

MONITORING, COUNTING AND TARIFFING BY INTERNET

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INTRODUCTION

Rising competition gives the utilities an opportunity to increase customer satisfaction and become more flexible and transparent. This paper presents a data collection and Information System that takes advantage of the Internet features to serve the utilities as well as their customer better. The outstanding resulting price/value ratio makes a considerable deployment possible.

NEW TECHNICS ARE REQUIRED TO FACE THE ONGOING EVOLUTION WITHIN THE DIFFERENT ENERGY MARKETPLACES

Customer orientation

The liberalisation of the markets of electricity, gas and other energy requires new skills and techniques from the utilities. In order to understand and anticipate the needs of their customer better, the utilities have to collect much more accurate information about the actual behaviour of their customers. To increase customer satisfaction, and therefore reduce the churn, they must offer attractive delivery and other services that have to be very flexible, which means fully customisable.

Transparency is required

As the diversity, the number and the complexity of the contracts grow, the customer is getting more mature and asks for more transparency, which means more information. Real time information should enable him to adapt and optimise his consumption in order to reduce the costs of energy according to his specific delivery contract.



Fig.1 More transparency is required

Accurate online measurement, aggregation over several sites, easy local and remote access for visualisation: these are the services that the consumer is asking for. Studies shows that load shedding capability and permanent real time monitoring **at the customer premises** are features that the SME's fundamentally desire.

A new challenge for the utilities

Acquisition, transmission and computation of meters are basically very well known techniques. Today each interconnection, transformation or injection point of the high-tension grid is measured and monitored. But through the opening up of the market, the definition of the eligibility and therefore the number of customers is exploding. For each customer within the old and new segments: factories, hospitals, hotels, malls but also more recently, SME's, building-owners and some residential customers, the utilities have to provide an adequate measuring, monitoring and billing system. But the cost of investment, operation and maintenance of such a System must be in relation to the quantity of energy delivered, that is to say less expensive for each new eligible category: from the large industry to finally the individual residential customer.

High requirements at low cost

The requirements for such a system are:

- Accurate measurement
- Short and synchronised cycles
- Online monitoring
- Quick and easy implementation of the equipment
- Transparency, support detailed billing
- Remote access, multi site configuration
- Easy to use man machine Interface
- System scalable with very low entry cost

Consequently, the question which arises is: how to stay profitable in a competitive market place while increasing the value of the services delivered to the final customer? All of those who were confronted with the evaluation of such a system some months ago will agree that they could not show any reasonable business case at that time.

Recent developments, which take advantage of the latest technology and **free software**, have dramatically changed the circumstances so that it is now time to reconsider the situation. The hereafter discussed System is in operation today and has been tested and validated by utilities and their customers in various environments!

BASED ON OPEN AND WIDESPREAD TECHNOLOGY, THE SYSTEM IS DESIGNED TO FIT ACTUAL AND FUTURE REQUIREMENTS

Overall concept of the presented System

The pulse delivered by any standard interface of energy meters are easily collected, conditioned, processed and memorised to built-in real time the flow of energy and the actual power delivered at this location.

The powerful build-in processor associated with a generously dimensioned memory running open standard software allows basic computation as well as sophisticated and future user defined local treatment.

The recording unit is then simply connected to an existing Local Area Network, using standard IP-Protocol. This guarantees a low cost implementation as well as access to the WEB and the huge range of free Internet software for secured transmission, authorisation and visualisation.

Sharing the network infrastructure provides better use of the bandwidth and therefore reduces the operating costs considerably.

Furthermore the use of the Internet technology and its open standards makes this System compatible and upgradable with every imaginable new computing or telecommunication device and therefore contributes to secure the investments.

These are basically the reasons why the discussed System can match the requirements at a very attractive price.

Technical highlights

Designed to interface up to 16 counters the recording unit may be used in various configurations: from a complex high voltage injection with active, reactive and auxiliary measurements to a residential building with several individual apartments.

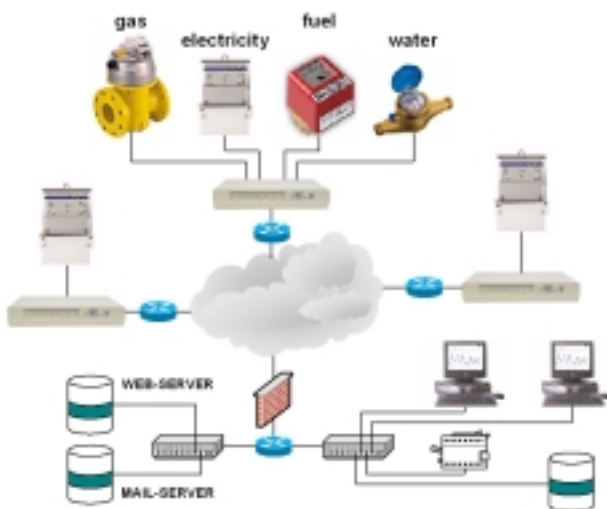


Fig.2 Take advantage of Internet for multipurpose measurements

Electrical power, but also several types of energy may

be collected and treated by this System as long as the related meters generate pulses¹ corresponding to the measured flow: e.g. water, gas or fuel.

The acquisition cycle can be set for a period of n seconds allowing real time monitoring.

Features of the latest IP-Protocol² allow synchronising of every recording unit connected to the network in an extremely precise way. This is significant in case of multi-site data acquisition with dynamic billing scheme. In addition, a dedicated IP-Network for Data transmission is not necessary because a standard high security feature of this most recent IP-Protocol to encode and decode all the data exchanged through the network has been implemented in the transmission software. Consequently the ciphered metering data may simply share any existing IP-Network, switch or router. A sole data set memorised and archived in the Flash Memory of the recording unit is accessible for the utility and its customers via IP authorisation procedures in local and remote mode over INTRANET or EXTRANET. A standard package of non proprietary programs that may run on almost every platform supports processing, reporting and visualisation of the collected data.

For more sophisticated computation and/or integration within an existing billing or administrative system the data are passed by standard query routines to any modern database.

The System is designed to be able to transmit information to the customer such as real time information about the actual and future delivery price scheme, set points according to the contract or switching command for load shedding,

Even if the collecting device is very sophisticated the size of its processing unit is small enough to be integrated in the metering device itself if required.



Fig.3 Practical implementation of the data collecting and processing unit

Implementing standard Internet technology not only reduces the unit price but contributes much more to reducing the cost of the planning, installation, operation and maintenance phases. Furthermore the System may be handled without special training or knowledge by any internet user.

1 Compatible with the SO-DIN 43864

2 SNMP V3

DEVELOPED JOINTLY WITH A RESEARCH INSTITUTE, THE SYSTEM HAS BEEN SUCCESSFULLY TESTED AND VALIDATED IN CLOSE COLLABORATION WITH UTILITIES IN A VARIETY OF TESTFIELDS AND IS TODAY IN COMMERCIAL OPERATION IN MANY PLACES

With a distributor of electricity

The Société Anonyme de l'Electricité d'Ardon in Switzerland is an early adopter of the System. In a first step, they seek to satisfy the requirements of their industrial customers who are permanently confronted with the adaptation of their production of supplies according to the market demand. The sale volume as well as the "time to market" principle drives the production level directly. As electrical energy represents important primary goods, the production costs are directly influenced by the mode of consumption. Therefore the industry was extremely interested in getting a powerful information tool that enabled them for short and medium periods of time to optimize their production relative to the availability and the dynamic spot prices of the electrical energy. The same principle was then adopted between the Ardon Utility together with most of their customers/ consumers and the primary energy provider. The implemented System is not only used for trading and billing of electricity but in addition, due to the outstanding quality of the transmission network and the availability of the System, is used for remote control of the distribution network.



Fig.4 The System deployed by the Ardon utility in Switzerland

With various kind of energy consumers

Regardless to its size, its nature or its mode of operation, a company must always be aware of utilising its primary goods in the most efficient and economical way. Any kind of company plans the workflow and the production processes in accordance with its market position. The System provides consumers with a real time indicator, which allows them to reduce their operational expenditures.

Remarkable results were achieved after the awareness of the employees was consequently trained just by monitoring in real time the actual consumed power.

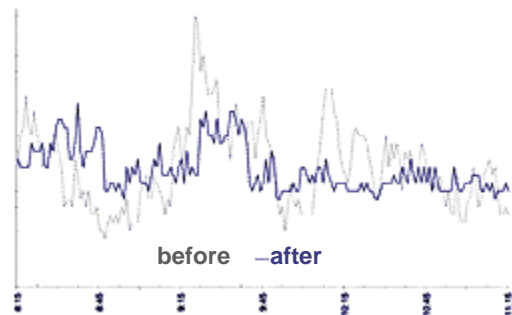


Fig.5 Savings by monitoring the energy consumed by a hospital

First example : Medical social complex

- Maximal load before : 126 kW
- Actual maximal load : 78 kW
- Investments : € 3'200.-
- Return on investments period: 14 months
- Annual achieved savings: 38 % of the total electricity bill

The profound knowledge about their consumption behaviour allows the consumer to plan an adequate concept of load shedding. The real time computation of the actual load through the System as well as load forecast permitted the customer to calculate and send load shedding commands over their own Information Technology Network



Fig.6 Business with significant peaks of consumption

Second example : Hotel and restaurant

- Maximal load before : 87 kW
- Actual maximal load : 58 kW
- Investments : € 1'750.-
- Return of Investments period: 11 months
- Annual achieved savings: 33 % of the total electricity bill

Another type of consumer is the classical industry site where the energy purchased is directly allocated to the corresponding product line or division concerned. The base for this allocation is provided by the System which allows a precise and synchronised multi sites meter reading.

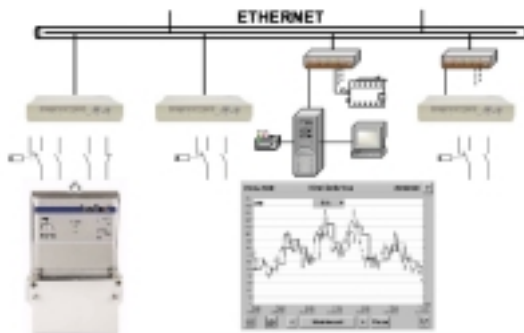


Fig.7 Multi Site large Industry with profit centres

Third example : large industry

- Maximal load before : 4'250 kW
- Actual maximal load : 3'870 kW
- Investments : € 75'200.-
- Expected Return of Investments: 3 years
- Achieved Savings: 8 %

ONE OF THE MOST ATTRACTIVE FEATURES OF THE SYSTEM IS THE CONNECTION OVER AN IP NETWORK. THEREFORE IT CAN BE IMPLEMENTED TODAY IN A MULTITUDE OF NETWORKS, EITHER FIX OR WIRELESS.

Transmission support today

The choice of the TCP/IP protocol complemented with ciphering of all the data allows the sharing of any existing Internet access line for transmission purposes. Within a Power Line Communication environment the meters data are presently exchanged via modem and transmitted over the xDSL router.

In another case access is granted directly over a CATV router and shares a sole infrastructure for multiples services:

- Electricity, water and gas
- Digital TV
- Telephony (Voice over IP)
- Internet

Depending on the building layout or on the distance between the recording points, regrouping can be easily achieved using the standard LAN Technology.

Corporate network, Intranet and Extranet may also be used to access and monitor the actual collected data.

A useful mobile application is the use of the WAP-features, well known in the cellular technology (GSM/GPRS), to inform and visualise at any time, anywhere about the current load of any authorised remote site.

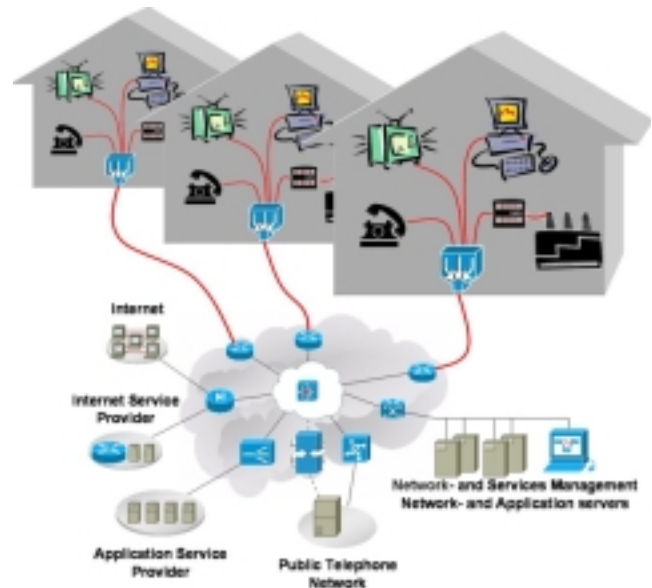


Fig.8 Broadband Access for multiple on-line services

Future developments

The ongoing implementation of Wireless LAN³ in corporate but also in residential environments increases and demonstrates the unique advantage of the System using the IP protocol and open platforms for transmission purposes.

In any building equipped with wireless LAN, the installation of the System can be further drastically reduced. Access to a wireless LAN is a standard component which will be included in every Laptop or personal assistant device.

SYNER collaborates very closely with research institutes to take advantage of any technological improvements and add new features to the equipment and the System: such as the WEB-Services Norm which is today a very hot issue.

CONCLUSION

Optimising the consumption of energy corresponds to a requirement of any large, medium and one day even the residential consumers. Getting and providing back accurate real time information and transparency about consumer behaviour becomes a necessity for every utility to underline its customer orientation.

Some time ago, the implementation of such a project would have been totally unrealistic due to the costs involved.

Time changes and huge technology improvements as well as solid development skills were necessary to create a System which meets the requirements at an attractive price.

This System is successfully in operation in many places today. This demonstrates the importance of partnerships between utilities and their customers.

³ IEEE 802-11b, Wi-Fi Technology