

Off-grid Commercial Micro-grid System Provides Energy Storage For Resort In India



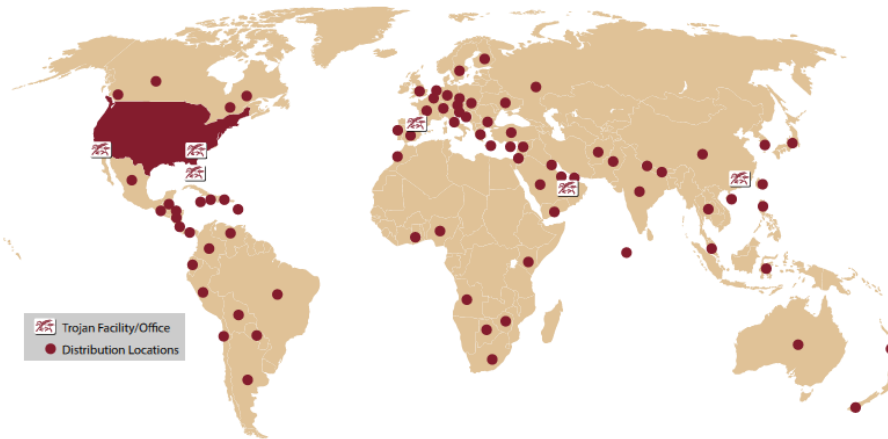
Energy Access Practitioner Network
Webinar on Energy Storage
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Quality Knows No Boundaries

- Trojan Battery has a legacy of building high quality “Made in the USA” batteries since 1925. Privately owned, under 3rd & 4th generation family leadership.
- Exclusive focus on manufacture of deep cycle batteries; flooded and VRLA.
- State of the art lean, ISO certified manufacturing facilities. A brand new production facility in the USA dedicated to VRLA batteries.
- Distribution in over 100 countries worldwide, with 100+ domestic warehouses.

TROJAN
Global Presence



Off-grid And Grid-tied Batteries By Trojan

Residential markets that we serve

Off-Grid Residential

Energy Storage Solutions for
Off-Grid Buildings

Remote Homes / Cabins / Farm & Agricultural Buildings



Self-Consumption

Reliable energy storage that helps you
store and use the energy from your
solar system, 24 hours a day



Rural Electrification

Energy Storage Solutions for
Rural Electrification Projects

Solar Home Systems / Home Backup Power
Hospitals / Schools / Water Treatment



Micro-Grids

Energy Storage Solutions for
Micro-Grids

Resorts / Off-grid Communities
Islands / Multi-Building Schools / Hospitals



Off-grid And Grid-tied Batteries By Trojan

Backup solutions

Inverter Backup

Energy Storage Solutions for
Unstable Grids

Residential Backup / Small Commercial Backup
School / Hospital Backup



Grid-Tied Emergency Backup

Energy Storage Solutions for
Grid-Tied Systems in Emergencies



Off-grid And Grid-tied Batteries By Trojan

Industrial solutions

Solar Street Lighting

Energy Storage Solutions for
Off-Grid Solar Street Lighting

Area Lighting / Street Lighting / Security Lighting



Remote Monitoring & Control

Energy Storage Solutions for
Remote Monitoring & Control

Well-site Automation / Monitoring and Control
Flow & Pressure Metering / Instrumentation & Measurement
Security / Oil & Gas / Wireless Communications



Telecom

Energy Storage Solutions for
Off-Grid & Unstable Grid Telecom Networks

Microwave / Cellular Base Stations / Repeaters / VSATS
Two-Way Radio Networks / Small-Load Telemetry Applications



The Spice Village Eco-Resort



**Micro-grid solar project
India**

**Installed capacity 65KWp
Total Cost: \$ 300,000 dollars
Commissioned in 2012**

System Integrator: Team Sustain

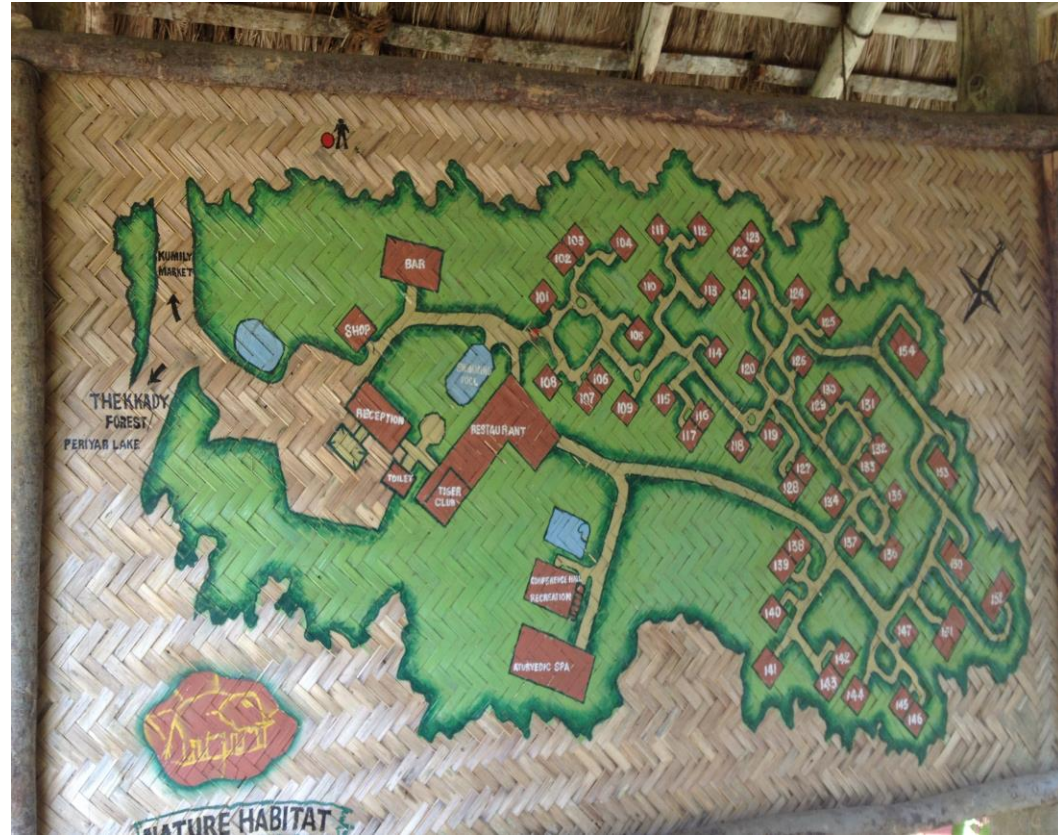
Location And Importance Of The Project

- Spice Village Resort was founded in 1992.
- 56-cottage resort with restaurants, spa, tennis and basket courts and swimming pool.
- Located in the Border of Periyar Tiger Reserve, Kerala Province, Southern India.
- Tribute to ancient way of life.



Motivation For The Project

- Poor grid quality. High cost of running and maintain a diesel generator for 8 hours a day.
- Governmental benefits for renewable energy projects.
- Incremental global demand for eco-friendly destinations to ensure lower environmental impact of the tourism.



Loads



- The original load was 750KWh and was reduced to 200KWh
 - LED Lighting
 - Appliances were upgraded to more efficient models – tv and air conditioners
 - Unnecessary items were removed from the room – hair dryers
 - Limited the appliances that are used at night

65KWp Battery-Based Pv System



650 Solar modules: 100Wp a-Si thin film PV modules



9 Dual-Mode Inverter-Chargers: SMA Sunny Island 5048

65KWp Battery-Based Pv System



65KWp Battery-Based Pv System



Trojan Industrial Line Batteries



48V 8,458Ah @ C₁₀ (392 KWh battery bank)

72 batteries, IND29-4V (1,361Amp-H @ C₁₀)

17 year service life (IEC 61427)

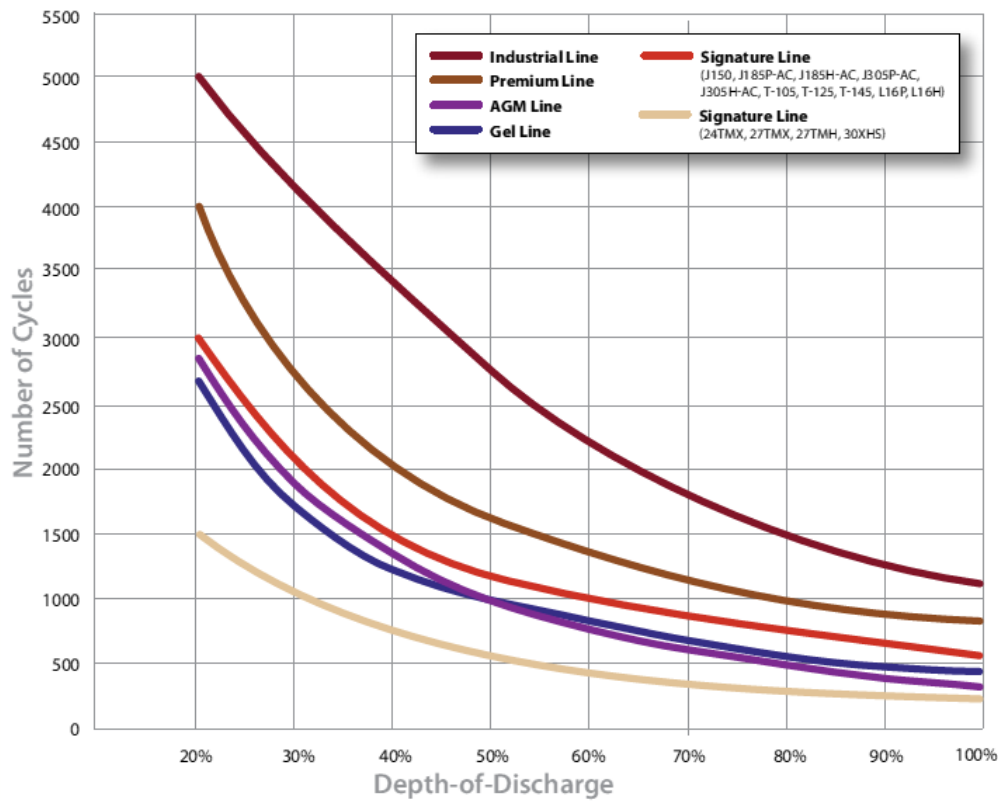
Battery Selection Factors

- Large size of batteries.
 - **Trojan Industrial (IND)** line of deep-cycle batteries is the newest addition to Trojan's lineage of high-quality flooded batteries.
 - The Industrial line is engineered specifically to support renewable energy systems with large daily loads where the batteries are cycled regularly.
 - Battery Line suitable for pv system from 2KW to 300KW.
- Cycle life and Service life of the batteries in a pv application.
 - **Trojan Industrial** line offers **2,800 cycles** at 50% Depth of discharge.
 - According to the IEC 61427 standard the **IND** Line batteries achieved **17 years service life**.



Trojan Battery Industrial Line

The five lines of Trojan RE products are organized by technology and according to cycle life characteristics



The Industrial Line offers 2,800 cycles at 50% Depth of discharge

IEC 61427 Standard For Industrial Batteries

- The International Electrotechnical Commission's (IEC) standard 61427, titled secondary cells and batteries for photovoltaic energy system – it offers a common and international accepted platform to compare and contrast batteries from different manufacturers.
- This standard test protocol uses elevated temperatures (40 degree C or 104 degree F) and a series of shallow cycle to simulate a real-world PV application. The battery being tested is considered to have reached end of life when its capacity drops to less than 80% of its rated capacity.
- According to the IEC 61427 standard the Trojan IND Line batteries achieved **17 years service life.**

Trojan Webinars

http://trojanbatteryre.com/Tech_Support/literature.html?tab=2#TabbedPanels1#top

View past webinars:

- **How to Size Battery Banks for Off-Grid Applications**
- **Maintaining Deep-Cycle Batteries in the Field**
- **Importance of Deep-Cycle Battery Test Data**

Register for upcoming webinars:

- September 18 at 8am PDT
An Overview of Trojan's Premium Line
Designed with a 10-year battery life, Trojan's Premium line will be reviewed including a discussion of the specific engineering and unique features of this battery line which make them ideal for a variety of renewable energy applications

Battery Selection Factors

- Maintenance vs non-maintenance (VRLA)
 - Flooded batteries are more economic.
 - Easier to charge than VRLA. In general if the battery is not charged correctly it is easier to recharge a flooded battery than a VRLA battery.
 - You can't overcharge VRLA batteries. In the case of flooded battery you can overcharge the batteries to give them a boost charge and then add water to compensate the gassing.
 - Flooded batteries perform better with high temperatures.
- Technical support from the manufacturer.



System Components

- Biodiesel genset.
- Genset will primarily be used for the Monsoon season when the irradiation is low.
- The diesel generator is also set to run early in the morning hours as well as in the evening hours at full load to cover the load and charge the battery bank. In the middle of the day most demand is covered by the pv generator.

Economics Of The Project



Financial Payback period: 6 years

First year estimated savings: \$ 45,000 dollars

Total estimated savings (assuming 25 year life span) : \$ 1,790,000 dollars

Savings And Payback Period

Economics and Financial Variables

System cost	\$ 300,000 dollars
Down payment	30 %
Finance	70 %
Interest Rate	10%
Loan Repayment period	10 years
Indian government subsidies	30%
EB base year Price/KW hr	\$ 0.34 dollars
DG Base year Price/KW hr	\$ 0.29 dollars
Carbon credit reduction	256 tones of C02
Annual Increase in energy bill (KSEB (electricity) + DG Operation Bill	10%

Savings

First year savings in the Energy Bill	\$ 45,000 dollars
First year savings after the installment	\$ 14,217 dollars
Total savings after 10 years	\$ 467,293 dollars
Financial payback period	6 years

Thank you for your attention!

