ESMIG Position paper

Interoperability for Demand Side Flexibility
29 February 2016

How to achieve interoperability for demand side flexibility

Summary

Interoperability is key in achieving a successful transition to a new, flexible European energy system. For implementing demand side flexibility, we need an integrated approach of selecting standards and defining functionalities for the data exchanges. All the steps for designing and implementing the data communication interfaces in the demand side flexibility architecture are described in this paper and should be strictly followed in order to create an open market for consumer focused energy services and products.

1. The energy supply system is undergoing a fundamental change

In the past, the energy system was designed around large, central, controllable generation units. The transition to sustainable energy sources introduces more dynamic and distributed feeding of energy into the system.

The current European energy system and the energy market are not designed to facilitate more flexibility in demand to cope with the dynamics in generation. The energy transition is still hindered by the current market design, regulated energy prices, administrative burdens combined with proprietary ICT infrastructures. Therefore, it cannot keep up with the increased production of renewables across Europe and prevents EU citizens from benefiting from the new smart technologies.

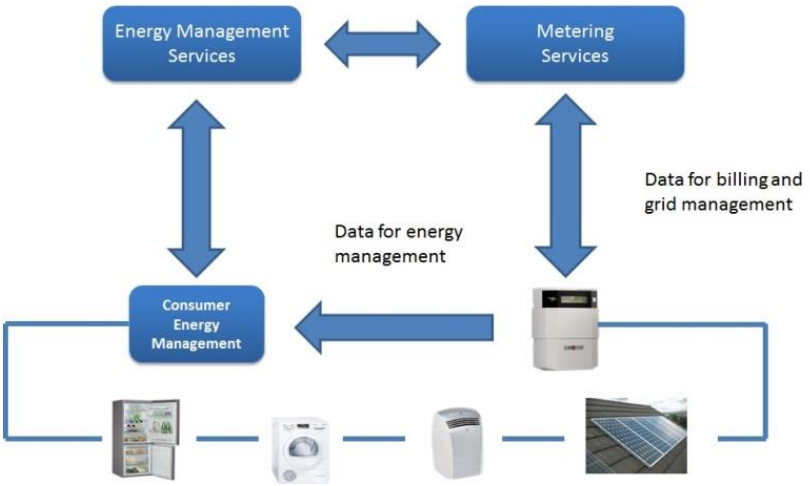
Consumers can play an active role with self-generation and pro-actively managing their demand according to their needs and the opportunities the system provides. Creating more flexibility in demand can reduce the investment required in the energy networks but in turn increases the complexity of the system operation.

At ESMIG, we believe smart meters are one of the cornerstones for the energy grid of the future. To enable demand side flexibility, the smart metering infrastructure must be extended with additional technology that offers energy service companies (ESCO's) the opportunity to implement aggregated energy management services to connected consumers and other players on the energy market.

In this extended infrastructure, interoperability is a pre-requisite for an open and multi-vendor environment. Consumers and service companies must be able to choose and connect their equipment without necessary adaptations to proprietary solutions.

2. Demand Side Flexibility Infrastructure

This diagram below, we call the "ESMIG square", shows the combination of the regulated and commercial channels to the consumer site. These (vertical) channels are logical channels that can be implemented in separate or combined physical channels.



ESMIG developed similar diagrams, with more details regarding infrastructure components and interfaces for the European standardisation organisations in order to identify the interfaces where interoperability is important.

The smart meter provides data for billing and grid management that is exchanged through a regulated channel. It also produces data for in-home energy management. A consumer energy management system controls demand and generation in order to achieve economic benefits within the limits that the energy grid allows. The consumer controls the use of data for economic energy management purposes. Commercial data needed for or generated by this energy management process can be exchanged through the regulated channel or a separate commercial channel.

For all these information exchanges standards, additional specifications and alignment of data models are needed in order to reach interoperability. Various organisations (IEC, CEN/CENELEC, ETSI, oneM2M) are working on standards for different interfaces but in a quite isolated way.

ESMIG calls for an integrated approach of standardisation for the data exchanges needed to implement demand side flexibility by European and International standardisation organisations. Proposals for this approach are defined by ESMIG in the Smart Grid Task Force of the European Commission.

3. Interoperability

First of all it is important to understand what exactly interoperability means.

The Smart Energy Grid Coordination Group (that executed the M490 mandate of the Commission to work on interoperability for smart grids) defined interoperability as:

"*The ability of two or more networks, systems, devices, applications, or components to interwork, to exchange and use information in order to perform required functions*".

In order to make this possible, several steps should be taken, such as: the definition of functionalities, the selection of official (de-jure) open standards, and additional definition of profiles and finally (conformance and interoperability) testing of the implementation.

Interoperability can generally exist on different layers of a system:

- Physical layer which is the hardware to connect systems or devices such as coax or power cables
- Communication layer which describes the communication technology (e.g. PLC or Ethernet) and communication protocol for transmission of data.
- Information layer detailing the data model to ensure that devices are speaking the "same language"
- Functional layer specifying the functions and related interactions to be implemented

(a) Definition of functionalities

Full interoperability can only exist if all layers are interoperable. The process of reaching interoperability therefore starts with the last bullet: defining the functionality of information exchange. In other words: what data will be exchanged and how. The development of Use Cases is a good practice to define the functionalities. These Use Cases describe the information exchange in steps of transactions between components of the metering system.

The Smart Meter Coordination Group (SM-CG) has defined a common set of Smart Metering Use Cases as a part of its work under the M441 mandate.

(b) Standards and specification selection

Based on the functional analysis and use case creation, the architecture showing the interfaces between components of the smart metering system is the basis for the selection of the appropriate standard(s) and specification(s). The Smart Meters Coordination Group developed a reference architecture specifically for smart metering.

Standards are available that cover the physical layer, communication layer and information layer mentioned above. Generally these standards are specified in separate documents belonging to a suite of standards. The Smart Meters Coordination Group has defined an overview of standards that can be used for smart metering infrastructure. The Smart Energy Grid Coordination created a similar overview for the wider scope of smart grids.

(c) Profiling based on standards and specifications as identified above

An interoperability profile is a document that describes how standards or specifications are deployed to support the requirements of a particular application or function. This means that on top of the selection of a communication standard (selected in step b) an additional specification has to be developed. In general, standards cover a broad spectrum of functionalities that not all have to be implemented. Furthermore they contain options that have to be further detailed. This implies that, additional definitions will have to be made that describe the way a standard will be used, and fixes the options. These additional definitions are called "interoperability profiles".

(d) Testing

Testing is one of the most important phases to reach interoperability. Although many other types of tests exist, the two main types of testing to demonstrate interoperability are conformance testing and interoperability testing.

An important condition in achieving interoperability is the correct implementation of the standards and specifications. This can be verified by conformance testing: the concerning system/component is tested against, a test tool or reference implementation of the standard. Conformance testing is also a prerequisite for interoperability testing. This test also verifies what part of the standard is implemented if it is not a full scope implementation.

Interoperability testing should be performed to verify that devices within a system are interoperable, i.e. they are able to exchange information according to the defined functionalities (Use Cases). During interoperability testing, devices are tested together with other components of the total architecture known to be correct. It is significantly different from conformance testing because it is possible for two devices that individually comply to a standard (resulting is a positive conformance test) to be still unable to interoperate. This situation can arise for example when devices have implemented different or conflicting options or cover a different part of the standard(s).

ESMIG calls on the member states to strive for maximum interoperability in the demand side flexibility architecture by following the necessary steps for designing and implementing the data communication interfaces. ESMIG can support this process by sharing expertise, examples and best practices that we have developed or are known to us.

About ESMIG

ESMIG is the European voice of the providers of smart energy solutions. Our members provide products, information technology and services for multi-commodity metering, display and management of energy consumption and production at consumer premises.

Our activities are focused around systems for smart metering, consumer energy management and safe and secure data transfer.

We work closely with EU policy makers and other EU associations to make Europe's energy and water systems cleaner, reliable, more efficient and the European consumer informed, empowered and engaged.