

# Chapter 1

## The ISES Project Information/Society/Energy/System

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### 1.1 Executive summary

*The ISES Project - Information/Society/Energy/System - is a three year multidisciplinary research activity that began in 1996. The project has been carried out as nine sub-projects, further described below.*

*The overall goal is to understand and develop electronic information tools integrated in energy distribution. Three main areas have been in focus:*

- *Understanding and developing the technical information exchange mechanisms in large distributed information systems through advanced computer science*
- *Understanding and developing the human information exchange mechanisms through advanced behaviour analysis*
- *Evaluating and developing applied technology for efficient information systems through full-scale fieldtests*

*EnerSearch AB is a research company that focuses on applying information technology to energy systems. EnerSearch has the principal responsibility for the project.*

*EnerSearch AB is equally owned by Sydkraft AB and IBM Utility and Energy Services. Apart from the two owners, powerful sponsors have joined the project.*

<i>ABB Network Partners AB</i>	<i>Arne Johansson</i>
<i>Electricité de France</i>	<i>Robert Froelich</i>
<i>IBM Utility and Energy Services</i>	<i>Peter Löffler</i>
<i>IT Blekinge</i>	<i>Svante Ingemarsson</i>
<i>PreussenElektra AG</i>	<i>Konrad Mussenbrock</i>
<i>Ronneby Municipality</i>	<i>Jan-Anders Palmqvist</i>
<i>Sydkraft AB</i>	<i>Lennart Fredenberg</i>

*A number of persons have contributed significantly to the results of the ISES Project, from financial support to discussions and advice. All project members (Chapter 11) are deeply grateful to the support that has made this stimulating work possible.*

## 1.2 Introduction

The development of electronic information systems and tools will create a demand for new services as well as opportunities for new business areas in the future society. This society, including all the inhabitants, the industries, the service sector and the trade and market organisations, will find it evident to make use of the digital information and related functions in a large number of applications. We have already seen examples of this happen. Much of those services and applications will be interactive based on two way communication between the parties involved in the functions.

The energy market in Sweden was opened-up for competition the 1st of January 1996. It was early understood, that the energy suppliers had to offer their customers more than just kWh and to challenge the market with value added services. The ISES Project was planned to create knowledge and experience in this new environment.

The project is one of several other projects within the framework of a joint development programme for IT Blekinge - one of the development programmes within the SPD (Single Programming Document) agreed on by the EU Commission for structural work. The ISES project aimed at establishing Blekinge County as a full-scale laboratory, in which various players were given opportunities of collaborating.

The aim of the total project was to perform research to gain insight regarding coming technology. Outcomes of the project are reports, dissertations, seminars and demonstrations.

As in many other deregulated sectors, the personalisation of services became vital. Sub-project 1: "New Business Strategies" was formed to understand and develop tools for interactive marketing.

The interactive communication needed for the new strategies, increased the demand on the electronic interface at the customers premises. In sub-project 2: "Customer Interactive Interfaces" new technology including information kiosks was planned.

One vital area in the creation of the new information society is the need for standards to allow for a transparent information system based on different data-bases. Sub-project 3: "Databases and Structure Documents" handled this area.

A complexity of new interest groups could be seen early on the deregulated

energy market. Those groups often acted as one customer through a new form of organisational rules. Sub-project 4: “Virtual Organisations” was decided to tackle this area by understanding the organisational behaviour of the ISES Project itself as a geographically distributed group of participants.

In sub-project 5: “Simulation of Energy Systems” the impact of market and energy related offerings were studied using computer models of energy distribution.

Sub-project 6: “Energy System Control Technology” implemented a two-way communication system on a secondary transformer station area in our test platform, Ronneby Municipality. The system is based on development by IBM and Sydkraft – IDAM, Integrated Distribution Automation and Management.

Sub-project 7: “Power Line Communications” was outlined to analyse the characteristic properties of the electrical low voltage grid as a new data communication medium.

The two last projects, sub-project 8: “Distributed Load Control” and sub-project 9: “Robust, Distributed Decision Islands” – were both based on intelligent agent technology – intelligent software modules – interacting on a communication network, the low voltage grid. Electrical load control – Load management – was chosen as one important application area for the new agent technology due to the need of advanced methods for increased precision of active measures. The robustness of the selected solutions is important to safeguard the needed functionalities. The “decision island” was defined as the basic area with seamless communication – in our case the secondary substation electrical grid.

In the course of the development of the future information society, it is vital to establish partnership between important players in order to achieve the needed synergy to meet costs and efficiency in the future information system. One such important player is the energy distributor, who’s need in his own operations largely coincide with the society’s IT requirements. The energy distributor is for those reasons an important IT partner.

### **1.3. The ISES Sub-Projects**

The Sub-projects have carried out demonstration activities when the technology used has reached commercial maturity. The Sub-projects have been outlined as research projects (licentiate or doctoral projects) if the technology was in the course of development. One important feature of the project was its ability to show a number of applications as specific demonstrations.

#### **1.3.1 Sub-project 1: New Business Strategies**

Theme:

Value creation through interactive marketing where product offerings and communication aim to accommodate different customer styles.

Objective:

To develop high-precision marketing strategies for the power industry based on decision style approach and relationship communication.

Implementation:

The research focuses on the development and empirical study of conceptual models for how power customers process information, how their different decision styles are related to attitudes and behaviours regarding purchasing and using power, how power suppliers can accommodate these customer styles through high-precision market communication, and how this communication can build better relationships with the power customers.

Area of application:

High-precision marketing strategies based on the decision style approach and relationship communication are developed and studied for industrial customer applications as well as private household applications, involving several smaller samples of power customers in Blekinge, Scania (Skåne), California, Germany and other research sites.

Results of this sub-project are presented in Chapter 3.

### **1.3.2 Sub-project 2: Customer Interactive Interfaces**

**Theme:**

Design, use and acceptance of information gateways within the society.

**Objective:**

Reinforced information opportunities for the society by the use of electronic gateways.

**Implementation:**

The project mainly involves work on new interactive interfaces like simple and advanced displays, digital TV-sets, home computers and information kiosks. Combining different technologies and interactions through shared workspaces will be studied. Co-ordination with equivalent EU projects is regarded.

**Area of application:**

The project mainly involves applied work for entering, processing as well as the presentation of the information in a way that is attractive to the user.

Results of this sub-project are presented in Chapter 4.

### **1.3.3 Sub-project 3: Databases and Structured Documents**

**Theme:**

The utilisation of information networks and the functionalities in communication systems by the use of standardised databases, interfaces and document handling.

**Objective:**

Improved searchability and interpretation of information in interacting networks.

**Implementation:**

The project maps out the different standards to be applied for different players in the information networks, and proposes co-ordination and general access to shared information.

Areas of application:

Practical questions will be studied, bearing in mind that there will be several different types of applications in the networks. Provided that the PDWeb and Attach Projects are implemented within Ronneby Municipality information network, initial experiments will be carried out with joint utilisation of information stored in the databases of the two adjacent projects.

Results of this sub-project are presented in Chapter 4.

### **1.3.4 Sub-project 4: Virtual Organisations**

Theme:

Developing virtual organisations with geographically distributed participants from several autonomous organisations through interorganisational learning, team-building, and information systems.

Objective:

To enhance the ability of virtual organisations to collaboratively develop knowledge by facilitating interpersonal and interorganisational communication with a decision style approach and IT systems.

Implementation:

The research focuses on developing understanding and management abilities of how members of virtual organisations process information, what methods and patterns of communication they have, how they collaborate in creating new knowledge, and how this interorganisational learning can be amplified by team processes and IT systems.

Areas of application:

Virtual organisation communication, learning and development are studied with the ISES research group itself as the main case that is compared with other collaborating set of organisations, such as related marketing companies and industrial networks involving utilities.

Results of this sub-project are available on the EnerSearch Knowledge Server.

### **1.3.5 Sub-project 5: Simulation of Energy Systems**

**Theme:**

Computer Simulation of energy systems for cost minimisation over a selected period of time, where investments, depreciation and operating costs are taken into account.

**Objective:**

Technical and economic rationalisation of energy systems.

**Implementation:**

The energy system will be simulated with respect to energy purchasing and generation opportunities and to market-oriented measures within the various customer categories.

**Area of application:**

The application-oriented part of the project includes the analysis of the power requirements of various customer segments and the opportunities for controllable loads. At the same time, the company's energy purchase situation at the utility will be studied, along with opportunities for local generation. The resulting measures will be analysed for a selected period of time, in the project duration set to 5 years.

Results of this sub-project are presented in Chapter 2.

### **1.3.6 Sub-project 6: Energy System Control Technology**

**Theme:**

Analysis of control systems and communication on the low-voltage electric grid, for increased technical and market-oriented functionalities.

**Objective:**

To study advanced microprocessor control and monitoring systems applied on distribution networks.

**Implementation:**

The sub-project involves the system developed by IBM and Sydkraft (IDAM) installed in a secondary sub-station area. The local system utilises the broadband data network linked to Ronneby Energy.

Area of application:

Meters and sensors in the network will communicate on the low voltage grid. The automation and operation will be monitored and controlled in the same manner. Opportunities for new business strategies are also introduced.

Results of this sub-project are presented in Chapter 7.

### **1.3.7 Sub-project 7: Power Line Communications**

Theme:

Analysis of criteria characterising communication in local networks.

Objective:

Specialised knowledge on the low-voltage grid communication (PLC).

Implementation:

The project will carry out an analysis of characteristic properties of a chosen low-voltage network; noise levels, attenuation and transient phenomena.

Area of application:

In the application of the results obtained, it should be possible to achieve an understanding and a methodology for predicting the communication characteristics on any low-voltage network.

Results of this sub-project are presented in Chapter 7.

### **1.3.8 Sub-project 8: Distributed Load Control**

Theme:

Automated, distributed load control for increased utilisation of present investments in existing distribution grids.

Objective:

Automated dynamic load control by advanced software agent technology.

**Implementation:**

Development of software, theoretical models and applied experiments for selected sections of the Ronneby Energy distribution grid. The control mechanism can be compared to an “enquiry/offer/decision” method, where the measure should result in the desired reduction in demand at a minimum cost and loss of customer comfort.

**Area of application:**

Application involves controllable loads (electric heating, water heaters, dual fuel heating systems) utilised so that the demand in the network area can be balanced during high-load periods.

Results of this sub-project are presented in Chapter 5 and Chapter 6.

**1.4.9 Sub-project 9: Robust, Distributed Decision Islands**

**Theme:**

Analysis of distributed, intelligent “decision islands” based on networked microprocessors.

**Objective:**

Evaluation of methods using software agents for providing new high-level services to the customer.

**Implementation:**

Using agent-oriented technology and concepts to implement distributed decision-making processes.

**Area of application:**

Energy saving and increasing customer satisfaction through value added services that uses the existing power lines for communication between the agents and the electrical devices of an office building.

Results of this sub-project are presented in Chapter 6.