Chapter 6

Electronic energy services to the home: A demonstrator of the Energy Barometer system

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6.1 Executive Summary

Electronic energy services are to an increasing extent distributed to the home. This paper presents energy services provided within the ebox-technology. The services offered are based on the Energy Barometer idea.

An application of the Energy Barometer in Blekinge County is also presented. This application intends to demonstrate how the Energy Barometer may be used to achieve energy efficiency in residential buildings.

6.2 Introduction

Improving energy efficiency in, say Blekinge County´s residential stock, requires a changed energy consumption behaviour of a large number of individual house owners.

The underlying hypothesis in the present paper is that energy consumers would change their behaviour if they are provided with answers to questions such as: “How much energy am I consuming?”, “Is my consumption increasing or decreasing?, “How much does it cost me? “Am I a high consumer of electricity?, Am I consuming more than other consumers in Blekinge?, How much would I gain by decreasing my indoor temperature with 2 degrees?”, How much would I gain by a night temperature set-back?” How much would I gain by washing during night nime?”, How much would I gain by retrofit insulation of my attic?” How much would I gain by buying electrical energy from another utility company?” To achieve maximum effect of the energy services to homes it is important that the answers to these questions are easy to understand and easy to get, preferably in an interactive fashion. Options for delivering tailored information to the particular needs of the individual user is also required. For a further discussion on this subject, see Lindfors et al. (1998a).

A number of technologies for collecting energy and temperature data in homes have been available for a long time. The costs of energy monitoring and control in homes have so far prohibited a wide-spread use, however.

Recently developed open system and internet-based technologies like the ebox- technology have changed the situation. These new technologies have the desireable property that the physical infra-structure needed for electronic energy services may be used by other electronic service providers as well. Examples of other electronic service areas are internet-access, security, alarm, home-care, medical care, IP-telephony, WebTV, education and entertainment.

The cost of electronic energy services is reasonable if the cost for the physical infra-structure in a home is shared among several different service areas.

6.3 The ebox-technology

The ebox may be considered as a technical manager of electronic services to the home (“home server”). The ebox consist of standard PC-components. The inter- and intranet networks linked to an ebox is illustrated in Figure 6:1.

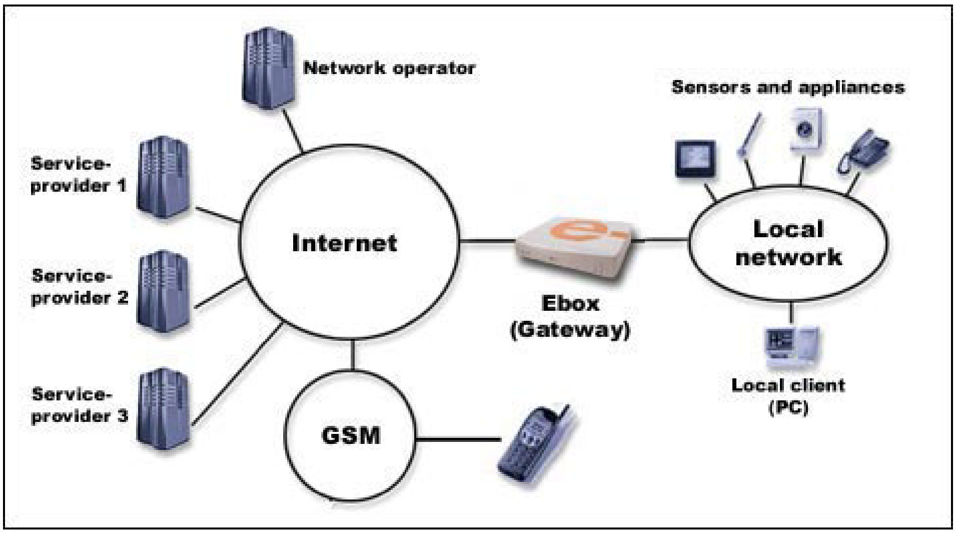

Figure 6:1. Network of an electronic service system

We make the following comments:

- The ebox is connected to inter- and intranets wire- and wireless, *e.g.*, with a intranet Lon-work system and Power Line Communication to internet
- Service providers share the same physical infra-structure
- Services are given independently of each other
- Functionality and up-dating of the ebox is managed by a network operator
- Functionality of the sensors and appliances may be remotely controlled by (other) specialised service providers

Authorised access to attributes of sensors, appliances, PC:s etc is required since appliances and sensors are connected to internet (*via* the ebox). Applications (services) must therefore be protected from each other by firewalls on several lawyers.

The design and architecture of the ebox-system is described in more detail by Lilliestråle et al. (1999).

6.4 The Energy Barometer system

The objective of the Energy Barometer (EB) is to provide energy services to residents, house owners, energy managers of housing companies and energy authorities. The name "Energy Barometer" is taken to allude to its possibility to follow the "pressure" on the demand for energy end-use.

Buildings are provided with sensors for measuring energy use for heating, household electrical energy and indoor temperatures. The software for handling the raw data from the sensors are installed in the ebox. The preprocesssed data are communicated to an Internet Building Service Provider (IBSP). Weather data from the nearest official climate station are communicated via FTP to the IBSP.

A data base system for analysis of data and presentation of results is linked to this IBSP. For a discussion of the EB data collection and analysis system, see Lindfors et al. (1998b).

EB is a "passive" monitoring system. Future developments of the EB include incorporation of soft-and hardware for controlling the heating system, the lighting system and other electric appliances in the home.

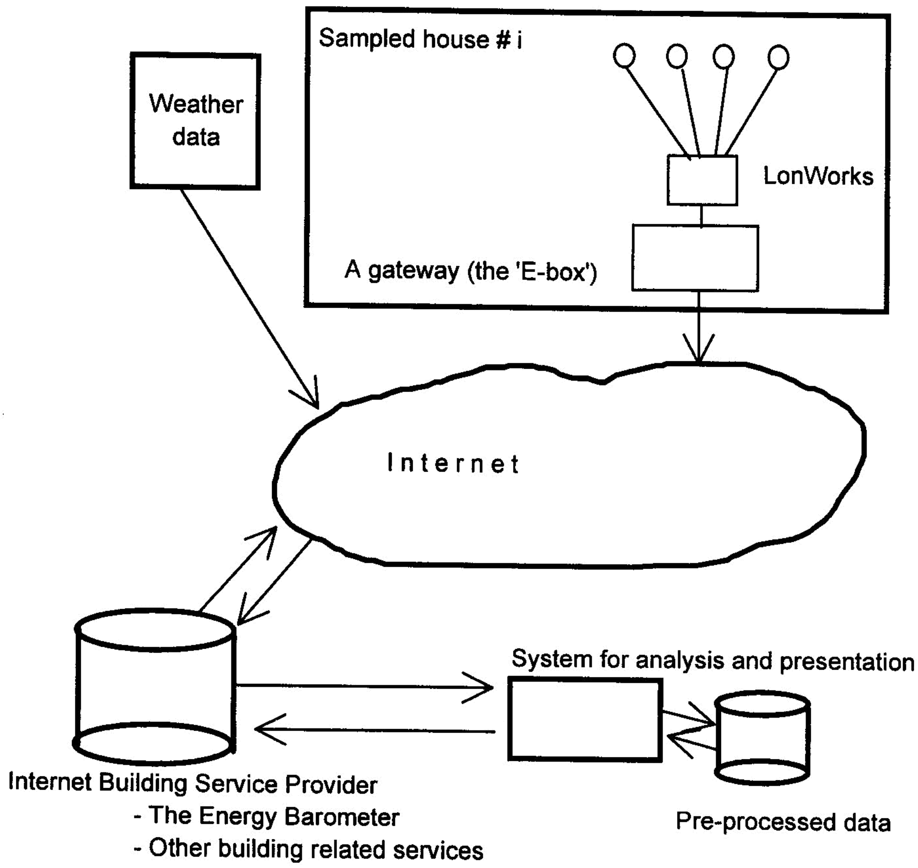

Figure 6:2. Structure of the Energy Barometer system

6.5 An application of the Energy Barometer in Blekinge County

An application or demonstrator of the EB system has been made in the laboratory at the Soft Center of the University of Karlskrona/Ronneby. Indoor temperature, electricity use for heating and electricity use for appliances are measured. Outdoor temperature data are collected from Ronneby Airport at a distance of 30 km from the Laboratory. LonWorks is chosen as intranet enabling physical lawyer communication on the existing 220V-cables in the Laboratory.

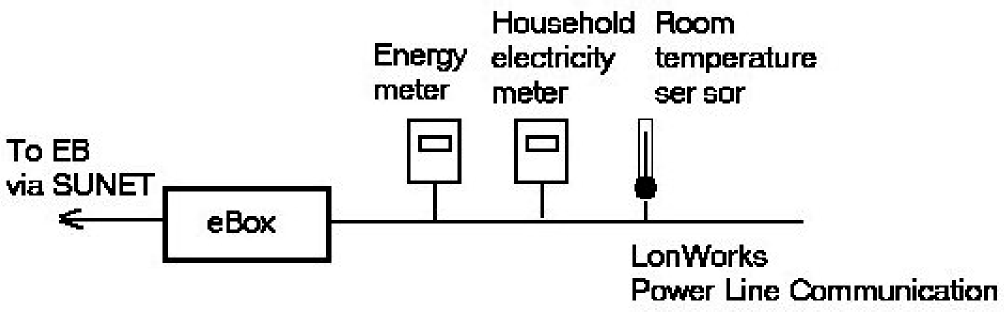

Figure 6:3. Measurement design of the Energy Barometer demonstrator

Communication from the ebox is performed from the ebox over SUNET to the IBSP in Gävle.

Results from the EB are given on a particular homepage on the Internet and on a WAP-telephone, a cellular terminal adapted for Wireless Application Protocol (WAP). WAP is a *de facto* standard for communication of information on the internet and for other advanced communication services to digital mobile terminals such as car-telephones. WAP corresponds to the html-language. WAP is devised for displays of relative few points and small cpu-resources. The WAP-telephone will be simulated by a PC in the present application since WAP-phones not are available on the market (August 1999).

Figure 6:4. Use of WAP-telephony as a thin client to the ebox makes it possible to remotely control the heating system and household appliances

6.6 A concluding remark

We face a situation where appliances in homes all over the world are becoming connected to each other and to the internet to a great extent. This evolution of the networked society enhances the functionality of household appliances and building services systems. The market is growing for services in the area of monitoring and control of systems for heating, cooling, ventilation and particular household appliances.

Further applications of the EB system described in this paper, and application of other similar systems, are needed to gain an understanding of how we now best can meet the needs of energy end-users and to achieve energy efficient buildings.

6.7 References

[1] Lilliestråle M., Idermark T. And Vasell J. (1999): Ericsson´s e-box system – An electronic services anabler. Ericsson Review, No. 1, 1999.

[2] Lindfors A., Högberg H. and Westergren K-E (1998a): Can Internet be used to reduce the national Energy Consumption for Rresidential heating? Proc. 2nd European Conference on Energy performance and Indoor Climate in Buildings. EPIC´98, Lyon, November 1998.

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[4] Westergren K-E, Högberg H. And Norlén U. (1998): Monitoring energy consumption in single-family houses. Energy and Buildings, 29, pp. 247-257.