

19-20 May
2005

**ASSESSMENT OF
OPPORTUNITIES IN RELATION
WITH A SUSTAINABLE ENERGY
FUTURE FOR THE EU**

**RENEWABLE ENERGIES:
SITUATION & PERSPECTIVES IN
THE 2010 HORIZON**

Madrid, 20th May 2005

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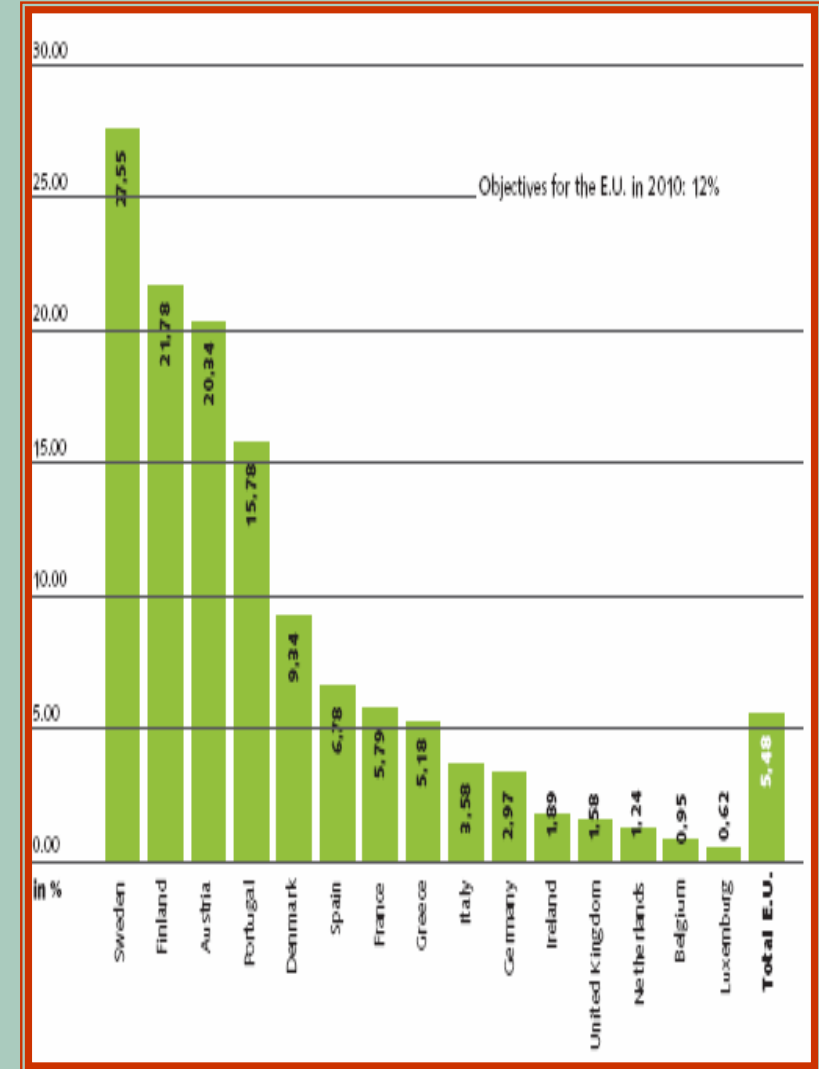
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1. THE SPANISH RENEWABLE ENERGIES IN THE EUROPEAN CONTEXT

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Share of renewable energies in primary energy consumption of European Union countries in 2003

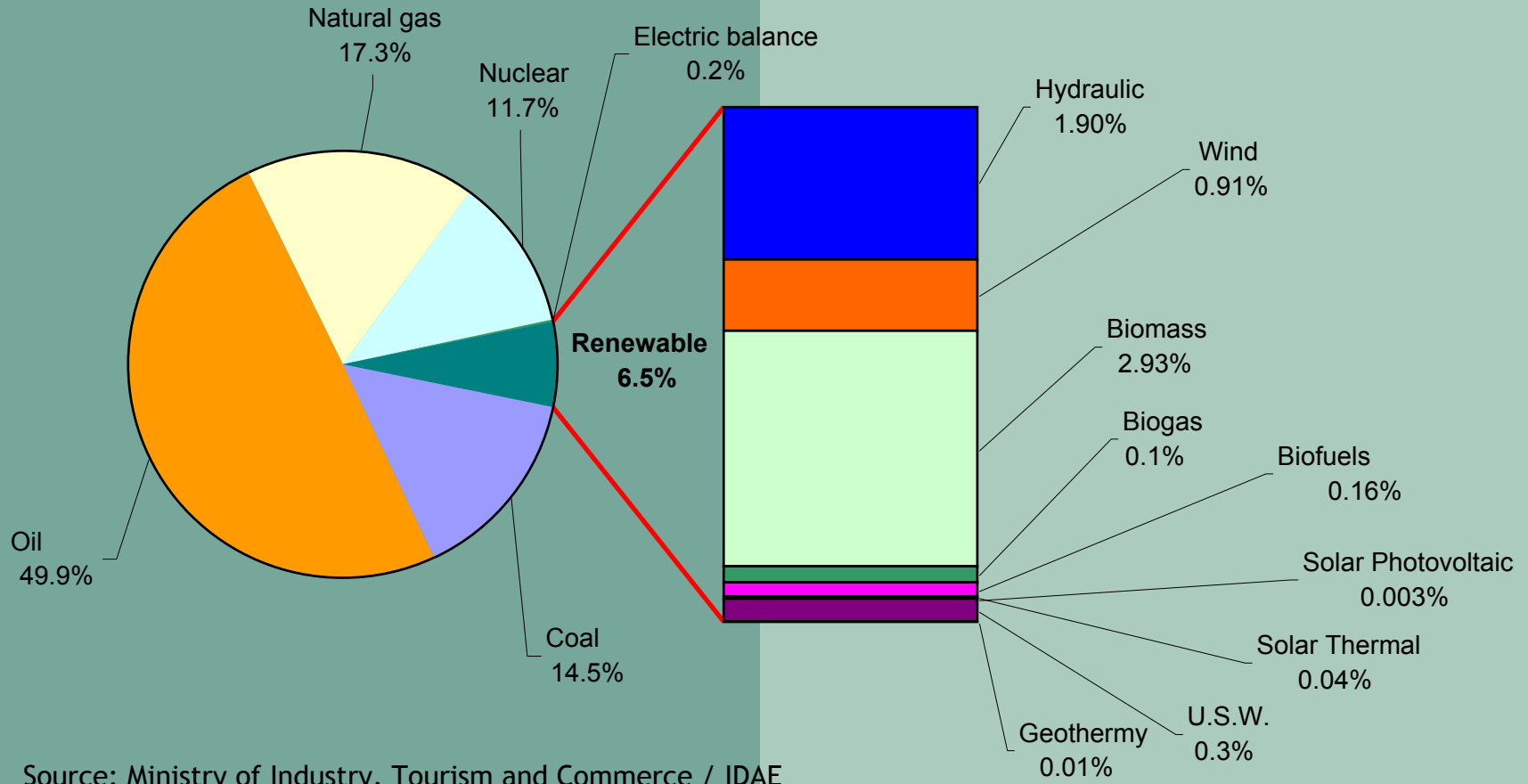
Source: EurObserER 2004



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The Contribution of Renewable Energies to Primary Energy Consumption

2004

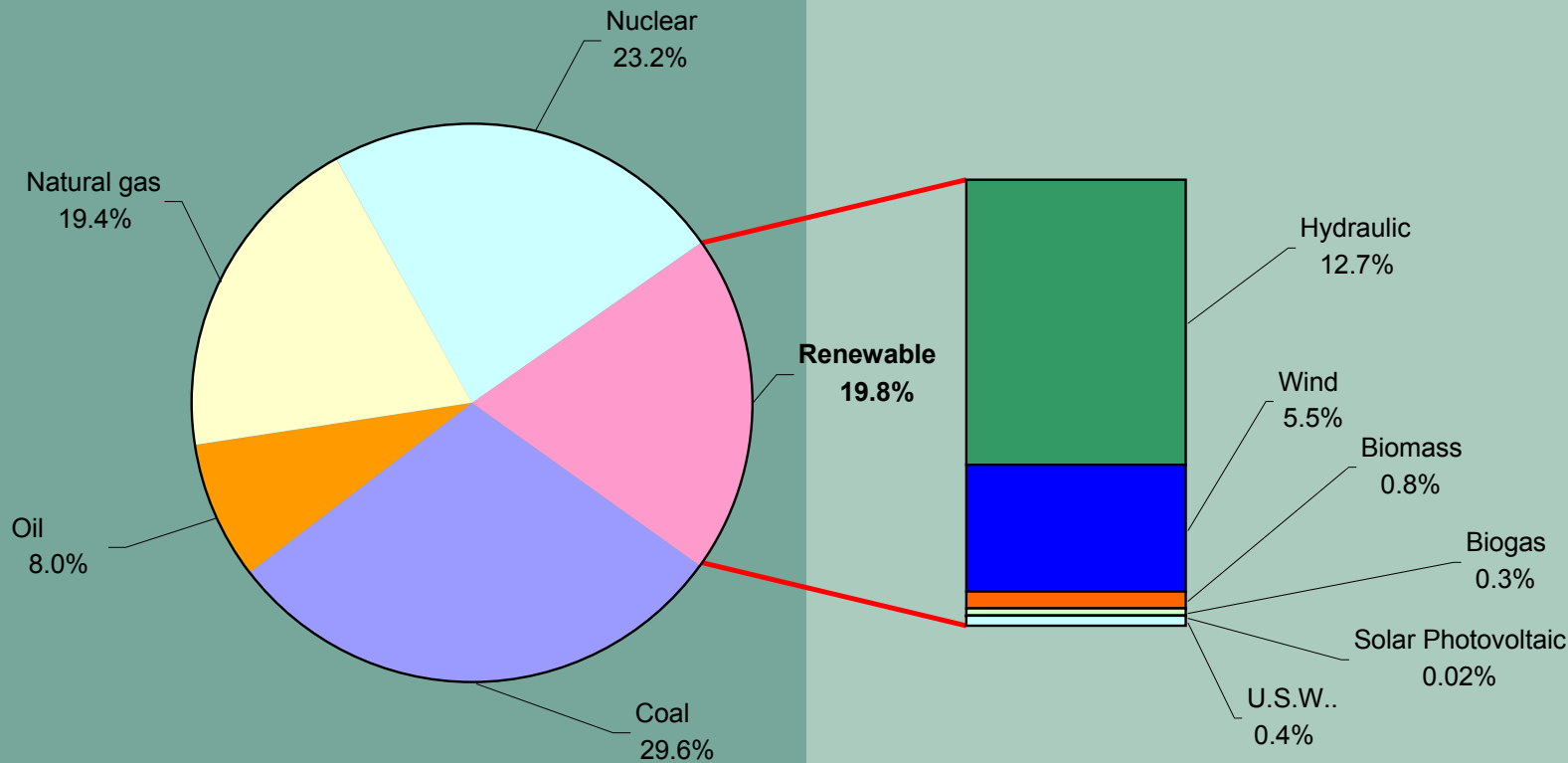


Source: Ministry of Industry, Tourism and Commerce / IDAE

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The Contribution of Renewable Energies to the Production of Electricity

2004

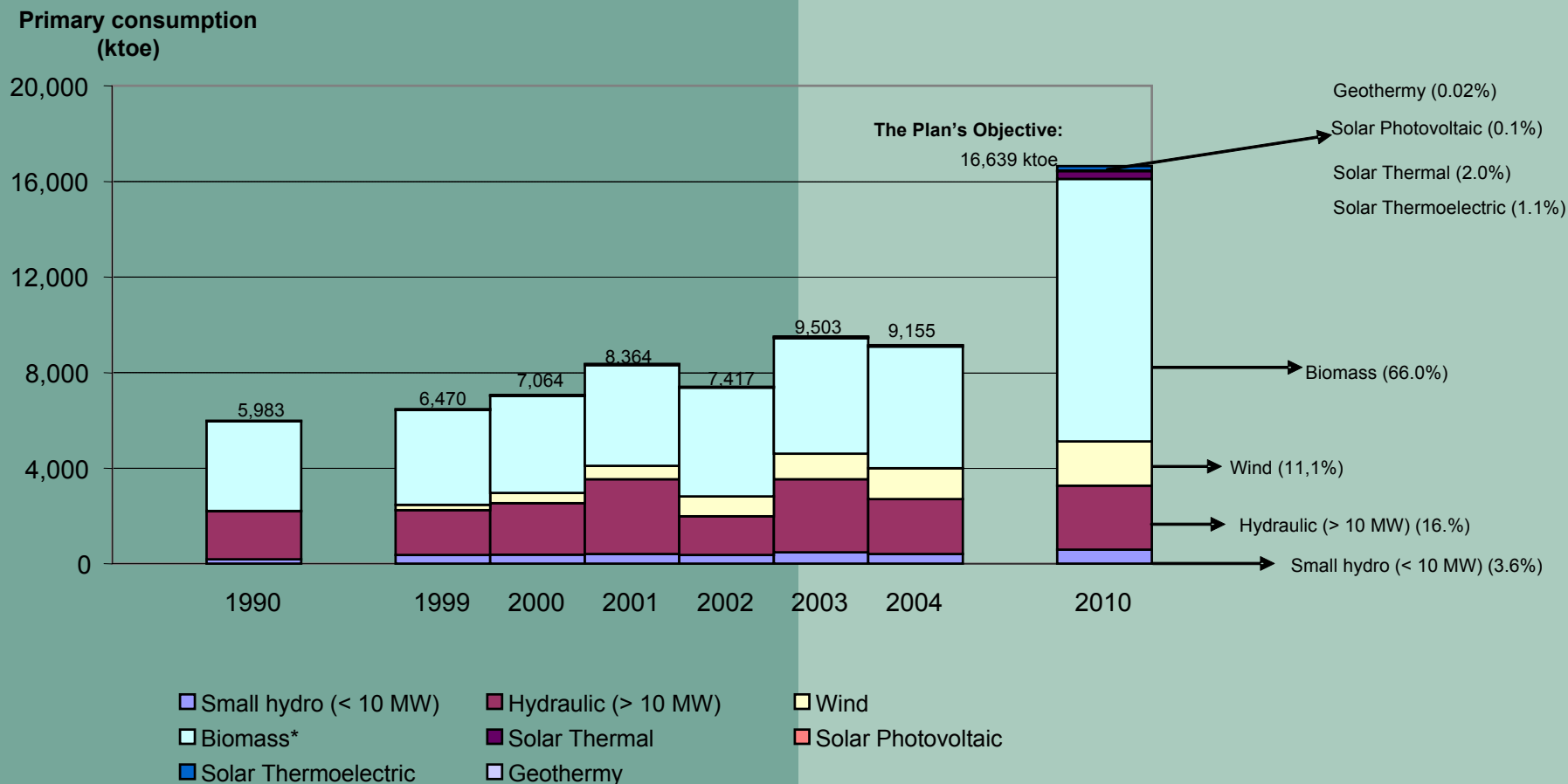


Source: Ministry of Industry, Tourism and Commerce / IDAE

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2. THE SITUATION OF RENEWABLE ENERGIES IN SPAIN

Aggregated Balance: Renewable Energy Consumption in Spain



*It includes U.S.W., biogas & biofuels

Source: IDAE

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2.1 Hydro

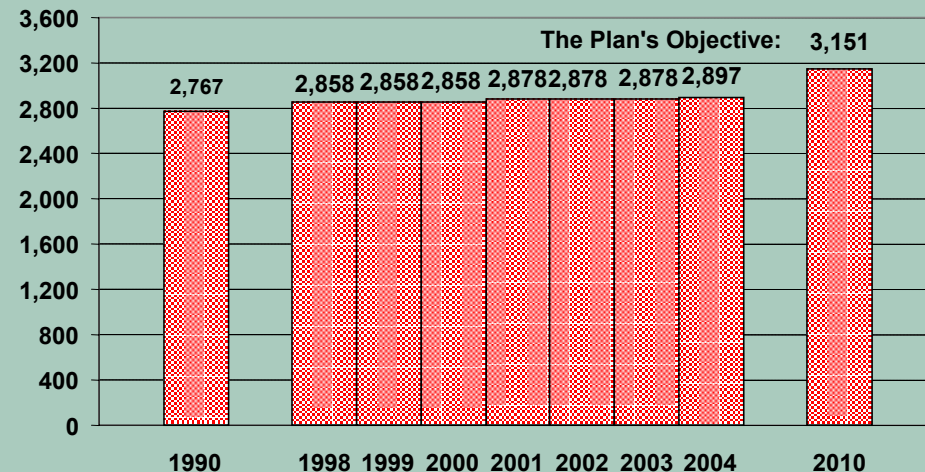
Hydro between 10 & 50 MW

2001: 20 new MW

2004: 19 new MW

- In 2001 & 2004, two plants became operational, with a power of 20 MW & 19 MW, respectively
- 11% of the objectives in the Promotion Plan for 2010 were achieved during 2004.
- Electric power generated in 2004: 5,075 GWh.
- Objective: 350 MW

Installed Hydro Power & Forecasts (MW) (Plants 10 & 50 MW)



Source: IDAE

Small hydro ≤ 10 MW

2002: 37 new MW

2003: 55 new MW

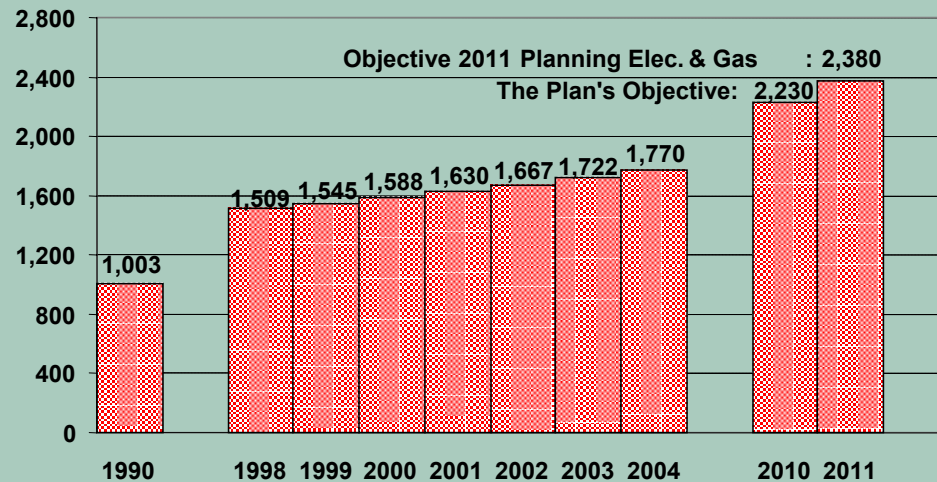
2004: 49 new MW

- Since 1999, some 40 new MW have been put into operation every year.

- In 2004, 33% of the objectives set in the Promotion Plan for 2010 were attained.

- Electric power generated in 2004:
4,729 GWh

Installed Small hydro Power & Forecasts (MW) (plants whose ≤ 10 MW)



Source: IDAE

Small hydro : Problems in 2004

Administrative barriers:

- Long and complex procedures to obtain water concessions.
- Stoppage of the concession files non-resolved.
- Problems with local authorities to obtain municipal permits.

Social & environmental barriers :

- Opposition of certain local ecology groups against the introduction of hydro plants.
- Lack of specific criteria to establish corrective measures.
- Important delays on the solving of Environmental Impact Declaration of new projects or enlargement of existing ones.

IDAE's Project Specifications (a)

Third Party Financing

PORMA Small Hyro Plant

Developer:

NATURENER, S.A. - IDAE

IDAE's Financing:

10.4 Million Euro

Location:

Porma Reservoir.

T.M. Boñar (León)



IDAE's Project Specifications (b)

Third Party Financing

PORMA Small hydro Plant

Investment:

12,4 Million Euro

Setting into Operation:

June 2004

Location:

**Porma Reservoir
T.M. Boñar (León)**

- Features of the awarded tender: Volume of flow 30 m³/s – Jump 71 m.
- 18.6 MW of rated power output
- Technology:
 - 2 Francis Turbines Vertical power axis 7,868 kW.
 - 2 synchronous vertical generators with a rated output of 8,656 kVA, power factor: 0.9 & generation voltage: 6 kV.
 - 1 Francis Turbine Horizontal power axis 3,017 kW.
 - 1 synchronous horizontal generator with a rated output of 3,315 kVA, power factor: 0.9 & generation voltage: 6 kV.
- 45,700 MWh (2,457 h. equivalent) of annual average production
- 3,930.2 toe/year in terms of primary energy
- 44,000 CO₂ t/year avoided (compared to a coal thermal plant)

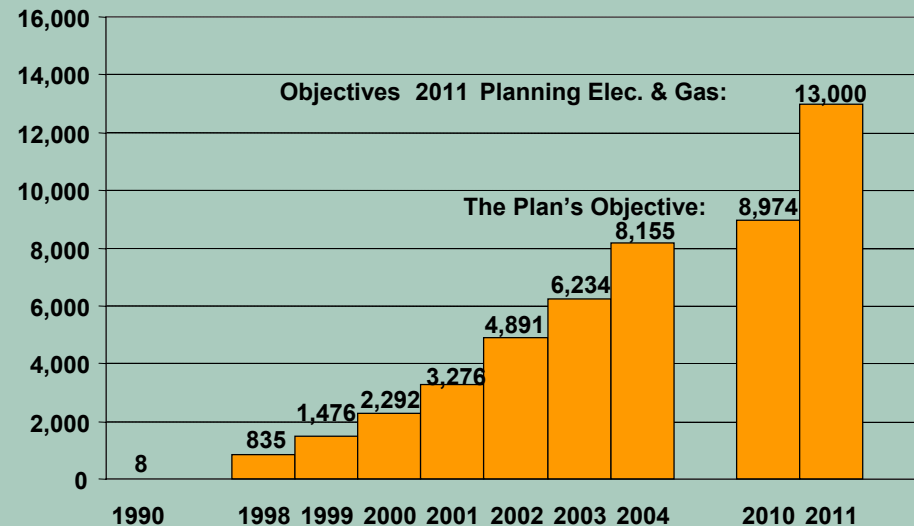
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2.2 Wind

Wind

- 2002: 1,615 new MW
- 2003: 1,344 new MW
- 2004: 1,920 new MW
- At the end of 2004, 90% of the objectives stated for year 2010 in the Promotion Plan had been met, and 60% of the objectives in the *Planning of Infrastructures for Electricity and Gas 2002-2011*.
- Electric power generated in 2004: 15,056 GWh

Installed Wind Power & Forecasts (MW)



Source: IDAE

Wind: Problems in 2004

Regulatory barriers:

- ✓ Connection, network access and & operational conditions.
- ✓ Regulation of the guarantees of origin.

Technical barriers:

- ✓ Development of transport infrastructures.
- ✓ Behaviour of wind generators and farms with regard to the network.
- ✓ Reliability of wind prediction tools.
- ✓ Offshore wind.

IDAE's Project Specifications

Third Party Financing

P.E. Penouta

Developer:

ELECTRA NORTE, S.L.U.

IDAE's Financing:

90.3%

Location:

Boal (Principality of Asturias)



IDAE's Project Specifications

Third Party Financing

P.E. Penouta

Investment:

5.07 Million Euro

Operation:

May 2004

Location:

Boal (Principality of Asturias)

- 5,95 MW of total installed power
- Technology: 7 GAMESA G-52/850 wind generator
 - Unit rated output of 850 kW, Ø 52m
 - Tube tower, hub height: 55m
 - Semivariable pitch & speed
 - Class I (according to IEC), strong wind locations
- 16,000 MWh (2,700 h. equivalent) of annual average production
- 1,376 toe/year in terms of primary energy
- 15,000 CO₂ t/year saved (in comparison to a coal thermal plant)
- Job creation:
 - 80 men-year (Design, Construction and Assembly)
 - 2 jobs (O&M)

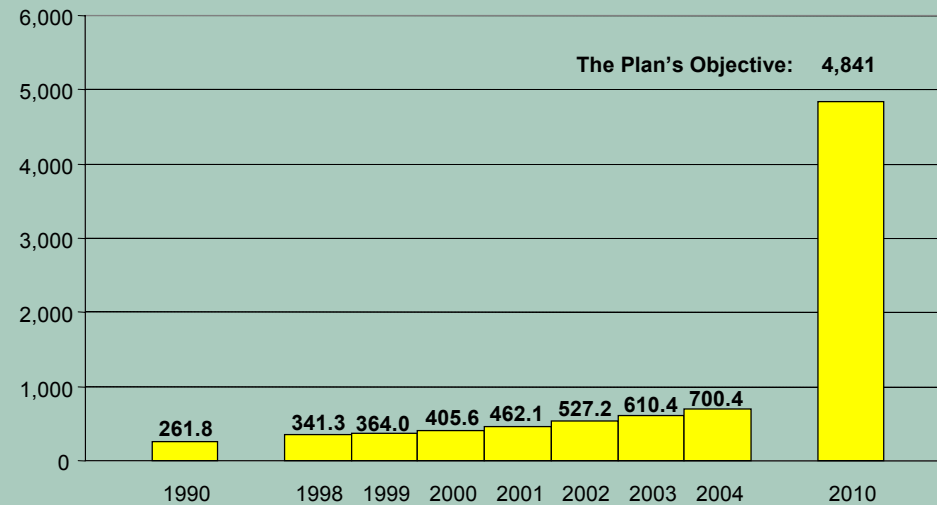
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2.3 Solar Thermal, Thermoelectric & Photovoltaic

Solar Thermal

- 2002: 65,101 new m²
 - 2003: 83,272 new m²
 - 2004(p): 90,000 new m²
- At the end of 2004, 8% of the objectives fixed by the Promotion Plan had been achieved
- Thermal energy generated in 2004:
54 ktoe

Intalled Surface Area of Solar Collectors & Forecasts (thousands of m²)



Source: IDAE

Solar Thermal: Problems in 2004

- Strong dependence on subsidies
- Rejection of promoters, architects and building contractors
- Lack of fiscal incentives
- Lack of support and technical documentation for the execution of facilities
- Poor specific training. Introduction of new agents
- Very few good practice/ exemplary projects

IDAE's Project Specifications

Hot sanitary water production in hotel facilities

Gran Tinerfe Hotel

*Third Party Financing.
IDAE's Participation 40 %*

*Location:
Adeje (Tenerife)*



IDAE's Project Specifications

Hot sanitary water production in hotel facilities

Hotel Gran Tinerfe

*Third Party Financing.
IDAE's Participation 40 %*

*Location:
Adeje (Tenerife)*

- 300 ESE TF-7911 flat gazed solar panels (510 m²).
- South facing and tilted at an angle of 40 °.
- Location: on the roof of one of the hotel buildings, in banks of 5 units connected in inverted return.
- 8 deposits of 5,000 l and 6,000 l, and 1 plate exchanger in the engine room.
- Remote control system through Viterra Sensonic.
- Auxiliary facility with diesel fuel boiler.
- Estimated saving: 304,271 toe/year.
- Year of operation: 1998.
- Supplying firm: PROCALOR, S.L..

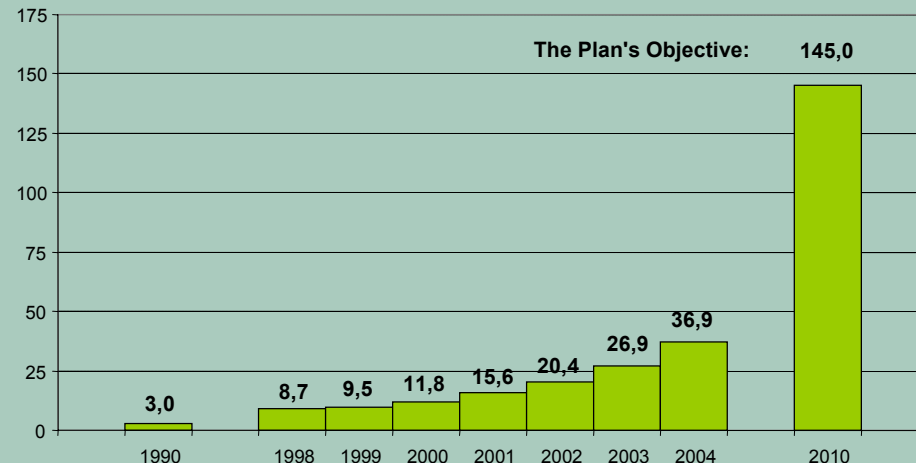
Solar Thermoelectric

- The first commercial PS-10 plant will enter into operation in 2006
 - 5 additional projects in the development phase, with a power capacity of over 300 MW.
 - ANDASOL is a remarkable project, with 50+50 MW and cylinder parabolic technology.
- The activity has taken-off thanks to:
 - RD 436/2004: 250% Premium & 300% Rate.
 - RD 2351/2004: hybridation with gas, up to 15% produced in market option or 12% in the opposite case.

Solar Photovoltaic

- 2002: 4.8 additional MWp.
- 2003: 6.5 additional MWp.
- 2004(p): 10 additional MWp.
- At the end of 2004, 21% of the increase objectives stated by the Promotion Plan had been achieved.
- Electric power generated in 2004: 55 GWh

Solar Photovoltaic Power and Forecasts (MWp)



Source: IDAE

Solar Photovoltaic: Problems in 2004

- RD 436/2004, of 12th of March.
- Strong dependence on premiums and subsidies.
- Procedures for connection points:
 - Low voltage
 - High voltage
- Administrative proceedings
- Lack of regulation in the design of new facilities

Solar Photovoltaic: Remarkable cases.

SOLARIZATE: Network of Solar Schools

(www.solarizate.org)

Current status of the existing installations:

- 18 already grid connected.
- 16 finished and with permits underway.
- 2 installations are in construction phase
- 3 with works about to start.
- 6 projects to be signed.
- 7 new feasibility studies underway.

PROJECTS UNDER WAY

NETWORK PROJECT OF SOLAR SCHOOLS



Solar Photovoltaic System at the Secondary School Building Infanta Elena. Galapagar (Madrid)

- Installation of 2.65 kWp with a power of 2.5 kW.
- Special Scheme awarded.
- Administrative authorisation awarded.
- Contract signed with the distribution company (IBERDROLA).

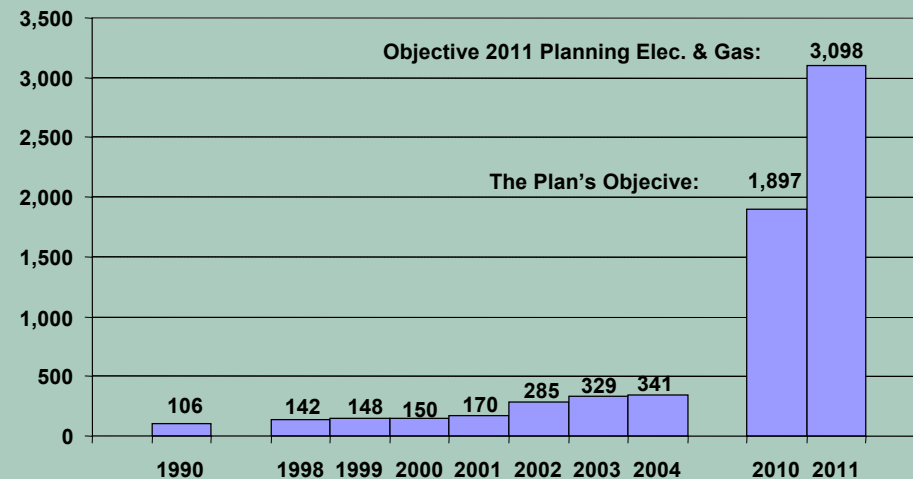
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2.4 Biomass, Biogas, Urban Solid Waste & Biofuels

Biomass – Electric Uses

- 2002: 115 new MW
- 2003: 44 new MW
- 2004: 13 new MW
- 12% of the objectives established in the Plan and 7% of the objectives in the *Planning of Infrastructures for 2002-2011* have already been achieved.
- Electric power generated in 2004: 2,193 GWh

Electric Power with Biomass & Forecasts (MW)



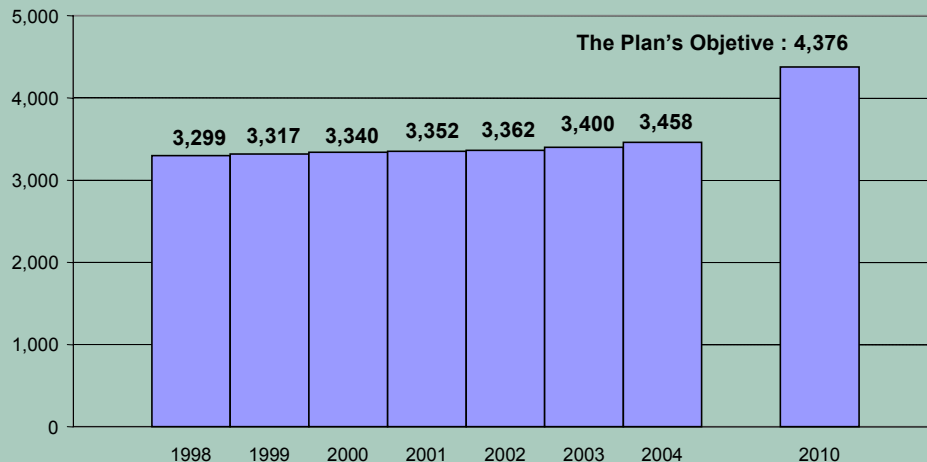
The installed power up to 1990 includes biogas.

Source: IDAE

Biomass – Thermal uses

- Δ 1999-2004 = 158 ktoe (18% of the objective increase of the Promotion Plan for 2010).
- Only 15% of biomass consumption increases established in the Promotion Plan relate to thermal applications.
- 50% of biomass consumptions takes place in the residential sector; some additional 18% in the paper & pulp sector and 11% in the timber and furniture sector.
- Biomass consumption in 2004: 3,458 ktoe

Biomass Consumption for Thermal Uses & Forecasts (ktoe)



Source: IDAE

Biomass: Problems in 2004

Thermal applications

- Early stage of the market
- They compete with fossil fuels
- Uncertainty as regards biomass supply

Electric applications

- Uncertainty as regards biomass supply
- Need to provide the appropriate regulatory framework for the promotion of the sector

IDAE's Project Specifications

Biomass: Forest industries waste

*Biomass district heating
grid in Cuellar*

Owner:

IDAE and EREN

User:

Cuéllar City Council
(Usage transfer)



IDAE's Project Specifications

Biomass: Forest industries waste

Biomass district heating grid in Cuellar

Owner:

IDAE & EREN

User:

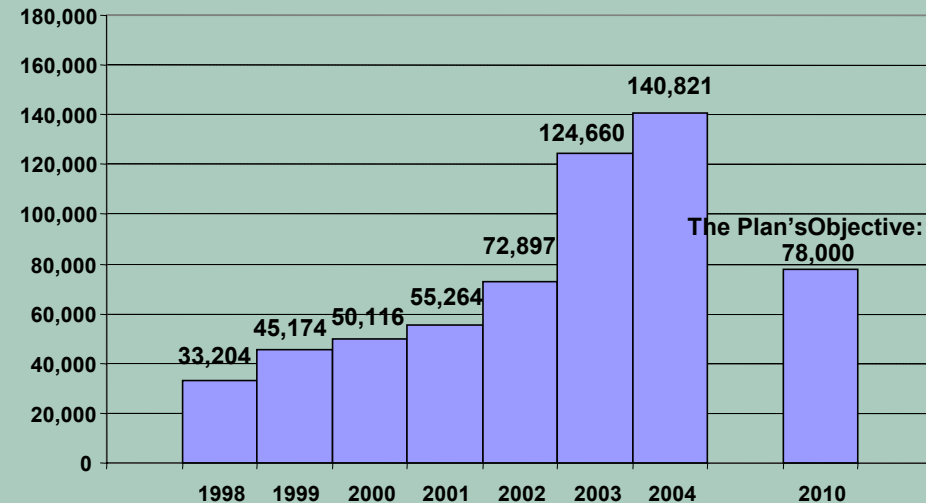
**Cuéllar City Council
(Usage transfer)**

- 789 toe/year of primary energy
- A boiler of 4,500,000 kcal/h, another of 600,000 kcal/h & a distribution network with preinsulated piping
- Supplies 3 municipal buildings, 3 co-operatives and 13 detached houses
- Supplies heating and hot water
- The first Spanish facility of this kind (without co-generation)
- Replaces old diesel oil boilers
- Environmental and social benefits
- Decrease in the user price & improvement of service management
- Operational since April 1999

Biogas

- Δ 1999-2004 = 108 MW (138% of the increase objective of the Promotion Plan).
- 74% of biogas consumption takes place in controlled landfill sites & some additional 17% in sewage treatment plants.
- Electric power generated in 2004:
825 GWh

Biogas Power & Forecasts (kW)



Source: IDAE

Biogas: Problems in 2004

▪ FARMING WASTE

- Intensive stock raising
- Anaerobic digestion for a high livestock concentration
- Present situation: low use

▪ ORGANIC FRACTION OF THE U.S.W.

- Controlled landfill sites with a capacity of over 200-250 t/day
- Degassing of the dumping site
- Anaerobic digestion in bio-reactors vs aerobic direct composting
- Present situation: growing use

▪ BIODEGRADABLE INDUSTRIAL WASTE

- Brewing, sugar-producing, alcohol, dairy, oil industries, etc.
- Anaerobic digestion
- Present situation: substantial degree of application

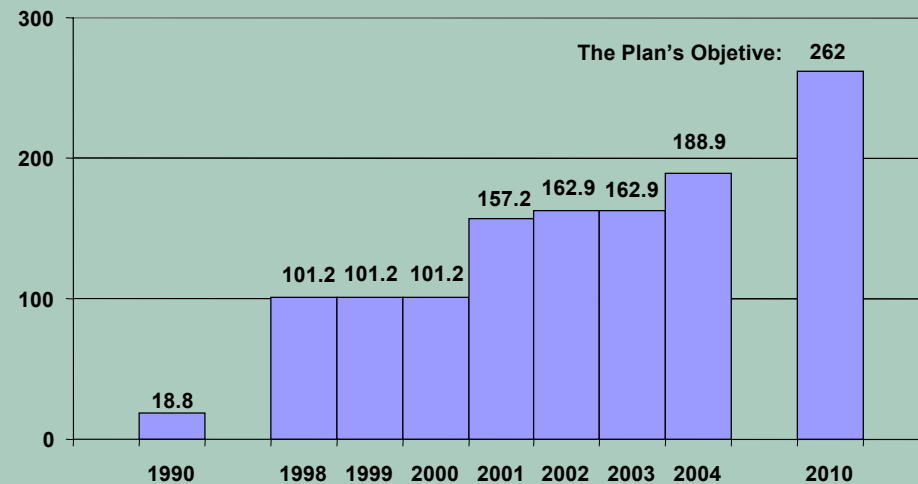
▪ SEWAGE SLUDGE OF U.W.W.

- Interesting from 100,000 inhab-eq at landfill level
- Primary and secondary treatment
- Anaerobic digestion
- Present situation: substantial degree of application

Urban Solid Waste (U.S.W.)

- Between 1999 & 2004, a total number of 82 new MW have been installed.
- 48.7% of the increase objectives established in the Promotion Plan for 2010 have been met so far.
- Electric power generated in 2004:
1,223 GWh

Electric Power with U.S.W. & Forecasts (MW)

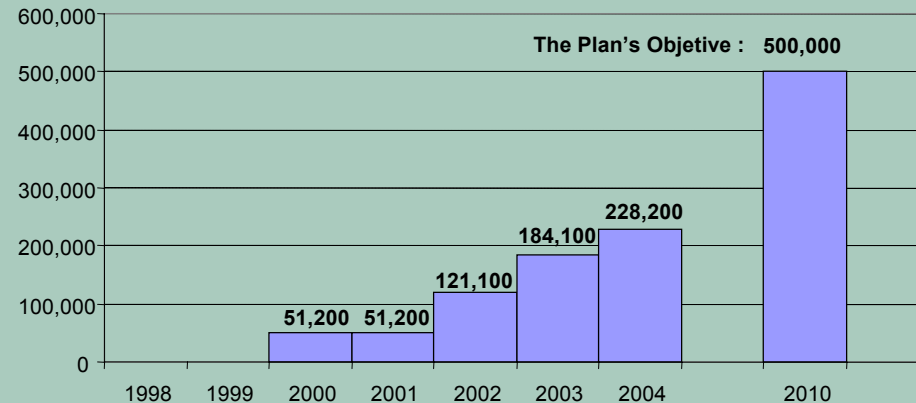


Source: IDAE

Biofuels

- 8 facilities were operational at the end of 2004, with a production capacity of 180,000 t of bioethanol & 125,800 t of biodiesel.
- 46% of the goals devised in the Promotion Plan for 2010 have already been met (0.5 Mill. toe), but Directive 2003/30 obliges to increase objectives four-fold (put at around 2 mill. toe)
- Favourable fiscal framework (tax exemption) for biofuels.

Biofuels Consumption and Forecasts (toe)



Source: IDAE

Biofuels: Problems in 2004

General

- **Blending market:** adapts to the parameters in RD 1700/2003 on the part of some market agents

Bioethanol

- Market expansion while waiting for the blending market evolution

Biodiesel

- Problems to meet the specifications for its use in the transport sector when it is made from used vegetable oils.

IDAE's Project Specifications

**IDAE's biodiesel
production plant**



IDAE's Project Specifications

IDAE's biodiesel production plant

- Location: Alcalá de Henares (Madrid)
- 4,00 toe/year of primary energy
- Capacity: 5,000 t/year of biodiesel
- Collaboration agreement between IDAE & the UCM
- Main processes in the plant: transesterification, purification & drying
- Biodiesel will be used in captive fleets
- Sub-products: glycerin, fatty acids & sodium sulphate

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3. SUMMARY

Summary

- Non satisfactory overall development during the first six years of life of the Promotion Plan. (28% of the objectives for the year 2010).
- In the case of windpower and photovoltaic solar energy, a leading position has been reached on the worldwide scale, with a very competitive industrial fabric.
- In this context, the IDAE plays a prominent role both as the promoter of suitable regulatory developments and in its capacity as a public stimulating agent of the market.
- There is a need to revise the Plan, in order to reach the objectives:
 - ✓ 12% primary energy in the year 2010.
 - ✓ 29% electricity generation in the year 2010
 - ✓ 5.75% of the demand in biofuels.