

The Enel Open Innovability[®] crowdsourcing Challenge
An innovative portable device that can communicate via Power Line Communication
with Enel’s smart meters | Solution requirements

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Introduction

The following requirements are necessary for the proposed solution to be evaluated. Please read them carefully and check that your proposed solution complies with them.

Brief description

Enel Grids is looking for a **portable device that field technicians can use and carry in order to connect to – and verify from a distance – the smart meter in question**. The connection is made by clamping the device to the physical electrical wires that connect to the meter and then using a powerline protocol to interact and communicate with it, specifically the version used by Enel in Spain known as “Meters and More”.

The device must have a **display** for basic configuration, connection procedure, diagnostics, information display and basic feedback for the technician. At the same time, the device must have a **Bluetooth connection** to enable meter access from a smartphone and provide advanced functionality.

Proposals are accepted from all over the world, but the testing phase will be conducted in Spain.

THE SOLUTION MUST HAVE

1. MAIN TECHNICAL REQUIREMENTS

1.1. Real-time clock

The device must have a **real-time clock** that complies with the IEC 62054-21 [30] requirements (date and hour drift must be less than 0.5 seconds per day).

1.2. Reliability

- Expected **lifetime**: 10 years (or more).
- **Failure** rate: limits and procedures must be described in detail in the tender and contract documents.

The expected lifetime and failure rate must consider the environmental, EMC and electrical conditions, constructive design and installation environment described in this document.

Furthermore, the expected lifetime and failure rate must consider the common use of the device described in this document.

1.3. Environmental

- Operative Temperature Range: from -10 °C to +40 °C
- Storage Temperature Range: from -40 °C to +60 °C
- Operating Humidity (non-condensing):
 - ≤ 90% HR (10 °C to 30 °C)
 - ≤ 75% HR (30 °C to 40 °C)
 - ≤ 45% HR (40 °C to 50 °C)

1.4. Electrical measurement requirements

- **Voltage measurement**: the device must be able to measure voltages between 0 and 600 V (F-N).
- **Current measurement**: the device must enable the use of different models of Rogowski coil.
- **Measurement category**: CAT III 1,000V, CAT IV 600V according to IEC 61010-1.

1.5. Terminals and interfaces

- **USB Type-C**: USB Type-C communication interface for operation, administration purposes and device charging.
- **Bluetooth**: the device must implement a low-energy Bluetooth 5.0 interface or better. This interface will be used for the operation of the device. The Bluetooth power level must be enough to reach 20 meters without obstacles and 10 meters with obstacles. Tests and test

conditions related to Bluetooth must fulfill all the existing regulations in *the Radio Equipment Directive (RED) 2014/53/UE [36]*.

- **Signaling LEDs:** the device must have the following signaling LEDs:
 - Power LED: no power/device off; powered; low battery.
 - Current direction LEDs (one per phase): No current; positive current; negative current.
 - Bluetooth LED: device not connected; device connected; pairing mode.
- **Power Supply:** the device must be powered by a rechargeable battery, to guarantee activity for at least 12 hours.

1.6. Conformity of materials

- Conformity with the provisions of the **European Directive 2004/107/EC [1]** relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.
- Compliant with the **European Directive 2011/65/UE [2]** on the restriction of the use of certain hazardous substances in electrical and electronic equipment, and the **European Directive 2014/35/UE [3]** relating to making available on the market electrical equipment designed for use within certain voltage limits.
- The device case and components **must have the following characteristics:**
 - made of synthetic resin suitable for recycling (related symbol must be molded on larger parts);
 - color and light-resistant;
 - heat and flame-resistant (class V0 in accordance with UL94);
 - low emission of corrosive and toxic gases and smokes;
 - the case must show no deformations, brittleness process or surface hardness reduction, in the temperature range from -25°C to $+70^{\circ}\text{C}$, and must be able to withstand up to -40°C temperature.
- Terminals and cables must be properly labelled so that they can be identified without error.
- Terminals must enable the connection of crocodile clip test leads including fuse protection. This connection must be secure but removable for easy cable replacement.
 - Cable length: 1.5m.
 - Fuses: FF 500 mA DMI 1000 V.
- Terminals must be properly labelled so that they can be identified without error.
- The terminals must enable the connection of different Rogowski coil models from different manufacturers.
- Rogowski coil minimum requirements:
 - AC current: 100mA to 1kA.
 - Measurement category CAT III 1.000V, CAT IV 600V according to IEC 61010-1.
 - Diameter: 100mm
 - Cable length: 1.5m
 - Ratio error (centered): 1%.
 - Ratio error (all positions): 2%.

1.7. Two-dimensional code

The device must include, in a visible zone at the front, a two-dimensional code, in accordance with the latest version of *UNE 207010 [29]*.

1.8. Model

The device must include, in a visible zone at the front of every module, the brand and the device name (to be defined).

1.9. Other markings

The device must include the Measurement category, in a visible zone at the front.

1.10. Cyber security

The device must be designed taking into consideration a high level of cybersecurity. The following issues must be addressed:

- Data must be encrypted.
- Data integrity must be checked.
- Authentication and authorization processes must be managed in the access phase (users and roles).
- Hardware characteristics that “strengthen” the device against physical attacks aimed at gaining access to the internal/logical components. Physical security characteristics that block acts of vandalism or enable an overall physical protection of the device.

1.11. Other physical requirements

- Rubber protection case (should the device not provide enough shock and drop protection).
- 3 x Rogowski coils with removable cables (current measurement).
- 4 x Crocodile clip test leads with fuse in connector and removable cables (voltage measurement).
- Fuse kit for replacement (4 fuses).
- Lightweight protective case for storing all the components.
- Maximum dimensions:
 - Width: 100 mm
 - Height: 180 mm
 - Depth: 50 mm
- Fastening system: The case must include some kind of holding system that facilitates the fastening of the device in the installation process. The holding system must not affect the device’s electrical security or degree of protection.
- Degrees of Protection: The device must ensure IP54 protection rating (in accordance with EN 60529).

2. FUNCTIONAL REQUIREMENTS

2.1. Meter reading through PLC Communication

The device must be able to communicate by **PLC communication (Meters and More)** to a specific meter by means of the OPA functionality.

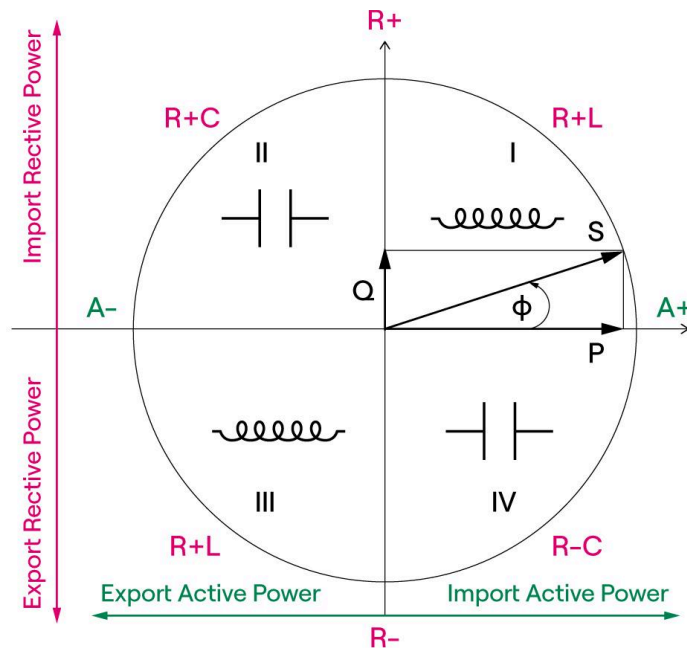
The device’s Bluetooth connection must be restricted to the use of the smartphone application designed for reading the meter’s instant parameters. The passwords for reading the smart meter data will be obtained through the application that will access the DSO system. The design of the

application for accessing the DSO system is beyond the scope of this project: a demo smartphone application that demonstrates this functionality will be sufficient.

2.2. Electrical measurements

The device must be able to **measure** and **store the following parameters** (explained graphically in the image below), with its associated timestamp in POSIX UTC:

- Imported active energy (A+).
- Exported active energy (A-).
- Imported inductive reactive energy (R+L).
- Imported capacitive reactive energy (R+C).
- Exported inductive reactive energy (R-L).
- Exported capacitive reactive energy (R-C).



- Imported active power $W_+(t)$ (total and per phase).
- Exported active power $W_-(t)$ (total and per phase).
- Imported inductive reactive power (Q+L) (total and per phase).
- Imported capacitive reactive power (Q+C) (total and per phase).
- Exported inductive reactive power (Q-L) (total and per phase).
- Exported capacitive reactive power (Q-C) (total and per phase).
- Imported apparent power (total and per phase).
- Exported apparent power (total and per phase) .
- 3 x Phase currents (with sign).
- 3 x Phase voltages (F-N).
- 3 x Phase angle (F-N). (0° - 360°).
- $\cos(\phi)$ (F-N) (total and per phase).
- Voltage rotation order (phase sequence).
- Voltage total harmonic distortion (THDv) (per phase).
- Current total harmonic distortion (THDi) (per phase).

Furthermore, it must **implement** the following **registers and functionalities**:

- Command to reset the energy registers.
- Load profile buffer (120 samples, sample rate 1s).
- Necessary configuration registers for the Rogowski coil (support for multiple manufacturers and models).
- Timestamp in POSIX UTC and necessary commands for synchronization.
- Hardware and firmware version identifiers.
- Serial number identifier.
- Battery status/level.
- Support for firmware update.

REQUIRED DELIVERABLES

3. DELIVERABLES FOR PRESENTING YOUR SOLUTION

Proposals must be submitted to the openinnovability.com platform in a single stage, and must include the following information in English:

- Solution name/title and overview
- Solution detailed description (e.g., Technical, Functional, Cybersecurity, Operational specifications, etc.)
- Solution design (e.g., Hardware, Software, Interfaces, electronic diagram, etc.)
- Development roadmap to market, indicating the estimated time for design, certification and prototypes
- Budget estimate for proposal development
- An estimate of the final price of the solution

Supporting documentation: any additional supporting materials, diagrams, simulations, or research that can help in understanding and evaluating the proposed solution can be uploaded.