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MINISTRY OF ELECTRONICS AND INFORMATION TECHNOLOGY
सत्यमेव जयते

India Smart Utility Week-2024

12-16 March 2024, New Delhi

Organized By

India Smart Forum

Dr Om Krishan Singh
Joint Director, Ministry of Electronics and Information Technology
Govt. of India, New Delhi

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National Mission on Power Electronics Technology (NaMPET)

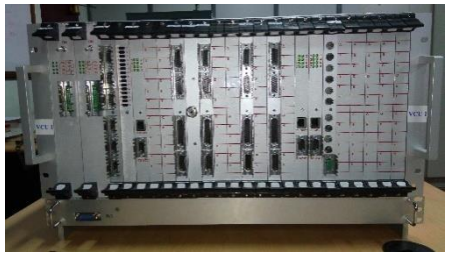
www.nampet.in

Objective: Make India a Dominant player in PE Technology

Focus	Applications
➢ Advanced Technology / Exploratory Research ➢ Deployment / Up-gradation of Technologies ➢ Awareness Creation & Training ➢ Infrastructure Development	➢ WBG Power Electronics ➢ Renewable Energy, Micro-grid ➢ Traction, E- Mobility ➢ High Voltage PE ➢ LVDC Power Distribution systems ➢ Power Quality, Smart Grid

Vehicle Control Unit (VCU) for 3 Phase Electric Locomotives

3 Phase Locomotive



VCU Module

Solar Powered Energy Efficient 48V LVDC Powering of Houseboat

Flexible solar panel

Solar Powered Micro-grid for Rural Electrification

Portfolio : Solar Photovoltaic power plants Deployed by CDAC

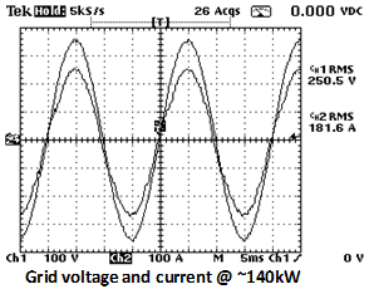
1. **1MWp Grid connected solar PV Power Conditioning System installation as part of a Smart Renewable Energy Park at Ramakkalmedu Idukki, funded by ANERT Kerala - Ongoing**
2. **1MWp Grid connected solar PV Power Conditioning System installation at Seebpore Solar Power Station, Jamuria, West Bengal , funded by MeitY through NaMPET – commissioned on 2016**
3. **330kWp Grid connected solar PV Power Conditioning System installation at CDAC Innovation park, Pune , funded by MeitY through NaMPET - commissioned on 2019**
4. **25KWp Grid connected solar PV Power Conditioning System installation at**

   (a) CDAC Technopark Campus, CDAC Thiruvananthapuram, funded by MeitY through NaMPET

   (b) NEHU Campus, Shillong, funded by DIT through North east fund - commissioned on 2012

   (c) WBREDA office, West Bengal funded by MeitY through NaMPET- commissioned at 2010

Major Highlights of technologies deployed



Grid voltage and current @ ~140kW

1,2,3……N

- **HIGH LIGHTS**
- Fail Safe Operation
- Export quality power
- Patented sandwich bus plate architecture
- Indigenous R&D Technology
- Hardware Modularity & Scalability
- Conform to PQ,DER intercon. standards
- Revenue Impact
- Environmental Benefits

- IEEE 519:2014
- IEEE 1547:2003

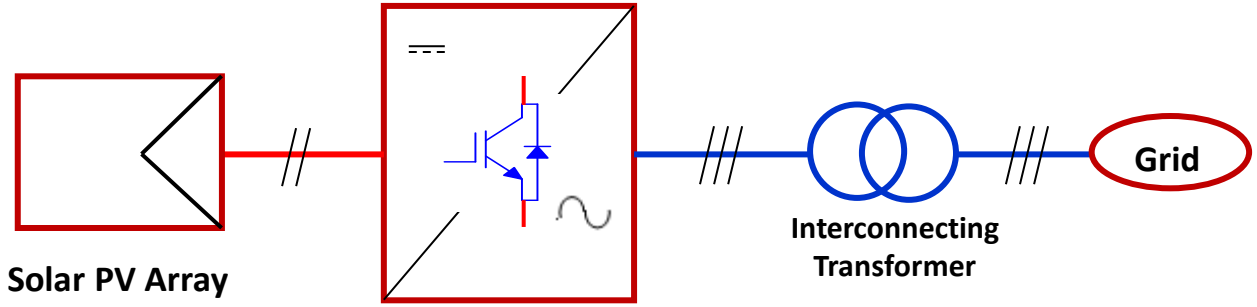
- Monthly reduction of CO_2 Emission : 129 Ton

MW Scale Grid Connected Solar Photovoltaic power plants

Indigenous design, development and demonstration of Grid Connected Solar Photovoltaic Power Conditioning systems suitable for solar power plants with large rating aiming Indian market.

Major features are

- Capability to ride through faulty and disturbed grid conditions
- Voltage stabilization by reactive power support
- Improved Power Quality
- Stiff control over active power like in conventional rotary generators
- Improved efficiency
- Improved reliability
- Better Modularity and Maintainability
- Operational redundancy
- Communication features and controllability



Power Conditioning Unit

Online monitoring system

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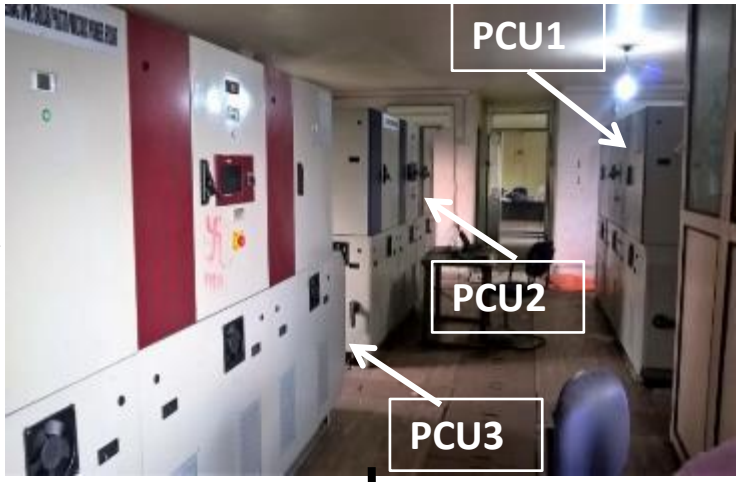
MW Scale Grid Connected Solar Photovoltaic power plants



Site Deployment of Power Conditioning System

Specification of Solar PV array	
Rated Peak power per set	1250 kW x 2
Array Tilt Angle	20^0
Bus Voltage	670 – 800 V
Module Rating	240 / 225 W
Specification of Power Conditioning Unit	
Nominal Power	1 MW (3* 330KVA)
Grid Voltage	415 ± 10 %, 3 Φ
Grid frequency	50 Hz ± 0.5 %
Power factor	> 0.95 above 10% of installed capacity
I_{THD}	< 5%, at full load as stipulated by IEEE 1547 – 2003
Efficiency	97 %
Converter	IGBT based voltage source Inverter
Protections	Anti-islanding, Over voltage, Over current, Temperature

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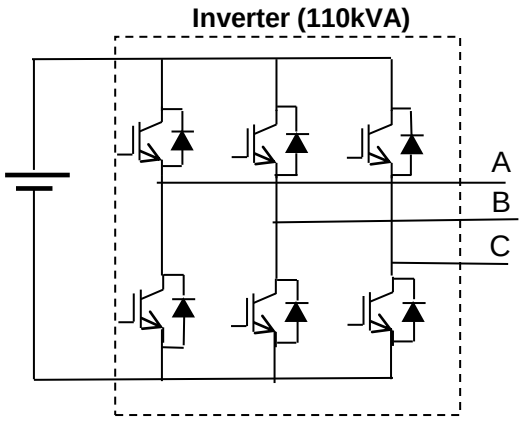
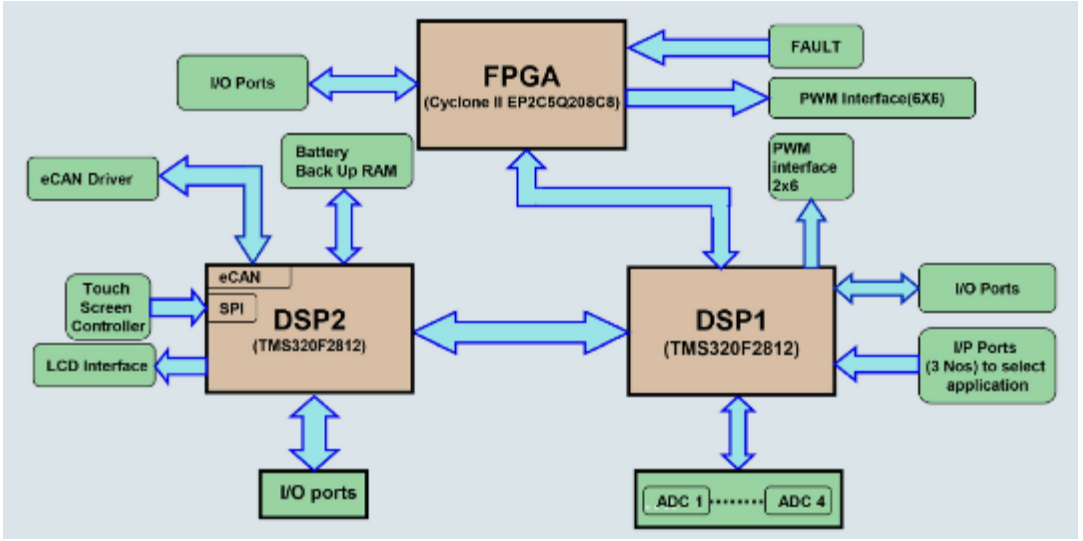
MW Scale Grid Connected Solar Photovoltaic power plants

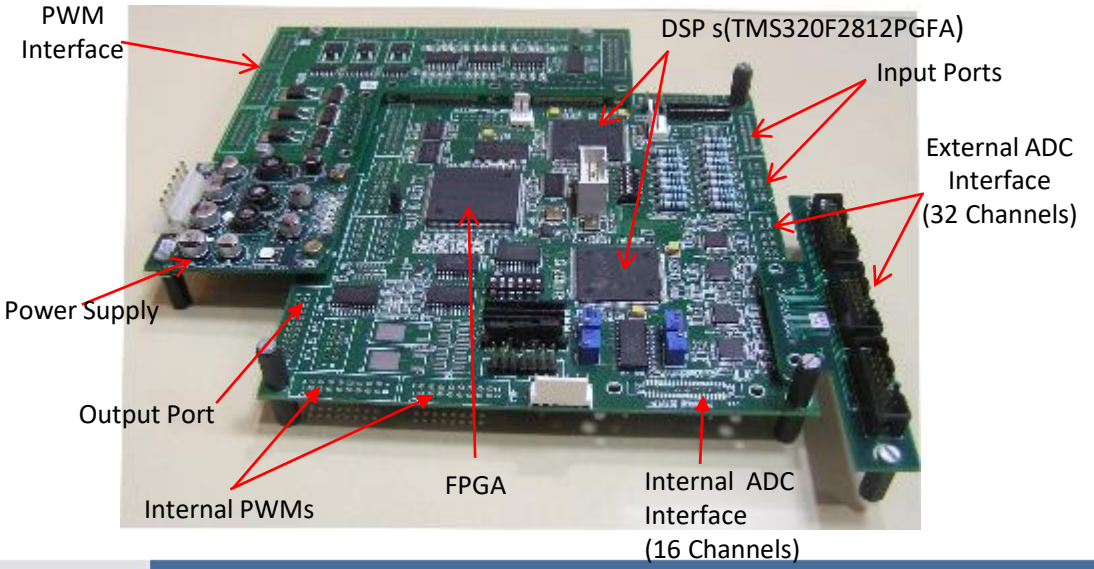
Power Hardware



IGBT Voltage Source Inverter and the VSI hardware stack

Control Hardware





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330kWp Grid connected solar PV Power Conditioning System installation at CDAC Innovation park, Pune

Average Monthly generation from SPV array : 34,000 units

Major deployments: 25 kWp Grid connected Solar PV power plants

Location : (1) WEBREDA building, Kolkatta **(2)** North East Hill University (NEHU), Shillong **(3)** CDAC, Trivandrum.
Funded and supported by : Ministry of Electronics and Information Technology (MeitY), Govt.of India

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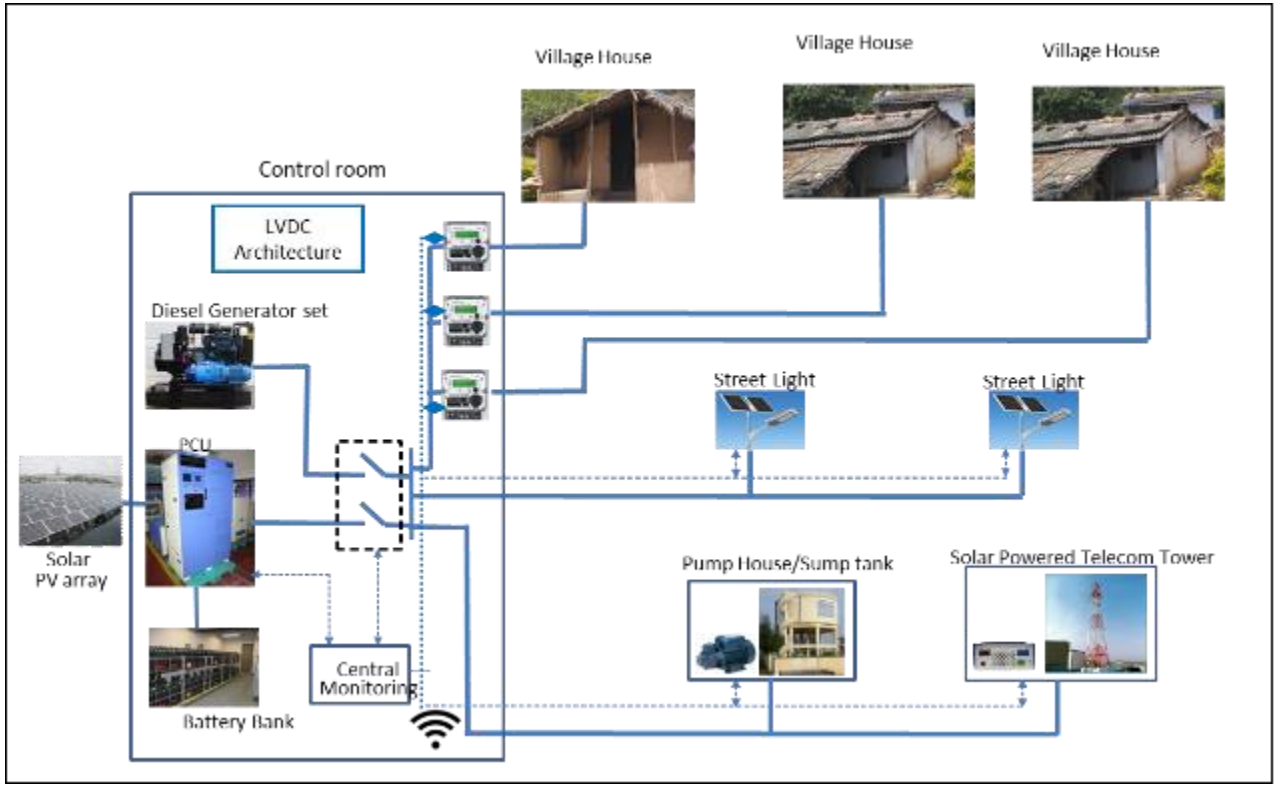
Remote Microgrid Deployments

Location : Puravayal Tribal colony (About 4-5 km inside forest), Marayoor , Kerala
Funded by : Ministry of Electronics and Information Technology (MeitY), Govt.of India
Supported by : Agency for New and renewable Energy Research & Technology (ANERT), Govt. of Kerala



Implementation Scheme

Features

- 25 kW solar PV
- 200 Ah, 400V battery bank
- Intelligent Microgrid Manager
- 5 kVA back up DG
- LVDC powered street lights
- Smart metering
- Solar PV based power supply for telecom needs

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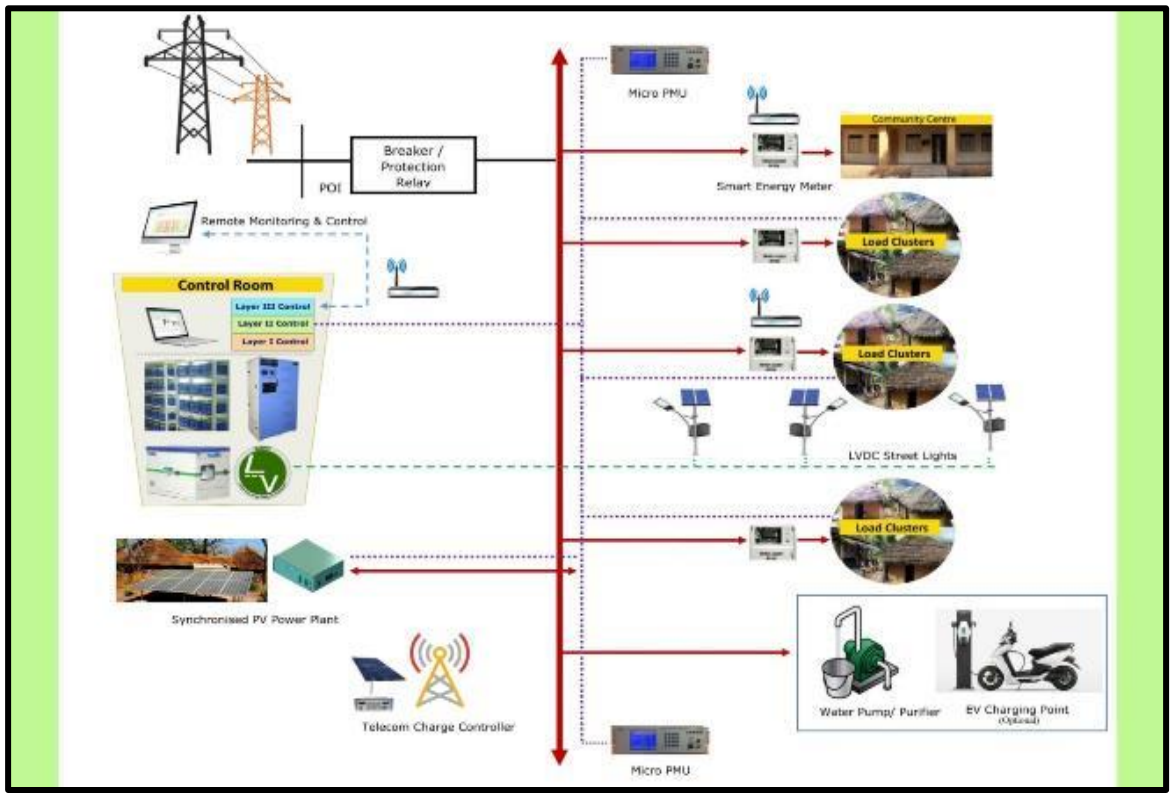
Grid connected Microgrid Deployment

Location : Elephant Rehabilitation Centre, Kottor, Kerala
Funded by : Ministry of Electronics and Information Technology (MeitY), Govt.of India
Supported by : KSEBL & Kerala Forest and Wildlife Department, Govt. of Kerala



Implementation Scheme

Features

- Communication with Microgrid assets using proprietary protocol
- Monitoring, Scheduling and data logging
- Scalable solution
- 20 kW solar PV
- 200 Ah, 400V battery bank
- Intelligent Microgrid Manager
- 5 kVA back up DG
- LVDC powered street lights
- Smart metering
- Solar PV based power supply for telecom needs

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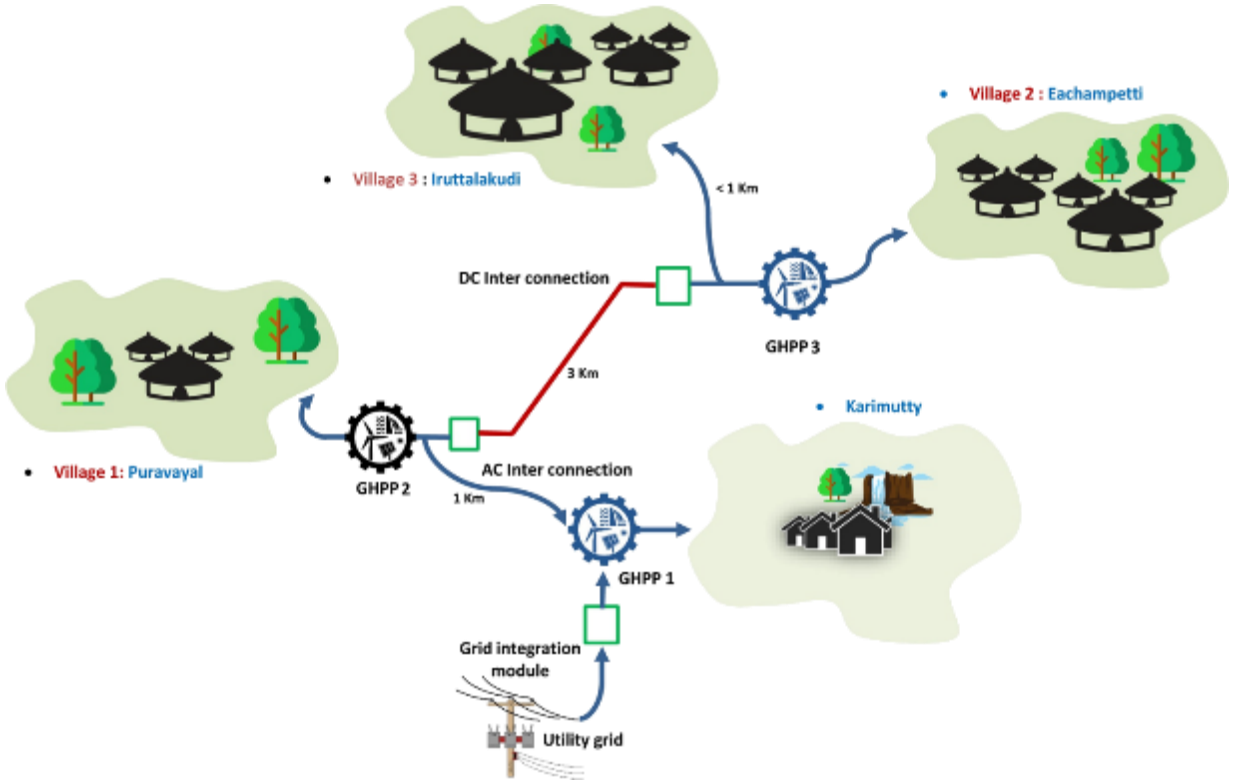
Interconnected Microgrid Deployment

Location : Marayoor, Kerala
Funded by : Ministry of Electronics and Information Technology (MeitY), Govt.of India
Supported by : KSEBL & Kerala Forest and Wildlife Department, Govt. of Kerala



Implementation Scheme

Features

- A model interconnected microgrid having 3 renewable energy microgrids suitably interconnected with DC and AC interconnection
- Intermittency of renewable sources can be tackled
- Flexibility to share excess generation and resources across a number of microgrids
- Reducing load-shedding possibility due to unexpected overloading of the microgrid
- Reducing renewable energy curtailment due to unexpected excessive generation
- Improving the self-healing, reliability, and resiliency of the electrical system of remote settlements

Energy Efficient LVDC Powering of Houseboat [2020]

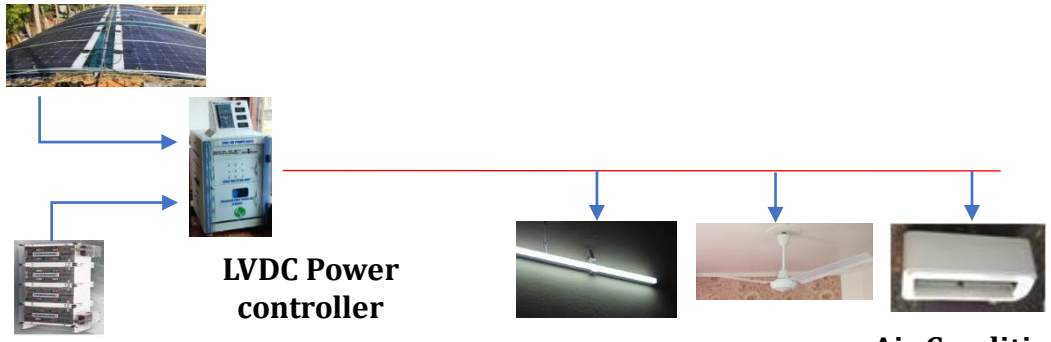
C-DAC Thiruvananthapuram, Energy Management Centre (EMC) Kerala, NIT Calicut

Need for Development…. To address the problems of Conventional Houseboat powering

- An Energy efficient & Green power distribution system for houseboat hotel loads through LVDC (48V) with solar PV primary source
- **2BHK Houseboat hotel load powering**
  - 6kWp monocrystalline flexible SPV (18-21 kWhr/day generation on average sunny days – 1/4th shall be used during day & ¾; 15kWhr to store in battery)
  - 24.5kWhr Lead acid battery storage – use factor 60%DoD
  - No external charging need- matching seasonal Conditions of generation and loads- onboard charger 3.3 kW
  - 48V Light, Celling Fan, Air Conditioner
  - Eco friendly and better tourist comfort– No CO emission, No oil spillover, No Noise
  - Energy Saving 5kWhr per day (20%)
  - CO2 removal - 40kgper day
  - 8 Lakhs capital investment /Rs. 2 Lakhs per year savings on diesel for 200days operation

- Hotel load powering : Operation- 230VAC from diesel genset, Halt- 230V grid supply
- Propulsion -:Second hand 6 Cylinder Diesel engine

Green & Efficient



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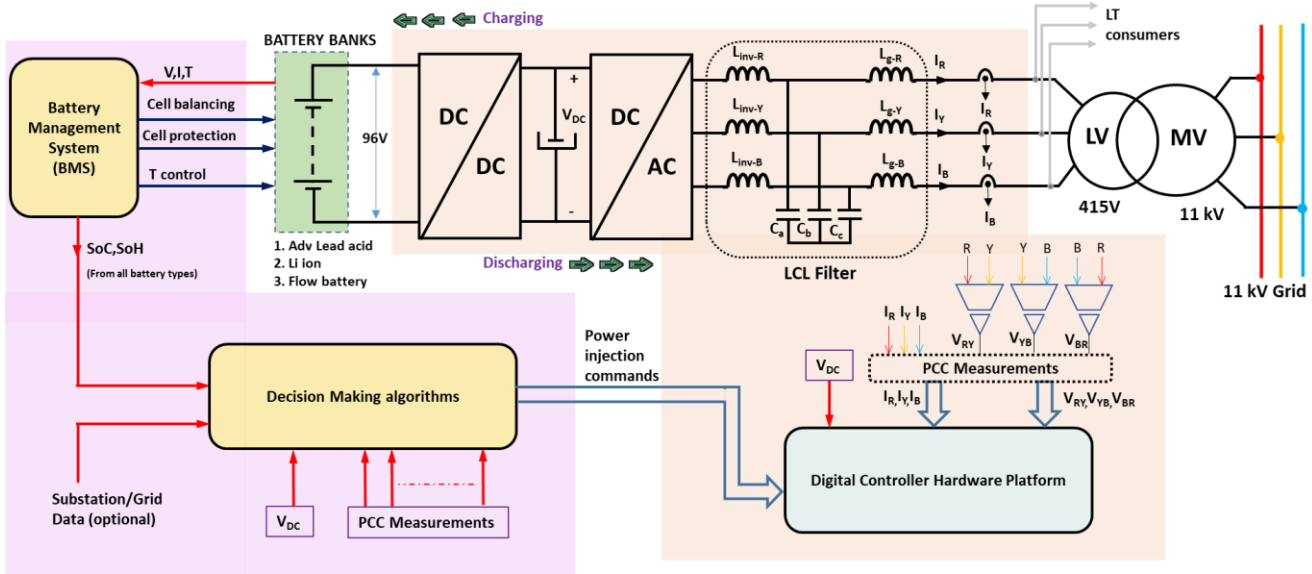
Development and Implementation of Battery Energy Storage System(BESS)

Location : Paruthipara substation, KSEBL,Trivandrum
Funded by : Ministry of Electronics and Information Technology (MeitY), Govt.of India
Supported by : KSEBL

Why BESS?

- **To achieve 100% Renewable Energy Penetration**
- Supply-demand balance
- Offsets Peaking Power plant
- Decarbonising grid
- Minimising capacity of Transmission & distribution grid



Architecture of BESS

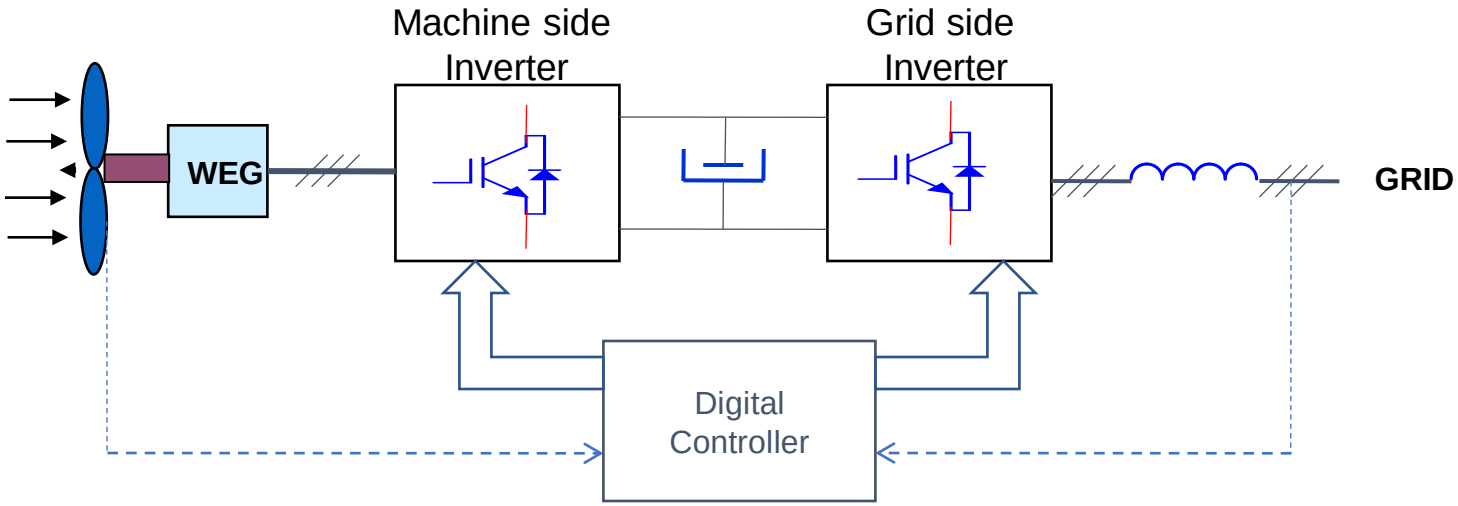
Scope of work

- Power electronic converter topologies suitable for BESS with different battery technologies
- Battery Management System
- Protection schemes and ancillary services
- Field implementation and technology demonstration

Major deliverables

- 250 kW system with advanced lead acid battery and indigenously developed power conditioning System
- 25 kW technology demonstration unit with Lithium-Ion battery
- 10 kW technology demonstration unit with Flow battery technology
- Development and implementation of BMS

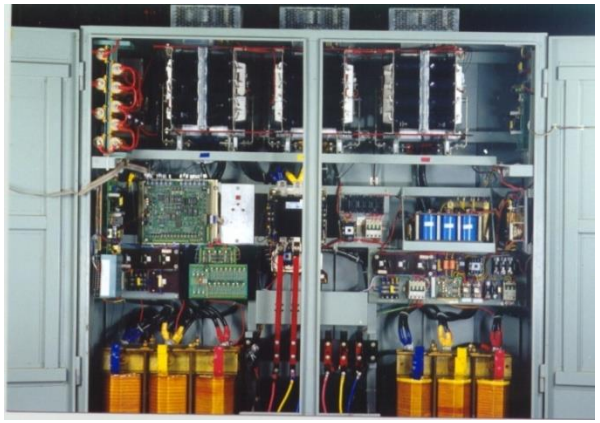
Power Converter System for Variable Speed Wind Electric Generator



- Power converter for 250 kW power rating
- MPPT control
- Reactive power support at Grid

(No separate compensation capacitor required)

- Vector control scheme for the induction generator
- Indigenous design and implementation of power and control hardware
- System was tested and verified with Vestas V27 WEG



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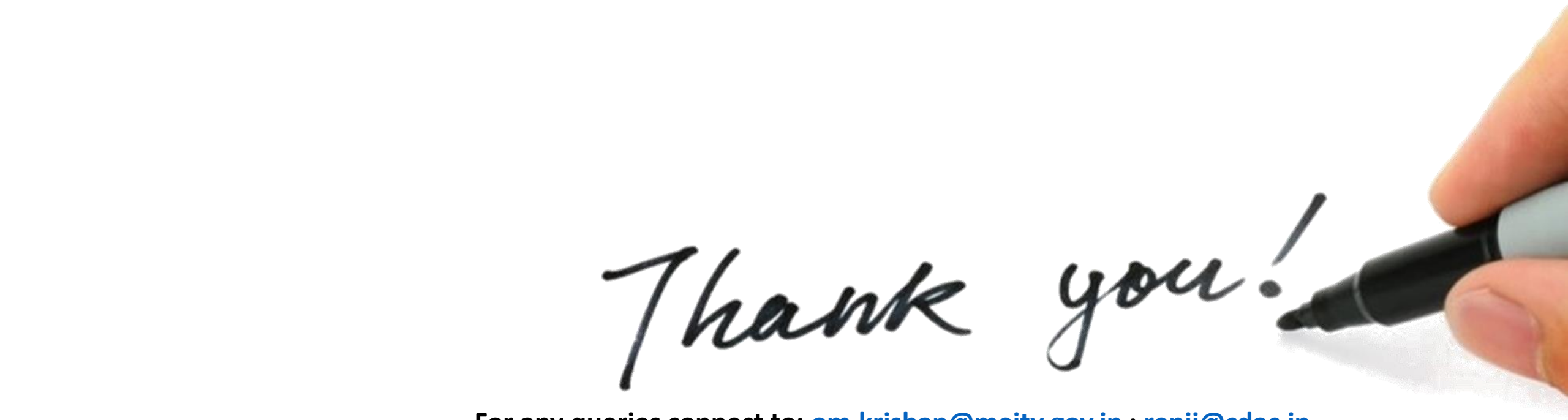

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