Smart Optimization of Pricing of Energy Consumption - SOPEC

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Description:

Main Idea:

The realization of that proposal should result in the development and implementation of smart sensor systems (hardware as well as software) to support the online decision of best prices for electricity consumption (some kind of “smart pricing”). Such kind of decision seems to get more meaningful in next years, because prices for energy consumption will permanent grow up and people will look for most appropriate conditions. The sensor system should monitor the energy consumption in real time, analyze actual offers and than propose optimal deliverers. The system therefore include measuring components (sensors), smart data- and knowledge bases together with algorithms for decision of optimal conditions as well as M2M communication.

This topic covers ENREGY.2012.7.1.2. as well as ENERGY.2012.7.1.3. and could integrate activities of different partners, such as universities, Innovation Centers, and enterprises.

We suppose, that an ICT component is the best choice for us and we could include some development in the field of M2M communication for supervisory control and data acquisition in real time and off-line data exchange for operational planning and business purposes (e.g. defense plans, power flow estimation, protection coordination and so on). The problem is related to medium and low voltage distribution networks, that means probably households and, may be, small and medium enterprises.

Aims of proposal:

Although there exist a lot of research and development, available solutions (if there are such solutions) stand apart from any regular ICT environment and may therefore cause serious problems. As Robin Duke-Wooley from Beecham Research stated, “the need of a middleware layer in the M2M market is vital for the continued rapid development of the market and for the emergence of a truly useful Internet of Things”. So in Europe over $8.1 billion will be awarded in smart meter contracts by 2015.

For communication wireless communication or the energy distribution network should be used first, but there could be alternative variants. Communication should be automatically, so the optimal price is "delivered" to consumer. For convenience a WEB-interface should be available to determine and/or refine manually some choices and so “teach” the system. The prices will be detected based on smart metering equipment in household devices. So an advanced metering structure should be developed and implemented in a network of connected devices. In such case some forecasting mechanisms could be defined as well as knowledge bases, but that seems not crucial at the first step. In general the project might follow the ZigBee philosophy.
Technical architecture:

From technical point of view we are concerned with a kind of M2M architecture. There are different M2M architectures, e.g. one is based on the ETSI standards:

Also users can refer to a technical paper “Applications of ITU-T G.9960, ITU-T G.9961 transceivers for Smart Grid applications: Advanced metering infrastructure, energy management in the home and electric vehicles” for possible technical components, e.g. receivers.

This technical paper describes typical network architectures, parameters, and implementation issues regarding Smart Grid (SG) applications that use G.9960/G.9961 transceivers (called here “G.9960 transceivers”). The main Smart Grid applications in which these transceivers are used are Advanced Metering Infrastructure (AMI), plug-in electrical vehicles (PEV), and various home energy management applications. G.9960/G.9961 devices are designed to be extremely flexible, capable of operating over different types of media, using different bandplans (frequency ranges), and different sets of PHY and MAC parameters. Each of these applications has a number of specifics that require corresponding settings (configuration options) to be used. Additionally, implementations themselves must consider various aspects of the applications, which are described in detail in this document.

Other possible technical solutions will be analysed during the second step of proposal preparation.

Metering components:

One of the main aspects are metering processes. In perspective M2M solutions meters become smart meters with possibilities to enable two-way communication, real-time data collection, power quality monitoring, and, of course, report statistics and possible recommendations. In this context, smart meters will enable future energy management services. So every customer
will be able to control the energy consumption and to cut the energy use. In the framework of this proposal we assume, that smart meters are available.

Using smart meters we need an appropriate smart grid infrastructure. One of the main part of such infrastructure is a system allowing automatic energy billing, so that energy suppliers are able to offer dynamic and flexible tariffs and so support energy saving as well as attract customers.

**Smart pricing:**

Especially the inclusion of renewable energy sources, which are highly volatile, demand dynamically adjusting of tariffs.

Flexible tariff philosophy allows to offer different kinds of pricing schemes, such as pre-paid, critical-peak or time-of-use pricing. One aim of the proposal is to define the optimum pricing scheme for customers and develop a set of tools for energy retailers to help them improve their pricing strategy.

In their book “Smart Pricing” the authors Raju and Zhang stated that, although much firms successful use pricing strategies, their responsible managers do not think systematically about those pricing strategies. That’s because pricing is a very risky decision. The outcome of such decision must be very immediate and may be or good or bad. Of course bad pricing decisions are very dangerous and a manager should try to avoid them. Another fact is, that for a good pricing one have to consider a lot of stuff and even if you know that, there is a big uncertainty how the price will influence the customers. So is one of important questions the right (or appropriate) choice of pricing model. Our proposal should help decision makers in this field, offering appropriate information for qualified decisions.

**Possibilities for handling by customers/users:**

Of course all propositions should be easy to use, easy to understand and should result in significant benefits for customers.

Analysing perspectives of social development we have to take into account, that in most of european countries a significant part of people will be older than 60+. These people probably are not very confirm with new ITC components. Therefore we should offer results of smart pricing in an intuitive and understandable way. So we should prepare necessary information in different languages as well in an acceptable visual form. Additionally we should guarantee a simple handling of components of our system.

**Consideration of forecasting:**

Qualified optimisation should include foresight possibilities. So should be taken into account wheather forecasts, forecasts of peak demands (e.g. depending on TV- or other events, and so on).

Forecasting or foresighting are usually not used in metering or pricing processes. To forecast behaviour you need appropriate information, mostly collected in data or knowledge bases. But if we are able to collect and analyse these data in a real time scheme, so the results could be a base for qualified price calculation. Therefore we propose the development of data and knowledge bases acting behind the pricing system and guaranteeing an actual optimisation.
We expect that, once consumers are able to receive optimal information, they may change their usage behaviour. Energy retailers, on the other hand, must offer attractive tariffs and services to attract more customers. So they should be indeed interested in qualified price optimisation systems.

Following Doug Zone, Chief Technology Officer at MetraTech Corp., for the customer control (especially while interacting with dynamic prices) is one of the cornerstones of smart billing. Of course there should be added more utilities, services and options, such as transparency (customer probably want to see exactly, how, when and for what he has to pay), real-time information (so customer me react, and, if necessary, switch to another retailer), and two-sided information (supplier and customer may interchange). The last option may become dominant as the renewable energy market evolves.

Modules:

The proposed project may be splitted into different parts (modules), which can be handled in separate manner. So we could start with the development of the hardware system based on available sensors to monitor energy consumption in households and small networks of devices (like SME). Another separate part is the development of analyzing tools for decision of a price optimum.