



IBERDROLA

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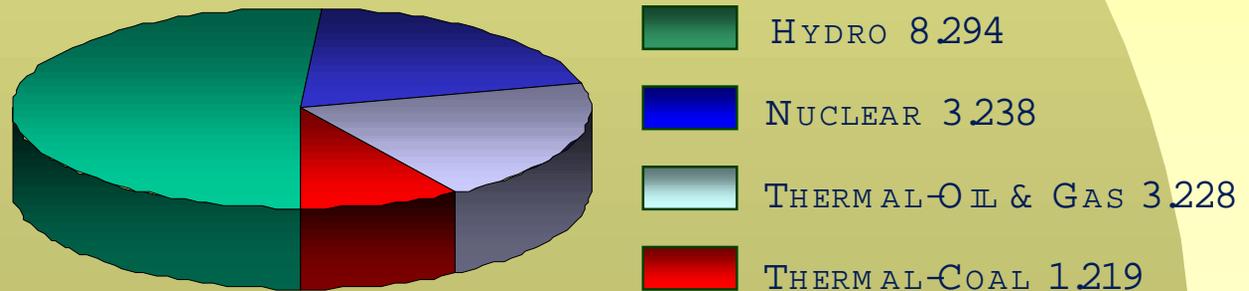
Power Generation

Business Area

One of Europe's leading electricity companies, providing a full power service involving the generation, transmission, distribution and marketing of electricity.

It provides services for a market of more than 16 million people and covers 38 % of the total territory of Spain.

IBERDROLA
CAPACITY
(MW)



Technology Demonstration Center

IBERDROLA
DIGEN

COMPANY

GENERATING CAPACITY (MW)

PRODUCTION (GWh)



EDF (F)

106.574

444.448



ENEL (I)

55.906

190.634



RWE (D)

26.460

124.300



NATIONAL POWER (GB)

20.243

92.300



PREUSSENELEK (D)

18.781

103.800



VATTENFALL (S)

17.319

79.300



IBERDROLA (E)

15.979

47.564



ELECTRABEL (B)

14.319

64.000



POWERGEN (GB)

12.000

65.300



PPC (GR)

9.198

37.550



EDP (P)

8.125

29.435



SYDKRAFT (S)

6.500

30.100



ELSAM (DK)

4.047

14.401



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D I G E N

HYDROELECTRIC PLANTS



POWER 8.294 (MW)

N ° OF FACILITIES 187

HYDRO PRODUCTION 17.291 GW h

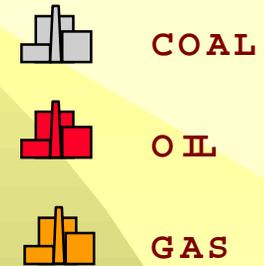
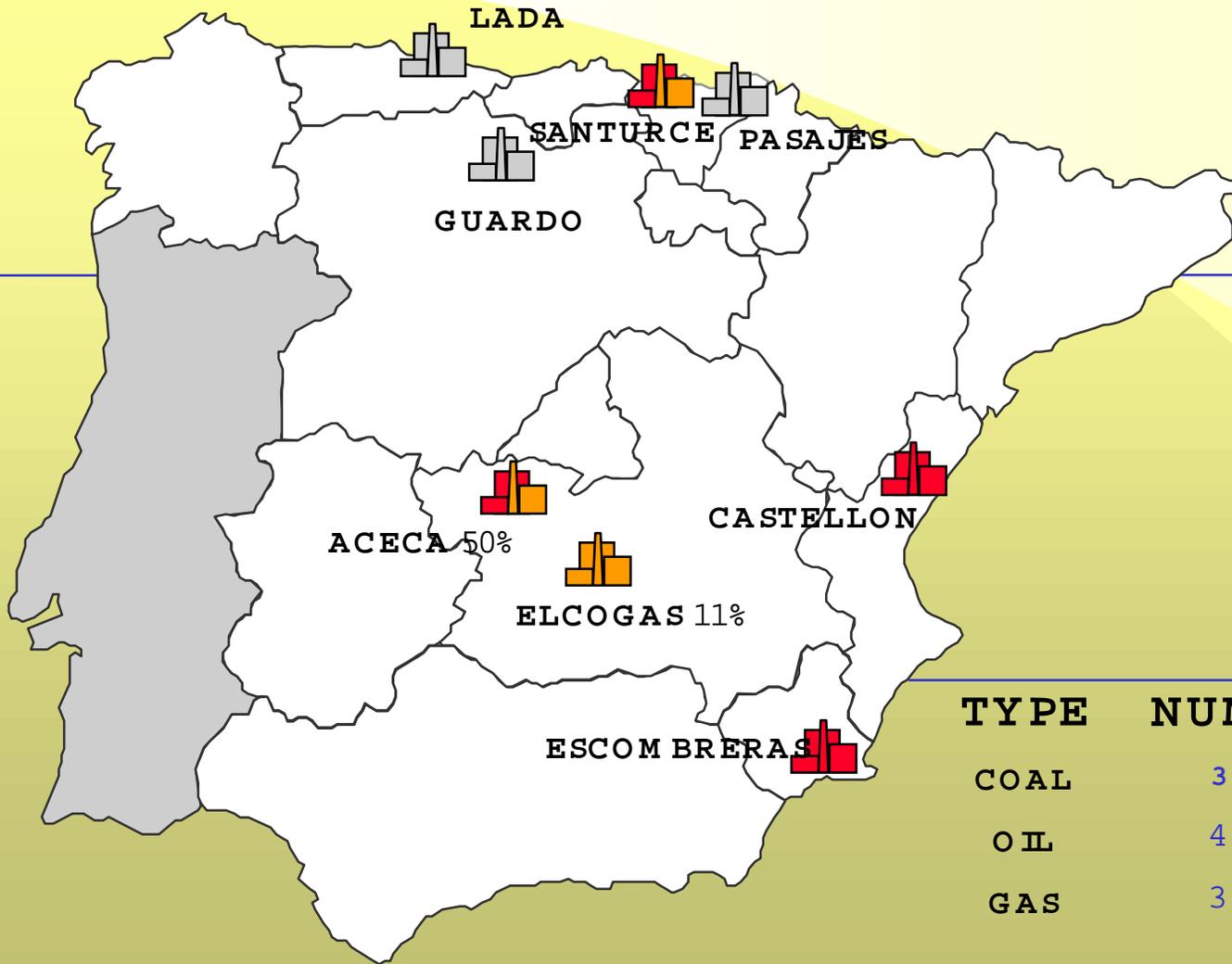


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IBERDROLA
D I G E N

THERMAL PLANTS



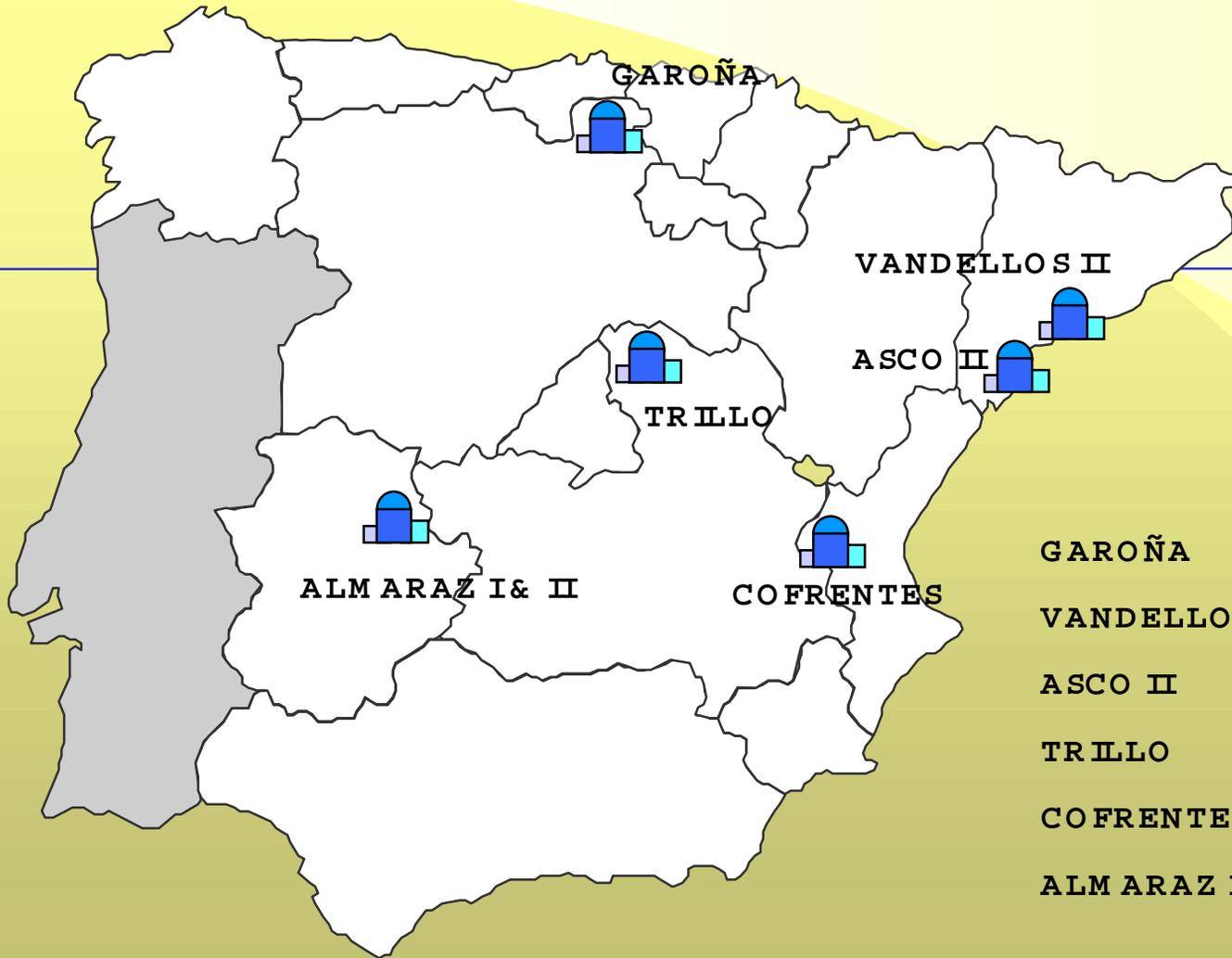
TYPE	NUM .	MW	GW h
COAL	3	1.219	5.942
OIL	4	2.657	206
GAS	3	571	901
TOTAL		4.447	7.049



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NUCLEAR PLANTS



	%	MW
GAROÑA	50	233
VANDELLOS II	28	282
ASCO II	15	146
TRILLO	48+1	522
COFRENTES	100	1025
ALM ARAZ I & II	52 + 52	1030

R & D
PLAN

OBJECTIVES OF THE R & D PLAN



To formalise and develop the technological demands and challenges that have arisen in the installations.

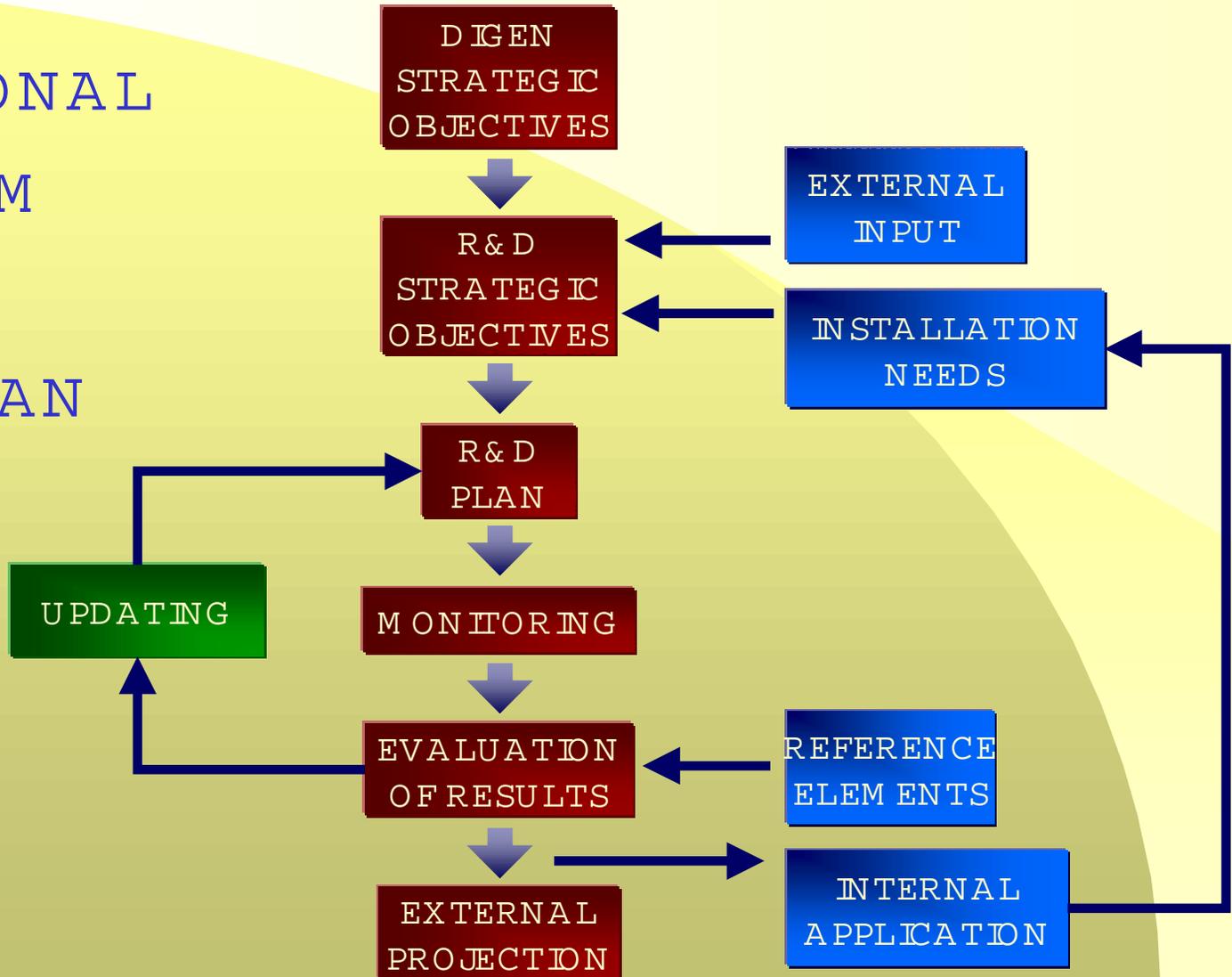


To establish R & D activities with a complete application cycle implementation.



To define a series of activity priority lines.

FUNCTIONAL DIAGRAM OF THE R & D PLAN



R & D ACTIVITY AREAS

1. Robotics and automation.
2. Materials technologies.
3. Maintenance technologies.
4. Lifetime management.
5. Environment and safety.
6. New power generation technologies.
7. Fuels.
8. Efficiency and power quality.
9. Management of the power generation system.
10. Information technologies.

TDC

WHAT IS TDC ?



The Technology Demonstration Center constitutes an essential support to the activities performed by IBERDROLA's Power Generation Business Area.

The TDC represents a competitive edge in the new liberalised electric power generation market.

OBJECTIVES



Accessible technologies evaluation.



Evaluation and introduction of new technologies.



Technological transfer to and from the company.



Reduction of innovation market introduction time.

TDC FOLLOWED STRATEGIES

Establishment of the technology inside the market; use of niches of the applications defined in the former stage.

Characterisation of possible uses and existing applications related to technological developments.

APPLICATION NICHES

Planning of an introduction line of the defined applications into the market

CHARACTERISATION

PLANNING

MARKET INTRODUCTION

Basic Research of novel technologies.

BASIC RESEARCH

Defined applications marketing.

MARKETING

CAPACITIES



Research facilities installations.



Wide serviceable infrastructure.



Highly qualified permanent human resources.



Extensive technological know-how.



Ample surface availability.

ACTIVITIES

- ✓ Performance of R & D projects; National and international Involvement.
- ✓ Technology characterization; development and testing.
- ✓ Design, construction and operation of new technologies based facilities.
- ✓ Maintenance and operational system 's design and adaptation with views to the improvement of efficiency and quality energy processes.
- ✓ Technical and economical feasibility studies.
- ✓ Technical and technological Advisory Services.
- ✓ Technology transfer and dissemination.
- ✓ Equipment and system testing and analysis.

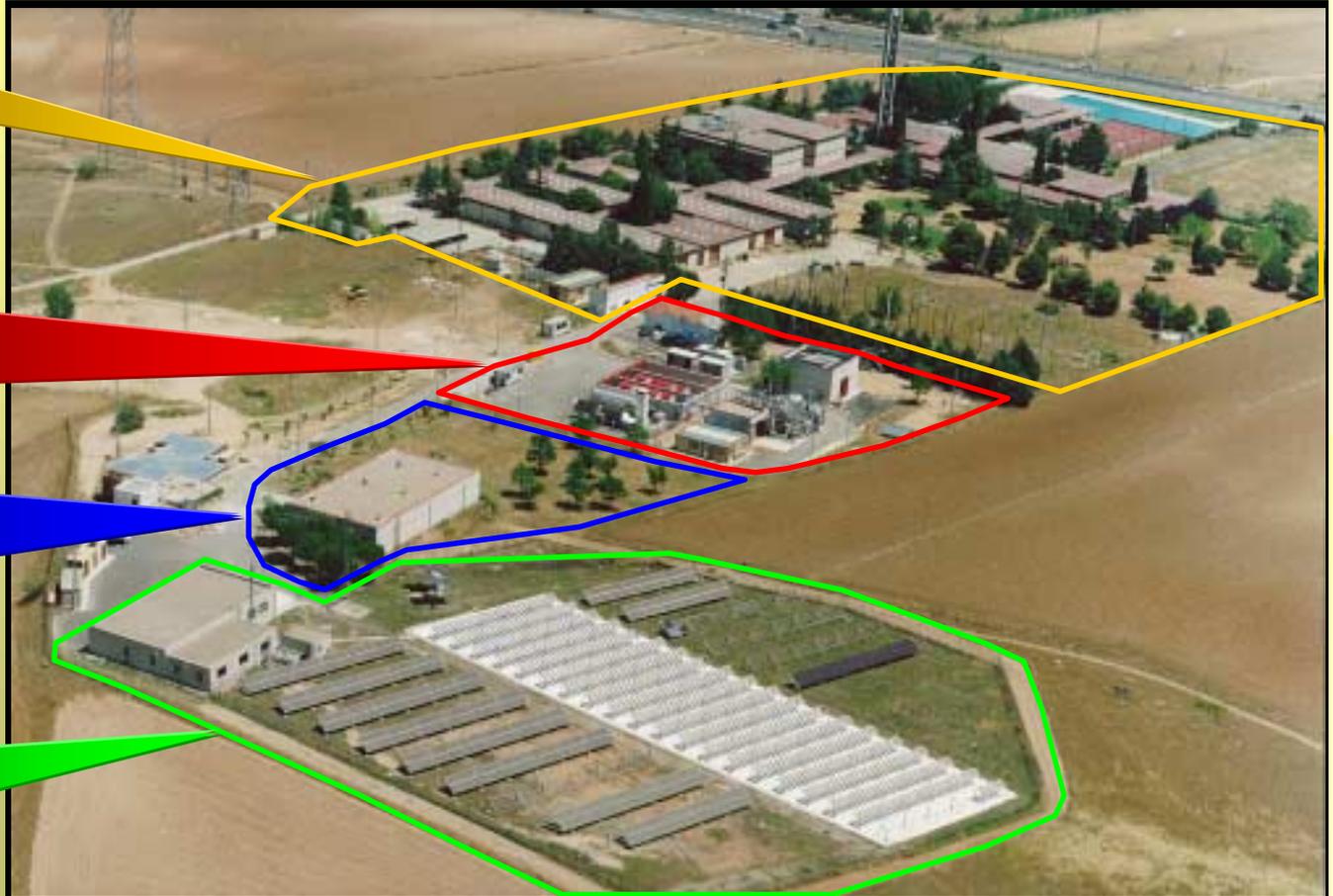
TDC STRUCTURE

TRAINING
CENTER

NEW POWER
GENERATION
TECHNOLOGIES
AREA

ENERGY
EFFICIENCY &
QUALITY
AREA

RENEWABLE
ENERGY
AREA



ENERGY EFFICIENCY AND QUALITY AREA



Strongly focused towards Energy Storage Systems.



Extensive knowledge on Rational and Efficient Use of Energy.



Concern about the Society requirements on High Quality Energy Supply under a Liberalised Market Scheme.

ESCAR Project

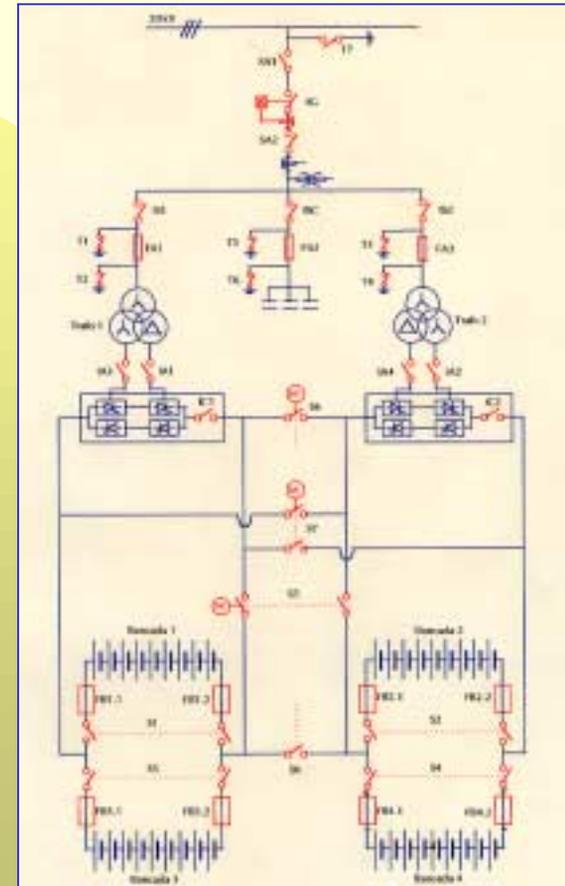
2 M W Battery Energy Storage System

Two different uses:

Load levelling (1 M W ; 4 M W h)

Peak Shaving (1.2 M W ; 2 M W h)

First facility in Europe regarding power and stored energy, and pioneer at load limitation.



ESCAR Project

Battery system

768 high capacity lead-acid cells grouped into 4 connected banks.

Elements: 20-EAN-HE-120 2400 Ah (C5)

Innovations introduced:

Automatic electrolyte filling system .

Electrolyte stirring system .



Technology Demonstration Center

ESCAR Project

Power system

2 MW static reversible unit made up of four thyristor bridges operating by way of natural switching.

Reduction of harmonics and reactive consumption by means of a transformer special disposition (dodecaphase effect).

Control system

Output and Input Continuous monitoring through voltage, current, density, temperature and level determining.

Automatic operation by means of a modular program mable automation.



RENEWABLE ENERGY AREA



Biomass, Photovoltaic and Thermal Solar, Wind Power and Hybrid systems developments.



Studies on the implementation of these technologies as an alternative to conventional generation.



Analysis and Studies on Market introduction of new technologies.

MOST RELEVANT PROJECTS

PV SCHOOL . Photovoltaic School

UM SEF . Photovoltaic mobile system

PV ISUAL . Photovoltaic Fence

D ISS II . Direct Steam Generation

B IO POW ER (B iom ass Pow erG eneration)



NEW POWER GENERATION

TECHNOLOGIES AREA



Advanced Technologies Development: Fuel Cells, Fuel monitoring, Advanced Thermodynamic Cycles, High energetic fluid gasification.



Integration and definition of New Power Technologies with Conventional Power Plants (Gasification, Combined cycles..).



Fuel Cells development and implementation.



Environmental New Generation considerations.

MOST RELEVANT PROJECTS



100 kW MCFC Demonstration Plant.

500 kW cogeneration plant conceptual design.



50-150 kW MC Fuel Cell Testing Facility Installation.

MOST RELEVANT PROJECTS



New Stack Generation development and evaluation through prototypes.



Power plants simulation for complex systems based on gasification (coal/biomass) and combined cycles integration.



SERVICE OFFER

R & D Activities

Support regarding R & D project developments

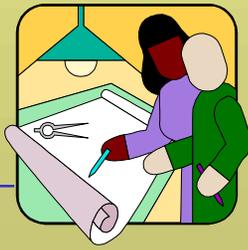


Test execution

A accomplishment of test concerning all sorts of systems and equipment



Technological Advice in facility development and implementation



Technological Advice and Consultancy

Dissemination

Demonstration and diffusion of various technologies

