Verified Carbon Standard

200 MW KOM OMBO SOLAR PV POWER PROJECT IN EGYPT

CORAL FUTURE

Document Prepared by: Coral Future Pte. Ltd.

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CONTENTS

1 PROJECT DETAILS

1.1 Summary Description of the Project

The demand for electricity in Egypt is growing and to meet the growing demand, the Egyptian government has set ambitious goal of supplying 20% of national electricity from renewable sources by 2022. The renewable energy mix is supposed to include 12% generation from wind energy, 5.8% from hydropower and 2.2% from solar energy.

ACWA Power Komombo for Energy (ACWA Power) is developing a 200 MWac photovoltaic power generation plant at Kom Ombo, Aswan Governorate, Egypt. The project will be developed under the Build-Own-Operate model and will be exporting electricity to the national grid through a 25 years PPA with Egyptian Electricity Transmission Company (EETC).

The project activity is expected to produce 630,000 MWh of electricity annually. The project's lifetime is 25 years. The total estimated emission reductions of the proposed project are 3,444,220 tCO2e during the first crediting period. The ex-ante emission reduction calculation shows that the project will avoid 344,422 tCO_2eemission annually.

The project activity is the installation of a new power plant at the site and is not a capacity addition or retrofit or replacement of any other existing plant. So any electricity generated and exported from the project activity would in its absence have been generated in the grid dominated by fossil fuelled power plants, which represents the baseline scenario. The project scenario is a Greenfield Solar PV power plant that would generate energy and supply it to the national grid through the Egyptian Electricity Transmission Company (EETC). The produced renewable energy will help to cover the growing energy demand of the Egyptian economy and the fast-growing population.

The project will not only reduce the GHGs emission but would also significantly contribute to sustainable development of Egypt and Aswan region by improving the overall economy of the area as the project will be located in an economically underdeveloped governorate compared to the Egyptian average. The newly developed solar PV projects will raise the attention of other investors on the Governorate of Aswan as potential investment location target. Apart from the economic improvement in the area, the project will create short- and long-term job opportunities for the local population and reduce unemployment in the area.

1.2 Sectoral Scope and Project Type

Sectoral Scope: 1, Energy industries (renewable - / non-renewable sources)

Type : Renewable energy projects (Large Scale)

Category : ACM 0002 - Consolidated methodology for grid-connected electricity generation from renewable sources (version – 19, EB 89)

The methodology refers to ACM0002 to the latest approved version of following tools-

- "Tool for the demonstration and assessment of additionality" version 07
- "Tool to calculate the emission factor for an electricity system" version 07

1.3 Project Eligibility

According to VCS Standard, version 4.0, the scope of the VCS Program includes:

1) The six Kyoto Protocol greenhouse gases.

2) Ozone-depleting substances.

3) Project activities supported by a methodology approved under the VCS Program through the methodology approval process.

4) Project activities supported by a methodology approved under a VCS approved GHG program, unless explicitly excluded under the terms of VERRA approval.

5) Jurisdictional REDD+ programs and nested REDD+ projects as set out in the VCS Program document Jurisdictional and Nested REDD+ (JNR) Requirements.

The project activity generated renewable electricity without any GHG emissions, which displaced part of the electricity otherwise been supplied by grid connected fossil fuel fired power plants generating mainly CO2 emission. Thus, GHG emission reductions can be achieved. The project is eligible under the scope (the six Kyoto Protocol greenhouse gases) of the VCS Program.

1.4 Project Design

The project activity involves the single installation and operation of 200 MW Kom Ombo Solar.

Eligibility Criteria

The proposed project is not a group project activity. Thus, this section is not applicable.

1.5 Project Proponent

Organization name	ACWA Power Komombo for Energy
Contact person	Eng. Hassan Ali Hassan Amin
Title	CEO

Address	Plot 176, Second Sector, Giza Systems Building, PO Box 351, Cairo, Egypt
Telephone	+20100 179 7532
Email	hamin@acwapower.com

1.6 Other Entities Involved in the Project

Organization name	Coral Future Pte. Ltd.
Role in the project	Consultant
Contact person	Santosh Singh
Title	Director
Address	20A, Tanjong Pagar Road Singapore -088443 www.coralfuture.com
Telephone	
Email	santosh@coralfuture.com

1.7 Ownership

The ownership of project activity to the project proponent can be verified through following documents from the government-authorised bodies.

- Commissioning Certificate
- Power Purchase Agreement
- Energy generation statement issued by state electricity board
- Statutory Approvals

1.8 Project Start Date

The project is expected to be in operation from 1 April 2021. The VCS Standard, v4.0 requires the start date to be "the date on which the project began generating GHG emission reductions or removals." Hence 1 April 2021 has been chosen as the project's start date.

1.9 Project Crediting Period

First Crediting Period 01/04/2021 – 31/03/2031 (10 year twice renewable)

(Second Crediting Period – 01/04/2031 to 31/03/2041)

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	
Large project	√

Year	Estimated GHG emission reductions or removals (tCO_2e)
2021	344,422
2022	344,422
2023	344,422
2024	344,422
2025	344,422
2026	344,422
2027	344,422
2028	344,422
2029	344,422
2030	344,422
Total estimated ERs	3,444,220
Total number of crediting years	10
Average annual ERs	344,422

1.11 Description of the Project Activity

The proposed project activity is a Greenfield development of 200 MW_{AC} capacity solar PV plant with an estimated lifetime of 25 years. The required infrastructural developments of the grid connection will be installed in parallel with the project activity, like substations. The baseline scenario of the project is that the generated renewable electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

The generated emission reduction will be calculated based on the amount of electricity fed in the grid. The installed Energy Meters will be the base of the proposed project's monitoring system. The technical specification of the meters complied with the Grid Code requirement. The Plant Manager will be responsible for the operation, maintenance and repair consistent with the Grid Code and the conditions given in the Power Purchase Agreement (PPA).

There are three measurement points installed in outgoing CB to the Grid to calculate the Site Energy Export and Energy Import. In each measuring points, there is a primary and backup meter to calculate the Plant Energy Export and Plant Energy Import. The project electricity generation meters will be placed in the interconnection facility (switching station) of the PV plan. For each outgoing feeder switchgear there will be one primary and backup meter. The facility will be equipped with three outgoing feeder.

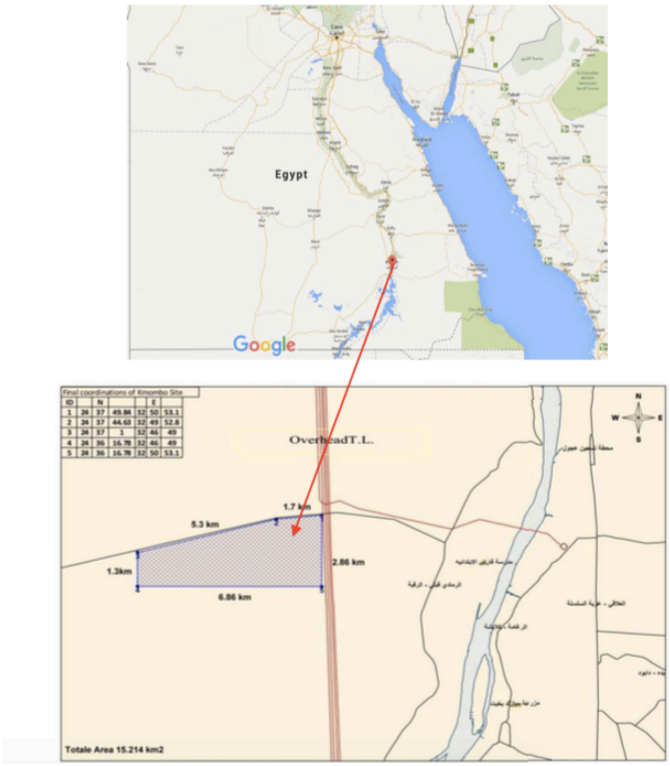
1.12 Project Location

The project is located in desert area of Kom Ombo in the Aswan, The project site is located over 600km South of Cairo, approximately 60km north of Aswan city and about 7 km west of the river Nile in Egypt.

Geographic coordinates:

Latitude: 24° 37' 49.84"N

Longitude: 32° 50' 53.1"E



1.13 Conditions Prior to Project Initiation

As part of the Egyptian Government's strategy to generate 2.2% solar power by the year 2022, the New and Renewable Energy Authority (NREA) with support from Agence Française de Development (AFD) has launched the development of a 200MW Photovoltaic Solar Power Project at Kom Ombo town in the Aswan Governorate of the Arab Republic of Egypt. The Project site is situated in an open desert terrain. It is predominantly flat with sand sheet overlaid with gravel, which is interspersed by low lying areas of sand sheet.

Coal fired plants accounts for almost 75% of total power generation leading to concerns over greenhouse gas emissions and impacts on human health and environment. In the absence of the project implementation, the region will continue to source electricity mainly from fossil fuel-based grid.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project activity meets all local laws and regulations of Egypt. The project proponents have signed a Memorandum of Understanding with the New and Renewable Energy Authority (NERA), Egypt to promote the development of renewable energy projects in the country.

The project is in early stages of implementation and is expected to start operation on 1st April 2021. The project will be applying for permits in compliance with the local laws and most of these permits are linked to project's implementation and construction status. At this stage, the following permits are currently in progress:

Permits	Issuing Authority	Status
Environmental approval for the ESIA study	Egyptian Environmental Affaire authority (EEAA)	In progress and expected within 3 months
Temporary Electricity generation license	Egyptian Electricity regulator (EgyptERA)	In progress and expected within 2 months,
Permanent Electricity Generation license	Egypt ERA	After Finance closure, expected in June 2020
Building construction license	Local Authority, Aswan	After approval of project's design documents, Sep. 2020

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

Project activity has not participated under any other GHG Programs.

1.15.2 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG program

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The letter of undertaking has been furnished by the project participant which confirms that the net GHG emission reductions or removals generated by the project activity will not be used for compliance with an emission trading program or to meet binding limits on GHG emissions.

1.16.2 Other Forms of Environmental Credit

The letter of undertaking has been furnished by the project participant, which confirms that the project neither has nor intends to generate any other form of GHG-related environmental credit from GHG emission reductions or removals claimed under the VERRA program, or that any such credit has been or will be cancelled from the relevant program.

1.17 Additional Information Relevant to the Project

Leakage Management

Not Applicable

Commercially Sensitive Information

Not Applicable

Sustainable Development

Government of Egypt has stipulated following indicators for sustainable development in the interim approval guidelines for CDM projects. The same is applied for this project.

- Social well-being
- Economic well-being
- Environmental well-being
- Technological well-being

Social well-being

The project site(s) in Egypt are almost situated in an isolated rural area where unemployment, poverty and other economic hardships are prevalent. Slow initiation of new investment in the region is attributed to lack of supportive infrastructure, which can favour private investment.

These projects will therefore, lead to the development of this region(s) through opening up of opportunities for income generation.

During civil work, the project is expected to generate considerable employment opportunities for the local population.

Other than these, there are various kinds of mechanical work, which will generate employment opportunity on regular and permanent basis.

Economic well-being

The project activity will generate employment in the local area. The installation of project activity direct (at site) and indirect (off site) employment. It is estimated that 2-3 job created per plant directly and 10-20 indirectly. The jobs in occupational category includes professional technical and managerial, clerical and sales, service, processing machinery trades, bench work, structural work miscellaneous

The project activity will lead to significant investment to a developing region which otherwise would not have happened in the absence of project activity.

Environmental well-being

The project utilizes solar and biomass energy for generating electricity which otherwise would have been generated through alternate fuels (most likely fossil fuel) based generator, contributing to reduction in associated specific emissions including GHG emissions.

Being a renewable resource, using solar and biomass energy to generate electricity contributes to resource conservation. Thus, the project causes no negative impact on the surrounding environment contributing to environmental well being.

Technological well-being

The project promotes new technology in the region in the form of solar power generation technology

Further Information

Not Applicable

2 SAFEGUARDS

2.1 No Net Harm

No negative impact of project activity.

2.2 Local Stakeholder Consultation

To be completed later.

2.3 Environmental Impact

The Environmental Impact Assessment was carried out for the 200 MW Kom Ombo Solar PV Project. ACWA Power commissioned 5 Capitals Environmental and management Consulting to prepare a preliminary Environmental Assessment. The summary of the findings of the report are the following.

Impact assessment methodology

The Kom Ombo Solar PV Project involve large-scale, short-term construction work on the entire site, involving a large number of workers and shipments/deliveries. During subsequent operations, comparatively few staff will be on site, mainly for control and maintenance work. The following assessment of impacts distinguishes between the construction phase and the operations phase. It covers impacts on

- land use, soil and groundwater;
- biodiversity
- noise and air quality;
- archaeological and cultural heritage;
- infrastructure and utilities;
- occupational health and safety;

- socioeconomic impacts
- community health, safety and security impacts
- land use, involuntary resettlement and economic displacement
- risk to existing infrastructure
- cultural resources impacts
- over consumption of community resources

Land use, soil and groundwater

It is understood that there are/have been no current or previous uses of the land. However, vehicle tracks have been observed across the Project site indicating its use overtime for access. A government owned weather station is located approximately 2km away from the Project site.

Soil and Groundwater

Impacts on soil and groundwater can occur during construction and operation if hazardous substances such as oils, paints, cleaning agents and other chemicals are spilt in larger quantities. It can easily be controlled by good working practices, worker and contractor training and supervision, and overall good site management practices.

Based on information provided in the ESIA report (August 2014), The project site is located within a desert plain area west of River Nile; the soil cover is mainly sandy-gravel.

During the 2016 geotechnical investigation, groundwater was not encountered in any of the boreholes at the time of investigation. However, it is anticipated that groundwater may exist at depth lower than 10m.

Biodiversity

The installation of solar PV panels elevated from the surface will also result large areas of shading in the project site footprint which may provide amenable conditions to certain flora and fauna species, particularly those that seek shade. Alternatively, the presence of shading is also not expected to limit the presence of sun seeking species, as there will also be non- shaded areas between the PV rows.

Migrating birds in proximity to the site are not expected to be impacted by the project directly, but may indirectly be attracted to the site under the influence of 'lake effect', a potential phenomenon whereby birds mistake the reflective surfaces of solar PV panels for the surface of water. Although lacking firm research, there is suggestion amongst the scientific community and avian protection bodies that 'lake effect' has the potential to injure birds of lead to their mortality where birds attempt to land on the PV panels. As such, there may be potential for such impacts to occur to birds attracted by 'lake effect'.

Archaeological and Cultural Heritage

The project site does not include any antiquity area, the nearest antiquity sites are the Bimban Village and the Kom Ombo Temple approximately 20km south east of the Project site.

Noise and air quality

The project site has very few noise influences, which are limited to vehicular noise from the Faris – Luxor Aswan Road adjacent to the northern border of the proposed project site.

It is understood that aircraft operating to and from Aswan Airport located approximately 70km from the Project site fly irregularly over the Project site. It is understood that at this distance aircraft tend to maintain a relatively high altitude with ground level noise being low, if discernible.

The project is not located in proximity to any vibration inducing activities/processes and as such existing vibration impacts at the project site are not expected.

Construction activities typically result in temporary and short duration increases in the noise and vibration levels of a site. Noise will be generated by construction and propagated to the surrounding environment via a range of processes. Pertinent construction activities in relation to noise and vibration are likely to include site preparation, earthworks, construction and installation, movement of vehicles, compaction works and piling.

Air quality

Construction Phase: During construction, local ambient air quality may potentially be affected by increased dust, particularly during the site preparation stage (site clearance, leveling of sand dunes areas and earthworks) and by the exhaust fumes of construction vehicles, equipment and temporary power generators. The typical air emissions resulting from these activities include: nitrogen oxides, sulphur dioxide, carbon monoxide, carbon dioxide, VOCs, particulates and BTEX.

Operations Phase: Once operational, there are no permanent fuel combustion requirements or any other associated air emissions directly from the Project. An emergency generator may be supplied to provide supply in case of a site connection issue or disconnection from the grid.

The facility will necessitate a minor vehicle usage of the access road to the site. However, impacts to receptors are not likely to be discernible.

Traffic and Transport

Transport to the Project site is understood to be via the 2-way dual carriageway approximately 2.7km to the southern boundary of the Project site. This road runs perpendicular to the Al Ramadi Kebii – Al Raqaba road & the Luxor-Aswan road and connects the village of Faris to the Luxor-Aswan road. It will also connect to the Project's external 4km access road for easy access to the site.

This road does not provide access to any residential area and is only anticipated to be used by some of the Faris village residents to connect to the Luxor-Aswan road.

Waste

The construction phase can often be the most environmentally damaging phase of a project, particularly in regard to the volumes of waste that are generated, if not properly managed. Such impacts relate to the management of such wastes, particularly hazardous streams.

Wastewater

The Project will require on-site sanitation facilities for the construction workers (expected to be toilets with collection septic tanks). These facilities will require regular emptying and removal from the Project site.

2.4 Public Comments

To be updated later

2.5 AFOLU-Specific Safeguards

Not Applicable

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

ACM0002 - Consolidated methodology for grid-connected electricity generation from renewable sources (version – 19, EB 89)

The methodology refers to ACM0002 to the latest approved version of following tools-

“Tool for the demonstration and assessment of additionality” version 07

“Tool to calculate the emission factor for an electricity system” version 07

3.2 Applicability of Methodology

The project activity is a solar power project of total installed capacity of 200 MW hence “Consolidated baseline methodology for grid connected electricity generation from renewable sources” ACM0002 is applicable for this project. The project activity is a installation of a new power plant at ta site where no renewable power plant was operated prior to the implementation of the project activity. (Greenfield Power Plant)

The methodology is applicable under the following conditions

This methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Install a Greenfield power plant; (a) Involve a capacity addition to (an) existing plant(s); (b) Involve a retrofit of (an) existing operating plants/units; (c) Involve a rehabilitation of (an) existing	The project activity is a greenfield solar: photovoltaic power plant. The produced renewable energy will feed into the national grid.

plant(s)/unit(s); or (d) Involve a replacement of (an) existing plant(s)/unit(s).	
The methodology is applicable under the following conditions: (a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; (b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	The option (a) of the applicability criteria is applicable as project is renewable energy solar power plant/unit.
In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m2; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as	The project activity is new installation of solar power plant hence, this condition is not applicable.

per equation (4), is greater than 4 W/m2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	
In the case of integrated hydro power projects, project proponent shall: a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	The project activity is new installation of solar power plant hence, this condition is not applicable.
The methodology is not applicable to: (a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; (b) Biomass fired power plants/units.	The project activity is new installation of solar power plant hence, this condition is not applicable.
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the	The project activity is new installation of solar power plant hence, this condition is not

identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	applicable.
In addition, the applicability conditions included in the tools referred to below apply	Please refer below table

"Tool to calculate the emission factor for an electricity system" Annex 4, EB 100 (Version 7.0)

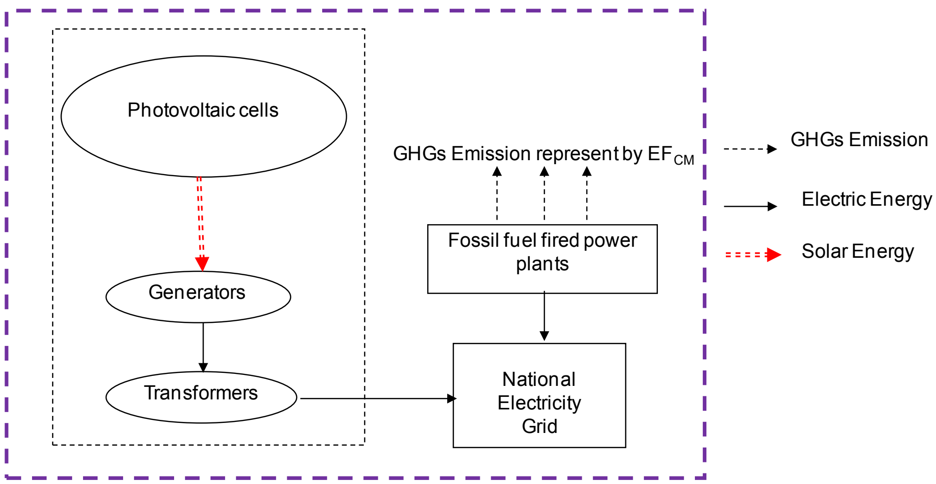
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	The project is a grid connected Greenfield solar power project and thus the tool is applicable.
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	Steps involved in calculation of Emission Factor is included in section 3.1 of the VCS PD as per the requirement of the tool
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	Project is located in non-Annex I country and hence the tool is applicable
Under this tool, the value applied to the CO2 emission factor of biofuels is zero.	The project is a solar Power Project and there is no involvement of biofuels.

3.3 Project Boundary

According to version 19.0 of the methodology ACM0002, the spatial extent of the project boundary includes the project power plant/unit and all power plants/units connected physically to the electricity system that the CDM project power plant is connected to.

For a typical project activity, the national/sub national grid in the corresponding host country will be the project boundary.

The flow diagram of a typical project is illustrated in the following picture.



Project boundary of a typical Solar PV Project

Source		Gas	Included?	Justification/Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO2	Included	Main emission source
		CH4	Excluded	Excluded for simplification. This is conservative
		N2O	Excluded	Excluded for simplification. This is conservative
		Other	Excluded	Not required for the project
Project	CO2 emissions from	CO2	Excluded	Not required for the project
		CH4	Excluded	Not required for the project

Source		Gas	Included?	Justification/Explanation
	combustion of fossil fuels for electricity generation	N2O	Excluded	Not required for the project
		Other	Excluded	Not required for the project

3.4 Baseline Scenario

According to the ACM0002 Large Scale Consolidated Methodology:

"If the project activity is the installation of a Greenfield power plant. The baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in "TOOL07: Tool to calculate the emission factor for an electricity system." [1]

Project activity is the generation of electricity from renewable energy sources. The power generated from the solar PV plant has zero emissions; there is no material leakage and the electricity generated will be fed into the fossil intensive national grid through the interconnection facility at the site.

The electricity consumption of Egypt rapidly increased in the last years. The government intensively support the development of new power plants in the country. The fuel of the newly installed plants is mainly natural gas, which helps the utilisation of the recently explored natural gas fields close to the Egyptian coast. The new developments apply state of the art CCGT technology that has a positive impact on the GHG emission of the country.

The country has substantial renewable capacity in the form of hydro, wind and solar. In the framework of the Egyptian strategic planning of power supply, the Electricity Sector's strategy depends on the diversification of diverse sources and expansion of utilisation of renewable energies and rationalisation of the use of conventional energy sources.

Until now the hydropower generation gave the significant portion of the renewable power generation capacity. The most important source is the High Dam, and Aswan Dam I. built in the 1960s. The share of the hydro-based generated electricity is around 6 per cent.

Egypt is supplied with rich wind energy sources especially in the Suez Gulf and the Red Sea area which is considered one of the best sites in the world due to its high and stable wind speeds. These areas are considered one of the most promising sites for construction of large wind farm projects due to the high wind speeds ranging between 8-10 meters/second and also

[1] https://cdm.unfccc.int/filestorage/5/8/I/58IAGB7SZUDEO2VN6LYM30K41HFPRQ/EB100_repan06_ACM0002.pdf?t=NDl8cHZtMXl5fDB7M0sdI0a9G7aW6DUgf8TO , page 10.

due to the availability of sizeable uninhabited desert areas which are perfectly qualified to assimilate the future wind projects. [2]

In the 2010s started the Zafarana wind project on the coastline of the Red Sea, but the couple realised parks have a limited share in the total generated electricity.

According to the TOOL05[3], the project will replace the weighted average of the ratio of emissions in the system represented by:

- The Operation Margin (OM) - the ratio of emissions from the generation of all power generating projects in the defined system over the latest three year period excluding least cost/must run projects; and
- The Build Margin (BM) – the ratio of emissions attributable to the higher of (i) generation (MWh) from five most recent power projects built or (ii) generation (MWh) of the most recently built power plants equating to 20% of the most current annual system generation.

Accordingly, it is proposed to present in this project design document the measurement of emissions observed when comparing the "business as usual" case (without the project activity) with emissions under the project (the "project scenario" case).

The baseline emission factor (EFy) represents a conservative estimate of emissions per MWh of grid generation, and the emissions avoided per MWh of the project generation. All calculation are based on official data available in the public domain in the "Annual Report" published annually by the Egyptian Electricity Holding Company.

The project boundary does not include the LCMR power plant and the import capacity accordingly of the TOOL07[4]. The National Grid has interconnection to the following National Grids according to 2017 data[5]:

- Egypt / Libya (Sold electricity – 107.6 GWh / Imported electricity 0.096 GWh)
- Egypt / Jordan (Sold electricity – 228.8 GWh / Imported electricity 65.3 GWh)

3.5 Additionality

According to section 5.3.1 of ACM0002_v19.0, solar photovoltaic technologies are in the positive list for grid connected electricity generation technologies.

Moreover, it states that: A specific technology in the positive list is defined as automatically additional if at the time of PDD submission, any of the following conditions is met[6]:

[2] http://www.moee.gov.eg/english_new/EEHC_Rep/2016-2017en.pdf page 51.

[3] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[5] http://www.moee.gov.eg/english_new/EEHC_Rep/2016-2017en.pdf page 47.

a) The percentage share of total installed capacity of the specific technology in the total installed grid connected power generation capacity in the host country is equal to or less than two per cent; or
b) The total installed capacity of the technology in the host country is less than or equal to 50MW.

The realisation of the project is part of a longer strategy of the Egyptian government. Accordingly, it will be increased the Solar PV electricity generation capacity significantly in the country. Egypt is one of the lands lying in the solar belt region the most convenient for solar energy applications. Solar Atlas reveals that the average of vertical solar radiation is between 2000 - 3200 KWh/m2 /year and the rate of solar rise ranges between 9 -11 hours/day offering opportunities of investment in the many solar energy fields. The New & Renewable Energy strategy aims to increase the share of generated energy from renewable energy to 20% out of the total produced energy in Egypt by 2022, out of which 6% from hydropower, 12% from wind energy and 2% from other renewable energy sources (especially the solar power).

Currently one solar PV plant feed in renewable energy to the National Grid of Egypt, this plant is a 140 MW thermal/solar plant. The development was supported by the non-refundable grant of the United States. The plant has 200 MW solar PV capacity.[7]

The proposed project will be one of the first constructed projects in the Aswan area, where the EETC started a massive solar PV development with 30 international and local developers with the total capacity of 1 450 MW. At the submission of the project design document, over the proposed project, six other projects with a full size of 280 MW is close to the commercial operation. Because of the conservative approach of the additionality test, we calculated with these six projects as already existing solar PV plants. These projects with the 20 MW former connected solar PV plant makes a total of 300 MW installed capacity. The entirety installed capacity of the Egyptian National Grid is 45 008 MW [8], so the installed solar PV capacity is 0.66 per cent of the grid-connected capacity. Therefore, the proposed project activity fulfils the criteria a.) of the positive list, so it is automatically additional. The Tool for the Demonstration & Assessment of Additionality will not be used here.

3.6 Methodology Deviations

Not Applicable

[6]https://cdm.unfccc.int/filestorage/5/8/I/58IAGB7SZUDEO2VN6LYM30K41HFPRQ/EB100_repan06_ACM0002.pdf?t=NDl8cHZtMXl5fDB7M0sdI0a9G7aW6DUgf8TO page 12.

[7] http://www.moee.gov.eg/english_new/EEHC_Rep/2016-2017en.pdf page 53.

[8] http://www.moee.gov.eg/english_new/EEHC_Rep/2016-2017en.pdf page 23.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

According to the latest version of the methodology, ACM0002 Large Scale Consolidated Methodology: Grid-connected Electricity Generation from Renewable Sources, Version 19.0, since the project activity is the installation of Greenfield Renewable Energy Power Plant, the baseline scenario is as follows:

If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources. As reflected in the combined margin (CM) calculations described in TOOL07: Tool to calculate the emission factor for an electricity system.

According to the ACM0002, Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel-fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above the baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants.

The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$

Where:

BE_y = Baseline emissions in year y (t CO_2 / yr)

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y(MWh/yr)

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of “TOOL07: Tool to calculate the emission factor for an electricity system” (t CO_2 / MWh)

Calculation of $EG_{PJ,y}$

In case of Greenfield power plant development, the calculation of the electricity system's combined margin (CM) shall be based on the following equation, according to the methodology:

$$EG_{PJ,y} = EG_{facility,y}$$

Where:

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

Calculation of $EF_{grid,CM,y}$

The ACM0002 defines the Methodological tool to calculate the $EF_{grid,CM,y}$ in case of adding renewable capacity to a National Grid:

TOOL07: Tool to calculate the emission factor for an electricity system (Version 7.0)

The Methodological tool stipulates 6 steps procedure for the calculation:

1. Step 1: Identify the relevant electricity system;
2. Step 2: Choose whether to include off-gird power plant in the project electricity system;
3. Step 3: Select a method to determine the operation margin (OM);
4. Step 4: Calculate the operating margin emission factor according to the selected method;
5. Step 5: Calculate the build margin (BM) emission factor;
6. Step 6: Calculate the combined margin (CM) emission factor.

Step 1: Identify the relevant electricity system

The project participant shall identify the **project electricity system** and **the connected electricity systems.** The Tool set 3 options how to determine the project electricity system:

Option 1: A delineation of the project electricity system and connected electricity systems published by the DNA – **NOT APPLICABLE**

Option 2: A delineation of the project electricity system defined by the dispatch area of the dispatch centre responsible for scheduling and dispatching electricity – **APPLICABLE**

Option 3: A delineation of the project electricity system defined by more than one independent dispatch areas, e.g. multi-national power pools. – **NOT APPLICABLE**

For the proposed project activity, the relevant electricity system is the National Grid of the Arab

Republic of Egypt, through which the electricity generated by the Solar PV power plant will be sold for the final customers. The EETC (Egyptian Electricity Transmission Company) built 22/220 kV substation to feed in the generated electricity to the national grid.

The connected electricity systems are not Annex I country's grids; therefore the related rule is not applicable for the proposed project.

Both interconnections have a net export figure from Egypt point of view; therefore the interconnections shall not take into account during the grid emission factor calculation.

Step 2: Choose whether to include off-gird power plant in the project electricity system

According to the tool, project participants may choose between including only grid power plants or both grid and off-grid power plants to calculate the operating margin and build margin emission factor. For this project, option I. is selected, that is, only grid-connected power plants will be considered for calculation of OM and BM emission factor.

Step 3: Select a method to determine the operation margin (OM)

According to the tool, the calculation of the operating margin emission factor ($EF_{grid,OM,y}$) can be based on one of the following four methods:

a) Simple OM

b) Simple Adjusted OM

c) Dispatch Data Analysis OM

d) Average OM

After the definition the low-cost, must run (LCMR) resources in the National Grid, that is less than 50% per cent and review of the available fuel consumption data power plant by power plant, the option (b) cannot be selected because LCMR resources less than 50 % in the last 5 years, the data are not available for the option (c) and (d), therefore the proposed project operation margin (OM) calculation method is the option (a) Simple OM.

Low-cost, must-run resources connected to the National Grid of Egypt

According to the Methodological tool TOOL07 version 07:

LCMR resources are power plants with low marginal generation costs or dispatched independently of the daily or seasonal load of the grid. They include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If a fossil fuel plant is dispatched independently of the daily or seasonal load of the grid and if this can be demonstrated based on the publicly available data, it should be considered as a low-cost/must-run. Electricity imports shall be treated as one LCMR power plant;

According the paragraph 40., The simple OM method can only be used if any one of the following requirements is satisfied:

(a) Low-cost/must-run resources constitute less than 50 per cent of total grid generation (excluding electricity generated by off-grid power plants) in: 1) average of the five most recent years, and the average of the five most recent years shall be determined by using one of the approaches described below; or 2) based on long-term averages for hydroelectricity production (minimum time frame of 15 years).

(b) The average amount of load (MW) supplied by low-cost/must-run resources in grid in the most recent three year is less than the average of the lowest annual system loads (LASL) in the grid of the same three years.

For the proposed project activity, the developer has chosen to prove the existence of requirement (a). The low cost must run resources constitute less than 50 per cent of the total grid generation. The proposed project use the Option (1) where is must be demonstrated with the data of the average of the five most recent years.

Parameter	Units	2017-18	2016-17	2015-16	2014-15	2013-14	Average
Must-run generation (Hydro)	**GWh**	12,726	12,850	13,545	13,822	13,352	**13,259**
Must-run generation (Wind)	**GWh**	2,334	2,200	2,058	1,444	1,332	**1,874**
Must-run generation (Solar)	**GWh**	537	580	168	0	114	**280**
Total Generation	**GWh**	1,96,760	1,89,550	1,86,320	1,74,875	1,68,050	**1,83,111**
Must-run Generation / Total Generation	**%**	7.93	8.25	8.46	8.73	8.81	8.42

Average of the recent five year must run is 8.43%. Hence option ‘a’ is applicable.

Step 4: Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (t CO_2 /MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated by one of the following two options:

(a) Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or

(b) Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

The Option A has been used by the proposed project activity, because the required data are available regarding the National Grid of Egypt.

Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OMsimple,y} = \sum_m EG_{m,y} \times EF_{EL,m,y} / \sum_m EG_{m,y}$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (t CO_2 /MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (t CO_2/MWh)
m	=	All power units serving the grid in year y except low-cost/must-run power units
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EF_{EL,m,y}$

The emission factor of each power unit m should be determined as follows:

(a) Option A1 - If for a power unit m data on fuel consumption and electricity generation is available;

(b) Option A2 - If for a power unit m only data on electricity generation and the fuel types used is available.

By the proposed project activity (a) the Option A1 has been used, because the required data are available.

The emission factor ($EF_{EL,m,y}$) has been determined as follows:

$$EF_{EL,m,y} = \sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y} \; / \; EG_{m,y}$$

Where:

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (t CO_2/MWh)

$FC_{i,m,y}$ = Amount of fuel type i consumed by power unit m in year y (Mass or volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fuel type i in year y (GJ/mass or volume unit)

$EF_{CO2,i,y}$ = CO_2 emission factor of fuel type i in year y (t CO_2 /GJ)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

m = All power units serving the grid in year y except low cost/must-run power units

i = All fuel types combusted in power unit m in year y

Where several fuel types are used in the power unit, use the fuel type with the lowest CO_2 emission factor for $EF_{CO2,m,i,y}$. The calculated Operating Margin is **0.5699 t CO_2/MWh**.

Step 5: Calculate the build margin (BM) emission factor

In terms of vintage of data, project participants can choose between one of the following two options:

(a) Option 1 - For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period;

(b) Option 2 - For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The proposed project activity has been used (a) the Option 1.

The sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently (SET 5 units) and determine their annual electricity generation (AEG SET-5-units , in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG total , in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20 per cent of AEG total (if 20 per cent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) (SET ≥ 20 per cent) and determine their annual electricity generation (AEG SET ≥20 per cent , in MWh)

(c) From SET 5-units and SET ≥ 20 per cent select the set of power units that comprises the higher annual electricity generation (SET sample);

Identify the date when the power units in SET sample started to supply electricity to the grid. If none of the power units in SET sample started to supply electricity to the grid more than 10 years ago, then use SET sample to calculate the build margin. In this case ignore Steps (d), (e) and (f).

After the identification of the power units in the step (a) and step (b) it has been stated, the identified power plant in both steps started supply electricity to the grid less than 10 year. Therefore the steps (d), (e) and (f) has been ignored by the calculation of the Build Margin (BM).

Step (a): The set of five power plants that started to supply electricity to the grid most recently, excluding projects registered as CDM, as per the available data for electricity generation are as follows:

#	Station	Installed capacity (MW)	Year of Commission	Power Plant Type	(Predominant) Fuel Type	Fuel Consumption 2010-11	Electricity Generation 2017-18 (Net)

						ktoe/year	GWh
1	Burulls	4,800	2017-18	Gas	NG	1,175.60	5,278.20
2	Beni Suef	4,800	2017-18	Gas	NG	2,370.90	11,399.90
3	New Capital	4,800	2017-18	Gas	NG	776.30	3,244.60
4	Benban	50	2018	Solar	Solar	0.00	53.00
5	Assult	32	2018	Hydro	Hydro	0.00	32.00

$AEG_{SET\text{-}5\text{-}units}$ = 20008 MWh

Step (b): The annual generation of electricity (AEG_{total}) for the year 2017-18 in MWh, excluding projects registered as CDM, is as follows:

AEG_{total} = 196,760 MWh

The set of power plants that started supplying electricity to the grid most recently, excluding projects registered as CDM, and for which data of electricity generation is available, and which constitute 20% or more of the total electricity generation for the year is as follows:

			PP Name	Produced electricity (GWh)	Fuel Consumption (kTOe)
2017	2400 MW	N.G. - L.F.O	Burulls	5278.2	1175.6
2017	2400 MW	N.G. - L.F.O	Beni Suef	11399.9	2370.9
2017	800 MW	N.G. - L.F.O	New Capital	3244.6	776.3
2017	650 MW	N.G. - L.F.O	Thermal Suez	2722.3	613.4
2017	288 MW	N.G. - L.F.O	El-Huraghada Ext	697.4	173.5
2017	84 MW	L.F.O.	Port Said Ext	88.7	21.6

2015	50 MW	L.F.O.	Hellopolis	5.2	1.5
2015	50 MW	L.F.O.	East Cairo	12.1	3.4
2016	500 MW	N.G.	West Damietta Ext.	772	219.9
2016	336 MW	N.G. - L.F.O	New Mahmoudia	23	6.8
2016	1000 MW	H.F.O - L.F.O.	West Assiut	2572.1	725.3
2015	50 MW	L.F.O.	El-Basateen	8.2	2.5
2015	1300 MW	N.G. - H.F.O	Ain Sokna	5151.1	1114.6
2016	288 MW	N.G. - L.F.O	Sharm El Sheikh Ext.	85.8	22
2014-2016	1200 MW	N.G. - L.F.O	6 October	2342.8	662.2
2014-2016	2250 MW	N.G. - L.F.O	North Giza	11224.4	1867
2018	32 MW	Hydro	Assult	32	0
2014-2015	750 MW	N.G. - L.F.O	Banha	4705.3	796.8
2015	640 MW	N.G. - L.F.O	Ataqa Ext.	337.4	88.6
2015	50 MW	H.F.O - L.F.O.	New Assiut	22.6	6.3
			SET 20 total	**50725.1**	**10648.2**

$AEG_{SET \geq 20\%}$ = 39,352 MWh

Step (c): Since SET ≥20% comprises of the larger amount of annual electricity generation, so it has been selected as the SET_{sample}. The oldest electricity unit in this sample started commissioning in 2015. Since the year 2018 is being used as the data vintage point, no plant in the set started supplying electricity to the grid more than 10 years ago and this set has been taken as the SET sample for the calculation of the Build Margin (BM) emission factor.

The build margin has been calculated using this set as per the data available in EEHC Annual Report 2017 / 2018.

The build margin emissions factor is the generation-weighted average emission factor (t CO_2 /MWh) of all power units m during the most recent year y for which electricity generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \sum_m EG_{m,y} \times EF_{EL,m,y} \; / \; \sum_m EG_{m,y}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (t CO_2 /MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (t CO_2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which electricity generation data is available

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the guidance in Step 4 section 6.4.1 for the simple OM, using Options A1, A2 or A3, using for y the most recent historical year for which electricity generation data is available, and using for m the power units included in the build margin. The calculated Build Margin is **0.4772 t CO_2/MWh**.

Step 6: Calculate the combined margin (CM) emission factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

For the proposed project activity, (a) Weighted average CM has been chosen, because the required data are available for the calculation.

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (t CO_2 /MWh)

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (t CO2/MWh)

w_{OM} = Weighting of operating margin emissions factor (per cent)

w_{BM} = Weighting of build margin emissions factor (per cent)

The following default values should be used for w OM and w BM:

(a) Wind and solar power generation project activities: w OM = 0.75 and w BM = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods. The calculated Combined Margin is **0.5467 t CO_2/MWh**.

4.2 Project Emissions

The project activity involves renewable power generation, hence PEy = 0

4.3 Leakage

No leakage emissions are considered. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected.

4.4 Net GHG Emission Reductions and Removals

Baseline emission

The Baseline emission is calculated as follows:

$$BE_y = EG_{pj,y} * EF_{grid,CM,y}$$

Where:

BE_y = Baseline emissions in year y (t CO_2 /year)

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh)

The grid emission factor is calculated above

$$EF_{grid,CM,y} = 0.5467 \text{ t } CO_2/\text{MWh}$$

The quantity of net electricity supplied to the grid is estimated by the feasibility study:

$EG_{PJ,y}$ = 630,000 MWh[9]

The calculation of the baseline emission of the proposed project activity is the following:

$$BE_y = 630{,}000 \text{ MWh} * 0.5467 \text{ t } CO_2/\text{MWh} = 344{,}422 \text{ t } CO_2$$

Leakage

Leakage emissions are not considered.

Emission reduction

The calculation of the emission reduction based on the following equation:

$$ER_y = BE_y – PE_y$$

$$ER_y = 344{,}422 \text{ t } CO_2 – 0 \text{ t } CO_2 = 344{,}422 \text{ t } CO_2$$

[9] CHINT: PV Syst Simulation (CH-TK-ASM-EL-05-02PV Syst Simulation.pdf) p.4.

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
2021	344422	0	0	344422
2022	344422	0	0	344422
2023	344422	0	0	344422
2024	344422	0	0	344422
2025	344422	0	0	344422
2026	344422	0	0	344422
2027	344422	0	0	344422
2028	344422	0	0	344422
2029	344422	0	0	344422
2030	344422	0	0	344422
Total	**3444220**	**0**	**0**	**3444220**

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid, CM, y}$
Data unit	t CO2 / MWh
Description	Emission factor of the Nation Grid of Egypt
Source of data	MOEE Annual Reports (2014/2015; 2015/2016; 2016/2017 & 2017/18)
Value applied	0.5467
Justification of choice of data or description of measurement methods and	Calculated using “Methodological Tool: Tool to calculate the emission factor for an electricity system, Version 07.0”.

procedures applied	
Purpose of Data	Calculation of Baseline Emissions
Comments	-

Data / Parameter	$EF_{grid,OM,y}$
Data unit	t CO2 / MWh
Description	Emission factor of the Nation Grid of Egypt
Source of data	MOEE Annual Reports (2014/2015; 2015/2016; 2016/2017 & 2017/18)
Value applied	0.5699
Justification of choice of data or description of measurement methods and procedures applied	Calculated using “Methodological Tool: Tool to calculate the emission factor for an electricity system, Version 07.0”.
Purpose of Data	Calculation of Baseline Emissions
Comments	-

Data / Parameter	$EF_{grid,BM,y}$
Data unit	t CO2 / MWh
Description	Emission factor of the Nation Grid of Egypt
Source of data	MOEE Annual Reports (2014/2015; 2015/2016; 2016/2017 & 2017/18)
Value applied	0.4772
Justification of choice of data or description of measurement methods and procedures applied	Calculated using “Methodological Tool: Tool to calculate the emission factor for an electricity system, Version 07.0”.
Purpose of Data	Calculation of Baseline Emissions

Comments	-

5.2 Data and Parameters Monitored

Data / Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Direct measurement of electricity supplied to the grid according to the Network Connection Agreement
Description of measurement methods and procedures to be applied	Monitoring: Tri-vector meter will be used for monitoring Data Type: Measured & signed Jointly by State utility officials & PPs representative. Frequency: Hourly measured Recording: Monthly from Main meter at state utility substation Archiving Policy: Paper & Electronic Responsibility: Project Head would be responsible for regular calibration of the meter. Calibration Frequency: 1 years
Frequency of monitoring/recording	Continuous monitoring and monthly recording
Value applied	630,000
Monitoring equipment	Energy Meter
QA/QC procedures to be applied	The project electricity generation is based on the net units displaced as measured by main metering system installed at the interconnection point (substation point) and losses are calculated for respective states whichever is applicable. The net electricity exported to the grid is cross checked electricity sales receipt (Invoice).
Purpose of data	Calculation of baseline emissions
Calculation method	Taken from credit report
Comments	Data will be archived for the entire crediting period + 2 years

5.3 Monitoring Plan

The power connection diagram of the project is the following. The Energy Meters in the plant complied with the Grid Code requirement, the Plant Management covenants to operate, maintenance and repair of the facility is undertaken in a manner consistent with the Grid Code, the conditions given in the Power Purchase Agreement (PPA)

There are three measurement points installed in outgoing CB to the Grid to calculate the Site Energy Export and Energy Import. In each measuring points, there is a primary and backup meter to calculate the Plant Energy Export and Plant Energy Import.

Description of the measurement points

The project electricity generation meters will be placed in the interconnection facility (switching station) of the PV plan. For each outgoing feeder switchgear there will be one primary and backup meter. The facility will be equipped with three outgoing feeder.

Electricity meter selection and installation

The three-phase multi-function energy meter is designed based on the IEC62053-21/22 and IEC62056-21. The meters have an accuracy class of 0.2 in active energy and 0.2 in reactive energy. The meters are equipped with LCD display and have RS 485 communication interface. CT's and VT's have a rated voltage of up to 24 kV. CT's have an accuracy class of 0.2 and VT's have an accuracy class of 0.2.

The main and backup meters will meet the following requirements:

- The meters will measure, record and locally display at least kW, kWh, kVAR, kVARh and cumulative demand, with cumulative demand, with the additional features such as time of use, maintenance records, power quality monitoring and pulse output. The pulse output for remote metering must be for all the major measurement feature.
- Non-volatile memory storage for program and registers data.
- Communication interface for meter programming via PC.
- Security codes and switches to prevent unauthorized reset or reprogramming,
- The ability to reset the meter registers with high security level by software only.
- All functions are fully programmed from the software.
- The ability of partial programming without resetting registers.
- Communication interface with Market Operator communication system and Transmission System Operator SCADA system.

Subject to the requirements of this Code being met, the Transmission System Operator's operational metering system can use all or part of the revenue metering system if it has the necessary operational features.

Data measurement

The Site Meter shall maintain hourly basis reading in accordance with the specification for those meters in the Design and Technical Specifications.

The Transmission System Operator will be responsible for the validation and metering data, collected by the SCADA System.

Backup metering data will be used to validate metering data, because the meters will meet the accuracy criteria stipulated by the Grid Code.

Electricity meter quality control

The energy meters calibration shall be carried out at least once per year in perusal to Clause 8.2. of the Network Connection Agreement to ensure that the meters accuracy are within the value given in schedule 6 of the foresaid Agreement.

> 8.2. Meter testing and calibration
>
> (a) The Power producer must test and seal the Site Meters at least once a Year and it shall be replaced them if they are found to be outside the acceptable accuracy stipulated in Schedule 5.

Both the Project Developer and the Transmission System Operator will take all reasonable steps to prevent unauthorised access to the equipment. All metering equipment cubicles will be securely locked and sealed provided any register of equipment is visible and accessible.

Both the Project Developer and the Transmission System Operator will install its seal on all revenue metering cubicles to prevent unauthorised access to and corruption of, data transmitted to the Market Operator. If either the Project Developer or the Transmission System Operator wishes to access the meters, it shall expect in the event of repair of a fault, give the other Party at least 5 Working days' notice. The other Party obliged to attend the repair and to remove its seal.

Roles and responsibilities

Plant General Manager (PGM)

Responsible for overall environmental performance of the O&M team, subcontractor and other third party service provider. He will be responsible for the supervision of the proper operation of the monitoring system described in this documentation, with special emphasis of data management and Q/A.

SCADA Operator

Monitor the compliance of Environmental aspects, Maintains a register of complaints of the environmental requirement, reports all incidents and non-compliance to PGM; Notifies the PGM of any changes on the program or methods which may affect the environmental mitigation measures and ability to comply with the environmental regulations; Maintains a register of incidents and waste management for future audits.

Maintenance Technician

He understands the CDM monitoring procedures, in case of an accident, fault or non-compliance, he reports that to the PGM immediately.

Equipment software

SCADA control system

MS office software

Fault detection

The rules of the fault detection procedures are based on the signed Grid Code. The 8.2.3. of the Grid Code stipulates the metering responsibilities as follows:

> 8.2.3. Metering Responsibility
>
> The User shall supply, install, connect, test, adjust, place in service, operate and check the main and the backup meters as well as the remaining metering equipment as mentioned above, unless otherwise specified in the Connection Agreement. The User will provide proofs of calibration and the certificates to the Transmission System Operator. The Transmission System Operator shall witness the commissioning tests

The Transmission System Operator shall own the main revenue meters, and the User shall own the back-up revenue meters.

Following commissioning, both the User and the Transmission System Operator shall install seals to prevent unauthorised alteration of site settings and calibrations. The meters owner shall ensure that installation, commissioning, maintenance, auditing and testing for the metering system are done following the appropriate IEC standards or manufacturer's recommendations. The Project developer shall be responsible for the communication facilities from the Meters to the data collection and storage system, while the Transmission System Operator shall be responsible for the communication facilities from the Meters to the SCADA system.

The Project Developer and Transmission System Operator shall test their meters at least once a year and recalibrate or replace such meters If found to be outside the accuracy stipulated in the Grid Code, and if the deviation of reading between primary and backup meters exceeds 0.4.

The Project Developer and the Transmission System Operator may request a test of the installed metering equipment if they have reason to believe that the performance of the equipment is not within the accuracy limits set out by the Grid Code.

If the Project Developer and the Transmission System Operator identifies a fault in the Metering System, they shall immediately inform the other Party. The meter owner shall then repair the metering system as soon as practical. The other Party shall be informed when the repair is to undertake and shall be obliged to attend.

Data collection and archiving

The Meters shall separately record the input and Active and Reactive Energy. The output from three meters may be combined into one integrating Recorder. The output that needs to be integrated into the recorder is, Active Demand incoming and outgoing in the Transmission System and Reactive Demand incoming and outgoing in the Transmission System. The meter will be capable of integrating this date over a period of 15, 30 and 60 min. The integration time is set according to the Market Rules. The meter will transmit this integrated data to the Market Operator, and will locally store the data for at least 60 days. The recorder will be capable of operating without an auxiliary supply for 48 hours.