India SMART UTILITY Week 2024

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ISGF India Smart Grid Forum

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Sustainable Energy system for Achieving Novel Carbon neutral Energy communities (SUSTENANCE)

Session: Emerging Technologies for Utilities

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This project has received funding from and the Department of Science and Technology (DST), Government of India, and the European Union's Horizon 2020 research and innovation programme under grant agreement No 101022587,. Any results of this project reflect only this consortium's view and the funding agencies and the European Commission are not responsible for any use that may be made of the information it contains.

SUSTENANCE

Objectives of the SUSTENANCE project

The project aims to develop concepts enabling a”green” transition to sustainable ”energy islands”

- **21 PARTNERS from 3 EU countries & India,**
- **Demos in Denmark, The Netherlands, Poland & India**

- **Goals**
  - **Decarbonisation** of local energy systems via optimal integration of locally available **renewables** (smart control, balancing of grids, storage solutions, and application of active load control)
  - **Integration of energy systems for local communities** (considering electricity, heat, water, waste & transport infrastructure),
  - **Technical benchmarking** and solutions matched with **business models** tailored to the different challenges identified in each country
  - Evaluation of the demonstration sites for **replicability across India, Europe & worldwide,**
  - Emphasis on **user involvement,** including the identification of the conditions and socio-economic characteristics behind the willingness to participate,
  - Enhancement of the **environmental, social and economic conditions** of local communities

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Consortium Partners

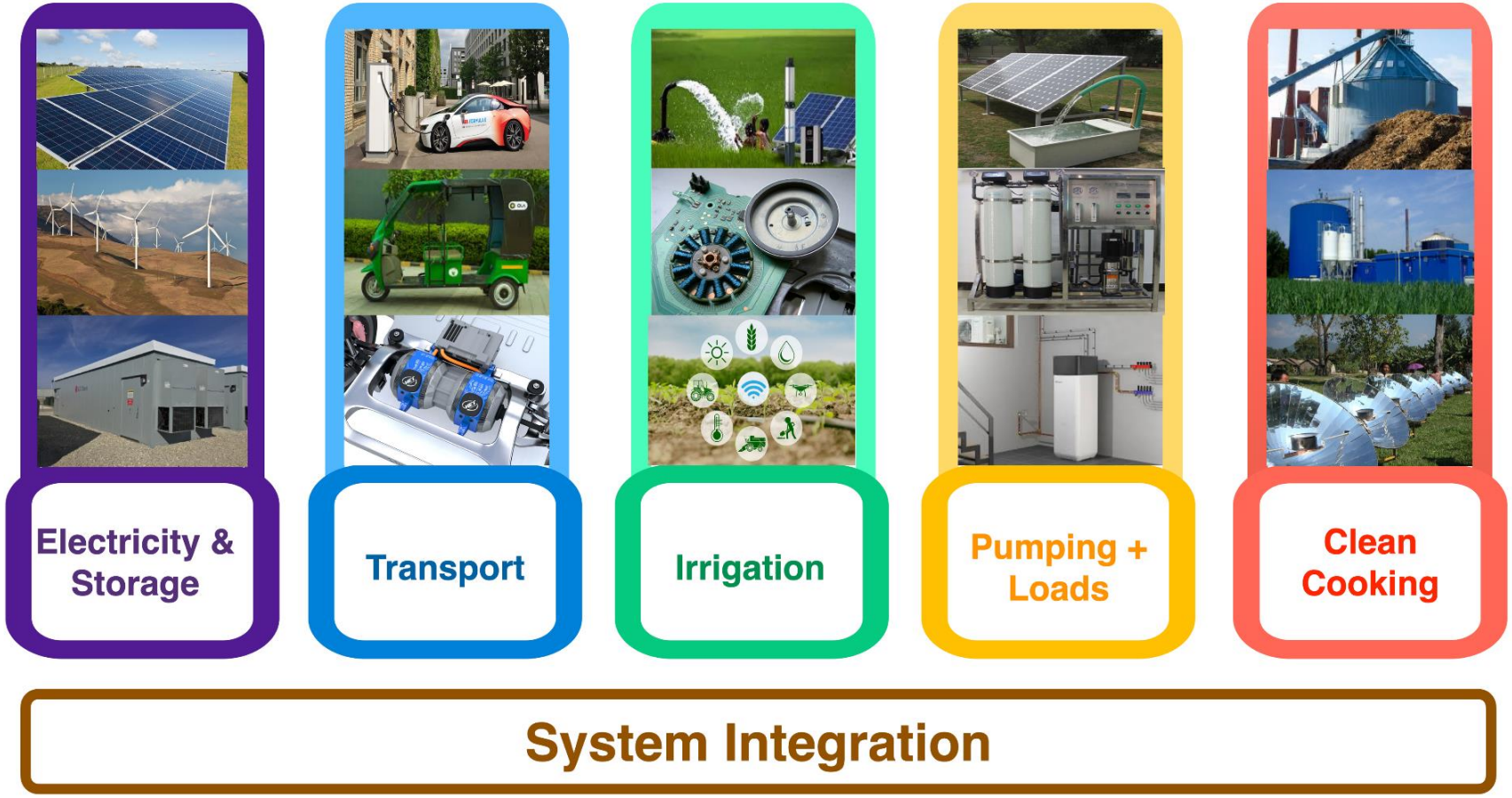
European partners

Aalborg University	Denmark
Skanderborg Kommune	Denmark
Aura Energi	Denmark
Neogrid	Denmark
Bjerregaard Consultants	Denmark
University of Twente	Netherlands
Saxion University of Applied Science	Netherlands
The Institute of Fluid-Flow Machinery of the Polish Academy of Sciences	Poland
Energa-Operator SA	Poland
Stay-ON Energy Management	Poland
KEZO Foundation at Polish Academy of Science Research Centre	Poland
Własnościowa Spółdzielnia Mieszkaniowa im. Adama Mickiewicza w Sopocie	Poland

Indian partners

Indian Institute of Technology, Bombay	India
Indian Institute of Science, Bangalore	India
Indian Institute of Technology, Kharagpur	India
Indian Institute of Technology, Delhi	India
National Institute of Technology, Tiruchirappalli	India
National Institute of Technology, Silchar	India
Visvesvaraya National Institute of Technology, Nagpur	India
Motilal Nehru National Institute of Technology, Allahabad	India
Gram Oorja, Mumbai	India

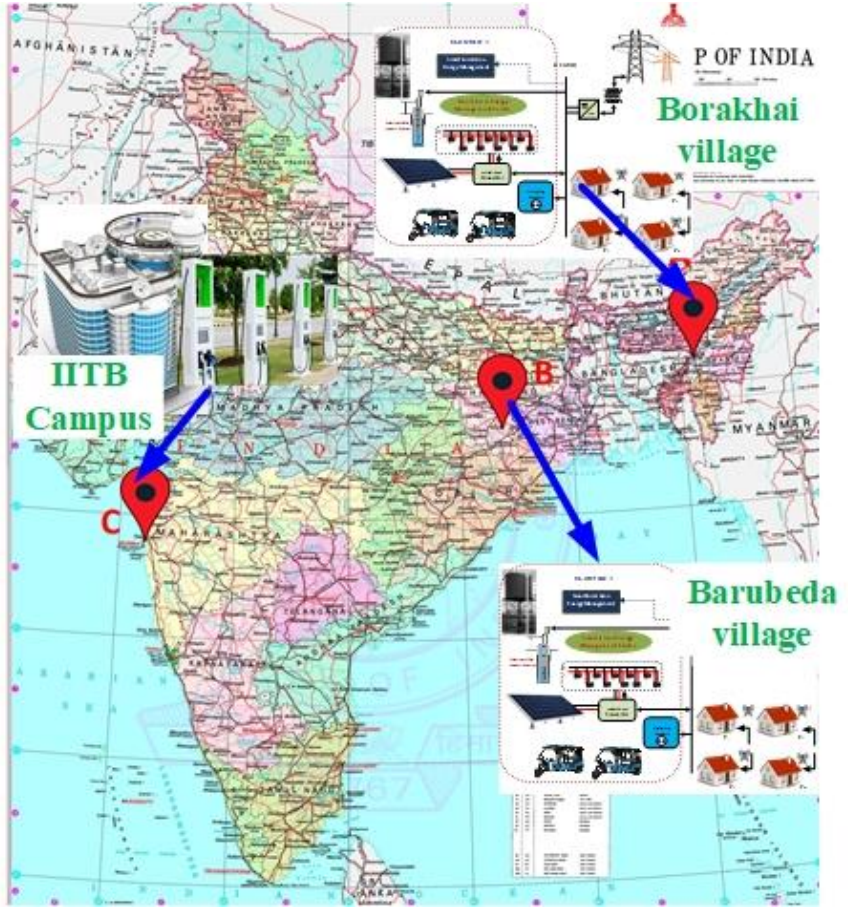
Focus areas-Energy verticals



Indian demonstrators

Focus on how three demonstrations aim to establish carbon neutral communities and become role models

- Local clean energy system with reliable electricity supply for a remote villages
- Sustainable clean energy system for rural village with weak grid access
- Intelligent electric vehicle charging system and electrically smart building system for urban application



Indian Demonstration Site – I: (Barubeda village, Jharkhand)

- Aims to deliver a sustainable clean local energy system with reliable electricity supply for the remote tribal village which can be replicated in other similar locations/communities.

- **Target energy vector**: Electricity, Water, Clean transport, Clean cooking, Heating and Cooling, Energy storage

Geographical Focus Area	
Village	Barubeda
Gram Panchayat	Sarle
District	Ranchi
Nearest main road	Around 3 kms away from the village
Local transport	No local transport option
No. of houses	57

Firewood/ cow dung based cooking

The only source of water for the entire village at around 1.5 kms distance

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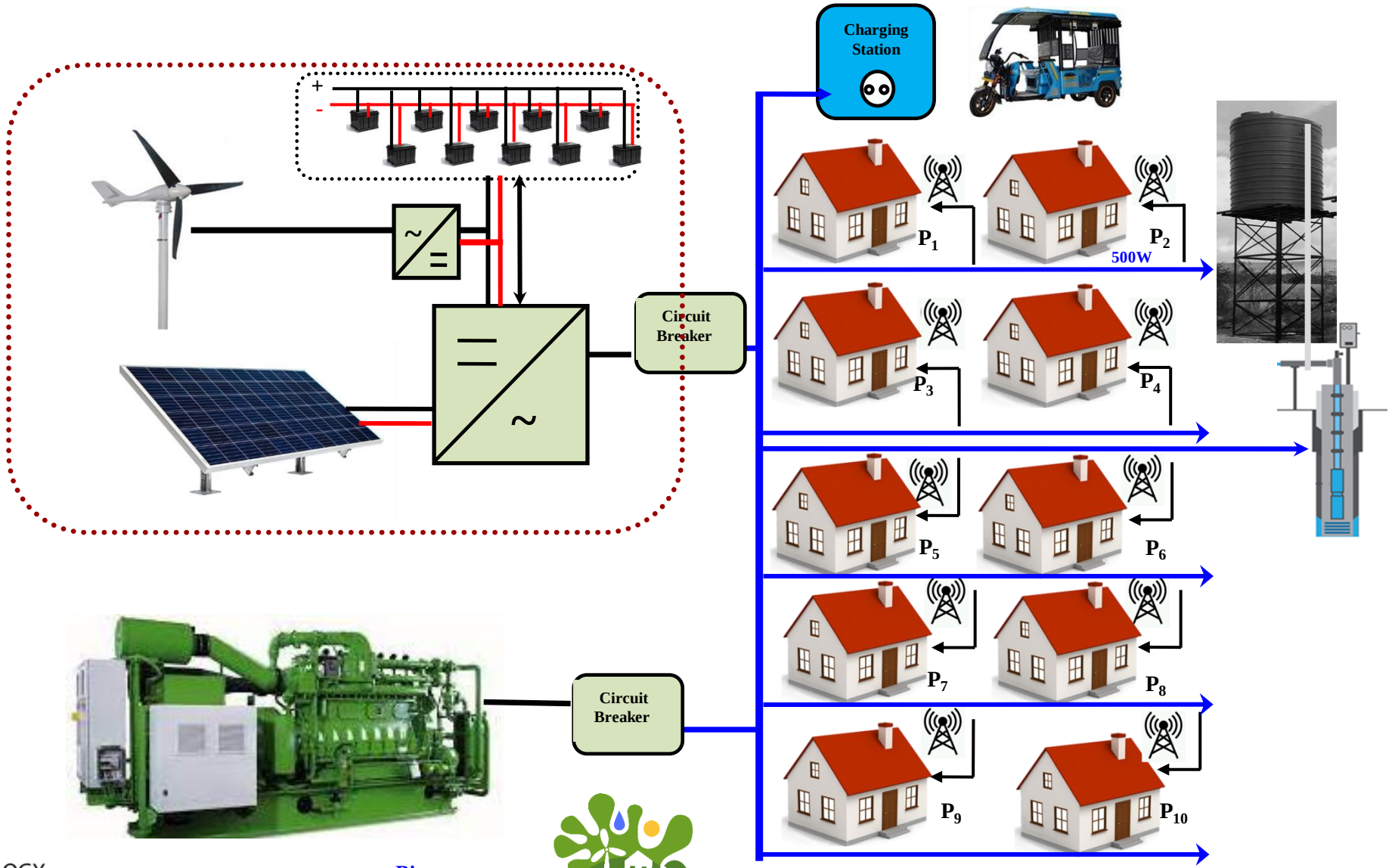

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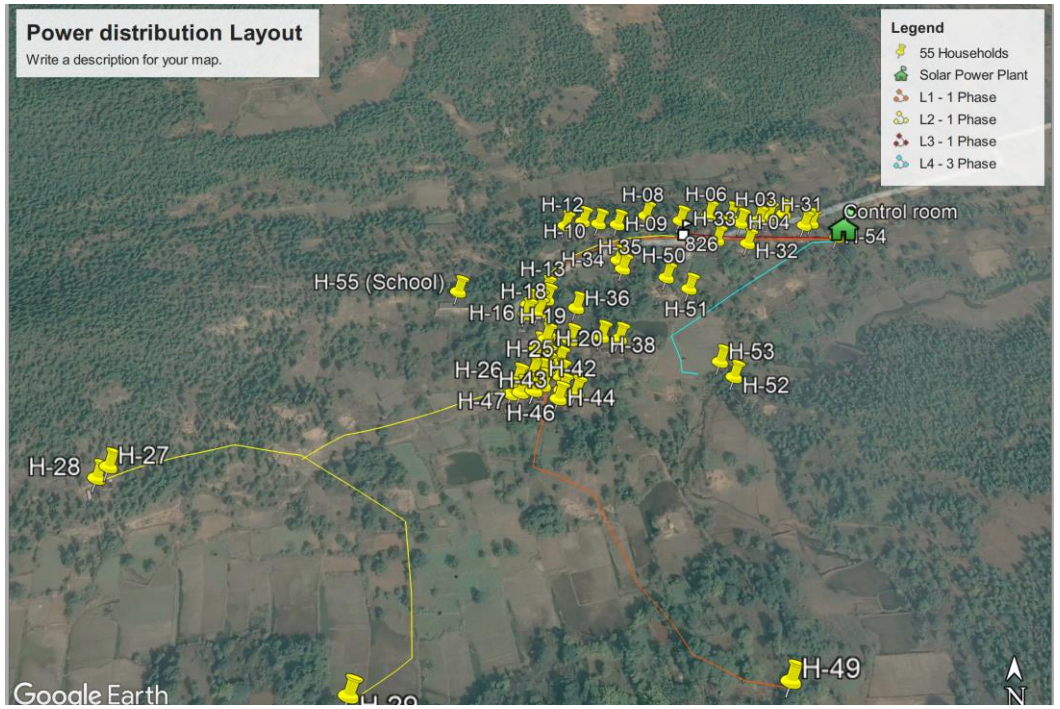
Electricity Vector Development



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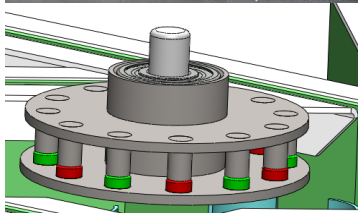
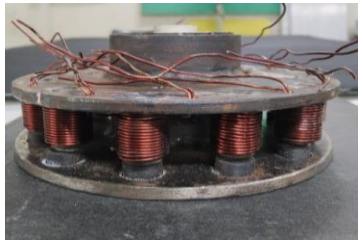
Technology Development Activities

Multi-Utility Heat Pumps for Rural Applications,

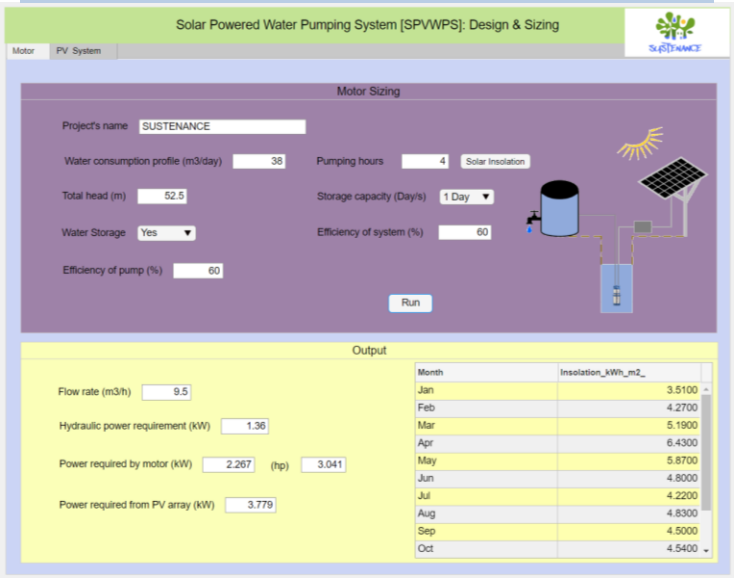
Low speed wind turbine





E-Rickshaw

Tool for Designing of SPVPWPS



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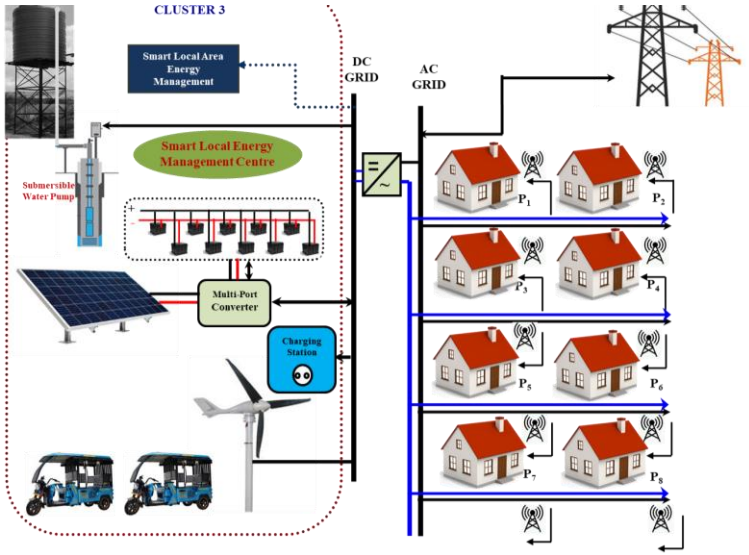
Indian Demonstration Site – II: (Borakhai village, Assam)

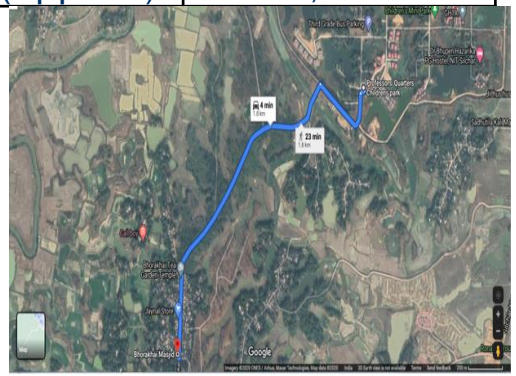
- Aims to deliver a sustainable clean local energy system for the remote rural village with weak grid connection, which can be replicated in other similar locations/ communities.

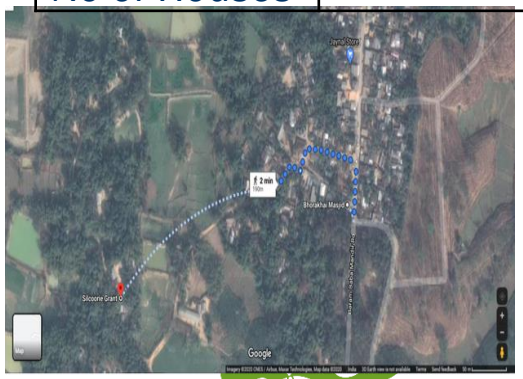
- **Target energy vector:** Electricity, Water, clean transport, energy storage

Broad Geographical Area	
Village	Borakhai Village
Block / Taluka	Barjalenga
District	Cachar
No. of Families (approx.)	2,857

Focus Area	
Village	Borakhai Grant village
Block / Taluka	Barjalenga
District	Cachar
No of Houses	40







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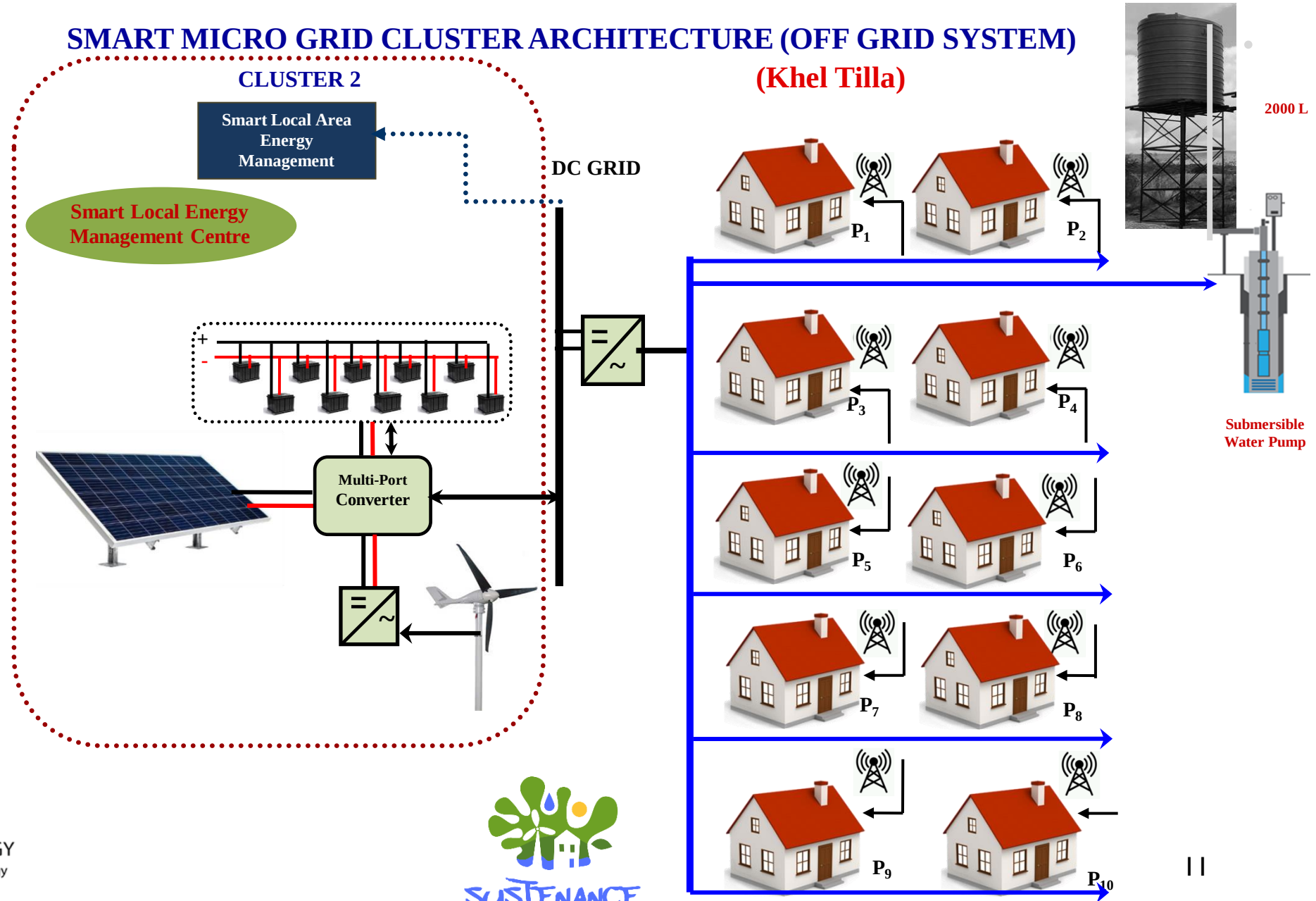
❖ Borakhai Site



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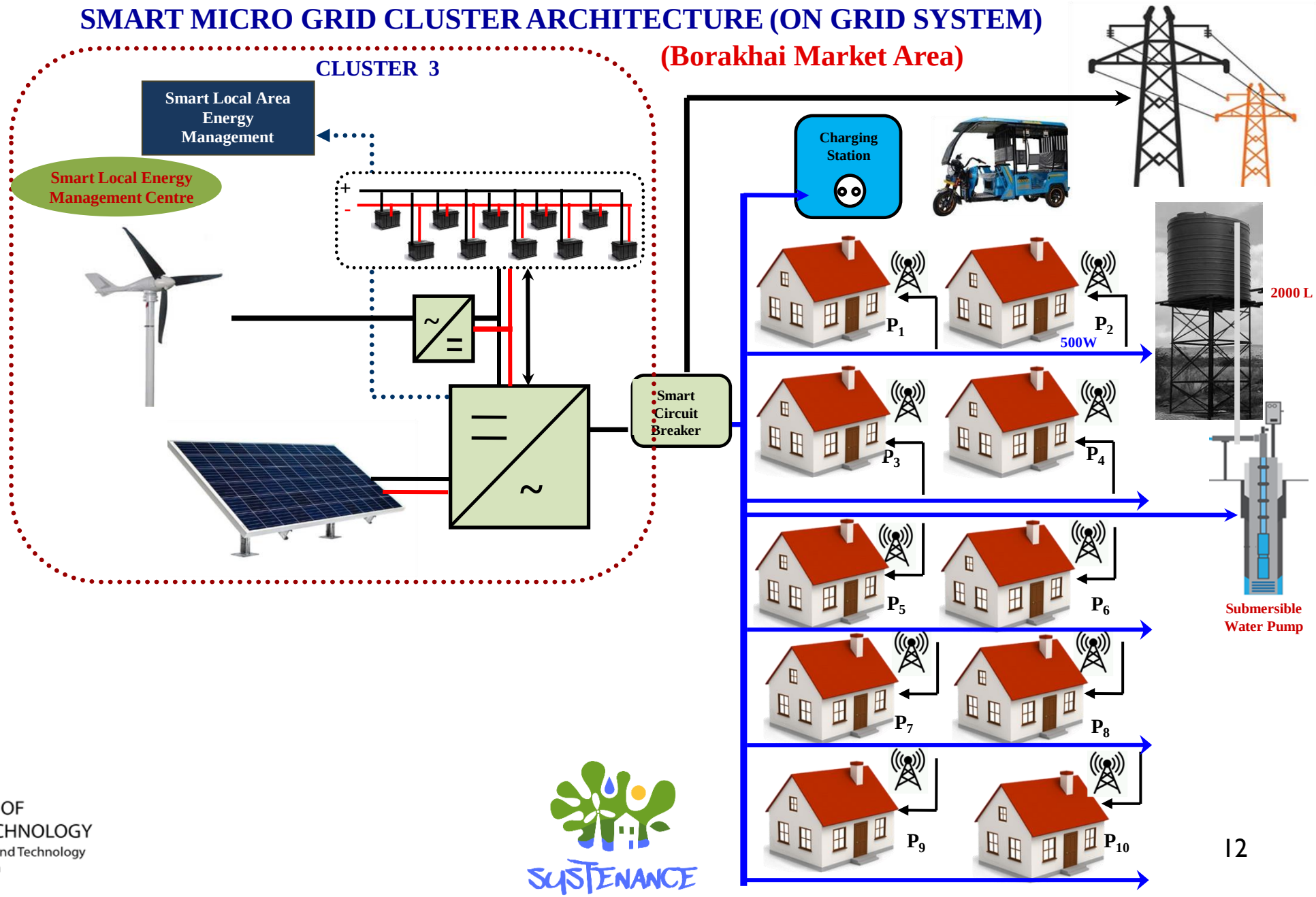
SMART MICRO GRID CLUSTER ARCHITECTURE (ON GRID SYSTEM)

(Borakhai Market Area)



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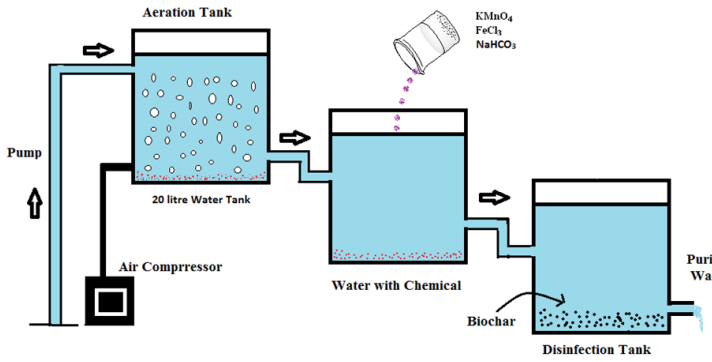
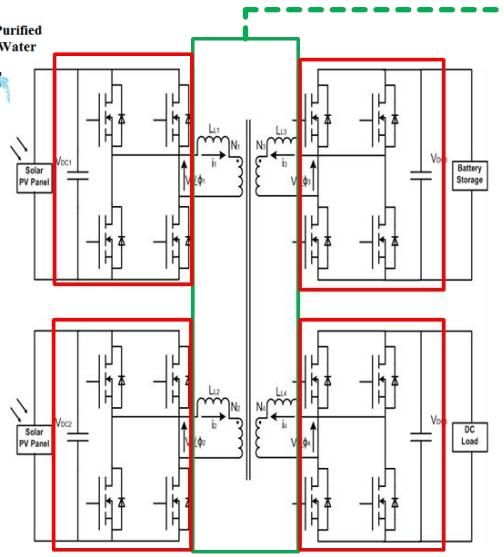
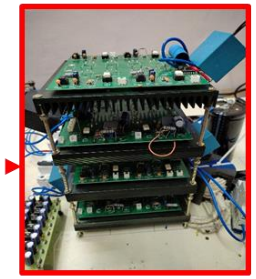
Technology Development Activities

Clean Domestic Water Supply System



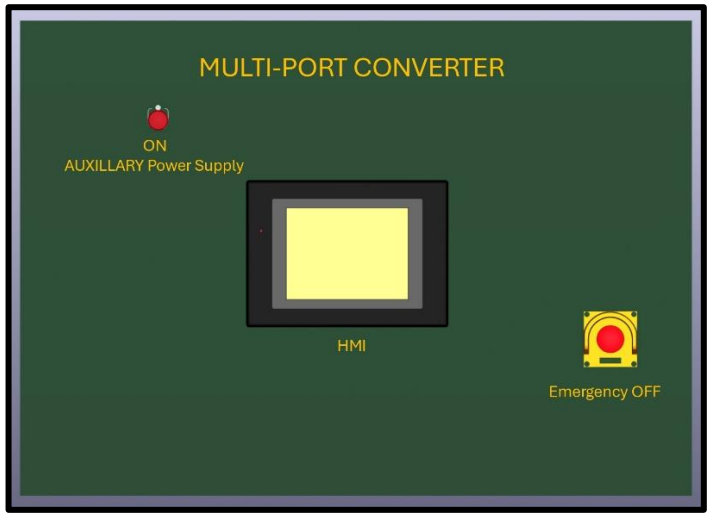
Cluster Based Multiport Converter





Ports of Multi Port Converter

Power Rating : 7.5kVA
No. of. Ports : 4 Ports
Core Type : PM Core
Frequency : 50kHz



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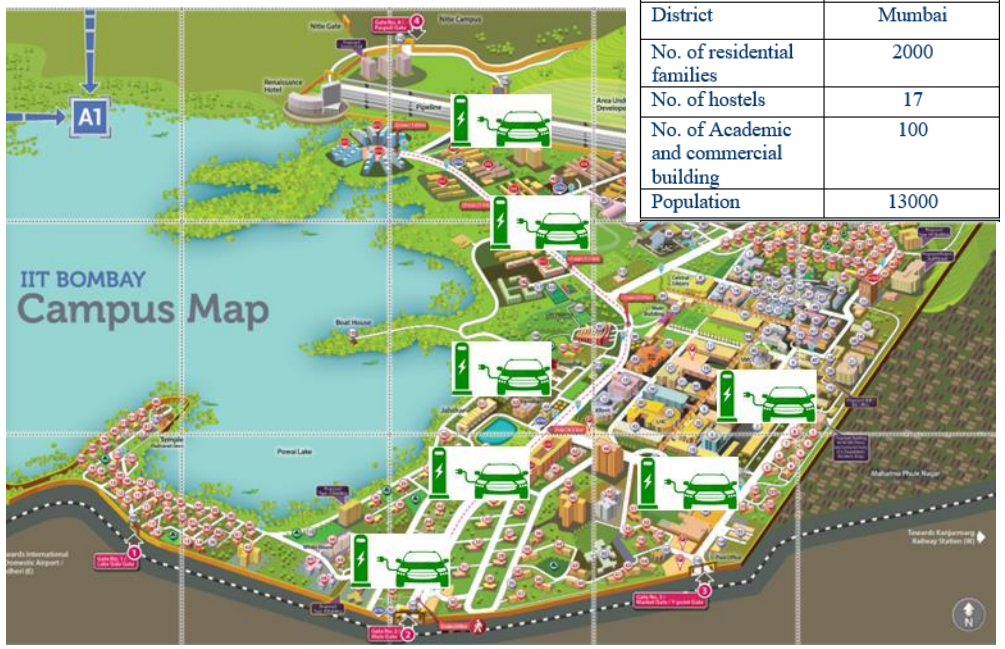
Indian Demonstration Site – III: (IIT Bombay campus, Maharashtra)

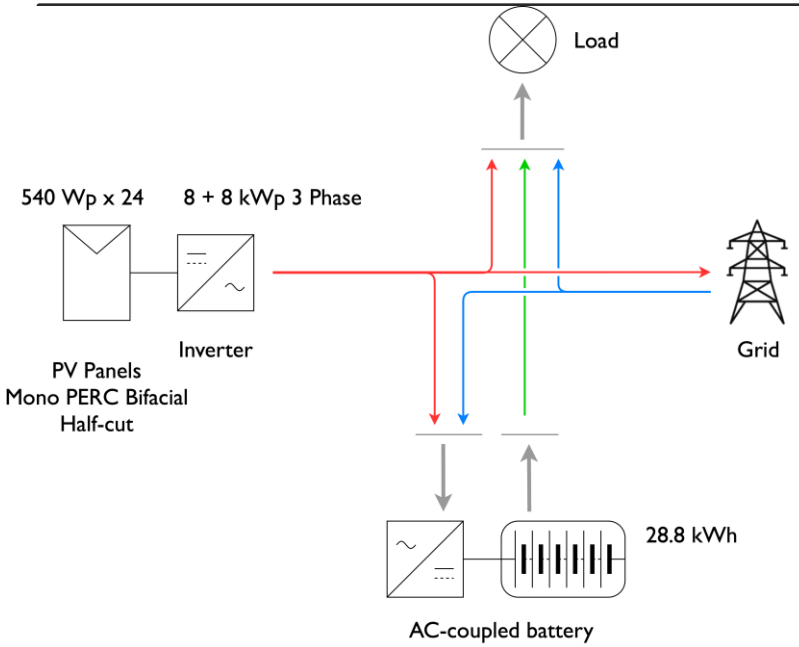
SHUNYA Building, IIT Campus

Broad Geographical Area	
Locality	IIT Bombay Campus
Ward	S
District	Mumbai
No. of residential families	2000
No. of hostels	17
No. of Academic and commercial building	100
Population	13000

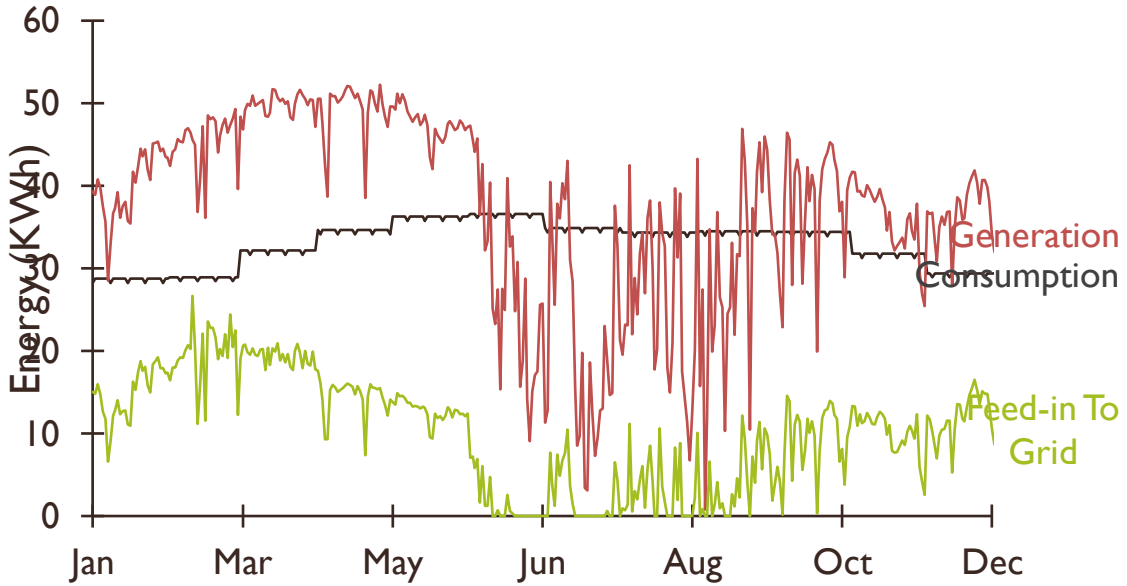


Smart EV charging infrastructure

Net Zero Electricity consumption



All values in kWh	Min	Average	Max	Total
Loads	24.5	34.2	44.5	12484
Generation	0.8	37.4	52.3	13635
Feed-in To Grid	0	10.2	26.6	3724
Consumption from grid	0	9.5	33.0	3464



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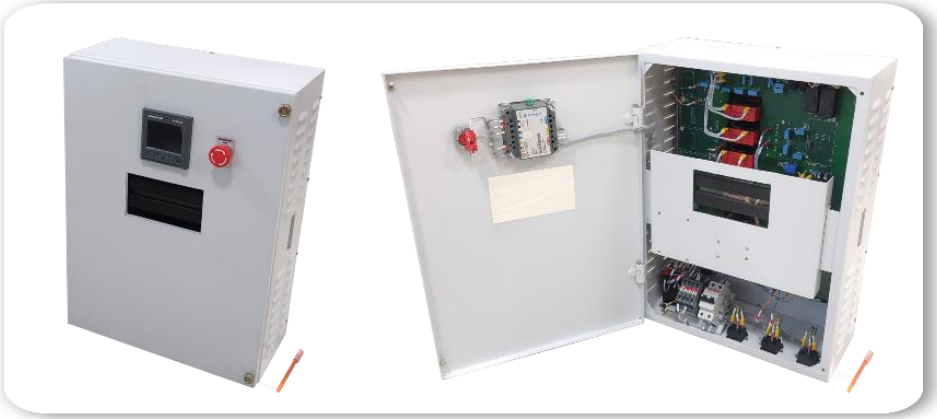
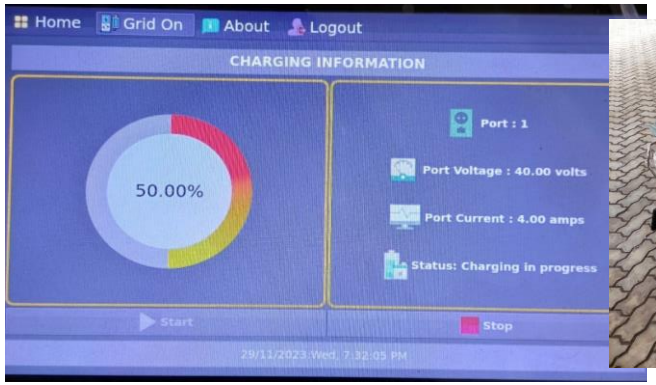
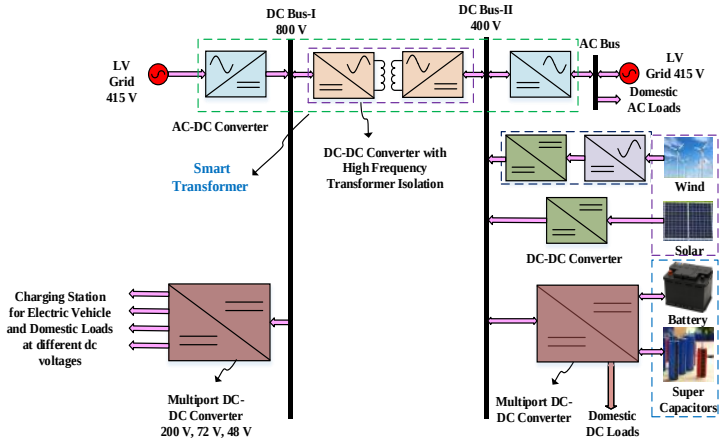
Technology Development Activities

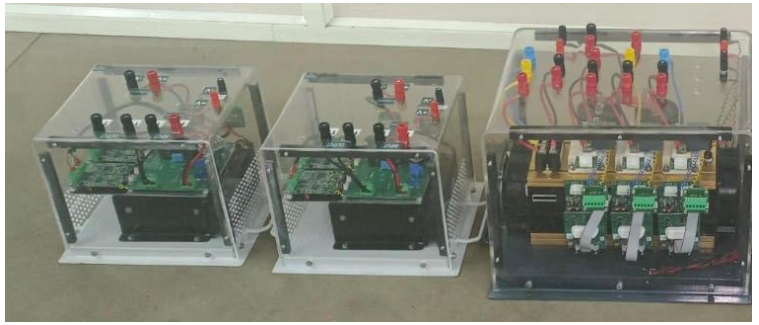
EV Charger



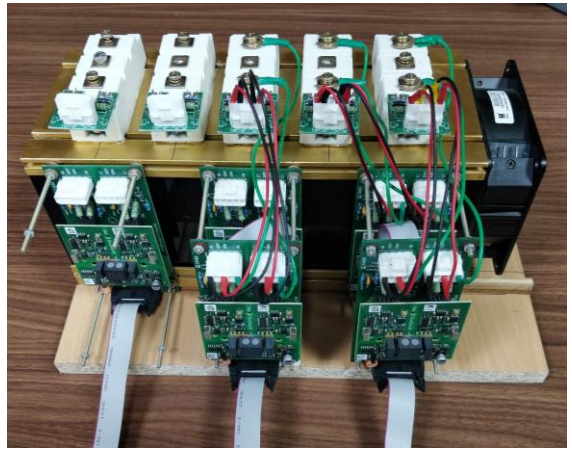


Smart Transformer





MPC



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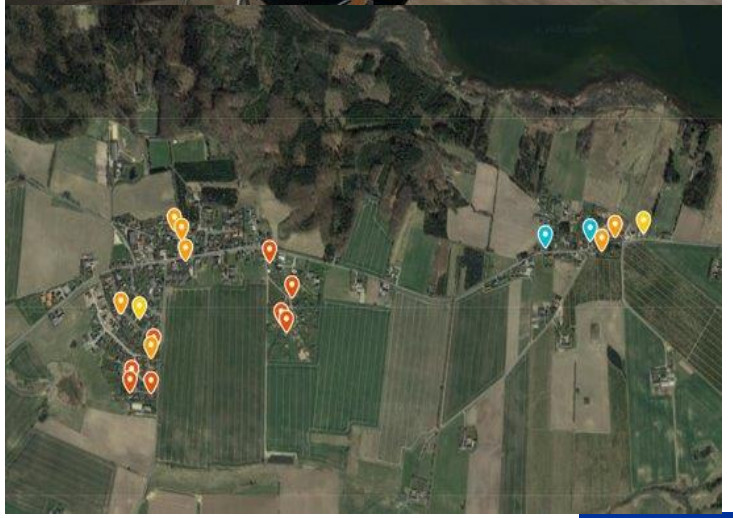
Danish Demonstrator

- **Voerladegaard in Skanderborg will show the way from heating with natural gas to a CO2 neutral village:**
  - Implement a community-based smart integration of renewable based electricity and heating systems using heat pumps and share any excess power to the local distribution grid using smart control.
  - Implement demand side response from electric vehicle charging from solar PV.
  - Optimised use of battery energy in the neighbourhood facilitates for increased share of renewable electricity and postponement of grid expansion and its subsequent investments.



- In spring of 2022 a town-hall meeting was held in Voerladegaard, and more than 50 families attended.
- 43 families showed interest
- 27 families were visited
- 20 families were selected

Dutch Demonstrator

- **Rethinking the ways we integrate renewable energy into out daily lives in the Netherlands**
- Investigate the desired level of autarky given the use-cases, constraints and business case (striving towards 100% renewables)
- Investigate possible setups for a balanced energy supply system
- Investigate different universal operation modii to ensure reliable supply under (challenging) energy scenarios (e.g. scarcity, disconnection)
- Algorithms that adapt the Quality of Service according to the active energy modus
- Implement IoT platform and test its technical and social performance in the demonstrator sites

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Polish Demonstrator

- **The Mickiewicza Housing Association in Sopot City takes its first steps towards a sustainable energy system and the creation of a local energy community**
- Aim to eliminate the use of natural gas from the energy system and replace it with electricity from renewable sources for domestic hot water (DHW) preparation.
- Aim to set up an integrated energy management system combining electricity, heat and transportation, along with energy storages at the pilot site.
- The community is planned to be actively involved in the development of the concept from the beginning and to co-decide on planned investments, as well as active in the education and awareness programs on the benefits of local energy island.

Source: Google maps

Sopot

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Thank You

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