Hybridization of Isolated Systems in Brazil Project

GPFM member

Brazil - Empresa de Pesquisa Energética (EPE)

Project name / acronym

Hybridization of Isolated Systems in Brazil

Project short description

Most of the Isolated Systems in Brazil (212 in total) are placed in the Amazon region and are made up of both small communities (less than 100 kW in peak demand) and cities (up to 20.000 kW) in which more than 90% of the generation comes from fossil fuels, in spite of recent initiatives and studies showing the technical feasibility of hybrid solutions. Because of that, a pilot project deployment is desirable to prove the reliability of renewables and the cost-effective solution for electric generation in isolated systems. For this project, EPE suggests selecting places where diesel is still the only source for generation like Coari (19.300 kW); Tabatinga (13.500 kW); and Tefé (20.000 kW), all in Amazonas State (AM), any of which are good options to receive the demo project. It is desirable that the demo project phase out diesel power plants generation by replacing it with biofuels, solar PV with batteries, or other renewable-based projects.

Main actors

EPE (BR), MME (BR), local IPP, Amazonas Energia (DSO), Financial Institutions, BNDES (National Development Bank), Eletrobras.

Project website

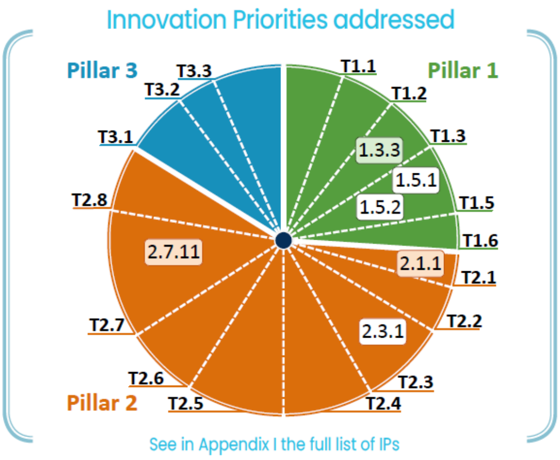
https://www.epe.gov.br/en/publications/publications/isolated-systems

Which of the GPFM's 50 most urgent Innovation Priorities does this pilot project cover?

Pillar 1 - Affordable and Reliable VRE

1.3.3 Distributed IRE generation at grid edge

Distributed IRE, including distributed photovoltaic, dispersed wind power and small hydro power, are located at the grid edge and provide a major part or even all the electricity for many towns, villages, islands, and other facilities far away from a central power grid. IRE generations depending on resource at site can provide adequate electricity. However, voltage and frequency stability issues and power quality issues, like harmonics resonance etc., at grid edge arise due to fluctuation of VRE and power electronics. To deal with these issues, methods to coordinate distributed IRE, stability, and power quality evaluation of distributed IRE at grid edge need to be developed.



1.5.1 Analysis of batteries life cycle and monitor, test and recycle of batteries

It is very important to understand and analyze batteries' life cycle and the processes necessary to monitor, test, and re-use or recycle batteries at the lowest environmental costs. The need for material development ranges from cell to system level or module to periphery. Fast, reliable measurement techniques are needed to test the suitability of such materials at the early stage of development. Electricity storage systems, components and their peripherals must be optimized to ensure that they are suitable for the application scenario and requirement. Object parameters include cost, overall efficiency, power density, energy density, storage capacity, response time etc.

1.5.2 Recycling and re-use batteries design

Recycling and re-use of batteries at the end of their lifetime should be explored so that they can be planned during development stage. These aspects of circular economy must be considered as early as the manufacturing stage. The aim is to continue using components and to recover as many raw materials as possible. Research on environmental impact and economic efficiency of battery life cycle, readily available materials that are harmless and high effectiveness, ideal production processes, the life cycle costs of recycling and re-used battery is needed.

Pillar 2 - System Flexibility and Market Design

2.1.1 VRE flexibility provision and contribution to generation capacity

VRE sources are intermittent and not programmable by nature, therefore they don't contribute to the overall generation adequacy as traditional power plants do. Nevertheless, VRE power plants, including those managed by utilities, energy communities and prosumers have the potential to provide a certain degree of flexibility and contribute to system adequacy, but technological, regulatory and economical barriers still hamper the development of innovative solutions to exploit this potential. To deal with this issue, methods and tools to reliably estimate and exploit the actual contribution of VRE power plants to system adequacy need to be developed.

2.3.1 System stability assessment considering high VRE penetration

VRE sources are typically connected to the power grid by means of power electronics converters, which show a dynamical behaviour significantly different from the one of conventional synchronous generators. Innovative methods to assess the frequency and voltage stability of VRE-based power systems need to be developed. In this view, all the information coming from these resources need to be properly and transparently collected and analysed by real-time advanced management systems, to monitor the system stability status and early identification of critical situations.

2.7.11 Social acceptance of technologies and required behavioural change

Final users' involvement and behavioural changes are essential to accelerate system decarbonisation. Beside technical feasibility of new solutions, the effective social acceptance of them should be assessed to ensure effective results. Grid investments could encounter opposition from local citizens (as has already happened) but this is not the only case where social acceptance of innovations could hinder deployment of innovative solutions. Increasing attention and care should be given to correctly communicating actual advantages and drawbacks of innovative solutions, especially when the direct participation of end users is involved, not to encounter social resistance due to lack of information and/or trust.