

# Energy & Information

Max F. A. Welling and Peter G. Visser, nv Energiebedrijf  
Ijsselmij, Holland

## 1. SYNOPSIS

The aim of the program "Energy & Information" is to develop a flexible multi-tasking platform and a two way telecommunication infrastructure for energy consumers. The transformation of a company from a distributor into a supplier of energy services is described.

## 2. ABSTRACT

N.V. Ijsselmij is one of the major energy distribution companies in the Netherlands. In 1991 the company started the project "Energy & Information" with the aim of stimulating and guiding efficient and effective consumption of energy by developing a two-way communication and information infrastructure and energy-related Value-Added Services. The aim is to provide a better quality of service and price/cost reductions for both the client/consumer and the power company.

The system gives among other things functionality on the following subjects:

- Energy-management, influencing the client's behaviour by:
  - a) The introduction of more differentiated tariff structures.
  - b) Advising the client by analysing the client data.
  - c) Load-management by SCADA-functions.
- Remote meter-reading for billing electricity-, gas-, water- and heat-products.
- Building-automation, control of light, power, temperature, entry authorisation and alarms.
- Delivery of general and energy-related information.

The expected results of the project are:

- Better controlled supply of energy by efficient guiding and controlling, with the possibility for the client to fully explore his contract.
- Possibility of introducing flexible account structures, "spot pricing".
- Peak load information to achieve better management of the energy distribution network.
- Meter-reading and the input of data for account management.
- Answer to the question of the way how information can contribute to company targets.
- Quantification of the impact of this system on financial, technical and management terrains.

The development of the necessary systems began in July 1991. A "local telematics system" will soon be installed in 250 client-sites and the process of product development has already started.

## 3. INTRODUCTION

NV Energiebedrijf Ijsselmij distributes electricity, gas, water and heat. The company was born in the mid-eighties. It was shaped by the division of the large scale electricity production and distribution of Ijsselmij and by merging the remaining distribution section with other distributors of electricity, gas and heat. The division has been formalised in the Electricity Law which was adopted by the parliament in 1989.

In a company with combined production/distribution company of electricity, much attention is directed towards the production section. Because of the separation, the distribution section was more or less forced

to discover the client.

This division of activity implies that the distributors have to buy the electricity from the producers. The distributors quickly understood that they could significantly reduce their purchase costs if it would be possible to react adequately to the signals from the National Bulk Supply Tariff. To reach their goal, the distribution sector has to influence its customers demand for electricity. This poses a twofold problem. The first aspect is that the distributors had very limited knowledge about the individual customers demand. The second aspect is that they had not developed an operational set of instruments to influence customers behaviour.

This problem became more urgent as the Dutch government became increasingly concerned with the environment and the European Commission gave more attention to competition between energy distribution companies.

In 1988 the Dutch government launched its National Environmental Plan in which, among others, a target concerning the reduction of carbon dioxide emissions was formulated. Both suppliers and distributors - separately- took initiatives to contribute to the realisation of this national goal.

The (electricity) distribution companies developed their respective Company Environmental Action Plans. These included activities directed towards the production of electricity in a highly energy-efficient manner and activities directed towards influencing the demand for energy by the customers. The aim was to reduce demand and/or to stimulate the more energy-efficient use of energy.

The European Commission has developed ideas about the introduction of competition between distribution companies. In a competitive environment it is necessary for the potential customers to be able to distinguish between the competitors.

IJsselmij has concluded that in order to survive it is necessary to change from an energy distribution company to a supplier of energy services. This implies a shift of the (main) attention from the reliable distribution of energy and invoicing to the creation and supply of energy services, while, of course, maintaining the high level of reliability of the core business.

#### **4. THE TELEMATICS SYSTEM**

At the same time IJsselmij had formulated internal objectives which have influenced the decision to begin the project Energy & Information. These objectives concerned minimising the purchase costs of energy, achieving the feasibility of remote meter-reading, the replacement of continuously registering meters, review of administrative systems, optimisation of maintenance of small combined heat and power plants and development of more time-differentiated tariffs to be able to link in a useful way the causes of the costs to the energy user.

There are, of course, several ways to develop energy services and related products. IJsselmij strongly believes that the use of modern technology, as a vehicle for this service-developments, will give unlimited possibilities.

Therefore telematics, the mix of telecommunication and information technology, is used. The project started in 1991 and at that time parts of the necessary equipment could be bought on the marketplace, however completely integrated systems were not found. IJsselmij made the decision to start up a development process for a two-way system to communicate with customers, consisting of an "open" standard and flexible structure which makes it possible to add further applications. To create a sufficient scale for such an innovative project we have chosen a pilot group of 250 larger clients.

##### **4.1. The Local Telematics Platform**

A local computer-based platform is installed for gathering relevant information at the client site. This platform is provided with connections for water, gas, electricity and heat meters. The communication

between these meters and the platform can be asynchronous serial or by pulses. For process measurement and control purposes digital inputs and outputs are used. Functionality for servicing the system, connection to the client information system and use of the platform for general purpose telecommunication services is provided as well.

The platform uses a multi-tasking operating system which gives the opportunity to download new functions in software modules. Communication with the central system is accomplished by V22bis/V42bis protocols for fault correction and data-compression. As communication carrier IJsselrij's own telecommunication infrastructure, Dutch PTT-Telecom leased lines and the Public Switched Telephone Network can be used.

#### 4.2 The Central System

At IJsselrij a central database system is used for the storage of all gathered information. Because of the enormous amount of data stored and the need to use parts of this information by several IJsselrij departments, the central system uses a relational database management system in a client-server architecture.

Local Platforms are connected through modem-pools. The central system is connected to IJsselrij's Wide Area Network which gives authorised personnel the ability to work with the stored data in using several applications. In a later phase gateway to X400-services for electronic billing and voice-response systems are foreseen.

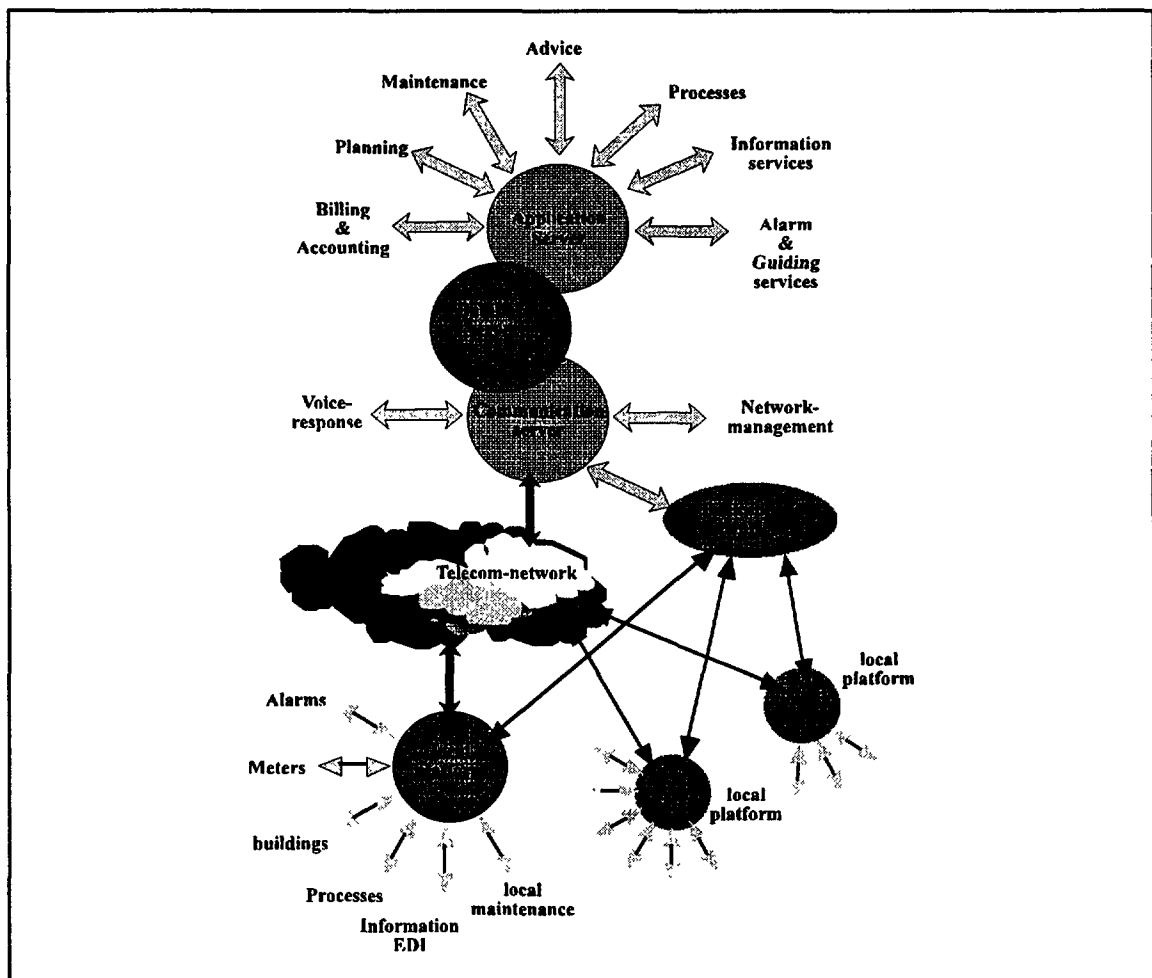


Figure 1 The telematics concept

### 4.3 Technical developments in the future

Further developments must fit in the long-term development strategy of IJsselmij, which must result in a complete business support system. In this section our long term strategy will be explained.

The strategy consists of three levels, the telematics system, the applications and the operation support tools. These levels will be explained hereafter.

#### 4.3.1 The telematics system

The flexible generic part of the telematics concept have been described in paragraphs 4.1 and 4.2 as a basis, with application-specific Inputs and Outputs and an "open database" shell for flexible connections with developed applications.

#### 4.3.2 Applications

Applications, in four separated functional groups :

- Maintenance applications, for example maintenance of meter-installations, heat/power-installations.
- Optimisation of internal processes, for example remote meter-reading and equipment registrations.
- Optimisation of client processes, for example simple remote energy-management programs.
- Communication, related to energy products such as load-curves, national load-curves, bills, tariff-information, tips and general purpose telecommunication functions such as Integrated Services Digital Network functionality.

In every part of the concept we foresee a growth in necessary applications. If possible, previously developed applications will be used.

In the short run several applications will be developed which use the multi-purpose platform technology. This applications will be :

- Energy-management for "Power-Heat" installations. This application will provide Supervisory Control and Data Acquisition functions for optimisation of exploitation and functionality for service-purposes.
- Building automation, measurement and control of heat, power, light and access.
- Network management functions for management of the telecommunication functions to provide the systems manager powerful tools to control and restore communication between local platforms and the central system.

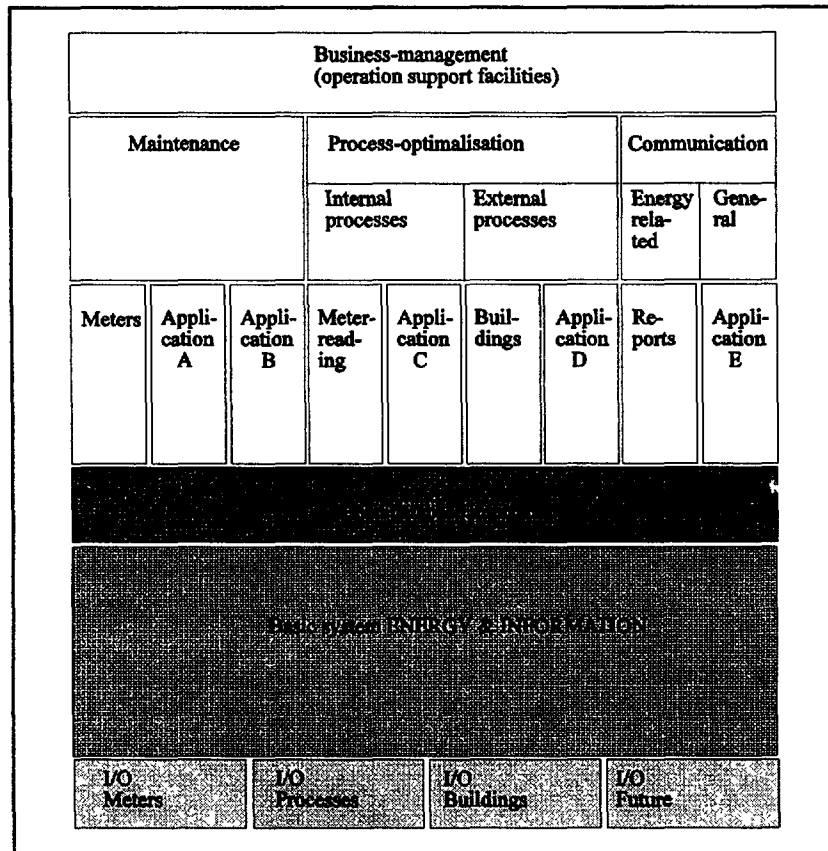


Figure 2 The long-term concept

#### 4.4.3. Operation Support Tools

Application-tools for efficient business exploitation will be developed, such as:

- Contract-management.
- Relation-management.
- Energy-management at a high level, decision- support systems
- Billing of all kinds of services delivered.

### 5. CHANGING INTO A SUPPLIER OF ENERGY SERVICES

To take full advantage of the possibilities of the developed telematics system, our company has to transform itself from a distributor of energy into a supplier of energy services. To determine a starting point for this innovative process we turned to our main product: electricity. The most important reason to do so is the clear relation between the structure of the costs to the distributor and that of the client-tariffs. The relation is so, that it gives a realistic chance to develop services in a win/win environment. The process of thinking through the steps of realisation of a change in the behaviour of our clients we discerned five steps. In this section we want to discuss these steps and their potential for the development of a service.

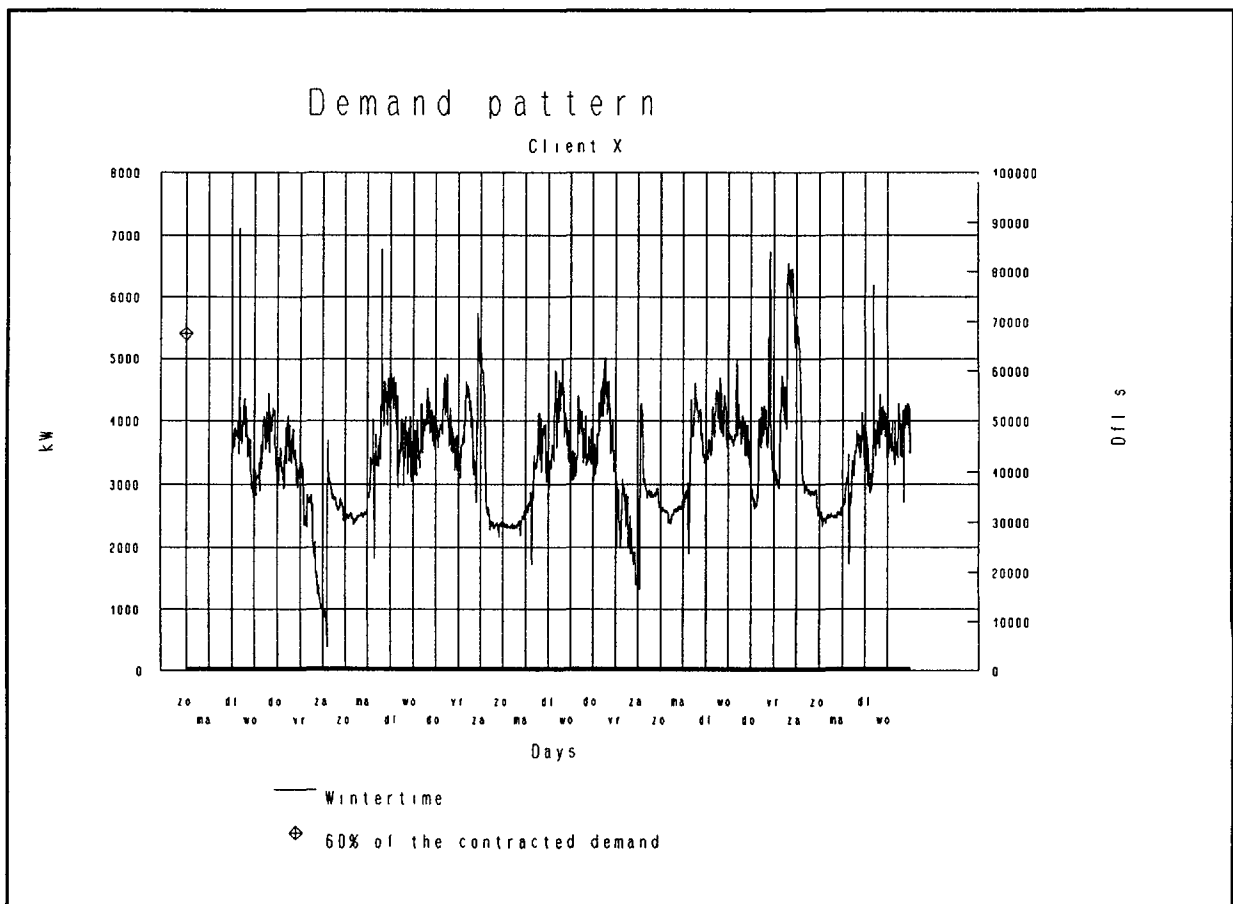


Figure 3 Relation between customer load and costs

## **5.1. Exchange of information**

To be able to influence the behaviour of our clients, knowledge about this behaviour is a prerequisite for both the distributor and the client. So the first energy service we want to develop concerns the supply of information to the customer about the characteristics of his energy demand.

The necessary available data will be obtained by the Local Telematics Platform. It measures the load-curves of clients on a 5 minute basis. The developing energy service could simply be the supply of all the 5 minute values in a table to the client. However we perceive that a significant number of our clients does not think about energy in terms of kW or kWh.

This is our first lesson : in the process of developing an energy service you have to think from the perspective of the customer.

For this energy service we formulated the perception of the customer in five elements. The first element is that the customer thinks of energy in terms of the monthly bill. The second element is that a customer is more prepared to make a change if this change realises a substantial saving in terms of a reduction of the energy bill. The third element is that most people prefer information in a graph to a table. The fourth element is that most people can more easily discern coloured lines in a graph than lines in different shades of black. The fifth element is that the customer likes to be informed about his energy demand as quickly as possible.

Against this background we are developing a set of graphs which shows the customer the relationship between his energy demand and his bill in a certain month. Furthermore the customer can see to what extent his demand differs between a number of selected days and to what extent his bill is determined by an exceptional element in his pattern of demand. Figure 3 gives an example of such a graph.

Those customers who are familiar with the concept of kW and kWh can, if they wish, use the users exit of the local platform to obtain data about their energy demand on a real-time basis. The customer has to invest in hard-, soft- and personnel to translate the data into information. We are planning to develop software which the customer can use in this process.

## **5.2. Flexibility in contracts**

Based on our contact with customers we have the impression that most of our customers will be prepared to change their behaviour or at least will be prepared to search for opportunities to change. It is natural that they ask for something in return. Only few, especially government institutions, are prepared to change in order to contribute to the realisation of the national environmental goals. Most of our customers, however, are more inspired by a financial compensation.

Due to our load-management activities we are faced with a growing number of hours with a high load. This requires increasing the number of contracts in which variable disruptable loads are regulated. If, with selected customers, these contracts can be realised and part of the profits made available to these participants, it is obvious that this has an impact on the rates of the non-participants.

This load control function requires measurement of the load-curves of the participants and increasingly also of the non-participants. It is our expectation that this will lead to a great variety of rates. These rates will depend on the load pattern and of the possibilities to disrupt the load and will probably be more time differentiated than our existing tariffs.

This implies that IJsselrij will have to create more individual contracts and tariffs. The Energy and Information project creates an environment in which these kind of contracts can be fulfilled. The Platform measures the demand on a satisfactorily detailed level and the Central Unit includes a tariff module that can handle tariffs that differ every 5 minutes.

## **5.3. Assisting the customer in the search for opportunities to change**

If a customer has become aware of his energy use pattern and of the contract options, he can make a decision whether or not he wants to alter his behaviour.

If he intends to change, he has to analyse his production process in search of opportunities to change. This implies that he has to gather information about "appliances that can control/steer his load", "alternative appliances which fit into his production process and increase the energy efficiency and/or the cost efficiency of his production process".

We would like to offer this information to the consumer as an energy service. At the moment we have to admit that we do not have this knowledge. Now we are facing the question whether we have to collect this information ourselves or enter into strategic alliances with commercial firms that do have this information.

This is our second lesson : The introduction of a new technology leads to changes in the organisation of our company. Not all of these changes are directly related to the handling of the new technology or even its products. Its leads to a change in culture.

#### **5.4. Assisting the customer in the realisation of changes**

If a client has selected a set of opportunities to change, he has to make a choice. He can be confronted with several thresholds concerning the implementation of preferred options.

For example the client can experience increases in costs. This could be the case if he has to select manpower to be able to react in a flexible manner as is requested by the contract. In such a case we expect that an energy service such as that "the utility will initiate the flexible reactions" shall be warmly welcomed.

The Platform is an instrument which is able to switch on and off certain loads or processes. As an energy service we can offer to take care of the clients load-management on the basis of what is agreed in the contract.

It is also possible that a change requires a large investment. In that case an energy service which lightens the financial burden will be very helpful. Especially in cases in which change also results in lower costs to the utility, such a service is easy to defend.

In other cases the Telematics Platform itself is the tool to realise the change. The Platform is able to control the load factors within offices or industrial premises by measuring temperature, time, humidity and other factors which are necessary to execute the load control.

The Platform has the ability to offer the customer current information about the electricity demand. This is especially targeted at the clients who are carrying out energy and/or load management measures themselves.

The platform also provides physical switches to manage or control parts of the production process which need electricity.

#### **5.5. Giving the client the possibility to verify**

If the client and the distributor have come to an agreement which includes, for example, that the distributor will disrupt the provision of energy within certain boundaries, the distributor prefers that the customer has the opportunity to verify whether or not the distributor acts according to the contract.

We are aware of the fact that the customer is and will be responsible for his production process. We take the view that, in order to execute this responsibility, he has to have the possibility to overrule the action of the distributor in case this action endangers his production process or if this action is outside the boundaries of the contract.

The Platform includes an overruling switch which enables the customer to overrule the actions of the distributor. Furthermore the Platform can send information directly to the customer about the status of all

the different switches -regardless of who has control over a particular switch- of the Platform.

It is clear in our view that this energy service can not be offered in isolation but needs to be a fixed part of the energy services which require instruments to verify the execution of these energy services.

## 6. NON ENERGY-RELATED SERVICES

The energy distribution sector in the Netherlands is using company-owned telecommunication-infrastructure instead of Public PTT services for the necessary communications. This infrastructure is of a high quality and "state of the art". The EC movement towards liberalisation in telecommunications and the possibilities of today's technical systems have started a nationwide plan to create a telecommunications Service Provider, in addition to Dutch PTT. To make deliveries of telecommunication products such as ISDN possible, the multipurpose local telematics platform can be used at the customer end. By downloading the right software in the local platform, the clients can be served with Wide and Local Area Network function.

Finally, national and international data service connections can be accomplished, with the benefit of shared member costs.

## 7. RESULTS

The project Energy & Information is used as a start in the process to become a market-driven energy distribution company. This process, which has just begun and will continue for several years, has already provided some results, and is expected to continue providing results in the future.

### 7.1. Obtained results

During the development period, IJsselmij has obtained lesser and more important results, most notably the process of growing from a passive way of delivering energy to a more marketing-driven, active method of distribution can be mentioned. On all management levels the impact of the system on clients and internal processes remain points of discussion, as do changes in procedures, training programs and public relations.

We have learned that development of necessary technical products is complex and time-consuming. We have especially experienced the creation of energy services is a highly complex process, because it involves all the departments of our company. In addition, it demands new requirements regarding the number and quality of our employees, because it involves the use of technology and a way of thinking that is not very familiar to us.

Furthermore, the following results have been obtained:

- Tested local and central hard- and software.
- Four basic applications in operation: meterreading, equipment maintenance and registration, simple energy-management and information services such as broadcasting services and local load-curve information delivery.
- The first service on the market: a monthly report, combining load-curves and costs in graph form.

### 7.2. Expected results

The most important expected results are

- Satisfied, now determined, clients who like our "value added" manner of delivering energy.
- Developing methods by which information can contribute to company targets.
- Quantification of the impact of this system on financial, technical and management terrains.

Related results are:



- Better controlled supply of energy by efficient guiding and controlling.
- Providing clients with information for operation within the limits of their contract.
- Possibility of introducing flexible account structures, "spot pricing".
- Peakload information to achieve better management of energy distribution.
- Cost reduction of internal processes .
- Account-management information.

