the energy mix expected by 2020. Thus, ONEE proposed to install a renewable energy dispatch desk, i.e. software and hardware, in the National Dispatch. These proposed activities will be implemented by the World Bank under the Clean and Efficient Energy Project.

11. The purpose of the present note is to propose changes to the Morocco IP in terms of focus pursuant the GoM's request as stated in a letter submitted to the World Bank dated March 14, 2013. In addition, this note provides an update of the progress of the revised Morocco IP of October 2011.

⁸ EUR 359 million (Exchange rate: 1 EUR = 1.426 US\$)

⁹ Letter from Mr. Mohamed Najib Boulif, Delegate Minister for General Affairs and Governance, to Mr. Simon Gray, World Bank Country Director dated March 14, 2013.

STATUS OF ORIGINAL INVESTMENT PLAN IMPLEMENTATION

12. As of January 2014, the Trust Fund Committee has committed US\$125 million out of US\$150 million originally endorsed for Morocco. The current status of the Morocco – ONEE Wind Energy Program (WEP) implemented with AfDB's support is presented below:

Table 3: Status of Approval of CTF Projects

Project Title	TFC Approval Date	Actual MDB Board Approval Date	CTF Funding (\$ million)	Leveraged Funding (\$ million)
Morocco – ONEE Wind Energy Program (AfDB)	October 2011	June 2012	125	2,075

Description of Morocco – ONEE Wind Energy Program (AfDB)

13. This Integrated Wind/Hydro and Rural Electrification Program comprises the following three components:

- i. **Wind and Hydro-Power Generation:** This component entails the construction of five wind farms with a total capacity of 850 MW: (i) Midelt (150 MW); (ii) Tiskrad (300 MW); (iii) Tangiers 2 (100 MW); (iv) Jbel Al Hadid (200 MW); (v) Boujdour (100 MW). AfDB intervenes in two of these wind farms, Tangiers 2 and Koudia El Baida, located in the North of Morocco, under a PPP in the case of Tangiers 2 and direct financing for the Koudia El Baida transformer station and electric power lines. This component also includes a pumped energy transfer station of 350 MW (STEP-Abdelmoumen) as well as a hydro-power complex with a total capacity of 170 MW (M'Dez El Menzel), (ii) construction of HV lines and substations to evacuate the electric power generated to the national grid and (iii) technical assistance. CTF is supporting this component of the project.
- ii. **Rural Electrification Distribution:** This component concerns the construction of MV and LV lines and MV/LV distribution sub-stations with a view to connecting 86,000 households in 25 provinces, in order to increase the electricity access rate to about 99%. This component will contribute to the achievement of the objectives of the National Global Rural Electrification Program.
- iii. **Program Management:** This component comprises works control and supervision, implementation of the Environmental and Social Management Plan (ESMP) and the Program audit. It includes the ESMP's of sub-projects, the implementation of environmental and social measures as well as audits and overall Program monitoring and evaluation.

Rationale

14. Morocco is almost 97% dependent on outside sources to meet its energy needs. Over the past ten years, electricity consumption in Morocco has increased at an annual average rate of 6% to 8%, due to the country's robust economic development and the implementation of a major Global Rural Electrification Program (PERG). This rising demand for electricity is expected to continue at an annual rate of 5% to 7% over the next ten years, in line with estimated GDP growth of 5.5%¹⁰.

15. The Integrated Wind/Hydro and Rural Electrification Program is in keeping with the vision of Morocco's energy strategy whose aims are mainly to: (i) improve energy security; (ii) increase the share of clean and renewable energies in the energy mix; and (iii) provide rural areas with access to energy. This Program will result in a reduction in energy product imports and help to prevent the emission of 65 million tons of CO₂ over its total life-span. It will also foster greater private sector participation in electric power generation investments. It will result in the electrification of 86,000 households, representing about 516,000 Moroccans living in rural areas.

Progress

16. The pre-qualification process of the integrated wind program and of the pumped energy transfer station at STEP Abdelmoumen has been completed. The RFP for selecting the developer is planned to be launched by January 2014. The pre-qualification process for the hydro-power complex of M'Dez El Menzel is in evaluation stage. As far as the MV and LV lines are concerned, construction contracts have been awarded and the projects are under implementation.

¹⁰ Source: African Development Bank (AfDB).

CIRCUMSTANCES AND RATIONALE FOR INVESTMENT PLAN UPDATE

Impacts of Morocco's rising electricity demand

17. The electricity demand in Morocco has been increasing rapidly at around 6.5 % per year since 2007 and it is expected to continue growing at a similar rate in the foreseeable future. Peak demand has followed a similar trend and has registered an 8% growth in 2012. To satisfy this demand, Morocco relies mainly on generation capacities running on fossil fuels, with heavy-fuel oil (HFO) representing more than 18% of power production in 2012. HFO is used in particular to meet noon and evening peak demand, and the reliance of Morocco on this petroleum product is likely to remain high in the coming 3 to 5 years. As it is, Morocco is currently the largest energy importer in Northern Africa, with fossil energy imports representing 97% of its energy consumption and petroleum products amounting to 62% of its energy needs.

18. The increased use by Morocco of thermal generation capacity to meet its rise in electricity demand has resulted in an important growth in the country's CO₂ emissions. Between 2000 and 2010, Morocco's CO₂ emissions increased by 56% to reach 46 million tons while the CO₂ emissions per capita increased by 41% during the same period to reach 1.44 tons¹¹.

19. As a result of the sharp rise in the electricity demand, technical losses are increasing due to growing strain in the national transmission network. ONEE's transmission losses are estimated at 4.4 %, while distribution losses are around 15%¹². These figures are slightly higher than other countries in the region such as Egypt and Jordan¹³. The increase in technical losses and the use of expensive heavy-fuel oil for power generation aggravates the delicate financial situation of the national electricity utility, ONEE, which has seriously deteriorated over the last two years.

Morocco's ambitious renewable energy strategy

20. In order to reduce its fossil-fuel dependency and curb the growth of CO₂ emissions, the GoM has taken decisive steps to diversify the country's energy mix. The promotion of renewable energy and energy efficiency is a national priority and the GoM seeks to position Morocco on a green growth path. To do so, the country aims to tap into its sizeable wind and solar energy potential and leverage its strategic geographical location at the doorstep of the European Union. Since 2009, Morocco has launched ambitious wind and solar plans (2,000 MW of new installed capacity each) to achieve a 42% share of renewables in the energy mix by 2020.

21. The Moroccan Agency for Solar Energy (MASEN) is in charge of implementing the 2,000 MW national solar plan (CSP and PV) composed of large-scale projects such as the CTF-funded 160 MW Nour I under construction. The national utility, ONEE, with government's support, has

¹¹ International Energy Agency, "CO₂ Emissions from Fuel Combustion 2012", 2012.

¹² Source: World Bank.

¹³ Jordan (2010): distribution losses estimated at 12.1% and transmission at 2%. Egypt (2010): distribution losses estimated at 8% and transmission at 4.2%.

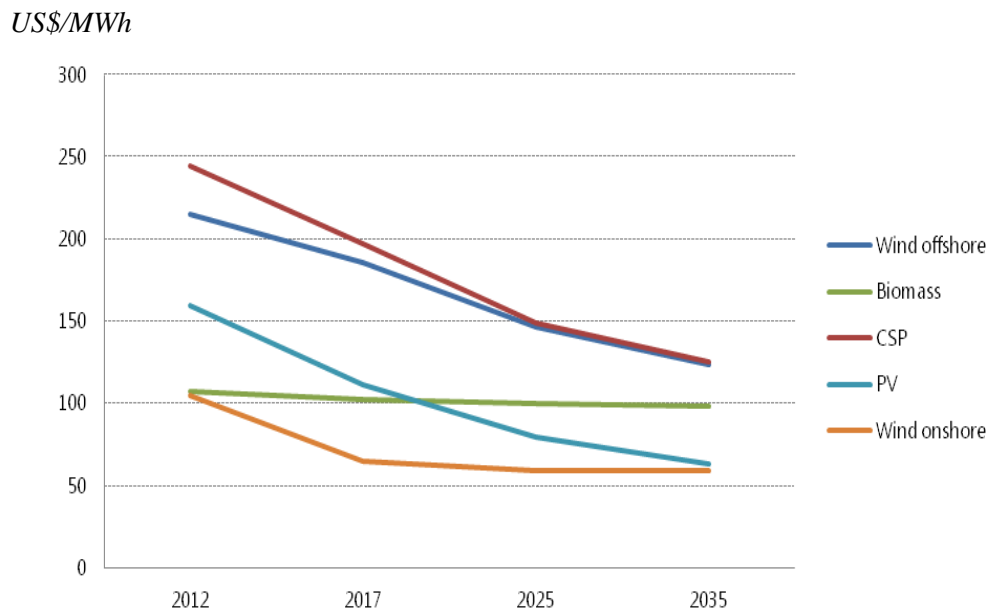
recently approved its solar strategy to improve the quality of supply in towns located at the end of transmission lines and to reduce technical losses. ONEE’s solar strategy will reinforce the country’s renewable energy strategy since it will add a total of 400 MW of solar PV capacity over twenty sites. ONEE’s mid-size grid-connected PV plants will be complementary to the utility-scale integrated solar program led by MASEN, with optional storage facilities to supply power during the night peak period.

22. CTF financing is currently being leveraged to support Morocco’s renewable energy strategy. The Updated CTF MENA CSP IP (endorsed in April 2013) channels US\$218 million into Morocco’s Concentrated Solar Power with storage program through the AfDB and the World Bank, while the CTF Morocco IP (endorsed in October 2011) contributes US\$125 million to the country’s Wind Energy Program (WEP).

Rapidly declining costs of solar PV technology and large potential

23. Costs of solar PV technology have declined dramatically in recent years¹⁴ due mainly to technology improvements and policy support around the world. The price of solar PV-generated electricity, calculated with the Levelized Cost of Electricity (LCOE) method, is expected to become competitive with wind energy by 2035 (see Figure 1). Despite its significant cost reduction, power generation from solar PV technology is still more expensive than from comparable alternatives in Morocco. CTF financing would bring generation costs of the technology close to grid parity, hence alleviating the financial burden on the national utility ONEE.

Figure 1: Levelized Cost of Energy for solar PV and other RES (Source: World Bank/Mercados)



24. Morocco has significant unexploited solar resources with an average solar radiation of 5 kWh/m²/day. Moreover, the technical potential is large as shown in the table below.

¹⁴With a learning rate between 18-22% for each doubling of installed capacity, PV module prices have dramatically dropped over the past two decades. A 60% reduction has been achieved over the last two years (Source: IRENA, Solar Photovoltaic Technology Brief, January 2013)

Table 4: Technical potential of wind and solar energy in Morocco

	Installed (2012)	Technical Potential
Solar PV	4.5 MW	11,000 GW
Solar CSP	20 MW	8,800 GW
Wind	280 MW	25 GW

Source: ADEREE, Morocco

Rationale for proposed IP update

25. Out of the US\$150 million allocated to the CTF IPforMorocco, the CTF Trust Fund Committee has already committed US\$125 million of CTF funds for the WEP project which is being implemented by the AfDB. The Government of Morocco (GoM) has requested to reallocate the remaining US\$25 million to support the deployment of the first mid-size solar PV plant in the country, as well as increase the capacity of the power system to absorb intermittent renewable energy sources. Despite this reallocation, the objectives of the WEP will still be achieved as stated in the first revision of the Morocco CTF Investment Plan.

26. In view of the rapidly declining costs of solar PV technology globally and the significant voltage drops at the end of Morocco's long transmission lines, ONEE approved a solar strategy, which aims at installing 400 MW of solar photovoltaic (PV) technology in several sites near towns in the east and southern regions. The Government of Morocco (GoM) would like to use the unallocated US\$25 million for the first phase of this strategy, which aims to develop 75-100 MW of solar PV capacity in three or four sites. This project will support the first mid-size solar PV plants in the country and will contribute to build-up local expertise, e.g. engineers, installers, in the solar PV sector.

27. The proposed reallocation of US\$ 25 million of CTF funds will be channeled through the World Bank in support of the Clean and Efficient Energy project. CTF funding to the project will pave the way for the penetration of solar PV in the country, which is expected to accelerate with the planned amendment to the Renewable Energy Law 13-09 to allow private sector operators to connect solar PV plants to the Medium Voltage grid.

28. Several mid-size solar PV plants will be located in Morocco's sun-abundant east and southern regions close to towns far away from the country's generation facilities located in the north-western and north-eastern regions. The generation of clean energy closer to the end users will reduce current electricity losses, improve the quantity and quality of power supply to the selected areas, and decrease the country's oil consumption for power generation.

29. The use of CTF funding will also support the creation of a renewable energy dispatch desk, which would allow for the integration of intermittent large-scale renewable energy sources in the power system. The dispatch desk will provide ONEE's grid operator with a reliable tool to support its decision-making process and to ensure optimal management of the national electricity system within highest safety conditions.

PROPOSED CHANGES TO THE INVESTMENT PLAN

30. This note proposes the reallocation of the remaining US\$25 million, which were originally planned to support Morocco's WEP. After the reallocation, the CTF funds will support two components within the Clean and Efficient Energy Project, which will be implemented by the World Bank. The proposed project would cost a total of US\$155 million, out of which US\$25 million would be provided by the CTF.

31. Tables 5 and 6 below present the Morocco CTF IP financing plan endorsed in October 2011 and the proposed financing plan after reallocation. The reallocation will allow for an increase leverage of CTF funding, i.e. leveraging factor increases from 14 to 15.7.

Table 5: Morocco CTF Indicative Financing Plan Endorsed in October 2011 (US \$150 million)

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Fond Hassan II, SIE, ONEE	162.6
EIB	173.01
CTF	150
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Private Investors	209.58
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Total (US \$ million)	2,166.43

Table 6: Morocco CTF Indicative Financing Plan after Reallocation in January 2014 (US \$150 million)

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WBG	0	125	125
Private Investors	209.58	0	209.58
Commercial Banks	1,017.68	0	1,017.68
Total (US \$ million)	2,199.87¹⁷	155	2,354.87

¹⁵It is estimated that ONEE finances US\$ 5 million for the project.

¹⁶EUR 359 million (Exchange rate of June 2012, at the time the project was approved: 1EUR = 1.426 US\$).

¹⁷ The difference with the total financing of previous endorsed financing plan is due to the updated exchange rate used in AfDB financing.

POTENTIAL IMPACTS OF PROPOSED CHANGES ON INVESTMENT PLAN OBJECTIVES

Table 7: Assessment of Proposed Changes

CTF Investment Criteria	Morocco's IP (1 st revision, October 2011)	Morocco's IP (2 nd revision, January 2014)
Transformational Impact	<p>The CTF resources can put Morocco on a transformational path to boost the development of its vast wind energy resources by supporting the necessary infrastructure for commercializing wind energy at a larger scale. Morocco has significant potential for generating wind energy: out of 25, 000 MW national potential, it aims to install 2,000 MW by 2020. The current installed capacity is still modest with about 280 MW.</p> <p>The CTF Funding will assist in establishing the necessary infrastructure to make wind energy commercially viable and to allow absorbing and evacuating the produced wind energy into the grid.</p>	<p>In addition to the transformational impacts stated in the revised IP, the CTF will focus in providing support to ONEE's solar strategy, which aims at installing 400 MW of solar PV technology in several sites near rural towns at the end of long transmission lines to improve the quality of their supply, reduce network losses and tap into unexploited solar resources. CTF funds will support the first phase of the strategy, i.e. 75-100 MW, and will be critical for achieving the final target.</p> <p>The implementation of the first mid-size grid-connected solar PV plants in the country will provide important expertise and know-how, i.e. technical, financing, to the Government of Morocco (GoM) in its efforts to allow private sector operators to sell directly to the Medium Voltage grid. GoM is currently considering an amendment to the Renewable energy law 13-09 to foster private sector participation, which could significantly increase the penetration of solar PV technology in the country.</p> <p>CTF funds will also support a new Renewable Energy dispatch center located at the existing ONEE's National Dispatch in Casablanca, which will allow the grid operator, ONEE, to safely manage the expected large amounts of renewable energy by 2020.</p>
Potential for GHG Emissions Savings	1.7MtCO ₂ /year and 33.8MtCO ₂ over 20 years	In addition to the 1.7 MtCO ₂ /year and the 33.8MtCO ₂ over 20 years avoided due to the WEP (as indicated in the Original IP), the proposed Clean and Efficient Energy project will contribute

		additional savings of 73,143 tCO ₂ /year, or 1,462,860 tCO ₂ over 20 years ¹⁸ .
Cost-effectiveness	US\$ 4.4 per ton of CO ₂	US\$ 4.2 per tons of CO ₂ ¹⁹
Demonstration Potential at Scale	The implementation of 1,070 MW of the WEP will allow ONE, FDE (SIE), the Hassan II Fund, and Moroccan investors (industrial, private funds and banks) to gain the experience and know-how necessary for the future realization of Morocco's total wind capacity, with 6 GW actually proven, and an estimated potential of up to 25 GW.	The 1,070 MW of the Wind Energy Program (WEP) paves the way for the realization of Morocco's wind potential: 6 GW proven and up to 25 GW of estimated potential. Despite the reallocation of CTF US\$ 25 million to support the development of mid-size solar PV plants under the Clean and Efficient Energy Project, the objectives of the WEP will still be achieved. The implementation of the first phase of ONEE's solar strategy, i.e. 75-100 MW of solar PV in three or four sites, under the World Bank-led Clean and Efficient Energy Project, will allow ONEE to gain the experience and know-how necessary to successfully complete the following phases until achieving 400 MW of solar PV capacity installed.
Development Impact	<ul style="list-style-type: none"> ▪ Green technology transfer and economy windfall ▪ Green job creation ▪ Increased Energy security 	In addition to the development impacts of the revised IP, the solar PV plants to be developed in Morocco's rural east and southern regions will bring positive economic benefits, e.g. job creation in impoverished towns. Moreover, the solar PV plants will allow satisfying an expected strong demand from irrigation due to the Morocco Green Plan ("Plan MarocVert") to be implemented in these regions. The target regions will also benefit from better power quality due to improved voltage and higher reliability of the power supply. A social impact study is underway to assess the project's impact on women.

¹⁸ Assuming a total installed capacity of 75 MW. The calculation methodology is based on the World Bank "Guidance Note: Greenhouse Gas Accounting for Energy Investment Operations, Version 1.0, June 2013". The avoided GHG emissions have been estimated following the formula: Net emissions = Project emissions – Baseline emissions, where Project emissions = 0 (solar PV plants do not emit GHG gases) and Baseline emissions = Combined margin emissions * electricity generated (GWh). Combined margin emissions = operating margin (75%) × grid emissions factor (638 gCO₂/kWh) + build margin (25%) × build margin emissions (354 gCO₂/kWh).

¹⁹ The Clean and Efficient Energy Project proposed in this second revision of the Investment Plan will contribute to additional savings of 1,462,860 tCO₂ over the lifetime of the project. Thus, US\$ 150 million / (33.8 tCO₂ + 1.4 tCO₂) = US\$ 4.2 tCO₂.

Implementation Potential	High potential as the approach chosen allows for fast disbursing and construction of wind farms.	In addition to the implementation potential of the revised IP, the implementation potential of the mid-size solar PV program is high due to the fact that the project will be implemented and eventually operated for the first two to five years by an experienced private sector operator through an EPC and O&M contract. ONEE successfully used this approach in other projects such as the Integrated Solar Combined Cycle Power Plant near the town of Ain Beni Mathar. This arrangement would allow ONEE to pass the operating risk to the private contractor, while obtaining the required supply of solar PV-based power according to contractual arrangements
CTF Additionality	CTF Financing brings internal rate of return (IRR) to 11%, which is the threshold IRR required by private investors to invest in wind in Morocco.	CTF Financing brings internal rate of return (IRR) to 11%, which is the threshold IRR required by private investors to invest in wind in Morocco. The capital cost for solar PV technology has dropped significantly in the last few years. The lower capital cost combined with the country optimal insolation conditions are expected to bring the cost of energy from solar PV close to grid-parity. CTF concessional financing is essential to further reduce the energy cost to make it cost-competitive with alternatives.

Table 8: Risks and Mitigation Measures

32. In addition to the risks and mitigation measures identified in the revised Morocco IP endorsed in October 2011, the following risks should be considered:

Risk Area	Risk Description	Mitigation Measure	Residual Risk (low/moderate/high)
Electricity Sector	The electricity utility (ONE) and the water utility (ONEP) merged in 2012 creating the new company ONEE (Office National de l'Electricité et de l'Eau potable). It remains to be seen whether the transition towards this new company affects the utilities' performance and capabilities.	Regular monitoring of this risk by the World Bank team during project preparation, supervision and other interactions with ONEE.	moderate
Stakeholder involvement	Risk of stakeholders (ONEE and Government) ceasing to support the Clean and Efficient Energy Project.	The commitment to the project by ONEE and Government is high. Moreover, regular dialogue with the Government and ONEE's management will	low

		continue to ensure adequate information flow on project progress.	
Technology	ONEE's inexperience with solar PV technology could delay project implementation.	Solar PV technology is mature and ONEE will hire a reputable consultant to provide high-quality advice during project preparation and implementation. This consultant will be financed with a CTF Project Preparation Grant.	moderate
Environmental and Social	The environmental risks of the Clean and Efficient Energy Project are low, but social issues regarding land acquisition for the three or four solar PV plants could delay project implementation.	The pre-identified sites are owned by the Moroccan state, which made them available to ethnic communities. Regular monitoring and support to ONEE to ensure that best practices on social safeguards are used.	moderate
	Overall risk after mitigation	Moderate	

ANNEX I: Morocco – Clean and Efficient Energy Project (World Bank)

Problem Statement

33. Electricity demand in Morocco has been increasing rapidly at around 6.5 % per year and it is expected to continue growing at a similar rate. Peak demand has followed a similar trend and experienced an 8% increase in 2012, thus outpacing economic growth. Morocco is largely dependent on imported fossil fuels (97 percent) to satisfy its energy demand, in particular petroleum products which represent 62 percent of the country's energy needs. Morocco uses expensive heavy-fuel oil for power generation²⁰ to supply its two peaks that are being observed around 7-9 am and between 8-10 pm.

34. To reduce the country's vulnerability to oil-price increases due to fossil-fuel dependency and enhance energy security, the government has adopted a national target to increase the share of renewables (hydro, wind and solar) in the energy mix to 42%. The development of the renewable energy and energy efficiency potential has become a national priority²¹, which aims to position the country on a green growth path. The Moroccan wind and solar plans (2,000 MW of new installed capacity each) have been launched to develop the country's vast unexploited wind and solar resources.

35. The national utility "Office National de l'Electricité et de l'Eau Potable" (ONEE) is strongly committed to develop the country's solar resources, alongside other Moroccan institutions²², by installing the first mid-size grid-connected photovoltaic (PV) plants. Moreover, ONEE will install a renewable energy dispatch desk in the existing national dispatch center to ensure increased penetration of planned intermittent large-scale renewable energy sources, i.e. wind and solar by 2020.

Description of Project Components

36. The project has the following components:

- **Component 1 – Mid-size solar PV program (CTF co-financing US\$ 22 million):** This component includes the supply, installation, connection, testing and commissioning of several mid-size solar photovoltaic (PV) plants in the range of 10-30 MW in Morocco's east and southern regions with a total installed capacity of 75-100 MW. This program corresponds to the first phase of the ONEE's solar strategy, which aims at installing 400 MW in around twenty sites across the country. The coincidence of local demand with solar resource availability on a daily basis is expected to reduce the stress on the high-

²⁰ The share of heavy fuel oil in power production exceeded 18% in 2012 and is expected to remain as high for the next three to five years.

²¹ Source: <http://www.mem.gov.ma/publications/StrategieEnergetiqueAout2011.pdf> (visited 10 May 2013). The document outlines the country's strategy as presented during the second edition of "Assises de l'Énergie" held 31 May 2011.

²² The government created the Moroccan Agency for Solar Energy (MASEN) to develop 2,000 MW of solar energy.

voltage network and losses. The Clean Technology Fund (CTF) contribution to this program will ensure the economic and financial viability of the first mid-size solar PV projects in Morocco and catalyze the emergence of a new market segment for renewable energies in the country. Moreover, the solar PV program will allow the on-the-job training to local engineers, installers and other technicians. In this context, the government plans to amend the Renewable energy law 13-09 to allow private sector operators sell their solar PV-based electricity to the Medium voltage grid, which is expected to facilitate further the penetration of solar PV technology in the country.

- Component 2 - Renewables dispatch desk (CTF co-financing US\$ 3 million):** This component includes the supply and installation of software and hardware to ensure optimal power dispatch and electric power system protection in view of the planned integration of intermittent large-scale renewable energy sources by 2020. Dispatch optimization will be carried out according to supply/demand forecasts and hence, will reduce investment needs in generation and transmission. The Renewables dispatch desk is a software and hardware platform aiming at (i) forecasting and monitoring real-time renewable energy flows, (ii) monitoring safety and stability of the national electricity system, and (iii) assisting the grid operator in its decision-making process. It will measure and control all renewable energy connected to the grid in order to integrate the largest possible amount of renewable-based electricity while maintaining the stability and security of the electricity system. The renewables dispatch desk will display information regarding real-time generation of wind farms and solar CSP and PV plants, as well as information about network conditions on screens in ONEE’s National Dispatch located near Casablanca.
- Component 3 - Demand-Side Management (DSM) program (No CTF co-financing):** Given the high proportion of low-voltage in total consumption during peak hours (63%), Morocco introduced an optional time-of-use tariff system for residential, industrial and agricultural clients. This component intends to support the installation of bi-hourly meters to all ONEE clients consuming more than 500 kWh/month (49,000 residential and 11,000 industry/agricultural clients) to contribute to shave the national peak load and, hence, to reduce expensive fuel-oil use for power generation during peak hours.
- Component 4 – Technical Assistance and Capacity Building (No CTF co-financing):** The technical assistance will include support for (i) developing technical specifications for the renewables dispatch desk (Component 2), and (ii) developing an awareness campaign to roll-out of bi-hourly meters for the demand-side management program (Component 3).

Table 9: Clean and Efficient Energy Project (World Bank) – Financing Plan

	Total	IBRD	CTF	ONEE
Component 1 - Mid-size solar PV program	125	100	22	3
Component 2 - Renewables Dispatch Desk	7.5	3.5	3	1
Component 3 - Demand-Side Management	14	13	0	1

Component 4 - Technical Assistance	3.5	3.5	0	0
Contingencies	5	5	0	0
Total (US\$ million)	155	125	25	5

Proposed Transformation

37. The proposed revised investment plan will pave the way for the introduction of the first mid-size grid-connected solar PV in Morocco and will be key for rolling out ONEE’s solar PV strategy. CTF support to the first phase of the strategy will develop the necessary technical capacities at government and private sector for further penetration of solar PV technology in the country, which is expected after the government authorization –under discussion- to allow private sector operators to sell their solar PV-generated power directly to the MV grid. CTF financing will contribute to bring down generation costs of the project and act as a catalyst for further penetration of solar energy in Morocco’s energy mix. Besides the on-going CTF contribution to the Morocco’s Wind Energy Program, the proposed revised investment plan will allow the country to develop an unexploited market segment in solar technology. Moreover, CTF will support a critical management tool to increase the grid operator’s capacity, ONEE, to maximize the integration of all renewable energies planned by 2020, i.e. 2000 MW of solar and 2000 MW of wind, in the electricity system. Indeed, the Renewables dispatch desk will aim at (i) forecasting and monitoring real-time renewable energy flows, (ii) monitoring safety and stability of the national electricity system, and (iii) assisting the grid operator in its decision-making process in order to integrate the largest possible amount of renewable-based electricity while maintaining the stability and security of the electricity system.

Implementation Readiness

38. To achieve the 42% renewable energy target by 2020, the Moroccan government strengthened the regulatory framework by adopting key pieces of legislation such as the Renewable Energy law 13-09, and creating specialized institutions such as the Moroccan Agency for Solar Energy (MASEN). MASEN’s mission is to develop integrated solar projects with a total capacity of 2,000 MW. This mission does not preclude the national utility ONEE to pursue its own capacity expansion investments in clean energy and innovative solutions to ensure the power system reliability. ONEE’s solar strategy targets mid-size PV plants to respond to inefficiencies in the grid and to bring electricity generation sources near demand centers, , and is therefore complementary to MASEN’s large-scale solar projects. So far, the private and public sectors have committed investments of around US\$ 2 billion to develop the Moroccan wind and solar plans, which have an estimated total cost of US\$ 12.5 billion. The current share of installed renewable energy is 25% due to the large installed hydroelectric capacity²³, but planned investments in solar and wind energy are expected to be the main driver to reach the national renewable energy target.

39. On April 2012, the Government of Morocco merged the water and electricity utilities (Law 40/09) into the integrated company Office National de l’Eau et de l’Electricité (ONEE). The move aimed at improving the management of both utilities and increase cross-sector synergies.

²³ Morocco’s total installed capacity is 6,377 MW (2011). Installed renewable energy is: hydro (1,306 MW), wind (280 MW) and solar (20 MW). 1,740 MW of wind energy are currently under construction or development, while 160 MW of solar energy (concentrated solar power) are under construction and 300 MW are under development.

However, the company's financials are fragile, mainly due to tariffs that do not allow for cost recovery and high fuel prices. The Government and ONEE are in discussions to improve the company's financial health.

40. ONEE is familiar with World Bank's policies and guidelines following the preparation of several projects including the GEF-financed Integrated Solar Combined Cycle Project near the town of AinBeniMathar. This pioneering project integrated a combined-cycle power plant with a 20 MW solar field using concentrated solar power (CSP) technology²⁴, the only experience that ONEE has in solar energy.

Rationale for CTF Funding

41. Despite the rapid decline of solar PV capital costs²⁵, power generation from mid-size solar PV projects is still more expensive than from comparable alternatives in Morocco. However, the coincidence of the solar PV generation with the daily peak-demand hours when the marginal cost of generation is higher will bring the generation costs close to grid parity. The CTF funding will bring down generation costs to cover the remaining gap and make the technology competitive. The CTF contribution will be key for completing ONEE's 400 MW solar PV strategy. The support to the first phase of the strategy, i.e. 75-100 MW of solar PV in three or four sites, under the World Bank-led Clean and Efficient Energy Project, will allow ONEE and local subcontractor companies to gain the experience and know-how necessary in subsequent phases. Moreover, CTF funding will allow the Government of Morocco (GoM) to obtain important expertise and know-how, i.e. technical, financing, through the project, which will set a sound basis for opening up the Medium voltage (MV) grid to private sector operators.

42. The use of CTF funding will also support the creation of a renewable energy dispatch desk, which would allow for the integration of intermittent large-scale renewable energy sources in the power system. The dispatch desk will provide the grid operator with a reliable tool to support its decision-making process and to ensure optimal management of the national electricity system within highest safety conditions.

Results Framework

Results	Indicator	Baseline	Target
Avoided GHG emissions	Tons of GHG emissions reduced or avoided		
	- tCO ₂ e/yr - tCO ₂ e over lifetime of the project	0 0	73,143 1,462,860

²⁴ There are two main categories of solar technologies: solar photovoltaic (PV) and concentrated solar power (CSP). While Solar photovoltaic (PV) directly converts solar energy into electricity using a PV cell made of a semiconductor material, Concentrated solar power (CSP) transforms the energy from the sun's rays into heat and then into mechanical energy by turbines or other engines and then into electricity.

²⁵With a learning rate between 18-22% for each doubling of installed capacity, PV module prices have dramatically dropped over the past two decades. A 60% reduction has been achieved over the last two years (Source: IRENA, Solar Photovoltaic Technology Brief, January 2013)

Increased finance for low carbon development	Volume of direct finance leveraged through CTF funding (US\$ million)		
	- public	0	130
	- private ²⁶	n.a.	n.a.
Increased supply of renewable energy	Installed capacity as a result of CTF interventions (MW)	0	75 -100

Financing Plan

Financing Source	Amount (US\$ million)
Borrower (ONEE)	5
International Bank for Reconstruction and Development	125
Clean Technology Fund	25
Total	155

Project Preparation Timetable

Milestone	Date
Quality Enhancement Review Meeting	May 8, 2014
CTF Trust Fund Committee submission	May 20, 2014
Decision Meeting	September 17, 2014
World Bank Board Approval	December 18, 2014

²⁶During preparation, the project will assess different options to crowd-in private sector financing. At this stage, it was not possible to confirm an estimate of private financing in the project.

ANNEX II: Results Framework

Table 10: Results Framework – Morocco CTF IP after Reallocation (January 2014)

Results	Indicator	Baseline	Expected Results in Morocco CTF IP (October 2011)	Expected Results in Morocco CTF IP <u>after</u> Reallocation (January 2014)
Avoided GHG emissions	Tons of GHG emissions reduced or avoided	0	1,700,000	1,773,143
	- tCO ₂ e/yr	0	33,800,000	35,262,860
	- tCO ₂ e over lifetime of the project			
Increased finance for low carbon development	Volume of direct finance leveraged through CTF funding (US\$ million)			
	- public	0	789.18	977.61
	- private	0	1,227.26	1,227.26
Increased supply of renewable energy	Installed capacity as a result of CTF interventions (MW)	0	1,070	1,145 – 1,170