Sustainable Integration of Renewable Energy Sources (solar PV) with SEC Distribution Network Low Voltage and Medium Voltage

Guidelines for Consumers, Consultants and Contractors to connect a small-scale solar PV system to SEC distribution networks

Version 3

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1 SCOPE

These Guidelines provide information meant for KSA Consumers, Consultants and Contractors on the essential aspects which have to be taken into consideration in order to connect a Small-Scale Solar PV System to the Low Voltage or Medium Voltage Distribution Network of SEC.
These Guidelines apply to the planning, execution, modification, operation and maintenance of the Small-Scale Solar PV Systems. These Guidelines comply with the Small-Scale Solar PV Systems Regulations - Electricity & Cogeneration Regulatory Authority (ECRA) – ERD-TA-012 (V02/19) (hereinafter referred to as "ECRA Regulations") that set out the regulatory framework for the connection of a Small-Scale Solar PV Systems to the Distribution System of SEC.
This document contains basic principles of small scale solar PV system along with the illustration of the connection process as per SEC specific conditions. Thus, this guide shall serve as a basis for SEC and for the Consumer or its appointed agent in the planning and decision-making process at all applicable stages.
The technical aspects are not treated here, but separately in the Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks of SEC (in this document referred to as "Technical Standards"), which represents the main reference document for the definition of the requirements that these generating facilities have to comply with in order to be connected to the Distribution Network.
The Annexes provide the Consumers and Consultants / Contractors with a template of the Initial Application Form, and instructions about the information and the documentation of the Solar PV system that shall be submitted at each stage of the connection process.

1.1 Notice to users

This document is for use of employees of SEC, Consumers, Consultants and Contractors. Users of this guideline should consult all applicable laws and regulations. Users are responsible for observing or referring to the applicable regulatory requirements. SEC does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.
Users should be aware that this document may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. These Standards at any point in time consist of the current edition of the document together with any amendments, corrigenda, or errata then in effect. All users should ensure that they have the latest edition of this document, uploaded on SEC website.
Finally, the user shall refer to Saudi Building Code – Section 401 - Chapter 712, as well as to applicable SASO Standards or International Standards mentioned in these SEC documents, unless differently indicated in other SEC documents related to Small-Scale Solar PV Systems Regulations.

2 REFERENCES

[1] Small-Scale Solar PV Systems Regulations - Electricity & Cogeneration Regulatory Authority (ECRA) – ERD-TA-012 (v.02/19)
[2] Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks of SEC
[3] The Saudi Building Code Electrical Requirements (SBC401) – 2007
[4] Inspection and Testing Guidelines
[5] Inspection and Testing Checklists
[6] Safety related to the installation of rooftop solar PV systems

[7] PV on buildings and safety
[8] Best Practice for Designing a PV system
[9] Manual for the Maintenance of the PV Systems
[10] Technical Assessment Guidelines

3 COMPANION DOCUMENTS

The documents listed hereinafter have to be considered a compendium of the current document. Therefore, they should be carefully read in addition to this.

a) Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks of SEC
b) Inspection and Testing Guidelines
c) Inspection and Testing Checklists
d) Safety related to the installation of the Solar PV systems
e) PV on buildings and safety
f) Best practice for designing a PV system
g) Manual for the maintenance of the Solar PV Systems

4 TERMS AND DEFINITIONS

Building-Attached Photovoltaic Modules (BAPV modules) – Photovoltaic modules are considered to be building-attached, if the PV modules are mounted on a building envelope and the integrity of the building functionality is independent of the existence of a building-attached photovoltaic module.
Building Attached Photovoltaic system (BAPV system) – Photovoltaic systems are considered to be building attached, if the PV modules they utilize do not fulfil the criteria for BIPV modules.
Building-Integrated Photovoltaic modules (BIPV modules) – Photovoltaic modules are considered to be building-integrated, if the PV modules form a construction product providing a function. Thus, the BIPV module is a prerequisite for the integrity of the building's functionality. If the integrated PV module is dismounted (in the case of structurally bonded modules, dismounting includes the adjacent construction product), the PV module would have to be replaced by an appropriate construction product.
Building-Integrated Photovoltaic system (BIPV system) – Photovoltaic systems are considered to be building-integrated, if the PV modules they utilize fulfil the criteria for BIPV modules.
Consultant / Contractor - An entity that is registered with Habilitation Committee (Qualification Committee) to carry out design and Electrical Installations work specific to solar photovoltaic (PV) systems as a consultant or contractor.
Exit/Connection Point - The joint point of delivery of electricity supply by SEC & export of surplus generation by Eligible Consumer linked to one single meter in a Premises.
Data sheet – Basic product description and specification (Note: Typically, one or two pages, not a full product manual).
Eligible Consumer/Consumer – A person who has an Exit Point that meets the requirements of these Regulations and the Connection Conditions between the Distribution System and the Consumer's Premises as defined in the Distribution Code.
Global horizontal irradiance (GHI) – Direct plus diffuse irradiance incident on a horizontal surface expressed in W/m^2.
Inspection – Examination of an electrical installation using all the senses in order to ascertain correct selection and proper erection of electrical equipment.

In-plane irradiance (Gi or POA) – The sum of direct, diffuse, and ground-reflected irradiance incident upon an inclined surface parallel to the plane of the modules in the PV array, also known as plane-of-array (POA) irradiance. It is expressed in W/m^2.
Interface Protection (IP) - The electrical protection required to ensure that either the generating plant and/or any generating unit is disconnected for any event that could impair the integrity or degrade the safety and reliability of the distribution network.
Inverter – Electric energy converter that changes direct electric current to single-phase or polyphase alternating current.
Irradiance (G) – Incident flux of radiant power per unit area expressed in W/m^2.
Irradiation (H) – Irradiance integrated over a specified time interval expressed in kWh/m^2.
Net billing: Energy exchange and financial clearance arrangements between a consumer & a distribution service provider at one exit point in facility.
PV array – Assembly of electrically interconnected PV modules, PV strings or PV sub-arrays.
PV cell – Most elementary device that exhibits the photovoltaic effect, i.e. the direct non-thermal conversion of radiant energy into electrical energy.
PV module – PV modules consists of electrically connected PV cells and packaged to protect it from the environment and the users from electrical shock.
PV string – PV string consists of two or more series-connected PV modules.
PV string combiner box – Junction box where PV strings are connected which may also contain overcurrent protection devices, electronics and/or switch-disconnectors.
PV sub-array – A subset of a PV array formed by parallel-connected PV strings.
Standard test conditions (STC) – Reference values of in-plane irradiance (1 000 W/m^2), PV cell junction temperature (25 °C), and the reference spectral irradiance defined in SASO IEC 60904-3.
Switch – Mechanical device capable of making, carrying and breaking currents in normal circuit conditions and, when specified, in given operating overload conditions. In addition, it is able to carry, for a specified time, currents under specified abnormal circuit conditions, such as short-circuit conditions.
Testing – Implementation of measures in an electrical installation by means of which its effectiveness is proved (Note: It includes ascertaining values by means of appropriate measuring instruments, said values not being detectable by inspection).
The computer program – It is an electronic calculator to analyze the financial aspects hosted by ECRA on its website. The calculator will carry out an economic feasibility study to calculate the cost of installing small solar PV systems, and estimate revenue and savings based on the energy produced from the solar system and the Consumer's consumption rates. Also indicate the expected time period for cost recovery, and includes information and data necessary to educate the consumer.
Verification – All measures by means of which compliance of the electrical installation to the relevant standards are checked

5 GLOSSARY

The following acronyms and symbols are used throughout the document:

AC	Alternating Current
AFCI	Arc Fault Circuit Interrupter
ASTM	American Society for Testing and Materials
BAPV	Building-Attached Photovoltaic Modules
BIPV	Building-Integrated Photovoltaic modules
DC	Direct Current
ECRA	Electricity and Co-Generation Regulatory Authority
GHI	Global horizontal irradiance
IEC	International Electrotechnical Commission
IP (or I.P.)	Interface Protection
IR	Infrared
ISO	International Organization for Standardization
MPPT	Maximum Power Point Tracker
NEC	National Electrical Code
NFPA	National Fire Protection Association
P	Active power
PELV	Protected Extra Low Voltage
Pnom	Nominal active power of equipment
POA	Plane of Array
PPE	Personal protective equipment
PR	Performance Ratio
PV	(Solar) Photovoltaic
Q	Reactive Power
RCD	Residual Current Device
S/Sn	Apparent Power
SASO	Saudi Standards, Metrology and Quality Organization
SBC	Saudi Building Code
SEC	Saudi Electricity Company
SELV	Safety extra low voltage
SPD	Surge Protection Device
SR	Soiling Ratio
STC	Standard Test Condition
UL	Underwriters Laboratories
UV	Ultraviolet
V	Voltage
Vnom	Nominal Voltage
Wp	Watt peak rating

6 SOLAR PV SYSTEMS – BENEFITS, TECHNOLOGY, ENVIRONMENT

6.1 The sun as an energy source

Every day we receive from the Sun thousands of times the energy we consume but the solar energy is distributed on the Earth's surface, and thus large collection surfaces are required to exploit it.
Furthermore, if we consider a given area, the sun energy is discontinuous, mainly for the following reasons:

- Variability during the day from sunrise to sunset and complete absence in the night periods
- Seasonal variations
- Meteorological conditions (clouds, fog, sandstorms, etc.)

The daily variability is due to the Earth rotation, which is the spinning of the Earth around its own axis. One rotation takes 24 hours and is called a solar day.

The seasonal variation is due to the orbit of the Earth around the sun, is called Earth revolution and takes 365 1/4 days to complete one cycle. The Earth's orbit around the sun is elliptical, thus the Earth's distance from the Sun varies at different times of the year.

Outside the Earth atmosphere, the solar irradiation has an average value of 1367 W/m^2 ±3%, called Solar constant. The variation of ±3% is due to the seasonal variation of the Earth's distance from the Sun.

From Figure 1, we can understand the effect of the Earth atmosphere on incoming solar radiation :

- A portion of the solar energy arrives directly to the ground (Beam or Direct radiation)
- A portion is diffused due to cloud and water molecules present in the atmosphere (Diffused radiation)
- The remaining portion is lost by reflection and absorption by various constituents of atmosphere

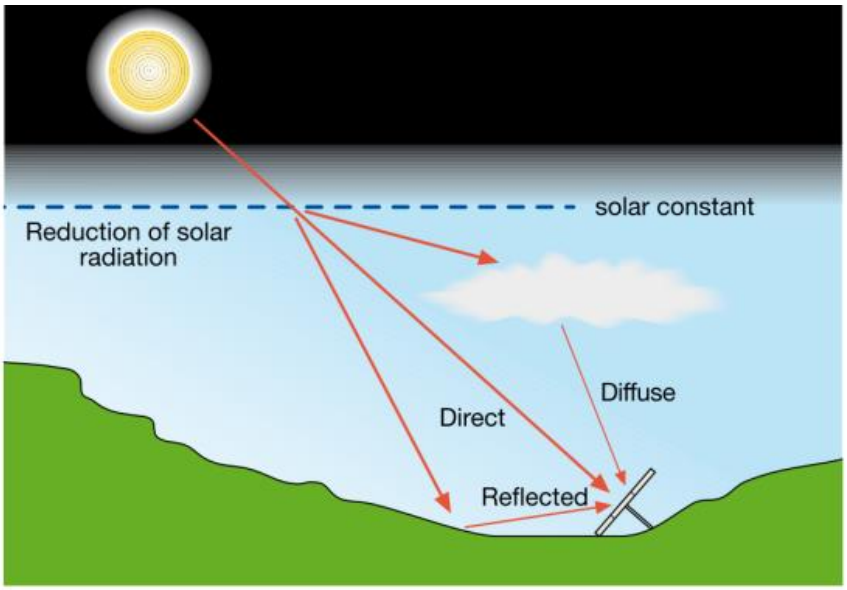

Figure 1 – Effect of the atmosphere on the sunlight

As a consequence, the trend of the solar radiation received at the ground level is partially unpredictable, because it depends on the local weather conditions. However, if we consider historical data collected by meteorological stations it is possible to have time-averaged data on an hourly interval for daily or monthly or yearly basis. Figure 2 shows average annual solar radiation received in KSA referred from Solargis database, a third-party service meteo data service provider.

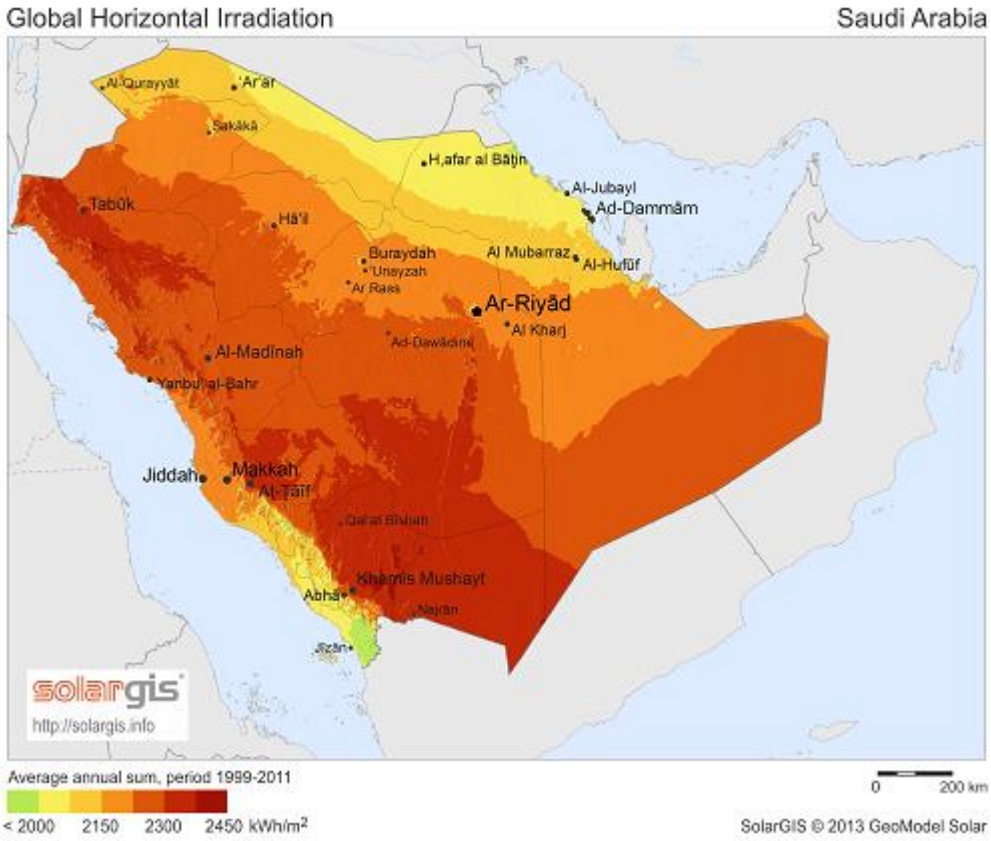

Figure 2 – Example of a yearly solar map for the Saudi Arabia

There are several databases on solar radiation and climate data that cover all the world or specific regions. In the Kingdom of Saudi Arabia, it is possible to refer to the monitoring network developed by the King Abdullah City for Atomic and Renewable Energy (K.A.CARE).

The solar databases contain the Global horizontal, Direct solar radiation and the Diffuse solar radiation on a horizontal surface expressed in kWh/m^{2}day. These data are normally available on hourly interval for daily, monthly and on a yearly basis or as a long-term average.

6.2 The PV Technology

The solar photovoltaic (PV) technology is undoubtedly the easiest way to produce electric energy from sunlight. It can be used for many purposes in households and in all sectors that need power as commercial activities, factories, office buildings and many others.
Solar systems are based on devices that transform sunlight into electricity, the PV cells, which perform the photovoltaic conversion. PV cells are composed of semiconductors purposely designed to be exposed to the sun light and collect as much energy as possible. Not surprisingly their shape is thin and wide.

The most widely used PV cells are made up of crystalline silicon (mono or poly-crystalline), whose shape is normally square or a pseudo square with edges trimmed, as the example in Figure 3, and whose thickness usually is no more than 0.2 mm. Solar cells are therefore very fragile and must be purposely protected in a rigid structure, namely a PV module, where a number of PV cells is assembled and connected together in a single body with a transparent front glass.

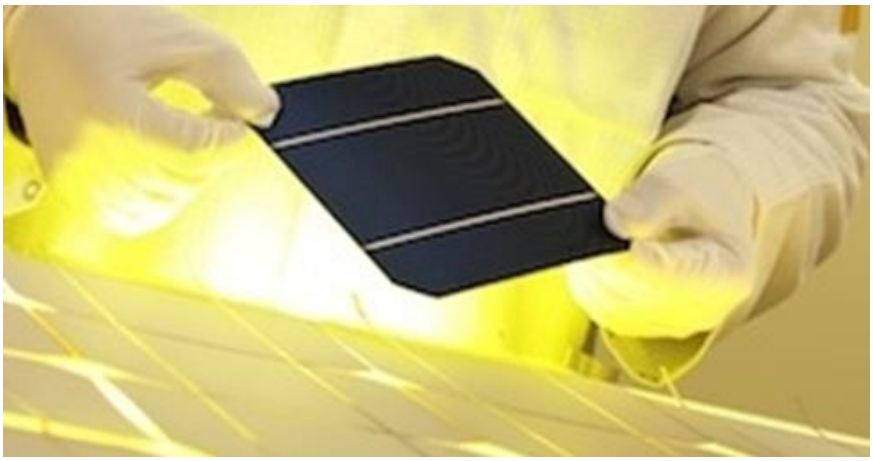

Figure 3 – Examples of a crystalline PV cell

The structure of a PV module resembles sandwich, because many layers tightly packed are necessary to protect the PV cells and give the necessary mechanical and electrical characteristics (see Figure 4).

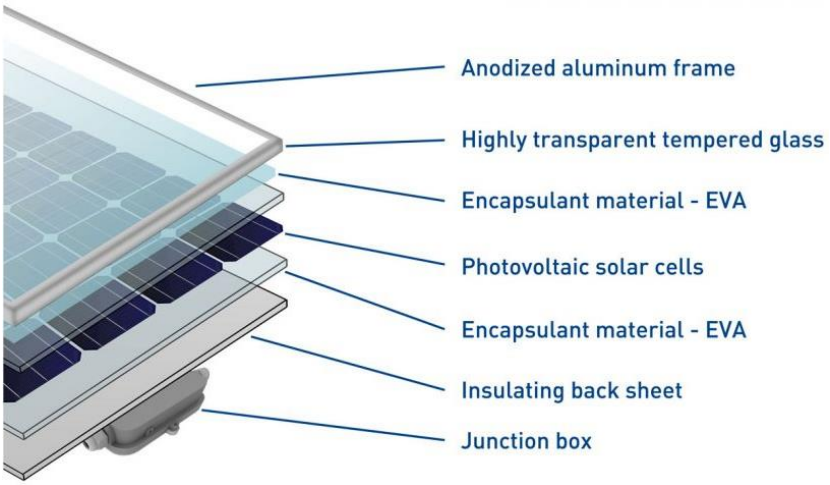

Figure 4 – Typical structure of a PV module

Presently the crystalline silicon PV modules available in the market has a nominal power typically in the range of 300Wp to 400Wp (sometimes more than 400 Wp), measured at specific irradiance and temperature called as Standard Test Conditions or STC (1000 W/m^2, 25 °C, AM 1.5).

Although the crystalline PV technology is the most widely used, there are also other technologies that are based on the deposition of a thin layer of semiconductor on a front glass. The resulting thickness of this deposit is a few µm and for this reason the resulting products are called Thin-film PV modules. Commercially available thin film PV modules technologies use CdTe (Cadmium Telluride), CIS (Copper Indium Selenide) or CIGS modules (Copper Indium Gallium Selenide) or Amorphous silicon can be used.

The higher costs of these expensive materials are largely compensated by the much lower quantities needed to obtain the photovoltaic conversion. Conversely, the efficiency of thin film technology modules is normally lower than their silicon wafer-based crystalline counterpart (except CdTe technologies, which has similar efficiency level as that of Crystalline Silicon).

Recent technology developments have led to bi-facial PV modules. These convert light captured on both the front and back side of the module into electrical power and can therefore (substantially) increase the electric yield of PV power plants depending on the specifics of the installation. The additional yield for bi-facial power plants depends on the tilt, height, and spacing of the modules, as well as the reflectivity of the ground: e.g. white foil, different soils or vegetation. (further details available in "Best practice for designing a PV system" document)

6.3 PV systems

PV modules are mechanically assembled and electrically connected is series and parallel to form a PV array. The PV array provides all the power coming from the solar conversion, but we cannot use it directly since it generates DC electricity which is not directly compatible with the electric appliances and the electric grid as these are based on AC electricity.

The DC power coming from the PV array is thus converted to AC power to be fully compatible with the public distribution networks. This function is operated by means of specific electronic equipment called Inverter. The inverter performs several functions: mainly it optimizes the electrical operation of the PV array and transforms the DC power into AC power that can be used by the electric appliances or injected into the distribution network when necessary.

Figure 5 shows the general configuration of a Small-Scale Solar PV System. Beside the inverter there are other equipment aimed to safeguard the distribution network (Interface Protection - IP), to measure the energy produced and exchanged with the distribution network (Meters) and to sort the power (AC switchgear). Such PV systems are called *Grid-connected PV systems* or *Grid-tied PV systems*.

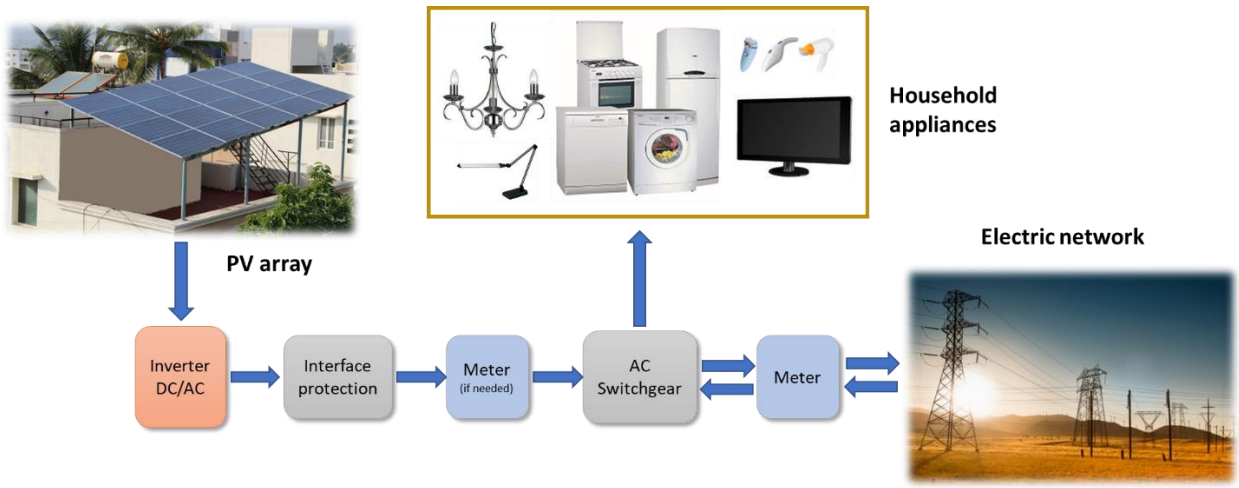

Figure 5 – General configuration of a Small-Scale Solar PV System

The environmental benefits of a grid-connected PV system are evident:

- The energy produced is 100% renewable and comes from the sun
- The plant does not produce any pollutant

- The energy produced can fully replace energy generated through fossil fuels, thus reduces emissions of pollutants and in particular greenhouse gasses in the atmosphere

Recent technology developments have led to bi-facial PV modules. These convert light captured on both the front and back side of the module into electrical power and can therefore (substantially) increase the electric yield of PV power plants depending on the specifics of the installation. The additional yield for bi-facial power plants depends on the tilt, height, and spacing of the modules, as well as the reflectivity of the ground: e.g. white foil, different soils or vegetation.

6.4 Net billing benefits

It has been illustrated that grid-connected PV systems converts solar irradiation coming from the sun to make it available for consumption using the grid. This power changes during the day, normally it reaches a maximum at noon and is zero from sunset to dawn. The production is also influenced by a seasonal variation.

However, from a technical point of view, shortfall between solar PV production and internal consumption may be easily managed by the presence of the public grid. When the solar PV production exceeds the internal consumption, the difference is sent to the distribution network and, conversely, when the solar PV production is less than consumption or is null (evening, night) the difference is taken from the distribution network.

Therefore, at the end of a billing cycle the energy meter at the Connection Point registers an amount of kWh that has been taken from the distribution network and an amount of kWh that has been injected to the distribution network. The net billing mechanism in its simplest version makes the monetary difference between input and output. In case of any surplus energy produced by the solar PV system and injected to the grid, a financial valuation will take place and the amount will be transferred and deducted from the next billing cycle.

6.5 Solar PV systems fit for everyone

The possibilities offered by Small-Scale Solar PV Systems are countless. A few examples are shown in

Figure 6. Sizes range from 1 kW to 2 MW and, depending on the rooftop and the area available, PV systems may have simple flat rooftop structures or canopies where PV modules are also used to create shading from sunshine. Other possibilities are represented by sloped roofs, sheds or facades.
Furthermore, especially in new buildings, Building Integrated PV (BIPV) represent an excellent use of this technology and allow achieving results of great aesthetic impact.

Figure 6 – Examples of PV installations

7 CONNECTION PROCESS OF A SMALL-SCALE SOLAR PV SYSTEM

7.1 Overview

According to

Figure 7, the overall connection process involving the Consumer and SEC is divided into three main stages, namely:

- Selection of Solar PV Contractor / Consultant
- Solar PV Initial Enquiry
- Economic Feasibility of Installing A Small Solar PV System
- Design Evaluation and Approval
- Inspection and Energization

Figure 7 – Solar PV connection process overview

From the point the consumer selects the Consultant / Contractor the complete process is shown in

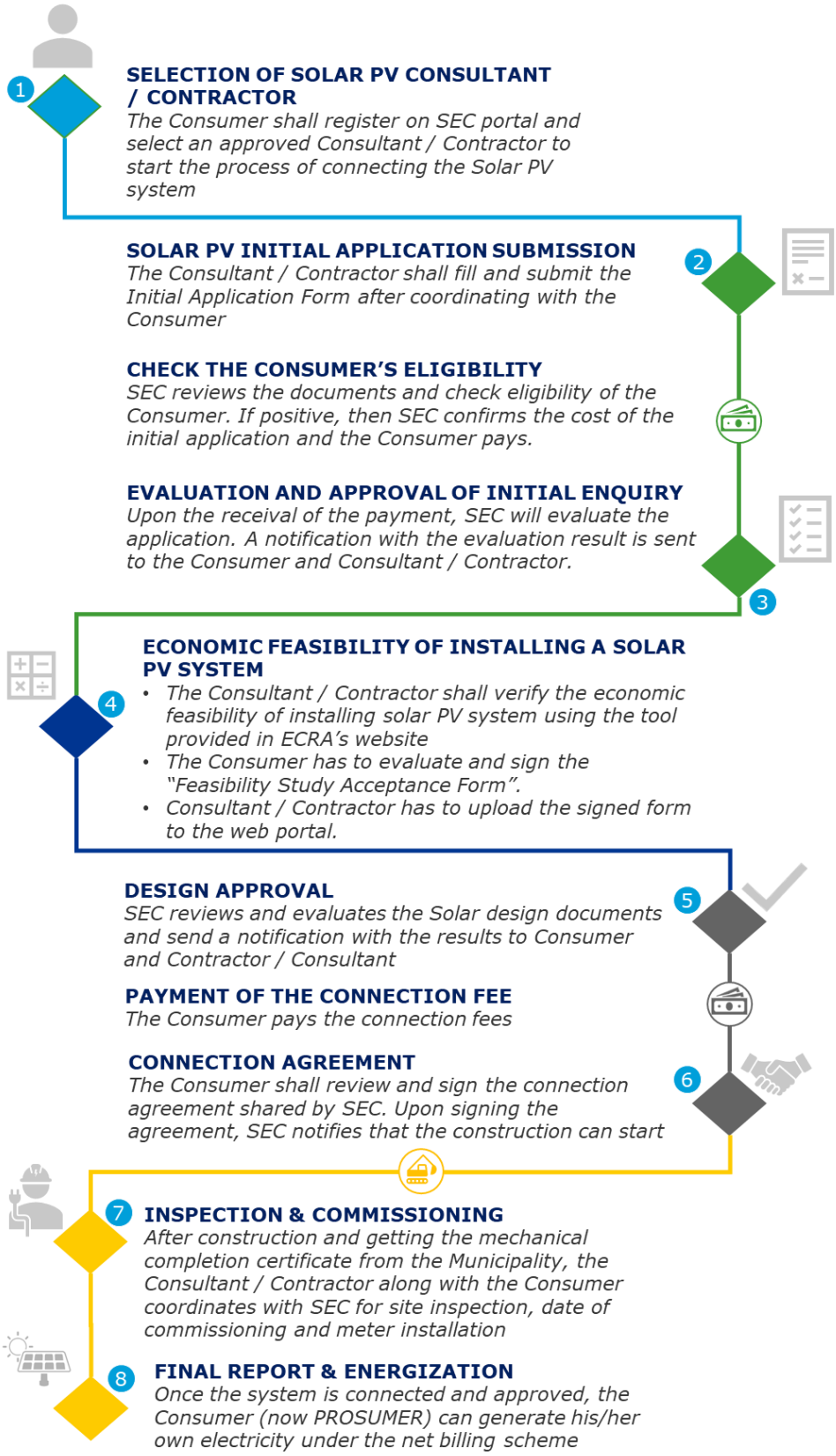

Figure 8.

The Consumer starts and completes the connection process via the Solar PV Web Portal. The web portal also provides the Consumer, as well as the Consultants / Contractors, with the information and the documents required going through each step of the process, and in particular:

- Safety recommendations for the designing and installation of the PV system.
- Guidelines and Checklists to carry out the inspection and testing in the frame of the Site Test and of the Commissioning Test, as it is required by the ECRA Regulations.

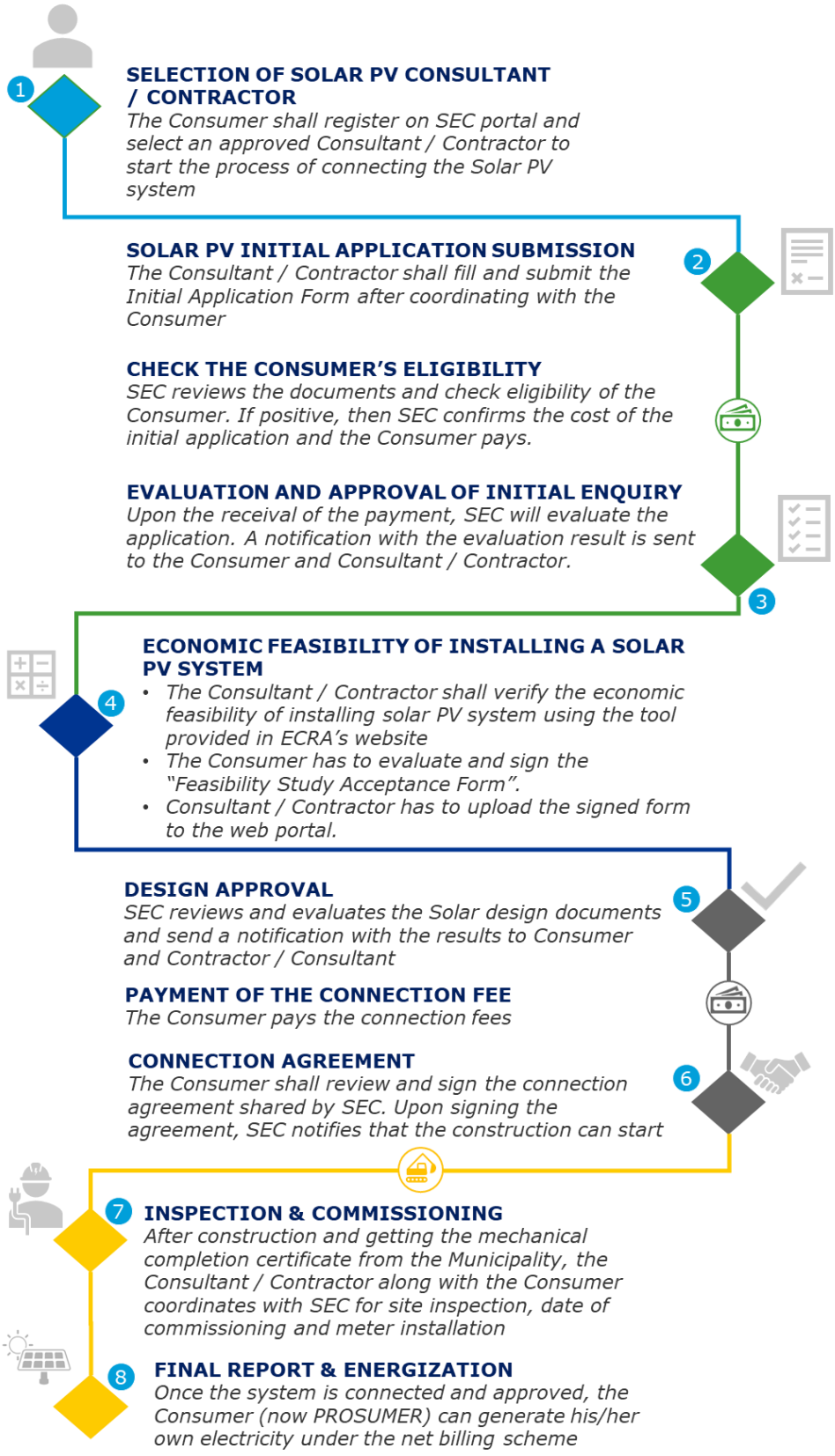

Figure 8 – Solar PV Connection stages for the Consumer

7.2 Connection process details

The details of the steps indicated in

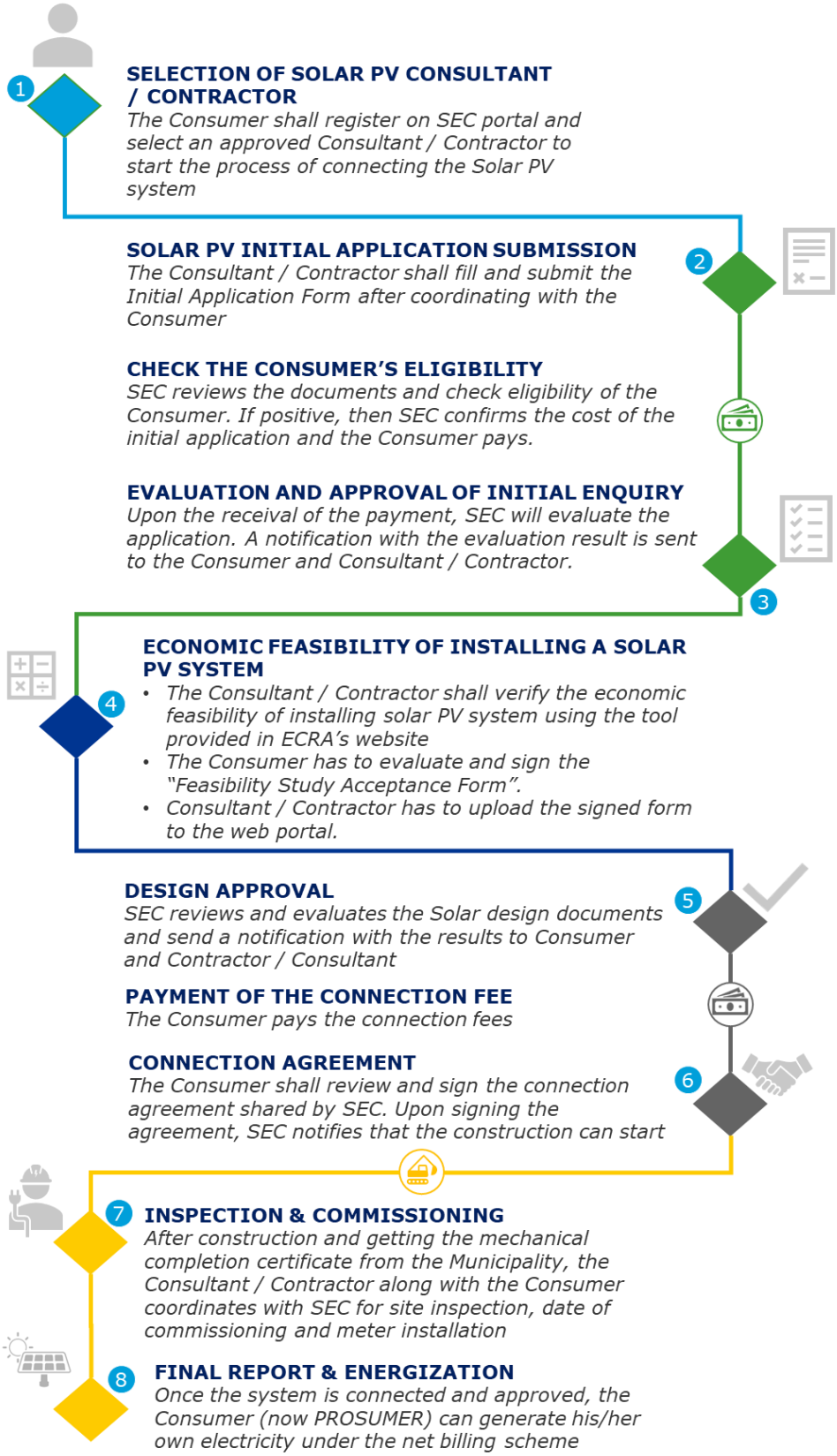

Figure 8 are described hereinafter.

7.2.1 Selection of the Consultant / Contractor

The Consumer shall register on the SEC website then select one of the approved Consultant/Contractor from the list available in SEC's web portal (provided by the Habilitation/Qualification Committee). This represents the first step in the process.

7.2.2 Request the source of supply and transformer capacity

The selected Consultant / Contractor logs into the SEC web portal and selects the received request from the Consumer. The consultant/Contractor requests SEC through the portal to provide the Transformer capacity (KVA), Peller Number, remaining capacity to connect solar System and SEC provide the data accordingly.

7.2.3 Submission of the Solar PV initial application form

The selected Consultant/Contractor shall complete and submit the Initial Application Form "ANNEX A – SOLAR PV INITIAL APPLICATION FORM" which specifies the data and information that the Consultant / Contractor shall submit when applying.

7.2.4 Checking the consumer's eligibility

The application and the documents submitted are then reviewed by SEC in order to check the followings:

- formal errors
- inconsistencies among information and documents
- requests that are out of scope in some parts

Then the eligibility of the Consumer is checked with respect to the requirements of the ECRA Regulations. These requirements are related to the capacity of the PV system in one premise or different premises owned by the same Consumer, the Small-Scale Solar PV Systems aggregated capacity allowed in parallel with SEC with reference to the peak load of the preceding year (3%), the maximum PV capacity as a percentage of the rated capacity of the transformer from which the load of the Consumer is fed (15%). The priority of connection will be given for the residential consumers.

7.2.5 Payment of Initial inquiry fee

If the Consumer is eligible, then SEC confirms the cost of the initial application and the Consumer pays. In case of any inadequacies or missing documentation SEC will notify the Consumer and the Consultant/Contractor with the needed action.

7.2.6 Evaluation and approval of initial application

SEC shall finalize the evaluation process and notify the Consultant / Contractor and Consumer within a maximum of 20 working days from the application date of the initial application form.

The connection of a new solar PV System to the SEC distribution network can have an impact on network integrity, operation and safety. This impact must therefore be accurately assessed in advance,

by means of the Technical Assessment of the network hosting capacity, in order to be able to mitigate possible negative implications. According to the ECRA Regulations (V02/19), this Technical Assessment is mandatory in case the capacity of the PV system exceeds 50 kW.

The results are then communicated with the Consumer and Consultant / Contractor as follows:

- If the evaluation is positive, the Consumer and Consultant / Contractor receives a formal enquiry approval from SEC. The validity of this approval is 180 days (6 months) from the day of SEC's approval.
- In case of non-positive result, the Consumer and Consultant / Contractor will be notified with the reason of rejection and will be given 60 days to review and resubmit the application without extra charges.

7.2.7 Conducting the economic feasibility study

After the Solar PV initial enquiry approval, the Consultant / Contractor has to conduct a feasibility study by entering the necessary information in the computer program (available in ECRA's website) which shows the economic feasibility of installing the small solar PV system. After reviewing the results, the Consumer has to sign the "Feasibility Study Acceptance Form" provided by ECRA.

7.2.8 Applying for design evaluation and approval

When applying for the Design Evaluation and Approval the Consultant / Contractor shall upload the final design of the Small-Scale Solar PV System on SEC web portal alongside the signed feasibility study and all other needed documents. The minimum requirements for the solar PV System design depend on the size of the system and are specified in the "

ANNEX B – SOLAR PV DESIGN DOCUMENTATION REQUIREMENTS".

SEC will check the documents submitted by the Consultant / Contractor in order to assure that the final design is complete and complies with the requirements of the Technical Standards before allowing the construction of the Small-scale Solar PV system. For the benefit of SEC as well as of the Consultant / Contractor, the evaluation checklist is provided in "ANNEX C – SOLAR PV DESIGN DOCUMENTATION CHECKLIST".

If the design contains some details that conflict with SEC standards or other standards in KSA, a note is sent to the Consultant / Contractor who is asked to fix these inadequacies within a period of 30 working days. Once the modifications have been made, the design can be submitted again to SEC for further evaluation.

7.2.9 Notifying with the cost of the Connection Fee

SEC notifies the Consumer with the cost of the connection necessary to proceed with the connection process, and the means of payment.

7.2.10 Signing the Connection Agreement

After the design approval and payment of the connection fees, SEC sends a message to the Consumer that includes a link to SEC website where the Consumer is asked to sign the Connection agreement.

SEC signs two copies of the Connection agreement within ten (10) business days from the date of payment of the connection fee.

The Consumer shall selects/confirms the Consultant/Contractor from the SEC approved list to start with the solar PV Construction.

7.2.11 Conducting the Site Test

After the construction of the PV system, a Site Test is conducted by the Consultant / Contractor. The Site Test consists of the tests before the interconnection aimed to ensure that the installation and the grid connection comply with the relevant SEC standards as well as with the laws and rules in force in KSA. Its main purpose is to verify the solar PV System's connection viability.

After the Site Test, the Consultant / Contractor prepares the Site Test Report[1] and uploads all relevant documents to initiate the Inspection request.

7.2.12 Applying for Inspection by SEC

After the performing the site test of the solar PV System, the Consultant / Contractor makes the Request of inspection after uploading all the needed documents.

When applying for inspection, the Consultant / Contractor is required to upload the Declaration of Conformity * issued and signed by the Consultant / Contractor that states the following:

[1] See the *Inspection and Testing Guidelines* and the *Inspection and Testing Checklists*

- Under the Consultant / Contractor's responsibility the plant has been made in a workmanlike manner.
- The plant has been constructed according to the design documents approved by SEC and minor changes (if any) do not worsen the compatibility with the distribution network, the performances and the safety. Any minor changes are duly reported in an as-built design attached to the Declaration of Conformity.
- All the materials, components and equipment used in the solar PV System have been chosen according to the design and to the laws and rules in force in the KSA.

Besides the civil mechanical work completion letter, the Consultant / Contractor uploads the Site Test Report and the following documents as required by *ECRA Regulations*:

- Specification of the Major Equipment *
- Details of the protection arrangement and settings referred to in the Distribution Code *
- Copies of all Safety Rules and instructions applicable to the Consumer's Equipment at the Exit Point
- Electrical Diagram of the Consumer's Equipment at the Exit Point
- Clearance and Readiness for Energization of the proposed Exit Point and Equipment *
- Proposed Maintenance Program for a small-scale solar PV Systems with capacity exceeding 100kW *

(*): Information and templates for the preparation of these documents are provided in the ANNEX D – DOCUMENTS REQUIRED WHEN APPLYING FOR INSPECTION of these Guidelines.

7.2.13 Schedule and agreement on the day(s) of inspection and commissioning

In case of no comments on the uploaded documents, SEC schedule day(s) of inspection and inform the Consumer and the Consultant/Contractor. The Consumer and Consultant/Contractor agree on the dates propose by SEC.

7.2.14 Site Inspection by SEC

During the Site Inspection SEC verifies the Small-scale Solar PV system, at least in those parts that SEC deems to be relevant to it. SEC may also witness the Site Test, if the capacity of the PV System exceeds 50 kW, in this case either some or all the tests undertaken by the Consultant / Contractor may have to be repeated at the presence of the SEC Inspector if deemed necessary. The site inspection is described in the documents *Inspection and Testing Guidelines* and *Inspection and Testing Checklists*.

7.2.15 Commissioning Test

The Consultant / Contractor makes the Commissioning Test with SEC inspector witnessing the tests, in particular as regards the inspection and test of the Interface Protection (IP).

At the completion of the test, the Consultant / Contractor uploads the Commissioning Test report to SEC portal. The Commissioning Test is described in the documents *Inspection and Testing Guidelines* and *Inspection and Testing Checklists*.

7.2.16 Installation of meter(s) and Energization

In case SEC has no remarks on the Commissioning Test Report submitted by the Consultant / Contractor, SEC complete the installation of the meter(s) and update the billing system.

At this stage the Small-scale Solar PV System is connected to the Distribution Network of SEC.

8 DEFINITION OF THE RESPONSIBILITIES

8.1 Foreword

The purpose of this Section is to define a list of obligations and entitlements that each one of the parties involved in the construction and in the connection to the network of the Small-Scale Solar PV System has to comply with.
The limits of responsibility of the below are outlined:

- SEC;
- the Consumer (as owner of the PV System); and
- the Consultant / Contractor (appointed by the Consumer).

8.2 SEC

8.2.1 Responsibility

SEC shall be responsible for:

- Operating and maintaining a secure, reliable and efficient electric distribution network, in order to be able to receive the power produced by the PV system;
- Connecting Consumers to the distribution network;
- Conducting the site and PV system inspections as defined above;
- Undertaking any possible provisions to clear a fault in the distribution network in the shortest time. SEC shall not be liable for the loss of production that the Small-Scale Solar PV Systems connected to the Distribution Network will undergo in case of disconnection following the intervention of the Interface Protection.
- If there is a risk for either the safety or the security of the system and the public electricity network, SEC is entitled to disconnect the DG System from the distribution network

SEC claims no liability for any personal injury, property or other damage, of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the connection point.

It is not the responsibility of SEC to check nor to approve the mechanical design of the PV systems, the mechanical and fire safety of the building without or with the PV systems, as well as any issues that regard the compatibility of the PV systems with the aesthetic rules or regulations in force, shall be the role of the Municipality or of any other governmental institutions deputed to manage the above mentioned duties and responsibilities.

8.2.2 Ownership Boundaries

The boundary between Consumer and SEC are regulated as follows:

- The boundary between SEC and the Consumer is the Connection Point as indicated in the connection schemes in the document
- Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks of SEC
- The respective ownership of Plant or equipment shall be recorded in the Connection Agreement between SEC and the Consumer in the form of a diagram.

8.3 Consumer

8.3.1 Connection Agreement

- The Consumer must enter into a Connection Agreement with SEC. The Connection Agreement encompasses both the technical and commercial aspects of the connection, addresses the Standards and Minimum Technical requirements and specifies the terms and conditions including the connection fee, net billing criteria, use of system and quality of supply in accordance with SEC Standards.
- The Consumer shall indemnify SEC and accept liability for safety and supply quality issues that occur when the Solar PV System is operating.
- The term of Agreement between the Consumer and SEC shall be valid for 20 years effective from the date of signing the Connection Agreement.[2]

8.3.2 Responsibility

The Consumer shall be responsible for:

- Selecting the Consultant / Contractor.
- Coordinate with the Consultant / Contractor with all information needed as relevant.
- Signing the Financial Feasibility Study and all other relevant agreements as applicable.
- All costs associated with the connection of a Distributed Generation (DG) system to SEC system shall be borne by the Consumer.

8.3.3 Disconnection

SEC may limit the operation and/or disconnect or require the disconnection of a Solar PV System from distribution network at any time, with or without notice, in the event of fault. SEC may also limit the operation and/or disconnect or require the disconnection of PV system from the distribution network upon the provision of notice for the following conditions:

- To allow for routine maintenance, repairs or modifications to the distribution networks.
- Upon SEC's determination that the Solar PV System is not in compliance with its Regulations.
- Upon termination of the Connection Agreement.

8.3.4 Termination of agreement

The Consumer may terminate the Agreement upon thirty (30) days written notice if the Consumer decides to discontinue the export of electricity to SEC. All rights and obligations accrued up to termination shall continue in force upon termination.

8.4 Consultant / Contractor

Consultant's responsibility and liability are defined by the laws in force. In particular, the Consultant shall be responsible for:

- Carrying out the application process on behalf of the Consumer as described above.
- Carrying out the design according to the technical requirements and specifications of SEC and Saudi distribution code[3].
- The installation, operation and maintenance of all the equipment forming the PV system. (if agreed with the Consumer on)

[2] As per ECRA regulation (ERD – TA -012 v09 - 19), Annex 2

[3] The Contractor shall deliver a Declaration of Conformity of the Solar PV System based on the template included in the Annex.

- Ensuring that there is a safe system of work for all representatives that are involved in the Small-Scale Solar PV System construction, in compliance with all applicable standards and statutory requirements.
- The protection and safety of the generating units.
- The reliable protection of the PV system (e.g. short-circuit, earth-fault and overload protection).
- Applying a safe system of work during the construction of a Small-Scale Solar PV System, in compliance with all applicable standards, regulations and statutory requirements.
- Appointing a Test Engineer to perform inspection and testing on the plant.
- Arrange all necessary requirements and systems to connect a Small-Scale Solar PV System to SEC distribution networks, including compliance with security and safety requirements, and providing the necessary equipment.
- Terms and conditions of offer to connection, connection agreement, connection conditions, and any other relevant requirement adopted by SEC[4].
- Not to exceed the authorized maximum generation capacity for exporting toward SEC system.
- Not to conduct any action impacting the safety and efficiency of SEC system.
- Cooperate with SEC staff in all matters related to electricity exported to the system.

As stated above, the limits of liability as specified for the Consultants apply also for the Contractors when their services extend to include consultancy services and the design of the plant.

SEC standards are indispensable for the solar PV application. All equipment in an installation connected to SEC system shall be designed, manufactured, tested and installed in accordance with all applicable statutory obligations and shall be conform to the relevant SEC standards in force at the time of the connection of the installation to SEC system.

8.4.1 Protection requirements

The PV system's protection and control diagrams for the interconnection shall be in accordance with the provisions of the Distribution Code and approved by SEC prior to the commissioning of the proposed interconnection facilities. The Consultant / Contractor will install a manual disconnecting device to isolate the PV system from the distribution network as also required in the Saudi Building Code (Section 401).

8.5 Manufacturers

Manufacturers' responsibility and liability are defined by the laws in force. The manufacturers shall in particular be liable in case of delivery of false certificates of compliance for the PV products (PV modules, inverters, cables, protections and so forth).

[4] Terms and conditions, including the Connection Agreement, available for consultation on the Solar PV Web Portal of SEC

ANNEX A – SOLAR PV INITIAL APPLICATION FORM

The following form is used by the Consultant / Contractor, as already available in the SEC website.

Small-scale Solar PV – Initial Enquiry Application	
Consumer Personal Details	
Personal name	
Father name	
Grandfather name	
Family name	
ID Number	
Nationality	
Mobile Number	
Email	
Consumer case	☐ Rental ☐ Owner
Contact Details	
Home phone number	
Office phone number	
P.O. Box	
Fax Number	
Address Details	
Region	To be chosen in a list
City	To be chosen in a list
District	To be chosen in a list
Nearest district (in case a District cannot be specified)	
Address	
Documents to be uploaded	
Personal ID copy or resident visa and passport copy for expats (non-Saudis)	Upload
Mandate or delegation (for the Consultant/Contractor)	Upload
Approved Building Document by the responsible Municipality (Can be Drawings, Tenancy Permit…)	Upload
Account details	
Account number	
Meter Number	
Type of premises	☐ Apartment ☐ Building ☐ Single Floor ☐ Office ☐ Villa ☐ Shop ☐ Others
Premises number	
Voltage	☐ LV 127/220 V ☐ LV 220/380V ☐ LV 230/400 V ☐ MV 13.8 kV ☐ MV 33 kV
Meter size	From ☐ 20A to ☐ 800A

Meter Data			
Number of meters in the premises			
Category			☐ Residential ☐ Commercial ☐ Service Meter ☐ Educational ☐ Agricultural ☐ Industrial ☐ Mosque ☐ Healthcare/Hospital
Number of meters for each category			
Sequence of settlements in case the Consumer has several accounts (in the same area of supply at one Electricity Department)			
1st Account details			
Account number			
Meter Number			
2nd Account details			
Account number			
Meter Number			
Source of Supply - informative[5]			
Substation Number			Automatically retrieved
Feeder Number			Automatically retrieved
Circuit Number			Automatically retrieved
Pillar Circuit Number			Automatically retrieved
Substation Transformer			
Transformer size (kVA)			
PV system			
PV Capacity (kW)			
PV module installation			☐ On building ☐ Ground ☐ Other structure (e.g. canopy)
Approximated area available for PV installation (m^2)			
Building installation (if applicable)			☐ Flat rooftop ☐ Roof flap ☐ Façade ☐ Other
Information on Consultant / Contractor			
Name of the company			Automatically retrieved
Eligibility Certification ID			Automatically retrieved
Name of the responsible person	Automatically retrieved	Designation	Automatically retrieved
P.O.BOX	Automatically retrieved	Mobile number	Automatically retrieved
E-mail	Automatically retrieved	Office phone number	Automatically retrieved
City	Automatically retrieved/select from a drop list		

[5] This section is under implementation and may be not available at the time of issue of this Guidelines

ANNEX B – SOLAR PV DESIGN DOCUMENTATION REQUIREMENTS

1 PREFACE

In this section the minimum documentation that should be provided in the frame of the process for the installation of a grid connected PV system is listed. This information will ensure key system data is readily available also to a consumer, inspector or maintenance engineer. The documentation includes basic system data and the information expected to be provided in the operation and maintenance manual.

The list reported hereinafter is based on the SASO IEC 62446-1 but depending on the size of the PV system that is up to 11 kW or above, the design documentation required, and its organization is different. Check lists are also provided in Annex C to assure all the required documentation is shared during the process.

1.1 All Solar PV systems

1.1.1 Basic system information

As a minimum, the following basic system information shall be provided. This “nameplate” information shall be presented on the cover page of the system documentation pack:

a) Project identification reference (where applicable)
b) Rated (nameplate) system power (kW DC and kVA AC)
c) PV modules and inverters – manufacturer, model and quantity
d) Installation date
e) Commissioning date
f) Consumer name
g) Site address

1.1.2 System designer information

As a minimum, the following information shall be provided for all bodies responsible for the design of the system. Where more than one company has responsibility for the design of the system, the following information should be provided for all companies together with a description of their role in the project.

a) System designer, company.
b) System designer, contact person.
c) System designer, postal address, telephone number and e-mail address.

1.1.3 System installer information

As a minimum, the following information shall be provided for all bodies responsible for the installation of the system. Where more than one company has responsibility for the installation of the system, the following information should be provided for all companies together with a description of their role in the project.

a) System installer, company.
b) System installer, contact person.
c) System installer, postal address, telephone number and e-mail address.

1.2 Solar PV systems up to 11 kW

1.2.1 Wiring diagram

As a minimum, a single line wiring diagram in a suitable and readable format shall be provided.
In general, it is expected that this information will be presented as annotations to the single line wiring diagram. In some circumstances, typically for larger systems where space on the diagram may be limited, this information may be presented in table form.

1.2.1.1 Array – General specifications

The wiring diagram or system specification shall include the following array design information.

a) PV module type(s).
b) Total number of PV modules.
c) Number of strings.
d) Number of PV modules per string.
e) Identify which strings connect to which inverter.

Where an array is split into sub-arrays, the wiring diagram shall show the array – sub-array design and include all of the above information for each sub-array.

1.2.1.2 PV string information

The wiring diagram or system specification shall include the following PV string information.

a) String cable specifications – size and type.
b) String overcurrent protective device specifications (where fitted) – type and voltage/current ratings.
c) Blocking diode type (if relevant).

1.2.1.3 PV array electrical details

The wiring diagram or system specification shall include the following array electrical information (where fitted).

a) Array main cable specifications: Size, type manufacturer and model.
b) Array junction boxes / combiner boxes: Locations, manufacturer, model and internal electric diagram.
c) DC switch disconnector: Location and rating (voltage / current), manufacturer and model.
d) Array overcurrent protective devices: Type, location, rating (voltage / current), manufacturer and model.
e) Other array electronic protective circuitry (such as arc fault detection), if applicable: Type, location, rating, manufacturers and models.

1.2.1.4 AC system

The wiring diagram or system specification shall include the following AC system information.

a) AC isolator location: Type, rating, manufacturer and model.
b) AC overcurrent protective device: Location, type, rating, manufacturer and model.
c) Residual current (where fitted): Device location, type and rating.
d) Interface protection: Type, manufacturing and model
e) Interface switch (and backup switch if applicable): Location, type, rating, manufacturer and model.

1.2.1.5 Earthing and overvoltage protection

The wiring diagram or system specification shall include the following earthing and overvoltage protection information.

a) Details of all earth / bonding conductors – size and type. Including details of array frame equipotential bonding cable where fitted.
b) Details of any connections to an existing Lightning Protection System (LPS).
c) Details of any surge protection device installed (both on AC and DC lines) to include location, type and rating.

1.2.2 Planimetry and String layout

Planimetry of the PV array has to include information about the tilt and orientation. Possible sources of shading shall be clearly indicated.
For systems with three or more strings, a layout drawing of the PV system showing how the array is split and connected into strings shall be provided.
This is particularly useful for finding faults in larger systems and on building mounted arrays where access to the rear of the modules is difficult.

1.2.3 Datasheets

As a minimum, datasheets shall be provided for the following system components:

a) PV module datasheet for all types of modules used in system
b) Inverter datasheet for all types of inverters used in system.
c) Interface protection datasheet

The provision of datasheets for other significant system components should also be considered.

1.2.4 Mechanical design information

A data sheet for the array mounting system shall be provided. If the mounting structure was custom engineered, include the relevant documentation.

1.2.5 Emergency systems

Documentation of any emergency systems associated with the PV system (fire alarms, smoke alarms, etc.). This information shall include both operation and design details.

1.2.6 Estimate of the yearly energy production

An estimate of the yearly energy production shall be calculated using solar energy simulation software like PVsyst or SAM.

1.3 Solar PV systems above 11 kW

1.3.1 Technical report

Here below the structure of the Technical report is described along with a list of the minimum information to be included. Further information might be required, depending on the type and size of the PV system, and the document might be organized differently. For example, in case of MV connection, a further section dedicated to MV shall be included.

Although the organization of the Technical report as described below is recommended, it might be possible to adopt a different structure, provided the general criteria be fulfilled (e.g. separation of the input data from the information elaborated during the design) and no information are missing.

1.3.1.1 Preliminary information

As a minimum, the following basic system information shall be provided. This "nameplate" information preferably shall be presented on the cover page of the system documentation pack:

a) Project identification reference or name
b) Rated (nameplate) system power (kW DC and kVA AC)
c) PV modules and inverters – manufacturer, model and quantity
d) Installation date
e) Commissioning date
f) Consumer name
g) Site address

1.3.1.2 Chapter 1 – Foreword (or Introductory section, or Preface, etc.…)

As a minimum, the following information shall be provided:

- Type of solar system (rooftop, ground mounted, façade, etc.…), integration if relevant (BAPV, BIPV, etc.…), fixed mounting or tracking, technology (monocrystalline, polycrystalline, thin-film, etc.…)
- A short description of the purpose of the project, also referring to the benefits for the client, for the environment, for the electric system, for the Nation, etc.…
- System designer information for all bodies responsible for the design of the system. Where more than one company has responsibility for the design of the system, the following information should be provided for all companies together with a description of their role in the project.
    a. System designer, company.
    b. System designer, contact person.
    c. System designer, postal address, telephone number and e-mail address.
- System installer information for all bodies responsible for the installation of the system. Where more than one company has responsibility for the installation of the system, the following information should be provided for all companies together with a description of their role in the project.
    a. System installer, company.
    b. System installer, contact person.
    c. System installer, postal address, telephone number and e-mail address.

1.3.1.3 Chapter 2 – Input data

It is important to dedicate a chapter for the input data used for the design (environment, local laws and rules, constraints, relevant grid characteristics, etc.) listed here below, whereas the information elaborated at design stage will be detailed in the upcoming paragraphs.

As a minimum, the following input data and information shall be provided:

- Definitions (recommended)
- Laws and standards applicable (the most relevant ones)
- Solar and environmental data on the site (monthly averages of direct and diffuse solar radiation, wind speed, average and maximum temperatures, etc.…)
- Geological and environmental constraints (if any) as type of soil, inclination, need of stabilization or other treatment, shading, presence of vegetation, animals, etc.…)
- Characteristics of the distribution network at POC: voltage, frequency, No. of phases, type of earthing system (TT, TN, IT, etc.…), short circuit current, any further available information on power supply.

1.3.1.4 Chapter 3 – Characteristics of the main devices and equipment

As a minimum, the following information shall be provided:

- PV modules (Manufacturer, model, technology, type of PV cells, Pn, Vm, Im, Voc, Isc, Temperature coefficients, NOCT, dimensions and weight, certifications, etc.…)
- Inverters (manufacturer, model, Pn, Max input current, Max input voltage, MPPT range, output voltage and frequency range, Max temperature, IP enclosure, dimensions, weight, certifications, etc.…)
- DC combiner boxes – if present – (Manufacturer, model, No. of inputs, protection on inputs, switch/disconnector, PV string monitoring if any, IP enclosure, dimensions, weight, certifications, etc.…)
- Interface protection – if external to the inverters – (Manufacturer, model, functions, standards compliance, certifications, etc.…)
- Monitoring system – if present – (manufacturer, model, solar and meteorological inputs, DC inputs, AC inputs, data line exchange, storage, data display, certifications if any, etc.…)

1.3.1.5 Chapter 4 – System architecture and dimensioning

As a minimum, the following information shall be provided:

- DC and AC capacity and how is obtained from PV modules and inverters
- General architecture of the system from PV modules to the POC (this should include a very simple block diagram with PV modules, inverters, main switches and protections, meters, POC, energy flows, etc.…)
- Characteristics of the PV strings and PV array(s) (Vm, Im, Voc, Isc, inclination(s), orientation(s))
- Verification of compliance for PV strings/array(s) and inverters (MPPT range, max volt ages, max currents, etc.…)
- Description of the distribution network connection and power delivery (protection, grid services, capability, etc.…)

1.3.1.6 Chapter 5 – DC section

As a minimum, the following information shall be provided:

- Verification of compliance for DC cables (current, voltage drops)
- Measures to prevent overcurrent in parallel PV strings

1.3.1.7 Chapter 6 – AC section

As a minimum, the following information shall be provided:

- Measures to prevent electric shocks from direct contacts (class II insulations, tubes and channels, etc.…)
- Measures to prevent electric shocks from indirect contacts (earthing, RCDs, etc.…)
- Characteristics of the main AC devices (Manufacturer, model, type of device, No. of poles, aux contacts, nominal current, short-circuit current, characteristics of the protection, etc.…)
- AC calculations (verification of compliance for AC devices and cables)

1.3.1.8 Chapter 7 – Civil and mechanical installation

As a minimum, the following information shall be provided:

- Description of the mounting structures

- Design philosophy
- Structural calculations and analysis
- Civil drawings

1.3.1.9 Chapter 8 – Performance calculation

As a minimum, the following information shall be provided:

- Calculation of the solar radiation on the PV system
- Energy Yield (monthly and yearly)
- CO_2 saved

1.3.2 Wiring diagram

As a minimum, a multiple line wiring diagram in a suitable and readable format shall be provided. If necessary, the diagram may be distributed in more than one sheet.
In addition, a single line diagram, which contains the most relevant information and gives an overview of the PV system, is recommended, especially in case of large systems.
The information listed below is also required. In general, it is expected that this information will be presented as annotations to the single line wiring diagram. In some circumstances, typically for larger systems where space on the diagram may be limited, this information may be presented in table form.

1.3.2.1 Array – General specifications

The wiring diagram or system specification shall include the following array design information.

a) PV module type(s).
b) Total number of PV modules.
c) Number of strings.
d) Number of PV modules per string.
e) Identify which strings connect to which inverter.

Where an array is split into sub-arrays, the wiring diagram shall show the array – sub-array design and include all of the above information for each sub-array.

1.3.2.2 PV string information

The wiring diagram or system specification shall include the following PV string information.

a) String cable specifications – size and type.
b) String overcurrent protective device specifications (where fitted) – type and voltage/current ratings.
c) Blocking diode type (if relevant).

1.3.2.3 PV array electrical details

The wiring diagram or system specification shall include the following array electrical information (where fitted).

a) Array main cable specifications: Size, type manufacturer and model.
b) Array junction boxes / combiner boxes: Locations, manufacturer, model and internal electric diagram.
c) DC switch disconnector: Location and rating (voltage / current), manufacturer and model.
d) Array overcurrent protective devices: Type, location, rating (voltage / current), manufacturer and model.

e) Other array electronic protective circuitry (such as arc fault detection), if applicable: Type, location, rating, manufacturers and models.

1.3.2.4 AC system

The wiring diagram or system specification shall include the following AC system information.

a) AC isolator location: Type, rating, manufacturer and model.
b) AC overcurrent protective device: Location, type, rating, manufacturer and model.
c) Residual current (where fitted): Device location, type and rating.
d) Interface protection: Type, manufacturing and model
e) Interface switch (and backup switch if applicable): Location, type, rating, manufacturer and model.

1.3.2.5 Earthing and overvoltage protection

The wiring diagram or system specification shall include the following earthing and overvoltage protection information.

a) Details of all earth / bonding conductors – size and type. Including details of array frame equipotential bonding cable where fitted.
b) Details of any connections to an existing Lightning Protection System (LPS).
c) Details of any surge protection device installed (both on AC and DC lines) to include location, type and rating.

1.3.3 Planimetry and String layout

Planimetry of the PV array must include information about the tilt and orientation. Possible sources of shading shall be clearly indicated.

For systems with three or more strings, a layout drawing of the PV system showing how the array is split and connected into strings shall be provided.

This is particularly useful for finding faults in larger systems and on building mounted arrays where access to the rear of the modules is difficult.

1.3.4 Datasheets

As a minimum, datasheets shall be provided for the following system components:

a) PV module datasheet for all types of modules used in system
b) Inverter datasheet for all types of inverters used in system.
c) Interface protection datasheet

The provision of datasheets for other significant system components should also be considered.

1.3.5 Mechanical design information

A data sheet for the array mounting system shall be provided. If the mounting structure was custom engineered, the relevant documentation should be included.

1.3.6 Emergency systems

Documentation of any emergency systems associated with the PV system (fire alarms, smoke alarms, etc.). This information shall include both operation and design details.

1.4 Operation and Maintenance Manual

The Operation and Maintenance manual shall contain at least the basic information that can be used in order to operate and maintain the Small-Scale Solar PV System in a safe and efficient manner.
Here below the minimum content of the Operation and Maintenance Manual is reported.

1.4.1 Shutdown/isolation procedure

Shutdown and isolation procedures are designed to ensure safe working practices and must be strictly followed whenever systems are de-energized prior to servicing.
Shutdown and isolation are required when energized equipment is serviced or maintained, safety guards are removed or bypassed, a worker has to place any part of his or her body in the equipment's point of operation, or hazardous energy sources are present. The procedures shall include:

- A list and description, where necessary, of the steps to be done for system shutdown and isolation achievement
- Safe operation of electrical disconnects
- Labelling of the equipment switched off (where necessary)

Care should be taken to observe and follow warning labels reading "DO NOT DISCONNECT UNDER LOAD" or having the similar meaning located on module connections, combiner boxes, disconnects, and some inverter switches not designed as a load-break switch. Failure to heed these warning labels can lead to instrument malfunction, arcing, fires, and personnel injuries.

1.4.2 PPE and other safety equipment

Service personnel must know what kind of PPE is required for a specific task and wear it while completing the task. PPE includes fall protection, arc flash protection, fire-rated clothing, hot gloves, boots, and protective eyewear, among other items. PPE is designed to help minimize exposure to inherent system hazards. Identification of potential hazards is crucial to the process of selecting the appropriate PPE for the task at hand.

1.4.3 Spare parts management

Spare Parts Management is an inherent and substantial part of O&M, especially for PV systems with a power capacity larger than 100 kW. It should ensure that spare parts are available in a timely manner for corrective maintenance in order to minimize the downtime of (a part of) a solar PV plant. As regards to spare part management, the following considerations have to be made:

- Ownership and responsibility of insurance.
- Stocking level.
- Location of storage (Proximity to the plant, Security, Environmental conditions).

1.4.4 Preventative maintenance activities

A provisional list of the preventative maintenance activities shall be produced. When required, it shall be integrated and refined later according to the specific needs of the Small-Scale Solar PV System to be maintained.
The list shall contain a short description of the activities and their interval (months, years, etc.).
Additionally, the list shall include at least the following sub-systems:

- PV modules.
- PV array and DC wirings.
- Inverters.
- AC section and wirings.

1.4.5 Warranty documentation

The warranty documentation shall concern at least PV modules and inverters. It shall include starting date of warranty and period of warranty.

ANNEX C – SOLAR PV DESIGN DOCUMENTATION CHECKLIST

The following pages contain the checklists used to validate the documentation at "Design Evaluation and Approval".

The Consultant or Contractor can use these checklists in order to check the completeness of documents and information required at "Design Evaluation Approval".

C.1. ALL PV SYSTEMS

Solar PV Design Check-list – All PV Systems		
Documents received and complete		
Basic System Information	☐ Yes ☐ No	
Information on Solar PV System Designer	☐ Yes ☐ No	
Information on Solar PV System Installer	☐ Yes ☐ No	
Technical Report (only PV systems above 11 kW, including estimate of yearly energy production)	☐ Yes ☐ No	
Wiring Diagrams (Single Line and Multi Line)	☐ Yes ☐ No	
Planimetry and string layout	☐ Yes ☐ No	
PV module datasheet	☐ Yes ☐ No	
Inverter datasheet	☐ Yes ☐ No	
Interface Protection datasheet (only for Solar PV Systems above 11 kW or with external IP)	☐ Yes ☐ No	
Mechanical design information	☐ Yes ☐ No	
Emergency systems	☐ Yes ☐ No	
Operation and Maintenance Manual	☐ Yes ☐ No	
Estimate of the yearly energy production (only PV systems up to 11 kW)	☐ Yes ☐ No	
Civil Work approval from MOMRA/responsible Municipality	☐ Yes ☐ No	
Expected date of installation/energization	☐ Yes ☐ No	
Signed Economic Feasibility Report from ECRA website	☐ Yes ☐ No	

C.2. SOLAR PV SYSTEMS WITH CAPACITY UP TO 11 KW

Solar PV Design Check-list – Pn ≤ 11 kW

Wiring Diagram – General Contents

Field	Result / Value	Notes
Inclusion of the Solar PV System in the existing installation is clearly indicated in the wiring diagrams	☐ Yes ☐ No	
Single line diagram, with details of metering and protection system (relays, CTs and VTs when adopted, e.g. for MV network connections)	☐ Yes ☐ No	

Wiring diagram

Field	Result / Value	Notes
Type of PV modules	☐ Yes ☐ No	
Tot. number of PV modules	☐ Yes ☐ No	
Number of strings	☐ Yes ☐ No	
Number of PV modules per string	☐ Yes ☐ No	
Connection strings / inverters	☐ Yes ☐ No ☐ Not applicable	
String cable size and type	☐ Yes ☐ No	
String overcurrent protective device – type and voltage/current ratings	☐ Yes ☐ No ☐ Not applicable	
Blocking diode type	☐ Yes ☐ No ☐ Not applicable	
Array main cable: Size, type manufacturer and model	☐ Yes ☐ No ☐ Not applicable	
Combiner boxes: Locations, manufacturer, model and internal electric diagram	☐ Yes ☐ No ☐ Not applicable	
DC switch disconnector: Location and rating (V/A), manufacturer and model	☐ Yes ☐ No ☐ Not applicable	
Other array electronic protective circuitry: Type, location, rating, manufacturers and models	☐ Yes ☐ No ☐ Not applicable	
AC isolator location: Type, rating, manufacturer and model	☐ Yes ☐ No	
AC overcurrent protective device: Location, type, rating, manufacturer and model	☐ Yes ☐ No	
Residual current (where fitted): Device location, type and rating	☐ Yes ☐ No ☐ Not applicable	
Interface protection: Type, manufacturing and model	☐ Yes ☐ No ☐ Not applicable	
Interface switch: Location, type, rating, manufacturer and model	☐ Yes ☐ No ☐ Not applicable	
Backup switch: Location, type, rating, manufacturer and model	☐ Yes ☐ No ☐ Not applicable	
Details of all earth/bonding conductors – size and type	☐ Yes ☐ No	
Details of array frame equipotential bonding cable	☐ Yes ☐ No ☐ Not applicable	

Details of any connections to an existing LPS	☐ Yes ☐ No ☐ Not applicable	
Details of any surge protection device installed	☐ Yes ☐ No	
Check of Connection Requirements		
Is the proposed diagram compliant with SEC applicable rules, in particular the Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks of SEC?	☐ Yes ☐ No	
In case three-phase inverters are not used, is the maximum power imbalance limited to the values specified in the Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks of SEC ?	☐ Yes ☐ No	
Planimetry and String layout		
Site setting out plan showing details of proposed works, PV modules layout, meter location(s), etc.	☐ Yes ☐ No	
Indication of tilt and orientation	☐ Yes ☐ No	
Sources of shading are clearly indicated	☐ Yes ☐ No ☐ Not applicable	
Layout drawing showing how the array is split and connected into strings	☐ Yes ☐ No ☐ Not applicable	
Sizing of the Solar PV System		
Is the compatibility between the strings and the inverter checked ?	☐ Yes ☐ No	
Is the sizing of the PV system elements (inverters, solar cables, cables, panels, etc...) correct ?	☐ Yes ☐ No	
Sizing of the Solar PV System		
In case of installation on buildings, is the maximum string voltage ≤ 1000 Vdc ?	☐ Yes ☐ No	
In case of ground mounted installation, is the maximum string voltage ≤ 1500 Vdc ?	☐ Yes ☐ No	
Protection against overcurrent: have suitable provisions in agreement with Building Code Section 407 been taken in the installation ?	☐ Yes ☐ No	
In case of use of transformer less inverters, has an RCD (Residual Current Device) of Class B (Class A is sufficient in case of inverters which cannot inject DC currents) been considered on AC side ?	☐ Yes ☐ No	
Lightning protection: has the need of LPS been evaluated and, if required, relative provisions taken ?	☐ Yes ☐ No	
Datasheets and Certification		

Details on PV modules, for each kind employed in the plant (Manufacturer, Model reference, Efficiency, Warranty years for manufacturing defects, Peak capacity per single PV module [Wp], Surface per single PV module [m²], Orientation (South= 0°, East= -90°, West=90°), Tilt angle (inclination with respect to horizontal), Number of modules of this type)	☐ Yes ☐ No	
Compliance (to applicable Standard) certificate of the modules	☐ Yes ☐ No	
Details on Inverters, for each kind employed in the plant (Number of inverters of each type, Manufacturer, Model reference, Compliance with the Inverters approved by SEC, Warranty years, Rated AC power, Nominal power factor and adjustable range, Maximum DC input voltage, AC output voltage, Connection phases, Total Current Harmonic Distortion, Synchronization method with SEC network, Environmental protection rating (IP), Means to avoid dust penetration in the installation room (if any)	☐ Yes ☐ No	
The Inverter AC Output Voltage is compatible with the LV Distribution Networks of SEC with which the Solar PV System is connected to	☐ Yes ☐ No	
The Inverters are compliant with Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks of SEC and with SASO Standards ([6])	☐ Yes ☐ No	
Degree of Protection IP of the Inverter compatible with the location of installation (Indoor min IP41 ; Outdoor IP54)	☐ Yes ☐ No	
Miscellaneous		
Ground Floor and / or Typical Floor Layout indicating Location of Electrical rooms, MDB / SMDB, DB, Inverters, etc.	☐ Yes ☐ No	
Dimensional layout of electrical RMU rooms, LV switch rooms with arrangement of the panels, metering rooms or enclosures	☐ Yes ☐ No ☐ Not applicable	
Array mounting system documentation	☐ Yes ☐ No	
Documentation of any emergency systems	☐ Yes ☐ No ☐ Not applicable	
Other drawings/technical specification as applicable complete	☐ Yes ☐ No	
Final result	☐ Passed ☐ Not passed	

C.3. SOLAR PV SYSTEMS WITH CAPACITY ABOVE 11 KW

Solar PV Design Check-list – Pn > 11 kW		
Field	**Result / Value**	**Notes**
Technical report – Foreword		
Type of solar system, integration if relevant, fixed mounting or tracking, technology	☐ Yes ☐ No	

[6] In future the proposed inverters shall be included in the list of those approved by SEC.

Short description of the purpose of the project	☐ Yes ☐ No	
information for all bodies responsible of the design	☐ Yes ☐ No	
information for all bodies responsible of the installation	☐ Yes ☐ No	
Technical report – Input data		
Definitions	☐ Yes ☐ No	
Most relevant laws and standards applicable	☐ Yes ☐ No	
Solar and environmental data of the site	☐ Yes ☐ No	
Geological and environmental constraints	☐ Yes ☐ No ☐ Not applicable	
Characteristics of the distribution network at POC	☐ Yes ☐ No	
Technical report – Characteristics of the main devices and equipment		
PV modules	☐ Yes ☐ No	
Inverters	☐ Yes ☐ No	
DC combiner boxes	☐ Yes ☐ No ☐ Not applicable	
Interface protection	☐ Yes ☐ No ☐ Not applicable	
Monitoring system	☐ Yes ☐ No ☐ Not applicable	
Technical report – System architecture and dimensioning		
DC and AC capacity and how is obtained	☐ Yes ☐ No	
General architecture of the system	☐ Yes ☐ No	
Characteristics of the PV strings and PV array(s)	☐ Yes ☐ No ☐ Not applicable	
Verification of compliance for PV strings/array(s) and inverters	☐ Yes ☐ No ☐ Not applicable	
Description of the grid connection and power delivery	☐ Yes ☐ No	
Technical report – DC section		
Verification of compliance for DC cables	☐ Yes ☐ No ☐ Not applicable	
Measures to prevent overcurrent in parallel PV strings	☐ Yes ☐ No ☐ Not applicable	
Technical report – AC section		
Description of measures to prevent electric shocks from direct contacts	☐ Yes ☐ No	
Description of measures to prevent electric shocks from indirect contacts	☐ Yes ☐ No	
Characteristics of the main AC devices	☐ Yes ☐ No	
AC calculations (verification of compliance for AC devices and cables)	☐ Yes ☐ No	
Technical report – Civil and mechanical installation		

Description of the mounting structures	☐ Yes ☐ No	
Structural calculations	☐ Yes ☐ No ☐ Not applicable	
Technical report – Performance calculations		
Calculation of the solar radiation on the PV system	☐ Yes ☐ No	
Energy Yield (monthly and yearly)	☐ Yes ☐ No	
CO2 saved	☐ Yes ☐ No	
Wiring Diagram – General Contents		
Inclusion of the Solar PV System in the existing installation clearly indicated in the wiring diagrams	☐ Yes ☐ No	
Single line diagram, with details of metering and protection system (relays, CTs and VTs when adopted, e.g. for MV network connections)	☐ Yes ☐ No	
Wiring diagram		
Type of PV modules	☐ Yes ☐ No	
Tot. number of PV modules	☐ Yes ☐ No	
Number of strings	☐ Yes ☐ No	
Number of PV modules per string	☐ Yes ☐ No	
Connection strings / inverters	☐ Yes ☐ No ☐ Not applicable	
String cable size and type		
String overcurrent protective device – type and voltage/current ratings	☐ Yes ☐ No ☐ Not applicable	
Blocking diode type	☐ Yes ☐ No ☐ Not applicable	
Array main cable: Size, type manufacturer and model	☐ Yes ☐ No ☐ Not applicable	
Combiner boxes: Locations, manufacturer, model and internal electric diagram	☐ Yes ☐ No ☐ Not applicable	
DC switch disconnector: Location and rating (V/A), manufacturer and model	☐ Yes ☐ No ☐ Not applicable	
Other array electronic protective circuitry: Type, location, rating, manufacturers and models	☐ Yes ☐ No ☐ Not applicable	
AC isolator location: Type, rating, manufacturer and model	☐ Yes ☐ No	
AC overcurrent protective device: Location, type, rating, manufacturer and model	☐ Yes ☐ No	
Residual current (where fitted): Device location, type and rating	☐ Yes ☐ No ☐ Not applicable	
Interface protection: Type, manufacturing and model	☐ Yes ☐ No ☐ Not applicable	
Interface switch: Location, type, rating, manufacturer and model	☐ Yes ☐ Internal ☐ No	
Backup switch: Location, type, rating, manufacturer and model	☐ Yes ☐ No ☐ Not applicable	

Details of all earth/bonding conductors – size and type	☐ Yes ☐ No	
Details of array frame equipotential bonding cable	☐ Yes ☐ No ☐ Not applicable	
Details of any connections to an existing LPS	☐ Yes ☐ No ☐ Not applicable	
Details of any surge protection device installed	☐ Yes ☐ No	
Fulfilment of the Connection Requirements		
Is the proposed diagram compliant with SEC applicable rules, in particular the Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks of SEC?	☐ Yes ☐ No	
Solar PV System > 11kW:		
– is the Interface Protection external to the inverter ?	☐ Yes ☐ No	
– does the Interface Protection act on a specific Interface Switch ?	☐ Yes ☐ No	
– is the Interface Switch a motorized circuit breaker or a contactor ?	☐ Yes ☐ No	
– is the Interface Switch opening coil an undervoltage release ?	☐ Yes ☐ No	
– are the Interface Protection and the undervoltage release fed via a UPS with at least an autonomy of 5s ?	☐ Yes ☐ No	
In case the size of the Solar PV System > 20kW:		
– is there a backup switch which can receive the opening command in case the Interface Switch fails ?	☐ Yes ☐ No	
In case the size of the Solar PV System > 100kW:		
– is there a backup switch which can receive the opening command in case the Interface Switch fails ?	☐ Yes ☐ No	
Does the external Interface Protection include all the needed protection functions (27,59, 81<, 81>)	☐ Yes ☐ No	
Does either the external Interface Protection or the protection built in the inverter include an Anti-Islanding protection function ?	☐ Yes ☐ No	
Is the Interface Protection correctly connected (line voltages sensed) ?	☐ Yes ☐ No	
In case three-phase inverters are not used, is the maximum power imbalance limited to the values specified in the Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks of SEC ?	☐ Yes ☐ No	
Planimetry and String layout		
Site setting out plan showing details of proposed works, PV modules layout, meter location(s), etc.	☐ Yes ☐ No	
Indication of tilt and orientation	☐ Yes ☐ No	
Sources of shading are clearly indicated	☐ Yes ☐ No ☐ Not applicable	
Layout drawing showing how the array is split and connected into strings	☐ Yes ☐ No ☐ Not applicable	

Sizing of the Solar PV System		
Is the compatibility between the strings and the inverter checked ?	☐ Yes ☐ No	
Is the sizing of the PV system elements (inverters, solar cables, cables, panels, etc...) correct ?	☐ Yes ☐ No	
Sizing of the Solar PV System		
In case of installation on buildings, is the maximum string voltage ≤ 1000 Vdc ?	☐ Yes ☐ No	
In case of ground mounted installation, is the maximum string voltage ≤ 1500 Vdc ?	☐ Yes ☐ No	
Protection against overcurrent: have suitable provisions in agreement with Building Code Section 407 been taken in the installation ?	☐ Yes ☐ No	
In case of use of transformer less inverters, has an RCD (Residual Current Device) of Class B (Class A is sufficient in case of inverters which cannot inject DC currents) been considered on AC side ?	☐ Yes ☐ No	
Lightning protection: has the need of LPS been evaluated and, if required, relative provisions taken ?	☐ Yes ☐ No	
Datasheets and Certification		
Details on PV modules, for each kind employed in the plant (Manufacturer, Model reference, Efficiency, Warranty years for manufacturing defects, Peak capacity per single PV module [Wp], Surface per single PV module [m^2], Orientation (South= 0°, East= -90°, West=90°), Tilt angle (inclination with respect to horizontal), Number of modules of this type)	☐ Yes ☐ No	
Compliance (to applicable Standard) certificate of the modules	☐ Yes ☐ No	
Details on Inverters, for each kind employed in the plant (Number of inverters of each type, Manufacturer, Model reference, Compliance with the Inverters approved by SEC, Warranty years, Rated AC power, Nominal power factor and adjustable range, Maximum DC input voltage, AC output voltage, Connection phases, Total Current Harmonic Distortion, Synchronization method with SEC network, Environmental protection rating (IP), Means to avoid dust penetration in the installation room (if any)	☐ Yes ☐ No	
The Inverter AC Output Voltage is compatible with the LV Distribution Networks of SEC with which the Solar PV System is connected to	☐ Yes ☐ No	
The Inverters are compliant with Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks of SEC and with SASO Standards [7]	☐ Yes ☐ No	

[7] In future the proposed inverters shall be included in the list of those approved by SEC.

Are the Harmonic Currents generated by the inverters retrievable from the received datasheets ? (Solar PV Systems > 50kW)		
Degree of Protection IP of the Inverter compatible with the location of installation (Indoor min IP41 ; Outdoor IP54)	☐ Yes ☐ No	
Details of external Interface Protections (Number, Manufacturer, Model reference, Compliance with the protections approved by SEC)	☐ Yes ☐ No	
Compliance to SEC and International Standard certificate of the external interface protection (if not in the list of the already approved ones) (until transitional rules are no more in force)	☐ Yes ☐ No	
Miscellaneous		
Plan of substation location (in case of MV connection)	☐ Yes ☐ No	
Ground Floor and / or Typical Floor Layout indicating Location of Electrical rooms, MDB / SMDB, DB, Inverters, etc.	☐ Yes ☐ No	
Dimensional layout of electrical RMU rooms, LV switch rooms with arrangement of the panels, metering rooms or enclosures	☐ Yes ☐ No ☐ Not applicable	
Array mounting system documentation clear and complete	☐ Yes ☐ No	
Documentation of any emergency systems	☐ Yes ☐ No ☐ Not applicable	
Other drawings/technical specification as applicable complete	☐ Yes ☐ No	
Operation and Maintenance criteria and main planned actions in agreement with SEC recommendations (see Operation and Maintenance Manual)	☐ Yes ☐ No	
Final result	☐ Passed ☐ Not passed	

C.4. OPERATION AND MAINTENANCE MANUAL

Operation and Maintenance Manual

Shutdown/isolation procedure

Field	Result / Value	Notes
Steps to be done for shutdown/isolation	☐ Yes ☐ No	
Safe operation of electrical disconnects	☐ Yes ☐ No	
Labelling of the equipment switched off	☐ Yes ☐ No ☐ Not applicable	
PPE and other safety equipment		
Description	☐ Yes ☐ No	
Spare parts management		
Description	☐ Yes ☐ No ☐ Not applicable	
Preventative maintenance activities		

PV modules	☐ Yes ☐ No	
PV array and DC wirings	☐ Yes ☐ No	
Inverters	☐ Yes ☐ No	
AC section and wirings	☐ Yes ☐ No	
Warranty documentation		
PV modules	☐ Yes ☐ No	
Inverters	☐ Yes ☐ No	
Final result	☐ Passed ☐ Not passed	

ANNEX D – DOCUMENTS REQUIRED WHEN APPLYING FOR INSPECTION

This Annex provides templates and information regarding some of the documents required when applying for inspection.

D.1. Declaration of Conformity

DECLARATION OF CONFORMITY

The Consultant/Contractor . . . . . .

Postal address . . . . . .

Telephone and e-mail . . . . . .

Reference person . . . . . .

Under his responsibility

DECLARES

That the Small-Scale Solar PV System described hereinafter

Name of PROJECT			
Name of CONSUMER			
Type of installation	☐ On building ☐ Other structure (e.g. canopy) ☐ Ground		
Address of the site			
Region / City / (nearest) District			
GIS - Latitude, Longitude	_____° N ; _____° E		
PV System Maximum Capacity @ AC	kW		

- has been made in a workmanlike manner.
- has been made according to the design approved by SEC and minor changes (if any) do not worsen the grid compatibility, the performances and the safety. Any minor changes are duly reported in an as-built design attached to the Declaration of Conformity.
- All the materials, components and equipment used in the solar PV System have been chosen according to the design and to the laws and rules in force in KSA.

Date . . . . . Signature . . . . . .

D.2. Specification of Major Equipment

Small-Scale PV Systems SPECIFICATION OF MAJOR EQUIPMENT			
Name of PROJECT			
Name of CONSUMER			
Name of CONSULTANT/CONTRACTOR			
Type of installation	☐ On building ☐ Other structure (e.g. canopy) ☐ Ground		
Address of the site			
Region / City / (nearest) District			
GIS - Latitude, Longitude	_____° N ; _____° E		
PV System Maximum Capacity @ AC	kW		
PV Modules			
TYPE 1 (Number . . . . .)			
Manufacturer	Model		
Pn (STC) [W]	Filename*		
TYPE 2 (Number . . . . .)			
Manufacturer	Model		
Pn (STC) [W]	Filename*		
TYPE 3 (Number . . . . .)			
Manufacturer	Model		
Pn (STC) [W]	Filename*		
Inverters			
TYPE 1 (Number . . . . .)			
Manufacturer	Model		

Small-Scale PV Systems

SPECIFICATION OF MAJOR EQUIPMENT

Maximum capacity @ AC [W]	Filename* . . . . .
TYPE 2 (Number . . . . .)	
Manufacturer	Model . . . . .
Maximum capacity @ AC [W]	Filename* . . . . .
TYPE 3 (Number . . . . .)	
Manufacturer	Model . . . . .
Maximum capacity @ AC [W]	Filename* . . . . .
TYPE 4 (Number . . . . .)	
Manufacturer	Model . . . . .
Maximum capacity @ AC [W]	Filename* . . . . .
TYPE 5 (Number . . . . .)	
Manufacturer	Model . . . . .
Maximum capacity @ AC [W]	Filename* . . . . .
Interface protection (when present)	
Manufacturer	Model . . . . .
* Filename where the serial numbers of equipment are recorded. The number of values shall be equal to the number specified for the given type of equipment. The format of the file is Text (TXT)	

D.3. Details of the Protection Arrangements and Settings

Small-Scale PV Systems DETAILS OF THE PROTECTION ARRANGEMENTS AND SETTINGS			
Name of PROJECT			
Name of CONSUMER			
Name of CONSULTANT/CONTRACTOR			
Type of installation	☐ On building ☐ Other structure (e.g. canopy) ☐ Ground		
Address of the site			
Region / City / (nearest) District			
GIS - Latitude, Longitude	_____° N ; _____° E		
PV System Maximum Capacity @ AC	kW		
Main Switch			
Manufacturer	Model		
Operating voltage	Device*		
Rated current [A]	Icw		
Interface Switch			
Manufacturer	Model		
Operating voltage	Device*		
Rated current [A]	Icw		
Solar PV Unit Switch			
TYPE 1 (Number . . . . .)			
Manufacturer	Model		
Operating voltage	Device*		

Small-Scale PV Systems DETAILS OF THE PROTECTION ARRANGEMENTS AND SETTINGS	
Rated current [A]	Icw . . . . .
TYPE 2 (Number . . . . .)	
Manufacturer	Model . . . . .
Operating voltage	Device* . . . . .
Rated current [A]	Icw . . . . .
TYPE 3 (Number . . . . .)	
Manufacturer	Model . . . . .
Operating voltage	Device* . . . . .
Rated current [A]	Icw . . . . .
* Depending on the voltage we may have different devices. In MV e.g. Vacuum switch + TA. In LV e.g. Circuit-Breaker with magneto-thermic curve or Circuit-Breaker + Fuses. Contactors are allowed only for Interface Switch.	

D.4. Maintenance Program for the Small-Scale Solar PV System

The Consultant / Contractor shall upload the proposed Maintenance Program for the Small-scale Solar PV System. This document is:

- additional to the Operation and Maintenance information provided with the Final Design submitted for Design Evaluation and Approval
- required when the PV capacity exceeds 100 kW

Recommendations for compiling a proper Maintenance Program when the capacity of the PV system exceeds 100 kW are available from the document *Manual for the Maintenance of the PV Systems*.

D.5. Clearance and Readiness for Energisation

Small-Scale PV Systems

CLEARANCE AND READINESS FOR ENERGISATION

The Consultant/Contractor . . . . . .

Postal address . . . . . .

Telephone and e-mail . . . . . .

Reference person . . . . . .

Under his responsibility

DECLARES

That the Small-Scale Solar PV System described hereinafter

Name of PROJECT			
Name of CONSUMER			
Name of CONSULTANT/CONTRACTOR			
Type of installation	☐ On building ☐ Other structure (e.g. canopy) ☐ Ground		
Address of the site			
Region / City / (nearest) District			
GIS - Latitude, Longitude	_____° N ; _____° E		
PV System Maximum Capacity @ AC	kW		

- The protection details are those indicated in the document DETAILS OF THE PROTECTION ARRANGEMENTS AND SETTINGS
- All the equipment and all associated apparatus related to the service connection are compliant with the applicable standards and in particular with the Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks of SEC
- The electric circuit is compliant with the applicable standards and in particular with the Technical Standards for the Connection of Small-Scale Solar PV Systems to the LV and MV Distribution Networks of SEC

Date . . . . . Signature . . . . . .