STORAGE RESEARCH INFRASTRUCTURE ECO-SYSTEM

RI Information sheet 2022

CENER, ATENEA MICROGRID

Electrochemical

Contact person 1:

AITOR OLLACARIZQUETA, aollacarizqueta@cener.com

Contact person 2:

FAISAL BOUCHOTROUCH, fBouchotrouch@cener.com>

Project Acronym	StoRIES
Call	H2020-LC-GD-2020
Grant Agreement No.	101036910
Project Start Date	01-11-2021
Project End Date	31-10-2025
Duration	48 months

1. Photo

...

2. Geographical coordinates (˚, “, … N/S, E/W)

Sangüesa, Navarra, Spain

3. Description of the research infrastructure for the webpage

ATENEA microgrid is basically oriented to applications in the industrial environment and initially designed to supply energy to some of the loads of the Wind Turbine Test Laboratory (LEA) and part of the lighting of the Rocaforte Industrial Area. It can operate in a connected or in an isolated mode from the grid. The main objectives of the installation are to manage in an efficient way the power generated by the renewable sources at all times while securing the power and energy needs of the loads connected to it. Ensure that the energy consumed by the local loads comes from renewable sources and the storage devices, therefore promoting the energy independence of the LEA while minimizing the grid energy exchange. To be able to send the energy surpluses produced to the electricity grid, so that the microgrid does not function as an isolated body of the distribution network but as an active part of it, promoting market participation and new business models. Serve as a controlled test bench for new equipment development and systems testing, energy storage testing, and control and energy management strategies and algorithms development and tuning in a controlled environment as well as a test bench for electrical protections equipment. The structure of the ATENEA microgrid is based on a low voltage bus (400 V, 50 Hz) to which each of the equipment that makes up the installation is connected. Renewable generation systems are connected to the bus bar through a three-phase converter each. In the case of photovoltaic installation via a DC/AC converter and the wind generator on the other hand, through a two-way AC/AC converter.

The non-renewable generation systems (microturbine and diesel generator) are directly connected to the busbar of the microgrid as well as the loads.

The storage systems are connected to the busbar through a bidirectional converter capable of working in the four quadrants.

ATENEA microgrid is counting with an electrolyser so testing hydrogen storage systems can be done.

This project has received funding from the European Union’s Horizon 2020
Research and Innovation Programme under Grant Agreement N. 101036910

The microgrid is connected to the LEA substation that transforms the 66 kV Grid Voltage into a 20 kV LEA network. A dedicated transformer, converts the 20kV to 400 V microgrid network.
Finally, between the transformer and the microgrid there is a grid emulator that can generate almost any kind of disturbances in the microgrid's busbar including a DC system. Thanks to it, different systems, equipments or its functionalities can be tested, characterized and also, validated according to standards such as IEC61000 (EMC), LVRT capability, SEMI-F47 and CBEMA (voltage perturbances), etc.

All in all, the microgrid counts with the following state of the art generation and storage technologies:

- Rooftop Photovoltaic installation of 25 kW peak of power.
- Full Converter Wind turbine of 20 kW of power.
- Genset of 55 kVA (48 kW).
- 30 kW gas microturbine with thermal recovery for both cold and heat
- Vanadium flow battery of 50 kW, 4 hours
- Gel type acid lead battery of 50 kW, 2 hours
- SCs of 30kW, 37 seconds.
- Ion-Lithium batteries of 30KW, 1 hours.
- Supercapacitor bank of 450kW, 4 seconds.
- Electrolyser of 35kW and a production of 6.66 Nm3/h and 3.33 Nm3/h of hydrogen and oxygen respectively.

In addition to the equipment described above, the microgrid counts with control systems both at the equipment level and at the management level or the entire microgrid. The local controllers are the lowest level of control and their function is focused on the control of generation, storage and load equipment (these are usually given in the equipment and developed by the manufacturers). At a higher level, there is the central microgrid controller that takes the action of opening and closing contactors, measuring signals for safety operations, as well as for sending specific instructions such as setpoints, reset, on/off, etc... to each of the items that makes part of ATENEA. The system is based on the Siemens S300 PLC that provides robustness to the installation, its efficiency has been widely proven in the industrial environment and it is a standard programming system. In parallel there are dedicated computers that allow for different strategies implementation and testing that communicates with the central controller to be able to read the equipment status and send the references to each of them. This allows carrying

This project has received funding from the European Union's Horizon 2020
Research and Innovation Programme under Grant Agreement N. 101036910

out different testing and scenarios implementations with the different devices simultaneously.
Services currently offered by the infrastructure:
The infrastructure currently is offering testing services for the equipment manufacturers such as:

- Power electronics generators test bed against an on-grid and off-grid network
- Grid profiles emulation and equipment response analysis
- Storage testing capacity for different technologies
- Test bed for Control and Energy Management Algorithms validation

The infrastructure has been widely used in many H2020 and regional R&D projects as a test bed for technical solutions testing and validation prior to its deployment into production in real applications. The most relevant H2020 projects are OSMOSE, STORY, EXCESS. Amongst the national and regional projects ARALAR, E-HIERA and HIPNESS are to be mentioned due to the impact of the results into the industrial and product market participation. ATENEA is also used by private companies to carry out their research activities concerning storage devices development, tuning and testing against a 20KV/8MW grid.

Description of work (where appropriate, broken down into tasks), lead partner and role of participants
Modality of access under this proposal:
The researchers will count on CENER's staff to operate the microgrid and its elements as per a set of predefined test scenarios that must be agreed on previous in order to operate the plant always within its safety parameters and also to accommodate the different devices configuration and parameters to the test to be performed. CENER's staff can potentially participate into the test data analysis although this is not considered a part of the services provided under this call and will be considered in case by case bases.
Guest researchers will have access to e mail, internet and standard office amenities, such as telephone, fax and copy machine and will have the right, on par with other researchers, to participate in lectures, seminars, colloquia, etc. In some cases, a mentor may be appointed tailor a set of relevant educational elements for a guest.
The researchers must agree with CENER about the dates to use the facilities depending on the availability of the infrastructure. Also, a list of test cases or studies to be performed must be submitted to CENER a month prior to the start of the test in order to be able to accommodate the facility and validate them according to safety and technical specifications.

This project has received funding from the European Union's Horizon 2020
Research and Innovation Programme under Grant Agreement N. 101036910

Support offered under this proposal: CENER will function as a scientific guide and problem solver at the host institute or company. The selected persons will assist visiting researchers and will act as a helping hand with respect to administrative tasks, provide access to experimental units, laboratory space, technical assistance, and office space and make supporting staff available. The guidance available to new users will include training for the available equipment and characteristics, instruction on safety operation within the microgrid, as well as any other technical or administrative assistance that should arise.
Outreach to new users:
ATENEA microgrid is being widely promoted through CENER's Website as well as through the participation of the department members in various technical associations working groups, technical discussions and presentations, as well as through R&D project proposal within H2020 calls as well as national and regional initiatives.

4. Availability of the research infrastructure

(Please indicate time periods in which infrastructure will not be available for StoRIES in the next 2 years – if already known)

…

5. Special considerations (confidentiality / NDA agreements, insurance requirement, special training, HSE training)

…

6. Energy storage technology that can be analysed/studied by using the research infrastructure

- Electrochemical ☒
- Chemical ☐
- Thermal ☐
- Mechanical ☐
- Superconducting Magnetic ☐
- Cross-cutting ☐ (Specifically: …)

7. Key words for the webpage

…ATENEA, microgrids, storage, EMS, Power electronics, Plant control

8. TRL level (if applicable):

This project has received funding from the European Union's Horizon 2020
Research and Innovation Programme under Grant Agreement N. 101036910

- 1-3 ☐
- 4-6 ☐
- Above ☐

This project has received funding from the European Union's Horizon 2020
Research and Innovation Programme under Grant Agreement N. 101036910