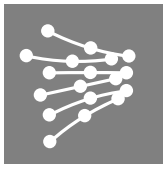

R E D
E L É C T R I C A
D E ESPAÑA

Spanish Technology Database

November, 2005

1-Nov.-05

Documento realizado por IIE-UPV para REE a través de la colaboración de los expertos de ambas instituciones para el proyecto EMERGIE de REE

ÍNDICE

1. INFORMACIÓN DEL DOCUMENTO

Nombre del documento: Spanish Technology database
Nombre del archivo: Spanish Technology database.doc
Versión actual: Versión 1
Fecha de la versión: 1-Nov-2005
Autores: IIE-UPV

Historial del Documento

Versión	Fecha Entrega	Modificación	Fecha de revisión de REE	Resultado revisión REE
V1	1/11/04	Versión Inicial		

2. TECH CASE # 1: GECO CONSUMERS MANAGEMENT TOOL

A. Brief Overview

GECO is a support tool used to increase the demand response participation which operates by REE, taking into account a medium and long term horizon. GECO analyzes DR programs operation, and allow planning and evaluate these DR programs.

GECO is a combination of many applications. All these applications use data provided by GECO/CORE tool, this tool organize and store the static and dynamic information about Spanish interruptible tariff consumers. The information is frequently updated through Consumer's Load Profile with new data every 15 minutes.

B. Description of the DR Technology

GECO has three applications:

1. OPCO: Forecast Model of consumer response during the operation period. It is a prototype for assisting the interruption system operation.

OPCO is an application designed to forecast and analyze the performance of Hourly Power Tariff Consumer when an interruption order is sent. It shows the order results in an easy and graphic manner.

OPCO resolve the following questions:

- ¿How munch interruption capacity will be available in one specific day, both by consumer, zone or total?
- ¿How many MW did one consumer use during the year?
- ¿How many MW one consumer used in comparison with its contract power, offer power, and average power in one specific day?

OPCO has three operation modes:
- Fast analysis of prevision for the current day.
- Detailed analysis of prevision for the current day, additionally the real behaviour consumer during previous 15 days is considerate.
- Analysis of historic behaviour of one consumer. The possibility to choose the date for the analysis is available.

2. CODIR. Consumer Directory, Negotiation and Planning Tool

CODIR is an application for monitoring and analysis consumers. It uses static data (identifying, contract type, supply type) and dynamic data (consumptions and load profiles); all data are provided by GECO. Furthermore CODIR is an interactive analysis tools, it study data for preparing one report of consumer' characteristic; the report shows contract type, location, consumption impact in the grid, and identifying. The calculation of energy consumption, power, economic estimations relating to tariffs are showed in clear and easy form.

With CODIR is available to calculate the amount to pay for consumer considering energy and power, this calculate can be development on different tariffs type.

CODIR has two operation modes:

- Automatic. This mode provides very recent data about one consumer.
- Study. It allows historic analysis of one consumer performance evolution.

3. ATLAS. It offers demand Characteristics. Planning and Valuation Tool.

ATLAS is an application that allows knowing the characteristics of interruptible demand offered that is operable. Furthermore, ATLAS shows these characteristics in a graphic. This study can be for all consumers or just for a consumer group with specific restrictions.

ATLAS use data which are provided by GECO (static and dynamic). It has access to get data of 10 years before. This capacity allows to analyse the evolution consumer in the long time.

C. Further Information

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3. TECH CASE # 2: RESEARCH AND DEVELOPMENT OF A NEW METHODOLOGY ABOUT DEMAND MANAGEMENT CAPACITY OF LARGE CONSUMERS OF ELECTRICITY

A. Brief Overview

The aim of the study is the development of a new methodology based on surveys that will help to determine the potential of demand management for large consumers of electricity. Based on the results, the study identifies mechanisms that would permit to increase the energy and economic efficiency of electrical systems.

Final results expected:

For electric systems:

- The economic side of management options is considered to:
  - Increase the energy efficiency of the system
  - Increase the reliability of supply
  - Comply with Kyoto (substitution of contaminant energies)

For Consumers:

- Reduction of Energy bill
- Lower energetic costs and higher economic productivity and better market competitive position

B. Description of the DR Technology

Four large consumers have been contacted/surveyed during development project:

- Motor vehicles manufacturer
- Fish farming
- Airport
- Trains manufacturer

The contents of previous surveys were used for complement the results:

- Siderurgical Arc furnaces (steel industry)
- Cement
- Hydrolysis

The survey has eight sections:

I. Characterization
   Identification data: Name, address, connection
   Consumption and power: Electricity and other sources.
   Load curve: Load curve, forecast
   Production: Organization, characterization, variability
   Costs: Energetic costs and relationship between energetic and production costs
   CHP and security generation

II. Electrical supply contract
   Tariff/Market:
      TARIFF: Tariff characteristics
      MARKET: Supply contract Identification data: Name, address, connection

III. Processes description
- Manageable processes:
  - Manageable power
  - Manageability scale

IV. Manageable processes analysis
- Process description: Functional description, load curve
- Future previsions: Substitution, evolution
- Active power management:
  - Management pattern: Power, notice time, duration, frequency.
  - Costs and barriers for its implantation (technical, logistical)

V. Reactive power management
- Capacity to supply/absorb reactive power:
  - Technology
  - Power (KVAr)
  - Notice time
  - Manual/automatic
  - Actuation periods

VI. Management options
- Application, barriers and suggestions:
  - Demand modifications to get profits in market
  - Growing of modulation
  - Relay for disconnecting charges
  - Collaboration with Operator System in operations
  - Offer secondary and tertiary regulation
  - Voltages control
  - Interruptible tariff
  - DESTENS contract (for access tariff: frequency relay and reactive power management)

VII. Electric market regulation
- Tariff to market change
- Risk management and evaluation
- Opinion about the deregulation of electricity

VIII. Demand management
- Opinion about the participation in management programs:
  - If consumer participates in management programs:
    - Strategies, power, profits, characteristics
- Suggestions

C. Conclusions

- Consumers aren't aware of their management options could be interesting for the System operation.
- There is a wide range of load management alternatives reported.
- The weight of manageable power in relation to the contracted power is frequently high.
  - Car industries: 22%
  - Fish farms: 96%
  - Airports: 96%
  - Train builders: 81%

- Consumers could interrupt consumption and give power from their generation capability. This can be done simultaneously or not.
  - Motor vehicles manufacturer:
    - 10 MW manageable
    - 1 MVA of security/emergency generation
  - Fish farm:
    - 3 MW manageable
    - 6.4 MVA of security/emergency generation
  - Airport
    - 14.5 MW manageable
    - 21 MVA of security/emergency generation
- Consumers haven't indicated important technological barriers.
- Consumers that buy the electricity in pool market have flat rate contracts.
- Consumers are not too interested in the market deregulation.
- Consumers consider that complete factory management is more realizable than an only process management.
- Complete factory management requires longer notice.

Extrapolation from Spanish survey:

The surveys' result was extrapolated for all Spain and Europe, the following table shows the result of this extrapolation.

ACTIVITY		SPAIN		EUROPE	
Description	**NACE code**	***Contracted Power MW***	***Reductible Power MW***	***Contracted Power MW***	***Reductible Power MW***
Manufacture of motor vehicles	3410	280	66	1595*	382*
Fish Farming	0502	7	7	-	-
Airports	6323	112	108	-	774
Manufacture of railway equipment	3520	-	50	-	-
** Only UCTE Countries*					

D. Further Information

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4. TECH CASE # 3: INDEL PROJECT (SPANISH ELECTRIC DEMAND ATLAS)

A. Brief Overview

It was initiated in 1988 with the finality to expanding the knowledge of Spanish behaviour in electric demand. In the investigation group participated all electric market actors and the government partially financed the project cost.

The general objectives were:

• Understand the evolution of the electric use in Spain.
• Energy uses identification.
• Create reliable statistically information.
• Determine the needs and technical solution to produce demand data.

Two instrumental outcomes developed were:

• Explain the demand by econometrics model in order to enable the prediction of the different scenarios.

• Create information of the demand on the greater segments of consumption, measuring directly on voluntary consumers representatives of the population and consulting directly to the consumers.

B. Description of the DR Technology

The investigation itself follows there steps:

•Initiate explanatory models with only available data (bus demand of generator plant).
•Initiate direct measure in the commercial and residential sector through surveys and power meters reading.
•Place new power meters.
•Develop explanatory and predictive models of the electric demand with the new data obtained by the power meters.
•Investigate the demand of the tourist services in Balearic Islands by controlled samples.
•Investigate the industrial and services sectors.

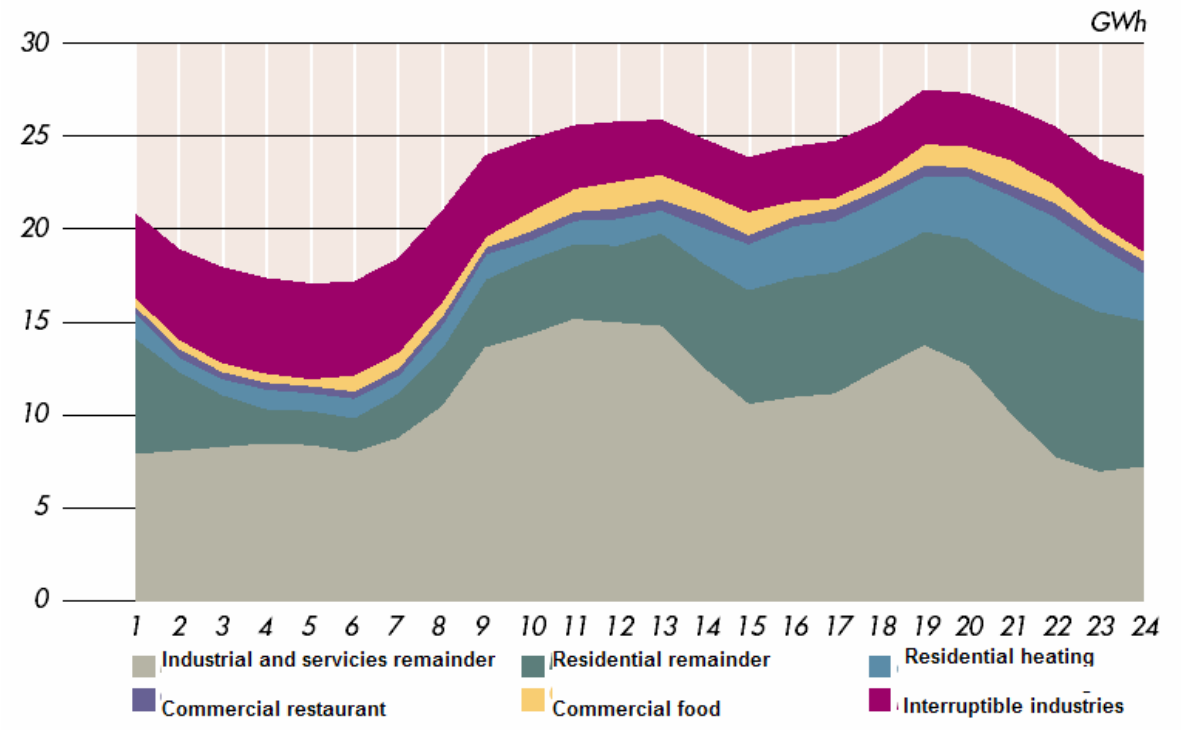
C. Results

The variable measures by the project are:

• Monthly Energy.
• Hourly Power.
• Equipment.
• Hourly use.
•Attitudes and environmental behaviours and energy efficiency.(environmental temperature, working days and economic activity effects).

Currently is possible to estimate the system demand in any hour by the consumption of 8 large segments of consumers. They represent the 51% of maximum power system demanded.

The 40% of the maximum demand is explained by the consumption of all its greater electric uses and registered its forms of use.



Electric power demand of system peak (16/12/1997).

Uses/Segments	Maximum Weight		Weight (%) of System Peak
	%	Hour	
Great Interruptible Industry and Hourly Rate	30	5	10.3
Commercial restaurant	6	22	2.1
Commercial food	6	12	4.1
Industrial and servicies remainder	59	11	49.3
Residential sector	52	23	34.2
Heating	16	22	11.2
Lighting	19	1	8.9
Television	9	22	4.1
Hot water	4	8	2
Refrigerator	4	5	2.5
Others	8	14	5.5
TOTAL	**-**	**-**	**100**

Composition of maximum hourly power of system peak (16/12/1997).

D. Further Information

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5. TECH CASE 4 # : INTERRUPTION FLEXIBLE MANAGEMENT PROGRAM (IFMP)

A. Brief Overview

Since 2002 a new Interruption Flexible Management Program (IFMP) has been development by REE (Operator System) in collaboration with large industrial consumers. We expect that the system initiate operations in December of 2004; although right now some delays could delay the proposed date.

The high security specifications emitted by the communication and control measurement hardware will allow the consumers to offer more complex services in the future. Accomplishing this, the participation of the demand will be increased.

Additionally, IFMP system increases the technical relation Consumers-System Operator. The system allows the collaboration between consumers and REE in the knowledge and development of Demand Response about its potential, prediction and certainty.

B. Description of the DR Technology

I. Requirements

Requirements of participation:

- To be supplied under a general tariff in high tension.
- To Offer an interruptible power (Pmax) greater that 5MW, in the case for off-peninsular systems smaller powers can be admitted.
- To have the adequate measurement hardware.

The flexible interruptibility types are shown in the following table:

Flexible Type	Characteristic,
A	• A maximum period of four continuous hours, decided by REE, when the company reduces its consume in Pmax stipulated in the interruptibility contract. • Another period lasting a maximum of four continuous hours, decided by REE when the company reduce its consume only 50 per cent of the Pmax. • All the other twelve hours, the company shall be free to maintain whatever capacity it has contracted. • REE shall state explicitly, giving minimum advance notice of two hours for the profile of the twelve hours of interruption. • The minimum advance notice to order a company to keep to the Pmax limit can be no less than one hour.
B	• A maximum period of three continuous hours, decided by REE, when the company reduce its consume in Pmax stipulated in the interruptibility contract. • Another period lasting a maximum of three continuous hours, decided by REE when the company reduce its consume only 50 per cent of the Pmax. • All the other six hours, the company shall be free to maintain whatever capacity it has contracted. • REE shall state explicitly, giving minimum advance notice of two hours for the profile of the six hours of interruption. • The minimum advance notice to order a company to keep to the Pmax limit can be no less than one hour.

The number of interruptions that a client can be submitted is limited by:

- 30 maximum annual interruptions.
- An interruption for day.
- Five interruptions each week.
- 120 monthly hours.
- 240 annual hours.

II. IFMP Operation

The System Operator is responsible of the Management System: is in charge of emitting, controlling and supervising all orders of interruption, change and/or annulment.

The participating consumers will communicate to the System Operator and its Distribution Utility, an hourly energy demand program for the following two months. Besides it will communicate the dates predicted of maintenance and/or stop of their installations although they be out of the time limit of two months before mentioned.

The hardware used by Customers and the Operator System should be provided with surveillance and supervision communications elements, in order to generate and to transmit the corresponding alarm signs that to facilitate to the SGFI the elaboration of the necessary conditions for the correct decision take and application of the interruption orders.

III. Measurement Hardware

The consumer's measurement hardware will provide information of the energy demand in real time. Besides, it should be capable to send to the System Operator acknowledgement of the state of orders of interruption: its change and/or annulment. The measurement hardware will be also formed by current and voltage transformers, sign converters and conditioners, besides they should be formed al least by the following:

- A Maximum-Power meter with integration periods of fifteen minutes.
- A Maximum-Power meter with integration periods of five minutes, synchronize with the start of the power reduction period that correspond with an interruption that register the maximum power demanded by the same.
- Internal clock that indicates the date and hour of the measures registered by the maximum-power meter.
- Manual Access to print demand data of the last interruption registered every five minutes.
- A communication unit for the reception of interruption orders, its change and/or annulment and for the emission of the corresponding acknowledgements, for the emission of analogical measures of active and reactive power in real time files with demand programs and files with data measures collected after each power interruption order.

IV. Communication Hardware

The communications of the SGFI will be carried out through a solution with IP-VPN, Virtual Private Network based on Internet Protocol, with the following characteristics:

- Establishment of a VPN service without a direct connection to Internet.
- The topology of the service will be a Star with the traffic concentrated in a central point located in the System Operator's workplace.
- The central point will be connected to the private network with redundancy lines dedicated using preferably Synchronous Digital Hierarchy (SDH) or Asynchronous Transfer Mode (ATM).

- User's data link requirements of the SGFI should comply with the following minimum requirements: technology of Asymmetrical Digital Subscriber Line (ADSL); 128Kbps network connection; 256 Kbps user connection; 10% traffic guarantee with a permanent connection.
- They should be protected by backup line that should be connected preferably to an Integrated Services Digital Network (ISDN)

V. IFMP Capacity and Experiences during operations

The total interruption capacity of the system is esteemed in 2600MW approximately. The instant interruption capacity is considered greater to the 1000MW. The capacity to absorb or to deliver energy revives of transport network is over 500MVAr.

Currently the total MW by step of interruptible power offered is observed in the following table:

Rank of Power	Total power offered (MW)	Percentage on the total power offered
$P_{interruptible} > 50\ MW$	615.080	25,71%
$25 < P_{interruptible} \leq 50\ MW$	199.100	8,32%
$15 < P_{interruptible} \leq 25\ MW$	214.117	8,95%
$10 < P_{interruptible} \leq 15\ MW$	519.861	21,73%
$5 < P_{interruptible} \leq 10\ MW$	576.651	24,11%
$P_{interruptible} = 5\ MW$	210.000	8,78%
$P_{interruptible} < 5\ MW$	57.362	2,40%
TOTAL	**2392.171**	**100%**

Source: REE

Table 1.- Total interruptible power offered by rank of power

In the next figure we show an example of the consumer response in attention of a REE Interruption order.

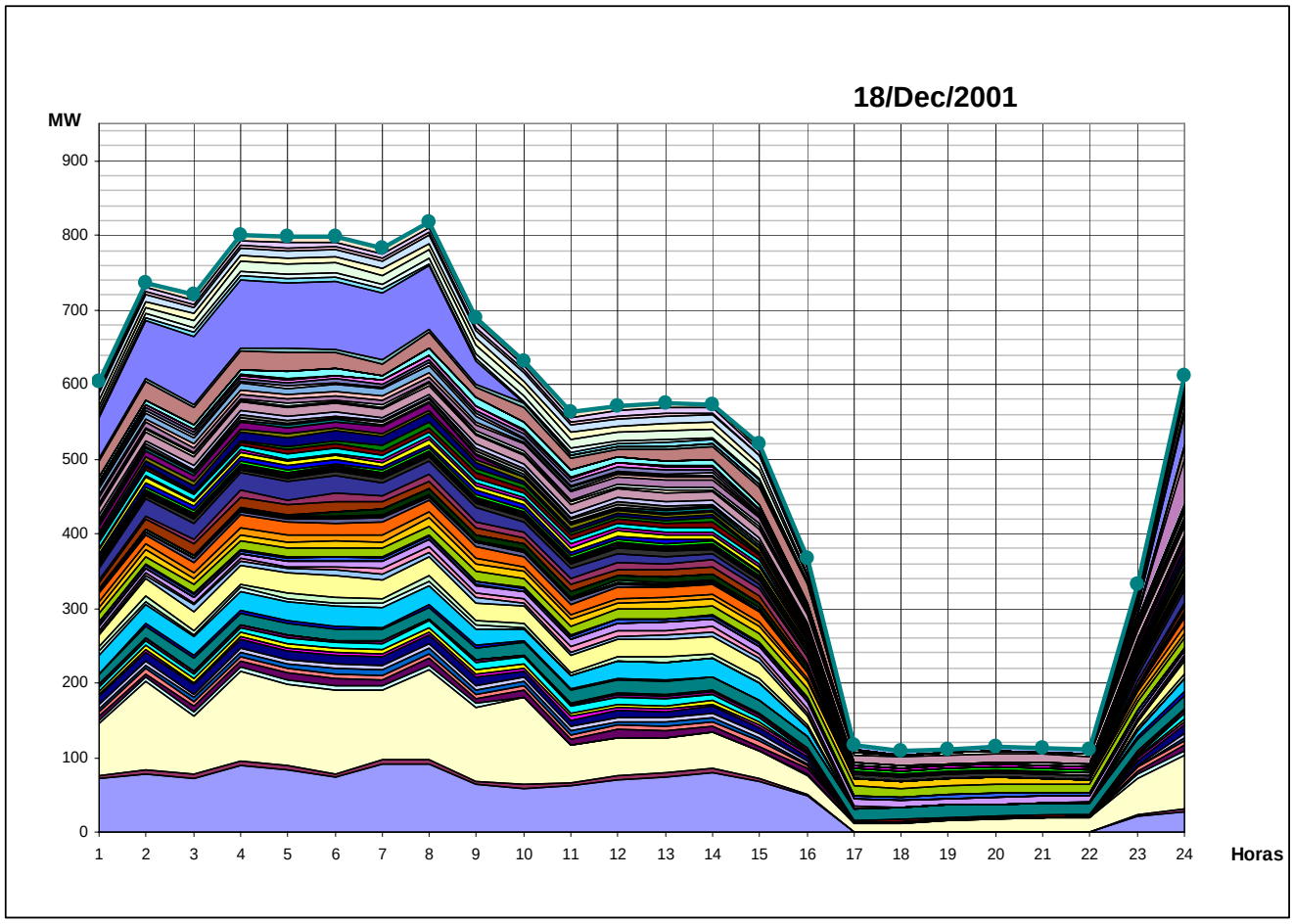

Figure 1. Consumers Load Profile in response of a REE Interruption order in December 18, 2001.

C. Further Information

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Paseo del Conde de los Gaitanes, 177 · 28109 Alcobendas · Madrid
Tel. 91 650 85 00 / 20 12 . Fax 91 650 45 42 / 76 77
www.ree.es

Camino de Vera s/n, Edificio I-4 46022 Valencia
Tel. 96 387 72 70 , Fax 96 387 72 72
www.iie.upv.es