EEBUS

Empowering the digitalisation of Energy transition

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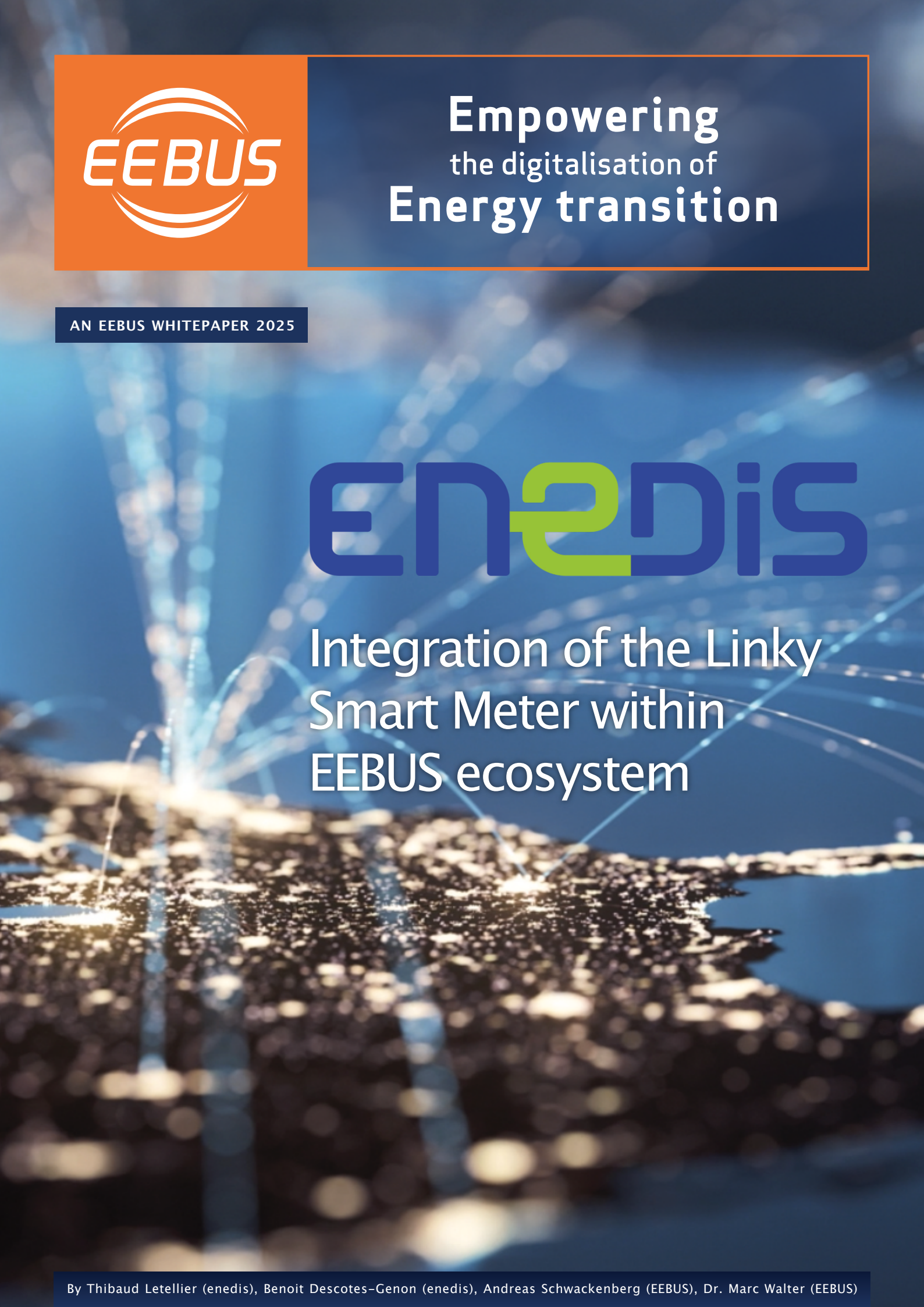

Integration of the Linky Smart Meter within EEBUS ecosystem

By Thibaud Letellier (enedis), Benoit Descotes-Genon (enedis), Andreas Schwackenberg (EEBUS), Dr. Marc Walter (EEBUS)

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INTRODUCTION AND GOAL

The integration of the Linky smart meter within the EEBUS ecosystem offers significant benefits by enabling seamless communication and data exchange for energy management. This white paper explores how mapping the Linky smart meter with EEBUS enhances energy efficiency, facilitates interoperability, and supports the energy transition.

Mapping the Linky smart meter with the EEBUS communication standard provides a unique opportunity to leverage the strengths of both systems for smarter energy management.

Linky meters provide near real-time consumption and production data through the TIC (Télé-Information Client) interface. This data can be directly mapped to EEBUS protocols (SPINE and SHIP), allowing devices within a building to make dynamic and informed energy decisions.

With over 37 million Linky meters already deployed across France, utilising existing infrastructure avoids the need for additional metering hardware. This reduces costs for consumers and facilitates immediate compatibility with EEBUS-enabled devices.

EEBUS ensures that energy-relevant devices from different manufacturers can communicate and operate seamlessly. Mapping Linky to EEBUS enables integration of the meter into a wider range of use cases, from electric vehicle charging to Home Energy Management Systems (HEMS).

Mapping Linky and EEBUS aligns with France's commitment to energy efficiency, renewable energy adoption, and the electrification of mobility. By connecting Linky data to EEBUS systems, stakeholders—consumers, grid operators, and device manufacturers—can optimise energy usage and contribute to carbon footprint reduction.

Conclusion

The synergy between the Linky smart meter and the EEBUS ecosystem creates a foundation for smarter, more efficient, and sustainable energy systems. By mapping these technologies, stakeholders unlock a range of opportunities to enhance energy management, reduce costs, and accelerate the energy transition. This collaboration exemplifies the potential of interoperable standards in driving innovation and supporting global energy goals.

1 Enedis and the Linky Smart Meter

1.1 Introduction

Enedis operates, manages and upgrades the electricity distribution grid covering 95% of mainland France (excluding Corsica). Enedis is contributing to the new wave of electrification in France and supporting new uses for electricity: energy efficiency, renewable energy roll-out, self-consumption, electric mobility, etc.

Some key figures about Enedis as of 2024:

- 1.4 million km of power lines
- More than 40.000 employees
- 38.8 million customers
- 2.8 million technical operations and 25 million remote operations made possible by the Linky smart meter
- 46 GW of Renewable Energy connected
- 620 000 individual self-consumption facilities

Advanced Metering Infrastructure (AMI) is a system that allows customers' electricity consumption to be managed remotely. AMI systems use smart meters and communication networks to collect and transmit real-time data. Smart meters provide more detailed and frequent consumption data than traditional meters.

In France, the AMI deployment started in 2015 with the roll-out of Linky, the French smart meter for customers with a subscribed power below 36 kVA. In 2024, more than 98% of Enedis customers are equipped with the Linky smart meter, which represents over 37 million meters. The vast majority of these meters are single-phase.

With the Linky meter, Enedis provides its customers with features that allow the energy management of certain uses (hot water tank, electric heating, electric vehicle, etc.). Generally, this management is associated with specific pricing offers, which propose different energy rates depending on when the energy is consumed.

Several methods are possible for this management:

- By using the dry contact (relay) of the meter, which typically controls the hot water tank. A specific device, the SDCC (Second Dry Contact Control), can control a second piece of equipment when associated with the meter.
- Through an energy manager system using real-time information provided by the TIC (Télé-Information Client), the local interface from the meter.
- By direct connection of the equipment to the TIC interface, such as an electric vehicle charging station.
- By adding a Local Radio Transmitter (ERL: Emetteur Radio Local), to transmit TIC information wireless to the customer's home or to their online customer space.

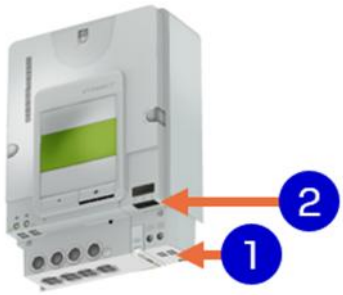
1.2 What is the TIC interface?

Linky meters have a digital interface output, known as the 'Télé-Information Client' or 'TIC.'

Accessible to the customers and their electrician, it allows for the transmission of data in almost real-time (approximately every 2 seconds):

- The contractual parameters defined in the supplier's offer: subscribed power, name of the supplier's offer, tariff period, etc.
- The data measured by the meter: current and/or power consumed, injected power, consumption or production for each time slot (index)…

The TIC interface (like the dry contact interface) is located on the meter, underneath the cover accessible to the customer. Enedis is not authorised to physically intervene on the TIC to connect a device, as this falls under the post-meter domain (NFC 15-100).



1= dry contact /
2 = TIC

Figure 1: TIC and dry contact interfaces

Two connection methods to the TIC (Télé-Information Client) exist:

- Wired: Wires are connected in series between the TIC Linky and the equipment, which thus receives real-time data.
- Radio with a Local Radio Transmitter (ERL: Emetteur Radio Local: An ERL is connected to the TIC interface and is powered by it (130 mW available). The ERL transmits data via radio waves to a receiving device (charging station, display, etc.), or to the cloud via the home's Wi-Fi connection. Several energy suppliers offer an ERL allowing customers to visualise their Linky data in real-time (via customer portal or apps). Various ERLs retransmitting TIC data in different communication protocols are already on the market.

Figure 2: Installing an ERL

There are two different TIC modes on a Linky meter:

- Historical mode: It transmits data equivalent to that carried by the TIC of old meters (e.g., consumption index; ongoing tariff period; warning of subscribed power exceeding) and ensures the compatibility of connected equipment when replacing a historical meter with a smart meter (e.g., historical energy manager).
- Standard mode: It transmits data from the "Historical" mode at a higher rate and in a different format, as well as additional data. It allows full utilisation of the new capabilities of the Linky meters.

Examples of additional data for Standard mode:

- consumption indexes (10 for supplier, 4 for DSO) (Wh)
- current tariff period labels
- cut-off power (kVA)
- subscribed power (kVA)
- instantaneous apparent power per phase and total (VA)
- maximum power consumed during the day and the previous day (VA)
- timestamps for the start and end of variable peak periods
- short message (32 ASCII characters)
- position of 8 relays (one physical dry contact and 7 virtual relays)

  The last 2 points of the active extracted load profile (W)

If the customer is an energy producer, with solar panel, for example, the TIC in standard mode allows access to specific information such as:

- The total active energy injected into the grid index (Wh)
- The 4 indexes measuring reactive energy (VARh)
- The instantaneous apparent power injected (VA)
- The maximum apparent power injected during the day and the previous day (VA)
- The last 2 points of the active injected load profile (W).

All available data on the TIC, as well as its technical and hardware characteristics are described in Note Enedis-NOI-CPT_54E from Enedis (available online).

Both modes, standard and historical, are compatible with all Linky meters. The request to change from historical TIC to standard TIC is a service from Enedis' catalogue offered to suppliers (F185 option 1[1]) and is therefore made at the request of the customer through their supplier. It is not billed to customers.

1.3 France: Time of Use Tariffs

In France, there are four main categories of electricity supply offers:

- "Base" (18 million residential customers[2]): a flat-rate contract, meaning the price is the same at all hours of every day. The energy consumed is recorded on index 1 of the TIC (EASF01 in standard mode, BASE in historical mode). Dry contact is always open.
- "HC/HP (Heures Creuses/Heures Pleines: low-price hours/high-price hours)" (14 million residential customers[1]): includes two tariff periods, one where the price is low, generally between noon and 2:00 pm and during the night, and one where the price is high for the remainder of the time. At least 8 hours during the day is in low price. The dry contact of the meter is open during high-price periods and closed during low-price periods. The energy consumed is recorded on indexes 1 and 2 (HCHC and HCHP in historical mode, EASF01 and EASF02 in standard mode).
- "Dynamic Peak Periods" (1 million residential customers[1]): features six different tariff periods, each with specific pricing and dry contact positions. The energy consumed is recorded on indexes 1 to 6 (BBRHCJB, BBRHPJB, BBRHCJW, BBRHPJW, BBRHCJR, BBRHPJR in historical TIC, EASF01 to EASF06 in standard TIC). During peak periods energy is very expensive.
- "Personalized contract": the choice of accounting indexes and the position of the dry contact is at the discretion of the supplier. For this offer, the TIC transmits only a very limited amount of information in historical mode; in standard mode, all data are transmitted.

[1] *See Enedis-NOI-CF_15E, available online*

[2] *As of Q1 2024, cf. Baromètre des flexibilités de consommation d'électricité, suivi du plan de passage à l'échelle des flexibilités.*

2 What is EEBUS?

EEBUS describes the communication interface that enables energy management relevant devices in buildings to connect and interact with each other and with grid and market operators. EEBUS empowers the digitalisation of the energy transition by creating a communication standard that ensures interoperability of all energy-relevant devices and systems across domains.

The main challenge is to connect independent actors with different interests and interactions at the same grid connection point. Each actor wants to influence the operation of the energy-relevant devices inside the building with different objectives (e.g. cost optimisation vs. grid stabilisation).

EEBUS defines how the devices should behave within the energy management and how the signals from the different actors should be coordinated and implemented. EEBUS thus enables easy data exchange with the corresponding control systems on the grid and energy trading side. By using EEBUS, the building owners can benefit from lower energy costs, higher comfort and security, and reduced carbon footprint. The grid and market operators can benefit from more flexibility, reliability and efficiency in managing the energy supply and demand.

EEBUS offers solutions for Device Manufacturers (Smart Meter Industry, Energy Management Providers, HVAC, EVSE, White Goods, Solar, Energy Storage Manufacturers) as well as for Grid Operators and Energy Service Providers (e.g. Aggregators, Sales Departments). EEBUS optimises local grid utilisation and ensures transparency and control at grid connection points. It facilitates market-organised flexibility and enables energy sales based on current market prices. Overall, EEBUS enhances interoperability and efficiency across the energy landscape. Furthermore, all EEBUS solutions are standardised in accordance with international standards set by CENELEC and IEC[3].

3 Linky Smart Meter and EEBUS

The smart meter Linky is at the grid connection point. The consumption and injection data of the Linky will reflect the energy imported from the grid and exported to the grid. If the customer is a self-consumption producer, the exported data will not match the total energy the PV produced. Linky data are used for billing: the customer will pay for the energy he imported from the grid measured by the Linky and will be paid for the energy he exported to the grid measured by the Linky.

The Linky, as a smart meter, is not an EEBUS actor (such as energy guard, CEM (Customer Energy Manager), monitoring appliances, grid connection point, etc.), because it does not communicate in EEBUS protocol directly. However, the data it transmits through the TIC can be convert to EEBUS protocol and is necessary for certain EEBUS use cases (see chapter 4).

[3] *EN 50631-x ED2: Household appliances network and grid connectivity*
IEC 63380-x ED1: Standard interface for connecting charging stations to local energy management systems
IEC TR 62746-2 ED2: Systems interface between customer energy management system and the power management system - Part 2: Use cases and requirements (In Progress)

Various architectures are possible:

1. An EEBUS actor (e.g. energy guard) connects via wire to the TIC, and integrates TIC data into EEBUS use cases (hence, is mapped to the protocols SPINE and SHIP). .
2. An EEBUS actor (e.g. energy guard) connects wireless to the TIC with an ERL (radio local transmitter) and integrates TIC data into EEBUS use cases (mapped to the protocols SPINE and SHIP).
3. An ERL is directly acting as EEBUS actor (e.g. energy guard), using TIC data.

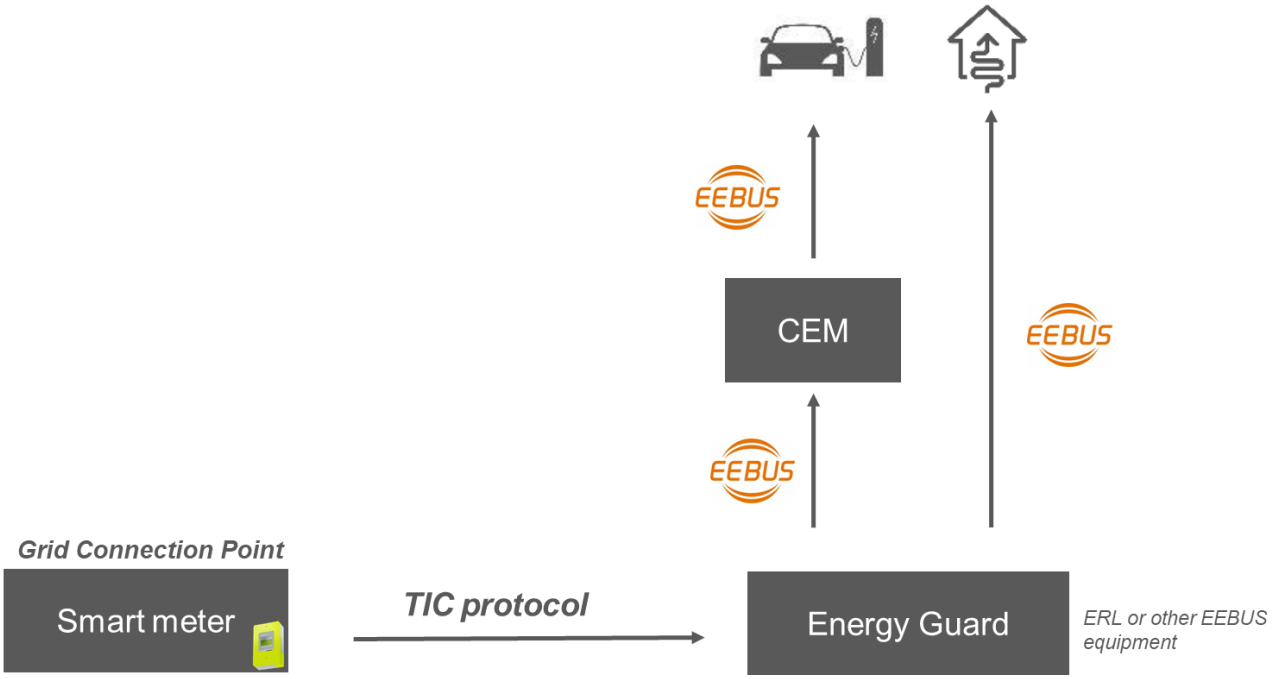


Figure 3: The different EEBUS architectures with the Linky Meter

4 Data Mapping between TIC & EEBUS for specific use cases

In this chapter, we are going to show in concrete terms how Linky meter data can add value to some EEBUS use cases.

Standard TIC mode is compatible for all the selected EEBUS use cases, while historical TIC mode is only partially compatible. That's why, a client with a Linky meter that uses EEBUS equipment should switch to standard mode (at no cost).

Category	Use Case	Scenario	How to integrate Linky Meter to the use case?	TIC Data (standard mode)
E-MOBILITY	**Overload Protection by EV Charging Current Curtailment**	**1**	In France, the smart meter ensures the client does not overpass its subscribed power. When a client buys an EVSE, it is sometimes not necessary to increase its subscribed power if he monitors the consumed energy with Linky meter and manages accordingly its EV Charging: *1.* The Energy Guard retrieves in real time data from the TIC of the Linky meter *(single phase: PCOUP, URMS1 and SINSTS; three phases: PCOUP, URMS1, URMS2, URMS3, SINSTS1, SINSTS2 and SINSTS3).* 2. The Energy Guard then curtails the charging current of the EV to ensure that no overload occurs.	***Sub-case #1: single-phase EVSE in a single-phase electrical installation:*** The energy guard computes the available current from the following TIC data: Idisp (A) = ([PCOUP]*1000 – [SINSTS])/[URMS1] *[PCOUP]: Apparent breaking capacity (kVA)* *[URMS1]: Effective voltage, phase 1 (V)* *[SINSTS]: Total extracted instantaneous app. power (VA)* ***Sub-case #2: single-phase EVSE in a three-phases electrical installation:*** Depending on the phase to which the EVSE is connected, the energy guard computes the available current from the following TIC data: Idisp (A) = ([PCOUP]*1000/3-[SINSTS1])/[URMS1] Or Idisp (A) = ([PCOUP]*1000/3-[SINSTS2])/ [URMS2] Or Idisp (A) = ([PCOUP]*1000/3-[SINSTS3])/[URMS3] *[SINSTS1/2/3]: Extracted instantaneous app. power phase 1/2/3 (VA)* *[URMS1/2/3]: Effective voltage, phase 1/2/3 (V)* ***Sub-case #3: three-phases EVSE in a three-phases electrical installation:*** The energy guard computes the available current per phase from the following TIC data: Idisp1 = ([PCOUP]*1000/3-[SINSTS1])/[URMS1 Idisp2 = ([PCOUP]*1000/3-[SINSTS2]// [URMS2] Idisp3 = ([PCOUP]*1000/3-[SINSTS3])/[URMS3] The energy guard needs to know which phase of the EVSE is connected to which phase of the electrical installation.

GRID	**Monitoring of Grid Connection Point**	**ALL**	The Actor "Grid Connection Point" represents the measured values of the physical Electricity Grid Connection Point. The measurement is typically performed by an electrical smart meter. For the French market, the measure is performed by the Linky Smart meter at the electricity grid connection point. The monitoring appliance can directly get the data from the TIC of the Linky Meter. ***Scenario 1 - Monitor PV feed-in power limitation factor*** *Information non-available from the TIC.* ***Scenario 2 - Monitor momentary power consumption/production*** The monitoring appliance gets in real time from the TIC the value of exporting/importing power. ***Scenario 3 - Monitor total feed-in energy*** The monitoring appliance gets in real time from the TIC the value of total Grid Feed-In Energy. ***Scenario 4 - Monitor total consumed energy*** The monitoring appliance gets in real time from the TIC the value of total grid consumed energy. ***Scenario 5 - Monitor momentary current consumption/production phase details*** The monitoring appliance gets from the TIC in real time the value of current. ***Scenario 6 - Monitor voltage phase details*** The monitoring appliance gets in real time from the TIC the value of voltage. ***Scenario 7 - Monitor frequency*** *Information non-available from the TIC.*	***Scenario 1 - Monitor PV feed-in power limitation factor*** n.a ***Scenario 2 - Monitor momentary power consumption/production*** Power data from the TIC are not signed (always ≥0). - If [SINSTS] = 0, the customer is exporting to the grid and the monitoring appliance gets the data [SINSTI]. - If [SINSTI] = 0, the customer is importing power from the grid and the monitoring appliance gets the data [SINSTS]. - If [SINSTS] = 0 and [SINSTI] = 0, the customer is not importing from the grid and not exporting power to the grid. *[SINSTI]: Total exported to the grid instantaneous app. power (VA)* *[SINSTS]: Total imported from the grid instantaneous app. power (VA)* *As stated in this EEBUS scenario data are not per phase but the sum of all phases.* *Active power to be approximated to apparent power (TIC of the Linky meter does not transmit instantaneous active power data).* ***Scenario 3 - Monitor total feed-in energy*** Monitoring appliance gets this data from the TIC: - [EAIT]: *total exported active energy to the grid (Wh)* ***Scenario 4 - Monitor total consumed energy*** Monitoring appliance gets this data from the TIC: - [EAST]: *total imported active energy from the grid (Wh)* ***Scenario 5 - Monitor momentary current consumption/production phase details*** Monitoring appliance gets this data from the TIC: - [IRMS1/2/3]: *Effective current, phase 1/2/3 (A)* [IRMS1/2/3] data is always positive. To determine if the installation is importing from the grid or exporting to the grid, there are two possibilities: - Refer to scenario 2. - Use the *status register* data from the TIC [STGE], which re-transcribes the meter's operating status. If the bit 9 is equal to 0, the installation is importing from the grid, if the bit 9 is equal to 1 it is exporting to the grid[4].

				Scenario 6 - Monitor voltage phase details Monitoring appliance gets voltage between phases and neutral data from the TIC: - [URMS1]: *Effective voltage, phase 1 (V)* - [URMS2]: *Effective voltage, phase 2 (V)* - [URMS3]: *Effective voltage, phase 3 (V)* *The TIC of the Linky meter does not provide voltage between phases; however, it is optional for this EEBUS use case.* ***Scenario 7 - Monitor frequency*** n.a.

Table 1: Data Mapping between TIC & EEBUS

Further EEBUS Use Cases

This white paper will be updated in the future with additional use cases that are already compatible with Linky such as Limitation of Power consumption or Optimisation of Self-Consumption.

5 Advantages for mapping Linky and EEBUS

- Linky provides data that can be used for EEBUS use cases and in a timeframe up to few seconds (depending on the configuration of the meter, e.g. producer/consumer, single-phase/ three-phases).
- Linky data are used for billing.
- Linky meter is already installed; using its data can help avoiding the cost of buying another meter.
- Linky is deployed over 37 million clients.

If you have any question about how to interface your equipment with the Linky Meter or if you want an English version of the Note Enedis-NOI-CPT_54E, please contact this email address: linky-tech-tic@enedis.fr.

For further information on EEBUS please go to https://www.eebus.org/ or contact info@eebus.org.

[4] *Please refers to Enedis-NOI-CPT_54E, if you want more details on the status register.*

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