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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED IBRD LOAN

IN THE AMOUNT OF US$ 125 MILLION

AND A PROPOSED CLEAN TECHNOLOGY FUND LOAN

IN THE AMOUNT OF US$ 23.95 MILLION

TO THE

OFFICE NATIONAL DE L'ELECTRICITE ET DE L'EAU POTABLE (ONEE)

FOR THE

CLEAN AND EFFICIENT ENERGY PROJECT (P143689)

Energy and Environment Unit (MNSEE)
Sustainable Development Department (MNSSD)
Middle East and North Africa Region (MNA)

ABBREVIATIONS AND ACRONYMS

ADEREE	Agence Nationale pour le Développement des Energies Renouvelables et de l'Efficacité Energétique
BOT	Build-Operate-Transfer
CCGT	Combined Cycle Gas Turbine
CO_2	Carbon dioxide
CPS	Country Partnership Strategy
CSP	Concentrated Solar Power
CTF	Clean Technology Fund
CTF IP	Clean Technology Fund Investment Plan
DPL	Development Policy Loan
DSM	Demand Side Management
EIB	European Investment Bank
ESMAP	Energy Sector Management Assistance Program
ESIA	Environmental and Social Impact Assessment
EU	European Union
FDE	Fonds de Développement Energétique
FM	Financial Management
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GoM	Government of Morocco
GWh	Gigawatt hour
IBRD	International Bank for Reconstruction and Development
ICB	International Competitive Bidding
IEA	International Energy Agency
IMF	International Monetary Fund
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
kWh	Kilowatt-hour
LCOE	Levelized Cost of Energy
LED	Light Emitting Diode
MAD	Moroccan Dirhams
MASEN	Moroccan Agency for Solar Energy
MENA	Middle East and North Africa
MW	Megawatt
NPV	Net Present Value
OCP	Office Chérifien des Phosphates
ONE	Office National de l'Electricité
ONEP	Office National de l'Eau Potable
O&M	Operations and Maintenance
ORAF	Operational Risk Assessment Framework
PAD	Project Appraisal Document
PDO	Project Development Objective
PLL	Precautionary Liquidity Line
PPA	Power Purchase Agreement
PPP	Public-Private Partnership
R&D	Research and Development
RE	Renewable Energy
RFP	Request for Proposal
RPF	Resettlement Policy Framework
TOR	Terms of Reference
TSO	Transmission System Operator
USD	United States dollar
WB	World Bank
WBG	World Bank Group

Regional Vice President:	Inger Andersen
Country Director:	Simon Gray
Sector Director:	Junaid Kamal Ahmad
Sector Manager:	Charles J. Cormier
Task Team Leader:	Roger Coma-Cunill

MOROCCO
Clean and Efficient Energy Project

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Morocco

MA-Clean and Efficient Energy Project (P143689)

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MIDDLE EAST AND NORTH AFRICA

MNSEE

Report No.: PAD1026

Basic Information			
Project ID P143689	EA Category B - Partial Assessment		Team Leader Roger Coma Cunill
Lending Instrument Specific Investment Loan	Fragile and/or Capacity Constraints [ ] Financial Intermediaries [ ] Series of Projects [ ]		
Project Implementation Start Date 15-Jun-2015	Project Implementation End Date 15-Jun-2019		
Expected Effectiveness Date 11-Jun-2015	Expected Closing Date 15-Dec-2019		
Joint IFC No			
Sector Manager Charles Joseph Cormier	Sector Director Junaid Kamal Ahmad	Country Director Neil Simon M. Gray	Regional Vice President Inger Andersen

Borrower: Office National de l'Electricite et de l'Eau Potable (ONEE)			
Responsible Agency: Office National de l'Electricite et de l'Eau Potable (ONEE)			
Contact:	Mohamed Fait	Title:	Director International Finance Department
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Project Financing Data(in USD Million)					
[X]	Loan	[X]	Grant	[ ]	Guarantee
[ ]	Credit	[ ]	IDA Grant	[ ]	Other

Total Project Cost:	153.00	Total Bank Financing:	125.00
Financing Gap:	0.00		

Financing Source	**Amount**

Borrower	4.05
International Bank for Reconstruction and Development	125.00
Clean Technology Fund	23.95
Total	153.00

Expected Disbursements (in USD Million)

Fiscal Year	2015	2016	2017	2018	2019	2020	2021	2022	2023
Annual	0	40	40	40	29	0.00	0.00	0.00	0.00
Cumulative	0	40	80	120	149	0.00	0.00	0.00	0.00

Proposed Development Objective(s)

To increase the Efficiency of the Power Generation System and the use of Clean Electrical Energy.

Components

Component Name	Cost (US$ Millions)
Component 1 - ONEE's Solar PV Program	119.25
Component 2 – Planning and Dispatching of Renewable Energy	5.2
Component 3 – Utility Demand-side Management and Revenue protection program	13.25
Component 4 - Technical Assistance	0.3
Contingencies	15

Institutional Data

Sector Board

Energy and Mining

Sectors / Climate Change

Sector (Maximum 5 and total % must equal 100)

Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Energy and mining	Other Renewable Energy	50		100
Energy and mining	Transmission and Distribution of Electricity	50		100
Total		100		

☐ I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.

Themes

Theme (Maximum 5 and total % must equal 100)

Major theme	Theme	%
Financial and private sector development	Infrastructure services for private sector development	10
Environment and natural resources management	Climate change	90
Total		100

Compliance

Policy

Does the project depart from the CAS in content or in other significant respects?	Yes [ ] No [X]
Does the project require any waivers of Bank policies?	Yes [ ] No [X]
Have these been approved by Bank management?	Yes [ ] No [X]
Is approval for any policy waiver sought from the Board?	Yes [ ] No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X] No [ ]

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	X	
Natural Habitats OP/BP 4.04		X
Forests OP/BP 4.36		X
Pest Management OP 4.09		X
Physical Cultural Resources OP/BP 4.11		X
Indigenous Peoples OP/BP 4.10		X
Involuntary Resettlement OP/BP 4.12	X	
Safety of Dams OP/BP 4.37		X
Projects on International Waterways OP/BP 7.50		X
Projects in Disputed Areas OP/BP 7.60		X

Legal Covenants

Name	Recurrent	Due Date	Frequency

Description of Covenant

Conditions

Source Of Fund	Name	Type

Description of Condition

Team Composition

Bank Staff

Name	Title	Specialization	Unit
Hassine Hedda	Senior Finance Officer	Disbursement	CTRLA
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Suiko Yoshijima	Environmental Specialist	Environmental Safeguards	MNSEE
Marcelino Madrigal	Senior Energy Specialist	Power engineer and Advisor	SEGEN
Manaf Touati	E T Consultant	Financial analysis	MNSEE
Silvia Martinez Romero	Sr. Renewable Energy Specialist	Solar technology	GEEES
Pedro Antmann	Lead Energy Specialist	Power engineer and Advisor	AFTG1

Non Bank Staff

Name	Title	Office Phone	City
Najat Mjid	Social Safeguards and Gender Consultant		Casablanca
Tayeb Amegroud	Engineer and Finance consultant		Casablanca
Alberto Cena	Power Engineer Consultant and CTF Independent Reviewer		Madrid
Said Mikhail	Sr. Power Engineer		Washington DC

Locations

Country	First Administrative Division	Location	Planned	Actual	Comments

I. STRATEGIC CONTEXT

A. Country Context

1. **Despite solid economic performance[1] and dramatic reduction of poverty rates since 2000[2], social demands are high due to Morocco's persistent large inequalities[3] and high unemployment rate.** The Morocco coalition government which was established following the Arab Spring of early 2011 accelerated political, institutional and social reforms that led to the adoption of a new Constitution, which improved the country's governance framework. In 2012, a moderate Islamist party won the democratic parliamentary elections and started implementation of a reformist development program (2012-2016), which included promoting decentralization and a more sustainable development.

2. **Morocco's economic performance improved in 2013 and fiscal deficit decreased due to a reduction in the subsidy bill.** The country's fiscal deficit decreased from 7.3% of GDP in 2012 to 5.5% in 2013[4]. The fall in government's revenues was compensated by a significant decline in expenditures due to a reduction in the subsidy expenses amounting to 2% of GDP. Government expenditures on subsidies were reduced due to the easing of international oil prices in 2013 and the introduction of a mechanism to partially index the domestic prices of some fuel products to world prices.

3. **The International Monetary Fund (IMF) and the World Bank (WB) support the government's reform agenda.** In August 3, 2012, the International Monetary Fund (IMF) approved a two-year US$ 6.2 billion Precautionary Liquidity Line (PLL) to support the government's reform agenda aimed at achieving higher and more inclusive economic growth by providing a useful insurance against external shocks. In December 19, 2013, the World Bank approved a US$300 million Development Policy Loan (DPL) on inclusive green growth to support a package of reforms to enhance Morocco's institutional, regulatory and fiscal framework to support a shift towards green growth.

4. **Morocco is positioning itself on a green growth path to become a model for the rest of Africa.** A sustainable and inclusive green growth is central to the government's agenda. In the last five years, an array of sector strategies have been adopted in order to decrease pollution levels and reduce Morocco's reliance on imported fossil fuels through substantial investments in renewable energy - and to a lesser extent in energy efficiency - thus contributing to the reduction of greenhouse gases (GHG).

[1] From 2000 to 2012, Morocco's average GDP growth was 4.8%. Source: World Bank, World Development Indicators, 2014.
[2] Morocco reduced its national poverty rate from 16.3% (1999) to 9% (2007), according to data from World Bank, Global Poverty Working Group.
[3] Morocco ranks 130 out of 186 countries in the United Nations Inequality-adjusted Human Development Index with a coefficient of 0.415 (Source = United Nations Development Program, Human Development Indices, A statistical update 2012)
[4] International Monetary Fund, Country Report No. 14/65, March 2014.

B. Sectoral and Institutional Context

5. **Morocco's fossil fuel import dependency exposes the country to volatile and expensive oil prices.** In 2011, the country met 95.6% of its primary energy demand through imported fossil fuels, which represented MAD 85 billion (about US$ 10.3 billion), up from MAD 19.1 billion (roughly US$ 2.3 billion) in 2002. Petroleum imports account for 20% of total imports and 50% of the current trade deficit. This poses a heavy burden on the government's budget because of subsidies to petroleum products (gasoline, diesel, industrial fuel, butane, and electricity generation fuel). In 2012, energy subsidies accounted for a total of MAD 47.5 billion, equivalent to roughly US$5.5 billion and 5.7% of GDP (against less than 1.5% of GDP in 2000). Subsidy outlays encourage the inefficient consumption of fossil fuels and compound energy dependence and environmental externalities by reducing incentives to investments in energy efficiency and renewable energy.

6. **Morocco continues to meet its substantive growth in electricity demand through imports of fossil-fuels and electricity.** Since 2002, the annual electricity demand has been increasing at a rate of about 7% to reach 32,015 GWh in 2013. Almost 70% of this demand growth has been covered with fossil fuel-based power plants and 18% with imports from Spain. Morocco has recorded a peak demand of 5,580 MW last summer due to increased used of air-conditioning, which has reduced the country's reserve margins closer to its totaled installed capacity of 6,892 MW. A new 1,320 MW coal plant in Safi is scheduled to be commissioned in 2017, but further delays in its financial closing could force ONEE to acquire further expensive diesel units to meet fast-increasing demand.

7. **To increase energy security, Morocco has adopted ambitious renewable energy targets and established a strong regulatory and institutional framework.** By 2020, Morocco expects that 42% of its power supply comes from renewable sources, including 2 GW from solar, 2 GW from wind and 2 GW from hydro. Morocco has created a specialized solar agency, the Moroccan Agency for Solar Energy (MASEN) in charge of the implementation of the Morocco Solar Plan (2009), which is currently focused mainly on Concentrated Solar Power (CSP). In addition, Morocco has agreed to improve energy efficiency by 12% by 2020, and 15% by 2030.

8. **A concerted effort by both ONEE and MASEN will be required to attain the Government objective of meeting 14% of energy demand from solar energy by 2020.** ONEE's solar PV strategy[5] aiming at developing decentralized mid-size solar PV plants will be complementary to the large-scale integrated solar program led by the Moroccan Agency for Solar Energy (MASEN). MASEN and ONEE have been coordinating their work on solar projects at management and technical levels[6] to achieve the national target. In 2013, ONEE's Board, chaired by the Prime Minister, approved a

[5] In 2013, ONEE's Board, chaired by the Prime Minister, approved a 400 MW solar photovoltaic (PV) strategy to complement the 2,000 MW of solar energy projects developed by MASEN.

[6] ONEE's experts, for example, have been working closely with MASEN in site and technology selection for developing the Noor complex in Ouarzazate.

400 MW solar photovoltaic (PV) strategy to complement the 2,000 MW of solar energy project developed by MASEN.

9. **Solar PV is a promising clean technology that could serve as an alternative to fossil fuels to meet the peak load arising during the day due to sustained economic growth and increased use of air conditioning.** Morocco is one of those countries where energy demand has evolved into a diurnal peak: (i) one peak during the day arising from general economic activity compounded by the rise in air conditioning use, which is especially pronounced during spring and summer, and (ii) a second evening peak arising from high domestic consumption of energy. The challenges of meeting this diurnal demand are substantial, as the peak demand has grown at an annual rate of 8 % in 2012. With regard to meeting energy demand arising from the evening peak, solar CSP with thermal storage is a good substitute for conventional fossil fuel generation. With regard to meeting the peak energy demand during the day, solar PV is a promising clean technology option. As World Bank studies have shown[7], solar PV technology is preferred for achieving Moroccan renewable energy's capacity targets at least cost, and is close to grid parity. In the long term, the development of CSP with thermal storage can contribute to firm-up PV variable generation, reducing the overall cost of solar generation while maintaining high levels of reliability.

10. **As a priority, ONEE also needs to reduce the substantial technical losses, which would serve to improve its revenue base.**.. Losses in the transmission and distribution grid are estimated[8] at 11.3%, slightly higher than other countries in the region such as Egypt and Jordan[9]. This is partly attributed to a rapid expansion of the grid, at the expense of investments in systems optimization. Indeed, a successful rural electrification program increased access to electricity from 55% to 98% of the population in the last decade. Also, transmission lines are increasingly loaded due to increasing electricity demand, in some cases beyond levels that would be considered efficient from a reliability and system security perspective. As a result, energy losses are increasing while interruptions and voltage drops are increasingly frequent. The increase of technical losses and use of expensive heavy-fuel oil for power generation aggravates the delicate financial situation of the national electricity utility, ONEE.

11. **The Bank continues to assist Morocco's transformational efforts in the energy sector**. The proposed project strengthens the Bank's support to implement Morocco's energy strategy, which has focused so far in: (i) increasing the share of renewable energies in the energy mix with the support to the 500 MW Noor Solar Complex implemented by MASEN; (ii) incentivizing policy change by providing a Green Growth DPL; and (iii) providing infrastructure and energy efficiency support to ONEE by combining transmission infrastructure investments and energy efficiency pilots (CFLs).

[7] World Bank/ESMAP/Mercados: Morocco: Analysis of Low Carbon Development Options in the Power Sector, May 2013.

[8] ONEE's share of distribution is 50% and the overall 2012 transmission and distribution losses acknowledged by ONEE are at 11.26%

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

C. ONEE: a key player in the energy sector

12. **The national utility "Office National de l'Electricité et de l'Eau Potable" (ONEE) is a historical actor which is undertaking a number of reforms.** ONEE is the state-owned company resulting from the recent merger between the country's water and electricity utilities, which is an important reform aimed at optimizing synergies and lowering costs. The strategy of ONEE's electricity branch has four main components (i) supply of electricity at the lowest possible cost, (ii) diversification of generation capacity, (iii) providing access to electricity, and (iv) expansion abroad. To achieve these goals, ONEE focuses on improving its operational performance by implementing several measures including, optimized planning of its investments and energy efficiency programs[10]. To diversify its primary energy portfolio, ONEE develops the hydro, wind and solar potential of the country.

13. **The private sector has a major role in Morocco's electricity sector.** Since 1994, the sector has been gradually opening up to private sector participation in the generation and distribution of electricity, while ONEE has kept the monopoly in transmission. Independent Power Producers (IPP), selling power to ONEE through power purchase agreements (PPAs), represent 26 % of the total installed capacity (see Figure 1 below). The distribution of electricity to retail customers is responsibility of ONEE (for most of the country), seven local municipal authorities, also known as "Régies" (Marrakech, Fès, Meknes, Kenitra, Safi, El Jadida-Azemmour and Larache-Ksar El Kébir) and four private companies, also known as "Gestionaire déléguées" (Lydec, Redal, Amendis Tanger and Amendis Tetouan). ONEE is the transmission system operator in charge of transporting the electricity at national level. ONEE owns the transmission grid consisting of 21,434 km of 400 kV, 225 kV, 150 kV and 60 kV lines.

14. **Private sector participation in the country's power generation allows ONEE to seek the best cost-effective options to implement its projects.** While ONEE plans to evaluate investment decisions on a case-by-case basis, the latest figures on power supply and generation expansion planning show that private producers will assume an even larger role. By 2020, the private sector is expected to supply 70% (40% in 2013) of power demand and operate more than 50% (26% in 2013) of installed capacity with half of private production from renewables. These will be achieved since 85% of planned additional capacity will be contracted to private producers.

15. **ONEE's delicate financial situation is aggravated by the use of expensive heavy-fuel oil for power generation and increase in transmission and distribution losses**. Morocco's electricity demand growth decreased from 8% in 2012 to 3% in 2013 due to

[10] ONEE has been a key stakeholder for implementing energy conservation measures in Morocco, such as the installation of 5 million LED lamps under a project financed by the World Bank in 2008. Moreover, ONEE aims to reduce peak demand by implementing a demand-side management program, which includes the roll-out of smart meters to its higher consumers.

the global economic crisis and abundant rains, which reduced electricity demand in the agriculture sector used for water pumping. This situation had a positive impact on an already extremely fragile ONEE's financial situation reducing its net income from -4.3 billion MAD in 2012 to -2.8 billion Dirhams (MAD) in 2013.

16. **In early 2014, the Government decided to cease the subsidies to most petroleum products[11], except for those used by ONEE for electricity generation.** The Government decided to substantially reduce or remove all subsidies to unleaded gasoline, PPM Diesel and fuel-oil No. 2, which represented 76% of the total amount (US$ 2.71 billion[12]) that the Government paid in subsidies to petroleum products in 2013. The subsidies for the fuel used by ONEE for electricity generation totaled US$ 624 million, representing 23% of total subsidies to petroleum products in 2013. Subsidies to ONEE's fuel are one of the main topics discussed in the framework of the on-going negotiations of Program-contract between ONEE and the State[13], but they are likely to be progressively removed until 2018.

17. **ONEE and the Government are negotiating a Framework contract in view of improving ONEE's financial sustainability.** Morocco's Government subsidizes ONEE directly, i.e. regular capital increases, and indirectly, i.e. subsidies to distributors of fuel for electricity production (5 billion MAD in 2013 and 7 billion MAD in 2012). ONEE and the Government are currently negotiating a Framework contract, which will overhaul the subsidy system in view of improving ONEE's financial sustainability. The Framework contract 2014-2017 will establish obligations for both parties and will include the following measures:

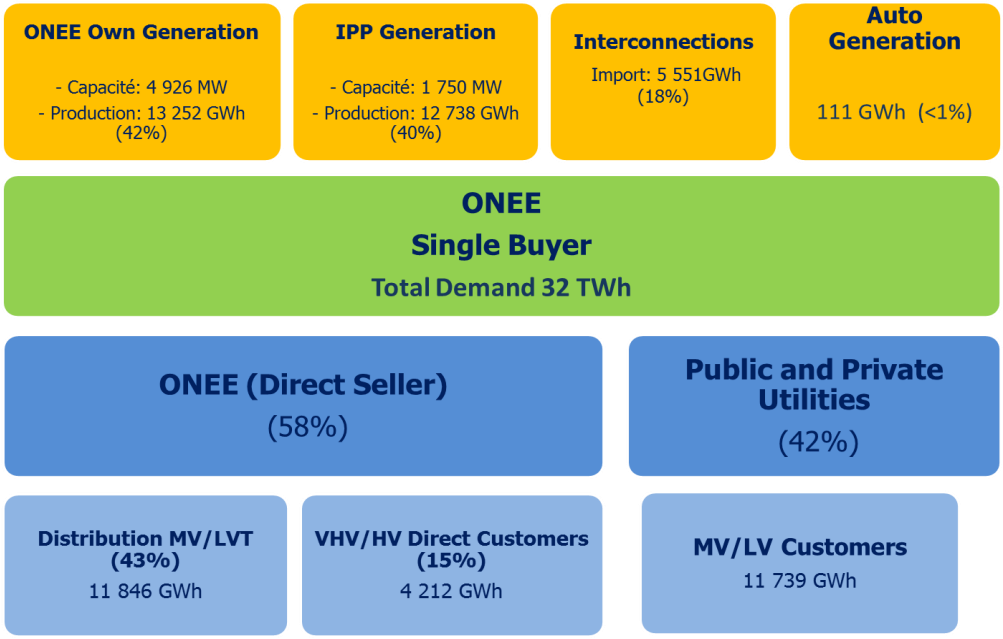
    a) Progressive increase of tariffs over four years for ONEE's clients, except for low-income consumers;
    b) ONEE's capital increase of 2 billion MAD over four years (there was a one billion MAD top up of capital in 2012);
    c) Government's payment of debt owed to ONEE on behalf of the debtor (2 billion MAD);
    d) Fixed subsidy to ONEE for fuel used in electricity production (14 billion MAD over four years)

[11] The Compensation fund, in French "Caisse de compensation", is a public agency under the authority of the Head of Government, which subsidizes petroleum products for transport and electricity generation. Subsidized petroleum products included fuel for electricity generation such as "fuel ONEE normal" and "special fuel ONEE", as well as unleaded gasoline, 50 PPM Diesel, Gasoil for coastal fishing and No. 2 fuel-oil. The subsidy amount of these products is fixed on the 1st and 16th of each month by the Ministry of Energy and Mines on the basis of Brent crude oil on the international market Rotterdam.

[12] 22,102 billion Moroccan Dirhams. Source: Morocco Compensation Fund, Activity Report – February 2014: http://www.cc.gov.ma/images/telechargement/Rapport-site/rapport%20FR-%2002-14.pdf

[13] The Program-Contract between ONEE and the State 2014-17 will define the paths to improve ONEE's financial position, specify the commitments of all parties in the implementation of the strategy and allocate financial resources.

Figure 1 – Balance of supply-demand 2013



Source: ONEE

18. **As the operator of the electricity grid in Morocco, ONEE intends to increase its efforts to modernize the grid to ensure its effective and reliable operation as large shares of clean variable generation are integrated into the system.** ONEE's interest in accessing CTF funds is a first step towards that modernization. The proposed project will facilitate clean energy generation closer to the end users and hence reduce current electricity losses, improve the quantity and quality of power supply to the selected areas, and facilitating the dispatching of large shares of renewable energy in the grid. Once it has gathered experience in the planning, design, construction and operation of solar PV technology, ONEE intends to develop a strategy to attract private sector financing in further deploying solar PV technology**.**

D. Higher Level Objectives to which the Project Contributes

19. **The proposed project has a strong country ownership and is fully in line with the Country Partnership Strategy (CPS) for the Kingdom of Morocco 2014-2017.** The project will contribute to achieving the CPS strategic outcome 2.2 "increase renewable energy generation and enhance energy efficiency" by developing the first phase of the 400 MW solar PV strategy, installing a Renewable Energy dispatch center to integrate solar and other intermittent generation and implementing a utility demand-side management and revenue protection program. The project is therefore supportive of the Government's top priority of developing the country's vast renewable energy resource potential to reduce its dependence on fossil fuels.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

20. The Project's PDO is to improve the capacity of ONEE to supply and dispatch clean electricity and to meet the demand of targeted customers more efficiently.

Project Beneficiaries

21. **The project will have several beneficiaries at local, regional and global level.** At local level, the first phase of ONEE's solar PV program will provide reliable green energy to inhabitants of the pre-identified areas in Erfoud, Missour and Zagora, in Morocco's south eastern region. Also, the solar PV plants will have positive impacts in the economy, health, and quality of life of citizens living in these areas.

22. **The poverty level in project beneficiary areas is between 11.3% to over 30% according to data from the national poverty map**[14]. The solar PV plants will contribute to unlock the economic potential of these regions by providing green power with adequate quality for agricultural, tourism and craft industries' projects[15]. These areas also benefit from cross-sectoral projects sponsored under several national programs, such as National Initiative for Human Development (NIHD)[16], the Communal Development Plans (CDP), the Green Morocco Plan[17].

23. **According to a World Bank study on the impacts of the solar PV plants on these local communities[18], particularly women,** the Project is also expected to have the following indirect positive impacts:

(i) *Health sector*: an improved electricity supply will reduce the failures in hemodialysis, radiography and ultrasound equipment in regional hospitals due to voltage drops and the need for expensive back-up diesel generators. The failure of this equipment entails

[14] 11.3 % in Erfoud; 12.4 % in Missour and over 30% in Zagora. Source: High Planning Commission, Poverty Map, 2007: http://omdh.hcp.ma/Carte-de-la-pauvrete-2007_a185.html

[15] The project will open up these regions and will be the backbone of the government's plans for their sustainable development. In the region of Missour, the project will facilitate the implementation of a large animal breeding project under the current Fes-Bousselmane Regional Agricultural Program. In the region of Erfoud, the project will bring enough power to respond to the demand of an additional twenty new touristic projects and one new crafts neighborhood. In the region of Zagora, the project will provide clean power to improve the productivity of twenty-three dairy farms currently using expensive gasoil.

[16] In French, Initiative Nationale de Développement Humain (INDH). National Program against poverty, insecurity and exclusion, based on a participatory and inclusive approach taking into consideration gender, launched in 2005 by the King with the support of the World Bank.

[17] In French, Plan Maroc Vert (PMV). The Green Morocco Plan, initiated by the Ministry of Agriculture aims to increase agricultural productivity, farmers' incomes and agricultural employment.

[18] World Bank, "Clean and Efficient Energy Project (P143689) – Revue des aspect sociaux", March 2014, internal document.

postponement of surgical interventions, relocations of patients to far-away hospitals and other problems.

(ii) *Education sector*: an improved electricity supply will reduce the negative impacts on schoolchildren suffering from severe cold in winter and very high temperatures in summer. Schoolchildren, particularly in poor areas, have a hard time to do homework regularly in the evening and to use computers because they are often broken due to voltage fluctuations. Improvements in electricity supply could mitigate these negative impacts.

(iii) *Gender and quality of life*: an improved electricity supply will reduce the power cuts and voltage drops that currently affect these areas (4-5 monthly power cuts and daily voltage drops). This improvement will particularly benefit women who are the main household electricity consumers and suffer from: inadequate refrigeration and regular appliance's breakdown.

24. At regional level, Morocco will become a reference for the development of grid-connected decentralized mid-sized solar PV plants providing critical learning effects for scaling-up this technology at utility-scale. At global level, the project is expected to have positive impacts such as avoiding 78,018 tons of CO_2 equivalent of greenhouse gas emissions per year and 1.95 million tons over the lifetime of the project.

PDO Level Results Indicators

25. The PDO level results indicators are:
    i. Generation capacity of renewable energy constructed - solar (MW)
    ii. Forecasted next day clean electricity generation is integrated into system dispatch (yes/no)
    iii. Customers subscribing to bi-hourly tariff (number)
    iv. Direct project beneficiaries (number), of which female (%)
    v. Avoided GHG emissions (tons of CO_2/year)

26. Indicators (i) and (iv) are core indicators.

III. PROJECT DESCRIPTION

A. Project Components

27. **The project will increase the ability of ONEE to supply and efficiently dispatch clean energy and meet demand more efficiently.** The country ambitious energy goals require a coordinated action to change the way in which energy is supplied, dispatched, and consumed in the system. This includes, first, collaborating between different stakeholders to meet clean energy supply goals. Second, modernizing the grid to ensure its effective and reliable operation as large shares of clean variable generation are integrated into the system. And, lastly, managing demand to reduce consumption and ensuring utility loses are controlled. These three complementary areas of action form the components of the project, which are detailed herewith:

28. **Component 1 – ONEE's Solar PV Program:** In December 2013, ONEE adopted a 3-phase corporate strategy to develop 400 MW of grid-connected decentralized solar PV in 16 sites located at the end of high-voltage transmission lines. The Government strongly supports the implementation of this strategy, which will contribute to achieve the ambitious national renewable energy targets established by 2020 (42% in installed capacity, including 14% of solar energy). The strategy is also expected to have important local benefits in terms of improved quantity and quality of electricity supply in communities with significant poverty rates where economic activities, i.e. agriculture, tourism, crafts, and household's life quality are affected by voltage drops and regular outages. As part of Morocco's national energy strategy, ONEE's solar PV strategy complements the 2,000 MW solar plan under implementation by MASEN.

29. The private sector will increase its already major role in power generation. By 2020, the private sector is expected to supply 70% (40% in 2013) of power demand and operate more than 50% (26% in 2013) of installed capacity with half of private production from renewables. These will be achieved since 85% of planned additional capacity will be contracted to private producers.

30. This component will finance the first phase of ONEE's solar PV program as public investment and will assist ONEE in transitioning towards private sector financing of solar PV plants in subsequent phases of its program based on lessons learned. The unfortunate experience of the unsuccessful 200-360 MW wind BOT tender launched by ONEE in 2002 led the national utility to adopt a cautious strategy when introducing new generation technologies in the country such as solar PV[19].

31. The project integrates a Technical Assistance activity (Subcomponent 1.2) to support ONEE in the transition from a public to an IPP model for developing solar PV plants in the country. The study "Enabling Environment for Private Participation" will include a market sounding analysis to test private sector interest for grid-connected PV in Morocco.

32. **Subcomponent 1.1: 1st phase – "Tafilalt" project (US$ 91 million from IBRD and US$ 23.95 from CTF):**

[19] In 2002, ONEE (former ONE) launched a tender (ref. SP40024) for the development, financing, construction and operation of wind farms in Tangier (140 to 200MW) and Tarfaya (60 to 160MW). After opening the financial offers in May 2002, ONEE decided to consider the tender "unsuccessful" without providing any explanation to the bidding consortia, which believed that the offered prices were in the low range for wind energy in that year. This decision had a major impact on wind farm developers, who began to doubt about ONEE's commitment to private sector participation in the wind sector. With the benefit of hindsight, a possible explanation to ONEE's decision lied in the structure of the energy mix in 2002. At that time, contracting such an important wind capacity was risky because thermal generation from coal-fired Jorf Lasfar and gas-powered Tahaddart plants developed by private operators in "take-or-pay" contracts had to cover most of the Moroccan demand until 2006. In addition, operational difficulties generally feared twelve years ago by electrical monopolies such as ONEE (former ONE) further complicated the development of wind power.

33. For the 1st phase financed by the Project, ONEE has pre-identified three sites near the town of Erfoud, Zagoura and Missour to develop a 25 MW solar PV plant in each of them. A fourth site near the town of Tan Tan is kept as a back-up in case the on-going feasibility study indicates the adequacy of such option. IBRD and CTF financing will finance the capital costs of these solar PV plants, while ONEE will finance the costs of land and evacuation lines from its own balance sheet. ONEE intends to launch an international competitive tender for an EPC and a 5-year O&M contract (optional) to design, construct, operate and maintain the three plants. For the 2nd phase, ONEE has approached EIB and kfW to secure the financing for installing 200 MW in eight sites. The 3rd phase is still at a conceptual stage and details are unknown, but it is likely to include the development of 125 MW in five sites.

34. **Subcomponent 1.2: Enabling environment for private participation in distributed PV generation** (**US$ 250,000 from IBRD**)**.** This subcomponent will finance the sharing of knowledge and best practices on private sector participation in the solar PV market, specifically in mid-sized distributed generation PV, i.e. scales smaller than utility-scale projects, but larger than roof-top solar. Topics will include forms of private sector participation, the design of power purchase agreements including proper risk distribution and best practices for bidding projects.

35. **Component 2 – Planning and dispatching of Renewable energies:** Transmission System Operators (TSO) such as ONEE are responsible for managing the electrical system under strict safety and quality parameters. TSOs control key variables such as the voltage at the local nodes and the frequency for the whole system. Both variables, voltage and frequency, should be kept within predefined range of values all the time. Thus, ONEE programs daily the production of the power plants connected to the high voltage grid to cover the forecasted demand at the minimum possible cost.

36. Meeting the country's renewable energy goals require a transformation in which the grid is operated. TSO's worldwide have transformed their operational practices to manage the increasing penetration of variable wind and solar energies. This transformation importantly includes the creation of specialized dispatch centers to have a closer control of renewable energy power plants[20]. The scattered location of renewable energy installations throughout a country, even connected to medium voltage grids, has also favored the global trend of creating centralized control centers to coordinate different power supply units and to avoid local problems such as grid congestions.

37. **Sub-component 2.1: Renewable Energy dispatch center (US$ 5 million from IBRD):** Solar and wind energy production is characterized by its intermittency, a combination of non-controllable variability and partial unpredictability, and its dependency on resources that are site-dependent. These features create distinct challenges for owners of generating

[20] This is specially the case when renewable energy plants contribute over 10-20% in the generation of a particular system.

plants and grid operators in integrating wind and solar generation[21], where forecasts for wind and solar are crucial for system balancing.

38. The proposed Renewable Energy dispatch center consists of SCADA software and hardware to ensure optimal power dispatch and system protection. This investment will provide more opportunities to ONEE, the transmission system operator, to optimally adjust supply and demand resources. Dispatch optimization will be carried out according to supply/demands forecasts and hence, reduce investment needs in generation and transmission. The dispatch center will be co-located with the existing National load dispatch center and integrated with real time measurement and information flow.

39. The Renewable Energy dispatch center would include the following functions:

- Forecasting of Renewable energy generation on month-ahead, week-ahead, day-ahead and hour-ahead basis.
- Real time tracking of generation from Renewable energy sources.
- Geo-spatial visualization of Renewable energy generation
- Close coordination with the National load dispatch center for Renewable energy generation and control and weather stations for smooth grid operation.
- Single source information repository and coordination point for Renewable energy penetration.

40. While there is no study available on the impact of the Renewable Energy dispatch center in Morocco, some regional or local integration cost studies[22] have found that the costs of integrating renewables are lower in areas with faster, flexible scheduling and dispatch. Integration studies conducted in ISO (Independent System Operator) areas with 5 or 10-minute dispatch had integration costs of $0-$4/MWh, while areas with hourly scheduling and dispatch had integration costs of about $8-$9/MWh or higher. The same studies found that using advanced wind and solar forecasts in the day-ahead unit commitment process would reduce system operating costs by $10-$17/MWh of renewable energy, compared to not considering renewables in the unit commitment process.

41. **Subcomponent 2.2: Increasing ONEE capacity to perform long-term power planning that considers renewables and synergies with the water sector (US$ 200,000 from IBRD).** This subcomponent will support ONEE's planning department by increasing their capacity and acquiring modern tools to further strengthen their capabilities in planning. Scaling-up renewables requires the use of proper planning methods and tools that consider how the location of projects and the variability of solar sources in particular locations impact grid operation and long-term supply adequacy.

[21] I. Perez-Arriaga: Managing Large Scale Penetration of Intermittent Renewables, MITEI Symposium on Managing Large-Scale Penetration of Intermittent Renewables, Cambridge/U.S.A, 20 April 2011.
[22] D. Lew, G. Brinkman, E. Ibanez, B.-M. Hodge, J. King "The Western Wind and Solar Integration Study Phase 2", Preprint National Renewable Energy Laboratory, http://www.nrel.gov/docs/fy12osti/56217.pdf , site visited 17 May 2014.

42. **Component 3 – Utility Demand-side Management and Revenue Protection program:** ONEE plans to install smart-meters to the highest consumers[23] among its households, small agricultural and commercial clients with two main objectives: (i) to keep non-technical losses (unmetered consumption) in electricity supply low systematically and, hence, increase the company's billing revenues; and (ii) incentivize consumers to subscribe to a time-of-use tariff and reduce their consumption during expensive peak hours. The smart meters will be installed to 60,000 low-voltage clients representing only 1.45% of ONEE's clients, but 13% of total consumption.

43. **Subcomponent 3.1: Smart Meters Program (US$ 13 million from IBRD):** The rollout of 60,000 smart meters to targeted customers constitutes the first phase of ONEE's smart meters program, which will be complemented by Advanced Metering Infrastructure (AMI), including the installation of communication devices, software (MDM) and a Metering Control Center (MCC). This infrastructure will allow ONEE to implement a revenue protection program by ensuring that all the amount of energy actually consumed is metered and billed on a permanent manner, therefore controlling or reducing non-technical losses. The functionalities of the Advanced Metering Infrastructure and Monitoring Control Center include: revenue protection (detection of theft, frauds, etc.), automatic meter reading, remote disconnection/ reconnection, time of use (TOU) rates, load control and outage detection.

44. Smart meters will also allow ONEE to introduce a time-of-use tariff[24] for these categories of consumers following its success with large industrial customers[25]. The expected change in behavior of customers from peak to off-peak hours will largely depend on the effectiveness of an awareness and communications campaign.

45. **Subcomponent 3.2: Deepening and identifying additional opportunities for utility-implemented energy efficiency and demand side management programs (US$250,000 from IBRD).** This subcomponent aims at helping ONEE to deepen actions to support national goals on energy efficiency, which include reducing energy consumption by 12% in 2020. The component will support the analysis of the results of the smart metering program to scale it up based on lessons learn from the first phase. This subcomponent will also identify options, define priorities and actions plan for selected energy efficiency and demand side management programs to be driven and implemented by ONEE.

[23] Consuming over 500 kWh/month.

[24] This time-of-use tariff was adopted by the Government in February 2009, but could not be implemented because of the absence of appropriate meters.

[25] Since 1996, ONEE has been testing different tariff structures. In 1996, ONEE negotiated with the government the approval of a three-hourly kWh tariff for very large industrial customers to reflect the real cost of production. A year later, ONEE introduced another tariff for large customers with high, medium and low load factors to penalize customers who had a high demand for low duration. More recently, in 2008, ONEE introduced a super-peak tariff for the two-hour evening peak to motivate large industrial customers to further lower their load during this period. While the super-peak tariff was optional, many large customers opted for it, especially cement factories and steelworks. ONEE estimates that by end 2013, industries benefiting from this tariff were able to shave 95 MW from the system peak demand.

46. **Component 4 – Technical Assistance (US$ 300,000 from IBRD):** This component will include training, capacity building, knowledge exchange, and study tour activities in the following areas: (i) best practices by system operators to manage large shares of renewable energy at the wholesale and distribution level, training and study tours (ii) new technology trends in control and performance capabilities of renewable energy technologies and interconnection standards, (iii) best practices and approaches for the supervision of PV, wind and other projects, and other such as (iv) new emerging regulatory practices for private participation in renewables, access to transmission networks, and others.

B. Project Financing

1. Lending instrument:

47. The lending instruments are a US$ 125 million IBRD loan and a US$ 23.95 million CTF concessional loan to ONEE. The CTF loan will be used for Component 1 - ONEE's Solar PV Program: 1st phase - "Tafilalt" project to cover the incremental cost of solar PV technology over conventional alternatives. The CTF loan has a 40 year maturity, a 10 year grace-period, a 0.25 % annual service charge and a one-time management fee of 0.45%.

48. The IBRD loan will be used for all four components, i.e. to finance the EPC and O&M (optional) contract for the construction, operation and maintenance of three 25 MW solar PV plants (Component 1); to finance the contract to supply a Renewable Energy dispatch center (Component 2); to finance the contract to supply 60,000 smart meters and associated Advance Metering Infrastructure (Component 3); and to finance a Technical Assistance, including training, capacity building and knowledge exchange, to assist ONEE in project implementation (Component 4).

2. Project Cost and Financing[26]:

Project Components	Project cost	IBRD	%	CTF	%	ONEE	%
Component 1: ONEE's Solar PV Program:							
• Subcomponent 1.1: 1st phase - "Tafilalt" project	119	91	76.4	23.95	20.2	4.05	3.4
• Subcomponent 1.2: Enabling environment for private participation in PV generation	0.25	0.25	100	0	0	0	0
Component 2: Planning and dispatching of Renewable energy:							
• Subcomponent 2.1: Renewable energy dispatch center	5	5	100	0	0	0	0
• Subcomponent 2.2: Long-term power planning tools for Renewable energy	0.2	0.2	100	0	0	0	0
Component 3: Utility Demand-side Management and Revenue Protection program:							
• Subcomponent 3.1: Smart-meters program	13	13	100	0	0	0	0
• Subcomponent 3.2: Opportunities for utility Energy Efficiency and DSM programs	0.25	0.25	100	0	0	0	0
Component 4: Technical Assistance	0.3	0.3	100	0	0	0	0
Contingencies (10%)	15	15	100	0	0	0	0
Total Project Costs without contingencies	138						
Total Project Costs	**153**	**125**	81.7	**23.95**	15.7	**4.05**	2.6
Front-End Fees	**0**						
Total Financing Required	**153**						

[26] On February 6, 2014, the CTF Trust Fund Committee approved a US$ 1 million grant allocation for project preparation and a US$ 50,000 allocation for the World Bank's project preparation and implementation services. The total CTF funding allocation for the Project is US$ 25 million.

IV. IMPLEMENTATION

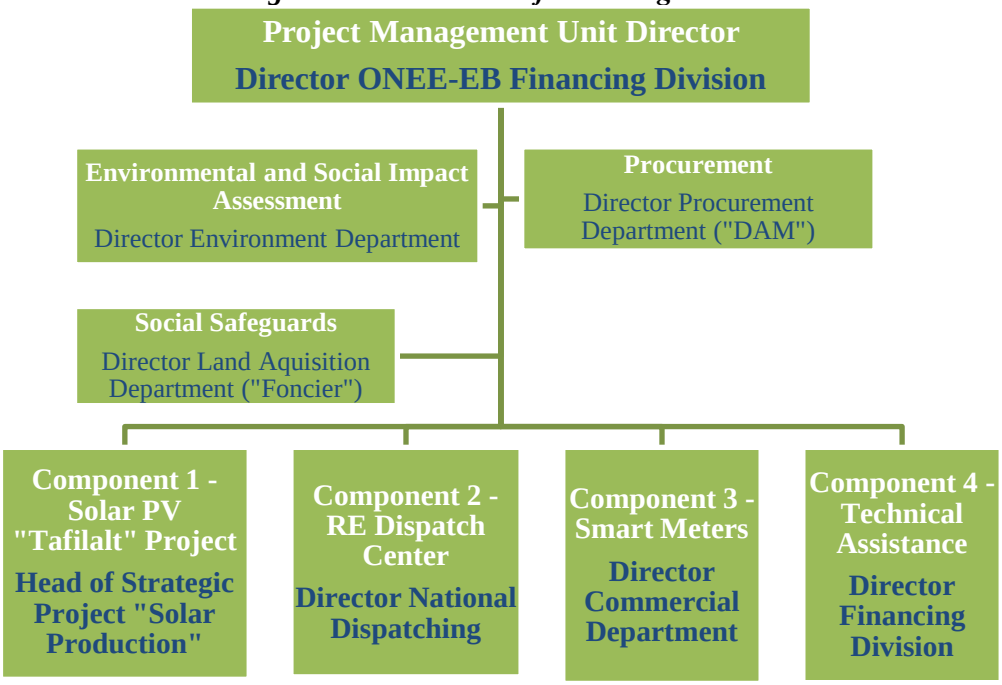
A. Institutional and Implementation Arrangements

49. **Executing Agency**: ONEE is the borrower (with a guarantee provided by the Kingdom of Morocco) and the executing agency of the project. ONEE was created by Dahir 163-226 on 5 August 1963 as a legally and financially autonomous entity. The Dahir entrusts ONEE with the public service responsibility for generation, transmission. A decree in September 1994 amended the Dahir giving ONEE the possibility of signing PPA contracts with IPPs for power generation.

50. **Project Management**: The Director of ONEE's Electricity Branch (EB) Financing Division has overall responsibility for project implementation and for achieving the agreed results (*see Figure 6 below*). The Director of ONEE's Financing Division acts as a Project Management Unit Director who coordinates closely three heads of sub-projects: (i) Head of Strategic Project "Solar Production", in charge of the implementation of ONEE's Solar PV Program – 1st Phase "Tafilalt" project (Component 1); (ii) Director of National Dispatching in charge of the implementation of Renewable Energy Dispatching Center (Component 2); and (iii) Director of Commercial Department in charge of Smart Meters deployment (Component 3).

51. The Director of ONEE's Financing Division will directly manage the Technical Assistance (Component 4), which will involve punctual coordination with other departments within ONEE-EB. The Director of ONEE's Financing Division will be supported by ONEE's Procurement Department as well as the Environmental, Social and Land acquisition departments.

Figure 6 – ONEE's Project Management Unit



B. Results Monitoring and Evaluation

C. Sustainability

V. KEY RISKS AND MITIGATION MEASURES

A. Risk Ratings Summary Table

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

B. Overall Risk Rating Explanation

52. The moderate overall risk recognizes potential social safeguard risks arising from land acquisition for solar PV plants as well as ONEE's inexperience in procuring such technology.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analysis

53. The economic and financial analysis are structured in two parts: first, an analysis for the first phase of ONEE's solar PV program (subcomponent 1.1), which is co-financed by the Clean Technology Fund (CTF), and second, an analysis for the overall Clean and Efficient Energy Project, which includes a cost-benefit analysis of the first phase of ONEE's solar PV program (subcomponent 1.1) together with the Smart-Meters program (subcomponent 3.1).

A.1 Economic analysis

1.1 First phase of ONEE's Solar PV program

54. As shown in Table 2 below, the resulting levelised (economic) cost of energy (LCOE) is 9.80 USc/kWh at the assumed flat gas price of US$11/mmBTU, i.e. US$ 1.3 cents/kWh above a gas-CCGT levelized cost of electricity. The project ERR is 3.97%, which shows that the project is uneconomical with an ERR well below the opportunity cost of capital.

Sensitivity analysis

55. Stress test of the PV component shows that its economic viability is only guaranteed under assumptions of 20% decrease in capital costs or 20% increase in gas prices. The recent trend of decreasing capital cost of PV is likely to continue and the actual costs arising from an EPC tender scheduled during the first semester of 2015 are likely to be in line with present projected values (baseline cost). Table 2 below summarizes the results of stress tests for the PV component.

Table 2 – Sensitivity Analysis of 1st Phase Solar PV -"Tafilalt" project (Component 1)

Dicount Rate	ERR	NPV mln US$	LCOE cUS$/kWh
2,00%	3,17%	16,1	7,31
4,00%	3,55%	-5	8,5
6,00%	3,97%	-18,6	9,8
8,00%	4,42%	-27,3	11,22
10,00%	4,91%	-32,7	12,74
Gas Price ($/mmBTU)	ERR	NPV mln US$	LCOE cUS$/kWh
8	0,83%	-43,7	9,8
9	1,94%	-35,3	9,8
10	2,98%	-27	9,8
11	3,97%	-18,6	9,8
12	4,90%	-10,2	9,8
13	5,80%	-1,9	9,8
14	6,67%	6,5	9,8
Capital Cost	ERR	NPV mln US$	LCOE cUS$/kWh
-20%	7,23%	9,6	7,74
-10%	5,47%	-4,5	8,77
0	3,97%	-18,6	9,8
10%	2,64%	-32,7	10,83
20%	1,46%	-46,8	11,87

56. The detailed switching values analysis can be summarized as follows:

- *CAPEX*: to reach the 6 percent hurdle ERR rate, CAPEX would need to be 87 percent of the baseline price, i.e. 1480 US$/kW. That may be in achievable price in the long run, but in the short run it is most unlikely to be achieved.
- Gas price: the gas price would have to rise to $13.2/mmBTU for the 6 percent hurdle rate to be achieved. This switching value is slightly above the price paid by ONEE for gas purchased from Algeria.

1.2 Clean and Efficient Energy Project (including Components 1 and 3)

57. The economic analysis of the overall Clean and Efficient Energy project focused on the contribution of Components 1 (PV project) and 3 (Smart meters) because they account for more than 90% of the project total budget and since fairly accurate estimates for expected economic benefits for both components can be provided.

58. Based on the above benefits and costs, the economic rate of return (ERR) and net present value (NPV) for the project are estimated and summarized in Table 3.

Table 3 – Project's NPV and ERR

NPV and ERR of the project	
Total Costs ($ mlns)	240,2
Total Benefits ($ mlns)	265,6
Net Benefits ($ mlns)	25,4
ERR	8,60%

59. The Overall Project Economic Analysis (Component 1 and 3) results in an ERR of 8.60% which shows that the project is economically viable.

60. Whereas the PV project component is unprofitable, the combination of both components 1 and 3 becomes profitable due to the strong return of the Smart meters component, which drives its benefits from financial economies resulted from a reduced reliance on expensive HFO.

A.2 Financial analysis

61. The financial analysis compares the financial costs of the project components with the financial benefits of selling the produced energy at the average power consumer price or, in the case of time-of-use/smart meters, the financial benefits from fuel displacement. The calculations are in nominal US$. The average consumer price of electricity is assumed flat and has not been inflated. The CO_2 price has been assumed at US$ 0.19/ton, which is the current trading value of certified emission reductions[27].

62. In the absence of financing from CTF, IBRD or other international financial institution, it has been assumed that the project would be financed by the Moroccan banking system.

[27] Future CER trades at 0.14 Euro or US$ 0.19: https://www.theice.com/emissions.jhtml

2.1 First phase of ONEE's Solar PV program

63. An analysis has been undertaken to estimate the impact of CTF financing and to justify the need for softer CTF concessional financing. For this purpose, the cash-flows of the project have been assessed under three scenarios: (i) 100% commercial financing, (ii) 100% IBRD financing, and (iii) CTF and IBRD financing. As shown in Table 6 below, the project is not financially viable under the first two financing scenarios, while CTF financing terms makes the project viable with an NPV of 4 million US$ in the case of a hard concessional CTF and 9 million US$ for the scenario of a soft concessional CTF.

Table 6 – Impact of Financing on key parameters

	100% Domestic Financing	100% IBRD	IBRD + CTF 20y	IBRD + CTF 40y
NPV mnl US$	-27	-3	4	9
LCOE cUS$/kWh	11,35	9,65	9,1	8,7

2.2 Clean and Efficient Energy Project (including Components 1 and 3)

64. CTF concessional financing improves substantially the project's financial cash flows. Assuming a joint CTF and IBRD financing (see table below) the NPV improves to US$ 39 million from a slightly positive US$ 0.1 million NPV in case of 100% domestic financing scenario.

65. The table 7 below shows the overall Project NPV under different financing assumptions:

Table 7 – Impact of Financing on Overall project NPV

	100% Domestic Financing	100% IBRD	IBRD + CTF 20y	IBRD + CTF 40y
NPV mnl US$	0	27	34	39

B. Technical

66. The implementation of the proposed project does not involve complex nor challenging technologies. Construction of solar PV plants, extension of evacuation lines, and installation of time-of-use/smart meters or implementing a renewable energy dispatch center are standard. ONEE has developed a number of more complex projects including large power facilities, extended transmission and distribution infrastructure, and implemented a state of the art control center of the whole power system.

67. The solar technology that is expected to be used in the proposed project, crystalline-silicone PV, is the most commonly used in large-scale solar farms worldwide. This technology has also been used in a pilot grid-connected solar power plant under operation (800 kWp) in Morocco, proving that it is well suited for the area. The selection of this mature technology would allow ONEE to significantly raise the interest from numerous

bidders and contractors worldwide with attractive bidding prices under keen competitions.

68. Detail designs, civil works, procurement of equipment, and installation of the solar PV plants will be done as a single package by an EPC Contractor selected through an international competitive bidding process. The technical risks on the project construction, including delay of construction, would also be minimized by selecting a competent contractor.

69. Moreover, ONEE intends to select a technical advisor to help draft project documents, including technical functional specifications and carry the required technical due diligence and preliminary technical studies that would allow the selected private partner to construct, operate and maintain the proposed solar power generation facility in an efficient, economic, reliable, safe and environmentally-sound manner.

70. ONEE's experience in acquiring and deploying more than 1 million prepaid meters and the feedback from a smart meters pilot in the region of Casablanca will minimize technical risks on the selection and installation of the appropriate meters.

C. Financial Management

71. **The financial management system of the ONEE, and specifically the Finance Division of the Financings in the financial department,** was appraised to determine if it complies with the requirements of the Bank in respect to OP/BP10.00. The financial management evaluation of the ONEE covered the areas of accounting and financial management, as well as the reporting and auditing process of the project. The financial management system, including necessary arrangements to respond to the needs of the financial monitoring of the project, satisfies the requirements of the Bank.

72. **The financial management system presents a low fiduciary risk.** The project will be carried out while being based on the procedures and the accounting and financial organization of the ONEE, which has a financial management system considered to be satisfactory. ONEE is a state-owned commercial and industrial enterprise with financial and administrative autonomy (*Etablissement public à caractère industriel et commercial*). Accordingly, it operates as a private sector entity and the systems in place are based on the principles and procedures of the commercial law of the Kingdom of Morocco. ONEE has a Managing Director and a Board chaired by the Chief of Government and composed of representatives of various ministries. ONEE issues year-end financial statements that are audited by external independent auditors with the required qualifications and experience. The accounting is centralized at Headquarters. ONEE's Financial Department is well structured, and it has an adequate staff with proven experience in donor-financed projects. ONEE already has significant experience managing Bank-financed projects.

73. **The financial management will be ensured by the Finance Division within the financial department of the ONEE,** in coordination with the concerned technical departments. Interim unaudited financial report, which will cover all the activities and

sources of funds of the project, will be prepared biannually by the ONEE and transmitted to the World Bank not later than forty five (45) days after the end of each calendar semester, covering the semester, in form and substance satisfactory to the World Bank.

74. **The ONEE shall have its Financial Statements for the project audited in accordance with the provisions of Section 2.07 (b) of the Standard Conditions**. Each such audit of the Financial Statements shall cover the period of one fiscal year of the Recipient. The external audit report of annual financial statements of ONEE, an annual audit report of the project accounts and the management letter covering recommendations to improve the internal controls and the accounting system will be transmitted by the Office to the Bank no latter than six months after the end of each exercise. Moreover, the annual audit report of the project accounts will be carried out in accordance with the Bank guidelines by an acceptable auditor and according to acceptable terms of references by the Bank

75. **Financial flow of funds will come from the grant funds of the Bank.** The project is co-financed by the World Bank, CTF, and ONEE. CTF will finance component 1 for US$23.95 million. The World Bank will finance all projects' components for $125 million and the ONEE will finance component 1 for US$ 4.05 million.

76. Financial flows will come from the World Bank, CTF and counterpart funds financed by ONEE. Flows of funds between the World Bank, CTF, ONEE and the recipients will be organized according to traditional disbursement procedures of the Bank.

D. Procurement

E. Social (including Safeguards)

77. **ONEE has pre-identified four sites for developing three or four solar PV plants, which the feasibility study will confirm**. A Resettlement Policy Framework (RPF) is being prepared as due diligence to specify the process for preparing, reviewing, approving and implementing subsequent Resettlement Action Plans (RAPs) for sub-projects before the relevant civil works are initiated.

78. **In March 2014, the World Bank undertook a "Social and Gender study" to assess the potential social impact of the Project on local populations, particular women** and make recommendations to the borrower, ONEE, to take into account the needs and expectations of local populations during project implementation to maximize its positive impact. The study included twenty interviews to local authorities, community representatives, local associations and ten focus groups with local women (10 women on average per focus group) from the three sites pre-identified by ONEE: Arfoud, Missour and Zagora.

79. The **main conclusions** of the study were the following:

- **Social impacts due to land sale**: Potential beneficiary communities, including women, have clearly expressed their consent to sell the land for the project given

their high poverty rates (poverty rates of these municipalities vary from 11, 3% - Erfoud, 12.4% - Ouizeght-Missouri, more than 30% - Tamegroute Zagora)and expected compensation for the land sale that could assist the community in:

(i) Improving their living conditions through improved housing, access to basic infrastructure (roads, public lighting, drinking water, sanitation), the creation of high-schools and kindergartens;
(ii) Improving their standards of living, through the strengthening or creation of income-generating activities for women and youth, and agricultural cooperatives;
(iii) Strengthening local associations (women's associations, local development associations and sustainable development, cultural and sports associations) through technical and financial support.

- **Social impacts due to improved electricity supply**:

(iv) *Improving access to health by*: avoiding postponement of surgical interventions, relocations of patients to far-away hospitals, better delivery conditions during night in the rural health facilities.
(v) *Improving household's quality of life, in particular women:* Women will benefit mostly from the project because they are the main electricity consumers in the household and suffer from inadequate refrigeration and regular appliance's breakdowns.
(vi) *Improving income-generation activities*: better refrigeration of dates and access to electric water pumps for irrigation.
(vii) *Increased safety* through: extension of municipal street lighting particularly in the suburban and rural areas districts (benefit sharing).

F. Environment (including Safeguards)

80. Solar PV power generation does not produce any pollutant. Therefore, the proposed project will have limited environmental impacts during installation and operation of PV plants. The main concern is expected to be on workers safety issues. Such impacts will be of small scale and site-specific, and can be readily avoided/mitigated with good construction specifications and operational management rules.

Annex 1: Results Framework and Monitoring

Country: Morocco

MA-Clean and Efficient Energy Project (P143689)

Project Development Objectives

To improve the capacity of ONEE to supply and dispatch clean electricity and to meet the demand of targeted customers more efficiently.

PDO Indicators	Core	Unit of Measure	Baseline	Cumulative Target Values					Frequency	Data Source/ Methodology	Responsibility for Data Collection
				2015	2016	2017	2018	End Target			
1. Generation Capacity of Renewable Energy	☒	Megawatt	0	0	25	75	75	75	Quarterly	Implementation agency report	ONEE
Breakdown: Solar											
2. Forecasted next day clean electricity generation is integrated into system dispatch	☐	Yes/No	No	No	Yes	Yes	Yes	Yes	Quarterly	Implementation agency report	ONEE
3. Customers subscribing to bi-hourly tariff	☐	Number	0						Quarterly	Implementation agency report	ONEE
4. Direct project beneficiaries	☒	Number	0						Quarterly	Implementation agency report	ONEE
Female beneficiaries	☒	Percentage							Quarterly	Implementation agency report	ONEE
5. GHG emissions avoided	☐	tCO_2eq/yr	0	0	26,006	78,018	78,018	78,018	At project end	Implementation agency report	ONEE

Intermediate Results Indicator	Core	Unit of Measure	Baseline	Cumulative Target Values					Frequency	Data Source/ Methodology	Responsibility for Data Collection
				2015	2016	2017	2018	End Target			
6. PPA standard contracts for private participation in PV generation developed	☐	Yes/No	No	No	Yes	Yes	Yes	Yes	Once	Implementing agency report	ONEE
7. Solar PV plants commissioned	☐	Number	0	0	1	3	3	3	Once	Implementing agency report	ONEE
8. Lessons on operating grids with large RE shares or other topics of relevance for ONEE RE development documented and applied (following training/study tours)	☐	Yes/No	No	No	No	Yes	Yes	Yes	Bi-annual	Implementing agency report	ONEE
9. Renewable Energy dispatch system performs according to standards specified in contract	☐	Yes/No	No	No	Yes	Yes	Yes	Yes	Quarterly	Implementing agency report	ONEE
10. Completed awareness campaign on smart meters	☐	Yes/No	No	No	Yes	Yes	Yes	Yes	Once	Implementing agency report	ONEE
11. Smart Meters installed	☐	Number	0	0	20,000	40,000	60,000	60,000	Bi-annual	Implementing agency report	ONEE
12. Bill collection ratio for customers with Smart Meters	☐	Percentage	n/a	n/a	n/a	n/a	n/a	n/a	Bi-annual	Implementing agency report	ONEE

14. Feedback from customers with smart meters collected	☐	Yes/No	No	No	No	Yes	Yes	Yes	Bi-annual	Implementing agency report	ONEE
15. Volume of direct finance leveraged through CTF funding	☐	US$ million	0	129	129	129	129	129	Bi-annual.	Implementing agency report	ONEE
16. Electricity losses per year in the project area	☒	Percentage	5.00					3.50	Bi-annual	Implementing agency report	ONEE
Total net injected generation	☒	Megawatt hour(MWh)							Bi-annual.	Implementing agency report	ONEE
Electricity losses per year in the project area-Technical	☒	Percentage							Bi-annual.	Implementing agency report	ONEE
Electricity losses per year in the project area-Non-Technical	☒	Percentage							Bi-annual.	Implementing agency report	ONEE

Annex 2: Detailed Project Description

MOROCCO: Clean and Efficient Energy Project

Component 1 – ONEE's Solar PV Program:

1. In December 2013, ONEE adopted a 3-phase program to develop 400 MW of solar photovoltaic (PV) technology by 2020. This component will help ONEE in developing the first phase of this strategy while ensuring an adequate phasing to ensure a successful penetration of private sector financing in future projects. IBRD and CTF financing will pave the way for development of solar PV in the country (no similar plants are currently in operation). The first phase will provide a valuable opportunity to draw the attention of major players in the PV industry to Morocco, and as a result, obtain valuable lessons for the next two phases such as: (i) cost per installed MWp in Morocco, (ii) local risk assessment by the industry (country, legal, institutional, etc.), (iii) share of local procurement, and (iv) job creation potential.

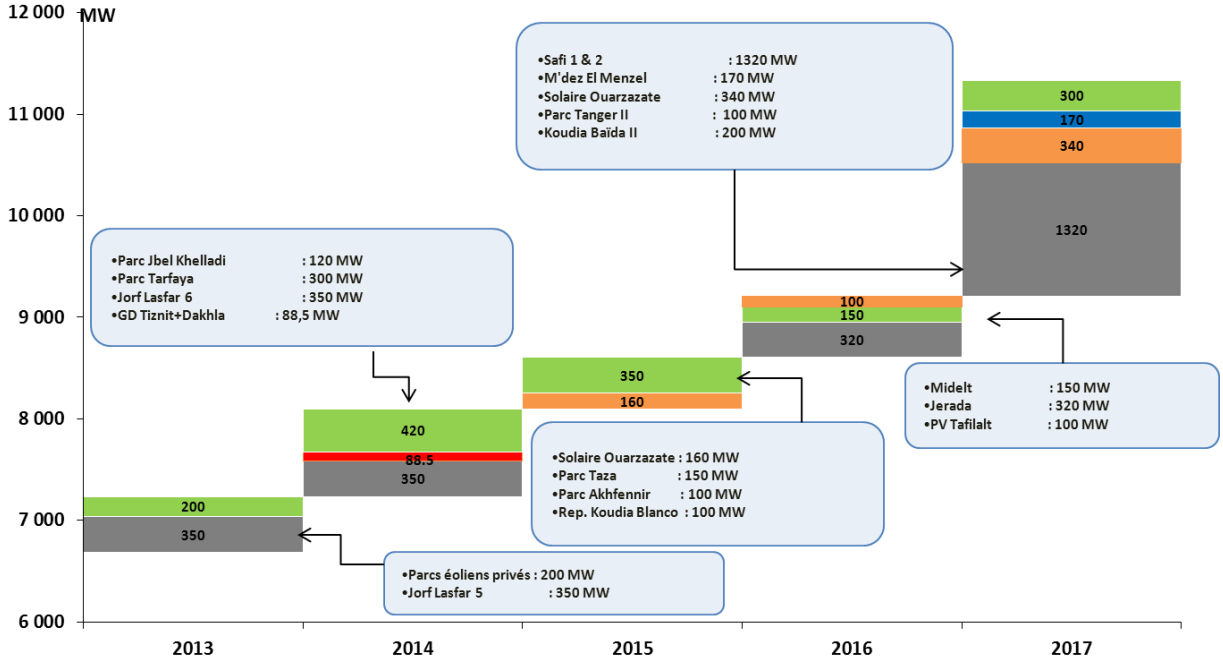
2. While ONEE and the Government are strongly committed to enhance the role of private sector in the country's power generation strategy[28], ONEE intends to develop the first phase as a public project[29] because of its need to learn about the technology and to understand its interaction and impact on the grid and the whole power system. ONEE was keen in adding subcomponent 1.2, which will provide ONEE with information about forms of private sector participation, design of power purchase agreements including proper risk distribution and best practices for bidding projects.

3. **Subcomponent 1.1: 1st phase – "Tafilalt" project (US$ 91 million from IBRD and US$ 23.95 from CTF):** This subcomponent intends to implement the first phase - 75 MW of installed capacity - of ONEE's solar PV program in three pre-identified sites near the towns of Erfoud, Missour and Zagora located in Morocco's south eastern region, i.e. 25 MW of installed capacity in each site. As shown in Figure 10, the solar PV plants are part of ONEE's capacity expansion plan. These three plants will integrate all communications and control devices required for its integration in the Renewable Energy Dispatch Center also financed by the Project under Component 2. The proposed solar PV project will be the first of its kind in the MENA region and will pave the way for the penetration of solar PV technology in the country.

[28] While ONEE plans to evaluate investment decisions on a case-by-case basis, the latest figures on power supply and generation expansion planning show that private producers will assume an even larger role. By 2020, the private sector is expected to supply 70% (43% in 2012) of power demand and operate more than 50% (28% in 2012) of installed capacity with half of private production from renewables.

[29] ONEE is considering outsourcing the O&M to a private sector operator.

Figure 10 – ONEE's capacity expansion plan



Source: ONEE, 2014

4. This subcomponent aims at exploiting the optimal untapped solar resources of the country and contributing to the country's renewable energy targets to increase energy security. Additional benefits of the proposed investment include (i) the improvement of the quality of electrical energy supplied in the areas around the three pre-identified sites and (ii) the reduction of transport and distribution losses in the project area.

5. Local communities around the three pre-identified sites near the towns of Erfoud, Missour and Zagora are affected by frequent voltage drops due to their distance with the generation plants located in the north and western shores of Morocco. The proposed project will provide a renewable energy source closer to these remote loads, not only for providing electricity, but also for enhancing their voltage and hence improving the quality of supply. Also, solar PV plants are nowadays able to control permanent and transitory events due to the advanced power electronics that they include in their configuration, which contribute to improve the voltage. The PV plants have the ability to increase the voltage to adequate levels. ONEE will ensure that voltage levels are within an acceptable range during the operation of the PV power plants. The impacts of this scheme will be very positive for the inhabitants near the pre-identified sites, which will be expected to experience less burn-out in household appliances and consumer electronic equipment.

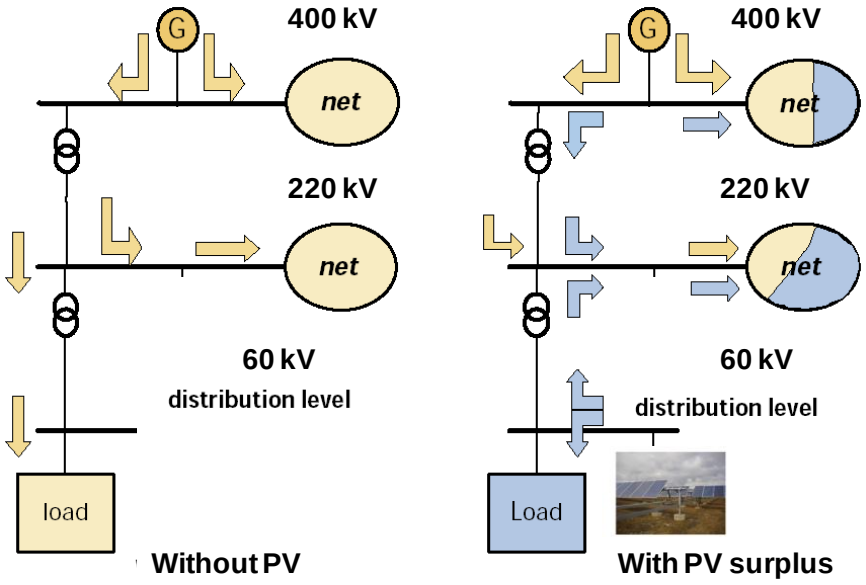
Table 1 – Voltage levels of the 60 kV System without solar PV in three pre-identified sites

	Without solar PV
Erfoud	56.5 kV
Missour	56.7 kV
Zagora	52.7 kV

Source: ONEE, 2013.

6. **Distributed generation with solar PV plants will also have non-negligible benefits in reducing 1.5%[30] of electrical losses on average in the transmission lines near the three pre-identified sites.** Electrical losses are reduced because the generation is closer to the load and the current has to move smaller distances along the lines. The changes in the load flow introduced by the proposed distributed generation concept in Morocco's electrical system are shown in the *Figure 11 below:*

Figure 11 – Morocco's transmission network (60, 220 and 400 kV) with and without solar PV project



The potential for losses' reduction in the 60 kV line where the PV plants will evacuate the power is significant as shown in Table 2 below.

[30] The estimation is based in the above formula *Losses = 3 x R x* I^2, with a current (I) necessary to supply peak load that it has a capacity factor (number of hours that this load is consumed in a year) of 10%. The R of line is of 0.4 Ω/km.

Table 2 – Potential losses' reduction

	Distance to HV substation (Km)	Potential losses' reduction			Voltage drop (kV)	Voltage drop reduction (%)
		Peak load (MW)	Annual energy (MWh)	Annual energy (%)		
Erfoud	55	2.29	2,004	1.1	9	15
Missour	78	1.72	1,506	1.1	3.2	5
Zagora	181	3.53	3,094	1.8	7.3	12

7. **Subcomponent 1.2: Enabling environment for private participation in distributed PV generation** (**US$ 250,000 from IBRD**)**.** This subcomponent will finance the sharing of knowledge and best practices on private sector participation in the solar PV market, specifically in mid-sized PV generation. Topics will include forms of private sector participation, the design of power purchase agreements including proper risk distribution and best practices for bidding projects. Based on experience, best practices and an assessment of conditions in Morocco, this component will produce recommendations on regulatory and contractual instruments for enabling efficient private sector participation in the PV market. With the establishment of an enabling environment and as PV becomes even more competitive, it is expected that the private sector will gradually help complement investment in PV generation.

Component 2 – Planning and dispatching of Renewable energies:

8. The national utility ONEE has a modern dispatch center with SIEMENS technology[31] in Casablanca to fulfill its role as a transmission system operator (TSO). The National Dispatch controls all generation plants connected to ONEE's High Voltage nodes and all exchanges with the Iberian system and with Algeria.

9. ONEE programs the production of all power plants for the following day according to the forecasted power demand. For this programming, ONEE also takes into account the hourly forecast of the wind power production of the existing wind plants, a total of around 500 MW, connected in different nodes of the electrical system. The National Dispatch control room is operated 24/7 with three technicians on every shift, who monitor the normal operation of the electrical system. In case of emergency or in deviations of certain variables of the electrical system, mainly node voltages, the control room sends orders to generation plants and large electricity consumers such as steel/iron industries and the national Moroccan phosphates company, OCP. The connection to the strong Iberian system makes frequency very stable and primary regulation of Moroccan power plants helps to control its short-time variations.

10. However, the existing National Dispatch center, similarly to other installations in the world, can only control few large installations connected to HV transmission lines

[31] SIEMENS has been the supplier of the SCADA (Supervisory Control and Data Acquisition) system installed in the National Dispatch located in Casablanca.

through strict protocols. The National Dispatch center is therefore not prepared for a more flexible grid operation with smaller installations such as renewable energy power plants with different technical and operational characteristics to conventional power plants.

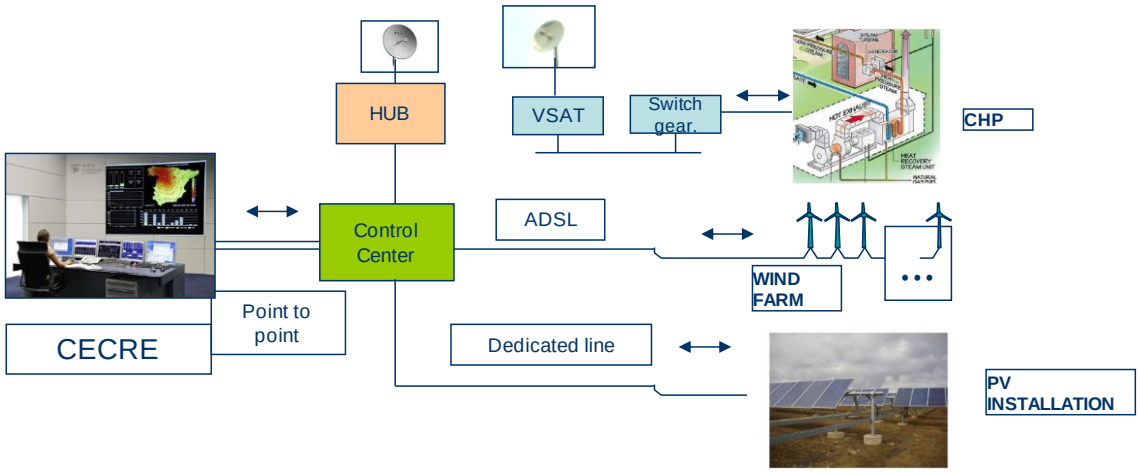
11. **Sub-component 2.1: Renewable Energy dispatch center (US$ 5 million from IBRD):** This subcomponent will finance the procurement of a Renewable Energy dispatch center integrated in the existing National Dispatch center following the example of Spain's CECRE[32]. ONEE has also requested World Bank and CTF support to finance a reputed consultant to assist ONEE in drafting the technical specifications for the RE Dispatch center. On February 6, 2014, the Clean Technology Fund Trust Fund Committee approved a US$ 1 million project preparation grant for the Clean and Efficient Energy Project. Out of this amount, around US$ 100,000 will be allocated to fund the consultant's work[33]. ONEE and the World Bank are finalizing the Expression of Interest for the international competitive selection of this consultant.

12. In contrast with the Spanish model, ONEE plans to request existing and future renewable energy installations to provide the forecasted generation for the following day in order to integrate it in the general dispatching models[34]. The extensive use of prediction tools in wind and solar installations has been key in optimizing the use of balancing power and spinning reserve of conventional power plants worldwide.

13. The large amount of renewable energies planned to be installed in Morocco by 2020[35] represent a significant challenge for the future sound operation of the Moroccan electrical system. Despite the technical benefits of the connection with the European system through Spain[36] and the advanced technical features of modern PV installations and wind turbine generators, a dedicated Renewable Energy dispatch center will be instrumental for sustaining Morocco's green future.

[32] Control Center of the Special Regime, or CECRE in the Spanish acronym.
[33] ONEE will commit around US$ 150,000 of its own resources to cover the remaining costs. The consultant's estimated total cost is US$ 250,000.
[34] In Spain these programs are submitted to the Economic Market Operator (OMIE) while the TSO, Red eléctrica (REE) has its own prediction tool to combine/compare with these programs.
[35] Morocco plans an almost tenfold increase in installed capacity of wind and solar energies, from around 500 MW to over 4,000 MW by 2020.
[36] The connection through Spain ensures primary load/frequency control to balance electricity supply and demand.

Figure 12 – Spain's RE dispatch center model



14. ONEE's Renewable Energy dispatch center would include the following features:

- Forecasting of Renewable energy generation on day-ahead, hour-ahead, week-ahead, month-ahead basis.
- Real time tracking of generation from Renewable energy sources.
- Geo-spatial visualization of Renewable energy generation
- Close coordination with the National load dispatch center for Renewable energy generation and control to smooth grid operation.
- Single source information repository and coordination point for Renewable energy penetration.

15. While there is no study available on the impact of the Renewable Energy dispatch center in Morocco, some regional or local integration cost studies[37] have found that the costs of integrating renewables are lower in areas with faster, flexible scheduling and dispatch. Integration studies conducted in ISO (Independent System Operator) areas with 5 or 10-minute dispatch had integration costs of $0-$4/MWh, while areas with hourly scheduling and dispatch had integration costs of about $8-$9/MWh or higher. The same studies found that using advanced wind and solar forecasts in the day-ahead unit commitment process would reduce system operating costs by $10-$17/MWh of renewable energy, compared to not considering renewables in the unit commitment process.

16. **Subcomponent 2.2: Increasing ONEE capacity to perform long-term power planning that considers renewables and synergies with the water sector (US$ 200,000 from IBRD).** This subcomponent will support ONEE's planning department by increasing their capacity and acquiring modern tools to further strengthen their

[37] D. Lew, G. Brinkman, E. Ibanez, B.-M. Hodge, J. King "The Western Wind and Solar Integration Study Phase 2", Preprint National Renewable Energy Laboratory, http://www.nrel.gov/docs/fy12osti/56217.pdf , site visited 17 May 2014.

capabilities in planning. Scaling-up renewables requires the use of proper planning methods and tools that consider how the location of projects and the variability of solar sources in particular locations impact grid operation and long-term supply adequacy. This component will support the purchase of advanced planning models that can capture such characteristics and help ONEE improve planning practices in the long-run. In addition, new models can help ONEE identify water-energy synergies. Using the new models, the component will also include a study of transmission expansion needs in Morocco for the long-term development of the solar program and identify the best longer-term mix and locations of further solar development in the country to reduce future impacts of variability and ensuring reliable operation and cost efficiency.

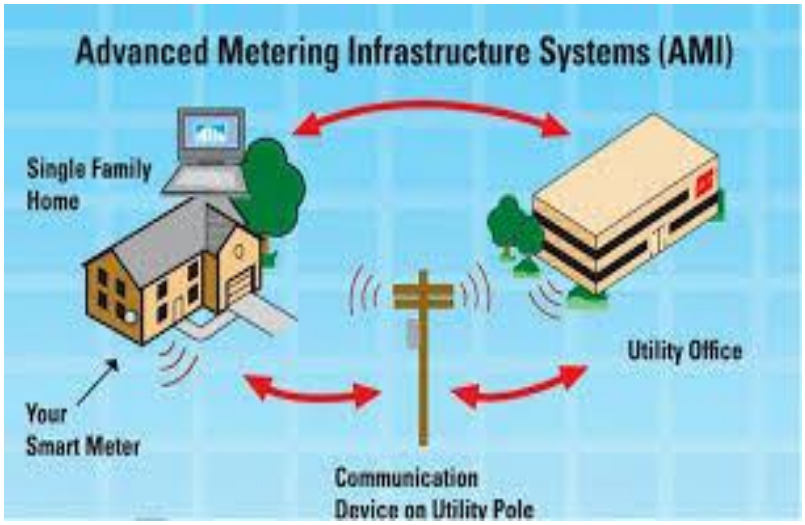
Component 3 – Utility Demand-side Management and Revenue Protection program:

17. **Subcomponent 3.1: Smart Meters Program (US$ 13 million from IBRD):**

18. ONEE has decided to install 60,000 bi-hourly kWh meters in order to apply the bi-hourly tariff instituted by the Government of Morocco in February 2009. This would be the first undertaking of its kind to replace all old electro-mechanical Watt-hour meters for large Residential customers (with consumption >500 kWh/month) and all small commercial and industrial customers (LV supplied), with the so called "Smart Meters" for ONEE service area.

19. A Smart meter is an electronic device or advanced meter that records electrical energy consumption in more detail than a conventional meter, in intervals of an hour or less. The Smart Meter communicates that information at least daily back to the utility, ONEE in this case, for monitoring and billing purposes. The technology of Smart meters is far more advanced than the current meters as it enables two way communications between the meter and a central system at the power company [see Figure 13]

Figure 13 – Smart meters systems



20. Time-of-use meters have existed for years, and have been installed to measure commercial and industrial customers' consumption, but "Smart Meters" involve real-time sensors, power outage notification, and power quality monitoring such as voltage drop, voltage surge, harmonic distortion and frequency changes, allowing diagnosis of power quality problems. These additional features are more than simple automated meter reading.

21. In addition to promoting time-of use tariffs with the introduction of this technology, ONEE's objective is to maximize efficiency, provide reliable and quality supply. Therefore a major novelty of this component is the introduction of advanced metering infrastructure systems (AMI) in order to start the implementation of the first stage of the roadmap for smart grid for power distribution. The component will assist to optimize distribution system configuration by providing valuable data and processed information from demand side. The component will include the infrastructure for load profiling and customer two-way communication that will enable efficient pricing of electricity (adequate time of use tariff structure) and demand response programs to encourage reductions in electricity consumption. These, in turn, should lead to reduction in investments in the distribution system, decrease in operating costs, improve reliability and quality of distribution services, and avoid GHG emissions associated with avoided thermal power generation.

22. Under this subcomponent, the proposed AMI includes the following types of investments: (i) Multifunctional electronic meters or smart meters; (ii) Meter data management system (MDMS); and (iii) a Meter Control Center (MCC). These investments will provide data (in real-time or short term near real time) on the state of the distribution system and consumption, to be analyzed and presented in a way that is useful for ONEE to remotely control and respond to events and optimize the operation of the distribution system, as well as to incorporate consumers' response. The adoption of this smart grid technology will contribute to improving ONEE's operating efficiency and optimizing the configuration of the distribution network to reduce overloads (loss reduction); increasing the accuracy of billing, avoiding loss of revenue (revenue protection); enabling the load profiling of electricity consumers to improve load forecasting, optimize generation dispatch, enhance demand response programs and efficiency signals in tariffs to promote efficient use of electricity.

23. From the consumer perspective, smart metering offers potential benefits to householders. These include: a) an end to estimated bills, which are a major source of complaints for many customers; b) a tool to help customers better manage their energy use and reduce their energy bills and carbon emissions. Electricity pricing peaks at certain predictable times of the day and the season. Billing customers by time-of-day will encourage consumers to adjust their consumption habits to be more responsive to market prices and hopefully these "price signals" could delay the construction of additional generation or at least the purchase of energy from higher priced sources, thereby controlling the steady and rapid increase of electricity prices. An academic study based on existing trials

showed that homeowners' electricity consumption on average is reduced by approximately 3 to 5 %.[38]

24. Smart Meters will change the way utilities, in general, carry out system planning studies and load forecasting as these two areas depend heavily on system data that was not available prior to the introduction of Smart Meters. Smart Meters will also contribute significantly in reducing arrears for none payment of electricity bills and non-technical losses as the Smart Meters have the capability of cutting off the power supply in case of non-payment and offer unparalleled consumption details to detect fraudsters. This is a considerable side benefit for many utilities in developing countries.

25. **Subcomponent 3.2: Deepening and identifying additional opportunities for utility-implemented energy efficiency and demand side management programs (US$250,000 from IBRD).** This subcomponent aims at helping ONEE deepen actions to support national goals on energy efficiency which include reducing energy consumption by 12% in 2020. First, the component will support the analysis of results of the smart metering program to design a larger rollout including the lessons learn from the pilot. This could include proposals for re-designing time-of-use tariff or implement other additional options such as dynamic and real time pricing in appropriate consumer categories. Second, the subcomponent will identify options, define priorities and actions plan for selected energy efficiency and demand side management programs to be driven and implemented by ONEE. These programs could include direct load control program, facilitation of appliance replacement programs, direct load control and voltage control programs at the distribution level among other.

26. **Component 4 – Technical Assistance (US$ 300,000 from IBRD):** This component will include training, capacity building, knowledge exchange, and study tour activities in the following areas: (i) best practices by system operators to manage large shares of renewable energy at the wholesale and distribution level, training and study tours (ii) new technology trends in control and performance capabilities of renewable energy technologies and interconnection standards, (iii) best practices and approaches for the supervision of PV, wind and other projects, and other such as (iv) new emerging regulatory practices for private participation in renewables, access to transmission networks, and others including technology trends and best practices in Smart Meters and Smart Grids.

[38] McKerracher, C. and Torriti, J. (2013) Energy consumption feedback in perspective: integrating Australian data to meta-analyses on in-home displays. Energy Efficiency, Volume 6 (2). pp 387-405

Annex 3: Implementation Arrangements
MOROCCO: Clean and Efficient Energy Project

Project Institutional and Implementation Arrangements

Project administration mechanisms

Financial Management, Disbursements and Procurement

Financial Management

Disbursements

Procurement

Environmental and Social (including safeguards)

Monitoring & Evaluation

Role of Partners (if applicable)

Annex 4 - Operational Risk Assessment Framework (ORAF)

Morocco: MA-Clean and Efficient Energy Project (P143689)

Appraisal

Risks

1. Project Stakeholder Risks

1.1 Stakeholder Risk	Rating	Low				
Risk Description: The project could be at risk if key stakeholders such as ONEE and Government cease to support it.	**Risk Management:** ONEE and the Moroccan Government have expressed their full commitment to this project. ONEE's Executive Board, chaired by the Head of Government, officially approved the development of ONEE's Solar PV program, which is supported by the Head of State. The project team will keep regular dialogue with ONEE's management and Moroccan Government during appraisal and project supervision to monitor any potential commitment changes from both key counterparts and mitigate any potential risk.					
	Resp: Both	Status: In Progress	Stage: Both	Recurrent:	Due Date: 28-Aug-2019	Frequency:

2. Operating Environment Risks

2.1 Country	Rating	Low
Risk Description: No significant risks identified in the country conditions for the short to medium term. The relationship between Morocco and the World Bank is considered strongly satisfactory over a long period. As part of the new CPS, the Government has requested stepped-up support from	**Risk Management:** There will be a continuous monitoring of overall country conditions, together with careful management of dialogue on sensitive reforms and/or sectors. Increasingly decentralized team in Rabat office will continue to strengthen program oversight and portfolio managemer	

the Bank and $1 billion of lending during the next 4 years.						
	Resp: Bank	Status: In Progress	Stage: Preparation	Recurrent:	Due Date:	Frequency:
2.2 Sector and Multi-Sector	Rating	Moderate				
Risk Description: Lower commitment of the Government and ONEE to eliminate fossil-fuel subsidies and to adopt measures to reduce fossil-fuel consumption.	**Risk Management:** In December 2013, the World Bank approved a Green Growth DPL in support of the Government's policy of reform, which includes dedicated triggers for the removal of subsidies for fossil fuels. In early 2014, the Government decided to cease the subsidies to most petroleum products, except for ONEE's fuel-oil used for electricity generation. ONEE and the Government are in advance stage of negotiations of the ONEE-State Contract-Program 2014-18, which is likely to remove the current subsidy scheme to ONEE's fuel-oil. Instead, ONEE is likely to receive a direct fixed subsidy for its consumed fuel-oil limited to four years. Moreover, tariffs for ONEE customers are likely to be increased gradually until 2018, except for low-income customers. Furthermore, ONEE and the Government have proven their strong commitment to energy security by adopting a 400 MW solar PV program, which complements the 2,000 MW solar plan under development by MASEN. The Bank team will keep monitoring ONEE and Government's commitment to fossil-fuel subsidy reduction, tariff reform and renewable energy development during project implementation.					
	Resp: Both	Status: Not Yet Due	Stage: Implementation	Recurrent:	Due Date:	Frequency:
3. Implementing Agency (IA) Risks (including Fiduciary Risks)						
3.1 Capacity	Rating	Low				
Risk Description: Risk that ONEE's financial management does not meet Bank's standards, especially regarding the content of the project financial statements and the quality and timeliness of the project audit report	**Risk Management:** In March 20104, an assessment of the financial management system in place at ONEE was carried out to determine if it complied with the Bank minimum requirements for the project management in respect to the OP/BP10.02. Given all the measures taken to reduce the level of exposure, to manage and to reduce the risks and weaknesses identified, the risk of residual financial management was considered low. The Bank team will continue assessing regularly ONEE's financial management capacity. In October 2013, the Bank's team procurement specialist made a presentation on the World Bank's selection					

Risk that ONEE is not experienced enough with Bank's procurement policies, which would create unnecessary delays in project implementation	of consultants (Guidelines: Selection and Employment of Consultants Financed by IBRD Loans and Credits and IDA Grants by World Bank Borrowers) for ONEE's staff from its procurement, finance and generation/solar divisions.					
	Resp: Client	Status: In Progress	Stage: Both	Recurrent:	Due Date:	Frequency:
3.2 Governance	Rating	Moderate				
Risk Description: 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.	**Risk Management:** The Bank team will closely monitor any potential negative impact on the project arising from the on-going fusion process of the electricity and water utilities. Both entities keep operating physically as separate companies.					
	Resp: Client	Status: In Progress	Stage: Both	Recurrent:	Due Date:	Frequency:
Fraud and Corruption	Rating	Moderate				
Risk Description: The main risk includes a weakness regarding tracking fraud and corruption cases and enforcing counter-measures, which could make project funds vulnerable to the risk of being misused. The restructuration following the merger of the national water (ONEP) and electricity (ONE) utilities increases this risk. The decentralization nature of the project and the important number of beneficiaries also enhances this risk.	**Risk Management:** ONEE project's implementation will strictly follow the Bank's fiduciary rules and fraud and anti-corruption guidelines.					
	Resp: Client	Status: In Progress	Stage: Both	Recurrent:	Due Date:	Frequency:
4. Project Risks						
4.1 Design	Rating	Moderate				
Risk Description: There is a risk that the beneficiary	**Risk Management:** ONEE has prepared a business plan to roll-out 60,000 smart meters to households, SMEs and agriculture					

consumers of smart meters do not switch consumption from peak to off-peak hours	businesses with consumptions > 500 kWh/month. This business plan includes a large communications campaign to inform beneficiaries about the advantages of behavior change due to the application of the time-of-use tariff. Also, ONEE was requested the government that the time-of-use tariff become mandatory in 2016 after a transition period. This request is currently being negotiated in the framework of the Program Contract between ONEE and the Government. The Director of tariffs at the Ministry of General Affairs and Governance (MAGG) has confirmed that governments' agreements on the principle of time-of-use tariff to reduce consumption during peak hours, which represent a particular high burden on ONEE, or to have the consumers who do not switch their consumption from peak hours to off peak hours pay for the real cost of power.					
	Resp: Both	Status: Not Yet Due	Stage: Both	Recurrent:	Due Date:	Frequency:
4.2 Social and Environmental	Rating	Moderate				
Risk Description: The environmental risk is low but some social issues related to OP4.12 could arise when acquiring lands for the three or four solar PV plants.	**Risk Management:** The Bank team will continue to work with ONEE to ensure that best practices on the social safeguards are used.					
	Resp: Both	Status: In Progress	Stage: Both	Recurrent:	Due Date:	Frequency:
	Risk Management: An Environment and Social Impact Assessment Framework will be prepared prior to appraisal and site-specific environment and social impact assessment will be prepared once the locations and number of the PV plants are confirmed by the feasibility study.					
	Resp: Client	Status: In Progress	Stage: Both	Recurrent:	Due Date:	Frequency:
4.3 Program and Donor	Rating	Low				
Risk Description: No risks have been identified	**Risk Management:** No risks have been identified					
	Resp:	Status:	Stage:	Recurrent:	Due Date:	Frequency:
4.4 Delivery Monitoring and Sustainability	Rating	Moderate				
Risk Description: There is a risk that ONEE incurs in	**Risk Management:** The Bank will ensure that project design establishes appropriate monitoring mechanisms and ensures					

delays in the roll-out of the bi-hourly smart meters and that ONEE does not ensure proper monitoring of its implementation and effectiveness. There is also the risk that ONEE does not monitor closely the performance of the solar PV plants operated by the private contractor due to the long distance from headquarters.	sustainability of results. Furthermore, the Bank's close project supervision will mitigate these risks.					
	Resp: Both	Status: In Progress	Stage: Both	Recurrent:	Due Date:	Frequency:
4.5 Other (Optional)	Rating					
Risk Description:	**Risk Management:**					
	Resp:	Status:	Stage:	Recurrent:	Due Date:	Frequency:
4.6 Other (Optional)	Rating					
Risk Description:	**Risk Management:**					
	Resp:	Status:	Stage:	Recurrent:	Due Date:	Frequency:

5. Project Team Proposed Rating Before Review

Overall Preparation Risk: **Moderate**	**Overall Implementation Risk:** **Moderate**
Risk Description: During preparation, there is a risk that the design of the smart-meter component does not provide enough incentives to targeted beneficiaries to switch consumption from peak to off-peak hours. There are also some moderate potential social safeguards risks related to land acquisition for solar PV plants.	Risk Description: The moderate risk for implementation is due to ONEE's inexperience in procuring solar PV plants.

6. Overall Risk

Overall Preparation Risk: **Moderate**	**Overall Implementation Risk:** **Moderate**
Risk Description:	Risk Description:

During preparation, there is a risk that the design of the smart-meter component does not provide enough incentives to targeted beneficiaries to switch consumption from peak to off-peak hours. There are also some moderate potential social safeguards risks related to land acquisition for solar PV plants.	N/A

Nondisclosable Information for Management Attention (Optional)
Risk Description:

Annex 5: Implementation Support Plan

MOROCCO: Clean and Efficient Energy Project

Strategy and Approach for Implementation Support

Implementation Support Plan

What would be the main focus in terms of support to implementation during:

Time	***Focus***	***Skills Needed***	***Resource Estimate***	***Partner Role***
First twelve months				
12-48 months				
Other				

Skills Mix Required

Skills Needed	***Number of Staff Weeks***	***Number of Trips***	***Comments***

Partners

Name	***Institution/Country***	***Role***

Annex 6: Economic and Financial Analysis

1. Project Overview:

1. The overall objective of the project is to assist Morocco in meeting its increased power demand by facilitating efficient and clean energy generation closer to the end users and hence 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.

2. The project has four components:
   (i) *ONEE's Solar PV Program:* This component includes the subcomponent 1st Phase - "Tafilalt" project (Component 1), jointly co-financed by CTF and IBRD, for the supply, installation, connection, testing and commissioning of several mid-size solar photovoltaic (PV) plants in Morocco's east and southern regions of Missour, Arfoud, Zagoura and Tan Tan with a total installed capacity of 75 MW.
   (ii) *Planning and Dispatching of Renewable Energgy (Component 2):* This component includes the subcomponent Renewable energy dispatch center, financed by IBRD with CTF grant support for preparation studies, comprising 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.
   (iii) *Utility Demand-side management and Revenue protection program (Component 3)* to be financed by IBRD. This component will support the installation of smart meters to all ONEE clients consuming more than 500 kWh/month (49,000 residential and 11,000 small commercial/agricultural clients) and associated to advanced metering infrastructure to control non-technical losses and also to contribute to shave the national peak load.
   (iv) *A Technical assistance (Component 4)* to assist ONEE in training, capacity building, knowledge exchange, and study tour activities.

2. Economic Analysis

3. The economic analysis is structured in two parts: first, an economic analysis has been undertaken for the first phase of ONEE's solar PV program (subcomponent 1.1), which is co-financed by the Clean Technology Fund (CTF); second, an economic analysis has also been calculated for the overall Clean and Efficient Energy Project, which includes a cost-benefit analysis of the first phase of ONEE's solar PV program (subcomponent 1.1) together with the Smart-Meters program (subcomponent 3.1). The assumptions taken for the analysis are the following:

2.1 Basic Assumptions

4. The following assumptions for the first phase of ONEE's Solar PV program (subcomponent 1.1) are made for the economic analysis:

   - Investment costs:

- Economic life: 25 years after a two year construction period,
- Total capital expenditure (Capex): 127.5 US$ million for 75MW

- Operating assumptions:
- Operating expenditure (Opex): 34 US$ per kW per year
- Net output: 127.5 GWh/y, with a 0.5 percent annual degradation factor
- Transmission Losses : 4.6%

5. The following assumptions for the Smart meters program (subcomponent 3.1) are made for the economic analysis:

- Investment costs:
  - Economic life: 15 years after a two year construction period,
  - Total capital expenditure (Capex): 14 US$ million for 60,000 meters

2.1.1 Discount rate

6. The value used for this project economic analysis is 6%. The value is in line with long term cost of borrowing of the Moroccan Government[39] and the cost of borrowing for Morocco's state owned National Phosphates Company, OCP[40]. As such, a discount rate of 6% for modeling purposes seems reasonable.

2.1.2 GHG Emission factors

7. Estimates of the avoided GHG emissions of solar PV plants are based on the emission factor for electricity generation in Morocco of 0.585 ton CO2/MWh, using the UNFCCC simplified methodology. While this may well be the basis for estimating CER revenue, in reality what is displaced by the PV generated energy is mainly natural gas generation in CCGTs, whose emissions per kg are much lower.

8. In short, when we compare solar PV with a gas CCGT in economic analysis, the appropriate emission factor is that for a new gas CCGT (the thermal generation that PV in fact would replace), not the "average grid factor" of the UNFCCC methodology. In a financial analysis that includes actual calculations of CER revenue, and then of course the relevant numeraire is indeed as per the UNFCCC methodology since that would determine the CERs available for sale and the actual financial impact.

2.1.3 Avoided Social Cost of Carbon

9. The estimated monetary benefits from reduced CO_2 emissions vary widely, reflecting differences in estimation methodologies and uncertainties related to the impact of climate

[39] Morocco issued US$500 million, 10-year 144a/Regulation S bonds in December 2012 at a coupon of 5.5%. The issue was reopened in May 2013 to increase the issue to US$750 million for a tap of 237.5 bp over US Treasuries, and is currently trading at a discount (.

[40] OCP (Office Cherifien de Phosphates) recently issued $300 million of 30-year debt to yield 7.375 percent, or 3.9 percentage points more than US Treasuries.

change. It has been assumed that the price of carbon dioxide is US$ 12/ton following the estimates from the Intergovernmental Panel on Climate Change (IPCC) review[41].

2.2 Economic benefits

10. The analysis takes into account four major benefits derived from the proposed investment. These benefits are explained below:

- Reductions in carbon emissions
- Sales of solar PV generated energy: Investment in solar PV plants would result in production of an annual 127.5 GWh of clean energy. This generated electricity is valued at the cost of replaced energy (gas-CCGT in case of the economic analysis) or at the current average electricity price charged by ONEE to residential customers, which is US$ 9.4 cents/kWh.
- Reduction in energy loss: Investment in distributed energy generation would address overload and voltage problems, and reduce energy losses resulting from voltage drops. A conservative estimation of the avoided energy loss was estimated at 4.6% based on the rate of transmission losses. The avoided energy loss is then estimated at 4.6% of PV generated electricity and valued at the current average electricity price charged by ONEE to residential customers.
- Reduction in fuel oil consumption: Investment in smart meters and deployment of a time-of-use tariff structure would encourage customers to adjust their load profile and shift consumption from peak to off-peak hours, hence reducing use of expensive generation capacity. The economic benefits are estimated by comparing financial savings from reductions in peak-hour generation (oil-fired plants), cost of additional off peak generation from gas and coal fired plants, and losses of revenues from energy sales. A conservative value of 60 MW was considered for the displaced peak load, which translates to a 5 hours 60 MW reduction of peak generation and a uniform 15.8 MW increase of generation during off-peak 19 hours.

2.3 Economic returns

2.3.1 Alternatives to the solar PV Program

11. The Bank's economic analysis guidelines requires to compare the project with a set of mutually exclusive project alternatives to determine that the project is the least cost solution among the alternatives.

12. The table below shows a set of potential generation alternatives to the proposed PV project. The assumptions for the Combined Cycle Gas Turbine (CCGT) and Steam Plants are taken from data tables used by ONEE to run WASP long term generation expansion planning analysis. The assumptions for a Wind plant are based on cost estimations used in the CTF-financed 850MW Moroccan Wind Program. Assumptions for solar PV are taken from International Renewable Energy Agency (IRENA) statistics.

[41] IPCC Fourth Assessment Report Working Group II report, 2007

13. Under the above assumptions, Table 1 below shows the levelised cost of energy for PV and its main alternatives. This analysis shows PV to have a higher cost than the least-cost wind energy and the second least-cost CCGT option. The highest cost is for a new HFO project, and such plants are indeed not considered as candidates in the ONEE expansion plan.

14. The Wind energy alternative, however, has been discarded because wind energy cannot provide the same energy during the day when the demand in the pre-selected areas is high (wind load does not match the local load curve as PV does). Therefore, the only relevant alternative to the proposed project is a gas-fired CCGT plant

Table 1 – LCOE for PV and alternatives

			CCGT	Steam Plant	Wind	PV
1	Fuel		Natural Gas	HFO		
2	Installed Capacity	[MW]	450	350	100	75
3	Operating Life	years	25	30	20	25
4	Overnight construction cost	US$/kW	900	1200	2000	1700
5	construction period	years	3	4	2	0,83333
6	Construction period adjustment factor	[…]	1,131	1,146	1,092	1,060
7	Total economic cost	US$/kW	1018	1375	2184	1802
8	capital recovery factor	[…]	0,078	0,073	0,087	0,078
9	annualized capital cost	US$/kW/y	79,63	99,89	190,38	140,96
10	fixed O&M	US$/kW/y	19,2	12	45	34
11	total fixed cost	US$/kW/y	98,8	111,9	235,4	175,0
12	**variable cost**					
13	efficiency	%	56%	35%		
14	heat rate	BTU/kWh	6107	9715		
15	fuel cost	US$/mmBTU	11	19,74		
16		US$/kWh	0,067	0,192		
17	non-fuel variable O&M	US$/kWh	0,0015	0,0015	0,001	
18	total variable cost	US$/kWh	0,069	0,193	0,001	
19	**total cost**					
20	capacity factor	%	75%	80%	38%	19%
21	annual generation	[kWh/year/kW]	6570	7008	3328,8	1700
22	**total cost/kWh**	US$/kWh	0,084	0,209	0,072	0,103
23	incremented cost over CCGT	US$/kWh		0,126	-0,012	0,019

2.3.2 First phase of ONEE's Solar PV program

15. As shown in Table 2 below, the resulting levelised (economic) cost of energy (LCOE) is 9.80 USc/kWh at the assumed flat gas price of US$11/mmBTU, i.e. 1.3 cents/kWh above a gas-CCGT levelized cost of electricity. The project ERR is 3.97%, which shows that the project is uneconomical with an ERR well below the opportunity cost of capital.

16. Note that the LCOE is a function of the discount rate: the lower the discount rate, the lower is the LCOE – but that is also true for the LCOE of the alternative CCGT – though with the bulk of CCGT costs in OPEX, the impact of lower discount rates is much smaller.

Sensitivity analysis

17. Stress test of the PV component shows that its economic viability is only guaranteed under assumptions of 20% decrease in capital costs or 20% increase in gas prices. The recent trend of decreasing capital cost of PV is likely to continue and the actual costs arising from an EPC tender scheduled during the first semester of 2015 are likely to be in line with present projected values (baseline cost). Table 2 below summarizes the results of stress tests for the PV component.

Table 2 – Sensitivity Analysis of 1st Phase Solar PV -"Tafilalt" project (Component 1)

Dicount Rate	ERR	NPV mln US$	LCOE cUS$/kWh
2,00%	3,17%	16,1	7,31
4,00%	3,55%	-5	8,5
6,00%	3,97%	-18,6	9,8
8,00%	4,42%	-27,3	11,22
10,00%	4,91%	-32,7	12,74
Gas Price ($/mmBTU)	ERR	NPV mln US$	LCOE cUS$/kWh
8	0,83%	-43,7	9,8
9	1,94%	-35,3	9,8
10	2,98%	-27	9,8
11	3,97%	-18,6	9,8
12	4,90%	-10,2	9,8
13	5,80%	-1,9	9,8
14	6,67%	6,5	9,8
Capital Cost	ERR	NPV mln US$	LCOE cUS$/kWh
-20%	7,23%	9,6	7,74
-10%	5,47%	-4,5	8,77
0	3,97%	-18,6	9,8
10%	2,64%	-32,7	10,83
20%	1,46%	-46,8	11,87

18. The detailed switching values analysis can be summarized as follows:

- *CAPEX*: to reach the 6 percent hurdle ERR rate, CAPEX would need to be 87 percent of the baseline price, i.e. 1480 US$/kW. That may be in achievable price in the long run, but in the short run it is most unlikely to be achieved.
- Gas price: the gas price would have to rise to $13.2/mmBTU for the 6 percent hurdle rate to be achieved. This switching value is slightly above the price paid by ONEE for gas purchased from Algeria.

2.3.3 Clean and Efficient Energy Project (including Components 1 and 3)

19. The economic analysis of the overall Clean and Efficient Energy project focused on the contribution of Components 1 (PV project) and 3 (Smart meters) because they account for more than 90% of the project total budget and since fairly accurate estimates for expected economic benefits for both components can be provided.

20. Based on the above benefits and costs, the economic rate of return (ERR) and net present value (NPV) for the project are estimated and summarized in Table 3.

Table 3 – Project's NPV and ERR

NPV and ERR of the project	
Total Costs ($ mlns)	240,2
Total Benefits ($ mlns)	265,6
Net Benefits ($ mlns)	25,4
ERR	8,60%

21. The Overall Project Economic Analysis (Component 1 and 3) results in an ERR of 8.60% which shows that the project is economically viable.

22. Whereas the PV project component is unprofitable, the combination of both components 1 and 3 becomes profitable due to the strong return of the Smart meters component, which drives its benefits from financial economies resulted from a reduced reliance on expensive HFO.

23. Assuming a lifespan of 15 years for the Smart Meters and using the unsubsidized cost of HFO, the ERR for the Smart Meters Program (Component 3) is 31.25% and its Net Present Value (NPV) is US$ 44 million.

Table 4 – Economic Analysis by component

Component	Total Costs	Total Benefits	Net Benefits	ERR
PV	141,1	122,5	**-18,6**	3,97%
Smart meters	99,1	143,1	44	31,00%

Sensitivity analysis

24. The project remains economically viable under stress tests assuming 20% increase in capital costs of the PV component or 20% decrease in gas prices. Table 5 below summarizes the results of stress tests.

Table 5 – Sensitivity analysis of key parameters

Dicount Rate	ERR
2,00%	7,94%
4,00%	8,24%
6,00%	8,59%
8,00%	8,97%
10,00%	9,38%

Gas Price ($/mmBTU)	
8	7,16%
9	7,66%
10	8,14%
11	8,59%
12	9,02%
13	9,43%
14	9,82%

Capital Cost	
-20%	11,67%
-10%	10,01%
0	12,28%
10%	7,34%
20%	6,24%

3. Financial analysis

25. The financial analysis compares the financial costs of the project components with the financial benefits of selling the produced energy at the average power consumer price or, in the case of time-of-use/smart meters, the financial benefits from fuel displacement. The calculations are in nominal US$. The average consumer price of electricity is assumed flat and has not been inflated. The CO_2 price has been assumed at US$ 0.19/ton, which is the current trading value of certified emission reductions[42].

26. In the absence of financing from CTF, IBRD or other international financial institution, it has been assumed that the project would be financed by the Moroccan banking system.

3.1 First phase of ONEE's Solar PV program

27. An analysis has been undertaken to estimate the impact of CTF financing and to justify the need for softer CTF concessional financing. For this purpose, the cash-flows of the project have been assessed under three scenarios: (i) 100% commercial financing, (ii) 100% IBRD

[42] Future CER trades at 0.14 Euro or US$ 0.19: https://www.theice.com/emissions.jhtml

financing, and (iii) CTF and IBRD financing. As shown in Table 6 below, the project is not financially viable under the first two financing scenarios, while CTF financing terms makes the project viable with an NPV of 4 million US$ in the case of a hard concessional CTF and 9 million US$ for the scenario of a soft concessional CTF.

Table 6 – Impact of Financing on key parameters

	100% Domestic Financing	100% IBRD	IBRD + CTF 20y	IBRD + CTF 40y
NPV mnl US$	-27	-3	4	9
LCOE cUS$/kWh	11,35	9,65	9,1	8,7

28. When comparing between hard and soft CTF financing terms, the difference in cash flows is US$ 5 million. While the hard concessional CTF yields an NPV of US$ 4 million, this potential revenue is deemed to be small and at risk to become negative in case of an increase of capital or operational costs, or in case of a lower solar radiation than expected. A 5% increase of capital costs assumed to be financed by ONEE, will result in a cash flow of negative US$ 2 million in case of hard concessional CTF and positive US$ 3 million in case of soft concessional CTF.

29. In conclusion, CTF soft financing terms are critical to make the solar PV project component possible and financially sound.

3.2 Clean and Efficient Energy Project (including Components 1 and 3)

30. CTF concessional financing improves substantially the project's financial cash flows. Assuming a joint CTF and IBRD financing (see table below) the NPV improves to US$ 39 million from a slightly positive US$ 0.1 million NPV in case of 100% domestic financing scenario.

31. The table 7 below shows the overall Project NPV under different financing assumptions:

Table 7 – Impact of Financing on Overall project NPV

	100% Domestic Financing	100% IBRD	IBRD + CTF 20y	IBRD + CTF 40y
NPV mnl US$	0	27	34	39

Annex 7 - Clean Technology Fund (CTF) Annex

Morocco: Clean and Efficient Energy project

Results Framework

Indicator	CTF/IBRD-funded Clean and Efficient Energy Project	ONEE Solar PV Program
Installed solar PV for power generation [MW]	75	400
Power Generation [GWh/yr]	127.5[43]	680
Tons of GHG emissions reduced or avoided -Tons per year [tCO_{2eq}/yr] -Tons over lifetime of the project [tCO_{2eq}]	78,018[44] 1.95 million	416,096 10.40 million
Financing leveraged through CTF funding [$ million] • CTF • IBRD • ONEE • Other (Commercial banks, IFIs…)	23.95 125 4.05 -	23.95 125 16 475
CTF leverage ratio	1:5	1:25
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]	12.31 78.5	n.a n.a
Other co-benefits	The project is expected to reduce power losses, improve quality of supply and hence reduce the likelihood of power interruptions in	

[43] The estimated annual PV energy production was based on a 19.4% load factor or 1,700 hours per year.

[44] The GHG estimate includes 74,587 ton CO_2 eq. per year avoided as a result of 127.5 GWh/year clean energy production, and 3,430 ton per year for avoided energy transmission losses.

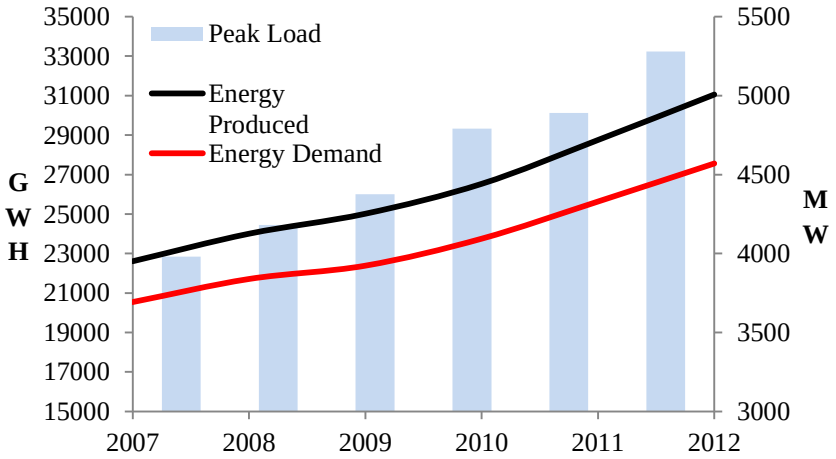
	the beneficiary areas during the day. This will improve household's quality of life, in particular women. The project will increase power availability to communities with significant poverty rates where economic activities, i.e. agriculture, tourism, crafts, and household's life quality are affected by voltage fluctuations and regular outages. In addition, the project will increase energy security from lower dependency on imported fossil fuels for power generation.

I. Introduction

a) Country and sector background

1. **Electricity demand in Morocco has been increasing rapidly at around 7 % 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 %) to satisfy its energy demand, in particular petroleum products which represent 62 % 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. Power generation in Morocco is dominated by thermal generation (installed capacity in 2012: coal 38%; fuel and gasoil 18%; and natural gas 20%), 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.

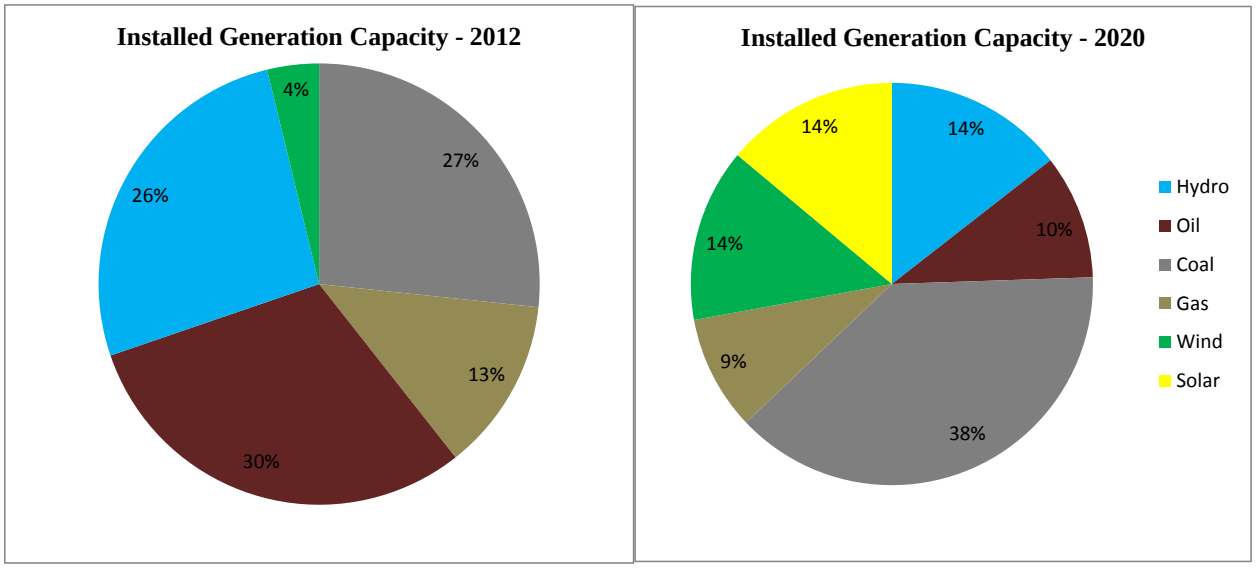
Figure 1 - Peak Power, Energy Production and Demand in Morocco 2007-2012



2. **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% (*see Figure 2 below*) and to reduce energy consumption by 12 to 15 % by 2020**.The development of the renewable energy and energy efficiency[1] potential has become a national priority[1], 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).

Figure 2 – Morocco's share of renewables in the energy mix by 2020



3. **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 billion[1]. The current share of installed renewable energy is 25% due to the large installed hydroelectric capacity[1], but planned investments in solar and wind energy are expected to be the main driver to reach the 42% target by 2020.

b) Morocco's CTF Investment Plan

4. **In October 2009, the Trust Fund Committee (TFC) of the Clean Technology Fund (CTF) approved an Investment Plan (IP) for Morocco, which was subsequently updated in January 2014**. The TFC agreed to allocate US $150 million to support the country's Energy Development Fund ("Fonds de Développement de l'Energie" - FDE), with a focus on increasing penetration of renewable energy into Morocco's electricity generating portfolio (wind and solar power).

5. **The Morocco IP Update of January 2014 reallocated US$ 25 million, out of US$ 150 million allocated to the CTF IP for Morocco, to support the Clean and Efficient Energy project, which includes the deployment of the first mid-size solar PV plant in the**

country. The CTF Trust Fund Committee has already committed US$125 million of CTF funds for the Wind Energy Program (WEP) project which is being implemented by the AfDB.

c) Brief Project Description

6. **The objective of the Clean and Efficient Energy Project is to improve the capacity of ONEE to supply and dispatch clean electricity and to meet the demand of targeted customers more efficiently**. The project will facilitate clean energy generation closer to the end users and hence 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.

7. **The project has four components: (i) ONEE's Solar PV Program: 1st phase – "Tafilalt" project (CTF co-financing US$ 23.95 million, 0.9 million PPG and 0.05 million for World Bank supervision),** which includes the supply, installation, connection, testing and commissioning of several mid-size solar photovoltaic (PV) plants in Morocco's south and eastern regions of Missour, Arfoud, Zagoura and Tan Tan with a total installed capacity of 75 MW; (ii) Planning and Dispatching of Renewable Energy, which finances the installation of a Renewable Energy dispatch center (CTF PPG funding of 0.1 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; (iii) Utility demand-side management and Revenue protection program, which includes the roll out of a Smart-meters program (IBRD financing). This component will support the installation of smart meters to all ONEE clients consuming more than 500 kWh/month (49,000 residential and 11,000 small commercial/agricultural clients) to control non-technical losses and also to contribute to shave the national peak load; and (iv) Technical assistance (IBRD financing): this component will include training opportunities for ONEE staff.

8. **Despite the rapid decline of solar PV capital costs, 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. CTF funding will bring down generation costs to cover almost all the incremental cost of the technology. The CTF contribution will be key for completing ONEE's 400 MW solar PV strategy. The support to the 75 MW first phase of the strategy 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.

9. **The use of CTF funding will also support the creation of a renewable energy dispatch center, which will be a key instrument to optimize and control the large amounts of renewable energies expected in Morocco's grid by 2020.** This component includes the

supply and installation of SCADA software and hardware to ensure optimal power dispatch and system protection. This tool would allow for the integration of intermittent large-scale renewable energy sources in the power system, 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

II. Assessment of Proposed Project with CTF Investment Criteria

a) Potential for GHG Emission Savings

10. **The proposed project aims to develop distributed mid-size renewable energy projects and improve the efficiency in the power sector while reducing its carbon emissions.** The additional CO_2 emissions reduction[45] due to the CTF project is estimated to be 78,018 tons per year for the first phase (75 MW), and approximately 416,096 per year for the total planned 400 MW of PV plants. Over the 25 year-lifetime of a PV plant, the cumulative emissions reduction of CO_2 is an estimated 1.95 million tons for the 75 MW first tranche and 10.40 million tons for the total planned 400 MW.

11. **Technology development status**: PV Solar plants are a widely used commercial technology and have high mitigation potential. In the last five years (*see Figure 3 below*), levelised costs of generation for crystalline silicon PV and thin-film PV fell by 53% and 34% respectively. This reflects a combination of technology improvements, economies of scale in module manufacturing, strong competition for market share among manufacturers, cost efficiencies in inverters and in balancing of plant items such as mounting systems and cables, and improved productivity in rooftop installation and utility-scale PV project construction. On the other hand, a faster implementation of PV projects the MENA region and Africa is being impeded by still relatively high costs (*see Figure 4 below*). The concessionary nature of CTF financing will be able to reduce the financial costs and pave the way for the penetration of solar PV technology.

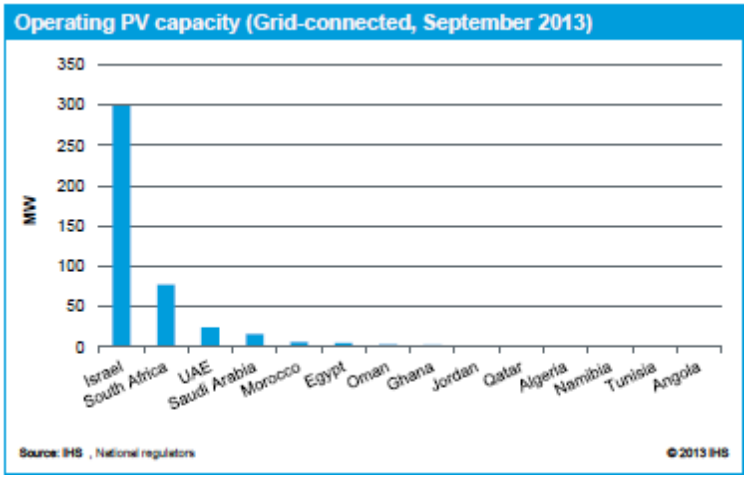
[45] Estimates of the avoided GHG emissions of the PV projects are based on the emission factor for electricity generation in Morocco of 0.585 ton CO2/MWh, using the UNFCCC simplified methodology.

Figure 2 – % change in levelized cost per MWh from 2009-2014

PV - c-Si	-52.7
PV - c-Si tracking	-49.2
PV - thin film	-33.9
Biomass - gasification	-27.6
Wind - onshore	-14.7
Municipal solid waste	-7.8
Landfill gas	-4.4
Biomass - anaerobic digestion	-4.2
STEG - parabolic trough	-3.8
Biomass - incineration	-3.3
Geothermal - flash plant	18.4
Marine - wave	36.8
Geothermal - binary plant	38.1
Wind - offshore	40.6
Marine - tidal	46.2

Source: Bloomberg

Figure 3 Operating PV Capacity in Africa and MENA Region



Source: HIS

b) Cost-Effectiveness

12. Considering CTF support for the proposed project and the projected emissions savings of about 2.4 million tons of CO_2 over its lifetime, the cost of each ton of CO_2 saved would amount to approximately US$ 12.90 of CTF funding and US$ 82.3 of the project total cost.

13. **Marginal abatement cost.** During the update of the Morocco Investment Plan Update from January 2014, the CTF Trust Fund Committee required justification for why the marginal abatement cost for the project is expected to be below the 100 US$/t$CO_2$ threshold. Based on 1.95 million tons of CO_2 savings over the lifetime of the project and total project cost of US$ 153 million, the project cost effectiveness is US$ 78.5 per ton of CO_2. Since total project cost effectiveness is US$ 78.5 per ton of CO_2, the marginal abatement cost – which is calculated as net incremental cost for reducing one ton of CO_2 – is certainly less than US$78.5 per ton of CO_2.

c) Demonstration Potential at Scale

14. **The proposed project supports distributed mid-size PV projects to develop untapped optimal solar resources in line with the Government's and ONEE's priorities**. The proposed project will also help the grid operator understand and better integrate solar and other renewable power projects to the grid at a larger-scale. The Clean Energy and Efficient Project will pave the way for the implementation of ONEE's 400 MW solar PV program.

15. **The project will introduce the first mid-size grid-connected solar PV in Morocco and will be key for rolling out ONEE's solar PV strategy, which will avoid around 10 million tons of CO_2 by 2042.** 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, such as understanding (i) costs of developing large PV projects in the country (ii) impact of PV production on the grid (iii) best practices in developing, construction and operation of PV plants. An even wider deployment of PV 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 project 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.

d) Development Impact

16. **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**. Tapping the country's huge solar resources will help reducing the carbon intensity of power generation (the full 400 MW PV plan would reduce CO_2 emissions by almost 397,800 tons per year).

17. **The proposed project is also expected to strengthen the power system by strengthening its management and expanding the automation of control to maintain grid stability,**

especially in the case of large-scale integration to intermittent renewable resources. As a result, the project is expected to contribute to more efficient and reliable power supply and reduced emissions associated with power generation. In terms of 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.

18. **According to a World Bank study on the impacts of the solar PV plants on these local communities[46], particularly women,** the Project is also expected to have the following indirect positive impacts:

    (iv) *Health sector*: an improved electricity supply will reduce the failures in hemodialysis, radiography and ultrasound equipment in regional hospitals due to voltage drops and the need for expensive back-up diesel generators. The failure of this equipment entails postponement of surgical interventions, relocations of patients to far-away hospitals and other problems.
    (v) *Education sector*: an improved electricity supply will reduce the negative impacts on schoolchildren suffering from severe cold in winter and extreme summer heat. Schoolchildren, particularly in poor areas, have a hard time to do homework regularly in the evening and to use computers because they are often broken due to voltage fluctuations. Improvements in electricity supply could mitigate these negative impacts.
    (vi) *Gender and quality of life*: an improved electricity supply will reduce the power cuts and voltage drops that currently affect these areas (4-5 monthly power cuts and daily voltage drops). This improvement will particularly benefit women who are the main household electricity consumers and suffer from: inadequate refrigeration and regular appliance's breakdown.

e) Implementation Potential

19. **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).

20. 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 ONE.

[46] World Bank, "Clean and Efficient Energy Project (P143689) – Revue des aspect sociaux", March 2014, internal document.

21. 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.

22. In addition, the World Bank is engaged with the Government to enhance the overall sector policy framework and advance reforms aimed at improving the sector's commercial environment and sustainability. In December 2013, the World Bank approved a US$ 300 million "Morocco-Inclusive Green Growth Development Policy Loan" to support a set of measures aimed at reducing the country's pollution levels, dependence on fossil fuels, and the total envelope allocated to energy subsidies. Among those measures is the adoption of a legal framework to allow and promote on-grid distributed renewable energy. A study aimed at proposing a cost-reflective structure for electricity tariffs has been launched. In parallel, a study was also launched to define the missions of a new regulatory authority to be created.

23. ***Leveraging of Co-financing*:** the project investments would be funded through a mix of CTF (USD 23.95 million), IBRD (USD 125 million) and ONEE financing (USD 4.05 million). IBRD and ONEE contributions on the CTF-funded component 1 "ONEE's Solar PV Program" are respectively US$ 91 million and US$ 4 million. The CTF leverage ratio will be 1 to 5. Further, the investments under this project would facilitate continued expansion of renewable energy capacity that would invite more private sector investments in additional wind and solar capacity.

24. More importantly, investor confidence and private sector participation in clean technology development in Morocco would be further boosted given the international support mobilized by CTF.

III. CTF Additionality

25. Despite the rapid decline of solar PV capital costs, 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 will allow ONEE and local subcontractor companies to gain the experience and know-how necessary in subsequent phases.

26. 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 scaling-up.

27. The financial analysis and the sensitivities developed show that the CTF contribution will have a substantial impact in making the solar PV project happen and bringing down its generation cost. As shown in the table below, if the project had to be financed with commercial domestic financing, the project would have a NPV of negative US$ 27 million. If

the CTF contribution was replaced by conventional IBRD funding, the project's cash flows net present value will still be negative US$ 3 million.

	100% Domestic Financing	100% IBRD	IBRD + CTF 20y	IBRD + CTF 40y
NPV mnl US$	-27	-3	4	9
LCOE cUS$/kWh	11,35	9,65	9,1	8,7

28. When comparing between hard ("CTF 20 years") and soft ("CTF 40 years") CTF financing terms, the difference in cash flows is US$ 5 million. While the hard concessional CTF yields an NPV of US$ 4 million, this potential revenue is deemed to be small and at risk to become negative in case of an increase of capital or operational costs, or in case of a lower solar radiation than expected. A 5% increase of capital costs assumed to be financed by ONEE, will result in a cash flow of negative US$ 2 million in case of hard concessional CTF and positive US$ 3 million in case of soft concessional CTF.

29. Without the CTF concessional financing under the project, construction of mid-size PV plants in the pre-identified areas would be delayed by several years because the project is uneconomic and yielding well below ONEE's cost of capital. Also, high costs would place pressure on an already financially fragile ONEE or burden electricity consumers in the unlikely case where additional costs could be passed on to consumers. A scenario without CTF concessional financing support would certainly delay the development of about 400 MW of solar power projects beyond 2020.

30. In conclusion, CTF soft financing terms are critical to make the solar PV project component possible and financially sound

IV. Implementation Readiness

31. **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 capacity[1], but planned investments in solar and wind energy are expected to be the main driver to reach the national renewable energy target.

32. 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. 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.

33. The process of hiring a technical advisor for the PV project and independent experts to carry environmental and social studies is underway. CTF investments will be able to be made alongside IBRD investments when the Project becomes effective.

34. 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 Ain Beni Mathar. This pioneering project integrated a combined-cycle power plant with a 20 MW solar field using concentrated solar power (CSP) technology[1], the only experience that ONEE has in solar energy.