MISSION INNOVATION
accelerating the clean energy revolution

IC2: OFF GRID ACCESS TO ELECTRICITY

OFF-GRID INNOVATION CHALLENGE:
SYNTHESIS REPORT-2019

Programmes, Initiatives and Collaboration of Participating Countries

ADEME
Agence de l'Environnement et de la Maîtrise de l'Energie

Department of Science & Technology
Ministry of Science & Technology
Government of India
सत्यमेव जयते

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE ET SOLIDAIRE

OBJECTIVES OF IC2

The objective for the Off-Grid Access to Electricity Innovation Challenge is to develop renewable systems that are cheaper than fossil fuel for affordable access to electricity by off grid.

For individual homes, the objective is to support the significant reduction in price and increase performance of renewable power systems by 2020 and for remote communities, by 2020 to demonstrate in diverse geographic and climate conditions, the robust, reliable, autonomous operation of renewable power systems up to around 100 kW at a significant lower cost than present cost.

FOREWORD

सत्यमेव जयते
प्रो. आशुतोष शर्मा
Prof. Ashutosh Sharma

स्वच्छ भारत
एक कदम स्वच्छता की ओर

सचिव
भारत सरकार
विज्ञान और प्रौद्योगिकी मंत्रालय
विज्ञान और प्रौद्योगिकी विभाग
Secretary
Government of India
Ministry of Science and Technology
Department of Science and Technology

Foreword

I am happy to note that Mission Innovation countries under IC2 Innovation Challenge have come together to address the challenge of providing cost effective and robust Off Grid solutions. Off Grid Energy strives to deliver, efficient, low carbon, grid quality power solutions for people, unapproachable from main Grid. The development of smart technology that delivers affordable, high performance off-grid energy access solutions are requisite. Often the off-grid power is generated by the solar panels, wind turbines or others, with battery support for its use, as and when required, which cannot be used for energy intensive appliances that are used in a mains-connected house. Development of energy efficient appliance, therefore, assumes greater importance.

Quality of life of Rural people is greatly enhanced by the availability of decent lighting, pumping, refrigeration and audio-visual/communication systems. However, matching voltage pumps, fridges, lights and other appliances with appropriate power sources is not always easy or straightforward, which calls for standardization of off-grid technologies to position them as cost-effective and technically viable alternatives.

In remote communities, mini-Grids are designed to meet the needs of a village or cluster of villages, and these can provide a higher level of electricity services than solar home systems, potentially also supporting productive enterprises. The research and innovation on maintenance free, cost effective, self-healing architecture and control of these mini-Grid is a challenge. Moreover, since the operation by the remote rural community need strong sense of ownership and therefore, building community buy-in and skilled human resource is essential.

The sustainable off-grid energy access can be a driver for increasing villagers' incomes through raising the productivity of existing, and introducing new, enterprises.

I am sure that this report will provide information about initiatives taken by different MI countries to develop Off Grid solutions and would be useful for individual scientists, institution and stakeholders in Mission Innovation Countries and beyond.

(Ashutosh Sharma)

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MISSION INNOVATION
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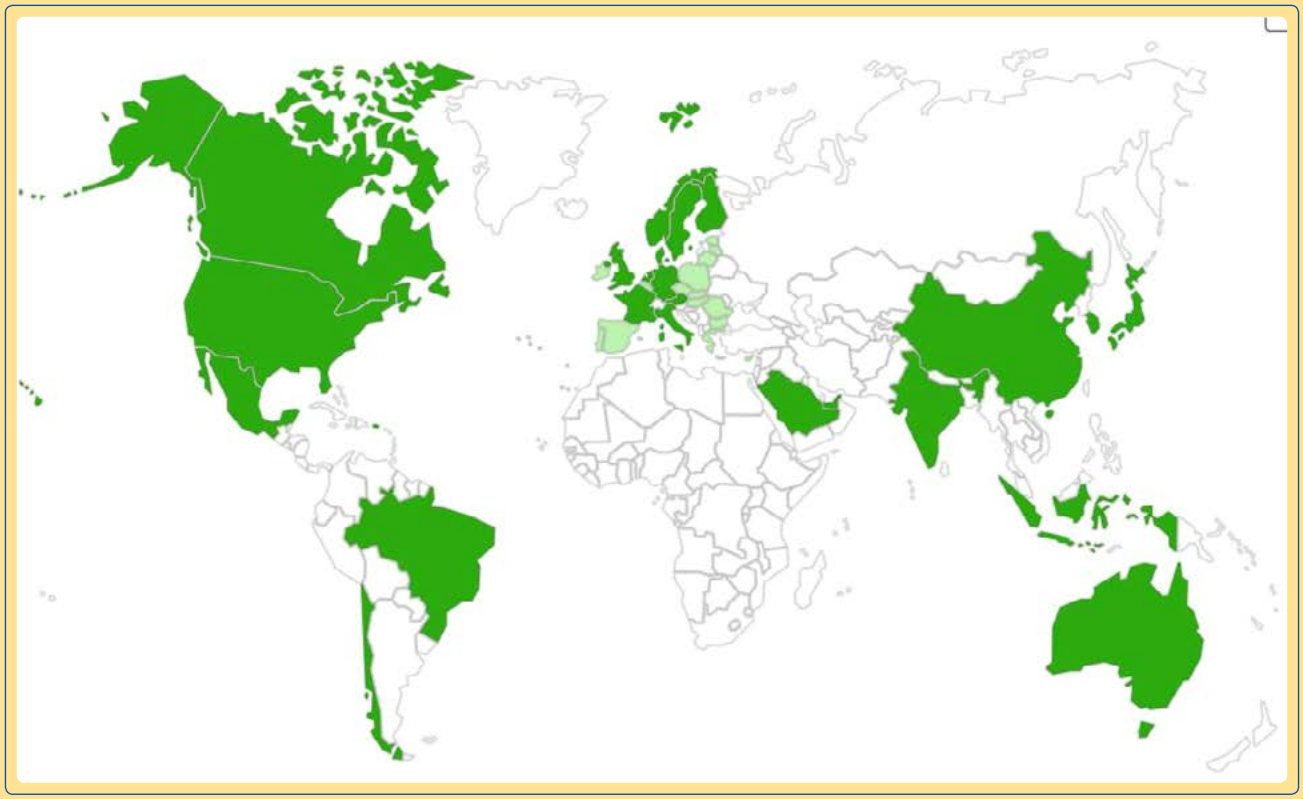
IC2- Off Grid Access to Electricity



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EDITORS PAGE

Sanjay Bajpai
DST

Dr. Sanjay Bajpai graduated in Mechanical Engineering from Malaviya National Institute of Technology, Jaipur and pursued Masters in Business Administration from University of Rajasthan, Ajmer. He was awarded Doctorate by Indian Institute of Technology-Delhi for his research work on 'Alternative Fuels for Internal Combustion Engines'. He has managed and shaped several national, bilateral and multilateral researches, development and innovation programmes. He specializes in Management of Technology Development and Socio-Economic programmes requiring application of S&T.

He is currently heading Technology Mission Division in Department of Science and Technology responsible for leading research, development and innovation activities in Water and Clean Energy domain. He has represented India in numerous bilateral and multilateral event and has articulated national and international endeavours in these domains.

Vineet Saini
DST

Vineet Saini is a qualified Energy and Environmental Engineer, an alumnus of IIT Delhi. He also holds an MBA in Technology Management and is also a Certified Energy Auditor of Bureau of Energy Efficiency. He is currently working as Scientist in Department of Science and Technology responsible for leading research, development and innovation activities in Clean Energy domain. His professional experience of 23 years encompass execution of various field projects in energy and water sector including indigenous development of systems. He is deeply engaged in promotion of inter -disciplinary area of science and technology in area of clean energy and water sector, executing various field and labs projects with scientists, academicians and technocrats of different academic backgrounds along with line department officials in addressing the core challenges and delivering solution in real field condition sync with social economical context. He is also associated with various bilateral and multilateral countries programme on energy and water sector which has resulted in establishment of Indo -US Joint Clean Energy Research Development Programme, Fellowship programme, New Indigo programme, Mission Innovation programme, Dutch India Water Initiative for leadership initiative program etc with collaborating partners.

François MOISAN
ADEME

François Moisan is executive Director of Strategy, Research and International Affairs and Scientific Director of ADEME. He is in charge of the "Investment for the Future" French public fund operated by ADEME dedicated to support innovation in low carbon technologies promoted by companies. François Moisan is involved in energy efficiency and renewable energy policies for more than 30 years and participated to several national and international committees on energy policies. He is a graduate on Electrical Engineer from Ecole Supérieured' Electricité de Paris (1972) and Doctor in Economic Science (Université de Grenoble, 1983).

EDITORS PAGE

PROF. SUKUMAR MISHRA

IIT, Delhi

Dr. Sukumar Mishra received his M.Tech and PhD in Electrical Engineering from National Institute of Technology, Rourkela in 1992 and 2000 respectively. After spending 9 years as a lecturer at Sambalpur University (Orissa), Prof. Mishra joined BPUT (Orissa) as a Reader at Electrical Department and served there for a period of 2 years. Presently, Dr. Mishra is a Professor at Indian Institute of Technology, New Delhi and has been part of IIT Delhi for the past 15 years. Prof. Mishra has won many accolades throughout his academic tenure of 25 years. He has been a recipient of INSA medal for young scientist (2002), INAE young engineer award (2009,2002), INAE silver jubilee young engineer award (2012) and has recently won the Samanta Chandra Shekhar Award (2016). He has been granted fellowship from many prestigious technical societies like IET (UK), NASI (India), INAE (India), IETE (India) and IE (India) and is also recognized as the INAE Industry Academic Distinguish Professor. Currently, Prof. Mishra is holding the position of Vice Chair of Intelligent System Subcommittee of Power and Energy society (PES) of IEEE, which is considered to be one of the oldest technical societies in the world.

PROF. VISHAL VERMA

Delhi Technological University

Dr. Vishal Verma received the B.Tech. degree from G.B. Pant University, Pantnagar, India and both M.Tech. and Ph.D. degrees in the area of Power Electronics from the Indian Institute of Technology, New Delhi, India. He served the Department of Electrical Engineering, G. B. Pant University, as an Assistant Professor for over fourteen year and thereafter served as Associate Professor and Professor at Electrical Engineering Department at Delhi Technological University (Formerly Delhi College of Engineering). He is currently serving as a Full Professor and is the Dean International Affairs. His fields of research interest include power electronics converters, power-quality issues, grid integration of renewable energy sources, hybrid ac–dc microgrids, charging infrastructure, and electric vehicles. Prof. Verma has served as expert members in different committees of DST, Ministry of New and Renewable Energy, Government of National Capital Territory of Delhi for Renewable Energy and E-Mobility.

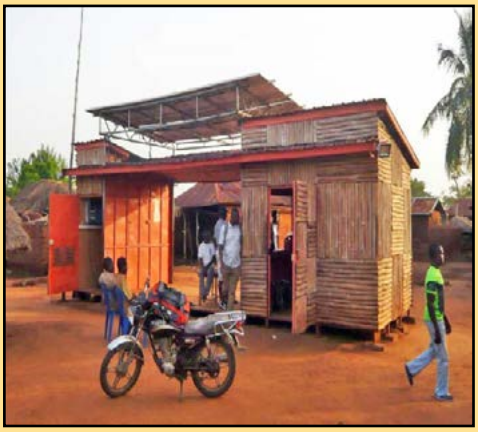
MI-OFF GRID PROJECTS FROM FRANCE

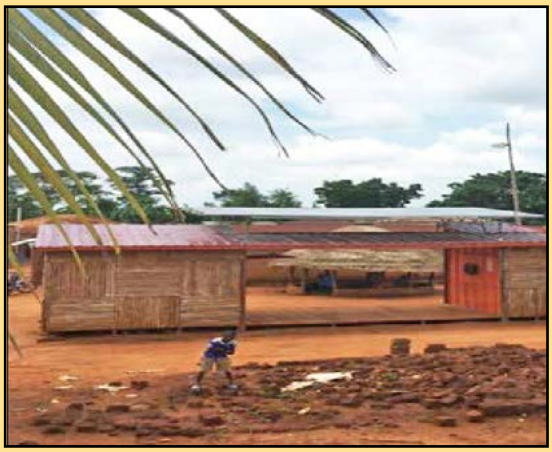
EMPER PROJECT (2018-2019)

Independent Energy Producers

Project Leader: Benoo Energies
Partners: Entreprises Territoires et Development

Project Location: Togo





BRIEF DESCRIPTION

Benoo allows African entrepreneurs to become independent energy producers.

This is possible thanks to two solutions:

- The energy agency, which is a solar kiosk equipped with a storage system that allows the entrepreneur to sell the services induced by the production of energy: telephone charging / freezing / lighting / multimedia. These are priority services for the villages. The entrepreneur can rent the agency or buy it under financial lease.
- A mobile application that allows the entrepreneur to carry out predictive surveys on village needs, manage mobile payments, record his turnover and monitor his installation. Benoo uses Artificial intelligence (AI) to analyze a diverse set of data on rural electrification and to predict how to deploy the next rural electrification solutions.

The project will allow the testing and improvement of the energy agency and the mobile application, as well as the training of local entrepreneurs.

The number of direct project beneficiaries is 24,623 with primary beneficiaries being Entrepreneurs and villagers.

Project Leader Contact

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MI-OFF GRID PROJECTS FROM FRANCE

SISAM (2018-2021)

An enhanced solar irrigation solution for market gardening

Project Leader: Electriciens Sans Frontières

Partners: DAKUPA, JARC, Action Bénin Solidarité (ABS), PRACTICA, Positive Planet International Développement (ETD)

Project Location: Benin, Burkina Faso and Togo

BRIEF DESCRIPTION

Improved access to irrigation water for small market-garden holdings (<1ha)

- Poverty reduction and reinforced food availability
- Benefits mainly women and children

Solution constructed by and for local actors (rural associations, private companies, institutions)

- Innovative technology
- Local production: pump assembly with local components.
- Performance: new technologies adapted to soil depth and to small surface areas for irrigation.
- Usage: solar powered motors with the possibility of manual use.
- Lifespan: over 20 years

Better access to finance

- Costs: decrease of acquisition and running costs
- Micro-financing: improved credit conditions
- Management: support before and after equipment acquisition
- Delays: the reality of agricultural constraints taken into account

Maintenance

- Training of distributers and end-users
- Maintenance kit available
- Easy availability of spare parts

Environment

- Evaluation of water resources
- Good irrigation practices encouraged
- 100% renewable energy (solar)
- Possibility of recycling wearing parts

The project has 1000 direct beneficiaries (more than 100 family farms; private sector capacity building) with a sustainable irrigation solution made available to 70000 farmers.

Project Leader Contact

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MI-OFF GRID PROJECTS FROM FRANCE

BTI (Biocharbon Typha Industrial) (2018-2020)

Industrial Typha Bio-charcoal

Project Leader: Gret

Partners: ISET - Institut Supérieur d'Enseignement Technologique (Rosso, Mauritania)

Project Location: Mauritania

BRIEF DESCRIPTION

Implementation of a pilot industrial production line: sustainable biomass energy using typha.

The Senegal River borders the South of Mauritania, a safe Sahelian country whose deserts have inspired travelers for generations. This river is the nation's main source of potable water and irrigation. Yet, an invasive reed, the typha, has spread into this precious lifeline between Sahel and Sahara: typha clogs over 40 000 hectares, causing the abandonment of farmland, rural exodus and an increase in waterborne diseases.

On the other hand, the most vulnerable urban dwellers depend on charcoal for cooking, which represents a high and unavoidable cost for their food security: it generates energy poverty and accelerates the deforestation of an already extremely arid natural environment.

Since 2011, Gret and ISET have developed and tested technologies to transform typha into charcoal. This renewable fuel has been tested in market conditions and revealed itself perfectly fit to replace wood charcoal to a large extent. Additionally, its usage is healthier and cheaper.

From 2011 to 2016, a pilot semi-industrial production line has been developed, tested and calibrated at ISET. All the technical and maintenance issues are handled locally: this solution is ready to be transferred to the private sector.

The BTI project will transfer the production technology from ISET to a Mauritanian private company and create the enabling environment for its commercial success. In particular, the project will:

- Secure access rights to typha at scale, with due respect to the water environment and its traditional users
- Set up a stable and reliable raw material supply for the sustainable fuel company;
- Install a production capacity of 1000T of green charcoal per year;
- Promote the product to consumers and distribution partners;
- Foster a supportive regulatory environment to speed up its development.

Project Leader Contact

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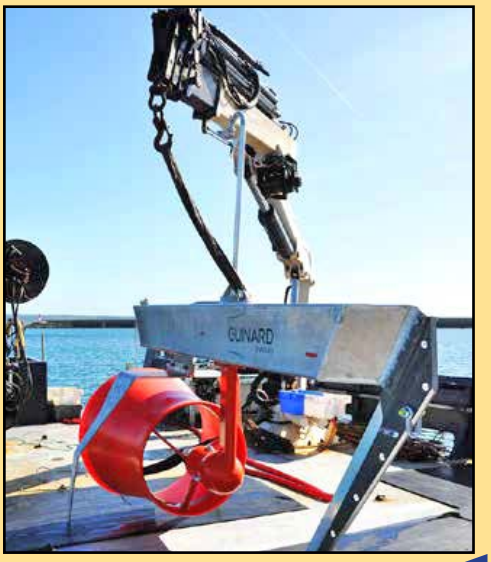
MI-OFF GRID PROJECTS FROM FRANCE

ERHYGE (AMBATOLOANA) (2018-2019)

Hydrokinetic River Turbine

Project Leader: Guinard Energies
Partners: GRET, SM3E, Ambatoloana municipality

Project Location: North-east of Madagascar, Analamanga Region Amboarakely: 100 households, 600 people.



BRIEF DESCRIPTION

Madagascar energy access through a hybrid system including a hydrokinetic river turbine

Step 1: Demonstration project of a hybrid electricity generation system including the hydrokinetic turbine P66. The hydrokinetic device produces 24h/24. Combined with panels and batteries, the system provides stable and continuous electricity access.

Step 2: Assessment of the hydrokinetic energy potential of remote locations in the North-east of Madagascar and realization of a business analysis.

River current measurements:

- Site location with GIS tools
- Measurement during dry and wet seasons
- Yearly electricity production assessment

Business:

- Business model
- Financial analysis
- Economic field evaluation

The project will thus:

- Promote Guinard Energies hydrokinetic turbine potential
- Reduce GHG emissions and protect the environment.
- Provide energy access through hydrokinetic turbines in off-grid areas of the North-East of Madagascar.

Project Leader Contact

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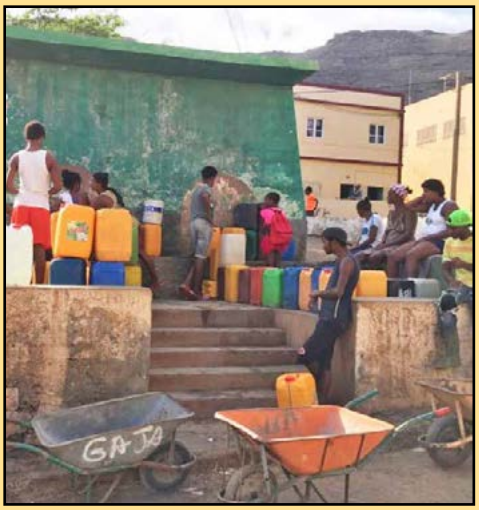
MI-OFF GRID PROJECTS FROM FRANCE

DESOLFU (2018-2019)

Sea water solar destination plant in Furna

Project Leader: Mascara Renewable Water
Partners: ELSEG, Furna municipality, fishermen association

Project Location: FURNA Village, Sao Vicente Island, CAPE VERDE



BRIEF DESCRIPTION

Construction of a 20m3 /day sea water solar desalination plant in Salamansa: OSMOSUN®20

- Designed for autonomous operation in isolated sites with few technical and logistical infrastructures: low maintenance needs.
- 100% powered by a 22 kwp solar generator and no battery: no fuel consumption
- Drinking water production cost: 1,5€ / m3

The involvement of local partners will guarantee the success and durability of the water supply in Salamansa. OSMOSUN®20 projects-like will be replicated in the several isolated islands of Cape Verde and the Pacific, as well as in the Caribbean Region.

Presently at the project location there is severe water stress: only 6 liters of unsanitary water available per person per day, at the prohibitive price of 6€/m3.

This has a negative impact on the population's health and prevents the island's touristic and economic development.

Project Leader Contact

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MI-OFF GRID PROJECTS FROM FRANCE

Lateral Electrification

Towards a new power infrastructure development path for Africa

Project Leader: Nanoé
Partners: Sintogno, Michaud Export, Club ER

Project Location: The Project aims to connect over 5 000 households in the Diana region (Madagascar) and train over 100 local entrepreneurs by June 2019.

BRIEF DESCRIPTION

The project aims to implement in the North of Madagascar an innovative electrification model for rural Africa, based on the collaborative building of smart power grids from the bottom up.

What?

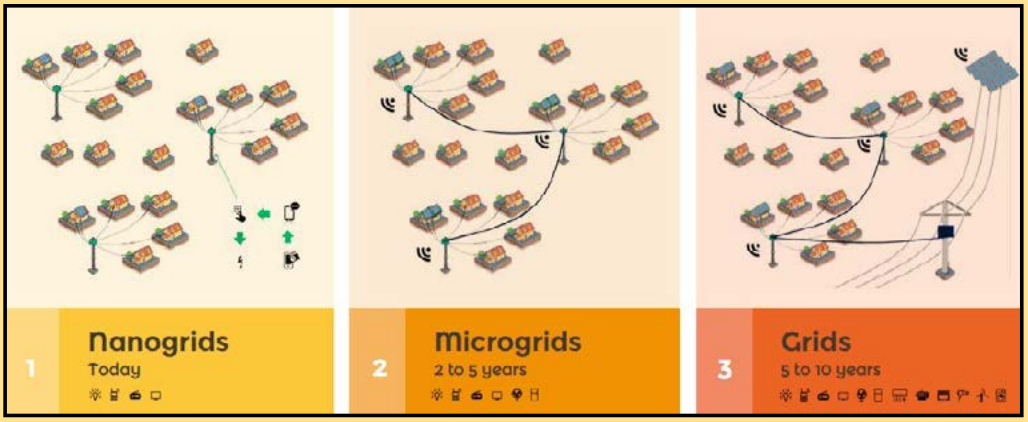
Lateral electrification is a process of diffusion and progressive interconnection of basic smart units of power production, storage and distribution called "Nanogrids", owned and operated by local entrepreneurs.

Why?

To answer off-grid households' basic energy needs more rapidly, flexibly and affordably than individual solar systems, while participating in the progressive building of 21st century infrastructures in Africa (decentralized, decarbonized and smart).

How?

Thanks to innovative technological (apps, mobile payment solutions, Smart energy management systems) and organizational (franchising, access to finance, ad hoc PPP) solutions developed by the Project's partners.



Project Leader Contact

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MI-OFF GRID PROJECTS FROM FRANCE

Pay as you go and microfinance in Benin (2018-2019)

Project Leader: Pamiga
Partners: ARESS, MyJouleBox

Project Location: Benin

BRIEF DESCRIPTION

The national electrification rate is 29% and drops down to 5.5% in rural areas in Benin. More than 7 million people do not have access to the grid.

The project aims to provide the access to energy through individual solar solutions, a financing mechanism handled by microfinance institutions and the development of the distribution network in rural areas made of energy entrepreneurs. The goal is to hand 5000 solar solutions out and train 50 entrepreneurs.

The overall project will result in the development of partnership agreements with microfinance institutions, establishment of a monitoring and maintenance platform, establishment of a network of energy entrepreneurs, impact assessment to scale up the project.

PAMIGA (Participatory Microfinance Group for Africa), a French NGO providing technical assistance to microfinance institutions in sub-Saharan Africa, will lead the project.

The project will develop innovative partnerships between ARESS, MyJouleBox and local microfinance institutions allowing each partner to focus on its field of expertise: access to renewable energy for ARESS, research and development for MyJouleBox and financing for microfinance institutions. The financing of the solar solutions will be provided by microfinance institutions instead of the pay-as-you-go distributors, reducing their financial burden and the responsibility of credit management. ARESS will ensure marketing, distribution, installation and after-sales services of PAYGO solar solutions, through the development of a rural network of Energy Entrepreneurs that will tackle the “last mile” issue.

The PAYGO meter developed by MyJouleBox is backed by a digital platform for monitoring customers, payments and consumption in real time. It offers a technical flexibility allowing a gradual increase of the system capabilities and financial flexibility: payper-view via mobile phone services and microfinance networks,while securing the loan through remote deactivation of the system

Project Leader Contact

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MI-OFF GRID PROJECTS FROM FRANCE

Pivert (2018-2020)

Rural Enterprise Clusters for green innovation, Energy and Processing

Project Leader: SENS France
Partners: SENS Benin, GIC, CCZ, INVESTI'SENS BENIN

Project Location: Rural off-grid areas of Benin in the departments of Borgou, Collines and Zou

BRIEF DESCRIPTION

The project aims to demonstrate an innovative solution for energy access in off-grid rural areas in Africa. This solution called PIVERT is a rural cluster of enterprises with access to energy and farming services. The project will implement 10 pilots in Benin to optimise the model and prepare the upscaling process.

PIVERT's features address the key challenges for energy access in remote rural areas in Africa:

- Entrepreneurship: energy and farming services are provided by enterprises to guarantee their quality and sustainability to the beneficiaries (other enterprises or households of the village).
- Economic viability: a PIVERT systematically implies agroprocessing activities relying on energy services that will create an added value in the village. It secures margins for the energy services providers and boosts the revenues and solvability of its clients.
- Sustainable cooperation: the infrastructure and main equipment of a PIVERT are managed by one entrepreneur according to the rules and commitments established with all its users. The users of a PIVERT are enterprises or individuals whose activities are interdependent, which reinforces their tendency to cooperate.
- Services upgrade: a PIVERT gets technical assistance from SENS Bénin to adapt and gradually develop its services offer to its village, while ensuring its viability at any stage. The most developed stage of a PIVERT is the mini-grid one.

The overall project will result in the development of a network of 10 pilot PIVERT in 3 departments of Benin, demonstration of the viability of the PIVERT model as well as expansion of energy services offered.

Project Leader Contact

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MI-OFF GRID PROJECTS FROM FRANCE

ZEMBO (2018-2019)

Zero Emissions Mobility Boda

Project Leader: ZEMBO France (R&D Financing)
Partners: ZEMBO Uganda (Operation)

Project Location: Uganda

BRIEF DESCRIPTION

Millions of motorcycle taxi drivers are present in sub-Saharan Africa. This is a revenue generating activity for young people and their families and an affordable transport solution for low-income people, which is adapted to African roads and is often the only strain on their revenues. Moreover, this activity is very polluting.

The project focuses on 2 complementary activities:

- The leasing of electric motorcycles to taxi drivers.
- The battery charging through a network of solar stations.

The overall project's electric solution will result in:

- Improvement of the drivers' revenues (who become owners of their vehicle after 2 years)
- Environmentally clean solution (lowering CO2 and particles emissions, reducing noise)
- Better service, including security training and equipments for driver and passangers.
- The objective is to lease over 200 vehicles in 2019 and 2000 in 2020.

Project Leader Contact

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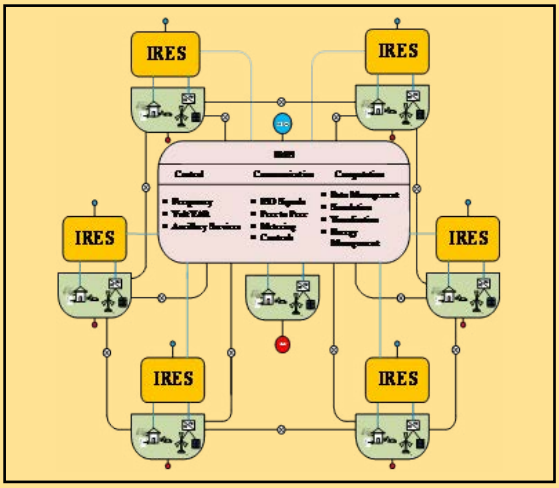
MI-OFF GRID PROJECTS FROM INDIA

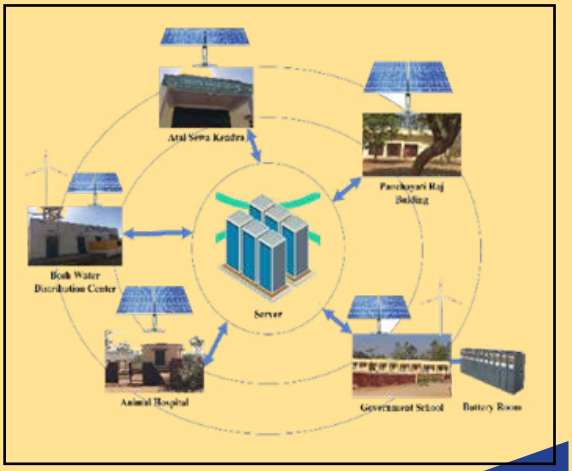
Cooperative Isolated Renewable Energy Systems (IRES) for Enhancing Reliability of Power in Rural Areas (2018-2020)

Project Leader: MNIT Jaipur

Partners: IIT Delhi, IIT Hyderabad, École de Technologie Supérieure Canada, UNSW Australia, UCLA USA, UIT Norway

Project Location: Boorthal, a Village in Bassi Tehsil, Jaipur District, Rajasthan, India. It is situated 16.7 km (approximate) away from MNIT Jaipur





BRIEF DESCRIPTION

Objective:

- To develop a prototype Isolated Renewable Energy Systems IRES to demonstrate the exchange of power among different IRES.
- To develop an integrated communication, control, and computing system for the exchange of power among an interconnection of IRES.
- To develop algorithm for maintaining microgrid power quality.
- To develop a local energy management system with demand response and electricity market pricing features.
- To develop a cyber-security system for secure communication of data and signals.

Expected Outcomes:

- Rural electricity infrastructure with renewable energy resource micro grids.
- Providing connectivity to off-grid households.
- Adequate supply with desired power quality.
- Electricity supply at affordable rates & power synchronization without using base generation.

Project Leader Contact

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MI-OFF GRID PROJECTS FROM INDIA

Sustainable Energy Storage Suitable for Microgrid (2018-2020)

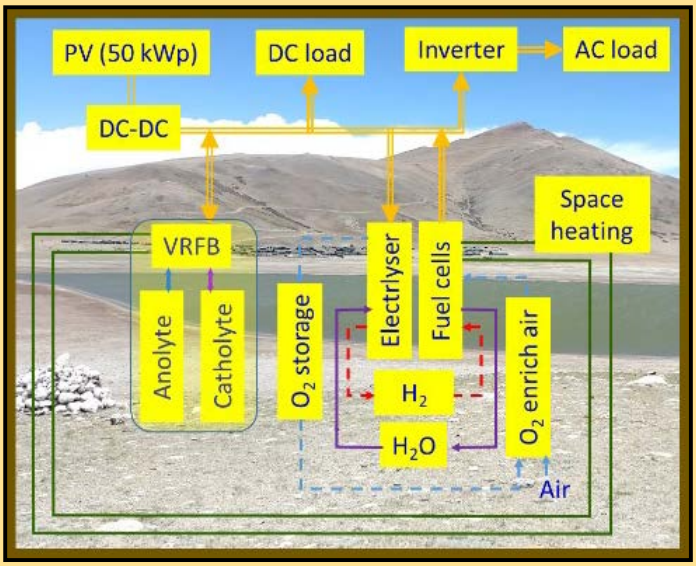
Project Leader: IIT Bombay
Partners: Tata Motors, Indian Army, Fraunhofer ICT Germany, University of Nottingham UK.

Project Location: Bunker, Forward area in North Sikkim.

BRIEF DESCRIPTION

Objective:

- Development of AC-DC hybrid microgrid supported by a 50 kWp PV system and DG system
- Development of hybrid storage systems suitable of operating at an extreme temperature conditions.
- Integration of the RE system and storage in North Sikkim to cater the partial energy requirements of an Indian army base



Expected Outcomes:

- AC-DC Microgrid based on 50 kWp PV system.
- Flow battery system of capacity 20 kW and 200 kWh.
- Hydrogen storage system 40 kWh with a fuel cell of 5 kW.
- Space heating system using the waste heat from the fuel cell.
- An integrated system consists of hybrid storage (hydrogen storage and flow battery) and PV system.

Project Leader Contact

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MI-OFF GRID PROJECTS FROM INDIA

Intelligent Off Grid System for Energy Sustainable Village (2018-2020)

Project Leader: VIT, Vellore

Partners: TREND Bengaluru, Solar Energy MGIRED Bengaluru, Sri Venkateswara College of Engineering Bengaluru, University of Strathclyde Glasgow, Roma Tre University Italy.

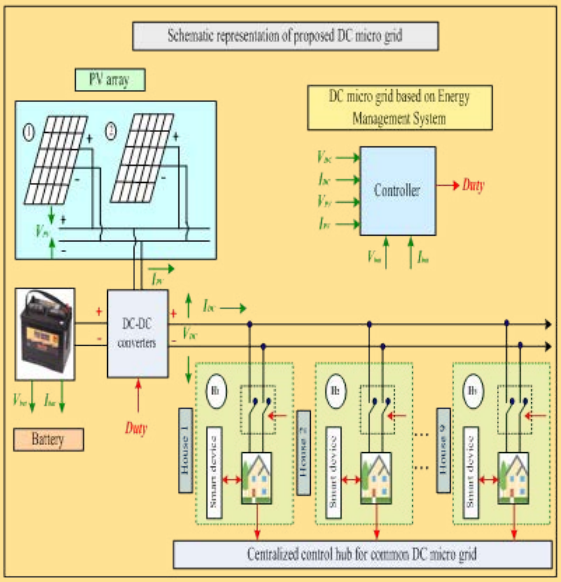
Project Location:

- Nellikatri village is located at a distance of 60kms from Kollegala located in deep interior forest.
- Belkotta village, Gulbarga district, Karnataka.

BRIEF DESCRIPTION

Objective:

- To design, install, commission, monitor and control two different off grid energy models which utilizes renewable energy resources as a primary source to electrify areas that have limited or no access to electricity within India.
- To design Energy Management System that supports the centralized power generation, storage and monitoring
- To design and implement suitable microgrid with IOT for the automation of microgrid operation including demand-side management.
- To develop an 'intelligent' data analysis algorithms for operator interface (i.e.EMS dashboard)
- To establish cloud-based server and hub/controller architecture to transmit data to a centralized location for visualization and processing.
- To conduct a socio-economic market assessment/analysis of business models for operation of Panchayath owned microgrids.



Expected Outcomes:

- Scalable, smart self-sustainable DC micro grid model which utilizes renewable energy resources as a primary source to electrify areas that have no access to electricity within India.
- Secure and reliable power for the rural with Energy Management system (EMS) and IOT based solution.
- A unique cluster based approach to reduce micro grid development and operating costs.
- Enable productive uses of renewable energy resources that can vastly improve the socio-economic development of local communities and employment rates for youths.
- Improve quality of life and wellbeing of the residents by providing energy access for Panchayath amenities, i.e. schools, healthcare facilities, sanitation facilities, etc.
- Generate employment opportunities by way for local youth in establishing entrepreneurial ventures using the uninterrupted power supply
- Improve the prospects for the elevation of consumers up to the multi-tier framework that measures electricity access in terms of improved capacity, Availability, Reliability, Quality, Affordability, Legality and Health and Safety.

Project Leader Contact

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MI-OFF GRID PROJECTS FROM INDIA

Efficient Portable Stand-alone Vaccine Refrigerator for Rural Application (2018-20)

Project Leader: CDAC Kerela
Partners: IISC Bangalore, Trivandrum Medical College Kerala, USC Columbia

Project Location: Remote location in Kerala.

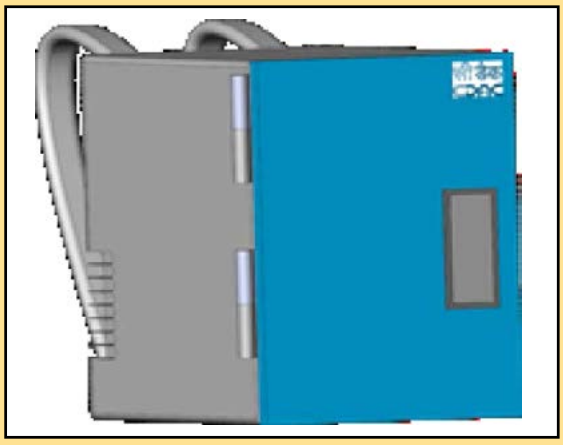
BRIEF DESCRIPTION

Objective:

- To research on portable stand-alone vaccine refrigerator, a transformative agent for lives of individuals and communities through providing quality of life and prosperity

Expected Outcomes:

- 1.5 litres or 3 litresportable refrigerator, Technology transfer package



Project Leader Contact

SUBHASH JOSHI
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MI-OFF GRID PROJECTS FROM INDIA

Uneven Span Greenhouse integrated Semitransparent Photovoltaic Thermal (GiSPVT) System for Agricultural Applications (2018-2020)

Project Leader: Jamia MilliaIslamia, Jamia Nagar, New Delhi.

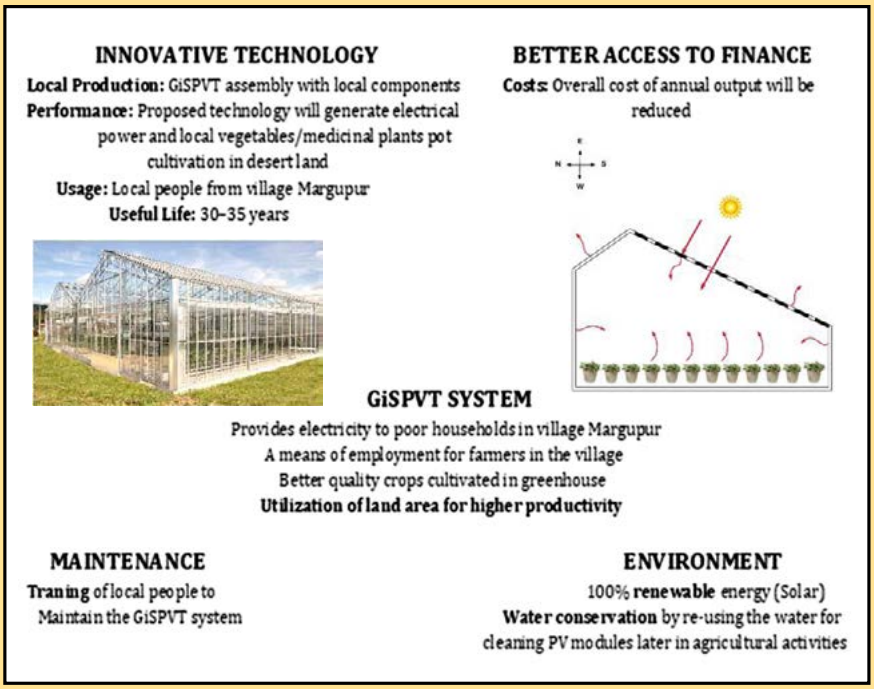
Partners: Bag Energy Research Society Delhi, Orissa University of Agricultureand Technology Odisha, School of Engineering and the Built Environment Edinburgh Napier University Edinburgh U.K.

Project Location: Mauza Village Margupur (Rasra), district Ballia, Uttar Pradesh, India.

BRIEF DESCRIPTION

Objective:

- Optimizing the packing factor of glass-glass PV module in GiSPVT system for better pot crop production preferably vegetables in winter and summer conditions.
- Overall energy and exergy analysis of GiSPVT system.
- Evaluation of energy matrices such as energy payback time (EPBT), energy production factor (EPF) and life cycle conversion efficiency (LCCE) for GiSPVT system.
- Performing techno-economic analysis of GiSPVT system.



Expected Outcomes:

- Increased access to energy services for un- or under-served population in Village Margupur.
- Renewable energy capacity addition and increased energy savings.
- Increased number of innovative clean energy tools, product, technologies, and methodologies adopted.
- Increased number of beneficiaries with relevant skills in clean energy technologies.

Project Leader Contact

MOHAMMAD EMRAN KHAN
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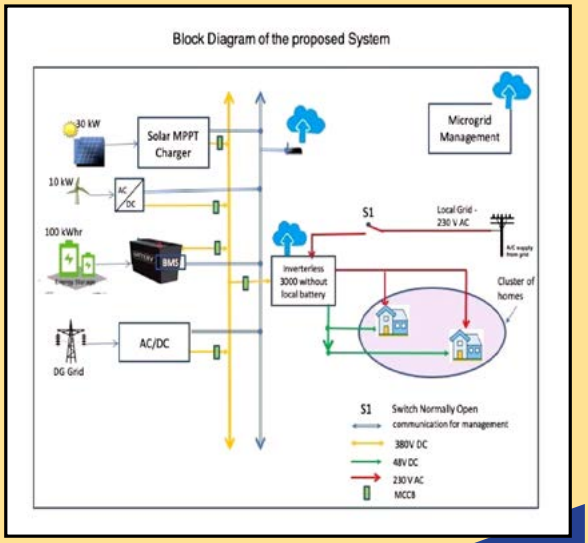
MI-OFF GRID PROJECTS FROM INDIA

A Localized Microgrid to power an off-grid locality (2018-2020)

Project Leader: : IIT Madras
Partners: Research Institute of Sweden

Project Location: Shoal Bay, Andaman Island, India. It is situated 53km (approximate) away from Port Blair



BRIEF DESCRIPTION

Objective:

- Introduce a new innovative electricity off-grid system with transmission of -±350VDC together with a distribution of 48VDC.
- Electrify about 150 households in a completely (or near) off-grid area connected through a small DC Microgrid
- Create a self-sustaining DC-based clean energy system.
- Local eco-system to manage and monitor the project.
- Collect data from each system for analysis and optimization studies.
- Develop an ecosystem in the region

Expected Outcomes:

- Development of a new hybrid power control system which allows for optimum usage and management of variety of clean power sources.
- Increase in energy efficiency and decrease in capex in comparison with equivalent decentralized power systems.
- Optimizing power distribution and load management in the village using data analysis.
- Data analytics to support power and demand management.
- Increasing number of clean energy enterprises with improved business operations.

Project Leader Contact

ASHOK JHUNJHUNWALA
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MI-OFF GRID PROJECTS FROM INDIA

Design and Demonstration of Off-grid Self-Healing & Sustainable DC Community Energy Solutions (2019-2021)

Project Leader: Delhi Technological University

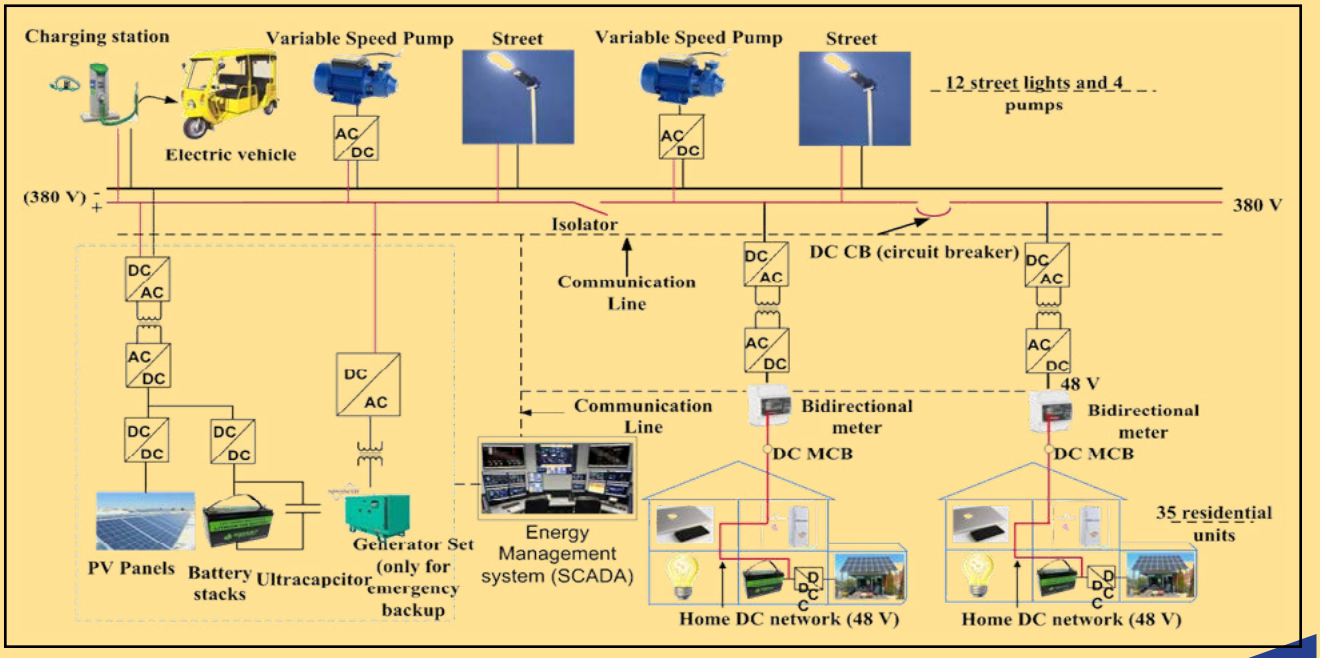
Partners: M2M Cybernetics Private Limited, Research Triangle Park (RTI, North Carolina, USA)

Project Location: Village Musepur, District Pilibhit (UP)

BRIEF DESCRIPTION

Objective:

- Designing of resilient, configurable, self-healing, scalable architecture for community energy solution
- Energy Efficiency: Generation/ Delivery/ Utilization
- Demonstration of PV – DC – µG and support eco–tourism near Sharda river adjoining tiger reserve
- Social and economic impact study, development of sustainable and scalable model for PV – DC microgrid



Expected Outcomes:

- Robust off-grid community energy solution.
- Flexible control algorithm and converter interface.
- Robust and self-healing architecture, operation and management of PV-DC-µG.
- Infrastructure development for nearby places and villages.

Project Leader Contact

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MI-OFF GRID PROJECTS FROM INDIA

Design and Development of biomass –solar electricity and cooling solutions for Rural India (2018-2020)

Project Leader: IIT Delhi

Partners: DTU, TERI, INES R&D (Department of Solar Technology, France), BRACCIO Trisaia Centre (Italy), Røykenviklinna (Brandbu, Norway)

Project Location: Distt. Koraput, Odhisa (Bilatpur, Bilatput G.P., Nandpur and Khajuripadar, Ramgiri, Baipariguda)

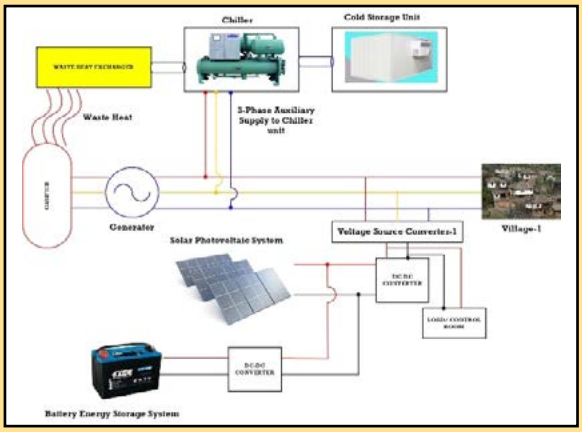
BRIEF DESCRIPTION

Objective:

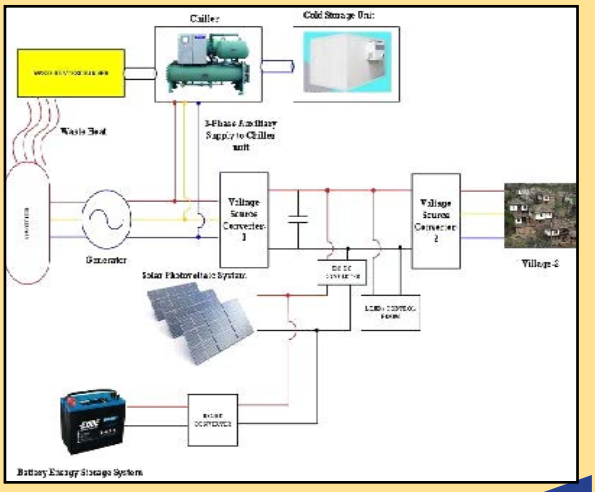
- Control algorithms for seamless control of voltage source converters from voltage control to current control modes.
- Demonstration of Green chill cold storage system using waste heat from two stage gasifier power plant.
- Demonstration of optimal PV-biomass Gasifier operation.
- Incorporation of the DSM practices to control the integrated operation and provide reliable electricity.
- Demonstration of AC-DC system concepts for reduction in losses of the overall system.
- Implementation of the PV-Biomass hybrid system for two villages. In Village 1, AC side Integration will be demonstrated while in Village 2 DC side Integration will be demonstrated (avoiding synchronization problems). The performance comparison between the two configurations will be carried out.

Expected Outcomes:

- Optimal sizing of the hybrid solar-PV biomass, battery systems with DSM enabled inverter support and direct DC load feed options.
- Energy Management Algorithms for optimal utilization of resources.
- Controllers for EMS, Biomass gasifier, solar PV/ MPPT, Battery Charging etc.
- Protection schemes and design for the two systems



AC Synchronization



DC Synchronization

Project Leader Contact

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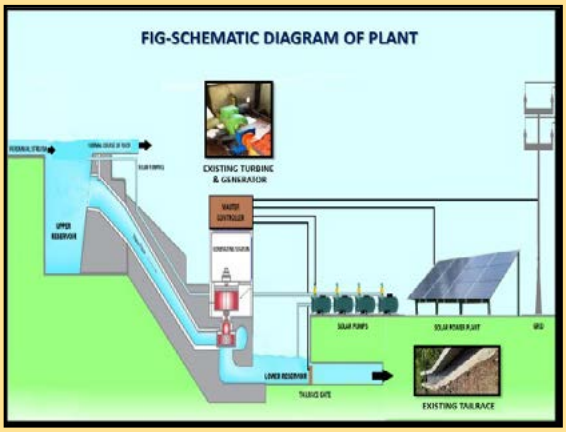
MI-OFF GRID PROJECTS FROM INDIA

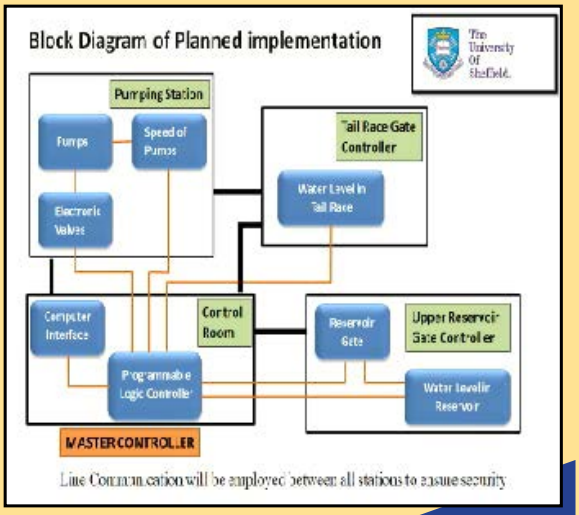
Development, Research and Pilot Scale installation of Solar-Hydro Pumped Storage Scheme in a remote village to ensure 24x7 electricity (2018-2020)

Project Leader: Visva- Bharati University, West Bengal

Partners: NB Institute for Rural Technology, Sheffield University (U.K.)

Project Location: Hengbung, Senapati District, Manipur





BRIEF DESCRIPTION

Objective:

- Interconnecting and interfacing a mini or micro hydel project with Solar Power
- Functional intelligent controller to operate pumping of tailrace water to upper reservoir water by using Solar pumps.
- Enhancing Capacity Utilization Factor of Mini/Micro Hydel plant along with stabilizing intermittent solar power to firm dispatch-able power.
- Training of the selected people from the local community.
- Different social activities like Women empowerment and socio-economic activity for banana stem fiber, broom making, Supari leaf plate making preparation of orange jelly, jam and squash., bamboo handicraft etc.

Expected Outcomes:

- Improving reliability of power generation
- Overcome limitations of Hydro plants in the dry season
- Continuous water supply
- Intelligent controller for Water and Power management
- Socio-economic and health status.

Equivalent battery saving

Payback period : 4 years

Project Leader Contact

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OFF-GRID PROGRAMMES IN MI-COUNTRIES

	National Programs	Responsible Agency
1	**Australia**	
	1. UNSWERV (UNSW Énergie Renouvelable Vanuatu) • Hands-on learning about off-grid PV systems • Development of low-cost and highly reliable systems for same.	https://www.engineering.unsw.edu.au/energy-engineering/
	2. Pollinate Energy • Off-grid solar lighting to urban slum dwellers	https://pollinateenergy.org/contact/
	3. Desert Knowledge Australia Solar Centre • Solar PV technologies in arid/remote context	http://dkasolarcentre.com.au
	4. Indigenous Business Australia, Ekistica. • Development of standardised, quality assured off-grid power systems	http://www.iba.gov.au/
	5. Intyalheme Centre for Future Energy • Knowledge sharing, community education and engagement, industry partnerships, and commercialization	https://roadmaptorenewables.nt.gov.au/information/centre-of-excellence-in-renewable-energy
2	**Brazil**	
	1. Universalization - Light for All ("Luz para todos") • Provide Universal access to electricity in the country, with the goal of bringing low-cost access to electricity for millions of people in rural areas.	MME, ANEEL, Eletrobras and utilities http://www.aneel.gov.br/universalizacao-legislacao https://www.mme.gov.br/luzparatodos/asp/ https://www.eletrobras.com/ http://www.planalto.gov.br/ccivil_03/leis/2002/L10438.htm
	2. Brazilian Electricity Regulatory Agency (ANEEL) • Regulamentation: Isolated Microsystem of Generation and Distribution of Electric Energy - MIGDI (up to 100 kW); Individual Power Generation System with Intermittent Power Supply - SIGFI (13, 30, 45, 60 and 80 kWh / month).	ANEEL, EPE, Eletrobras http://www2.aneel.gov.br/cedoc/ren2004083.pdf http://www2.aneel.gov.br/cedoc/ren2012493.pdf
	3. ANEEL R&D Program • Use of Advanced Battery Technologies in Energy Storage System for Integration of Photovoltaic Mini-Plants in Isolated Communities	Amazonas Distribuidora De Energia, CPqD
	4. ANEEL R&D Program • Use of energy accumulators associated with photovoltaic generation to increase the efficiency of diesel generators that serve isolated communities	Amazonas Distribuidora De Energia, CPqD

	National Programs	Responsible Agency
	5. ANEEL R&D Program • Multi-objective Optimization of Distributed Energy Resources aimed at Sustainability and Reliability in Isolated Micro grids including Energy Storage System with Batteries	CompanhiaEnergética de Pernambuco - CELPE
	6. ANEEL R&D Program • Evaluation of energy storage technologies and operation and maintenance management solutions for application in isolated systems in the Pantanal region	EmpresaEnergética de Mato Grosso do Sul S.A., ENERGISA, LACTEC
3	**Canada**	
	1. Natural Resources Canada - Innovative technology demonstrations • To reduce the use of diesel fuel in off-grid, remote and Northern communities (indigenous and non-indigenous) through innovative technology demonstrations (Includes demand reduction through energy efficiency technologies, renewable energy technologies, energy storage and/or smart grid technologies, waste-to-energy, combined heat and power, clean transportation, and microgrid optimization.)	Natural Resources Canada call for proposals (deadline October 2, 2017) https://www.nrcan.gc.ca/energy/science/programs-funding/19791 Natural Resources Canada – Canmet ENERGY Research Laboratory http://www.nrcan.gc.ca/energy/offices-labs/canmet/5715
	2. Science and Technology Program – Canadian High Arctic Research Station (CHARS) • Alternative and Renewable Energy Infrastructure for Development	POLAR Knowledge Canada https://www.canada.ca/en/polar-knowledge.html
	3. Northern Responsible Energy Approach for Community Heat and Electricity (REACHE) Program	Indigenous and Northern Affairs Canada https://www.aadnc-aandc.gc.ca/eng/1481305379258/1481305405115
	4. Arctic Remote Energy and Networks Academy (ARENA)	ARENA: https://www.uoguelph.ca/research/alerts/content/call-participants-arctic-remote-energy-network-academy-arena
	5. Pan-Canadian Framework – complementary actions on reducing reliance on diesel working with Indigenous Peoples and northern and remote communities • Accelerating and intensifying efforts to improve the energy efficiency of diesel generating units, demonstrate and install hybrid or renewable energy systems, and connect communities to electricity grids.	Canada: https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework/complementary-actions-reduce-emissions.html
	6. Canada Remote Microgrid Technical Expert Working Group	Natural Resources Canada –CanmetENERGY Research Laboratory http://www.nrcan.gc.ca/energy/offices-labs/canmet/5715

	National Programs	Responsible Agency
4	**China**	
	1. Smart microgrid based on renewable energy in remote district	BJ CORONA http://www.bjcorona.com/en/
	2. Smart microgrid based on renewable energy in remote districts	IEECAS http://english.iee.cas.cn/intro/bi/
	3. Technology of CCHP microgrid based on renewable energy	IEECAS http://english.iee.cas.cn/intro/bi/
5	**European Union**	
	1. Global Energy Efficiency and Renewable Energy Fund (GEEREF) • Broad mix of energy projects and technologies	DG – DEVCO https://ec.europa.eu/europeaid/general_en
	2. ACP – EU Energy Facility • Increase and improve access to modern, affordable and sustainable energy services for the rural poor in ACP countries	DG - DEVCO https://ec.europa.eu/europeaid/general_en
	3. Horizon 2020 • Low Carbon Energy (LCE) calls on microgrid and small-scale storage	DG – ENER DG – RTD https://ec.europa.eu/programmes/horizon2020
6	**Finland**	
	1. Smart Energy Program • Create testbeds for smart energy solutions, also off-grid and island solutions	Tekes https://www.tekes.fi/en/
	2. BEAM Program • Support R&D&I projects which solves problems in developing countries	Tekes https://www.tekes.fi/en/
7	**France**	
	1. Innovative power system based on PV	ADEMEhttps://ec.europa.eu/europeaid/general_en
	2. Investment for the future • Electricity Storage Innovative technologies	ADEMEhttps://ec.europa.eu/europeaid/general_en
	3. Investment for the future • small scale smart grid innovative solutions	ADEMEhttps://ec.europa.eu/europeaid/general_en
	4. Durasol R&D • Accelerated ageing tests on PV modules	CNRS; Universitieshttp://www.cnrs.fr
	5. G2E lab • Isolated microgrid stability and power electronics control	Grenoble Institute of Technology http://www.grenoble-inp.fr/welcome/grenoble-institute-of-technology-9224.kjsp
	6. EDF R&D activities on off grid access	Électricité de France R&D department / Les renardières https://www.edf.fr/en/the-edf-group/who-we-are/activities/research-and-development
	7. Powidian multi energy autonomous power station	Powidian France http://powidian.com
	8. R&D, business development and supply	Off-Grid Electric http://offgrid-electric.com
		EDF https://www.edf.fr/en/the-edf-group/who-we-are/activities/research-and-development

	National Programs	Responsible Agency
	9. Corporation agreement to use renewable energy	G2Elabhttp://www.g2elab.grenoble-inp.fr Catholic Universityhttp://www.ucacue.edu.ec
8	**Germany**	
	1. Electrification through Renewable Energy (ELREN)	BMZ, EBTKE, Federal Ministry for Economic Affairs and Energy https://www.bmwi.de/Redaktion/EN/Dossier/energy-transition.html https://www.giz.de/en/worldwide/72595.html
	2. Promotion of Rural Electrification through Renewable Energies	BMZ, ADER, Federal Ministry for Economic Affairs and Energy https://www.bmwi.de/Redaktion/EN/Dossier/energy-transition.html https://www.giz.de/en/worldwide/20065.html
	3. Energy Solutions for Off-grid Applications	Dena German Energy Agency, Mittelstand Global Energy Solutions Federal Ministry for Economic Affairs and Energy https://www.dena.de/en/home/ https://www.german-energy-solutions.de/GES/Redaktion/EN/Publications/GermanEnergySolutions/energy-solutions-for-offgrid-applications.pdf?__blob=publicationFile&v=2 https://www.bmwi.de/Redaktion/EN/Dossier/energy-transition.html
9	**India**	
	1. Clean Energy Research Initiative • To support clean energy solution including off Grid	Department of Science and Technology http://www.dst.gov.in/clean-energy-research-initiative
	2. Off Grid Power • Aerogenerators / wind Hybrid; Biomass Gassification; Biogas; Small Hydro; Biomass Power; Solar; Remote Voltage Electrification; waste to energy	Ministry of New and Renewable Energy http://mnre.gov.in/schemes/offgrid/
	3. Research Scheme on Power	Central Power Research Institute http://www.cpri.in/r-a-d-schemes/research-scheme.html
	4. Decentralized Distributed Generation (DDG) • Electricity Access to un-electrified village	Rural Electrification Corporation Limited http://www.recindia.nic.in
10	**Indonesia**	
	1. Model development of utilization of solar energy for community business in borders of West Kalimantan	http://panasonic.net/sustainability/en/power/solution/indonesia.html
	2. Indonesia 30kW Off Grid Solar System	https://www.bluesunpv.com/indonesia-30k-off-grid-solar-system_n44
	3. Electrification through Renewable Energy (ELREN)	https://www.giz.de/en/worldwide/72595.html
11	**Italy**	
	1. Power Network Project • Innovative technologies, production and storage for power network	RSEhttp://www.rse-web.it/home.page CNRhttps://www.cnr.it/en ENEAhttp://www.enea.it/en

National Programs		Responsible Agency
	2. Regional Energy Plan for off grid small islands	CNRhttps://www.cnr.it/en
		ENEAhttp://www.enea.it/en
	3. Poligeneration and storage for smart grid islands	ENEAhttp://www.enea.it/en
	4. Africa – EU Energy Partnership	COMESA, Egypt, European Commission, Germany, Italy http://www.africa-eu-partnership.org/en
	5. European Energy Research Alliance – Joint Programme on Smart Grids	European Research Centers and Universities https://www.eera-set.eu/eera-joint-programmes-jps/smart-cities/
	6. VSC –HVDC (Voltage Source Converter – High Voltage Direct Current) transmission system	ENEAhttp://www.enea.it/en
		NEDOhttp://www.nedo.go.jp/english/whatsnew_20160225.html
		Toshiba Corporationhttp://www.toshiba.it
		Toshiba transmission & Distribution Europe http://www.toshiba-tds.com/tandd/index.htm
12	**Mexico**	
	1. Mexico-Offgrid Rural Electrification	Secretaria de Energia http://documents.worldbank.org/curated/en/551701468774564674/Mexico-Off-Grid-Rural-Electrification-Project-LIL
	2. Electricity to 188 OffgridMuncipalities (720 Homes)	Fondo del Servicio Universal Electrico https://www.acciona.com/pressroom/news/2017/november/acciona-participating-mexican-government-programme-provide-universal-access-electricity/
13	**Netherlands**	
	1. Lighting Global, Lighting Africa	IFChttp://www.resource-alliance.org/ifc/
		World Bankhttp://www.worldbank.org
		Climate Investment Fund http://rise.esmap.org/country/netherlands
		SREPhttps://www.climateinvestmentfunds.org/
	2. Global Minigrid Facility	World Bankhttp://www.worldbank.org
		Climate Investment Fund http://rise.esmap.org/country/netherlands
		SREPhttps://www.climateinvestmentfunds.org/
	3. Urban poor electricity access power	World Bankhttp://www.worldbank.org
		Climate Investment Fund http://rise.esmap.org/country/netherlands
	4. Energising Development	RVO (Netherland Eneterprise Agency) in collaboration with Geselischaft fur InternazionaleZusammenarbeit (GIZ) http://english.rvo.nl https://www.giz.de/en/worldwide/314.html

	National Programs	Responsible Agency
14	**Norway**	
	1. ENERGIX	RCN http://www.forskningsradet.no/en/Home_page/1177315753906
15	Republic of South Korea	
	1. Ulleung Island • Microgrid Project operating PV, Wind, Hydro, Geothermal, Fuel Cell combined with ICT, as well as ESS and EMS	
	2. National R&D projects • Development and Subsequent Commercialization of a 50 kW Wave Power Generation System for Distributed Generation on Remote Islands	INGINE- yjsung75@gmail.com
	3. Convergence technology development and demonstration of standardized energy independent island model for south pacific nations	Woojin Industrial Systems Co., Ltd. jklee@wjis.co.kr
	4. Development and Demonstration Project of ICT based Microgrid System in Rural Area of Southeast Asia	Kumho ENG chbae@4kumho.com
	5. A development of micro-grid smart operating platform and BM for small industrial complex	Green Energy Institute jhko@gei.re.kr
	6. Development of "Integrated Electricity Prosumer Operation & Management System" based on Microgrid EMS and Test-bed build for Energy Independent type of Industrial Complex and Eco-town	Globalups steve@globalups.co.kr
	7. Development of 30kW-class tactical mobile microgrid module	Luxco nsjung@luxco.co.kr
	8. Joint Advanced Microgrid Analysis, Design, and Implementation at Military Installations in Korea	KIER eugenesong@kier.re.kr
	9. Development of 20kW Wind Power System for micro-grid	Sun-tech air0427@empal.com
	10. Development and 100kW System Demonstration for Economic Dispatch Microgrid PV System based on 1000V DC BUS	S-Energy byeongman.kim@s-energy.com
	11. Development on hybrid generation technology of new renewable energy sources for off-grid based on IoT	S-Energy engine29@s-energy.com
	12. Development for Micro Grid Common Platform Technology	KEPCO parkhj33@kepco.co.kr

	National Programs	Responsible Agency
16	**Saudi Arabia**	
	1. Off-Grid Hybrid Solar plant • 14MW Diesel- Solar Plant	Smart Energy Solutions (SES) http://www.sesrent.com/news.php
17	**Sweeden**	
	1. Off-Grid System • Glava Energy Center	http://www.glavaenergycenter.se/index.php/en/tecknikomraden-en/solarergi-en/248-offgrid-systems-en
	2. Standalone Village Microgrid • The Simris project is one of six regional demonstrations in the Horizon 2020InterFlex project supported €23m (EU)	https://www.engerati.com/energy-generation/article/demand-response/stand-alone-grid-solution-comes-swedish-village
	3. Off-Grid Swedish House Block	https://www.betterenergy.com/news/off-grid-swedish-housing-block-powered-100-by-sun-and-hydrogen/
18	**United Kingdom**	
	1. Green Mini-grids Africa • Support emergence of Green mini grids	World Bankhttp://www.worldbank.org
		AFDhttp://www.afd.fr/lang/en/home/AFD/presentation-afd
		SIDAhttp://www.sida.se/English/
		African Development Bank https://www.afdb.org/en/
	2. Transforming Energy Access (TEA) • Support energy technology and business model innovation	Innovative UK/Energy Catalyst https://www.gov.uk/government/organisations/innovate-uk
		Shell Foundationhttp://www.shellfoundation.org
		Acumenhttp://acumen.org
	3. Scaling-off-grid grand challenge • Scaling up household solar and minigrids	USAIDhttps://www.usaid.gov
		Shell Foundationhttp://www.shellfoundation.org
		AfDBhttps://www.afdb.org/en/
	4. Global LEAP • Focus on appliance efficiency	US DoEhttps://energy.gov
		CEMhttp://cem.com
19	**United States of America**	
	1. Grid Modernization Laboratory Consortium (GMLC) – Alaska Microgrid Partnership	Grid Modernization Laboratory Consortium (GMLC) https://energy.gov/under-secretary-science-and-energy/grid-modernization-lab-consortium
		DOE (NREL)http://www.nrel.gov
	2. Industrial scale microgrid at United Parcel Service	DOEhttps://energy.gov
		ORNLhttps://www.ornl.gov
	3. GMLC – microgrid design for New Orleans, Louisiana	DOEhttps://energy.gov
		SNLhttp://www.sandia.gov
	4. Small Solar Home Systems	IEA PVPShttp://www.iea-pvps.org/
	5. Renewable Energy Services for Developing Countries	IEA PVPShttp://www.iea-pvps.org/

POTENTIAL PARTNERS FOR INTERNATIONAL INITIATIVES

Potential Partners for MI IC-2	
1	**Australia**
	• Commonwealth Scientific and Industrial Research Organisation (CSIRO) • University of New South Wales • Global Sustainable Energy Systems • 5B Australia
2	**Brazil**
	• MME • ANEEL • Eletrobras and utilities
3	**Canada**
	• Pembina (NGO) • Lumos Energy • World Wildlife Fund (WWF)
4	**China**
	• Shandong Huaye Wind Power Equipment CO. LTD. • Tianjin University (University) • Institute of Electrical Engineering Chinese Academy of Sciences
5	**European Union**
	• IEA – PV Power Systems Implementing Agreement (IEA-PVPS) • International Renewable Energy Agency (IRENA) • Global Off Grid Lighting Association (Gogla)
6	**Finland**
	• Nocart • Volter • Doranova • Convion
7	**France**
	• ADEME • Group for Environment, Renewable Energy and Solidarity (GERES) • Schneider Electric Foundation • Schneider Electric, Engie
8	**Germany**
	• Dena German Energy Agency • German Federal Ministry for Economic Cooperation and Development (BMZ)
9	**India**
	• Department of Science and Technology (DST) [ARCI, CEERI; CECRI; IITs; NITs and other national technical Universities • Ministry of New and Renewable Energy (MNRE) [IREDA; NISE; NIWE, SSS-NIBE] • Ministry of Power (MoP) [CPRI] • TERI-The Energy and Resources Institute
10	**Indonesia**
	• Ministry of Energy and Mineral Resources • Badan Perencanaan Pembangunan Nasional (BAPPENAS)

Potential Partners for MI IC-2	
11	**Italy**
	• TERNA • SMEDE • ENEL GREEN POWER • FZSonick – FIAMM • RES4Africa • La Fabbrica del Sole • Elettrici Senza Frontiere
12	**Mexico**
	• Secretaria de Energia • Centro Nacional de Control de Energía (NationalCenter for Energy Control; CENACE) • ComisiónReguladora de Energía (Energy Regulatory Commission; CRE) • Secretariat of Energy (Secretaría de Energía; SENER)
13	**Netherlands**
	1. StichtingNederlandseVrijwilligers (SNV)
14	**Norway**
	• Norwegian University of Science and Technology (NTNU) • The University of Tromso • NorgesmiljoogbiovitenskapeligeUniversitet (NMBU) • IFE • TronderenergiNett AS • SolvindProsjekt AS • Cambi
15	**Republic of South Korea**
	• Ministry of Trade, Industry and Energy (South Korea) • Korea Institute for Energy Research • Global Green Growth Institute
16	**Saudi Arabia**
	• Renewable Energy Projects Development Office
17	**Sweden**
	• Swedish Energy Agency • Interreg Sverige-Norge • Swedish Agency for Economic and Regional Growth
18	**United Kingdom**
	• Carbon Trust
19	**United States of America**
	• Microsoft • Facebook • SimuSolar • PV Enabled Microenterprise
20	**International Organization**
	• IEA • IRENA • Rocky Mountain Institute • International Solar Alliance • Village Energy • World Energy Forum • World Energy Council • UNIDO • ADB

EVENTS ON MI IC-2 CHALLENGE: OFF-GRID ACCESS TO ELECTRICITY

Event description	Dates	Place	Web- link / Remarks
First MI-India Workshop on "Off – Grid Access to Electricity Innovation Challenge"	23rd May 2017	Delhi, India	http://dst.gov.in/sites/default/files/5-MI-India% 20 Off%20Grid%20 Workshop%20Report_0.pdf
Launch of Mission Innovation–India Funding Opportunity Announcement (FoA): Off Grid Access to Electricity during Second MI Ministerial meet	8th June 2017	Beijing, China	http://dst.gov.in/sites/default/files/4-MI%20Off%20Grid%20Call%20VF .pdf
Stakeholder Workshop: Identifying Technology Innovation Needs and Opportunities Under Mission Innovation Challenge no#2: Off-grid Access to Electricity	12th July 2017	Paris, France	https://www.iea.org/workshops/identifying-technology-innovation-needs-and-opportunities-under-mission-innovati.html
Mission Innovation India – Stakeholder's meet on Public-Private Cooperation for Clean Energy Innovation 2017	20th Dec 2017	Delhi, India	http://mission-innovation-india.net/wp-content/uploads/2018/01/Stakeholders-Meet-on-Public-Private-Cooperation-for-Clean-Energy-Innovation-2017.pdf
MI Project partner meeting Cooperative Isolated Renewable Energy System for Enhancing Reliability of Power in Rural Areas	12-13th Dec. 2018	Jaipur India	Knowledge partner: India -Australia-Canada
MI Project workshop-Biomass -Solar electricity and Cooling solution for Rural India	12 Dec. 2018	Gurugram, India	Knowledge partner: India -Italy- France -Norway
Energy Access	13 Dec. 2018	Katowice, Poland	At COP24 http://enb.iisd.org/climate/cop24/enb/
IRENA General Assembly	15-17 Jan 2019 (Held in Sep Annually)	Abu Dhabi, UAE	http://www.irena.org
MI Project partner-Uneven Span Greenhouse integrated Semitransparent Photovoltaic Thermal (GiSPVT) System for Agricultural Applications	6 Feb 2019	New Delhi, India	Knowledge partners: India -UK-Japan

Event description	Dates	Place	Web- link / Remarks
Second International Stakeholders Meet on MI Challenge IC2: Off –grid Access to Electricity on 1-2nd March 2019	1-2 Mar 2019	New Delhi, India	Knowledge partner: India -France
Intersolar Europe	15-17 May, 2019	Munich	https://www.intersolar.de/
EUPVSEC	9-13 Sep 2019 (Held in Sep Annually)	Marseille, France	https://www.photovoltaic-conference.com/
IEA REWP events	Periodic		https://www.iea.org/topics/renewables/renewablesiea/workingpartyrewp

MISSION INNOVATION
accelerating the clean energy revolution

IC2- Off Grid Access to Electricity

ADEME
Agence de l'Environnement et de la Maîtrise de l'Energie

Department of Science & Technology
Ministry of Science & Technology
Government of India
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