European Union / Instrument For Pre-Acession Asistance (IPA) Energy Sector Technical Asistance Project

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MENR IPA12/CS02

Project Selection Criteria and Implementation Procedure Report

13 April 2017

T.C. ENERJİ VE TABİİ KAYNAKLAR BAKANLIĞI

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Summary

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Employer:	General Directorate of Foreign Relations and EU of the Ministry of Energy and Natural Resources
Observer:	EUD (European Union Delegation)
Lead Terna Plus Srl:	
Name:	Terna Plus Srl
Address:	Viale Edigio Galbani, 70 – 00156 Rome, Italy
Tel. number:	+39 06 83 138 340
Contact person:	Antonio Moretti
JV:	
Name:	MWH (Montgomery Watson Harza)-Gazel Enerji Yatırımları Taahhüt A.S
Address:	Salih Omurtak Sok. No: 61 Koşuyolu, Kadıköy / İstanbul
Tel. number:	+90 216 545 32 28
Contact person:	Dr. Murat Sarıoğlu
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Acronyms

EPC	Engineering Procurement Construction
FI	Financial Institutions
MENR	The Ministry of Energy and Natural Resources
NGO	Non-Governmental Organization
PC	Project Consultant
PV	Photovoltaic
SME	Small-Medium Enterprise
TOR	Terms of Reference
WB	The World Bank

Executive Summary

This project is executed by the Ministry of Energy and Natural Resources (MENR) and administered by the World Bank (WB). WB signed an administrative agreement between the European Commission (EC) and a grant agreement between MENR in order to finance the implementation of the project.

This report explains the background of the project selection criteria and the details of the implementation procedure. The primary aim is to promote the renewable energy sector in Turkey in line with European Union energy strategies. In this scope, a comprehensive plan will be established in order to ensure larger integration of renewable electricity to the system together with the elimination of identified barriers.

The target sector under the study are small and medium-sized industries (that is, an enterprise that has less than 40 million Turkish Lira in sales and employs less than 250 employees) that are composed of small-scale renewable energy investors such as building and house owners, municipality companies/affiliates/facilities, irrigation unions, and cooperatives such as agriculture, fishing, etc. so long as they meet the criteria of being a small and medium enterprise.

Project assessment reports that will be prepared is aimed at supporting the financing opportunities of small scale renewable energy projects which are also supported in Turkish regulations as can be seen on amendments made in regulation on Unlicensed Electricity Generation on March 2016. These reports will make the process from both investors and financers' point of view easier. Under this scope, 186 project assessment reports will be prepared by PC. Since, there will be numerous renewable projects to assess, in order to maximize the benefit of the project, these project assessment reports will be written for bankable renewable energy projects and to ensure the most efficient use of the fund.

A project methodology was established based on the extensive experience of PC in this sector. PC will separate renewable energy projects into three sub-categories based on their investment costs: Mini (≤ $50,000), Normal ($50,000 – $300,000), and Complex (≥ $300,000). In general, the scope of these reports will be the analysis of the projects in terms of technical, financial, environmental, and social aspects. For complex projects, if the capacity is greater than 1 MW, wind and solar energy licensing procedures will be considered in implementation process. The pre-license applications for wind and solar are taken after the capacities are declared by TEIAS. Furthermore, project regions, which are determined in their licences, will also be analysed carefully, so that the projects are realised for these regions. Moreover, PC will also look at the auction procedures which the projects experienced. The depth of the analysis will differ based on the classification of the project by PC.

The methodology contains six phases:

1. Project origination
2. Pre-screening
3. Energy assessment
4. Assessment report preparation

5. Project financing
6. Project implementation

PC is confident that, through the methodology and project selection & implementation procedure explained in this report, CS02 project will be a success and have lasting positive effects on renewable energy sector for SMEs and Turkey.

1 Objective of the Task

The objective of the task is to establish project selection criteria by determining key performance indicators for each technology, along with other important specifications. This is crucial for the success of the project since the identified projects will be assessed based on these criteria. Another importance is selecting projects which have the highest possibility of reaching the implementation phase in order to develop the renewable energy sector for SMEs and to ensure efficient use of World Bank funds. In addition, the other objective of the task is to establish an implementation procedure to successfully carry out the process starting from project origination to implementation. PC will also monitor regulations and possible amendments in order to increase the realization rate of the projects.

2 Project Selection Criteria

The scope of this technical consultancy project covers provision of business development services to small and medium-sized industries (that is, an enterprise that has less than 40 million Turkish Lira in sales and employs less than 250 employees), including preparation of feasibility studies and business plans.

These enterprises are composed of small-scale renewable energy investors such as building and house owners, municipality companies/affiliates/facilities, irrigation unions, and cooperatives such as agriculture, fishing, etc. so long as they meet the criteria of being a small and medium enterprise[1].

Based on the investment cost, three types of project assessment reports will be written. These are classified as Mini, Normal and Complex assessment reports. As a result, the assessment of some applicable renewable energy technologies are limited. For example; concentrated solar, geothermal and large hydropower technologies will be possibly not included under the project scope since they often have high investment costs. The target is small-scale renewable energy projects such as rooftop PV, small biomass biogas plants, micro wind and micro hydro for electric power generation. In addition, some renewable heating and cooling technologies are also suitable under the project scope.

PC established a set of eligibility criteria for each relevant technology based on some important considerations. The approach for the definition of these criteria took into account the following:

1) Energy production performance of the equipment/systems available in the local market

2) Energy production performance of the equipment/systems and systems representing Best Available Technologies (BAT)

3) Average energy production performance of the equipment or capacity factor of the system in the existing reference stock

4) Performance requirements set by national standards and regulations

However, these established criteria for each relevant technology must be updated in time and more stringed eligibility criteria needs to be established in the future since the market is consistently improving. In addition, more efficient equipment is evolving and new national and international standards might be applied. These aspects must be considered to guarantee satisfying performance of the technologies.

[1] An enterprise that has less than 40 million Turkish Lira in sales and employs less than 250 employees.

The reference baseline for a specific technology is defined as the energy performance (energy production per investment cost) benchmark reflecting the common practice in the given country and/or the national regulations, whichever is higher. Where national regulations are not specific enough on requirements at the technology level, simple energy production calculation approach which is commonly used in the given country is used as a reference. In some cases, the performance requirement goes beyond the reference baseline for some technologies and criteria is set according to four major principles like technological progress, maturity of market supply, market penetration rates, and technology costs.

In order to evaluate each technology in a more efficient way, key performance indicators are established for each technology. In this way, with the specific indicator, it could be possible to evaluate the technology based on a certain variable. Moreover, this indicator will guarantee a certain level of performance. Key performance indicator value for each technology is selected slightly above the average of local market conditions.

2.1 Technical Eligibility Criteria for Mini & Normal RE Projects

As it is defined in TOR, SME type renewable energy projects can be grouped based on their investment costs. Projects with investment cost lower than $50,000 and between $50,000 and $300,000 are classified as Mini and Normal renewable energy projects. For most of the renewable energy technologies the investment cost per unit power is still relatively high due to advance technology used for equipment manufacturing. Therefore, renewable energy investments are generally type of power plants with high installed capacities and commissioned by large scale enterprises with strong financial conditions.

Mini and Normal RE projects consist of single or combined equipment/systems and might be installed either to produce electricity or used for heating and cooling purposes. Thus, the eligibility of these projects directly related with the technical compliance of the equipment/system with the set of KPI selected for each technology.

However it is challenging to originate renewable energy projects for self-consumption since the market in Turkey favours the installation of renewable energy projects basically to produce electricity and sell it to grid to generate income. There are two main reasons. The first one is that the FIT is higher than the general electricity cost and this discourages potential investors to implement self-consumption projects. Secondly, the technical and legal procedures that need to be carried out for small scale projects are exactly the same with larger unlicensed applications which require long time and high effort to be implemented.

<u>Roof-Top Solar PV</u>

Photovoltaic (PV) cells convert sunlight directly into electricity without causing any air or water pollution. Power generation from solar panel is a clean way of sustainable energy production since the technology is based on sun which is widely distributed renewable energy source.

PV is classified into two main categories: crystalline silicon and thin film. Crystalline silicon technology dominates the market compare to thin film technology. However, thin film cells are also favorable in aspects such as, flexibility, cost, lighter weight, and easiness in integration. Another benefits of thin film PV technology are the amount of reduced material required in manufacturing a solar cell and reduced efficiency loss due to ambient temperature.

Main Advantages of the technology include the rapid installation of the equipment and safe electricity generation. This technology provides an immediate and measurable reduction in fuel bills together with reduction in carbon dioxide emissions.

Applications

a) Rooftop applications (industrial and commercial facilities)

b) Electricity supply in remote areas where there is no access to grid connection

c) Energy efficient lighting and emergency call boxes

d) Water pumping and desalination

e) Solar refrigeration

The Polycrystalline PV panels in the Turkish market delivered in the range of 15% - 17% efficiency. Given the fast increase of PV solar panel performances, the market penetration rate of products which exceed the baseline criteria will increase in the following period.

Technology costs of PV installations have been dropping drastically due to the decrease in panel costs attributable to the surplus supply in the world markets. The average PV panel costs in the market are in the range of 1,000-1,500$ / kW_p. The panel costs in the market are seen to be more affected by the stability and performance guarantees of the panels than efficiencies.

The majority of installers in Turkey prefer to use mono or poly crystalline panels in their projects. This can be explained in connection with the relatively high average insolation level in the southern parts of Turkey, which is the rational target market in PV market development.

Although thin film panels appear in the product lists of the installer companies, the market penetration is weak due to several reasons. As these panels are expected to have higher output in lower direct irradiation and construe lower unit costs, in the future, they can be expected to be used for projects in northern parts of Turkey that have significantly higher cloudy days than south.

The next table summarizes the key performance indicator for mono/polycrystalline and thin film PV panels and includes suggested technical eligibility criteria for the selected technology.

Table 2-1: Technical eligibility criteria for Solar PV panels

Solar PV	
Type of Technology	Mono/Polycrystalline & Thin Film PV Panels
Key Performance Indicator (KPI)	Module electric efficiency (%)
Technical Eligibility Criteria (Mono/Poly)	• Electric efficiency ≥ 15% • Energy saving ≥ 20% • Performance tests based on IEC 61215, IEC 61730 • IEC 61701 & PID Tests (Recommended)
Technical Eligibility Criteria (Thin Film)	• Electric efficiency ≥ 10% • Energy saving ≥ 20% • Performance tests based on IEC 61646, IEC 61730 • IEC 61701 & PID Tests (Recommended)

The *key factors* affecting the financial profitability of the technology is the correct selection of the capacity, size and type of technology together with the appropriate location selection.

Solar energy potential has to be analyzed taking into account local climate conditions (solar intensity, ambient temperature, estimated losses etc.), efficiency of the panels, required area and, needed electricity output.

PC has additionally introduced the below mentioned selection criteria for rooftop PV applications. If either one of them holds true, then the project will be assessed:

- At least 20% of the generated electricity needs to be self-consumed
- The project has the potential to become a showcase for the community and/or public

Solar Water Heater (Solar Thermal Collector)

Solar heat supply is one of the most wide spread practical applications of solar energy. A solar thermal system is a convenient way to convert the energy from the sun into energy for utilization. It consists of evacuated tube collectors or flat plate collectors that absorb the energy from the sun to heat water or other heat transfer fluid.

Main Advantages of the technology include the rapid installation of the equipment and the generation of thermal energy. This technology provides an immediate and measurable reduction in fuel bills together with reduction in carbon dioxide emissions.

Applications

a) Space heating of commercial buildings, offices, greenhouses

b) Heating for commercial purposes such as dairies, sheltered housing etc.

c) Space heating in the service sector

d) Heating for indoor and outdoor swimming pools

e) Industrial process heating (low temperature heat up to 250°C)

f) Solar cooking

g) Desalination

h) Agricultural purpose (crop drying)

Solar Water Heaters have been produced and installed in Turkey for over 20 years. As a result of that, the market mature in terms of supplier, installer and geographical distribution. Another reason behind the market development is that in most of the provinces, Solar Water Heaters are fully operational around 70% of a year.

The installed Solar Water Heaters in Turkey are estimated to have a total surface area of 12 million m^2 producing an estimated 420,000 TEP of annual thermal energy. The annual panel production corresponds to approximately 750,000 m^2 including nearly 30% to be exported to 80 countries all over the world.

Most of the technological progress in Solar Water Heater technology in the recent years has been done in applications of hybrid space/water heating systems incorporating fossil fuel heaters. Improvements in surface selectivity as well as thermal insulation and better control/automation systems have increased overall system efficiency without resulting in large increases in panel efficiencies.

The majority of Solar Water Heaters in Turkey are flat panel units, often used for domestic hot water heating systems for seasonal use in Southern and Western Turkey. The vacuum type units are recently coming into use in climate zones in which regularly experience freezing temperatures, like central Anatolia, eastern Turkey and the rest of the northern regions.

The range of Solar Water Heater efficiency within the market is very narrow and there are not so many suppliers which can guarantee much higher level of efficiency.

The market prices for a 2.5 m^2 solar heater is in the range of 500 to 1,400 $ largely based on the amount of automation the product contains.

The next table summarizes the key performance indicator for Solar Water Heaters and include suggested technical eligibility criteria for the selected technology.

Table 2-2: Technical eligibility criteria for Solar Water Heaters

Solar Water Heaters	
Type of Technology	Evacuated Tube Collectors and Flat Plate Collectors
Key Performance Indicator (KPI)	Thermal conversion (%)
Technical Eligibility Criteria	• Conversion factor ≥ 75% • Compliance with the requirements of BS EN 12975-1:2006 • CE Marking • TSE Conformity

The *key factors* affecting the financial profitability of the technology is the correct selection of capacity, size and type of technology together with appropriate location selection.

Solar energy potential has to be analyzed taking into account local climate conditions (solar intensity, ambient temperature etc.), type of collectors, its efficiency and total area and, required heating output.

Solar Water Pumps

A Solar Water Pumping system consists of photovoltaic (PV) solar panel which produces electricity, pump to transfer the water and the controller. Solar Water Pumping systems are particularly preferred to provide power supply in remote regions where the grid connection is limited or not available.

Main Advantages: Solar water pumps are especially useful in small scale or community based irrigation. The operation of solar powered pump is more economical mainly due to the lower operation and maintenance costs. Additionally, it has less environmental impact than pumps powered by grid electricity or diesel fuel.

Applications

a) Delivery of drinking water

b) Delivery of water to livestock

c) Agricultural irrigation

The next table summarize the key performance indicator for Solar Pumps and include suggested technical eligibility criteria for the selected technology.

Table 2-3: Technical eligibility criteria for Solar Water Pumps

Solar Water Pumps	
Type of Technology	Centrifugal and Helical Solar Water Pumps
Key Performance Indicator (KPI)	Electric efficiency (%)
Technical Eligibility Criteria	• Equipped with MPPT technology • Motor electric efficiency ≥ 90%

The *key factors* affecting the financial profitability of these technologies are the selection of capacity, size and type of technology together with the orientation of PV system.

Mini Wind Turbines

Wind Turbines are designed to convert the kinetic energy of the wind into electricity. When the wind blows, the blades rotate and the turbine starts to generate electricity. Mini Wind Turbines are preferred in the individual buildings and plants. The majority of Mini Wind Turbines are traditional horizontal axis wind turbines whereas vertical axis turbines has a potential for some applications. There are two types of mini-sized wind turbine: pole mounted and building mounted.

Pole mounted are free standing and are erected in a suitably exposed position, often around 5kW to 10 kW.

Building mounted are smaller than mast mounted systems and can be installed on the roof of a home where there is a suitable wind resource. Often these are around 1kW to 2kW in size.

Main Advantages of the technology include independent supply of electricity, avoidance of greenhouse gas emissions and fuel cost and, requirement of smaller space compared to average power station. Mini Wind Turbines can be used as stand-alone energy generation systems for local power supply to optimise the available potential of wind energy in isolated rural conditions.

Applications

a) Big countryside farmsteads and settlements with autonomous energy supply

b) Individual countryside farmsteads, mansions, pastures, beacons, buoys

c) Wind-power stations of small capacity with accumulators for electricity

d) Regions with hard-access for electricity transmission lines

The next table summarizes the key performance indicator for Mini Wind Turbines and include suggested technical eligibility criteria for the selected technology.

Table 2-4: Technical eligibility criteria for Mini Wind Turbines

Mini Wind Turbines	
Type of Technology	Mini Wind Turbines
Key Performance Indicator (KPI)	Electric efficiency (%)
Technical Eligibility Criteria	• Maximum installed power < 50 kw • Minimum hub height 18 m from ground level • Minimum 2 years product guarantee

The *key factors* affecting the financial profitability of the technology are the selection of appropriate wind power plant location considering the wind resource and cost for foundation.

2.2 Technical & Financial Eligibility Criteria for Complex RE Projects

According to TOR, projects with investment cost above $300,000 or equivalent are classified as Complex renewable energy projects. The investment cost of Complex project is capped with SME criteria. The potential investors may carry out Complex projects either for self-consumption or electricity production to feed the grid. Within this framework, the Complex projects may include solar PV, concentrated solar, wind, hydro, biomass, geothermal technologies. Based on PC's previous experience, a single key performance indicator (KPI) is determined for all renewable energy projects. Therefore, KPI is the ratio of annual net electricity production of the facility per total investment cost. The capacity factor for each renewable energy source and the maturity of the technology are the main parameters for the establishment of rational KPI value.

Due to higher investment costs of Complex renewable energy projects, feasible projects should comply with the determined financial eligibility criteria along with the technical eligibility criteria. The financial performance of the project will be assessed based on the most common financial indicators such as simple payback time (SPT), internal rate of return (IRR) and net present value (NPV).

The financial indicators affecting the financial eligibility of the project usually includes:

- **Simple Payback Time (SPT)** - the length of time required to recover the cost of an investment.
- **Net Present Value (NPV)** - the difference between the present value of cash inflows and the present value of cash outflows.
- **Internal Rate of Return (IRR)** - the discount rate that makes the NPV of all cash flows equal to zero.

The following rules of thumb give an idea when the above parameters should be used:

- **SPT** must be preferred when the life duration of the project is known.
- **NPV** must be preferred to compare projects which have similar investment costs and similar lifetimes. It considers the value of money, but not the risks.
- **IRR** must be preferred when the discount rate is unknown or questionable; on projects with different levels of investment and project lifetime are compared with each other. The NPV must be determined complementarily.

The next table summarize the key performance indicator for complex renewable energy projects and include suggested technical and financial eligibility criteria.

Table 2-5: Technical and financial eligibility criteria for Complex RE Projects

Complex RE Projects	
Type of Technology	Solar PV, Concentrated Solar, Wind, Biomass, Hydro, Geothermal
Key Performance Indicator (KPI)	Coefficient
Technical & Financial Eligibility Criteria	• KPI ≥ 1.2 kWh/$/year • NPV ≥ 0 • IRR ≥ 7 • Simple Payback Time ≤ 15 years

Solar PV

Solar PV is one of the fastest developing renewable energy technologies of the recent years. Technological progress has been seen in various components of the panels such as decrease in wafer thickness, improvement of efficiencies of electrical connections, reduction of raw material consumption, leading to an increase in cell efficiencies and panel costs.

Solar PV is currently evaluated as the most popular renewable energy investment opportunity in Turkey. As the actual market structure is following the regulatory developments, it is reasonable to expect major fluctuations in the price structures and available products and services as well as the depth of market.

As of October 2016, installed PV solar capacity in Turkey is 745.7[2] MW. Turkey aims to reach 5 GW of solar capacity (PV and CSP) by 2023.

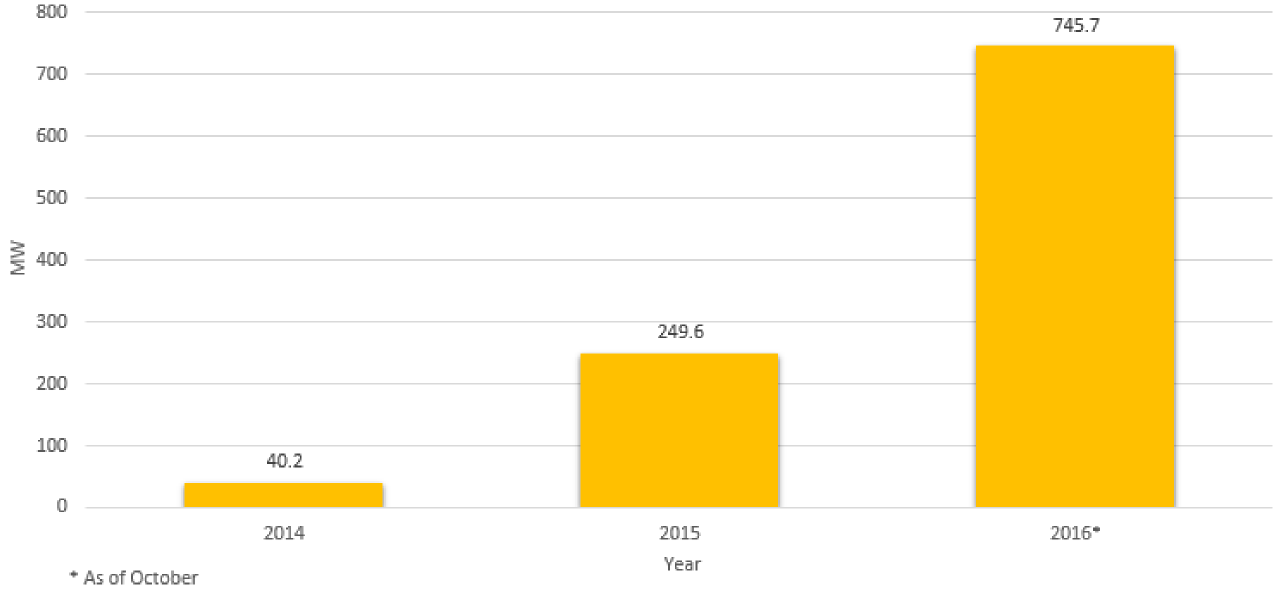

Figure 2-1: Installed Solar PV capacity of Turkey (TEIAS) [3]

PV solar sector is one of the faster growing sectors in Turkey, if not the fastest. Before 2014, the installed capacity in Turkey was insignificant. However, during the recent years, the PV sector has experienced a massive growth to reach 745.7 MW in almost 2.5 years.

Concentrated Solar Power (CSP)

Another way of exploiting the energy of the sun is to concentrate the sunlight through lenses and mirrors. There are various types of technology that concentrate sunlight including but not limited to, parabolic trough, Fresnel reflector, dish Stirling and solar power tower. Some of the technologies use tracking systems to maximize the amount of sunlight available. Through these processes substantial amounts of heat and can be obtained, which subsequently convert fluids into steam. Then, this steam can be used to generate electricity through steam turbines.

Turkey has a substantial solar energy potential due to its geographic location. Through concentrated solar power technology, 380 billion kWh/year of gross potential can be obtained (GEPA). Remarkably, the only installed capacity Turkey has, is a 5 MW plant that generates thermal energy.

[2] 732.8 MW unlicensed, and 12.9 MW licensed
[3] TEIAŞ, October 2016

Wind Power

Wind comes into being as a consequence of heating differences around the world, topography, the Coriolis Effect and the seasons. The energy from the wind can be converted into mechanical power through wind turbines. This mechanical power is then used to generate electricity with the help of electrical generators. The speed and the availability of wind are extremely important for the amount of energy a wind turbine can convert to electricity. Therefore, areas where wind resource is stronger and more constant, such as offshore and high altitude sites are preferred locations for the installation of wind farms. Most large scale applications use three bladed horizontal axis wind turbines, but those with fewer numbers of blades and those that have vertical axes are also being used.

Main barriers of the technology include the unreliability of the supply. Therefore, it is more feasible to install such units in a centralized method, uniting them into single electricity net. Longer approval processes especially for the environmental and social aspect may also affect the project implementation.

Turbines with rated output of 1.5-3 MW are the most common for commercial use. Offshore resources experience mean wind speeds of ~90% greater than that of land, so offshore resources could contribute substantially more energy, however they have higher investment costs and operational complexity. Offshore wind projects have not been the case for Turkish market up to now.

The key factors affecting the financial profitability of the technology are the selection of appropriate wind power plant location considering the wind resource and cost for foundation, the proximity to the public affecting the costs for switching to the grid, access route to the construction site to reduce the transportation costs.

Turkey has 48,000 MW mid-high efficiency wind energy generation potential having an annual average wind speed of 7.5 m/s and higher. Almost 8,000 MW of this potential can be used with high efficiency while remaining potential can be used at the mid-efficiency levels. 20 GW of installed capacity was set as a target for 2023.

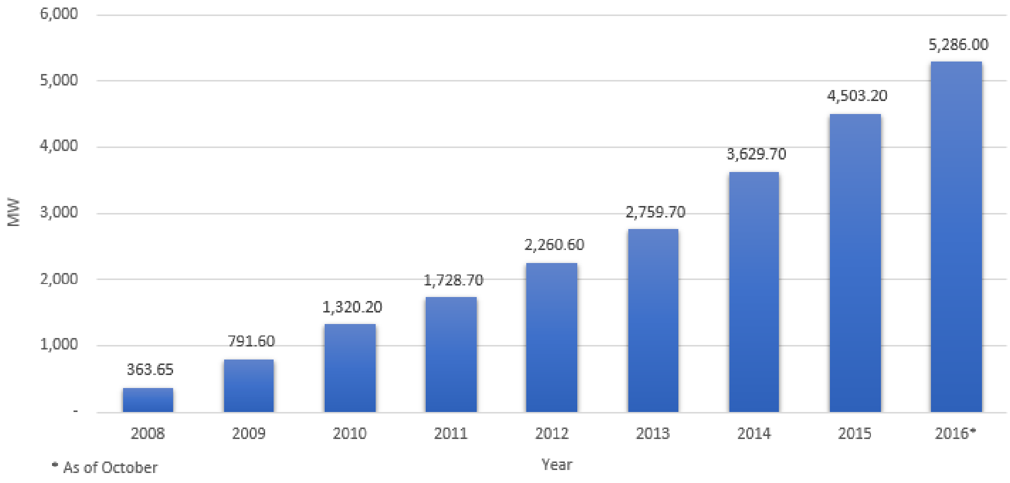

Figure 2-2: Installed Wind Power capacity in Turkey (TEIAS) [4]

As of October 2016, the licensed and unlicensed wind capacities in Turkey are 5,275.4 MW and 10.6 MW respectively.

Hydro Power

Hydropower refers to the energy that can be extracted from falling or running water. The mechanical energy of the water source is used to spin turbines which then generate electricity.

Hydropower plants can be classified in different ways: storage wise (dam, run-of-the-river), head wise (high head, low head), and installed power wise (micro, mini, small, large).

As of October 2016, the installed capacity in Turkey for dam type hydro is 19,408.5 MW and for run-of-the-river type is 7,034.5 MW. Approximately 7.5 GW of installed capacity is needed for Turkey to reach its 2023 target; 34 GW.

[4] TEIAŞ, October 2016

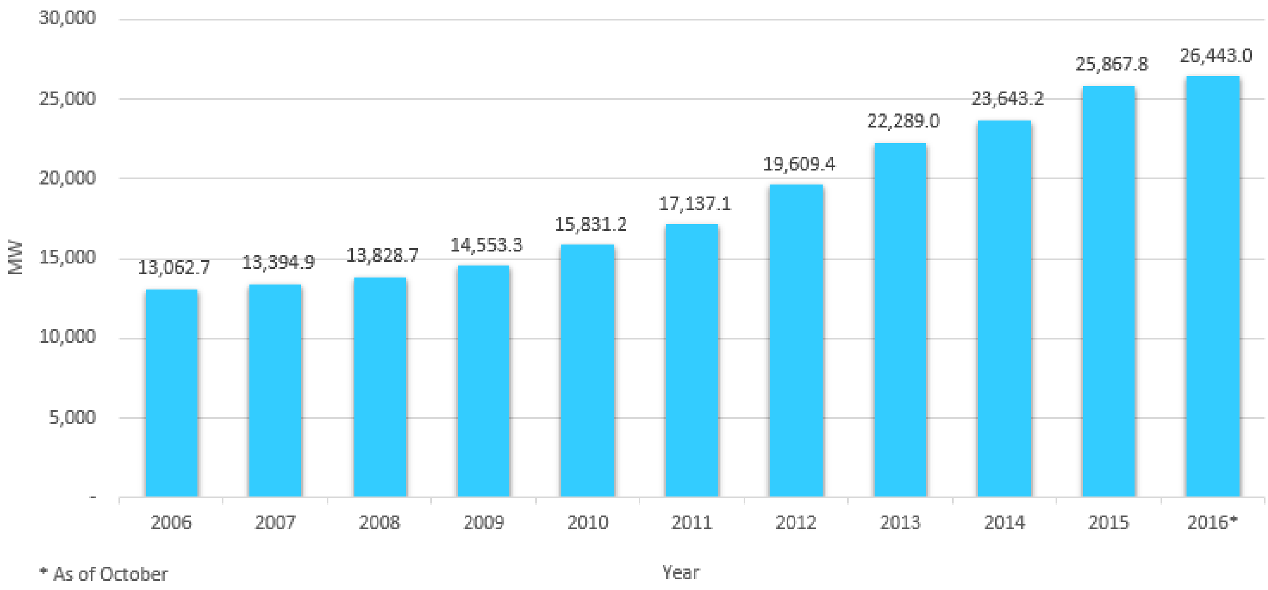

Figure 2-3: Installed Hydro Power capacity in Turkey (TEIAS)

In the context of this project, mainly small run-of-the-river hydropower plants will be evaluated. It is a mode of operation in which the hydro plant uses only the water that is available in the natural flow of the river. “Run-of-the-river" implies that there is no water storage and maintain the natural flow of a river, which also means that power fluctuates with the stream flow.

The technology is more consistent and reliable than wind or solar energy source. Therefore, it may lead to reduced exposure to energy price volatility. Additionally, low operating cost of the hydro power plant can be also seen as major advantage of this technology. Small hydro hydropower plants can provide electricity to central grids, isolated grids and remote power suppliers without carbon emissions.

The technical and financial viability of each potential small hydro project are very site specific. Power output depends on the available water (flow) and head (drop in elevation). The amount of energy that can be generated depends on the quantity of water available and the variability of flow throughout the year. Thus, weather conditions may directly affect the electricity production of the plants. Moreover, longer time periods are needed to undertake site studies, design the power plant, and to receive the necessary approvals and to construct the project. Although large up-front investment is required, the economic lifetime of a hydropower project is often far longer than the repayment period for the loan.

Biomass

Energy can be obtained through burning of organic matter such as, plant, animal and municipal domestic waste. These resources can be directly burned or processed into different products through physical, thermochemical and biochemical methods, and then burned according to need. Chipping, gasification, pyrolysis and anaerobic digestion are examples of such processes. Energy from biomass can be classified into three categories:

- Biomass

- Direct combustion
- Pyrolysis
- Gasification

- Biogas
  - Anaerobic digestion
- Landfill gas
  - Anaerobic digestion

Main advantages of the technology include cost reduction through self-generation, flexibility, reliability, waste reduction, distributed generation, reduction of greenhouse gas emissions, the improvement of the environment by waste utilization, and the formation of high quality fertilizer from the remains of the organic biomass.

Main barriers of the technology includes high transportation and maintenance cost, need for waste treatment, and low conversion efficiencies. Additionally, since these systems have to work continuously, the availability of local feedstock has to be guaranteed.

The biogas can be used as a fuel source either in properly modified diesel engines, which can allows saving 86% of the fuel consumption, or in new biogas engines to generate electricity for on-farm use or for sale to the electrical grid, or for heating or cooling needs. They can generate power for use in lighting, processing plants and greenhouses.

The key factors affecting the financial profitability of these technologies are the type of waste treated and the consequent design of the plant. The availability, quality and the type of raw material has to be considered before the implementation of project. In order to provide continuous sufficient storing capacities for at least one heating season has to be provided.

The aim of Turkey is to reach an installed capacity of 1 GW by 2023 through the usage of vast resource potential in the sector; 4.8 million tons of wood waste, 15 million tons of agricultural waste, and 29.6 million tons of municipal solid waste. In Turkey, there are currently 72 biomass power plants whose total installed capacity is 365 MW, some of which are currently under construction[5].

Geothermal Power

The thermal energy inside the ground can be extracted in order to generate electricity. Within this scope, geothermal power plants use geothermal fluids and steam to turn the turbines. Then generally, the used geothermal fluids could be re-injected into the well to preserve the resource.

[5] EMRA, October 2016

There are several types of geothermal plants: directly dry steam plants that primarily use steam, flash and double flash cycle that use high temperature geothermal fluids, and binary cycle plants that use heat exchanger to drive turbines with another fluid.

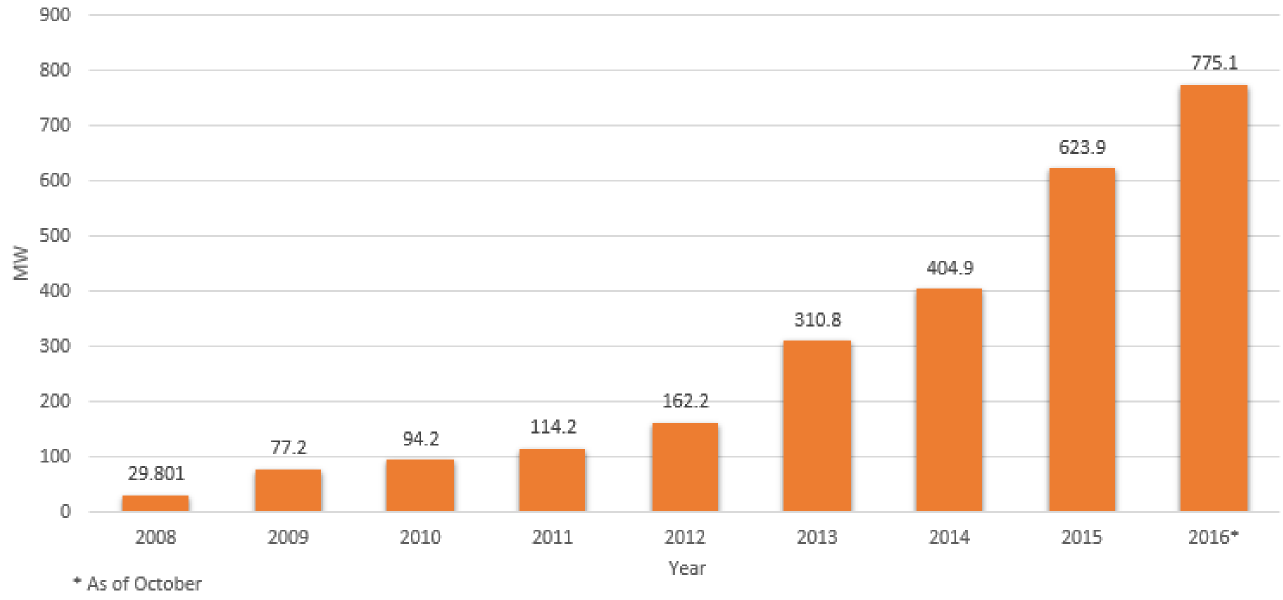

Figure 2-4: Installed Geothermal Power capacity in Turkey (TEIAS)

Geothermal potential for heat and power generation is estimated at 31,500 MW, of this potential Turkey aims to utilize 1,000 MW by 2023 for electricity generation. As of October 2016, Turkey has 775,1 MW installed capacity for geothermal energy.

2.3 Environmental & Social Eligibility Check

It is widely accepted that the renewable energy projects are considered to be cleaner way of electricity production. Therefore, these technologies are evaluated as environmentally friendly due to the same reason. However, when implemented, such projects may have some adverse environmental and/or social impacts which need to be addressed comprehensively. Therefore, PC will check the project compliance with national legislation and prepare environmental and social impact assessment (ESIA) reports with reference to WB's safeguard policies. The objective of the ESIA study is to carry out an assessment of the proposed projects to determine whether or not the proposed projects and associated activities will have any adverse impacts on the environment, taking into account environmental, social, cultural, economic and legal considerations. However, depending on the source of finance, environmental and social requirements may slightly subject to change. In order to facilitate the assessment of renewable energy projects, a draft environmental and social check list is prepared. The check list consists of questions regarding the general acceptance and technology specific acceptance criteria and will be filled out for each project. All field type solar PV assessment reports will be subject to an ESIA study. The details of the draft check list are provided in the Annex.

3 Implementation Procedure

After establishing the project selection criteria, the next step is to identify the implementation procedure of the project. Within this scope, the implementation procedure is broken down into phases in order to carry out the process successfully as seen in figure below. The procedure consists of phases such as project origination, pre-screening, energy assessment, project assessment report preparation, project financing and finally project implementation. Since the purpose of the project is to promote small scale renewable energy projects, the details of each phase for the successful implementation are explained in the following sections.

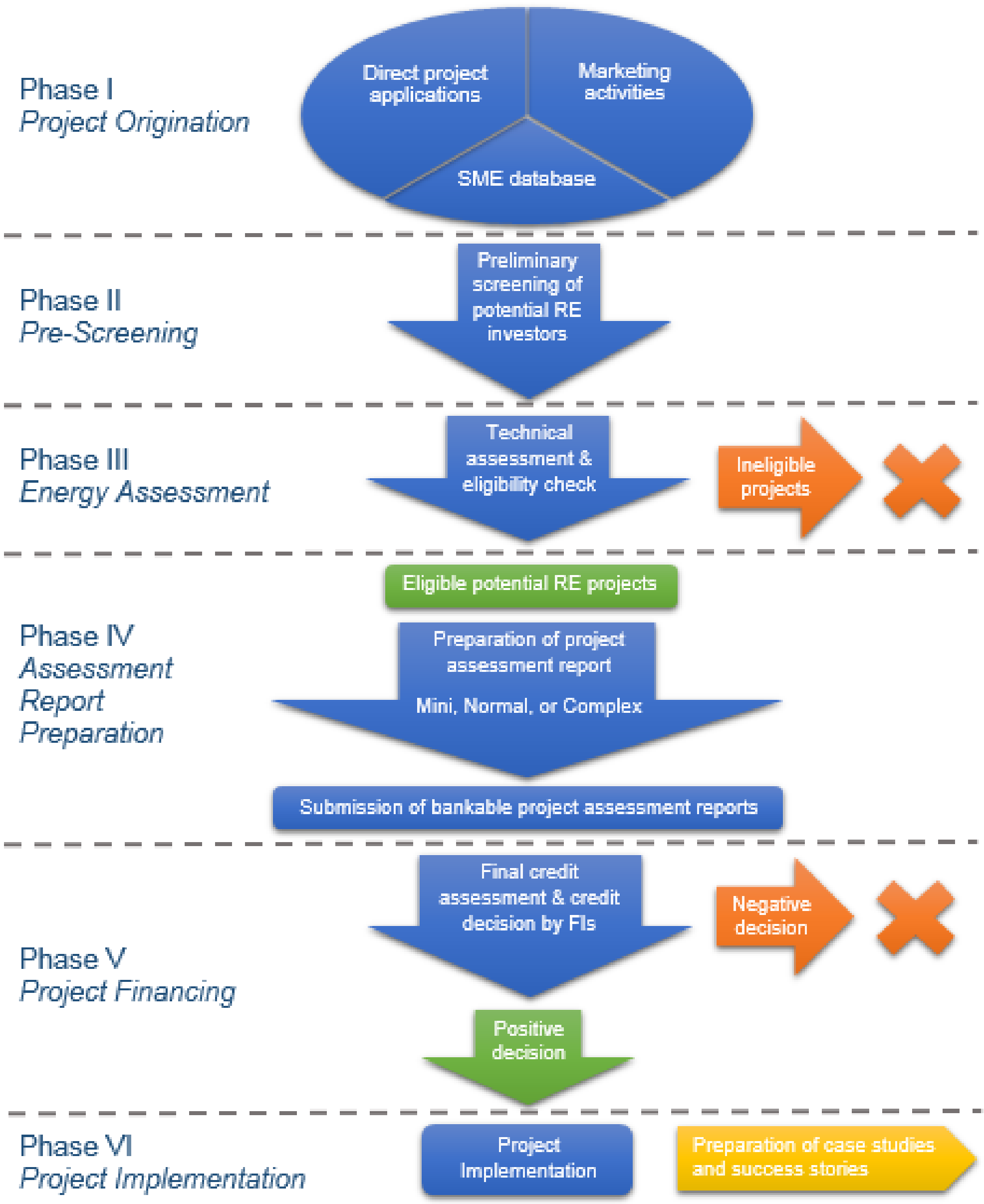

Figure 3-1: Renewable energy project implementation structure

Phase I: Renewable Energy Project Origination

The first phase of the process is the project origination. Since a total of 186 project assessment reports will be written, it is important to choose the most applicable renewable energy projects. Therefore, this phase plays a crucial role in the success of this project. PC established several project origination channels such as FIs, NGOs, EPC firms, equipment suppliers, house and building owners, municipality companies or affiliates, irrigation unions, and cooperatives such as agriculture, fishing, etc. Based on PC experience, the most efficient way to originate these sub-projects is through FIs and NGOs. FIs, with their portfolio of renewable energy investors, and NGOs, with their members who have renewable energy project investments, will be essential. Thus, building relations with these stakeholders through field studies and workshops is crucial. Before establishing the subsequent phases, these studies under the project origination have been carried out by PC to better comprehend the extent of the current situation and understand the stakeholder perspective on renewable energy projects. The stakeholders are eager to take part through their renewable energy projects to further benefit from PC's experience on the technical project assessment.

As previously mentioned, visits have been concentrated to Turkish FIs to identify the possible mechanisms for project financing under the survey study conducted by PC. Since, banks and leasing firms are the only available financing mechanisms in the market, the project origination is concentrated mainly on FIs.

However, project origination through FIs is not the only channel. To support SME scale renewable energy projects, PC will even provide technical information to stakeholders who only have project idea. In addition, advices and resource based assessment reports will be given to investors on the investment environment including the benefits, current mechanisms, incentives, and regulations. PC especially aims to facilitate the awareness raising and capacity building activities for rooftop PV applications whose primary aim is self-consumption. For the projects that are in the idea level, it is hard to follow up with the status of the project since it takes a long time for the projects to reach implementation step starting from project origination. Therefore, the chance of realizing the idea level projects is anticipated to be low. Apart from that, it would also be hard to follow up with the project implementation, if the assessed project is totally self-financed through the equity of the investor. As a result, the strategy of the project is to use many different project origination channels to increase the success rate.

Other project origination channels can be seen in the Figure 3-2. PC's SME database and marketing activities were established as project origination tools to increase the number of direct applications. PC has already prepared a list of EPC companies that have a track record on small scale renewable energy projects. However, since the assessment of the projects will be based on the information from feasibility studies provided by the EPC companies, they might not prefer that their projects are assessed by PC. Any negative outcomes during this assessment will discourage EPC firms from collaborating with PC. Therefore, PC does not expect a serious contribution from EPCs in project origination.

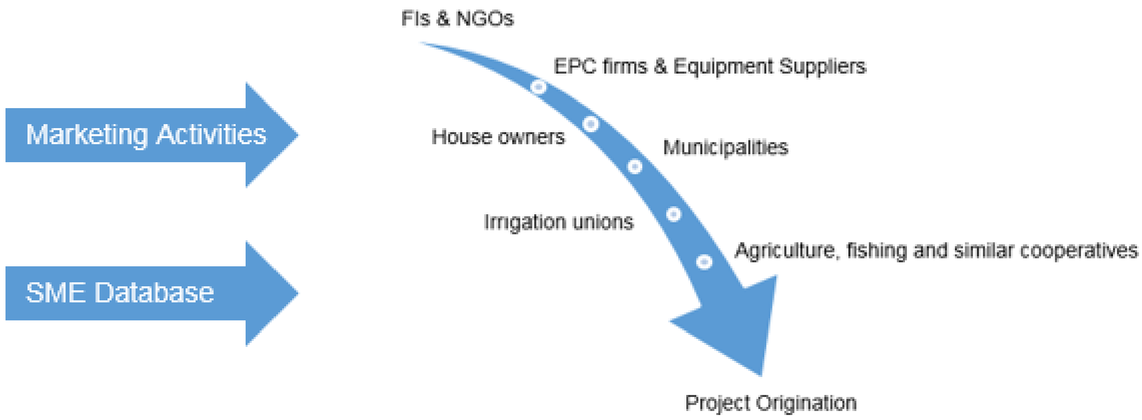

Figure 3-2: Project origination channels & tools

PC will try to work on the projects with real investment plan in order to increase the implementation rate of the received projects. It is important to highlight that the project origination channels of FIs and NGOs that are expected to be much more useful than the others.

Other activities such as marketing and trainings will also be used to originate more projects. These sub activities will continue throughout the project for supporting beneficiaries from wide range of industrial and commercial sectors in different regions. It is crucial to stimulate the small scale renewable energy projects within different geographical regions in Turkey while increasing their diversification. Under this scope, trainings in different regions will be beneficial to increase the awareness towards the importance of renewable energy technologies for Turkey's future.

Phase II: Pre-Screening

PC will carry out effective marketing and communication activities. As a result, this will allow behaving more selectively in the pre-screening phase because a wide range of projects will be available to PC. In this way, it will be much easier to identify and select SMEs who are more committed to implement a project or who have already started to look for financers. Initial pre-screening will be based on the investment cost of the project and the type of the proven technology. A total of 186 project assessment reports will be written. There is a classification based on the number of assessment reports that fall under each category. As a result, there are limitations for each category with respect to applicable technologies. PC will specifically give attention to the self-consumption projects together with heating and cooling applications in pre-screening phase.

The scope of the project covers renewable technologies such as rooftop PV, small biomass plants, micro hydro plants, and wind applications for electric power generation. Some renewable heating and cooling technologies are suitable as well. As a result, the pre-screening will start from these projects. However, particularly for the PV power plants, opportunities are stronger due to market conditions in Turkey. A special attention will be given to these projects in the pre-screening phase.

In case of Mini and Normal assessment reports, most probably applicable technologies for electric power generation will be rooftop PV and mini wind turbines. Additionally, some renewable heating and cooling technologies will be assessed under this scope. Other renewable technologies for electric power generation will probably fall under the Complex assessment report category. The main reason is their high upfront costs because technologies such as biomass/biogas, and micro hydro and wind power plants are commissioned with large capacities. Although concentrated solar power and geothermal power plants are listed under the renewable energy technologies, PC does not expect any SME scale projects for these technologies.

As previously mentioned, the projects in the idea level can also be received. In that case, besides assessing whether the technology is applicable in Turkey or not, PC also needs to assess if the technology is proven in the market. Additionally, PC will assess the purpose of the potential project together with a resource based analysis. This way, PC aims to encourage the investor by providing a resource based assessment report to show the real potential behind the planned investment. A project pool will be established through storing the received projects under a project pipeline. Therefore, PC has the possibility to behave more selectively among the received projects to ensure success.

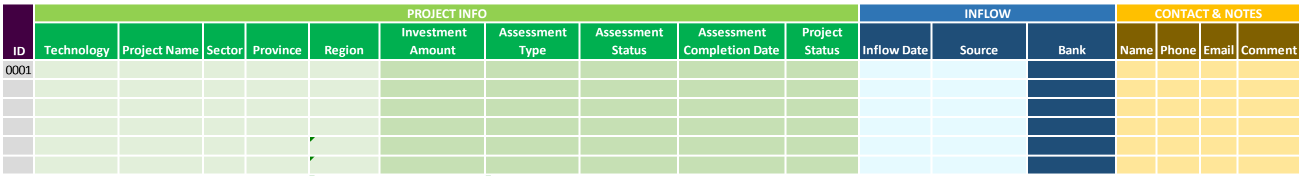

Figure 3-3: Project pipeline developed by PC

The pipeline that was prepared by PC is seen in the figure above. Detailed information will be entered to the pipeline to simplify the pre-screening phase and to obtain useful information. The details of the pipeline can be seen in Table 3-1.

Table 3-1: Pipeline data

Project Data	Inflow Data	Contact Data
• Technology • Project Name • Sector of the Beneficiary • Province • Region • Investment Amount • Assessment Type • Assessment Status • Assessment Completion Date • Project Status	• Inflow Date • Source	• Name • Phone • E-Mail

Phase III: Energy Assessment

After the pre-screening phase, the next step is to complete the energy assessment of the defined projects. Energy assessment will be carried out based on the feasibility documents and the technical data provided by the relevant investor/EPC Company of the project. PC will be able to conduct technical and financial assessment once the necessary data is provided.

In case of idea level projects, PC will carry out resource based analysis rather than detailed project assessment. The purpose is to evaluate the potential project to understand its benefits. The assumption will be based on the generic equipment that will be used in these kinds of assessments.

In order to run the project assessments accurately and standardize the evaluation process, PC has established technical and financial criteria based on its extensive experience on renewable energy projects. Moreover, key performance indicators are established to better assess the performance of the technologies.

For the projects with investment cost lower than $50,000, the eligibility of the project will be based on eligibility of the equipment. Tests and certifications are also important in order to ensure the usage of high quality equipment. The assessment is performed based on the key performance indicators for each relevant technology. In order to guarantee a certain level of performance, the criteria are set slightly above the local market conditions. In case the investment costs of the projects are between $50,000-300,000, the established eligibility criteria are similar to the projects that have investment costs lower than $50,000.

On the other hand, for the projects with investment cost higher than $300,000 (Complex projects), the evaluation procedure is different and more complex. There are established criteria including both financial and technical aspects of the projects. Some of which are; internal rate of return of the project, payback period of the investment, net present value of the cash flow and expected energy production. All of the projects will be also evaluated in terms of environmental and social sets of rules.

PC has additionally introduced the below mentioned selection criteria for rooftop PV applications. If either one of them holds true, then the project will be assessed:

- At least 20% of the generated electricity needs to be self-consumed
- The project has the potential to become a showcase for the community and/or public

The established eligibility criteria were developed by taking the current renewable energy finance mechanisms in the local market into account. In addition, these must be submitted to Ministry of Energy and Natural Resources (MENR) for the approval. Although the approval from MENR is necessary, PC asserts that these are the appropriate project assessment criteria for an accurate assessment.

Phase IV: Project Assessment Report & Feasibility Study Preparation

Project assessment reports and feasibility studies will be prepared after the completion of energy assessment phase for the projects which are eligible according to the established criteria.

PC foresees to receive application through several project origination channels such as FIs, NGOs, EPC firms, equipment suppliers, house and building owners, municipality companies or affiliates, irrigation unions, and cooperatives such as agriculture, fishing, etc.

Project reports that will be prepared to provide technical assistance to the municipality companies or affiliates for their renewable investments will consist of the following:

- Needs Assessment for the investment on the particular building/for the particular facility
- Technical and Financial Feasibility Study
- Technical Specifications with minimum requirements and cost estimations of the equipment/manday identified as well as Market Research Report

The following will be taken into account when preparing project reports:

Projects should aim self-consumption, in other words, as put forth by the legislation the amount of unlicensed electricity generated cannot exceed more than 30 times of the electricity consumed for self-consumption. Small-scale unlicensed RE projects meeting the self-consumption criterion are the only projects that can be selected under this project. However, projects that do not meet self-consumption criterion because they obtained TEDAS approval before this criterion was brought by the legislation on 23 March 2016, may only be selected for Type 1 Bankability Reports to facilitate financing from Financing Institutions. These reports will be approved only if they turn into investments with credit disbursement or equity. Additionally, a single technology of renewable energy cannot dominate more than half of the total number of projects. For the avoidance of doubt, roof-top and field type solar projects will be regarded as different technologies.

There will be three categories of reports based on the investment costs of the projects as seen in the table below. These could be broken down into Mini, Normal and Complex reports as mentioned before.

Table 3-2: The classification of Project Reports

Categories of Project Reports	Investment Amount
Mini	≤ $50,000
Normal	$50,000 – $300,000
Complex	≥ $300,000

The reports will be further divided into three types according to the needs of the beneficiary, and target party. These types can be seen in the table below.

Table 3-3: The types of Project Reports

Types	Target	Content
Type-1: Reports for projects already contracted with EPCs	Investors, Banks and Financial Institutions	Project Assessment Report (Bankability report)
Type-2: Reports for projects at idea level	Investors, EPCs, Banks and Financial Institutions	Feasibility Analysis with Project Design, Costs of the Project Components
Type-3: Reports for idea level municipality water supply, treatment and pumping facilities projects	CFCU (for EPC & supply tendering) and EU Delegation/IFIs & Local Banks	Feasibility Analysis with Project Design + Procurement Documents (All Technical Specifications and Standards Defined for Tendering and Market Research)

Type 1: The purpose of the project assessment report is to provide clear overview to the FIs and investors about the project. The necessity of accurate project assessment stems from the nature of the project. In general, small scale renewable energy investors are unable to get loans mainly due to inaccurate project risk assessments by FIs and inexperience in the energy sector. In addition, they have low credibility due to their low assets. Therefore, an accurate project assessment could increase their chance to get financing from Turkish FIs. In commercial banks, generally there is no separate renewable energy project assessment department. Therefore, from the banks point of view, the reports symbolize bankable projects. On the other hand, from investor's point of view it can be seen as a proof of secure investment. The content of the bankable project assessment report can be found in Annex B.

Type 2 & 3: Purpose of these reports is to prepare a feasibility study for the beneficiaries to provide technical and economic analysis with project design. The technical analysis will include site assessment, technology options and comparison, and energy yield prediction, while the economic analysis will consist of financial appraisal with projected revenues, costs, cash flows, and financial performance indicators. For Type 3 reports, there will be an additional procurement section including all the technical specifications and standards defined for tendering and market research. The content of the feasibility study can be found in Annex C.

Further details of the Type1,2 & 3 Reports are provided under Annex D.

Phase V: Project Financing

A field study was conducted in order to identify the financing mechanisms in the market and understand how these FIs finance renewable energy projects. Two financial mechanisms for renewable energy project financing have been identified during the survey study: banks and leasing firms. In general, these FIs do not finance the projects from their own equity but through international funds. Some of these are shown in the table below.

Table 3-4: List of international funds

AFD	French Development Agency
EBRD	European Bank for Reconstruction and Development
EFSE	European Fund for Southeast Europe
EIB	European Investment Bank
GGF	Green for Growth Fund
IDB	Islamic Development Bank
IFC	International Finance Corporation
JBIC	Japan Bank for International Cooperation
KfW	German Development Bank
OEEB	Development Bank of Austria
OPIC	Overseas Private Investment Corporation
WB	World Bank

PC identified the distribution of the international funds in the FIs through several channels and the result is depicted in the following table. The green colour depicts the availability of the fund whereas the grey colour refers to the opposite.

Table 3-5: List of international funds used by banks

Bank	AFD	EBRD	EFSE	EIB	GGF	IDB	IFC	JBIC	KfW	OEEB	OPIC	WB
ABank			✓				✓					
Akbank		✓										
Albaraka												
Burgan Bank												
Denizbank												
Finansbank		✓										
Garanti Bankası	✓	✓		✓								
ICBC												
ING												
İş Bankası		✓		✓				✓			✓	
Kalkınma Bankası				✓		✓		✓	✓			✓
Kuveyt Türk												
Odeabank	✓		✓		✓							
Şekerbank		✓			✓							
TEB	✓											
TSKB				✓		✓			✓			
Türkiye Finans												
Vakıfbank		✓										✓
Yapı Kredi		✓		✓			✓	✓				
Ziraat Bankası												✓

The international funds are long term and they have low interest rate which means it is beneficial for the investor to use this loan to implement the projects. Thus, they can greatly help the financing of renewable energy project which are in the scope of this study.

Phase VI: Project Implementation

The last phase is the project implementation. Project assessment reports will play a crucial role in order to increase the implementation rate of projects. Since FIs do not often have enough knowledge or experts to assess the projects accurately, the investors and financers frequently experience misunderstandings. This situation will be avoided with the help of the accurate assessment reports provided by PC. In addition, if the project is found to be eligible, this will correspond to a bankable project from FIs' point of view. Thus, the investor can use this advantage to negotiate on the terms and conditions of the loan.

The projects will be implemented following the loan disbursement. PC will prepare case studies and success stories for some of the successful projects. These will help achieve PC's aim of raising awareness in the market to ensure a continuing increase in capacity.

ANNEX A: Environmental & Social Checklist

The following Checklists refers to Unregulated Developments

The checklist requires either a ‘Yes’ or a ‘No’. If in doubt, use ‘No’.

A ‘No’ means that there is a deficiency and that the project does not meet eligibility criteria. This does not necessarily exclude the project for potential funding, at the time of appraisal or in the future, but means that an issue has to be addressed. Should this be the case then a reasoned judgement should be made by the environmental specialist appraising the project. This judgement, to be added to the Checklist, should detail the deficiency (e.g. a non-compliance with national law) and should then identify potential remedial measures. This will then need to be discussed with the project developer.

Based on this discussion (which might/might not result in an agreement about changes to the project) will then be the basis for making a final appraisal judgement.

Eligibility Criteria - Unregulated Developments			
No.	**Criterion**	**Yes**	**No**
1	The borrower is in compliance with the applicable national environmental, social and health and safety legislation in Turkey.	☐	☐
2	The project is carried out in accordance with applicable relevant EC environmental legislation and World Bank Environmental Safeguards standards relating to environmental protection; social impact; heritage/cultural impact; stakeholder engagement.	☐	☐
3.1	The Project is not potentially affecting a nature conservation area or otherwise protected site (or a site which may potentially become such a site, e.g. Natura 2000).	☐	☐
3.2	If the project is potentially affecting a protected or designated area (or an area which has the potential to become a designated area, e.g. Natura 2000), an appropriate assessment has been carried out and appropriate mitigation measures have been agreed and will be implemented.	☐	☐
4	The project is in compliance with all relevant occupational and public health and safety requirements.	☐	☐

5.1	The project is unlikely to raise local public opposition.	☐	☐
5.2	If the project has the potential for local public opposition, an appropriate stakeholder consultation mechanism (inclusive of a grievance mechanism) for the duration of the project is in place or will be put in place.	☐	☐
Reasons for a ‘No’ in Section xxx : Mitigation measures: Are mitigation measures sufficient for eligibility of the project?			

<u>The following Checklists are for Regulated Developments.</u>

The Checklists consists of a

General Checklist (General Eligibility Criteria) and **Additional Checklists (Specific Eligibility Criteria)** relating to either

- Wind farms
- Solar PV developments
- Hydro power plants
- Geothermal power plants
- Biomass power plants.

The checklist requires either a ‘Yes’ or a ‘No’. If in doubt, use ‘No’.

A 'No' means that there is a deficiency and that the project does not meet specific eligibility criteria. This does not necessarily exclude the project from funding, at the time of this appraisal or in the future, but means that an issue has been identified and needs to be addressed. Should this be the case then a reasoned judgement should be made by the environmental specialist appraising the project. This judgement, to be added to the Checklist, should detail the deficiency (e.g. a non-compliance with national law) and should then identify potential remedial measures where possible. This will then need to be discussed with the project developer.

The outcome of this discussion (which might/might not result in an agreement about changes to the project/inclusion of mitigation measures) will then be the basis for making a final appraisal judgement - either confirming project eligibility for financing, or rejecting the project due to unmitigated deficiencies.

Eligibility Criteria – Regulated Developments			
List A: General Eligibility Criteria			
Criteria		**Yes**	**No**
1	**Regulatory Compliance**		
1.1	The project meets all relevant national environmental, health and safety legislation	☐	☐
1.2	The project is carried out in accordance with local development plans.	☐	☐
2	**Impact on Landscape and Visual Amenity**		
2.1	The project has been designed and implemented to minimize impact on the natural landscape and avoids significant changes in the landscape fabric, character and quality.	☐	☐
2.2	Where necessary, mitigation measures have been included.	☐	☐
3	**Impact on Habitats and Biodiversity**		
3.1	The project is not carried out in a designated/protected area or in an area which may be considered for designation (e.g. Natura 2000 site).	☐	☐
3.2	If the project is carried out in an area with significant environmental features (habitats and plant and animal communities), these have been identified, taken into account in project design, and protection.	☐	☐
3.3	Where necessary mitigation measures have been identified and are being implemented.	☐	☐

4	**Impact on Local Communities**		
4.1	Setback: the project is sufficiently distant from residential premises to exclude negative visual impact.	☐	☐
4.2	The site (turbines and associated structures inclusive of access roads and overhead connections) has been designed to avoid impacts on local residents, schools, hospitals and businesses.	☐	☐
4.3	Facility construction management measures will minimize any negative impact on the local population; this includes traffic/road safety, noise, dust etc.	☐	☐
4.4	There are tangible benefits for the local communities.	☐	☐
5	**Associated Facilities**		
	All associated facilities (site access roads; permanent buildings; connection to the grid) are designed, constructed and operated so as to avoid, and where this is not possible, sufficiently mitigate adverse environmental impacts and impacts on the local communities.	☐	☐
6	**Cumulative Impact**		
	Site design and construction has taken account of cumulative impacts such as visual intrusion arising from other existing, planned or potential facilities in the area. A cumulative impact assessment has been carried out where appropriate, including similar facilities (e.g. other wind farms) as well as all other developments.	☐	☐
7	**Health and Safety**		
7.1	The project is in compliance with all relevant national occupational and public health and safety requirements.	☐	☐
7.2	The project meets the requirements set out in the World Bank Group 'Environmental, Health and Safety General Guidelines (2007)'	☐	☐
8	**Stakeholder Engagement**		
	Public information and consultation has been carried out in compliance with national legislation and World Bank standards. This includes plans for continued stakeholder engagement and also a grievance procedure.	☐	☐
9	**Archaeological, Heritage and Cultural Issues**		

	The project does not have any negative impact on archaeological or other protected or important heritage sites.	☐	☐
List B: Specific Eligibility Criteria			
Criteria for Wind Farms			
1	**Impacts on Birds and Bats**		
1.1	The wind turbines are located, designed and configured to minimise impacts on local or feeding bird and bat communities.	☐	☐
1.2	The project is not located in a bird migration pathway or (if so) appropriate mitigation action has been put in place to reduce impact.	☐	☐
2	**Local Nuisances**		
2	Noise: The wind turbines are sufficiently distant from residential premises to avoid noise levels above national noise thresholds for permanent residential areas. The facility will also meet the noise thresholds for receptor areas according to the World Bank 'Environmental, Health and Safety General Guidelines (2007).	☐	☐
2	Shadow Flicker and Light: The wind turbines are sufficiently distant from residential premises to avoid shadow flicker and disturbance by lights.	☐	☐
Criteria for Solar PV Plants (excluding roof-top installations)			
1	**Protection from Glare**		
1.1	The project site (arrays of panels) is located so that there is no intrusion on residents and others from panel glare.	☐	☐
1.2	If there is the potential for panel glare on residential areas, passers-by and on any roads and motorway users, sufficient protection (e.g. in the form of hedgerows or other planting) is in place to avoid intrusion.	☐	☐
2	**Resource Use**		

	Water use for panel cleaning will not deplete local water sources and will not have a negative impact on current use (e.g. agriculture; recreational use etc.).	☐	☐
<u>Criteria for Hydro Power Plants</u>			
The following criteria apply to small to medium sized hydropower facilities of less than 20MW installed capacity. If they require a large dam (as defined by the World Bank Safeguards Policy on Large Dams) and create a large reservoir, a detailed ecological survey should be carried out to determine impact on habitat. For facilities larger than 20MW the recommendations of the International Commission on Large Dams (ICOLD) on dam safety are to be applied and the WB Safeguard Policy 'Safety of Dams' applies. Larger dams will require a full international-standard Environmental and Social Impact Assessment.			
1	**Minimum Water Flow**		
	The Facility is designed and constructed to guarantee the minimum flow required for river to sustain the existing environment.	☐	☐
2	**Water Quality**		
	The facility has a minimal impact on water quality in the head pond, bypassed reach and the reaches downstream of the tailrace and diversion dams / dykes.	☐	☐
3	**Existing Wildlife and Fish Populations**		
3.1	The facility has no significant impact on existing wildlife habitat and its populations. Flows in the bypassed reach and downstream of the tailrace are adequate to support aquatic and riparian species at pre-facility ranges.	☐	☐
3.2	The dam and upstream reservoir does not destroy any protected or ecologically important habitats.	☐	☐
3.3	The facility will cause only minimal (ecologically insignificant) loss of fish or fish habitat.	☐	☐
3.4	The facility preserves the ability of fish to move and migrate	☐	☐
4	**Watershed Protection**		

	The facility does not affect the integrity of the existing ecosystem either upstream or downstream of the facility.	☐	☐
5	**Associated Facilities and Project Components**		
5.1	Additional components of the facility e.g. access roads, power lines, and generation facilities have minimal impact on the riparian environment.	☐	☐
5.2	The visual impact of auxiliary project components such as water collection channels and their service roads will be minimised by ensuring the buildings and structures blend into the existing environment.	☐	☐
6	**Recreation**		
	Access to the water remains unchanged by the facility and accommodates recreational activities on the river.	☐	☐
7	**Use of the River**		
	The facility does not stop or limit local use of the river to provide a livelihood, i.e. by fishing, as a leisure amenity or as a source for irrigation.	☐	☐
8	**Dam Safety**		
	Dam Safety has been checked as part of the technical appraisal of the project, and was found to meet national and industry standards.	☐	☐
9	**Construction**		
	Project construction (dam plus all associated facilities) is in compliance with the WB Environment, Health and Safety General Guidelines (2007).	☐	☐
Criteria for Geothermal Power Plants			
1	**Environment, Health and Safety Requirements**		
	The project complies with the requirements as set out in the WB Environmental, Health and Safety Guidelines for Geothermal Power Generation (2007).	☐	☐

<u>Criteria for Biomass Power Plants</u>			
1	**Requirements for <u>Biomass Gasification</u>**		
	The project complies with the design, risk and safety requirements as set out in the (EU) Guideline for safe and eco-friendly biomass gasification, 'Gasification Guide'; EU ALTENER Deliverable D18	☐	☐
2	**Requirements for <u>Biomass Combustion</u>**		
2.1	Combustion of waste (solid non-hazardous, cellulosic waste material that is segregated from other waste materials; this includes forestry and agricultural waste): • Consists entirely of segregated, non-hazardous materials not suitable for re-use.	☐	☐
2.2	Combustion of energy crops (organic material from a plant that is grown for the purpose of being used to produce electricity): • Production of energy crops does not adversely affect natural habitats and protected areas and is carried out in areas with no potential for higher-value agricultural crops. Energy crop production is in compliance with national law and regional plans.	☐	☐
2.3	Combustion emissions comply with national emission limits.	☐	☐
2.4	Solid combustion waste is disposed of safely and accordance with national waste disposal regulations.	☐	☐
3	**Requirements for Power Generation based on <u>Anaerobic Digestion</u> of Biomass (biogas; landfill gas)**		
3.1	Anaerobic digesters meet all public and occupational safety regulations.		
3.2	Feedstock material is not contaminated by significant amounts of physical contaminants (which can affect the digester and which will have to be disposed off).		

ANNEX B: Type-1 Project Assessment Report Table of Contents

*: System distribution and utilization costs (see: EMRA) and anti-damping & supervisory document costs (see: Official Gazette) are also taken into account.

Annex C: Type 2 & 3 Feasibility Study Table of Contents (with Procurement Documents)

<u>Solar:</u>

Introduction and Scope of the Project
Executive Summary

1. Overview of Solar Energy Sector
    - 1.1. Licensed Electricity Generation
    - 1.2. Unlicensed Electricity Generation
        - 1.2.1. Unlicensed Generation Procedure
    - 1.3. Renewable Energy Resource Zones (RERZs)
2. Beneficiary Information
3. Feasibility Study
    - 3.1. Site Assessment
        - 3.1.1. Site Characteristics
        - 3.1.2. Electrical Connection Accessibility
        - 3.1.3. Site Ownership
        - 3.1.4. Site Accessibility
        - 3.1.5. Water Availability
        - 3.1.6. Geotechnical Studies
        - 3.1.7. Availability of Work Force
    - 3.2. Technical Details and Options
        - 3.2.1. PV Panel Technology
        - 3.2.2. Inverter Technology
        - 3.2.3. Mounting Structure
    - 3.3. Options Comparison
        - 3.3.1. Electricity Generation Values
        - 3.3.2. Economical Evaluation (LCOE)
    - 3.4. System Design
        - 3.4.1. Energy Yield Predictions
    - 3.5. Financial Appraisals
        - 3.5.1. Assumptions
            - 3.5.1.1. CAPEX & Bill of Materials*
            - 3.5.1.2. OPEX
        - 3.5.2. Modelling
        - 3.5.3. Results
        - 3.5.4. Analysis
        - 3.5.5. LCOE Scenarios: Base, Best & Worst Cases
4. Environmental Indicators

    Annex A: Procurement Documents (for Type-3)
    Annex B: Project Details and Financial Results
    Annex C: Monthly/Yearly Cash Flow Tables and Graphs
    Annex D: Permits
    Annex E: Other Technical Details

*: System distribution and utilization costs (see: EMRA) and anti-damping & supervisory document costs (see: Official Gazette) are also taken into account.

Wind:

Introduction and Scope of the Project
Executive Summary

1. Overview of Wind Energy Sector
    1.1. Licensed Electricity Generation
    1.2. Unlicensed Electricity Generation
        1.2.1. Unlicensed Generation Procedure
    1.3. Renewable Energy Resource Zones (RERZs)
2. Beneficiary Information
3. Feasibility Study
    3.1. Site Assessment
        3.1.1. Site Characteristics
        3.1.2. Wind Data Analysis
        3.1.3. Electrical Connection Accessibility
        3.1.4. Site Ownership
        3.1.5. Site Accessibility
        3.1.6. Geotechnical Studies
    3.2. Technical Details and Options
        3.2.1. Turbine Technology
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        3.3.2. Economical Evaluation
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        3.5.1. Assumptions
            3.5.1.1. CAPEX & Bill of Materials*
            3.5.1.2. OPEX
        3.5.2. Modelling
        3.5.3. Results
        3.5.4. Analysis
4. LCOE Scenarios: Base, Best & Worst Cases Environmental Indicators

Annex A: Procurement Documents (for Type-3)
Annex B: Project Details and Financial Results
Annex C: Monthly/Yearly Cash Flow Tables and Graphs
Annex D: Permits
Annex E: Other Technical Details

*: System distribution and utilization costs (see: EMRA) and anti-damping & supervisory document costs (see: Official Gazette) are also taken into account.

Biomass / Biogas / Landfill:

Introduction and Scope of the Project
Executive Summary

1. Overview of Biomass Energy Sector
    - 1.1. Licensed Electricity Generation
    - 1.2. Unlicensed Electricity Generation
        - 1.2.1. Unlicensed Generation Procedure
2. Beneficiary Information
3. Feasibility Study
    - 3.1. Resource Assessment
        - 3.1.1. Resource Characteristics & Availability
        - 3.1.2. Electrical Connection Accessibility
        - 3.1.3. Site Ownership
        - 3.1.4. Site Accessibility
        - 3.1.5. Availability of Work Force
        - 3.1.6. Biomass Supply Chain
    - 3.2. Technical Details and Options
        - 3.2.1. Plant Technology
        - 3.2.2. System Equipment
        - 3.2.3. System Design
    - 3.3. Options Comparison
        - 3.3.1. Electricity Generation Values
        - 3.3.2. Economical Evaluation
    - 3.4. Energy Yield Predictions
    - 3.5. Financial Appraisals
        - 3.5.1. Assumptions
            - 3.5.1.1. CAPEX & Bill of Materials*
            - 3.5.1.2. OPEX
        - 3.5.2. Modelling
        - 3.5.3. Results
        - 3.5.4. Analysis
4. LCOE Scenarios: Base, Best & Worst Cases Environmental Indicators

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*: System distribution and utilization costs (see: EMRA) and anti-damping & supervisory document costs (see: Official Gazette) are also taken into account.

Annex D: Details of Type 1, 2 & 3 Reports

All Types of Reports shall include the following:

For Solar PV:

- Annual (Jan-Dec) irradiation durations by hours;
- Annual (Jan-Dec) Daily global irradiation values kwh/m^2;
- Information on the direction of the module installation (whether it will be mono-directional or bi-directional, and fixed or adjustable) and its impact on performance efficiency;

For All Kinds of RES Plants:

- CAPEX Table including data on costs of PV modules/turbines/blades etc., installation, construction, inverter, mounting materials, cables, transformer, DC boxes etc.;
- Risks that can be encountered for power plants that are at the stage of either pre-licencing or reception of call letters before licensing/connection agreement phase

Type 2 & 3 Feasibility Reports:

The following Tables are samples for PV plants but the PC is expected to adapt these to other kinds of RES plants.

Assumptions Table

Site Location
Number of Shareholder (if any) (person)
DC Power per shareholder (kWp per person)
Specific Yield (kWh per KWp)
Annual Net Production (kWh per KWp)
Annual (Jan-Dec) irradiation durations by hours
Annual (Jan-Dec) Daily global irradiation values kwh/m2
DC Installed Capacity (kWp)
Grid AC Installed Capacity (kWe)
DC/AC Ratio
Installation Area (sqm)
PV System Durability (years)
USD/Euro Parity
FiT for 10 Years (USD/kWh)
Residential electric fee (TL/kWh)
USD Forex Selling Rate (TL)
USD Forex Date
FiT duration (years)
Panel Degradation (per year)
Corporate Tax Rate (%)
VAT (%)
Depreciation year (years)
Monthly self-consumption (kWh/month)
Annual self-consumption (USD/TL/year)
Annual system usage fee for unlicenced PV (kr/kWh)

Table for CAPEX Plant Cost $ per kwP

Electromechanical materials (all equipment breakdown must be provided)
Energy Transmission Overline
Excavation for construction
Land Costs
Commissioning
Initial Costs
Total System Cost
Total CAPEX
Project Development (Excavation, Land Costs, Initial Costs)
Credit-Based CAPEX

Table for OPEX Cost Assumption $ per kWp/per year

Operation period
Insurance
Salary
Maintenance and Cleaning
Self-consumption
General office costs
Grid fee
Total

Table for Financial Data

Credit-based CAPEX $
Equity % of CAPEX
Debt % of CAPEX
Credit-based amount of equity $
Total amount of debt $
Total amount of debt re-payment $
Personal amount of equity ($/person)
Personal amount of debt ($/person)
Debt Amortization years
Estimated Interest Rate on Debt %
Financing Period years

Graph and Table on Cash Flow TL/Years
Graph and Table on Cumulative Flow TL/Years
Graph and Table on Dividend TL/Years

Profit and Loss Table by years

Annual energy production kWh
Annual amount of self-consumption kWh
Annual bill-based production kWh
Annual income
Annual cost
EBITDA (Earnings before interest, taxes, depreciation and amortization)
Depreciation cost
EBIT (Earnings before interest and taxes)
Interest repayment
Principal repayment
Total loan repayment
Corporate tax limit
Total tax
Net operation income
DSCR (Debt Service Coverage Ratio)
Cash flow
Cumulative cash
Net profit
Annual amount to be paid to dividends TL
Annual self-consumption TL
IRR Project %
IRR Equity %
ROI year

Taking into consideration the above mentioned assumptions and CAPEX/OPEX/Financial Tables, LCOE shall be calculated for base, best and worst case scenarios to see if it still remains under the FIT revenues after taxes and costs for the first 10 years of operation. For the remaining years of operation, PC shall determine an assumption methodology to foresee revenues.

According to IRENA, The formula used for calculating the LCOE of renewable energy technologies is:

$$\text{LCOE} = \frac{\sum_{t=1}^{n} \frac{I_t + M_t + F_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+r)^t}}$$

Where:
LCOE = the average lifetime levelised cost of electricity generation;
It = investment expenditures in the year t;
Mt = operations and maintenance expenditures in the year t;
Ft = fuel expenditures in the year t;
Et = electricity generation in the year t;
r = discount rate; and
n = economic life of the system.

"Levelized Cost of Energy*: *An analysis based on nominal values with specific inflation assumptions for each of the cost components is beyond the scope of this analysis. Project developers will develop their own specific cash-flow models to identify the profitability of a project from their perspective.*

The LCOE of renewable energy technologies varies by technology, country and project based on the renewable energy resource, capital and operating costs, and the efficiency / performance of the technology. The approach used in the analysis presented here is based on a discounted cash flow (DCF) analysis. This method of calculating the cost of renewable energy technologies is based on discounting financial flows (annual, quarterly or monthly) to a common basis, taking into consideration the time value of money. Given the capital intensive nature of most renewable power generation technologies and the fact that fuel costs are low, or often zero, the weighted average cost of capital (WACC), often also referred to as the discount rate, used to evaluate the project has a critical impact on the LCOE.

There are many potential trade-offs to be considered when developing an LCOE modelling approach. The approach taken here is relatively simplistic, given the fact that the model needs to be applied to a wide range of technologies in different countries and regions. However, this has the additional advantage that the analysis is transparent and easy to understand. In addition, more detailed LCOE analyses result in a significantly higher overhead in terms of the granularity of assumptions required. This often gives the impression of greater accuracy, but when it is not possible to robustly populate the model with assumptions, or to differentiate assumptions based on real world data, then the "accuracy" of the approach can be misleading." (IRENA: 2012)

***: Source:** *IRENA, Renewable Energy Technologies: Cost Analysis Series. June 2012, Solar Photovoltaics Volume 1: Power Sector Issue 4/5*

Type 3 Procurement Documents:

In addition to all of the above, Type 3 reports shall include Procurement Documents containing the following:

- **Technical Specifications Report:** Project Design, Products and Equipment List with Technical Specifications (Functional or Specific Features) with cost-estimation
- **Market Research Report:** containing prices, brands and product catalogues by suppliers to ensure that all products and equipment listed in Technical Specifications Report can be supplied from the countries listed as eligible by the EU's PRAG Guidelines (production location is sufficient for eligibility) and to make a cost-estimation for budgeting
- **List of all permits, studies (EPC work/owner's engineering) and bureaucratic procedures** to be conducted by the Supplier/Contractor (F.e.: TEDAS Approval, EIA Report, Ground Examination Study, Connection Agreement etc.), man/day and cost-estimation to be provided for all studies and cost-estimation for permission fees
- **Ancillary Services Report:** list of ancillary services for commissioning, installation, operation and maintenance including man/day and indicative cost-estimation with a budget breakdown