Host Utilities

TATA

TATA POWER

TATA POWER-DDL

BSES

BSES Rajdhani Power Limited

BSES

BSES Yamuna Power Limited

Co - Host Utility

ORGANIZER

ISGF

India Smart Grid Forum

India SMART UTILITY Week 2024

Supporting Ministries

MINISTRY OF POWER
GOVERNMENT OF INDIA

MINISTRY OF NEW AND RENEWABLE ENERGY
GOVERNMENT OF INDIA

नीति आयोग

MINISTRY OF ELECTRONICS & INFORMATION TECHNOLOGY
GOVERNMENT OF INDIA

MINISTRY OF HEAVY INDUSTRIES
GOVERNMENT OF INDIA

MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES, RIVER DEVELOPMENT & GANGA REJUVENATION,
GOVERNMENT OF INDIA

MINISTRY OF POWER
CENTRAL ELECTRICITY AUTHORITY

Session : EVOLVING TRENDS IN UTILITY AUTOMATION

Smart Grid & Automation Initiatives at CDAC

Presented By

Shri. Aby Joseph, Scientist G, CDAC

Renewable Energy

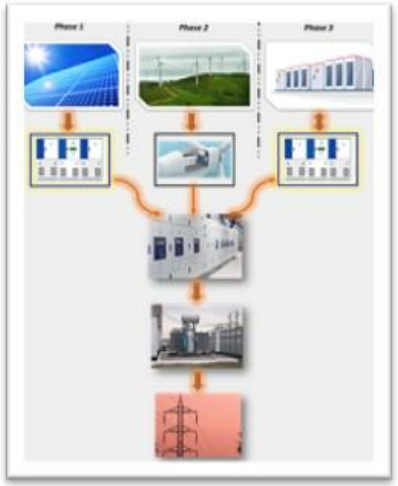
R&D/Deployment projects related to renewable energy in kW-MW level. TRL 7-8

- Power Conditioning Systems (kW – MW scale) for Solar PV
- Green energy Microgrids
- Industrial microgrids
- Hybrid energy stations (renewable sources and energy storage technologies)
- Power Conditioning Systems for Wind Electric Generators
- Power Quality Solutions for Wind Electric Generators
- Digital Control platforms for renewable power plants

Design & Engineering of Power Converter Modules

State of the art Controllers

Field deployment & ToTs



Wind farm, Tamil Nadu

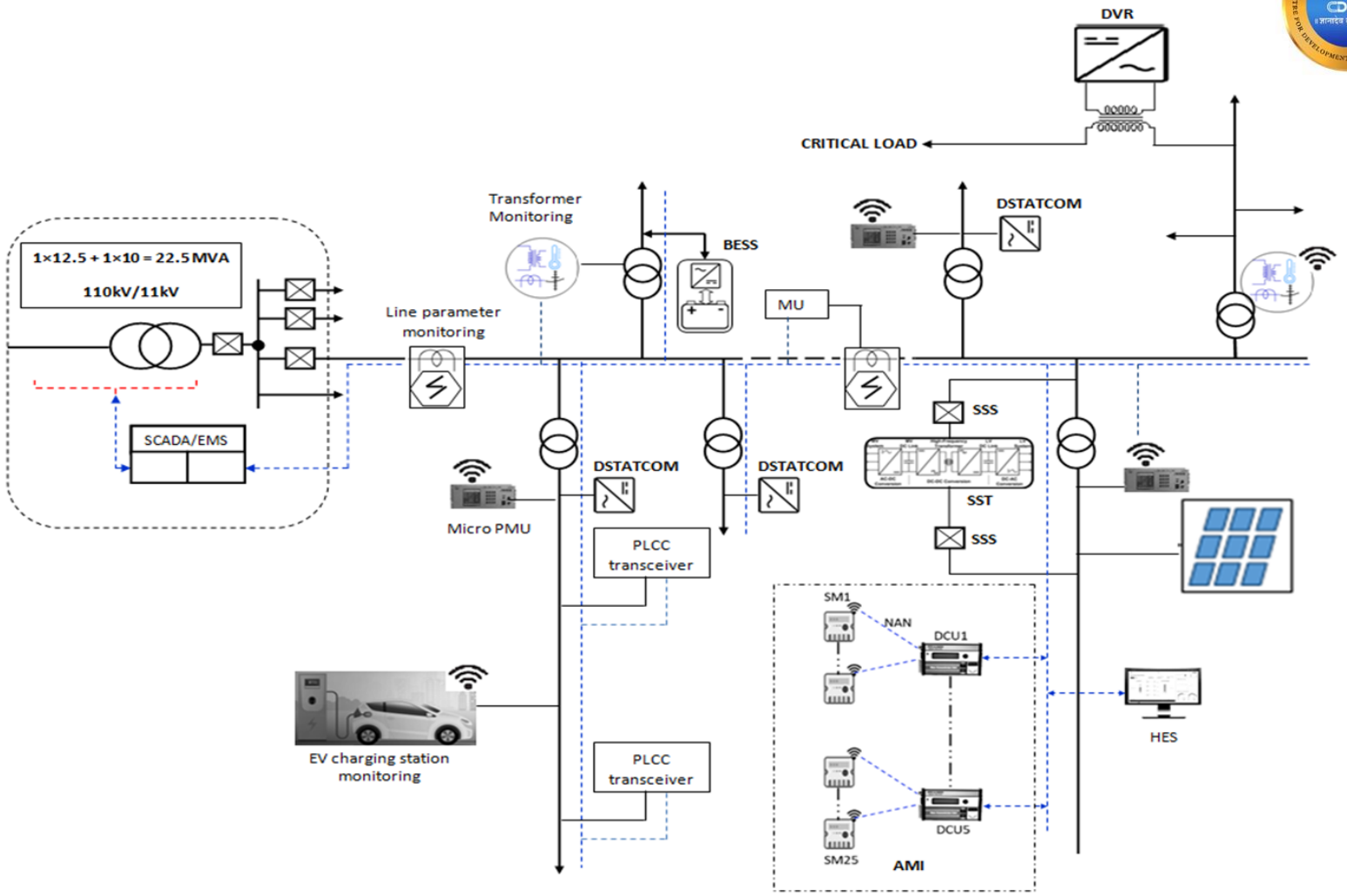
1MW SPV Power Plant (Idukki, Kerala)

25kW SPV Microgrid (Tribal Colony, Kerala)

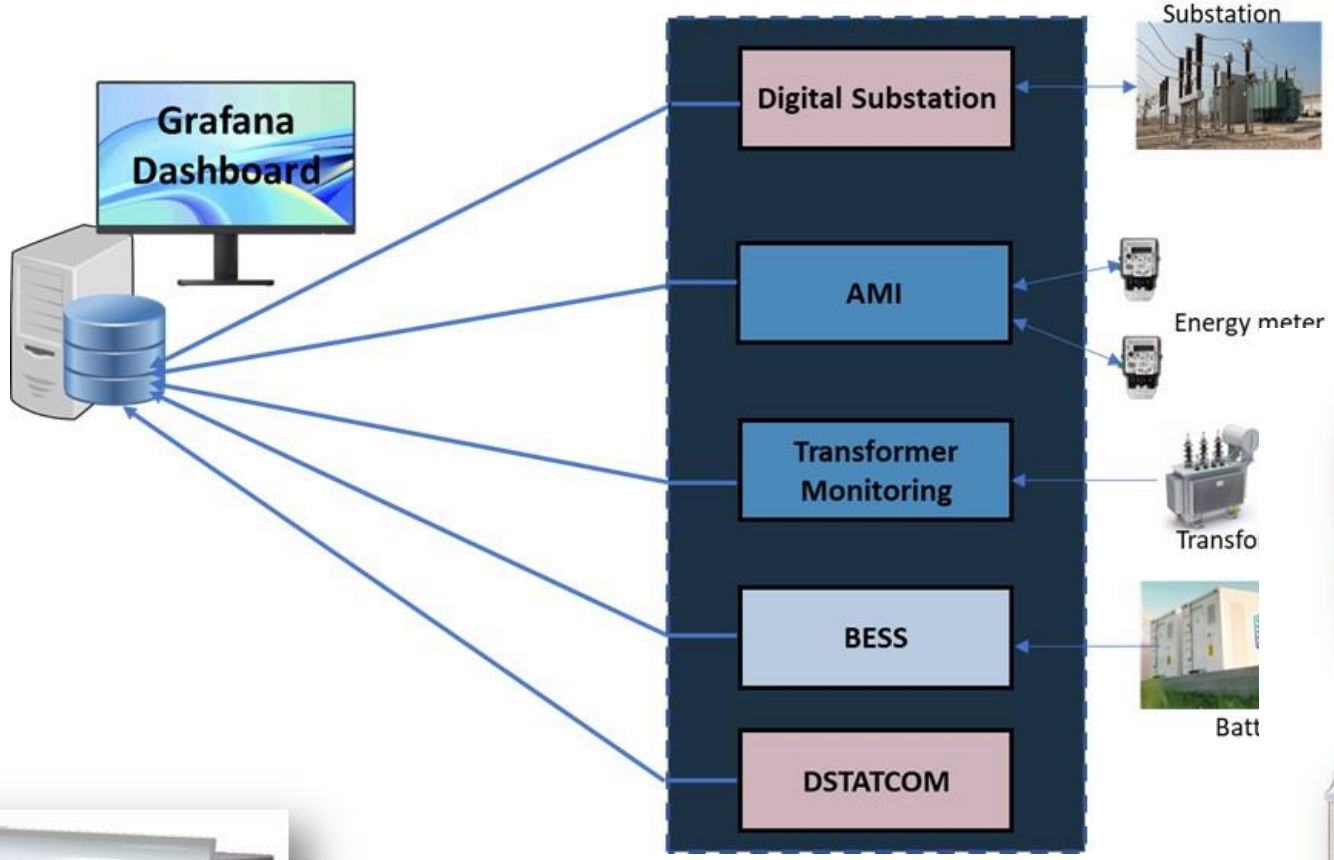
Smartgrid Technology for Distribution Grid – Indigenisation

Smart Power Quality Centre

- Digital Substation
- Advanced Metering Infrastructure
- Intelligent Sensor Network for Distribution Grid
- Utility Scale BESS
- Power Quality Devices for Dist. Grids
- Solid state transformers and Solid state switches



Smartgrid Technology for Distribution Grid – DSS

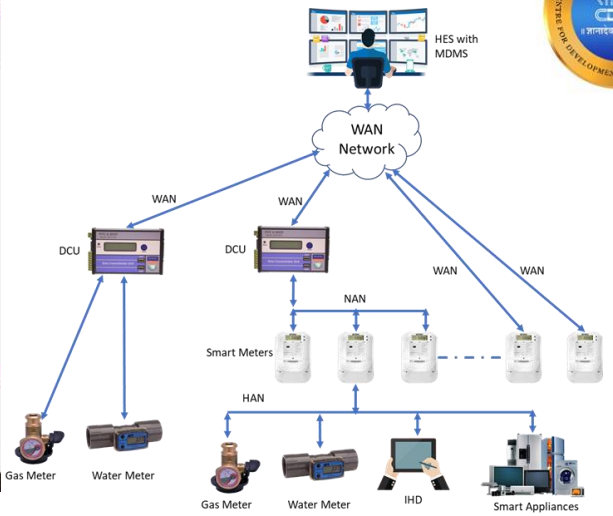


- Substation merging unit
- Smart Digital IO Module
- Bay Control Unit
- SCADA Dashboard

Smart meter and Advanced Metering Infrastructure(AMI)

Three Phase Smart Meter(3ø)

Indigenous Meter Data Acquisition Solutions



Single Phase Smart Meter(1ø)

Data Concentrator Unit

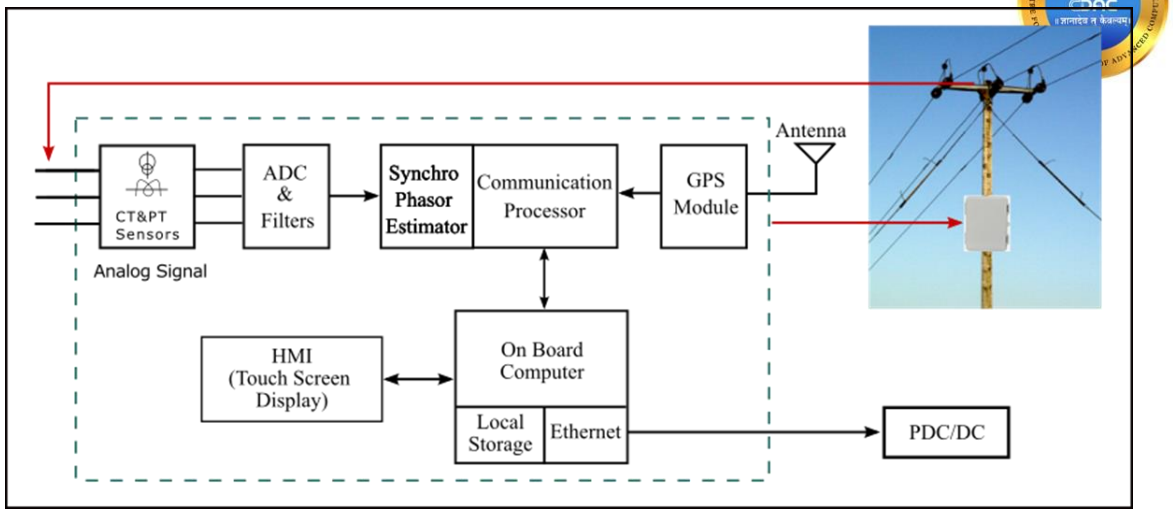
- Technology transferred to 10 industry
- One industry has already qualified/certified and commercial production initiated
- AMI project with KSEBL
- Closed AMI networks for military camps
- Smart meters tested for cyber security performance

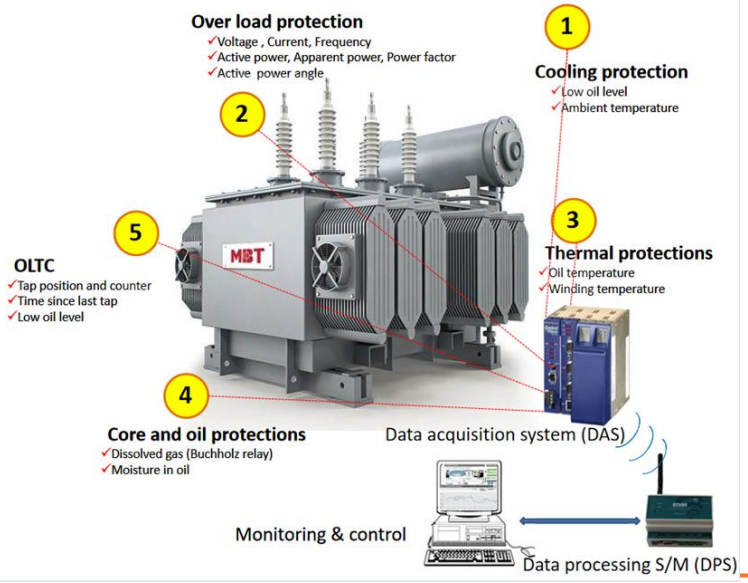
Intelligent Sensor Network

Sensor data driven smart measurement and monitoring system for distribution electric grid.

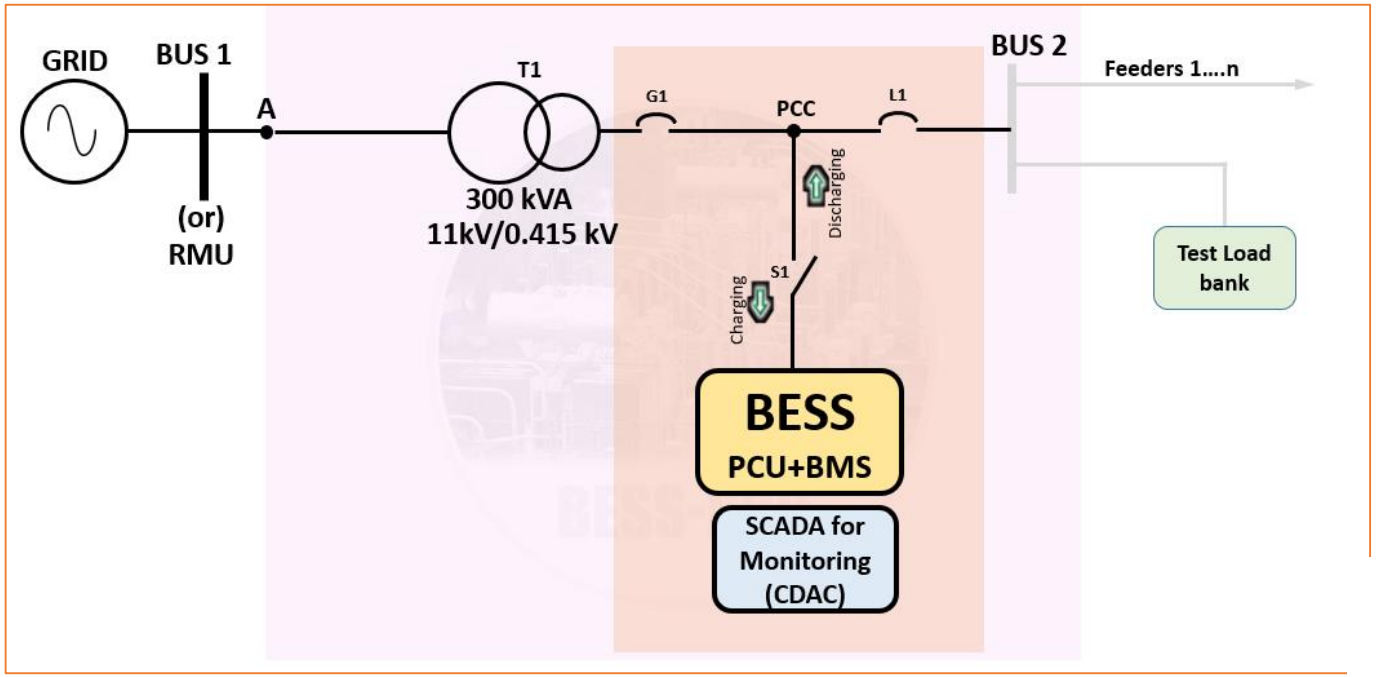
Major subsystems:

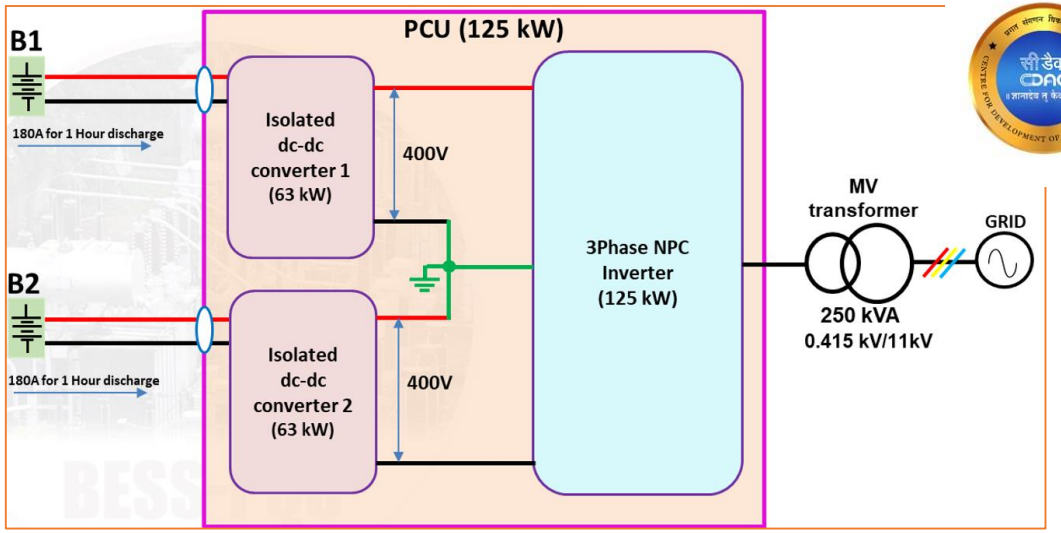
- Distribution PMUs
- Transformer Monitoring Systems
- Smart sensors
- Distribution data management

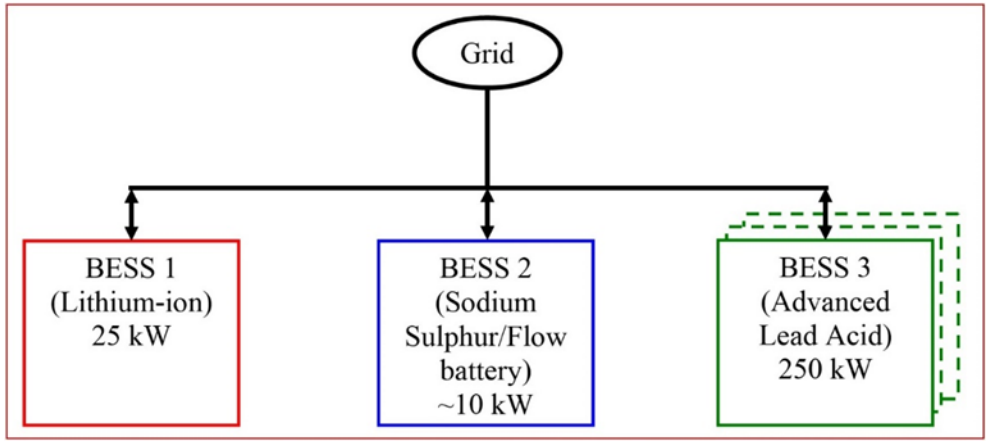




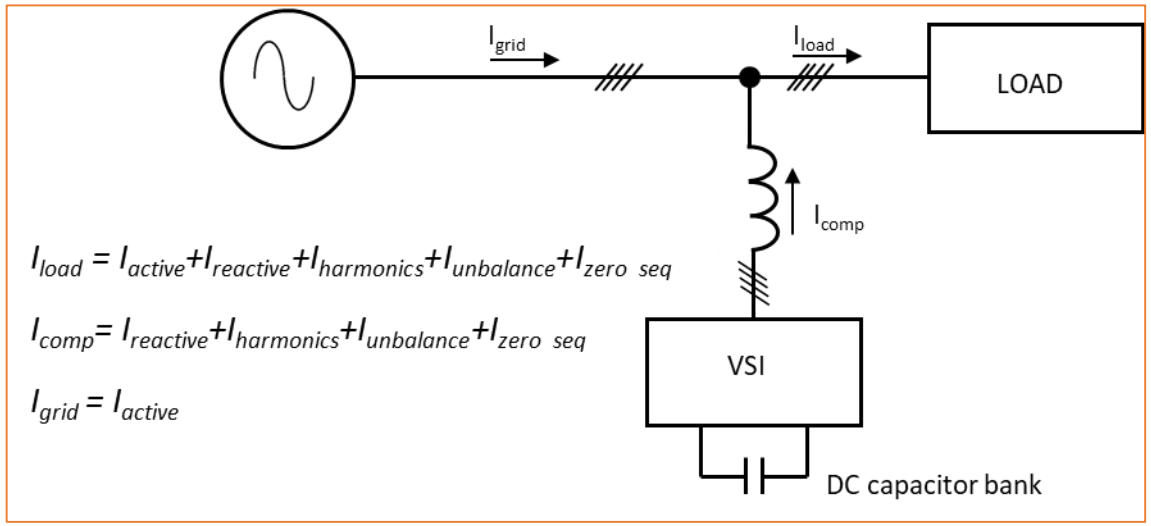
Battery Energy Storage Systems



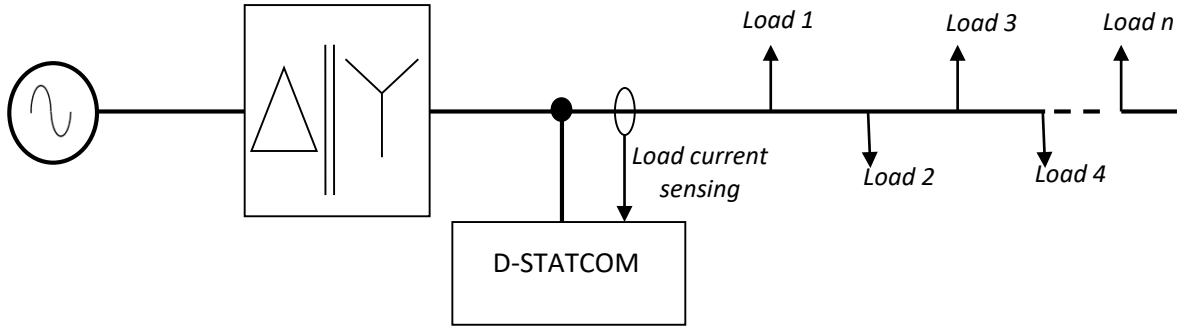


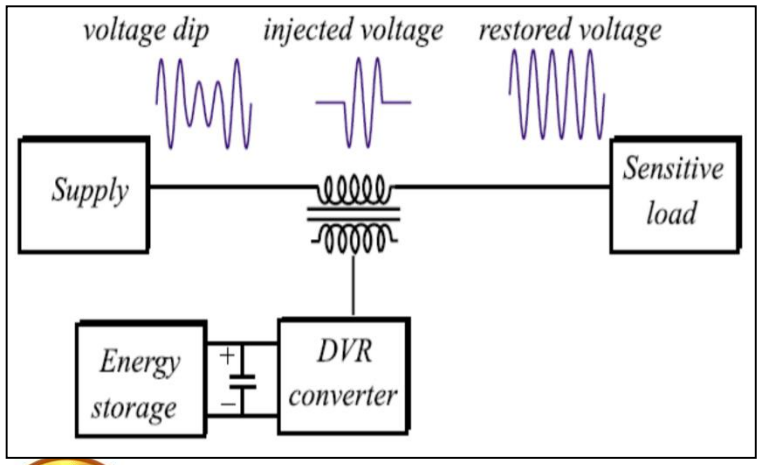


Power Quality Devices



- 100kVA DSTATCOM at Urban Transformer
- 50kVA STATCOM & 10kVA SiC-based STATCOM
- 50kVA DVR for an Industrial feeder





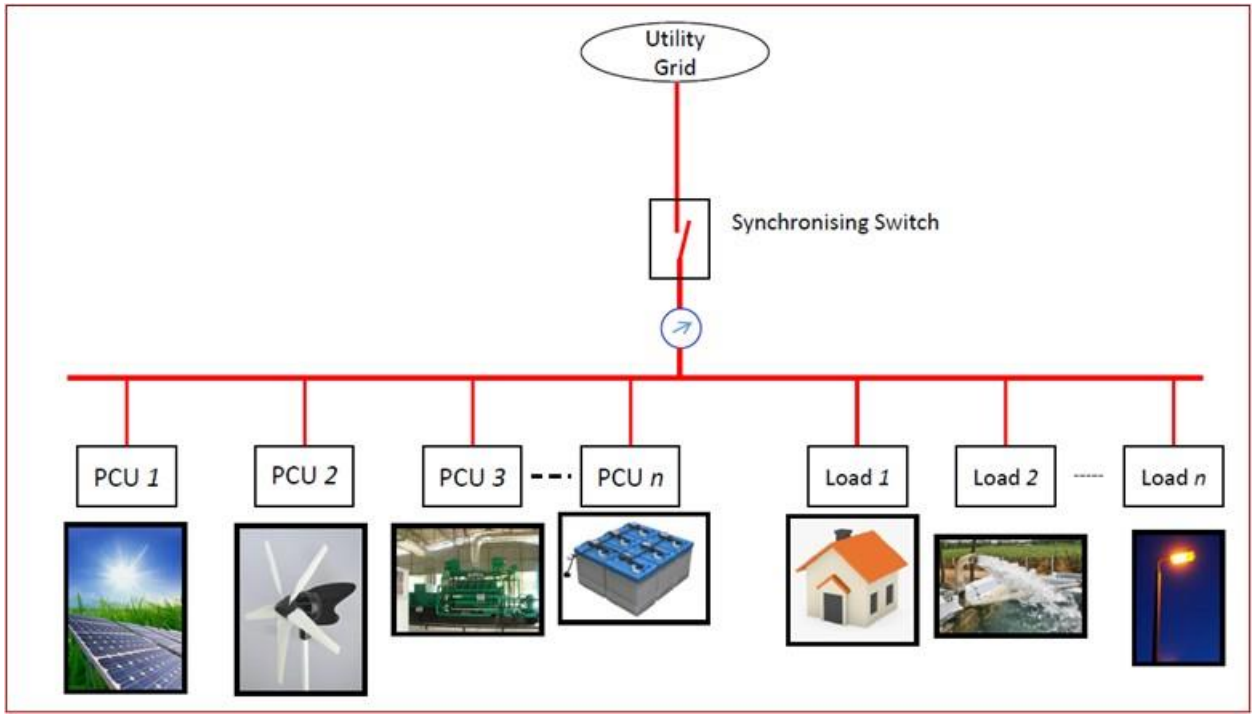

10kVA STATCOM


50kVA STATCOM

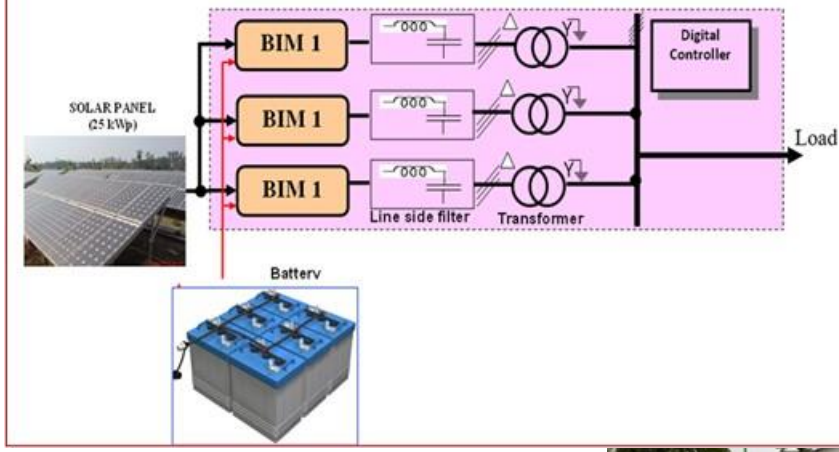

100kVA STATCOM


50kVA DVR

Microgrids



- 25 kWp Solar PV array
- 25kW Power Conditioning Unit
- 300 Ah Battery Bank
- 15 kVA backup diesel generator



Microgrids

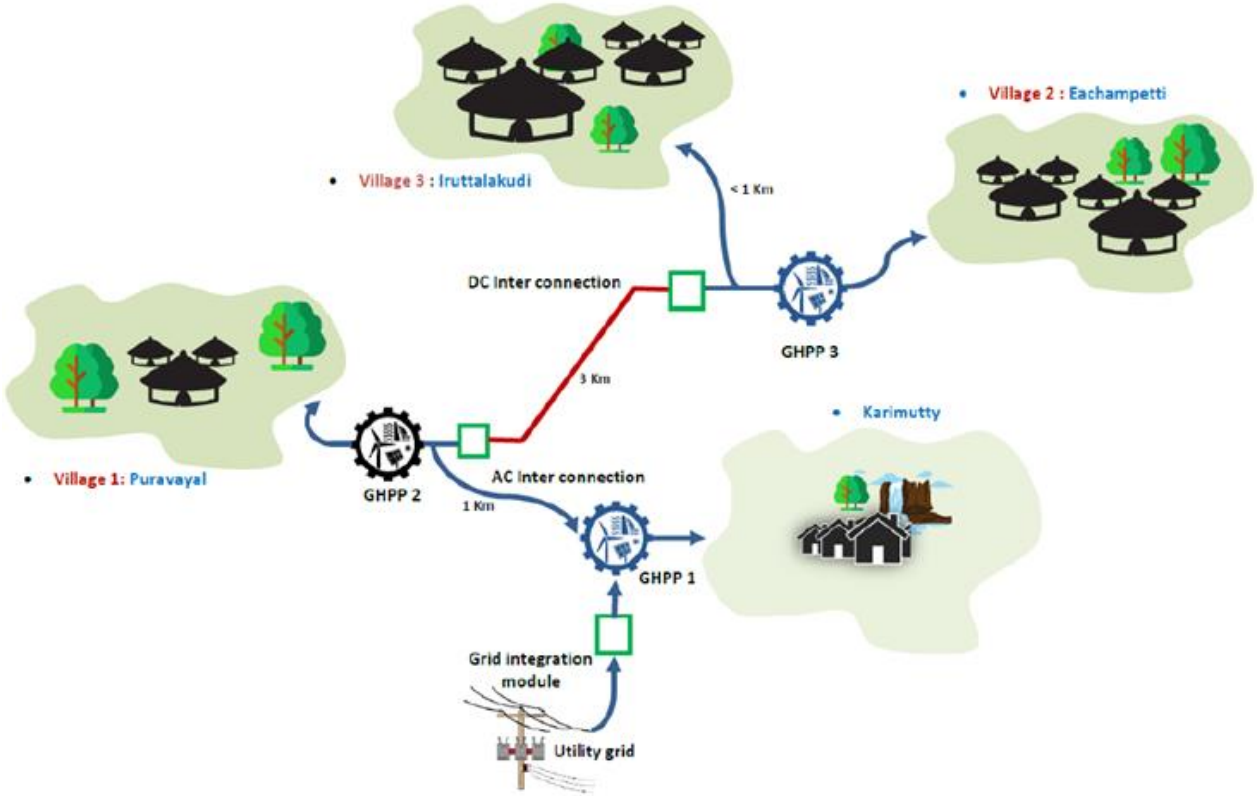
DC Side DB

Dimension(HxWxD):(1400x800x400)mm

AC Side DB

- Stainless steel, IP66 enclosure
- Super power heatsinks exposed outside
- Heat exchanges for climate control
- SiC swithing devices for better efficiency and power density
- AC/DC Energy metering
- IP rated cable harnessing, switchgears
- Semiconductors with environmental compliance

Microgrids


Village 2 : Eachampetti
Village 3 : Iruttalakudi
< 1 Km
DC Inter connection
GHPP 3
3 Km
Karimutty
Village 1: Puravayal
GHPP 2
AC Inter connection
1 Km
GHPP 1
Grid integration module
Utility grid

Off grid solutions – Vaccine Refrigeration System

Innovative, indigenous refrigeration technology for preservation and transportation of vaccines in a controlled temperature.

Parameters	Specifications
Refrigerator capacity	1.5Litre
Cooling temperature range	Between 2˚C and 8˚C
Battery back-up time	48hours
Total weight (excluding medicine)	< 10kg
Battery charging source	Solar and grid
Battery specification	Li-Ion, 14.8*V*, 29Ah
Compressor rating	Reciprocating, 24*V* dc, 48*W*
Refrigerant	R134a
Thermal insulating material	Polyurethane
Temperature hold time	> 20minutes
Dimension (Width x Depth x Height)	29 × 30 × 40 (in *cm*)

Developed **1.5litre/3.0litre portable stand-alone refrigerator** for vaccine storage application which includes subsystems like **refrigeration unit, dc-dc converter, Li-ion battery and battery charger**.

- The innovative research on efficient portable stand-alone vaccine refrigerator will become transformative agent for lives of individuals and communities through providing quality of life and prosperity.
- Li-ion battery used in the system allows the refrigerator to run for 48 hrs by maintaining the vaccine temperature between 2˚C and 8˚C and it can be charged through solar or grid.
- The refrigerator unit has USB communication which allows the user to download data such as temperature, door operation status , battery voltage and state of charge.
- Ergonomic backpack type package with weight within 7kg, hence it can be easily carried to remote locations on shoulders.

1.5L and 3L refrigerator Units

Charging Infrastructure

Power Electronics solutions and communication interfaces addressing EV charging requirements complying Bharat /other EV charging specifications.

- SiC 15kW DC Dual Point Charger
- GaN 3.3kW SPV DC Charger
- SiC 50kW DC fast charger and
- 3.3kW Single Phase AC Charger
- 7kW and 22kW AC Fast chargers

SPV Charger

Three port & Single Port 3.3kW AC EVSE

7kW and 22kW AC Fast chargers

15kW and 50kW DC EVSE

AC Charger technology transferred to 2 industries

WBG based Integrated Drive System

SiC based
30kW PMSM drive

Development Focus:

- Compact and light weight SiC drive with Active Gate Driver
- Attempt of ZC and ZV Switching and loss reduction using Active Gate Driver.
- Integrating the Electric motor with Drive system for Integrated Drive Systems (IDS)
- Application focus for Electric Vehicle Propulsion systems

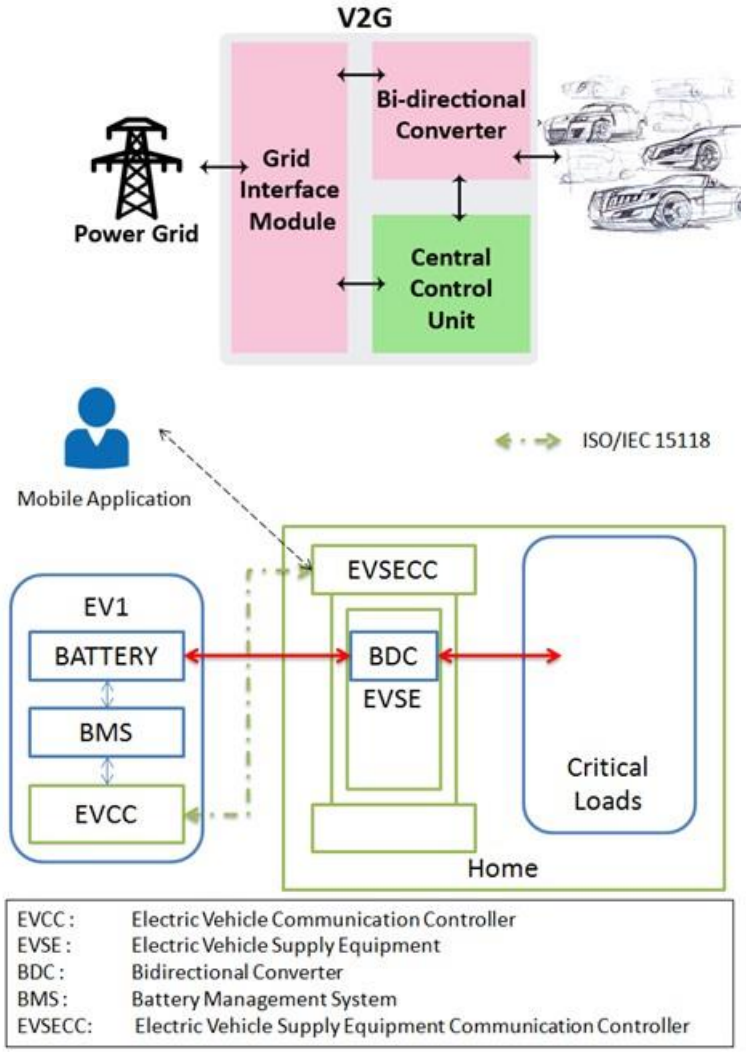
Development Focus:

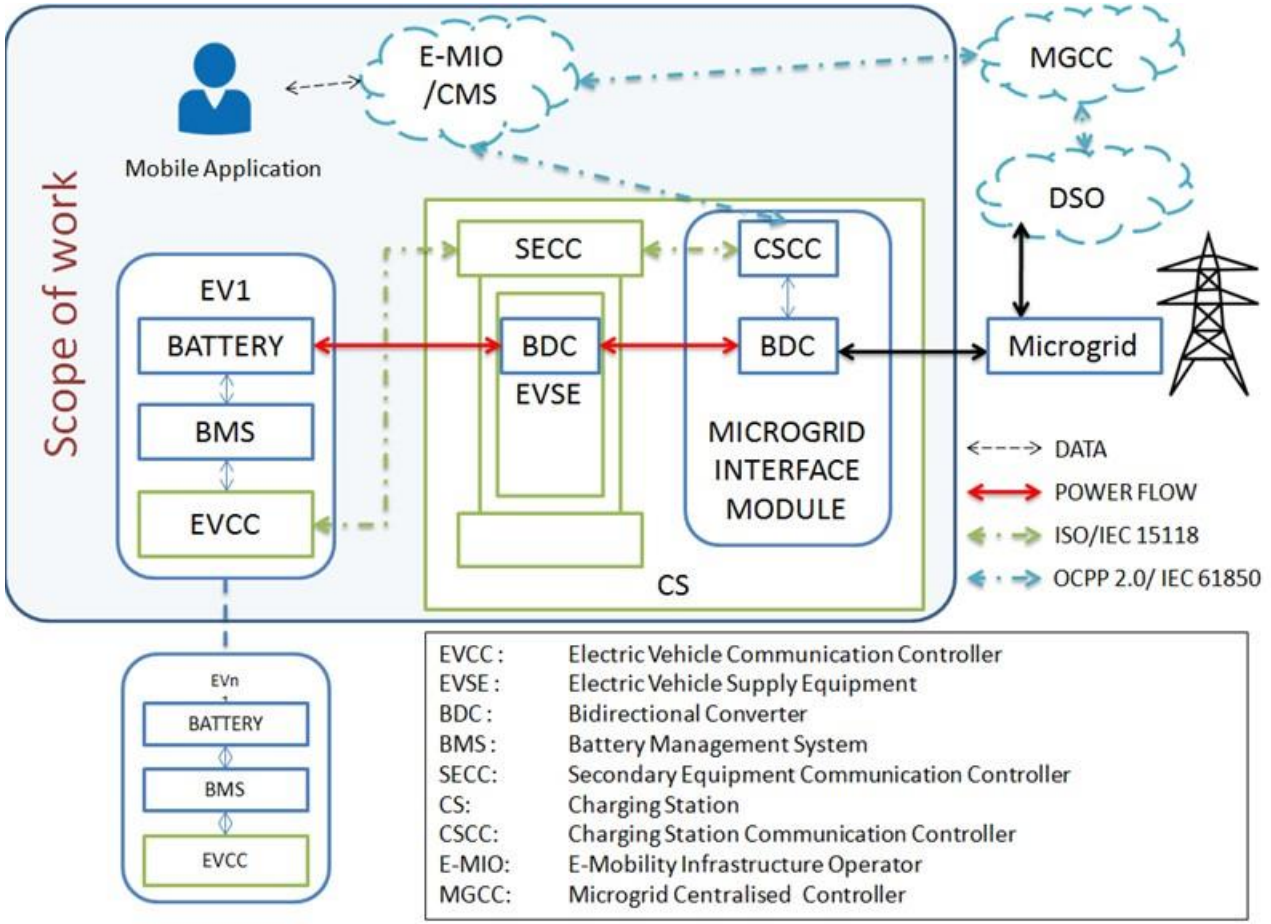
- Compact and light weight drive using GaN devices
- Packaging of drive for integration with the BLDC motor

**Under NaMPET-III*

GaN based
3kW BLDC drive

Vehicle to Grid / Business / Home (V2X)

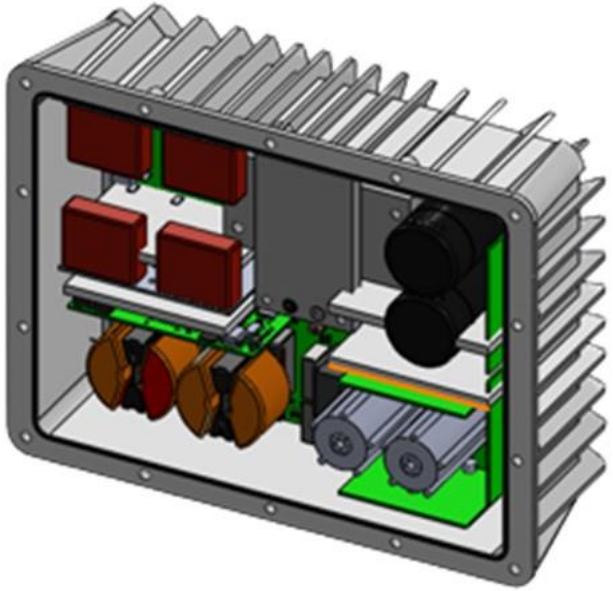




**Under NaMPET-III*

GaN based On-Board Chargers (OBC)

- ✓ Bridgeless totem-pole PFC
- ✓ DAB at rear end for bi-directional capability
- ✓ High Efficient & Compact
- ✓ Power density >40 Watts/Cubic inches



3D Model

**Under EVSS-01*

Integrated Mother Board

48V Output Nominal , 3.3kW Max power
230V, 50Hz, Single phase input

Development in joint with IISc, Bangalore
Industrial partner – Ather Energy, Bangalore

THANK YOU

abypj@cdac.in