

Sustainable energy system for achieving novel carbon neutral energy communities



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101022587, and the Department of Science and Technology (DST), Government of India under the SUSTENANCE project. 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.

The SUSTENANCE project focuses on the development of smart technological concepts enabling a “green transition” of the energy systems. It will be achieved with a higher share of local renewable energy and more efficient integrated energy solutions for the electrical, heat, water, waste and transportation infrastructure.

SUSTENANCE will demonstrate cost-effective, sustainable, and customer-centric solutions for the effective integration of various energy vectors. Thereby enabling regional communities to meet their energy needs from local renewable energy sources and clean technology.

This 3.5-year long H2020 project involves 21 partners from 3 EU countries and India. The demonstration sites are set up in: Denmark, the Netherlands, Poland and India.

SUSTENANCE will employ mutual learning and cooperation to show how the same technical concepts can be applied to all the demonstration cases despite significant local differences.



PROJECT GOALS:

The decarbonisation of local energy systems via optimal integration of locally available renewables (via smart control, energy balancing, storage solutions, and application of active load control),

Integration of energy systems for local communities (considering electricity, heat, water, waste and transport infrastructure),

Technical benchmarking and solutions matched with business models tailored to the different challenges and actors identified in each country,

Evaluation of solutions from the demonstration sites for replicability across Europe, India and worldwide,

Emphasis on user involvement, including the identification of the conditions and socioeconomic characteristics behind the willingness to participate,

Enhancement of the environmental, social and economic conditions of local communities.

VOERLADEGÅRD WILL SHOW THE WAY FROM HEATING WITH NATURAL GAS TO BECOMING A CO₂ NEUTRAL VILLAGE



The demonstrator in Denmark are the villages of Voerladedgård and Dørup located in the Skanderborg Municipality. There are around 600 residents, living mostly in villas and a few in townhouses. The houses are currently heated by individual gas boilers.



The demonstration activities aim to integrate electricity generated from renewable energy sources (RES) into the local power grid and the household heating systems. The existing gas boiler heating systems will be replaced with heat pumps (HP) and the photovoltaics (PV). Heat pump control systems will be coordinated in relation to electrical vehicle (EV) charging in some houses. These activities are to be demonstrated with the close cooperation and active participation of the local citizens, municipality, energy stakeholders and local industries. They will include the use of smart control and ICT technologies to smarten the energy networks to increase the self-consumption of solar PV and wind power supplied from the external grid.

The specific objectives for the Danish demonstrator include:

- Demonstration of smart control and energy management of salt phase change material (PCM) storage based heat pumps in synergy with solar PV systems in residential households;
- Demonstration of PV and heat-pump systems in relation to electrical vehicle charging and application of suitable demand-side response schemes;
- Impact assessment of community integrated energy system on the local distribution grid for smartening its operation, maximise use of renewable and cheaper electricity from the grid, thereby establishing economic benefits to the citizens and stakeholders;
- Development and demonstration of novel business and community based ownership models for operating the smart microgrid based solar PV-HP-EV energy systems where energy can be shared between households in the community within a regulatory test zone. ■

UNIVERSITY OF TWENTE & OLST COMMUNITIES AIM TO BE INDEPENDENT BY SMART ENERGY SHARING



The Dutch demonstrator involves two small living labs equipped with various types of flexible appliances, storage options, PV generation and an electric vehicle charging station. The ultimate goal is to operate the living lab (almost) autarkic from the main utility grids. Furthermore, an energy cooperative in the region, which strives for energy autarky, will be involved.

6



The specific objectives of the demonstrator include:

- Development and demonstration of a smart grid energy management system to employ flexibility options (batteries, electric vehicles, heat pumps) as a local integrated community setup to utilise high levels of self-consumption based on generated solar PV and wind. The system has to be able to operate – at least for some time period – in islanded mode;
- Development and demonstration of an Internet of Things (IoT) data platform to support the planning within the system and the economic and reliable operation of the (islanded) local energy system;
- Development and demonstration of smart grid ready interfaces for asset utilisation and control to support DSM, peak shaving, offering flexibility options to larger networks and increasing the degree of autarky;
- Development of organisational models, a dashboard, and Multi Criteria Analysis tools for energy communities for collective energy exchange and effective management of the local integrated energy systems. ■

MICKIEWICZA HOUSING ASSOCIATION IN SOPOT TAKES ITS FIRST STEPS TOWARDS A SUSTAINABLE ENERGY SYSTEM AND AIMS TO SET-UP A LOCAL ENERGY COMMUNITY

The Polish demonstrator is located in Sopot resort on the Polish coast. The buildings are owned by Mickiewicz Housing Association (WSM), and demo consists of 5 multi-family blocks of flats (each approx. 3400m²), with 10 floors and 77 apartments in each block. Some residents are apartment owners, but a large proportion are tenants.

The buildings are powered by traditional energy system. Therefore, the modernisation of the transformer station and integration of new energy technologies in the local energy system is planned. Furthermore, the long term ambition of the housing association is also to fully eliminate natural gas from domestic use.



The objectives of the SUSTENANCE project in Sopot are to explore the capabilities of the selected renewable energy technologies, which will be implemented in the local energy system, aiming also at the reduction of the use of fossil fuels and enabling a “green energy transition”.

The specific objectives for the demonstrator include:

- Demonstration and test of integrated electricity-to-heat system with solar PV and heat pumps for heating domestic hot water and supporting heating system in the selected building;
- Demonstration of electric vehicle (EV) chargers and electricity storage integrated with the local energy system in the community;
- Demonstration of smart utility meters (electricity, water) and Advanced Measuring Infrastructure (AMI) systems to effect demand-side response and optimal operation of the local community energy systems;
- Demonstration of AMI and LV automation/switchgear systems to enhance the level of observability, quality of supply and monitoring of the low voltage distribution grid in cooperation with the active energy communities;
- Development of business and ownership model for cooperation between individuals, community and local DSO for sharing renewable energy installations;
- Development of a concept of the “energy island” for the local community (around 500 apartments) as well as possible business models and financial structures for such investment. ■

1st INDIAN DEMO: BARUBEDA VILLAGE AIMS AT BECOMING A CARBON NEUTRAL “ISLANDED” ENERGY COMMUNITY



In Barubeda Village, the core income source of villagers is agriculture. There is limited access to water in general, and clean water in particular. The inhabitants (mostly women) have to fetch water manually since there is no water pumping system, mainly due to the lack of electricity. Firewood is primarily used for cooking, and kerosene based lamps for lighting.

10



The village does not have access to public transportation, and thus the inhabitants walk over 3 kms to reach the nearest road. For several months in a year, the men migrate to the city for work.

Since the village is in dire need for a stable energy supply, the inhabitants are keen to establish a local sustainable energy system.

The objectives of SUSTENANCE in Barubeda Village are to deliver a sustainable clean local Energy system for the remote off-grid village; to improve the living standards of the villagers

by providing reliable electricity access, e-rickshaw based green transportation, reliable water supply - all of which will contribute to improving their socioeconomic status. ■

2nd INDIAN DEMO: BORAKHAI VILLAGE AIMS AT DELIVERING SMART CLUSTERS BASED ON A LOCAL ENERGY SYSTEM POWERED BY RENEWABLES



Borakhai Village is partly electrified, albeit sporadically. In general, the residents are getting electricity for only one third of a day.

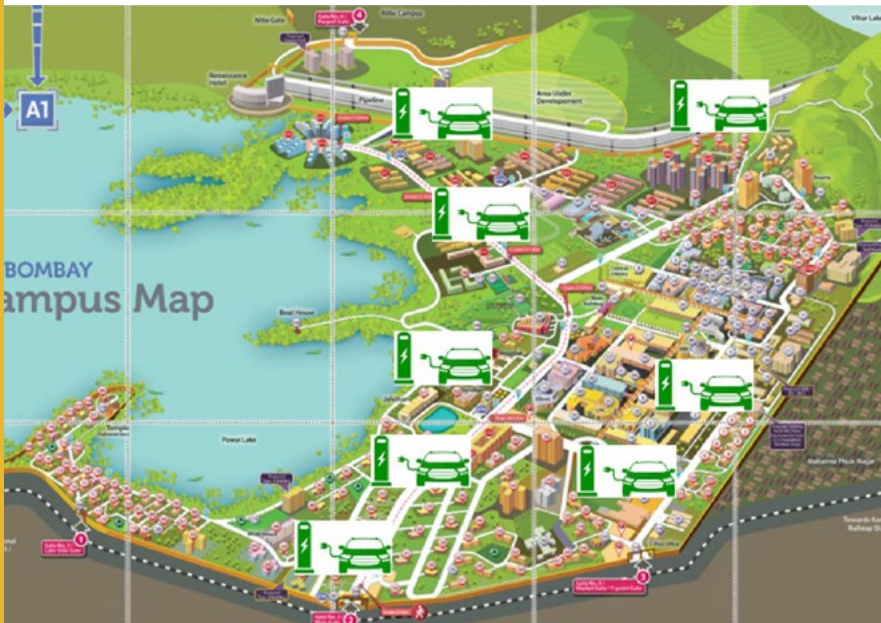


The villagers do not have access to a clean and reliable domestic water supply. Moreover, while some families have a gas (LPG) connection, firewood is primarily used for cooking. Kerosene-based lamps are used for lighting. The residents have very limited access to an unreliable public transport system.

The objectives of SUSTENANCE in Borakhai Village, are to deliver a sustainable and reliable local energy system, and in general, to improve the living standard of the inhabitants by providing access to electricity, e-rickshaw mobility, reliable water supply, waste treatment plant, and thus providing a scope for improving their socio-economic status. In both rural sites the added value is to also improve the healthcare and education system thereby empowering women and children.

In Barubeda and Borakhai, the overall goal is to develop a community-based integrated renewable energy system, enabling smart energy solutions for supplying 24x7 reliable, low-carbon, efficient and quality energy supply for meeting the basic daily needs of the community. Around 50 households in the Barubeda village, and 40 households of Borakhai village are involved for implementing the local energy system. ■

3rd INDIAN DEMO: IIT BOMBAY CAMPUS IN MUMBAI ACTS TO ACHIEVE INTELLIGENT, GREEN, SUSTAINABLE TRANSPORTATION AND SMART BUILDING SYSTEM

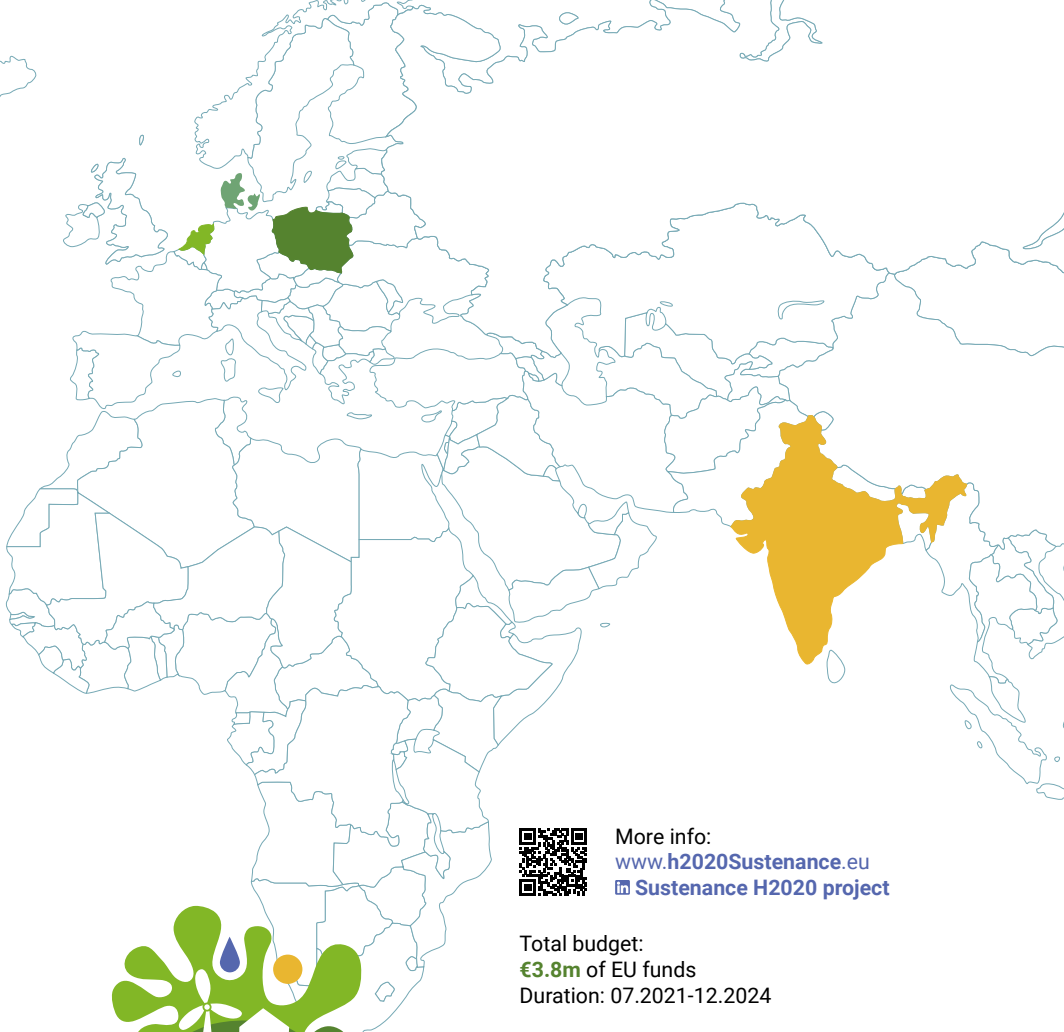


The IIT Bombay campus demonstration is significantly different from the other two sites as the campus has a 24x7 power supply from the main grid as well as rooftop solar PV systems of around 1 MW installed capacity.



The objective of SUSTENANCE for IIT Bombay is to develop an intelligent electric vehicle charging infrastructure, utilizing local renewables, which will be coupled with a smart electric building system.

Last but not least, in all of the demonstration sites in the SUSTENANCE project the overarching intention is to establish technical and business solutions, which will stimulate further replication in other villages and urban communities. ■



More info:
www.h2020Sustenance.eu
#Sustenance H2020 project

Total budget:
€3.8m of EU funds
Duration: 07.2021-12.2024

Project Coordinator:
Birgitte Bak-Jensen
Professor in Intelligent Control of the Power Distribution
System at Aalborg University, DK
contact@h2020sustenance.eu

Project Partners

