INNOVATIVE SOLUTIONS FOR OFF-GRID ACCESS TO ENERGY

Projects led by French companies or NGOs for off-grid communities
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Mission Innovation, launched at COP 21, gathers 23 countries aiming at reinforcing public R&D investments for the development of innovative clean energy technologies. Among the 7 Innovation Challenges identified by Mission Innovation, the Challenge on “Off-grid Access to Electricity” is co-led by France and India.

In July 2017, France organized an international workshop on this Innovation Challenge IC#2 “Off-grid Access to Electricity” in Paris with the International Energy Agency. This workshop gathered more than 100 stakeholders involved in off-grid access to electricity (large and small enterprises, NGOs, governments, funding institutions) in order to exchange on innovations needed to address this Challenge.

The main conclusions of the workshop highlighted the need to direct innovation efforts towards technology improvements in electricity production systems (including storage and system management) and in the use of efficient equipment for electricity consumption, but also on new business models, maintenance and empowerment of local professionals.

The French Ministry for an Ecological and Solidary Transition asked ADEME (the French Environment and Energy Management Agency) to launch a call for proposals (CFP) on innovative solutions for off-grid access to energy. The CFP was launched on July 12th 2017 and closed on November 20th. More than 90 projects have been received. On January 11th and 12th 2018 a selection was made by a jury that included French Ministries (energy, research and economy), the French Development Agency (AFD), the International Energy Agency and ADEME. The jury selected 9 projects for funding, with a global budget of 5.8 million Euros and ADEME’s aid of 1.8 million Euros.

The selected projects develop several innovative technologies (hybrid electricity production, solar PV, river stream generator), innovative uses of electricity enhancing local economic development (irrigation, agriculture, desalination, mobility…) and electricity payment models (pay as you go, leasing…). The projects also explore new business models and institutional innovations through governance models that are adapted to the local needs and realities.

This document presents the 9 selected projects.
EMPER PROJECT
Independent energy producers

Project
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.

Project Localisation
Togo (SSA Region): Haho prefecture, Plateaux Region
75% of the households without access to energy

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Partner
Innovative Solutions for Off-Grid Access to Energy

SISAM
An enhanced solar irrigation solution for market gardening

Project

- 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 distributors 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

1000 direct beneficiaries (more than 100 family farms; private-sector capacity building). A sustainable irrigation solution made available to 70 000 farmers.

Partners

Project localisation

Burkina Faso: Center-East Region; Togo: Savannah Region; Benin: Atacora Region

Project Leader’s contact

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Industrial Typha Bio-charcoal

Project

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.

Partner

Mauritania

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**AMBATOLOANA**

Hydrokinetic river turbine

**Project**

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 localisation**

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

**Project leader’s contact**

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**Partners**

[Image of partners logos]
DESOlsa
Mascara Renewable Water

Project
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.

Partners
ELSEG
CAMARA SALAMANSA

Project Localisation
SALAMANSA Village, Sao Vicente Island, CAPE VERDE
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.

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Lateral Electrification
Towards a new power infrastructure development path for Africa

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.

Partners

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

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Pay as you go and microfinance in Benin

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: pay-per-view via mobile phone services and microfinance networks, while securing the loan through remote deactivation of the system.

Partners

ARESS is a Beninese distributor of pay-as-you-go solar solutions specialized in renewable energy.

MyJouleBox is a French start-up that is developing an innovative pay-as-you-go meter for developing countries.

Project localisation

The project will be implemented in Benin, where the national electrification rate is 29% and drops down to 5.5% in rural areas. More than 7 million people do not have access to the grid. Many marketing studies highlight the following facts:

- the use of polluting energy sources is high and rural households are not satisfied with their current access to energy,
- the lack of proper access to energy hinders the development of productive activities and the education of young people.

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Innovative Solutions for Off-Grid Access to Energy

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.

**Partners**
Solidarités Entreprises Nord-Sud (SENS), a group of two social businesses (SENS France and SENS Bénin) as leader and local operator of the project.

Local authorities (at the municipality and the department level) and InvestiSENS Bénin, a group of local impact investors, will also contribute to the project.

**Project Localisation**
Rural off-grid areas of Benin in the departments of Borgou, Collines and Zou.

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**Pivert**
Rural Enterprise Clusters for Green Innovation, Energy and Processing
Innovative Solutions for Off-Grid Access to Energy

Leasing of electric motorcycles to taxi drivers

**Project**

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 available solution. Yet, there is a problem: the drivers rent their vehicle, putting a strain on their revenues. Moreover, this activity is very polluting.

In this context, 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 advantages of the project’s electric solution are the following:
- 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 equipment for drivers and passengers.

After the pilot phase in 2018, the objective is to go over 200 vehicles in 2019 and 2000 in 2020.

**Partners**

ZEMBO France (R&D and financing)
ZEMBO Uganda (operations)

**Project Localisation**

Uganda

**Project Leader’s contact**

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ABOUT ADEME

The French Environment and Energy Management Agency (ADEME) is active in the implementation of public policy in the areas of the environment, energy and sustainable development. The Agency provides expertise and advisory services to businesses, local authorities and communities, government bodies and the public at large, to enable them to establish and consolidate their environmental action. As part of this work ADEME helps finance projects, from research to implementation, in the areas of waste management, soil conservation, energy efficiency and renewable energy, raw materials savings, air quality, noise abatement, circular economy transition and food wastage abatement. ADEME is a public agency under the joint authority of the Ministry for an Ecological and Solidary Transition and the Ministry for Higher Education, Research and Innovation.

ADEME’S COLLECTIONS

FOCUS ON ACTION
ADEME is a catalyst: Actors and stakeholders talk about their experience and share their know-how.

EXPERTISE
ADEME is an expert – ADEME reports on research, studies and collective work carried out under its supervision.

FACTS AND FIGURES
ADEME is a reference – ADEME provides objective analyses based on regularly updated quantitative indicators.

KEYS TO ACTION
ADEME is a facilitator – ADEME compiles practical handbooks and guidelines to help actors implement their projects methodically and in compliance with regulations.

HORIZONS
ADEME looks to the future – ADEME promotes a forward-looking and realistic view of the energy and environment transition and what is at stake for society, to build a desirable future together.
INNOVATIVE SOLUTIONS FOR OFF-GRID ACCESS TO ENERGY

At the beginning of 2018, the Call for Proposals « Innovative solutions for off-grid access to energy » has led to the selection of 9 projects from companies and NGOs working on this topic. These projects, which are presented in this document, develop technological, organizational and business models innovations that are likely to ensure a decrease of the solutions’ costs and a stronger involvement and appropriation by the concerned populations.

Nowadays, direct off-grid access to energy can guarantee economic development through the implementation of reliable and lasting solutions, going beyond the lighting needs of households: irrigation for agriculture, energy services at the village level, water desalination… Micro-grids and nano-grids projects prove to be solutions that in some situations are more competitive and accessible than the extension of national grids.