

Report on Solar Power Professional Workshops

A comprehensive overview of training workshops organized by GERMI pertaining to Solar Photovoltaic - Design, Technology and Application

The Key takeaways:

1. In-depth knowledge of basics, various components of a photovoltaic power plant such as photovoltaic modules, inverters, charge controllers, batteries, switchyard, SCADA, structures, and so on.
2. Photovoltaic system types, design philosophy, principles, examples and calculations.
3. Hands-On: Site survey tools, weather measurements, photovoltaic system installation.
4. PV Systems: Comprehensive learning of industry-standard software.
5. Project management, economics and finance of projects, solar policies, REC and carbon credits.
6. Immense information and material through worked-out examples, data sheets, discussions, etc.
7. Site visit to megawatt-scale PV power plant.

The workshop offered to setup a comprehensive capacity – building mechanism for professionals entering or established in the solar photovoltaic power sector.

Purpose of the workshop was to provide cutting-edge education to transform professionals into ‘Solar’ professionals. These workshops are an intensive exercise chalking out a roadmap from concept to commissioning.

The idea was, not only provide room for perceptive thinking but also to make the professionals employ these skills in their respective work domains. The curriculum had been carefully crafted to make the technical, theoretical and practical ends meet. With the testimonies and feedbacks we have been able to evolve and set new benchmarks and achieve new heights in content development and course delivery.

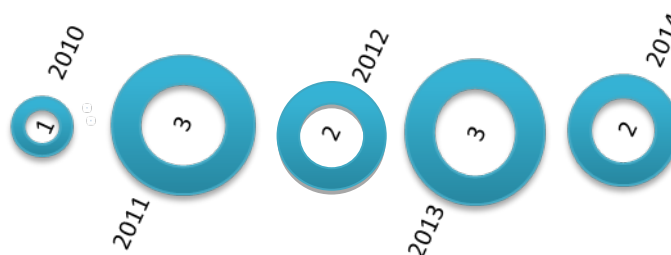
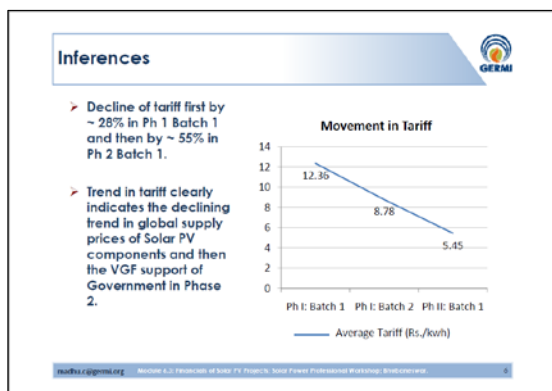
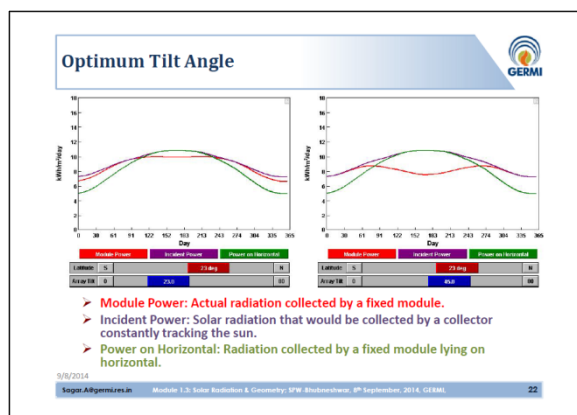
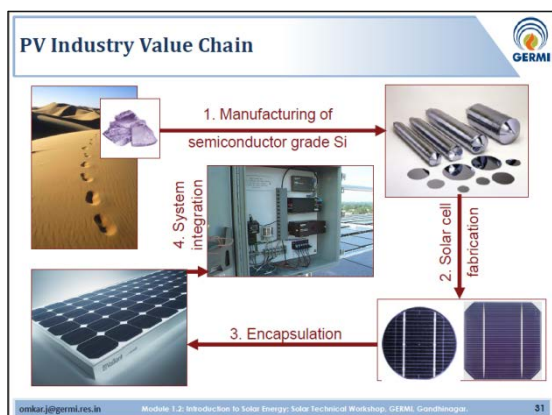


Figure 1: Timeline of the training workshops held till now

On account of a feedback session with the participants, of the previous trainings, it was considered that managerial and entrepreneurial perspective shall also be incorporated. Along with technical fundamentals even fundamentals of economics and finances of the solar PV market was introduced.

Total ten training workshops have been organized so far and Two out of the ten training workshops, were organized in collaboration with Underwriters Laboratory (UL) India and National Council for Promotion of Renewable Energy (NCPRE), IIT Mumbai in the years 2010 and 2012 respectively. The collaborative trainings were an enriching learning experience. Since, GERMI received a myriad trainee audience from various backgrounds (not particularly from a technical background); we

structured the curriculum in a way which was relevant to cater to each participant to maintain an all-embracing attention from the trainees and ensure full attendance.



- ### Significance of DPR
- The information contained in the DPR is mainly useful for:
 - Entrepreneur / developer of the project
 - Financiers
 - It is required to get assistance from financial institutions.
 - It is required for obtaining necessary Government clearances.
 - It will pinpoint the matters for which Government sanction have to be obtained.
 - It will provide an independent assessment of the feasibility of the project.
- inofra@germi.org Module 1.7: Detailed Project Report: Solar Power Professional Workshop, Bhimnagar. 24

(Snapshot of the curriculum of the workshop – from technical points to financial points)

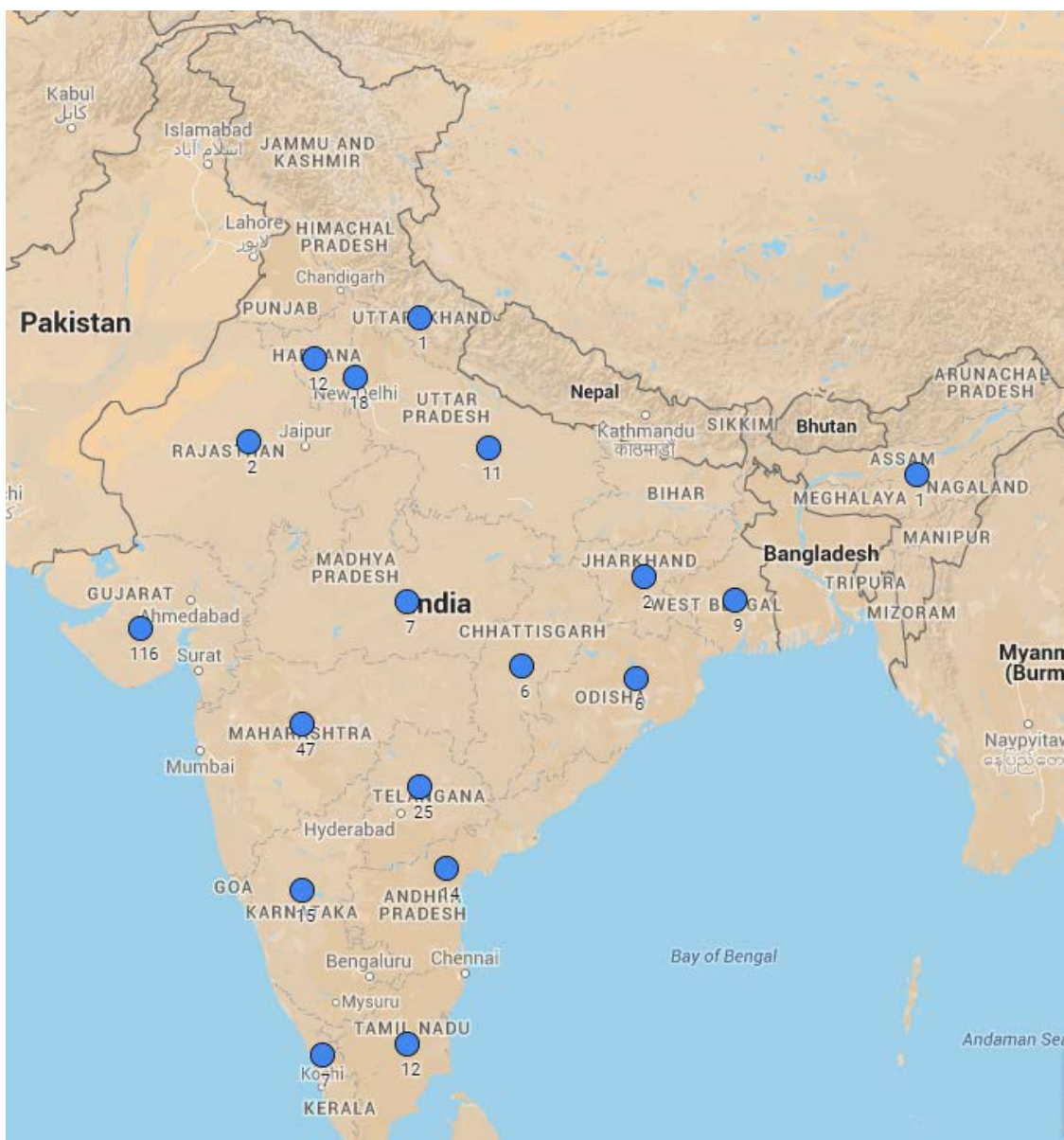
Objectives:

GERMI organizes the workshop sessions focused on the following objectives:

1. Make educated decisions for implementing solar photovoltaic power projects
2. Access site potential and suitability for establishing a plant
3. Selection of Various PV Modules, Inverter and other Technologies
4. Appreciate the details for installing a solar power plant
5. Theoretically deduce the plant performance and output and ensures best practices in terms of safety and quality
6. Experience sharing among instructors and the participants.

The comprehensive workshops have now been frozen to 6 days, although 2 to 3 days customized training programs are also designed based on the companies requirements. For the comprehensive workshop all the sessions are designed to be a blend of theory and hands-on experimental work to give the participants a good understanding of the design, technology and

its application. There are participants from across the country who has attended these workshops.



(Snapshot: India Map showing the vast spread of participation from different states of India)

The workshop is divided into the following sessions:

Day 1 After an immersed inaugural session, an ice-breaking activity is organized by the GERMI team and the participants to get acquainted. The technical session focuses on fundamentals of solar energy, wherein participants are briefed about fundamentals of solar radiation, solar geometry, solar noon, site survey and shadow analysis. The session also talked about different types of modules and storage devices.

Day 2 was focused on integrating the fundamentals. The participants gained initial practical experience on solar resource measurement and analysis, PV system configuration, design

philosophy and system designing. Emphasis is laid on the standards in design, safety and performance. This is taken care by gaining hands-on experience on grid-tied inverters, junction boxes and balance of systems, by framing general arrangement of utility-scale power plant and by understanding the general arrangement of switchyard and metering methods.

Day 3 is particularly dedicated to site visit to a megawatt scale power plant that facilitates an understanding of the end application that is involved in the functioning of a power plant. A session on SPV Power Plant O&M helps participants to understand the intricacies at the plant and delve into the best practices and troubleshooting.

On **Day 4** of the workshop, the participants try their hands on PV Syst. There are a number of software systems that are used within the solar industry. One such software used is called 'PV Syst', this is being taught on trial version to the participants. The participants simulate the PV Power plants and learn to operate on PV power plants– on-grid and off grid applications and also learn how to report them. Before gaining physical experience and getting effectively acquainted with the business of a solar power plant, it becomes important to understand how a solar power project works. Through this study, the participants receive a comprehensive understanding of how a solar power plant works.

A brief overview is provided and emphasis is laid on the standards in design, safety and performance, PV array structural design etc.

Then the participants are introduced to a monitoring and communication system called 'SCADA' (Supervisory Control and Data Acquisition) which operates with coded signals over communication channels that provide control to remote equipment. This system helps participants to design a system that helps in string – inverter and generation level monitoring. This knowledge is helpful to:

1. Ensure plant availability
2. Generation monitoring
3. Equipment downtime recording

Day 5 majorly focuses on hands-on installation exercise of 2.6 kW systems wherein participants by themselves install the system, perform electrical connections and produce electricity. A hybrid inverter is used to demonstrate the PV plant. This session on safety and protection devices helps all the participants to understand the importance of plant lighting and surge protection. On the same day, participants are taken on the site to effectuate their class learning and to closely understand the operation and management (O&M) procedure. They are advised to take field notes, derive calculations, carry out plant sizing and designing; and get the feel of different components – like it's quality standard, type, make etc. The day would end with problem solving and Q&A session along with a session on preparation of detailed project report (DPR).

Day 6 focuses on 'Project Management', 'Economics and Financial' exercises, scaffolding an entrepreneurial framework for them to start thinking of application in solar terms. The last two

days are specifically added to polish the professionals to ‘Solar professionals’. The idea is to train them to plan, size, design and construct starting with kW power plant to a MW scale PV power plant.

This part of the day includes project management, grid connected PV power plant from an EPC (Engineering, procurement and construction) point of view, financials of solar PV projects and how project financing should be taken up. A brief introduction is provided to the REC mechanism and carbon credit mechanism, State and National Solar Mission etc. Hence, the participants gain an overall understanding of the fundamentals, design, management and existing policies relating to solar PV technology. This abundantly helps the ground engineers, the middle management as well as the top management personnel to view solar PV power plant and understand its overall dimensions. These aspects make the course very comprehensive and practical.

GERMI has in-house subject matter experts and it also invites other industry experts to deliver subject specific sessions. The richness of the experience adds tremendous value to the participant’s learning. Thus truly this is comprehensive and industry oriented course. In additions to the learning’s participants also carry specialized reading materials.



(Snapshot: In action pictures of the participants’ hands on experience)

Testimony:

“On Google, this training page came first when searched. It clearly is one of the best training programs, I never expected it to be this detailed. Definitely the best Institute in India to hold such courses.”

~ Naeem Salim, CEO, York Engineering Solutions, Dubai, UAE.

“Thanks to GERMI for carrying the vision of Modi and Gujarat. GERMI is doing a very good job of carrying forward devotion and dedication towards RE sector. This will carry India to new heights in the near future. Keep up the innovation with resourceful training for new entrant.”

~ Radhamadhab Ota, (Deputy Manager - Electrical), GEDCOL.

Authors:

*Dr. T. Harinarayana, Ms. Narinderjit Kaur Sethi and Ms. Sowbhagya Rao
Gujarat Energy Research & Management Institute (GERMI)*