

# Smart Gas Meters & Middleware for Energy Efficient Embedded Services

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Kuala Lumpur



Patron



Host

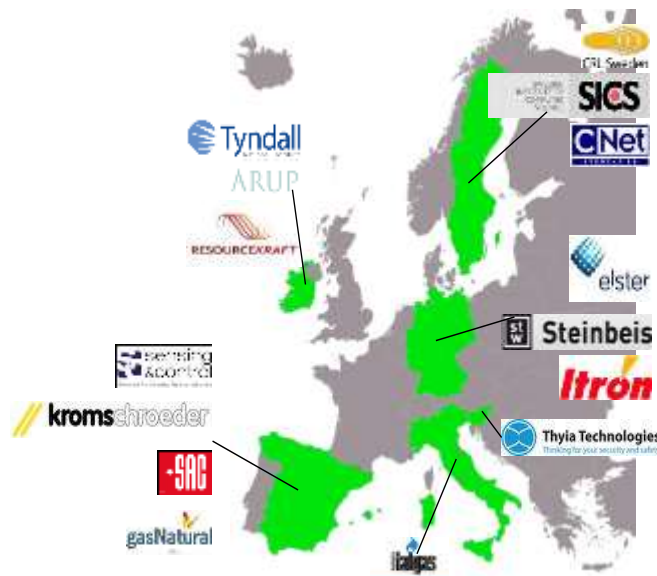


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ME<sup>3</sup>Gas is a three-year project, co-funded by the European Commission (through ARTEMIS JU) and the National Governments of the countries of the participants, aimed at:

- developing a new generation of smart gas meters based on embedded electronics, communications and the remote management of a shut-off valve;
- developing an energy-aware middleware platform.



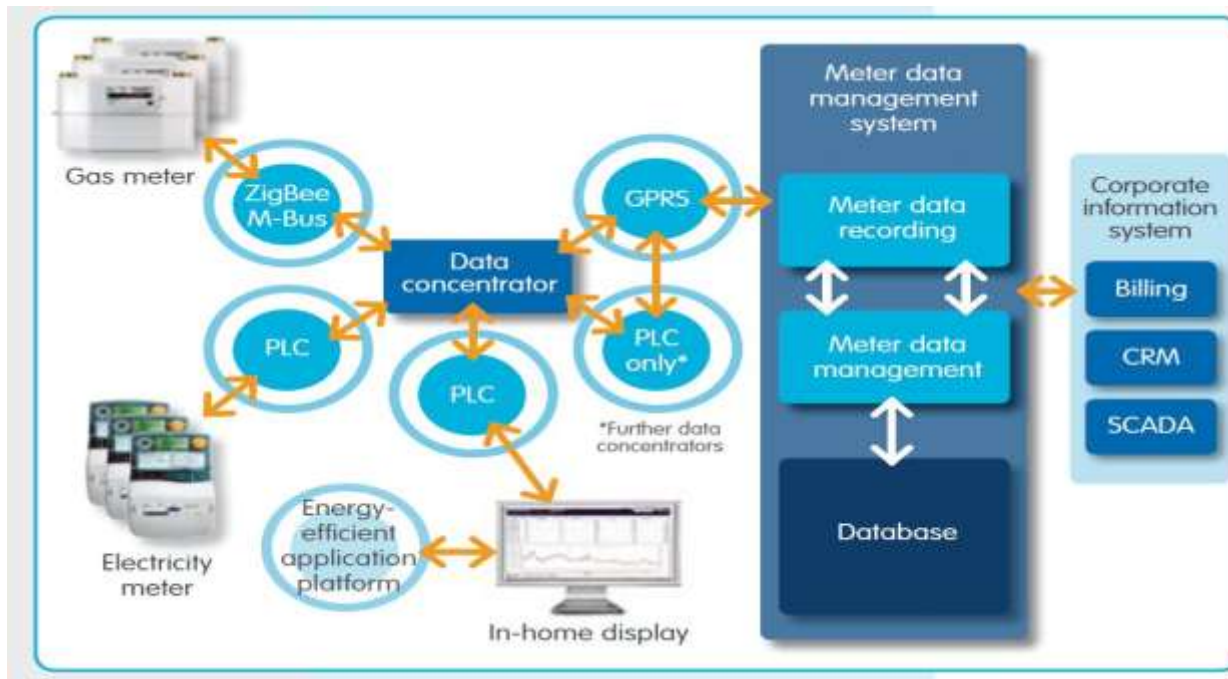
## Partner classification

- **Industry/Services:** Sensing and Control, Kromschroeder, Itron, Elster, Sistemas Avanzados de Control and Thyia Tehnologije.
- **Software developers:** Cnet, ResourceKraft and Communications Reseach Labs.
- **Technology research:** Tyndall National Institute, Arup, Steinbeiss and Swedish institute of Computer Science.
- **End user:** GasNatural and Italgas.  
Telefónica Soluciones

# Project ME<sup>3</sup>Gas

The desired results of the ME<sup>3</sup>Gas project consist in the specification, development, validation and the roll-out of a Smart Gas Metering System. This will be responsible for a managing & controlling the “smart” meters, allowing for remote meter reading and new functions such as:

- viewing the actual consumption, remote disconnection of the gas supply
- detecting malfunctions, alarms, tariff systems



# The Regulatory Context in Europe



The European Union is promoting and regulating the adoption of energy efficient systems. The key Directive is the 2006/32/EC on the energy end-use efficiency and energy service

At the same time, the European Union has been pushing for the deployment of smart metering also for gas, to provide accurate information to the customers in order to make them aware of their energy consumption.

However there is a lack of standards that is slowing the deployment of smart metering systems. EU is investing important efforts to this aim through Mandate 441 of 12 March 2009, the goal of which is the creation of a European standard to enable interoperability of utility meters (water, gas, electricity and heating).

The development of such standard is asked to the European Standardization Organizations: CEN, CENELEC and ETSI.

## The Regulatory Context in Italy

In ME<sup>3</sup>gas project, Italy was given a major emphasis because this is the country where the National Regulator (Authority for Electricity and Gas) already issued quite precise requirements and defined a time schedule for the implementation of smart metering in the gas industry. As a matter of fact, in year 2008 they issued Resolution ARG/gas 155/08, that applies to all consumers connected to gas distribution networks.

It provides a minimum set of functional requirements that all the new gas meters will have to fulfil. It also defines a roadmap to implement such functional requirements.

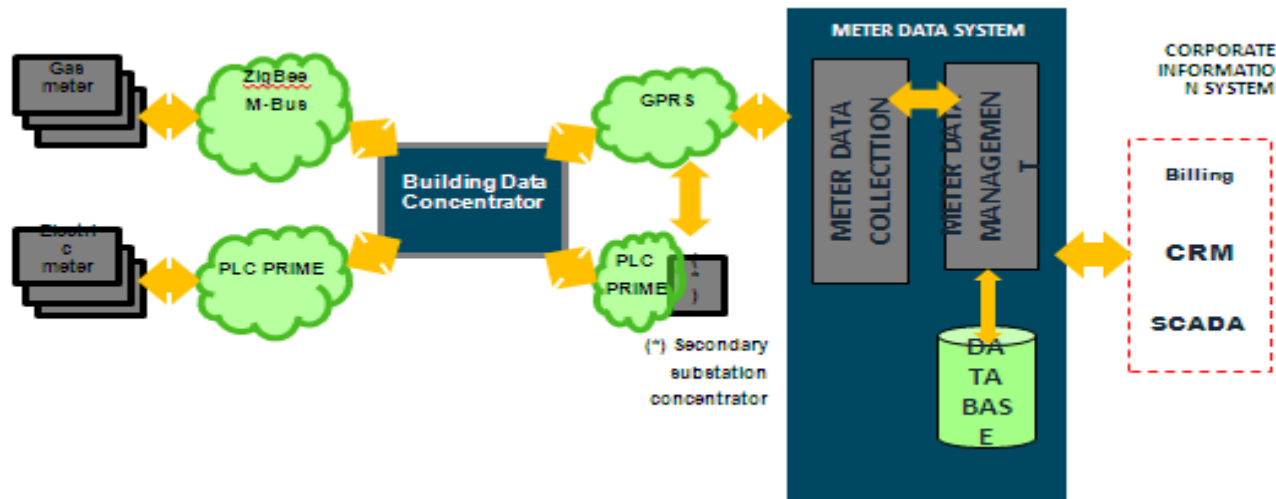
The resolution is integrated and completed by the technical specifications listed in UNI/TS 11291 series, which establish the minimum requirements and performance of all aspects of the smart metering system and network (device requirements, communication protocol, central data centre structure, data security).

# Approach for Smart Meter

The development of a new generation of smart gas meters and the design and specification of an overall smart gas metering system are ME<sup>3</sup>gas objectives.

The system developed includes:

- the smart gas meter and an associated communication network;
- the local consumer display to give information to the end users about their gas (and electricity) consumptions;
- the data concentrator, which would also be able to communicate with a back-end system through a Wide Area Network (WAN).



## Approach for Middleware (1/2)

One of the main objectives of the project has been the development of an energy-aware middleware platform, making it possible to network heterogeneous physical devices into a service-oriented architecture.

The goals that have been set for the middleware platform are:

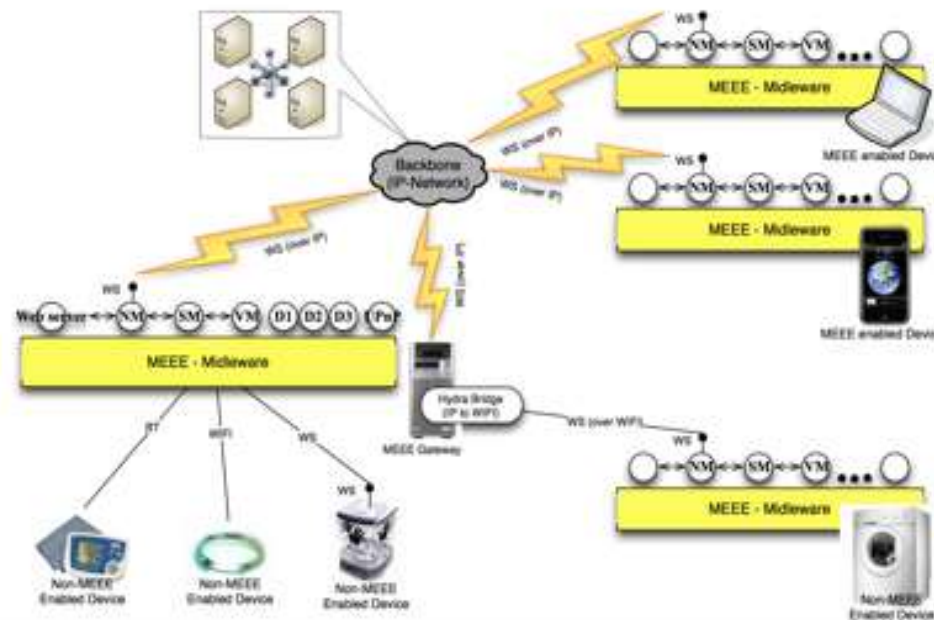
- monitoring energy consumption at home;
- user-driven planning and controlling of devices while optimising energy consumption;
- connecting user behaviour/external information sources with energy consumption;
- combining different energy sources and profiles to achieve user defined goals;
- learning and sharing energy consumption patterns.

An innovative feature of ME<sup>3</sup>Gas is a P2P architecture that provides means for devices in different local networks to communicate and access each other without compromising security and privacy.



## Approach for Middleware (2/2)

One main feature of the middleware platform is that it can handle many different physical devices and communication protocols and automatically create a web service for a device. This provides application developers with an easy-to-use high level interface for integrating and using devices and home appliances in their applications, such as home automation and personal health monitoring. The figure below shows its basic architecture:





# The ME<sup>3</sup>Gas Smart Meter (1/3 )

- The main task in this project is the development of a new generation of smart gas meters, based on embedded electronics, communications and the remote management of a shut-off valve, to offer a whole range of added values:
  - management of multiple tariffs and payment modalities
  - remote gas cut off (shut-off valve)
  - security alarms
  - absolute index
  - temperature compensation, etc.
  
- Both manufactures (Elster & Itron) have committed to deliver a complete smart gas meter. The requirements are defined in a way to ensure same functionality and interoperability on the one hand and ensuring implementation freedom to allow innovation on the other hand. Where appropriate implementation proposals are given, but also other implementations are acceptable as long as key requirements are met.
  
- The ME<sup>3</sup>Gas project aims to achieve a rationalization and an optimization of the energy consumption in households and commercial building without compromising comfort or convenience.

# The ME<sup>3</sup>Gas Smart Meter (2/3 )

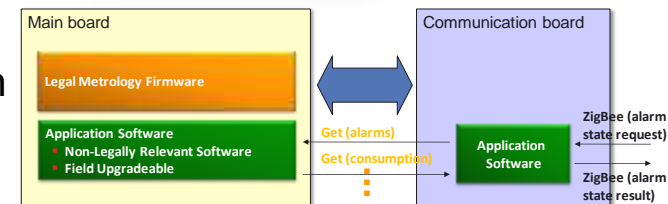
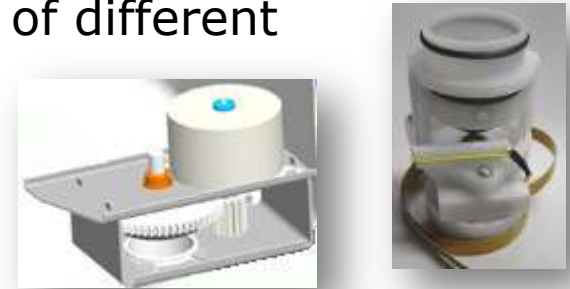
## ▪ **Smart Valve & meter communication solution led by Itron**

The aim of the “Smart Valve” activity is to make the development of a “smart” valve and its control/command circuit for the new smart gas meters.

The “Communication Solution” activity aims to develop the communication solution for the new gas smart meters with a completely modular design allowing adoption of different communication solutions.

### The main objectives of the workpackage are:

- Specify and develop a “smart” valve and its control / command circuit for the new smart gas meters
- Valve integration in meter casing and integration with electronic Index
- Technology assessment of available communication solutions
- Specification, development and test of suitable communication solutions for the market
- Integration with the data concentrator
- Component validation
- Lab testing and approvals



# The ME<sup>3</sup>Gas Smart Meter (3/3 )

## ▪ **Electronic Index, Meter Integration & Validation led by Elster**

The electronic index pursues the development of the embedded electronics, hardware and firmware to meet all functionalities to be provided by the new generation of smart gas meters.

The main objectives of the Electronic Index are:

- Define basic requirements for the new generation of "smart" gas meter
- Describe the architecture for a new generation of Electronic Index
- Development of an Electronic Index for Diaphragm Gas Meter
- Integration of several smart meter components, like the shut-off valve
- Define a state of the art security model to thoroughly protect sensible data against unintended exposure and manipulation
- Meter System Validation
- Lab testing and metrology approvals



## Pilot Tests on Middleware (1/2)

A middleware pilot was developed and deployed in Crossleigh house, a two storey building in Cork, Ireland, used as an office building by the University College Cork.

The objective of the first stage of the Cork Pilot was to successfully integrate a multi-service and multi-device environment in a real environment and start to test the energy services.

Later the pilot further developed, updating the nodes of the sensor network to a newer more capable platform, and provided the middleware with exterior data. The installation in Crossleigh also incorporated a data concentrator in order to exhibit the convergence of gas technologies into the middleware platform.



## Pilot Tests on Middleware (2/2)

The second part of the pilot initiates a migration of the technologies developed for the Crossleigh house into a domestic environment. This part targets a prototype pilot, in order to be able to experiment with a more advanced logic. The prototype pilot will target the combined production of hot water and heating and, more specifically, their control over time. It will build upon results from successful deployment of smart electricity grids for deciding when to start producing hot water, conducting a number of experiments seeking to reduce the CO<sub>2</sub> footprint and to attain energy savings as compared to present logic.



## Pilot Tests on Smart Meters

Field tests are planned in order to make the validation of the features and the reliability of the smart gas meters and of the associated system infrastructure under real operation conditions.

Field tests that are currently being developed have been designed in order to be statistically representative, covering different user types (residential and commercial), and different deployment areas (high and low density).

The selected roll-out site is Italy since it is one of the current countries with a regulated deployment requirement.

Field trial experiences and results will be evaluated in order to get conclusions with a view to deploying smart meters in different countries, building business cases and giving recommendations for improving present smart meter design for the next generation (pre-series) mass production.

# Conclusions

At the present stage of project ME<sup>3</sup>Gas, the following points have emerged:

- Integration of power line and wireless communications for reading both smart gas and electricity meters using the same Building Data Concentrator has been demonstrated a good approach and it opens the possibility to provide energy consumption to Home Area Network applications & services.
- Modular design of smart gas meter allows to easily adapt to the evolution of technology, user requirements and standarization mandate in Europe, basically for communications protocols, battery durability or new functionalities that might appear in the future.
- Middleware platform plays a very important role to guarantee interoperability between different products and applications in a home environment and to make easy investment return through the involvement and synergies with ESCOs & TELCOs.
- Main challenge of this project has been to mix technologies and partners of Smart Metering & Home Area Network that are traditionally two independent worlds promoted by energy market deregulation.



Thank you for your attention!