GET MORE FLEXIBILITY: THE METERS AND MORE® SOLUTION FOR YOUR ENERGY MANAGEMENT

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Energy Flexibility: architectures and solutions in the market

Energy flexibility in homes and buildings is becoming increasingly crucial as the demand for sustainable and efficient energy solutions grows. The key goals of energy flexibility are **grid stability, cost savings** for utilities as well as for consumers, **energy efficiency** to minimize the carbon footprint.

End users are indeed set to become the center of new energy markets[1]. According to an IEA analysis, demand-response measures can reduce household electricity bills by 7% to 12% by 2050[2]. For this reason, government policies and incentives are **promoting the adoption of energy flexibility solutions**[3].

Key energy flexibility architectures

- **Decentralized** Energy Systems
  - **Microgrids**: operate independently or in coordination to enhance reliability and flexibility
  - **Virtual Power Plants**: aggregate resources to optimize generation and consumption
- **Centralized** Energy Systems
  - **Smart Grids**: digital communication technology to detect and react to local changes
  - **Demand Response**: demand modulation triggered by grid conditions or economic incentives

Protocol Solutions

Digital technologies are essential tools to engage customers, offering real-time data and control over their energy consumption, while **allowing a more conscious and efficient use of available resources.** Several application protocols are aimed at creating an interactive system: some are more focused on the grid side; others are specific for home and building automation. There is, however, a lack of integration between the grid and the customer sides of the energy system; the same integration issue is there when trying to interconnect appliances inside the customer premises. **Standardized** connectivity solutions that are **simple, reliable** and **cost-effective** can actually give a boost to such integration and enable higher energy flexibility. The key requirements for such solutions are:

- **interoperability** between systems to achieve effective interaction with networks, energy management systems or directly with different equipment[4], which requires **open standard communication protocols**[5];
- **simplicity**: for the end user acceptance of flexibility solutions, it is essential that the devices are **easy to install and use**, able to ensure **multiple functions** at the same time and with reduced interactions through **automatic controls**;
- **scalability** at system level: aggregating energy data and flexibility services to create a "critical mass", for instance through energy communities.

Standardization bodies, regulators and industrial alliances are all working in the direction of enabling flexibility through interoperable, simple and scalable solutions.

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Evolution of the Meters and More® protocol: from Chain 1 to Chain 2

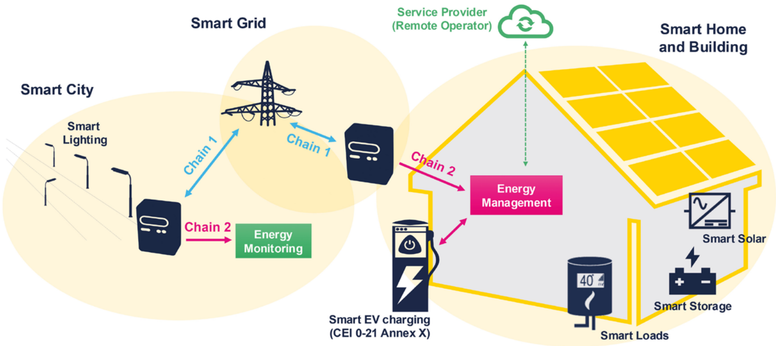


Figure 1. Connectivity solutions for energy flexibility - Power Line Communication as key enabled

Smart meters, at the forefront of digitalization, are one of the most important system components to manage the exchange of energy and data between distribution system operators and end users. The first automated meter reading solutions were based on power line communication **(PLC)** – a well-established, field-proven technology converting the energy network into a **cost-effective communication infrastructure** with inherent high security and data confidentiality. Such technology has been referred to as **Chain 1** i.e. the connectivity link between the DSO and the smart meter. Aiming now at higher end-user awareness and stronger connection between the end user and the DSO, a simple, low-cost, standard connectivity solution is still essential. **Real-time digital access to the energy data**, such as energy consumption and generation, instantaneous power, and tariff information, has been achieved in Italy through a natural extension of the usage of PLC to a solution called **Chain 2**, i.e. the connectivity link between the smart meter and the end user. The second generation of smart meters, already massively deployed in Italy, is designed to enable both Chain 1 and Chain 2 through PLC. The Chain 2 technology, based on the Meters and More® PLC protocol and on DLMS/COSEM application and data model, has been specified by **CEI**[6] as a suite of Technical Specifications, as illustrated in the following diagram, to address a number of energy awareness and flexibility use cases.

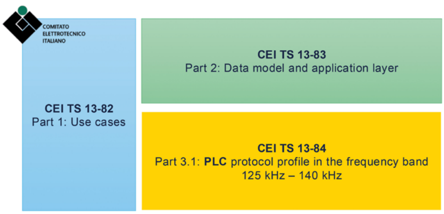


Figure 2. Chain 2 - Technical specification suite ***"Electrical energy measurement systems - Communication with user devices"***

Extending Chain 2 to Chain2Net Profile

The natural extension of Chain 2 is the creation of a peer-to-peer network for distributed energy management. The Meters and More **Chain2Net Profile** coexists side by side with the Chain 2 unidirectional profile, enabling PLC peer-to-peer network capabilities for real time energy management use cases. It has been conceived for lightweight, application layer agnostic implementation. Unicast, multicast and broadcast connections are enabled to give the maximum flexibility to the application.

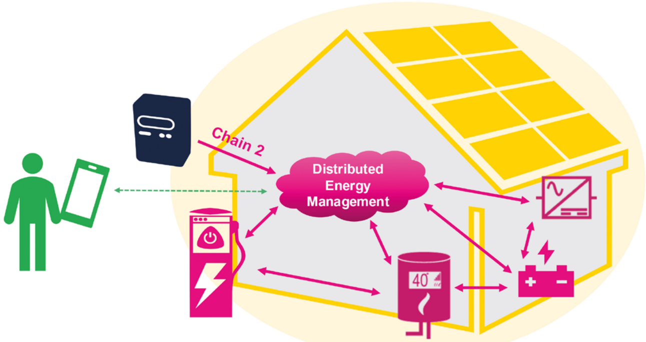


Figure 3. ***Chain2Net Profile*** *enabling interconnected devices for real-time Distributed Energy Management*

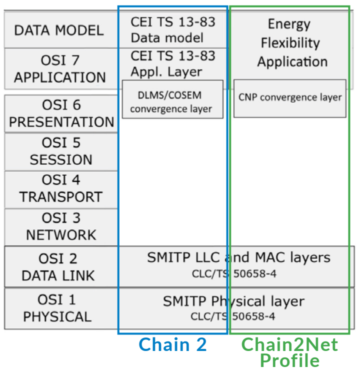


Figure 4. Meters and More protocol - ***Chain 2*** *and* ***Chain2Net Profile*** *profiles*

The WP3 of the Meters and More association is actively working on the **Chain2Net Profile** specifications, fully harmonized with the complete, field-proven Meters and More stack and Chain 2 applications.

The use cases for **Chain2Net Profile** identified by Meters and More association emphasize its versatility, efficiency, and applicability across a wide range of energy management scenarios.

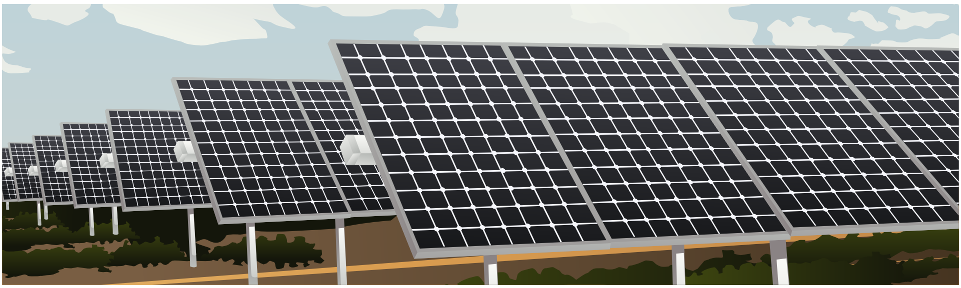
Chain2Net Profile use case examples

1. **Self-consumption**: Automated optimization of locally produced energy from photovoltaics and self-consumed by household devices. It enables the user to minimize their energy costs by maximizing the consumption of energy produced by their own PV system.
2. **Peak management**: Automated management of power peaks to avoid unpleasant power blackout and reduce peak power related electricity bill costs.
3. **ToU (Time of use tariff)**: Automated optimization of energy consumption based on electricity prices to minimize energy costs. It enables consumption to be conveniently activated during the off-peak tariff times, minimizing usage during peak tariff times.

Such energy management use cases are particularly relevant for **Renewable Energy Communities (REC)**, where devices can be managed by a remote operator for optimization of energy flows within the REC. Peer-to-peer network enabled by **Chain2Net Profile** allows device to exchange their energy related real-time data, such as instantaneous power consumption/generation, energy profile, rated power/capacity, state of operation/state of charge, and so on. Devices can be controlled via **Chain2Net Profile** by **switching on/off** non-modulable controllable devices or modulating power consumption of modulable controllable devices (increase or decrease). All use cases are subject to the constraint to satisfy the **end user's needs**, such as the request for thermal comfort from a heat pump or the need to have the vehicle sufficiently charged by a certain time. Existing or specific user interfaces, such as smartphone app or smart thermostats, can be used to provide related energy usage configurations, that can be exchanged locally between devices via the **Chain2Net Profile**.

What's next

More use cases, including industrial applications such as photovoltaic fields, can benefit from the usage of a simple, reliable and cost-effective power line communication protocol. The WP3 of the Meters and More association is also actively working to explore additional use cases to improve sustainability through energy management for higher efficiency.



References

[1] Clean energy for all Europeans package:
https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en

[2] IEA (2023), World Energy Outlook 2023, https://www.iea.org/reports/world-energy-outlook-2023

[3] See for instance the current focus on flexibility in the EU as reflected in the Code of Conduct for Energy Smart Appliances, or the amendments to the Regulations (EU) 2019/942 and (EU) 2019/943 and Directives (EU) 2018/2001 and (EU) 2019/944 to improve the electricity market design

[4] Reidenbach, B. et al. (2022), "Towards net-zero: Interoperability of technologies to transform the energy system", OECD Going Digital Toolkit Notes, No. 24, OECD Publishing, Paris, https://goingdigital.oecd.org/data/notes/No24_ToolkitNote_InteroperabilityEnergy.pdf

[5] https://www.iea.org/energy-system/decarbonisation-enablers/digitalisation

[6] Comitato Elettrotecnico Italiano www.ceinorme.it

Are you willing to enhance the energy management of your products, minimizing the cost through a real-time, connected and flexible solution?

Stakeholders in smart devices and energy smart appliances are especially welcome to join us!

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