FICHTNER

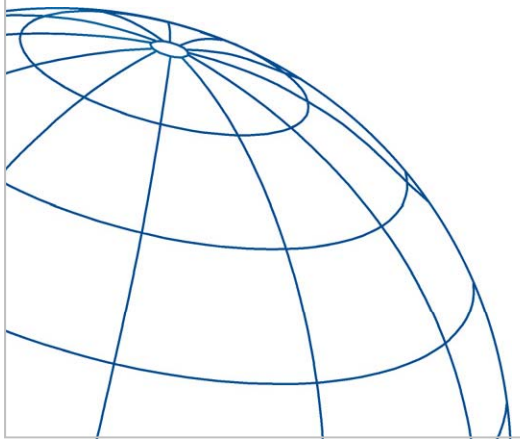
THE FICHTNER GROUP

Engineering & Consultancy – Worldwide

Technical and Commercial Aspects Related to the Implementation of Solar Power Plants – Part 2

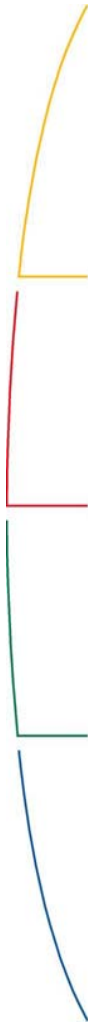
Felix Gudat

Ukraine, March 2012



Content

- Site Suitability
- Project Participants
- Key Components
- Plant Design
- EPC Contract
- O&M Contract
- Timeline
- Electricity Generation
- Permits



Site Suitability

- Is a geological survey available with trial drillings?
- Is the site contaminated, e.g. due to military usage?
- Is the MV power grid close to the site?

Site Suitability

- Is there any risk of flood water?
- Are there any negative effects of near shading, like trees etc.?
- Are there any negative effects of horizon shading, like mountains etc.?

Site Suitability

- Is the site close to the sea (salty air)?
- Is there any other negative influence close to the site like polluting factory, sewage works, farm?
- What is the current utilisation of the site?

Site Suitability

- Is the site flat?
- Is the site easily accessible also for heavy loads?
- For roof-mounted projects – is a structural analysis available for the roof?

Project Participants

- The EPC contractor has to be experienced, have a good reputation and possess adequate technical and financial capability for the project.

- The chosen subcontractor needs adequate technical and financial capability for the project.

Key Components – Inverter

- The manufacturer has to be experienced and the products have to be tried and tested.
- The inverter guarantee should be for a minimum of 5 years.
- The inverter requires a CE declaration.

Key Components – Inverter

- Electromagnetic compatibility has to comply with EN 61000-6-2 / EN 61000-6-4.

- The inverter must possess the technical possibility of power management if this is required in the country or by the grid operator.

Key Components – Inverter

- The inverter guarantee should have the option of extension up to 25 years.
- The inverter manufacturer must have sufficient service technicians in the region.
- It should be possible to sign a service contract with the inverter manufacturer.

Key Components – Inverter

- The efficiency of the inverter as defined by European standards should be more than 97%.
- The IP protection class of the inverter has to match the planned location.
- All distributors and connection boxes have to comply with EN 60439-1.

Key Components – Inverter

- All distributors and connection boxes installed outdoors must have protection class IP 65.
- All distributors and connection boxes are to be installed under a roof to protect against direct sunlight.
- The MV transformer must be appropriately dimensioned, with low losses and supplied by a reputable manufacturer, with an option to extend the guarantee to 25 years.

Key Components – Inverter

- The warranty conditions must be acceptable.

Key Components – PV Modules

- The PV module manufacturer has to be reputable and experienced.
- A record of measurements of PV module performance by an external laboratory should be available.
- Test results from Photon or similar should be available.

Key Components – PV Modules

- The power tolerance may not be outside of the range +/-3%, with a plus tolerance preferable.
- The module has to be certified under IEC 61215 (61464), IEC 61730 and Safety Class II.
- The module purchase contract should allow spot tests of the modules by the authorized technical inspection agency, TÜV, to verify the flash test data.

Key Components – PV Modules

- The product guarantee has to be for a minimum of 5 years.
- The procedure for claim management has to be reasonable and adequate.
- The module data sheet has to comply with DIN EN 50380.

Key Components – PV Modules

- The output power guarantee has to be a minimum of 90% over 10 years and 80% over 20 years.
- The module technology has to be proven.
- The warranty conditions have to be acceptable.

Key Components – Mounting System

- A structural analysis has to be prepared for the foundations.
- The structural analysis for the mounting system has to be prepared, taking into account the applicable snow and wind loads.
- Contact corrosion at metal-to-metal connections has to be prevented.

Key Components – Mounting System

- Expansion joints must be provided for long structural members.

- The material must have a lifetime of more than 20 years: aluminum, stainless steel or hot-dipped galvanized steel (DIN EN ISO 1461) have to be used.

Key Components – Mounting System

- The mounting system must be approved by the PV module manufacturer.
- The mounting system must comply with the standards DIN 1055 and Eurocode 9 if these are applicable.
- The warranty conditions must be acceptable.

Plant Design

- The preferred location for the inverters is in the shade, in a shelter, and not affected by snow when installed above-ground.

- The inverter station requires air ventilation and/or a cooling system as set out in the installation manual.

- The AC/DC power ratio should be between 0.86 and 1.10, and optimized for the location.

Plant Design

- The cable loss under standard test conditions (STC) should not exceed 1.5% on the DC side and 0.5% on the AC side up to the MV transformer.

- Surfaces of conductor loops have to be minimized to avoid overvoltage due to lightning strikes.

Plant Design

- All cables have to be double insulated and UV resistant.
- A risk analysis with regard to surge protection in compliance with EN 62305-2 must be available.
- A surge protection concept according to DIN EN 62305 must be in place.

Plant Design

- Overvoltage protection has to be implemented in the DC section connection boxes, combiner boxes and AC section.

- The plant has to be free of shading on 21 December at midday.

Plant Design

- All conductive parts of the plant have to be connected to the potential equalization system with the required material and dimensions.

- Outdoor cables have to be UV resistant, for example, by installing these in conduits.

Plant Design

- Labeling: all strings, connection boxes, cables, inverters have to be labeled UV resistant in compliance with execution plans.
- Cable laying has to be done according to DIN VDE 0100 Part 520.
- The plant must be designed in line with the manufacturers' guidelines, e.g. the maximum voltage for the inverter may not be exceeded.

Plant Design

- The modules may require sorting and classification by maximum power point (MPP) current.
- All open ends of cable conduits must be closed off by shrunk-on tubes to prevent ingress of water and vermin.
- Dimensioning of the transformers has to match the planned inverters.

EPC Contract

- The contract price has to be in line with current market prices.
- For a turnkey project, the scope of works has to cover all tasks.
- The payment schedule has to be in line with usual EPC contracts, and payments by the client have to be secured by delivery against payment.

EPC Contract

- The program and organization of the Acceptance Test has to be defined and has to correspond to standard market practice.
- The investor should not bear the risk of a decreasing feed-in-tariff due to delayed grid connection.
- Penalties have to be defined and should be realistic.

EPC Contract

- The project budget has to be reasonable.

- Documentation has to be in compliance with IEC 62446:2009 for grid-connected photovoltaic systems, with minimum requirements for system documentation, commissioning tests and inspection.

O&M Contract

- The O&M contract should possibly be combined with an inverter service contract or a guarantee extension for the inverter.
- Sufficient spare parts have to be included in the O&M contract, especially for modules and inverters.
- The contract price has to be in line with current market prices.

O&M Contract

- The scope of work has to cover all necessary tasks.
- The contract has to include an availability and/or performance guarantee.
- The contract has to provide for a reasonable schedule for preventive maintenance, like module cleaning, measurements etc.

Project Timeline

- The timeline for the project has to be realistic.
- Influences due to bad weather conditions have to be allowed for, by scheduling sufficient extra time.
- It must be ensured in the supply contracts that material deliveries will be on time.

Electricity Generation

- Yield reports from two independent engineering consultants should be available.
- All negative impacts must be considered in the simulation, e.g. shading, soiling, mismatch etc.
- The source for the meteorological data has to be reliable and reasonable.

Permits

- Grid connection has to be permitted in the range of the planned power output.

- The MV power line to the grid connection point should avoid crossing property owned by third parties. If this is the case, are easement rights in place?

Permits

- A construction permit must have been applied for and granted.

- Any additional requirements pertaining to the construction permit have to be considered, such as land recultivation.