

Kadiri Captive PV Power Plant Report



A question of timely delivery and quality

ENERGETICA INDIA

Twelve weeks is not too much time at all to hand over a 5 MW captive solar power plant to a client in India. However, neither the tight deadline nor the challenging rocky area location could prevent the referred to as the “Solar Pioneers”, AIC Solar Projects, from creating another masterpiece of a plant as a project planner. Due to the close cooperation between AIC Solar Projects, and the global provider of photovoltaic (PV) solar solutions Hanwha SolarOne, together with the rest of the suppliers for the Plant Project in Kadiri, India - Gantner Instruments, Schneider Electric and Jakson Engineers, Bizlink Cables and Tata International, the project was completed even ahead of schedule.

Power outages in India are still a severe problem. Large energy intensive Indian industries or SMEs are both suffering revenue losses due to power shortage. However, the situation seems to change. Falling costs are likely to make photovoltaic captive solar plants a viable source for electricity production in India. The diesel generator solution seems to lose market share.

These considerations made the global IT services company ValueLabs LLP, headquartered in Hyderabad, take the decision to invest in a 5 MW captive power plant and identify solar energy as a suitable option. The company covered the entire investment. A decision that is being each time more frequent in India and shows not only economical aspects but also environmental awareness of the companies,

an appreciated value in times of climate change concerns.

The EPC, an experienced company
AIC Solar Projects, from Hyderabad was selected as ValueLabs’ partner of choice for planning and construction. The story of the Indo-German AIC Solar Projects goes back to 2011 when the company was founded as a Joint Venture between



the Indian Raajratna Energy Holdings Pvt. Ltd. (REHPL) and the German AIC Projects GmbH (AIC). While REHPL is an experienced power developer with its core competence in development and execution of energy projects (like solar and hydro), the German partner AIC, on the other hand, brought in its technical knowledge in planning and designing of solar and industrial projects. The company provides design, turn-key construction and operational management of solar plants. Being one of the first companies realizing solar projects in India under the National Solar Mission. In 2011 the company commissioned the first grid connected 1 MW solar PV plant in Orissa (Energetica India Plant Report, July/August issue 2011). Later, during the first quarter of 2012, AIC Projects commissioned a 1 MW captive solar plant for a client in Kadiri, the same location where they had to develop the new power plant, only five times the capacity of this. Their success stories has positioned AIC Solar Projects as an appreciated EPC company that is contributing actively to the proliferation of solar energy in diverse Indian regions, but also in Europe, Asia and the Arab world.

AICs background and the local expertise proved useful as the site is situated in a challenging location directly between the two megacities of Bangalore and Hyderabad, in a flat, but rocky area characterized by intense heat.

In 2009, when the Indian solar boom was just starting, the government from Andhra Pradesh unveiled a plan named

“Solar City” searching to attract companies to form an exclusive cluster for setting up solar farms and boost the solar power in the energy hungry state. In this sense the Kadiri area, where the 5 MW plant is installed, is a well known region for solar projects in India. The Anantapur district was identified as the ideal location for the setting up of solar-based power projects, along with four other districts in the state of Andhra Pradesh.

However, since 2009 the worldwide solar market has undergone profound changes. And the government plans in the Kadiri area were not developing as fast as expected. The international solar crisis had also impacted in the emerging Indian market. PV module prices have fallen by nearly 80%. New legal environments and the cutting or disappearing of

Feed in tariffs (FITs) hit the whole value chain of the solar industry. At the same time the photovoltaic plant components have improved significantly. The efficiency of PV modules has increased the same as BoS components optimizing the entire PV installation and reducing lifecycle costs. Finally, it seems that the market players have learned their lessons, and the speculative expansion has finished; time is ripe for the solar market consolidation. The 5MW Kadiri plant is a proof of a high technology and professional maturity.

Tight Deadlines and Challenging Logistics

In order to develop a photovoltaic plant, a confluence of factors should be considered so that it converts into reality. In the case of the Kadiri project tight deadlines



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Technical details

Solar Modules from Hanwha Solar

The 5 MWp project consists of 21,120 Hanwha Solar modules.

Hanwha SolarOne is one of the top 10 photovoltaic manufacturers in the world, providing cost-competitive, high quality PV modules. It is the flagship company of Hanwha Group, a FORTUNE Global 500 company.

Hanwha SolarOne serves the utility, commercial, and residential markets for a growing network of third-party distributors and system integrators.

The company maintains a strong presence worldwide, with employees located throughout Europe, North America and Asia, and embraces environmental responsibility and sustainability, with an active role in the voluntary photovoltaic recycling program.

The modules come with industry-leading warranty terms: 12 year product warranty, 25 year performance warranty. As a part of Hanwha Solar's efforts to continuously improve the portfolio and its features, the new Hanwha Solar module series HSL was introduced this spring, replacing the SF-series.

Some other features include:

- Predictable output: Positive power sorting of 0 to + 5 W

- Innovative solutions: Anti-reflecting coating for high sunlight absorption
- Robust design: Module certified to withstand high snow loads, up to 5.4 kN/m2 **
- Long term responsibility: Free module recycling in PV Cycle member countries

Specifications

Model Number	SF220-30-1P245
STC Rating	245
PTC Rating	221.5
Open Circuit Voltage (V)	37.1
Shor Circuit Current (A)	8.64
Frame Color	Silver
Origin	China
Power % ±	03-Mar
(W/ft²)	14.78
Area (ft²)	16.6
Weight (lbs)	46.2
Length (in)	65.04
Width (in)	39.37
Heigth (in)	1.77

and challenging logistics were an additional pressure factor and required a perfect coordination of high skilled professionals. Therefore, the choice of developers and suppliers was of extreme importance to fulfill the expectations of the customer and satisfy the time and quality aspects.

The core elements of a photovoltaic power plant are the PV modules. Already a partner of German AIC Projects, Hanwha SolarOne was selected as the module supplier for the PV park in Kadiri. The company is one of the top 10 photovoltaic manufacturers in the world. They were able to guarantee the supply although

the deadline to commission the park was very tight. The supply logistics from the module production facility in China to the construction site in India constituted one of the biggest project challenges. Through close cooperation between all three partners, a streamlined process for timely delivery was accomplished. Transportation of the modules from the harbor to the construction site on 150 kilometers of bumpy roads was another hurdle that was mastered by the project team – not a single module showed signs of cracking.

All panels put together have a capacity 5MWp, a huge plant but still a small per-

centage in comparison to the four gigawatts (GW) of photovoltaic (PV) modules that Hanwha SolarOne has shipped to 35 countries around the world until today.

Explaining the successful expansion of Hanwha SolarOne Mr Min-Su Kim, the president of the company outlined recently the following reasons “the company made tremendous strides in improving quality, lowering cost and expanding its international sales channels.

Matthias Gerhardt, Head of Project Development & Project Management at AIC Projects explained the additional advantages received from choosing Hanwha SolarOne “With several parties in multiple countries involved, it was ideal to have the German Hanwha SolarOne sales team acting as our contact point for all topics on the module side. Hanwha SolarOne has already supplied PV modules to a number of our projects, and the performance of the running solar parks demonstrates the high quality of their products. Additionally, the company carries out regular customized TÜV tests on behalf of AIC, which further confirms the excellent reliability.”

The PV modules from Hanwha SolarOne:

For the Kadiri plant where chosen the SF 220-30-1P245 models. The PV modules from Hanwha Solar are characterized by





String Combiner Boxes from Gantner Instruments, India

String.Bloxx 108

In large solar systems monitoring and troubleshooting becomes more complex. It becomes important to find errors in a module, string, or group quickly to increase the efficiency and life of the system. The string.bloxx makes it possible to monitor and control the DC side of photovoltaic systems. Defects, contamination, theft, installation/production errors, or misinterpretation of individual strings can be detected and corrected. The data exchange between the string.bloxx to a management system is done via a data logger (test controller).

Features:

- 8 analog input channels for current (± 20 A)
- 1 analog input channel for voltage (0-1000 V)
- 2 input channels for temperature (Pt1000)
- Signal conditioning
- RS485 fieldbus interface
- Electromagnetic Compatibility
- Web portal provides flexible access worldwide
- DIN rail mounting according to DIN50022

String.bloxx 116

Features:

- 16 analog input channels for current (± 26 A, ± 416 A)
- 1 analog input channel for voltage (0-1000 V)
- 2 input channels for temperature (Pt1000)
- 3 digital inputs
- 1 digital output
- Wall or DIN rail (50022) mountable
- Integrated LCD
- Modbus RTU

excellent real-life performance and robust design, certified to withstand high wind loads. The modules come with industry-leading warranty terms: 12 year product warranty, 25 year performance warranty. As a part of Hanwha Solar's efforts to continuously improve the portfolio and its features, the new Hanwha Solar module series HSL was introduced this spring, replacing the SF-series.

Some other features include:

- Predictable output: Positive power sorting of 0 to + 5 W
- Innovative solutions: Anti-reflecting coating for high sunlight absorption
- Robust design: Module certified to withstand high snow loads, up to 5.4 kN/m²
- Long term responsibility: Free module recycling in PV Cycle member countries

Please see technical details in the box of the previous page.

The combiner boxes from Gantner Instruments

Since its foundation in 1982 the Austrian company has turned into a multinational company with offices in different continents. In India they have opened a location in Chennai in the state of Tamil Nadu. The high quality of its products made them the ideal choice for the Kadiri solar power plant

In large solar systems monitoring and troubleshooting becomes more and more complex. Each operator is interested in finding errors in PV modules, strings, or a group quickly because they can reduce the amount of energy produced and the life of

the system greatly. The string bloxx makes it possible to monitor and control the DC side of photovoltaic systems. Defects, contamination, theft, installation/production errors, or misinterpretation of individual strings can be detected and corrected. The data exchange between the string.bloxx to a management system is done via a data logger (test controller).

In the Kadiri solar plant were installed 40 Combiner boxes with String.bloxx devices. The string combiner box assembly was carried out at Chennai at Hensel Electric India the combiner box partner of Gantner and at Gantner's factory. There were supplied a total of 30 models "String 16 in 1 out" and another 10 models of "String 8 in 1 out"

The drawings has been approved for manufacturing by the EPC Contractor AIC Solar Projects. On completion of manufacturing the String combiner boxes has been inspected by EPC contractor at Gantner's facility. For a perfect control the engineers of the Gantner company personally guided the site persons to install all in proper way.

The coordination with Schneider Electric the inverter & SCADA supplier to interface the String.bloxx devices with Schneider's SCADA software, was done in perfect tuning.

Since the commissioning of the plant the supplied String Combiner Boxes are performing satisfactory to the customer expectations.

(Please see the technical details of combiner box models used in the plant in the beside box).



Schneider Electric was in charge of the solar inverter supply

Schneider Electric supplied a total number of four PV Boxes of Solar Inverter Sub-station (SISS) 1260KW - to the plant. In each PV are included two inverters. JAKSON Engineers, the alliance partner of Schneider Electric in India was in charge to survey the delivery. The Solar Inverter Sub-station (SISS) from Schneider Electric is a power conversion system. In PV plant installation, it operates between DC field and AC MV grid connection point. The SISS performs the DC power concentration, the DC/AC conversion and the AC voltage elevation to the grid voltage level. The optimized versions of the SISS allow a reduction of the BOS cost, an increase of the reliability and an improvement of its deployment speed. Other advantages are the suitability for harsh environments and conditions, -an important characteristic for the Kadiri region- and its compact and light weight that allows the transportation on standard carriers.

Each PV Box includes the following equipments

- 2 Inverters - 630KVA
- 1 Main Transformer
- 1 RMU
- 1 Aux Panel
- 1 Aux Transformer
- 1 UPS
- Safety Equipment's and accessories
- Internal & external Lighting
- Cooling Solution for the Box

Connectors and Solar Cables were supplied by BizLink. The Taiwanese company has opened in 2008 an office in Chennai. The cables and connectors fulfill all safety standards and have TÜV, UL and NEC certifications. Approximately were used 70,000 meters of solar cables and 4,500 connectors. Tata International the Indian giant delivered the mounting structures.

The construction of the 5 MW capative solar power lasted 12 weeks and the



PV Connector (MC4 MC3) (mm)	
Cable length (mm)	110
Conductor Temperature (mm)	1000.00
Cable diameter (mm)	4.0
10V Rated Current (A) DC	20
Contact Resistance (mΩ)	1.30

solar park was finally connected to the grid ahead of schedule with an expected annual output of 8.4 million kWh.

Today 21,120 Hanwha Solar modules are covering an area of 20 acres and have found their definite "home" at Kadiri. Located in the heart of the triangle formed by three important Indian cities Bangalore, Chennai and Hyderabad, -all of them actively involved in the expansion of renewable energies.

After finishing the work, Matthias Gerhardt, Head of Project Development & Project Management at AIC Projects said, "We are very pleased to see another successful PV installation in India realized and connected to the grid."

Sure that much more projects will follow.

THE SISS 1260

Input ratings (DC)	
Recommended PV power	2 x 725 kWp
Voltage range, operating	510 - 850 V
Voltage range, MPPT	510 - 800 V (at PF=1)
Max. input voltage, open circuit	1000 V
Max. DC current	2 x 1280 A
Number of protected DC inputs (parallel)	2 x (4/5/6/8)
Output ratings (AC)	
Nominal power	1260 kVA
Nominal output voltage	up to 36 kV
Frequency	50 Hz
Harmonic distortion	< 3% rated power
Power factor range	0.8 to 1 lead / lag
Inverter	
Type	2 x XC630



> **Reliable technology**
based on rigorously tested, proven hardware

> **Flexible design**
due to comprehensive grid-management features

> **Easy-to-service**
with full suite of alarms and troubleshooting tools

High efficiency and proven reliability, from a bankable supplier

Introducing Conext Core XC central inverters for PV power plants and large buildings

Available in three models ranging from 540 to 680 kVA, Conext™ Core XC inverters are the smart choice for PV power-plant or commercial-building applications. Here are a few reasons why.

Best-in-class efficiency resulting in higher CUF

To help maximise your solar harvest, Conext Core XC provides best-in-class efficiency and an innovative fast-sweep maximum power point tracking (MPPT) algorithm.

Reliability baked in

Designed for long-term performance and tested in harsh environments, Conext Core XC offers increased uptime and a great total cost of ownership.

Flexibility to fit your needs

Conext Core XC inverters are compliant with most local standards and evolve to meet future standards.

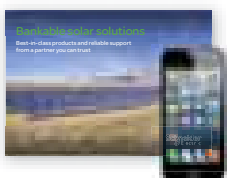
On top of all that, Schneider Electric™ has a local presence in over 100 countries and a global service network, meaning we offer professional support for solar investments practically anywhere in the world.

More than just an inverter

With Conext Core XC you get the core of a high-quality balance-of-system solution and the support of a trusted supplier. Our large-scale solar solutions include:



1. PV Box 2. Array Box 3. Transformer 4. Conext Control



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