

Evaluation of loan application for grid-connected rooftop solar PV projects: Checklist

Important Notes:

- *Non-sequential checklist*
- *Encompasses various technical and financial aspects of projects*
- *Applicable from time of loan application and onwards*

Checklist Points for Evaluation of Loan Application:

- Checking regulatory eligibility for GCRSPV installation in state**
 - *Does the state in which the project is located have prevalent regulations allowing grid connection of rooftop solar projects? (Y/N)*
- Developer experience check**
 - *What is the applicant's (i.e. developer) experience in development, installation and/or operation of grid-connected rooftop solar PV projects? Preferably, there should be project development and installation of at least 5 projects of comparable size as the project under consideration for loan.*
- Prefeasibility and feasibility check**
 - *Have prefeasibility and feasibility studies been conducted for the project under consideration for loan? (Y/N)*
 - *If 'Y', check feasibility report for minimal compliance with the following aspects:*
 - Solar resource assessment*
 - Roof structural integrity*
 - Shading analysis*
 - System sizing*
 - Cost calculations*
 - Requirements of permits/ clearances/ approvals from various authorities*
- Product quality check**
 - *What are the product quality standards and certifications for the system components? These should hold minimum compliance with the product standards listed in Appendix – I.*
- PV system design quality check**
 - *PV system design should preferably hold compliance with IEC 62548 "PV arrays – Design requirements".*

- *PV system design should preferably be done using one of the more prevalent software packages in the market (refer Appendix – II).*

Project AMC check

- *Is the project planned to have a comprehensive AMC agreement for the first 5-10 years of the project life?*

Performance monitoring check

- *What performance monitoring measure is planned for the project during system operation? This will vary heavily with the general system capacity; larger installations generally need a SCADA component, while in smaller installations the performance monitoring is generally done by evaluating the data stored in inverter(s) and/or meter(s).*

Cost estimation check

- *Capital cost break-up should not vary substantially from that given in the table below.*

PV system component	%age of Capital Cost	Average Cost
PV modules	45-55%	~ Rs. 36/W _p
Inverter	20-30%	~ Rs. 22/W _p
Mounting structure	15-20%	~ Rs. 15/W _p
Other BOS (Junction box, cables, meters, etc.)	5-10%	~ Rs. 7/W _p

- *Annual O&M costs should not vary substantially from ~ 2% of capital cost in the first year, with annual O&M cost escalation rate not varying substantially from 5.72%.*

Policy incentives check

- *What are the various financial and /or fiscal incentives/benefits available for the project under consideration for loan?*
- *What are the associated risks in availing of the various incentives/benefits?*

Insurance terms check

- *Insurance contracts and the terms within them are not yet standardized in the Indian grid-connected rooftop solar PV market. A thorough due diligence is recommendable in this regard.*

Project security coverage check

- *What is the applicant's view on security for the loan?*

Payment security check

- *What is the borrower's credit profile?*
- *What is the risk associated with reliability of revenue stream?*

System anti-theft/vandalism check

- *Has the developer planned for anti-theft/vandalism measures in the project?*

Checklist Points for Enhancing Internal Bank/FI Capability:

- Developing preferred list of project developers / loan applicants**
 - *It is recommended for banks and FIs to prepare their own lists of preferred project developers / loan applicants gradually with experience in lending to grid-connected rooftop solar PV projects. This would serve to reduce lending risk due to history of mutual experience.*
- Developing standard templates for loan applications**
- Developing in-house team with technical and market expertise**

Appendix – I: Product quality standards and certifications

		Mandatory	Advisory
<i>Solar PV Modules/Panels</i>			
IEC 61215/ IS 14286	Design Qualification and Type Approval for Crystalline Silicon Terrestrial Photovoltaic (PV) Modules	Yes	
IEC 61646/ IS 16077	Design Qualification and Type Approval for Thin-Film Terrestrial Photovoltaic (PV) Modules	Yes	
IEC 62108	Design Qualification and Type Approval for Concentrator Photovoltaic (CPV) Modules and Assemblies	Yes	
IEC 61701	Salt Mist Corrosion Testing of Photovoltaic (PV) Modules	Yes	
IEC 61853- Part 1/ IS 16170 : Part 1	Photovoltaic (PV) module performance testing and energy rating –: Irradiance and temperature performance measurements, and power rating	Yes	
IEC 62716	Photovoltaic (PV) Modules – Ammonia (NH3) Corrosion Testing		Yes (As per site condition like dairies, toilets)
IEC 61730-1,2	Photovoltaic (PV) Module Safety Qualification – Part 1: Requirements for Construction, Part 2: Requirements for Testing	Yes	
IEC 62804 (Draft Specifications)	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation. IEC TS 62804-1: Part 1: Crystalline silicon		Yes (PID-resistant modules)
IEC 62759-1	Photovoltaic (PV) modules – Transportation testing, Part 1: Transportation and shipping of module package units	Yes	
<i>Solar PV String Inverters/PCUs</i>			
IEC 62109-1, IEC 62109-2	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements, and Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters. Safety compliance (Protection degree IP 65 for outdoor mounting, IP 54 for indoor mounting)	Yes	
IEC/IS 61683 (For Standalone System)	Photovoltaic Systems – Power conditioners: Procedure for Measuring Efficiency (10%, 25%, 50%, 75% & 90-100% Loading Conditions)	Yes	

		Mandatory	Advisory
BS EN 50530 (Will become IEC 62891) (For Grid-connected System)	Overall efficiency of grid-connected photovoltaic inverters: This European Standard provides a procedure for the measurement of the accuracy of the maximum power point tracking (MPPT) of inverters, which are used in grid-connected photovoltaic systems. In that case the inverter energizes a low voltage grid of stable AC voltage and constant frequency. Both the static and dynamic MPPT efficiency is considered.	Yes	
IEC 62116/ UL 1741/ IEEE 1547	Utility-interconnected Photovoltaic Inverters - Test Procedure of Islanding Prevention Measures	Yes	
IEC 60255-27	Measuring relays and protection equipment - Part 27: Product safety requirements	Yes	
IEC 60068-2 (1, 2, 14, 27, 30 & 64) (Already present except 27,64)	Environmental Testing of PV System - Power Conditioners and Inverters a) IEC 60068-2-1: Environmental testing - Part 2-1: Tests - Test A: Cold b) IEC 60068-2-2: Environmental testing - Part 2-2: Tests - Test B: Dry heat c) IEC 60068-2-14: Environmental testing - Part 2-14: Tests - Test N: Change of temperature d) IEC 60068-2-27: Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock e) IEC 60068-2-30: Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle) f) IEC 60068-2-64: Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance	Yes	
IEC 61000 Series	Electromagnetic Interference (EMI), and Electromagnetic Compatibility (EMC) testing of PV Inverters (as applicable)	Yes	
<u>Fuses</u>			
IS/IEC 60947 (Part 1, 2 & 3), EN 50521 (Already present)	General safety requirements for connectors, switches, circuit breakers (AC/DC): a) Low-voltage Switchgear and Control-gear, Part 1: General rules b) Low-Voltage Switchgear and Control-	Yes	

		<u>Mandatory</u>	<u>Advisory</u>
	gear, Part 2: Circuit Breakers c) Low-voltage switchgear and Control-gear, Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units d) EN 50521: Connectors for photovoltaic systems – Safety requirements and tests		
IEC 60269-6	Low-voltage fuses - Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems	Yes	
<u>Surge Arrestors</u>			
IEC 60364-5-53/ IS 15086-5 (SPD)	Electrical installations of buildings - Part 5-53: Selection and erection of electrical equipment - Isolation, switching and control	Yes	
<u>Cables</u>			
IEC 60227/IS 694, IEC 60502/IS 1554 (Part 1 & 2)	General test and measuring method for PVC (Polyvinyl chloride) insulated cables (for working voltages up to and including 1100 V, and UV resistant for outdoor installation)	Yes	
BS EN 50618	Electric cables for photovoltaic systems (BT(DE/NOT)258), mainly for DC cables	Yes	
<u>Earthing/Lightning</u>			
IEC 62561 Series (Chemical earthing)	IEC 62561-1 Lightning protection system components (LPSC) - Part 1: Requirements for connection components IEC 62561-2 Lightning protection system components (LPSC) - Part 2: Requirements for conductors and earth electrodes IEC 62561-7 Lightning protection system components (LPSC) - Part 7: Requirements for earthing enhancing compounds	Yes	
<u>Junction Boxes</u>			
IEC 529	Junction boxes and solar panel terminal boxes shall be of the thermo plastic type with IP 65 protection for outdoor use, and IP 54 protection for indoor use	Yes	
<u>Energy Meter</u>			
IS 16444 or as specified by the DISCOMs	a.c. Static direct connected watt-hour Smart Meter Class 1 and 2 – Specification (with	Yes	

		Mandatory	Advisory
	Import & Export/Net energy measurements)		
<i>Battery/Electrical Storage</i>			
IEC 61427-1	Secondary cells and batteries for renewable energy storage - General requirements and methods of test - Part 1: Photovoltaic off-grid application	Yes	
IS 13369	Stationary lead acid batteries (with tubular positive plates) in mono-bloc containers		
IEC 61427-2	Secondary cells and batteries for renewable energy storage - General requirements and methods of test - Part 2: On-grid applications		
<i>Solar PV Roof Mounting Structure</i>			
IS 2062/IS 4759	Material for the structure mounting		
DIN EN 1991-1-4	Actions on structures, Part 1-4: General actions - Wind actions	Yes	

Appendix – II: Software packages for system design

Software	Description
RETScreen	<p>Developed by: Canadian government, industry, academia</p> <p>Use: Evaluation of energy production, savings, costs, emission reductions, financial viability, risk</p>
HOMER	<p>Developed by: Originally developed by NREL; Now licensed to HOMER Energy</p> <p>Use: Design of distributed energy systems, including technical and economic feasibility analysis</p>
NREL Solar Advisor Model (SAM)	<p>Developed by: NREL (National Renewable Energy Laboratory)</p> <p>Use: Estimation of energy production, peak and annual system efficiency, LCOE, capital cost, O&M costs (used with TRNSYS)</p>
SolarGIS – pvPlanner	<p>Developed by: SolarGIS</p> <p>Use: Site prospecting, prefeasibility and pre-design assessment, yield assessment</p>
PV F-Chart	<p>Developed by: F-Chart Software</p> <p>Use: Estimation of energy generation, efficiency, load, economics, life cycle costs, equipment costs</p>
PVSYST	<p>Developed by: PVSYST Photovoltaic Software</p> <p>Use: Study, sizing, simulation and data analysis</p>
SolarPro	<p>Developed by: LaPlace Systems</p> <p>Use: Estimation of power production, life cycle analysis</p>

Appendix – III: List of Documents (for commercial loan applicant)

1. Bio Data of all directors/qualifications /experience
2. Pan cards of all directors and company
3. Photo Identity of all directors
4. Residence proof of all directors
5. Address proof of Company and factory
6. Personal Balance sheet/Asset Liability Statement of all Directors as on 31/3/2012 duly signed by directors along with latest IT return
7. Affidavit in Banks format
8. DIN no of all directors
9. Balance sheet of associate Concern, if any, as on 31.03.2012
10. Contract copies with customers
11. Projections of sales for next 5 years
12. Credit period for purchases
13. Monthly expenses
14. Monthly income (gross)
15. Debtors period/days/months
16. List of fixed assets already purchased and to be purchased
17. Cost of all items source of funds duly certified by auditors
18. Last 6 months statement of accounts of all banks
19. Originals of all certificates for verification
20. Copy of lease agreement
21. SME Registration (as relevant)
22. Shop and establishment Registration (as relevant)
23. Service Tax/Sales Tax/VAT Registration
24. Legal opinion of property
25. Valuation of property