

# Renewable Energy in Spain

**EXECUTIVE EXCHANGE ON THE USE & INTEGRATION OF  
RENEWABLE ENERGY IN THE POWER SECTOR**

**USEA, USAID, SARI/ENERGY**

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Diversificación y  
Ahorro de la Energía

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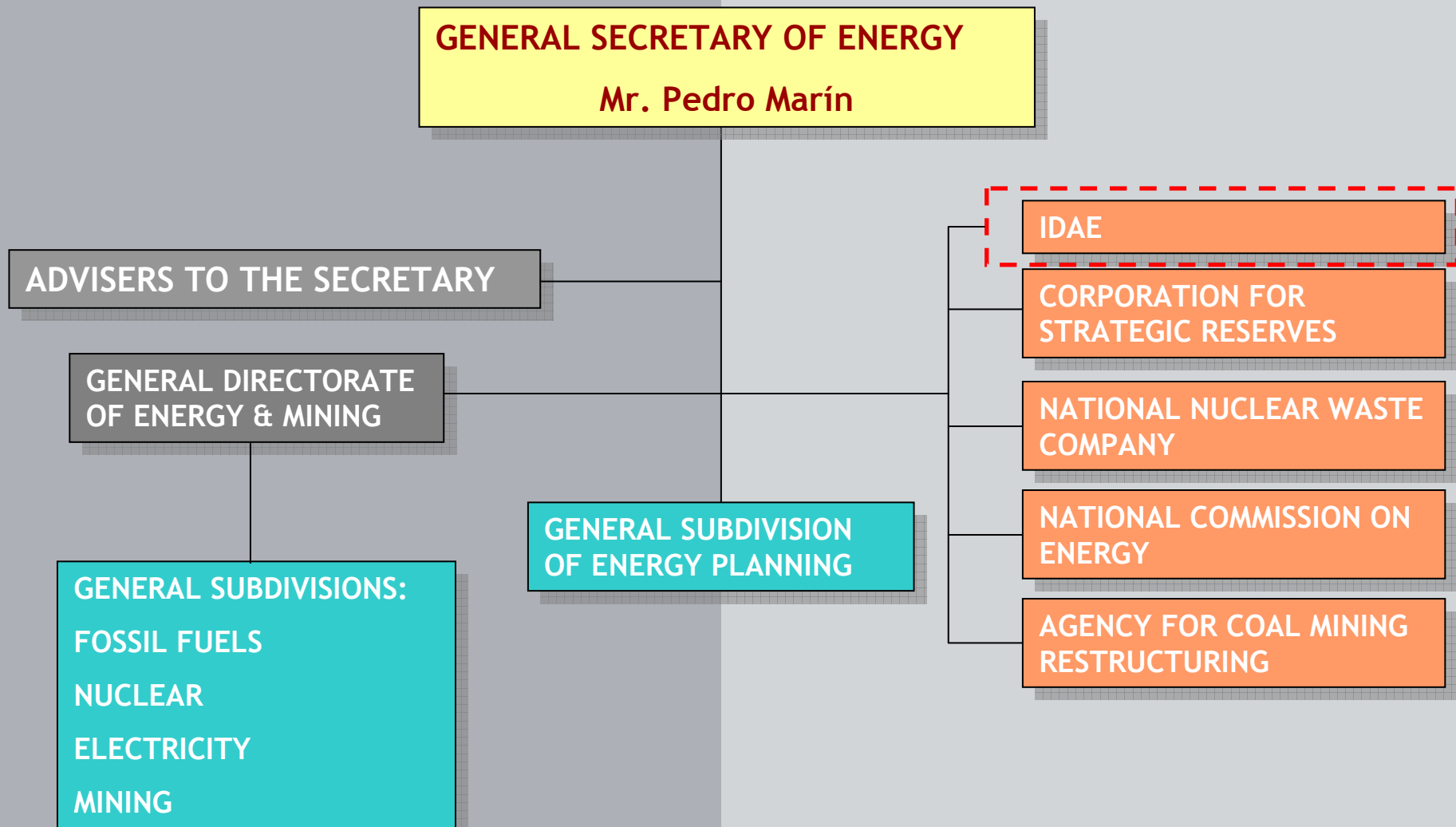
- 1. IDAE, nature, objectives, activities**
- 2. Energy and Renewable Energy in Spain**
- 3. Energy Legislation**

## WHAT IS IDAE?

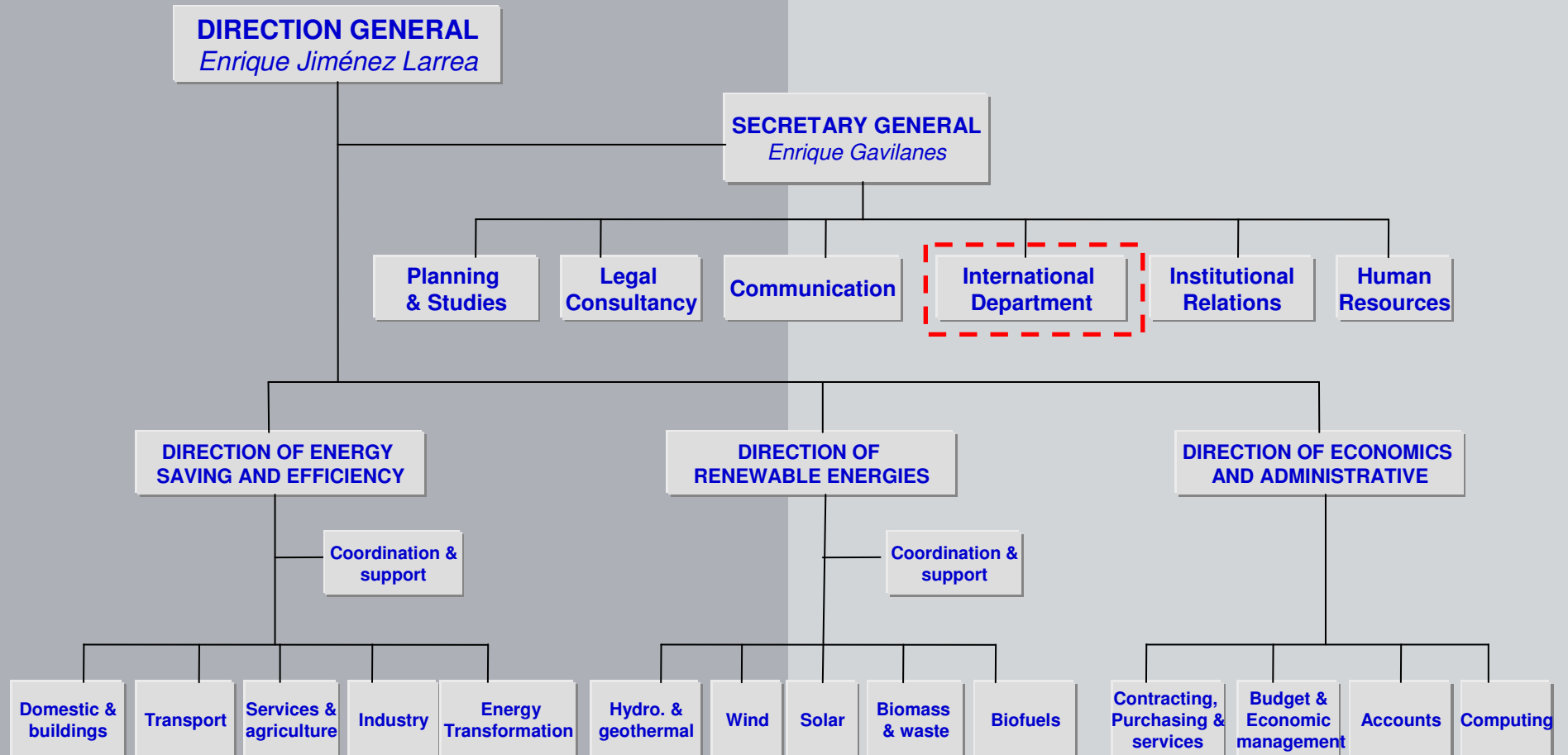
- ❖ **A Public Business Entity**
- ❖ Reporting to the Ministry of Industry, Tourism and Trade, through the **General Secretariat for Energy**

## MISSION

- ❖ Promote energy efficiency and the rational use of energy in Spain
- ❖ Promote the diversification of energy sources and the increasing use of renewable energies
- ❖ Foster these activities through technical consultancy and implementation of innovative projects



# ORGANIZATION CHART (1/10/2008)



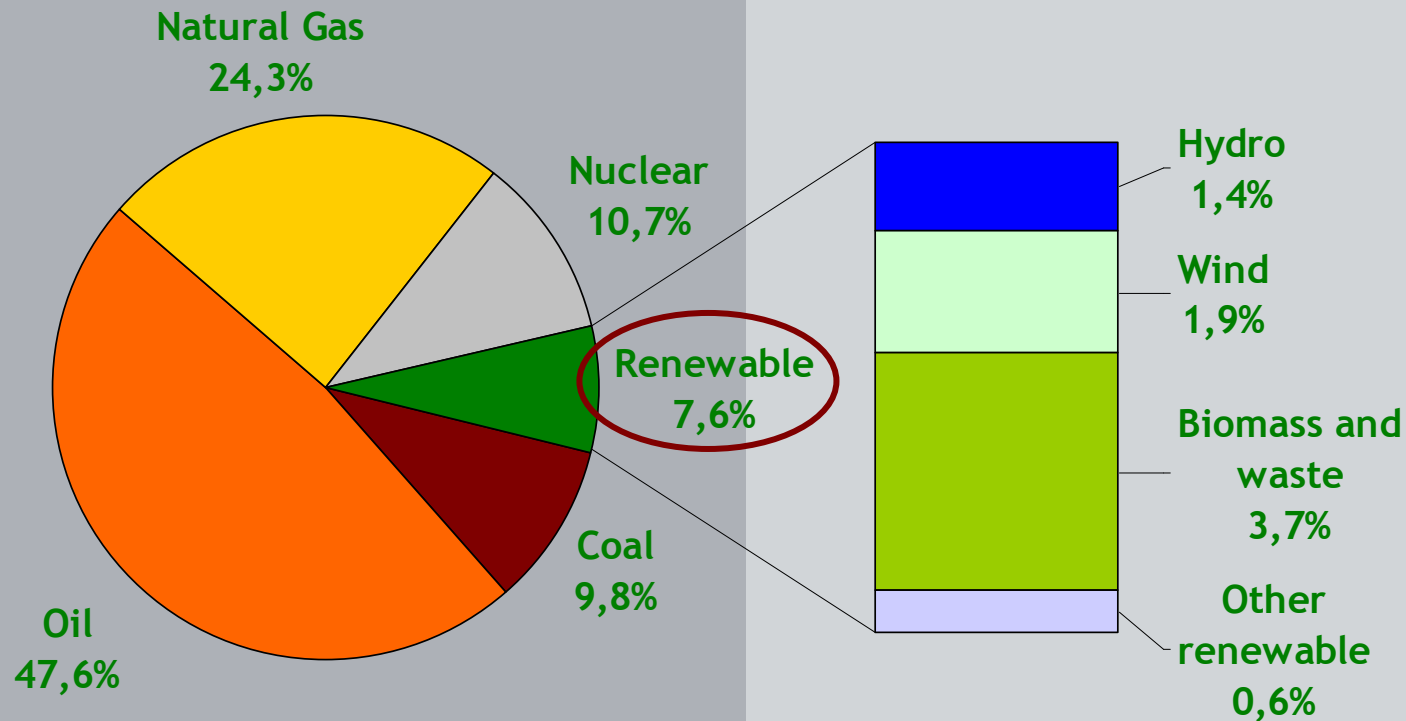
## ACTIVITIES

- Technical and financial **support for RES and RUE projects**
- Technical **consultancy to the public administration**
- Actions to **introduce new, more efficient technologies** into the market and incorporate mature technologies into the Spanish market
- **Dissemination** activities
- Negotiation of **co-operation agreements** with industrial sectors for the uptake of RES/RUE
- Participation in the management and promotion of **EU programmes** and participation in **international networks**
- **Dissemination** of Spanish technologies abroad and capture of international information of interest to Spanish firms

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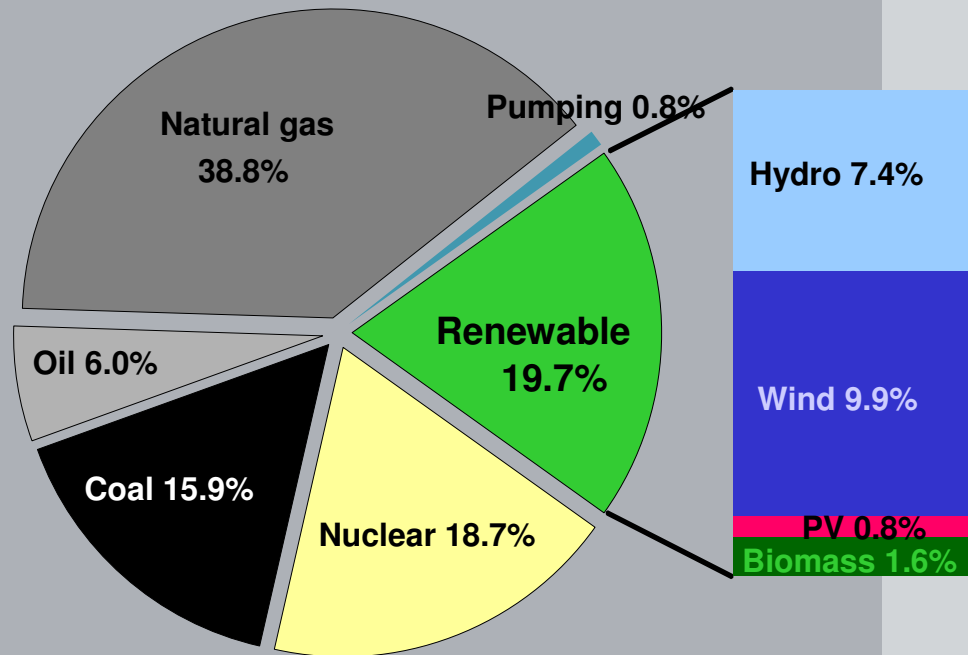
## PRIMARY ENERGY CONSUMPTION, 2008



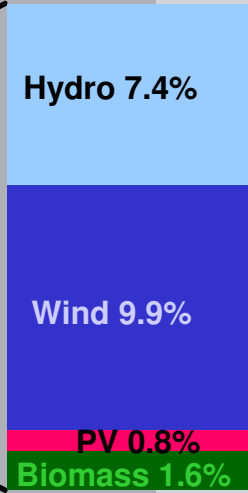
**Total Consumption : 142.078 ktoe**  
 (Year 2007): 146.929 ktoe

**RREE Consumption: 10.846 ktoe**  
 (Year 2007): 10.254 ktoe

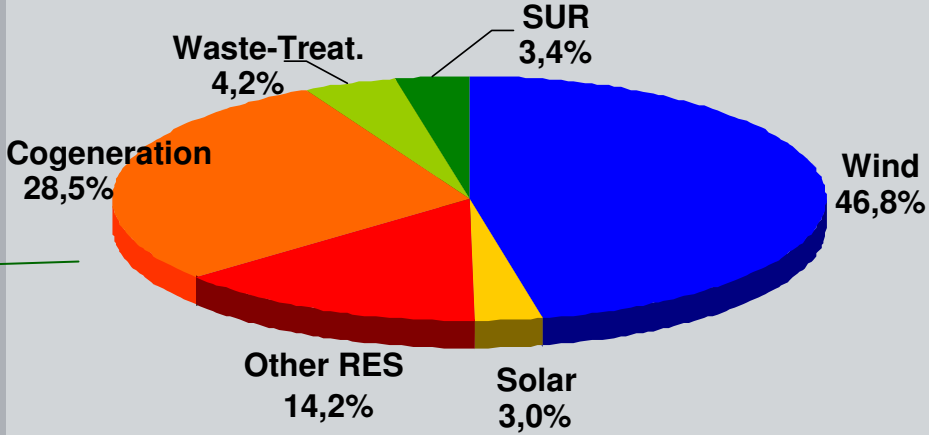
## RES CONTRIBUTION TO ELECTRICITY PRODUCTION, 2008



**RES production: 62,2 TWh  
(Total: 315 TWh)**



**% Special Regimen Production**



## WHY PROMOTING RES IN SPAIN?

- High external energy dependency:
  - Almost **80% primary energy dependency**
  - 99.5% oil dependence
  - 97.1% gas dependence
- **High potential** for generating energy from renewable sources
- RES promotion responds to economic, social and environmental strategy

↳ **RES are key elements to reduce energy dependence**

**Spanish energy policy in accordance with EU energy policy**

**Security of supply and internal market**

**Competitiveness**

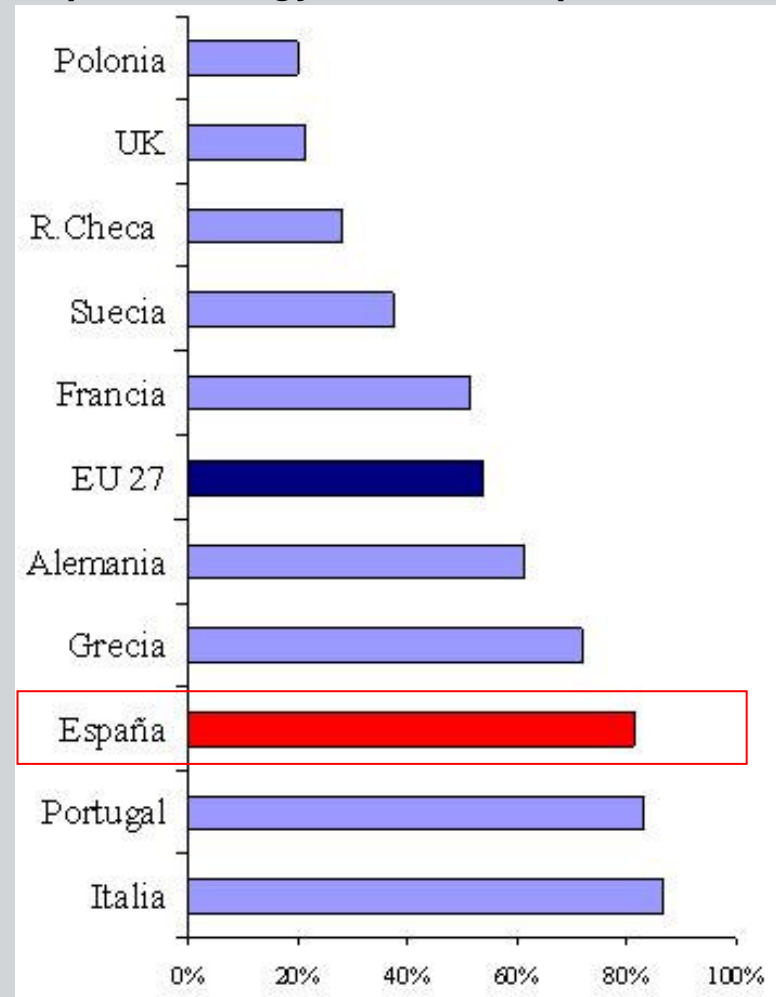
**Sustainability & environmental targets**

## SPANISH ENERGY POLICY: CHALLENGES

### *Sustainability*

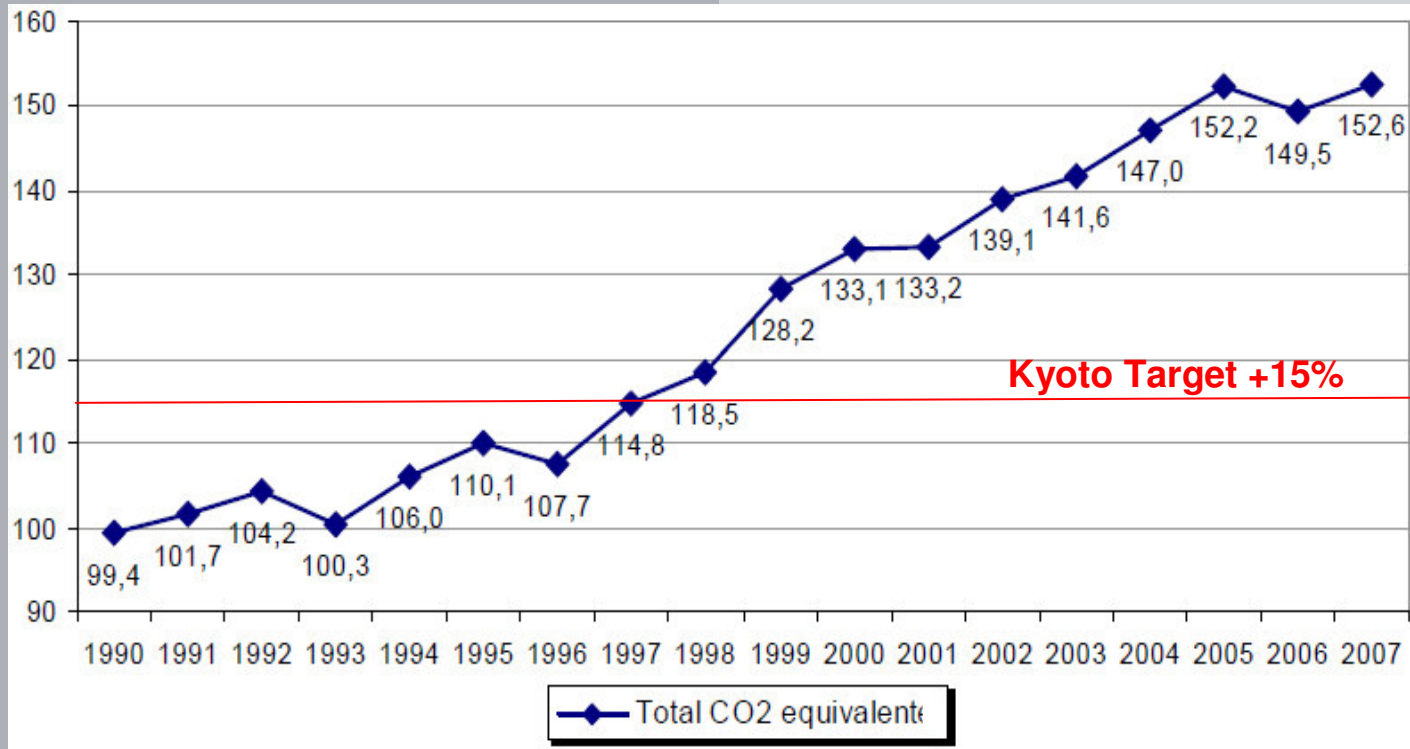
1. Reduce external energy dependency
  - Integration of RES into electricity grid
  - International interconnections
2. Competitive energy prices
3. Security of supply
4. Environmental and GHGs targets
5. Energy Efficiency improvement

Imported energy/total consumption 2006



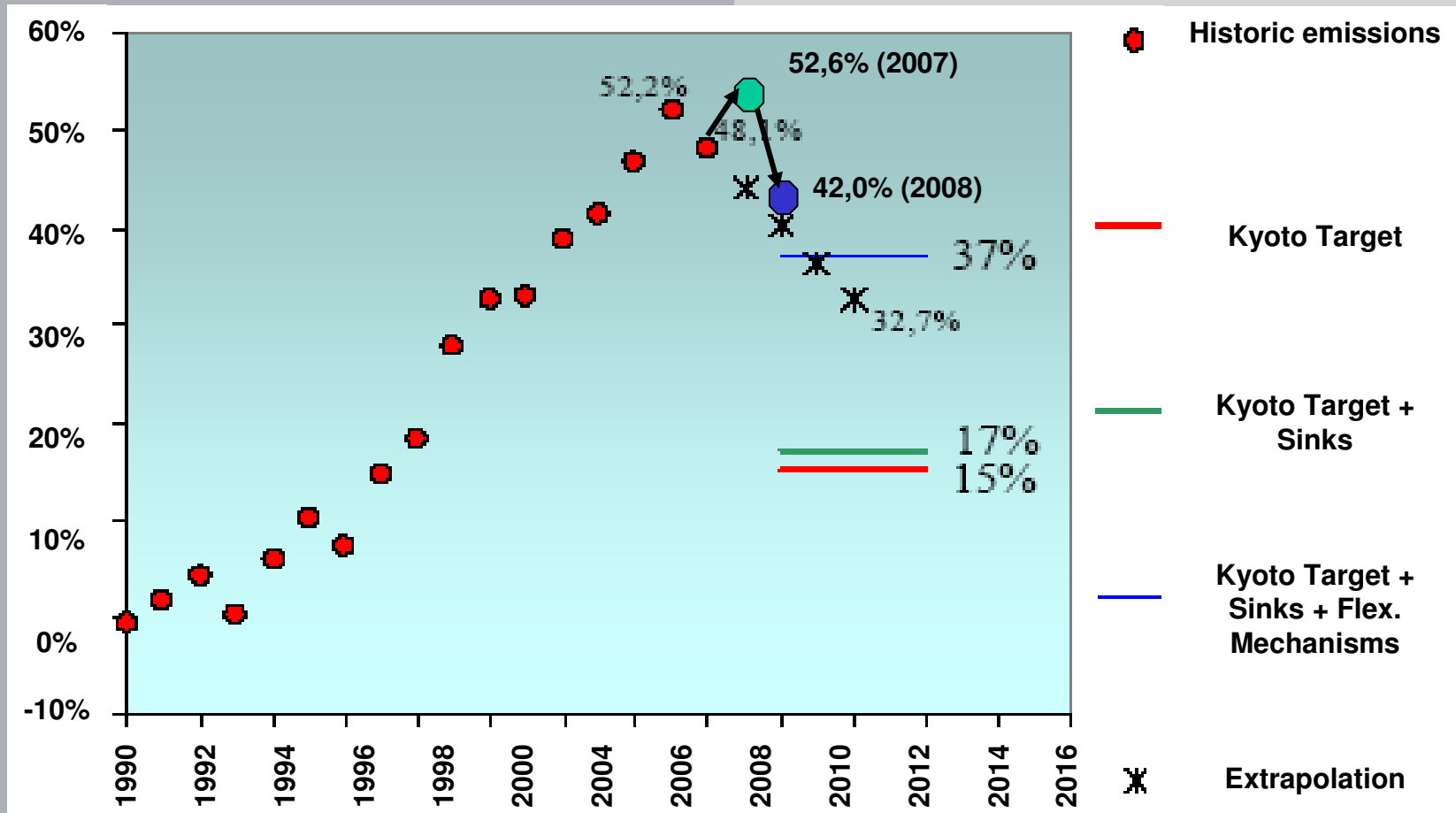
Source: EUROSTAT

## SPAIN GHG EMISSIONS



- **Data 2008: + 42,0 % in 1990**
- **Cleaner mix of electricity and increase energy efficiency**
- **Compliance path NAPII: + 37%**
  - +15% UE overall objective (-8%)
  - +2% sinks
  - +20% flexible mechanisms (CDM, JI, GIS) (E.g. MoU Spain-Poland)

## GHG & COMPLIANCE PATH



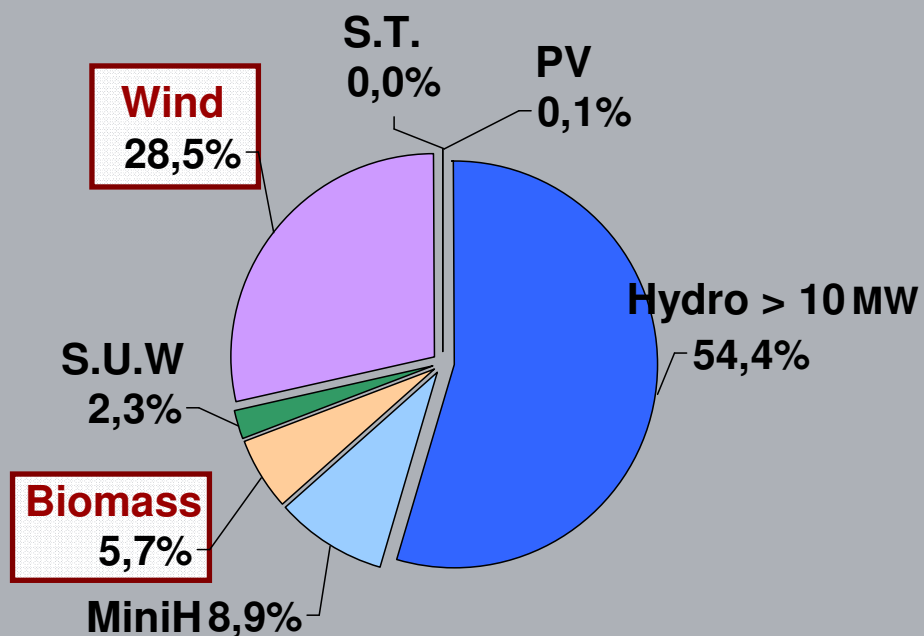
## THE RENEWABLE ENERGY PLAN (REP) 2005-2010

The PER is not binding. The aim is to create **an attractive framework based on stability and profitability.**

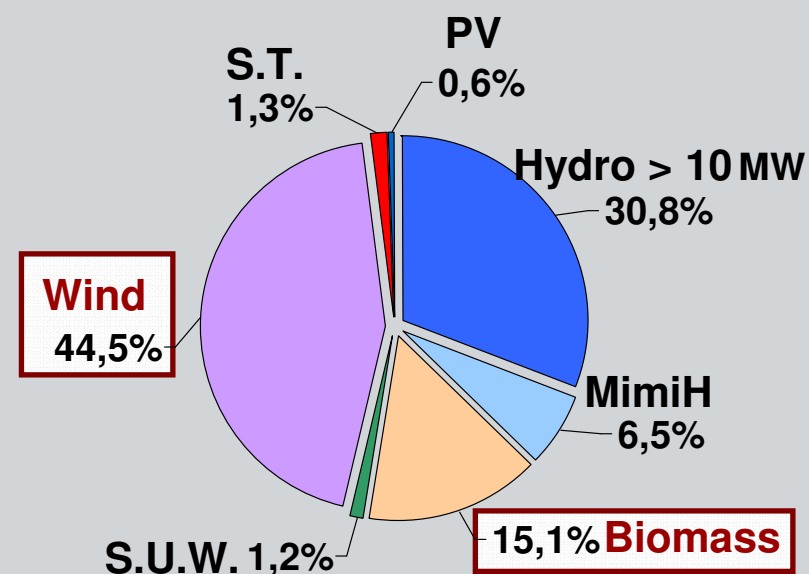
- Targets of REP 2005-2010:
  - **12.1% of total energy consumption will come from RES**
  - Electricity generation from **RES will represent 30.3% of electricity production**
  - **Biofuels will correspond to 5.83%** of diesel and petrol consumption in the transport sector
- Investment (2005-2010): 23.598,64 M €
- Public funds (2005-2010): 8.492,24 M €
- Premium paid for electricity: 4.956,21 M €
- Tax exemption (LBT): 2.855,09 M €
- Subsidies (Biomass, solar-thermal): 680,94 M €
- Establishment of sectoral measures to meet the objectives
- Wind and biomass are fundamental

## PER 2005-2010: ELECTRICITY PRODUCTION

	2004	2010
<b>Total</b>	<b>275.497 GWh</b>	<b>337.407 GWh</b>
<b>Renewable (%)</b>	<b>21,8 %</b>	<b>30,3 %</b>

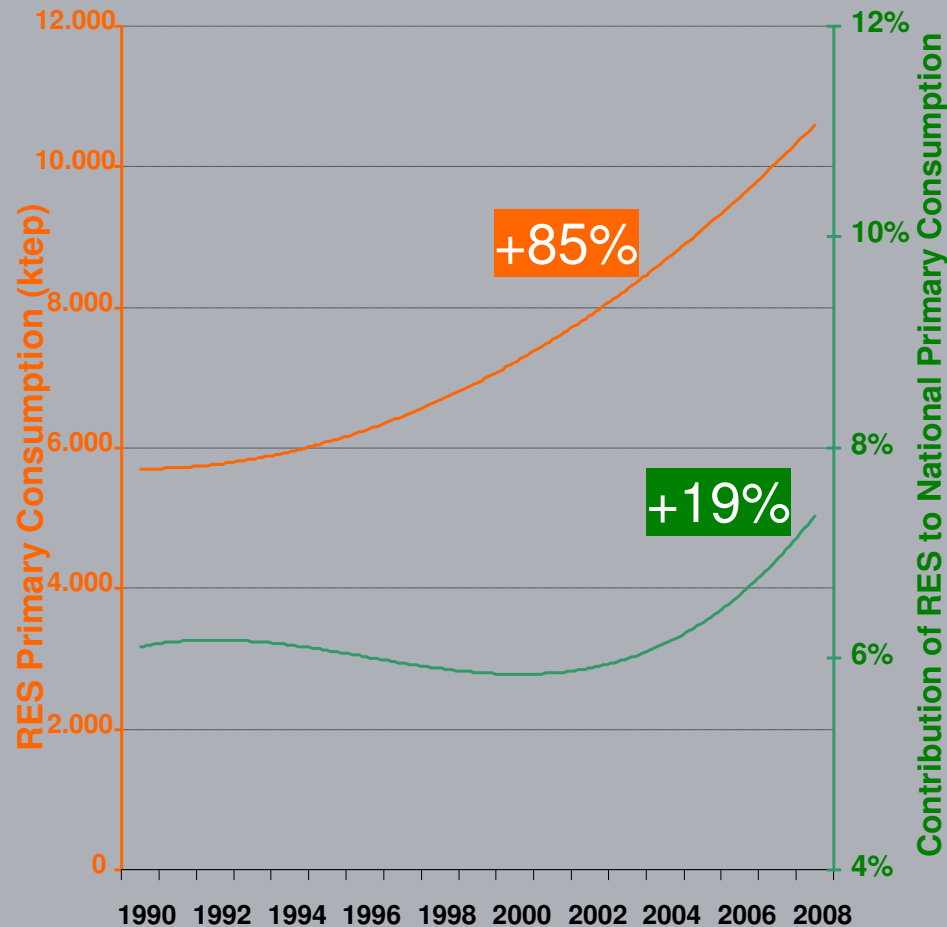


**Renewable 2004 (60.096 GWh)**



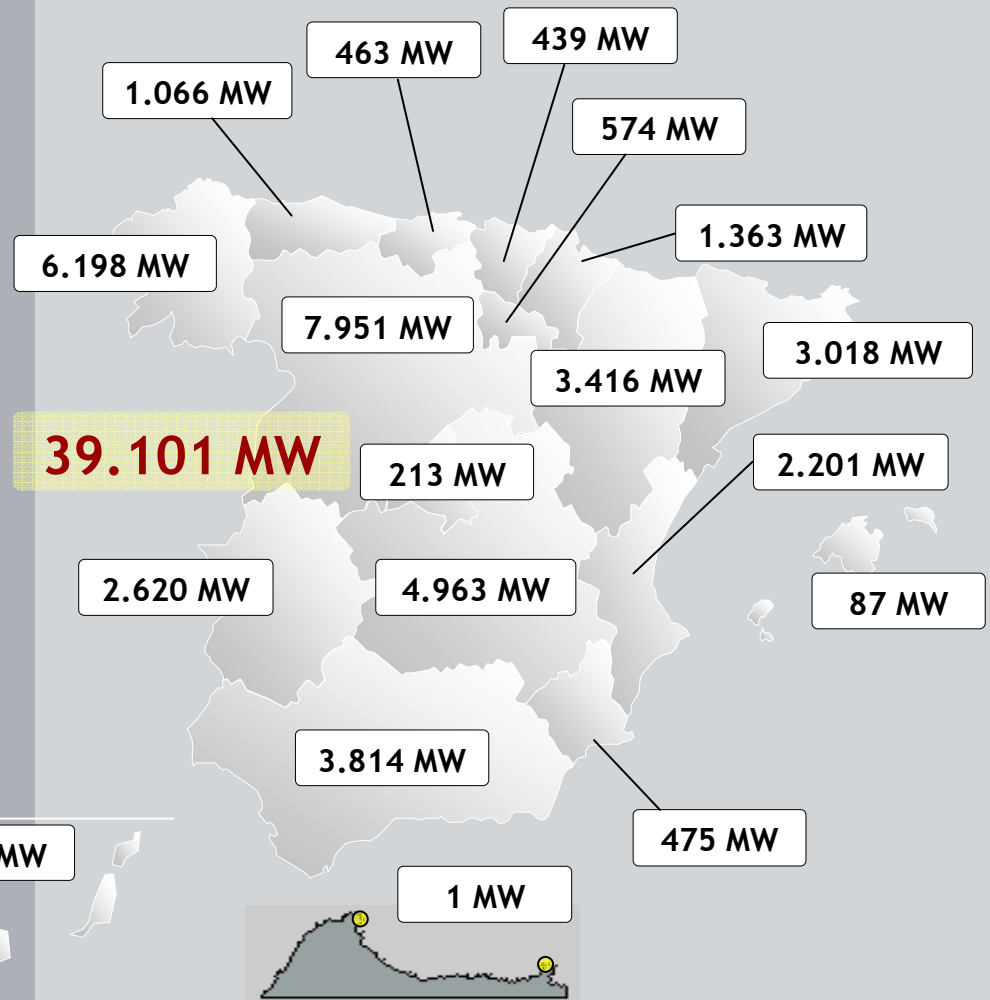
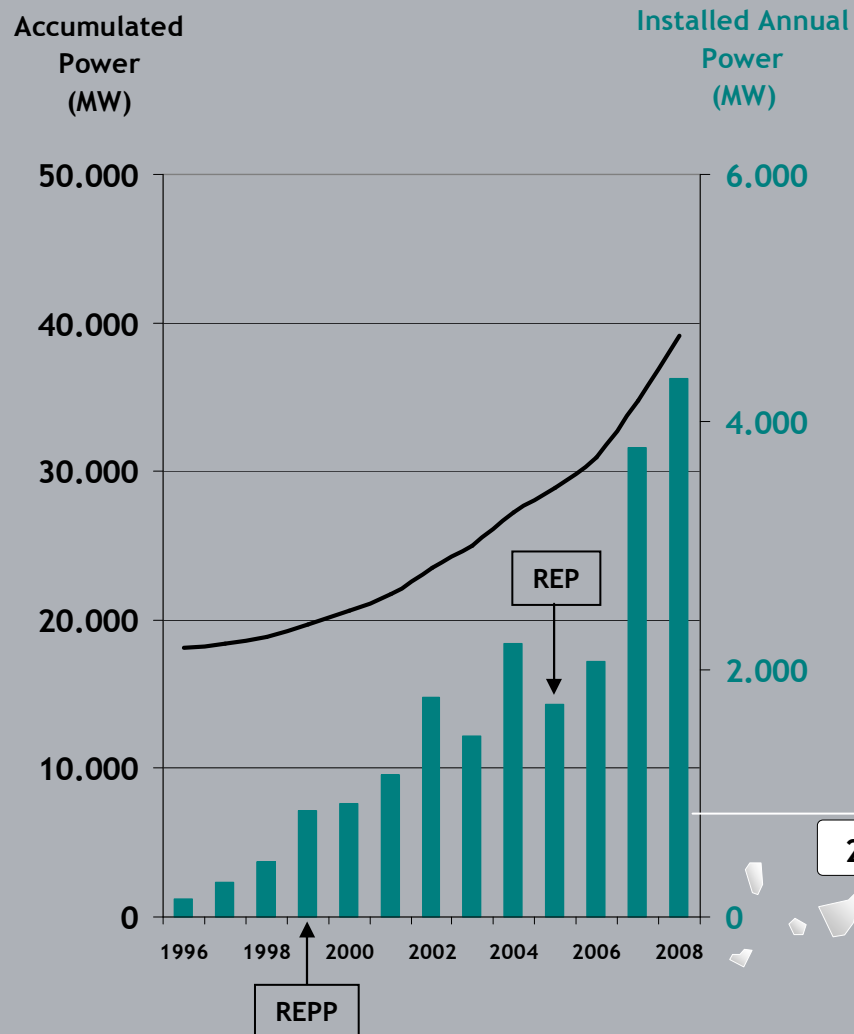
**Renewable 2010 (102.259 GWh)**

## EVOLUTION OF RES IN SPAIN

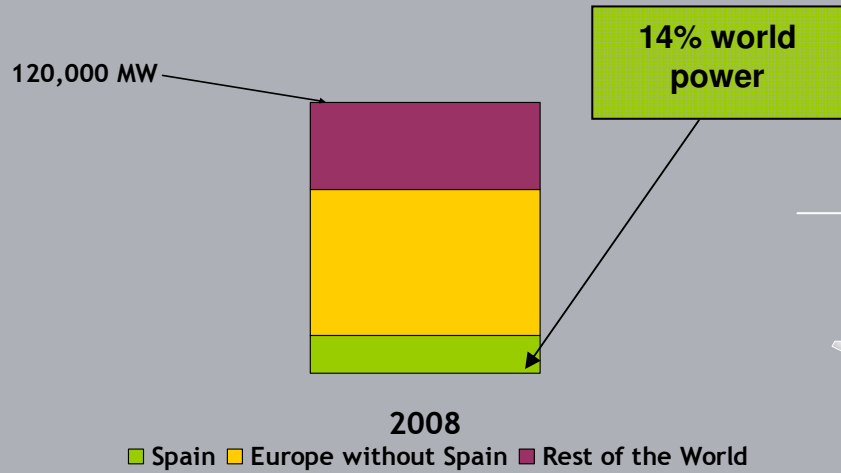
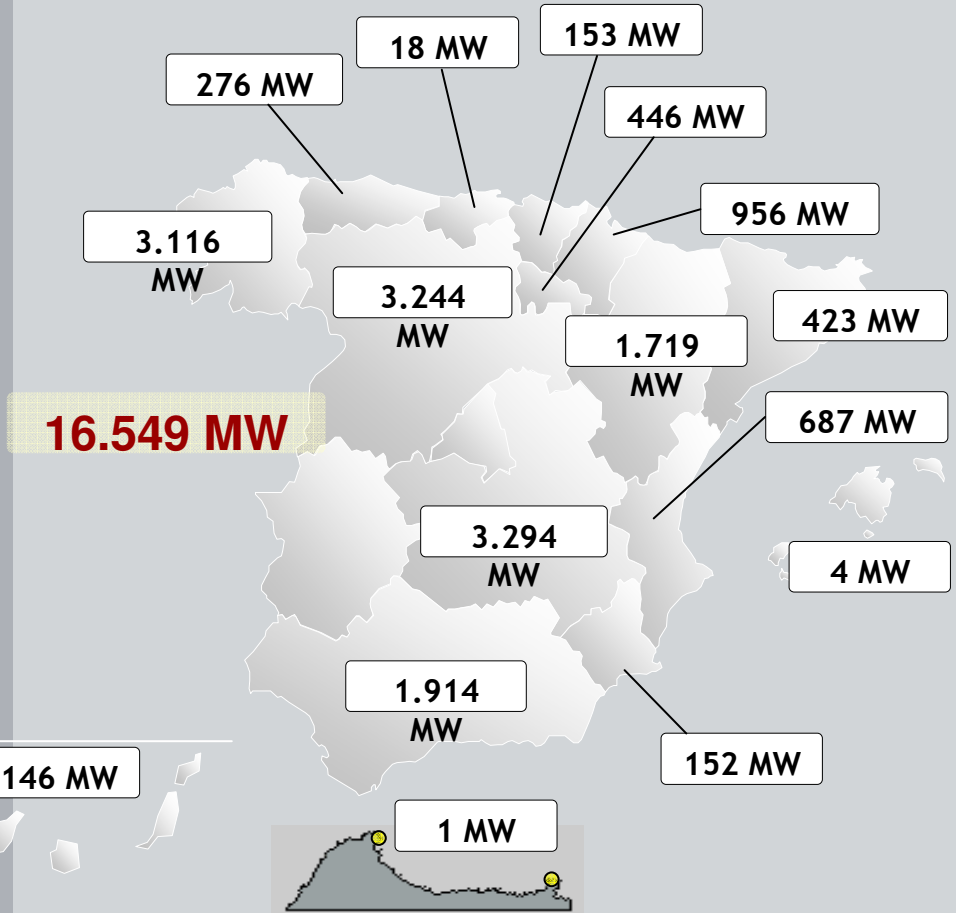
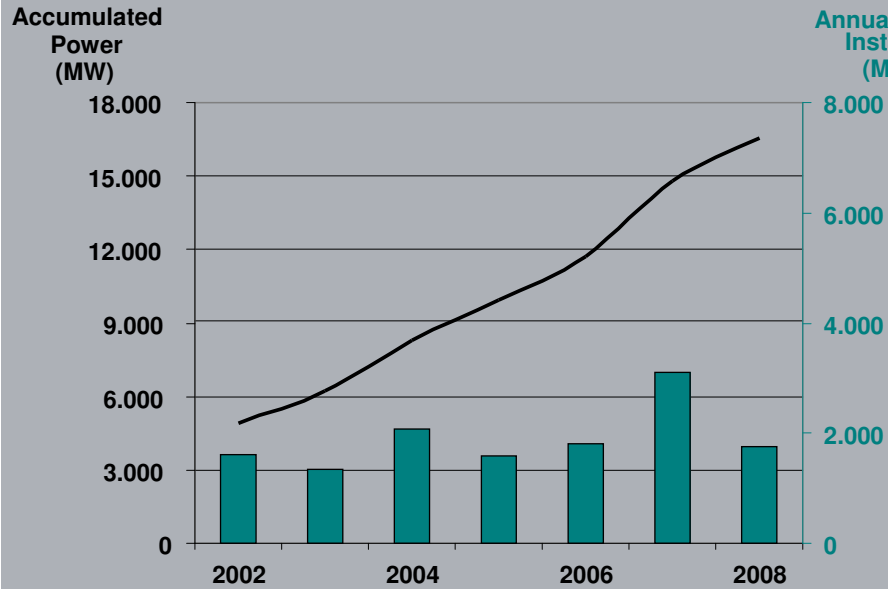


- **Spain position in UE (installed capacity)**
  - 1<sup>st</sup> in thermoelectric
  - 2<sup>nd</sup> in wind energy and photovoltaic
  - 3<sup>rd</sup> in mini-hydroelectric
- **Employment: 73,900**
- **Renewable Energy Grid Integration: overcoming planning hurdles, sharing costs, accessing equipment, etc:**
- **Renewable Energy Source Control Centre (CECRE in Spanish) a worldwide pioneering initiative to monitor and control RES.**
  - Allows the maximum production from RES, especially wind energy, to be integrated into the power system under secure conditions.
  - Operation unit integrated into the Power Control Centre (Cecoel)

# RENEWABLE ELECTRICITY POWER

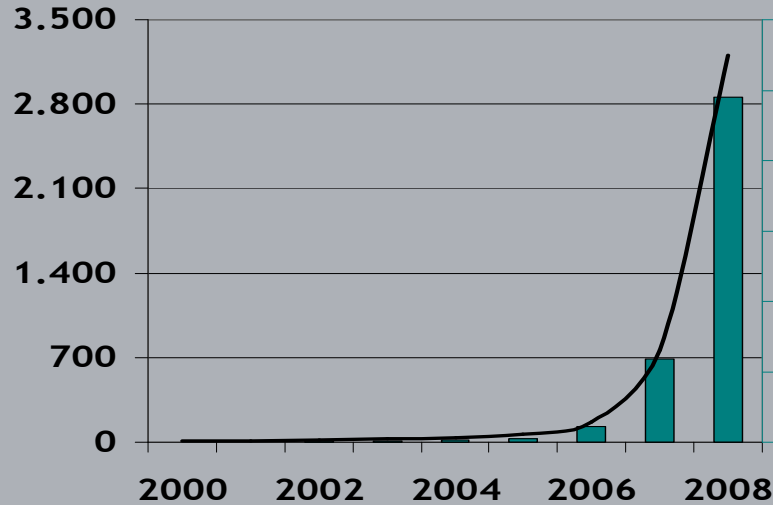


# WIND ENERGY SECTOR: INSTALLED POWER

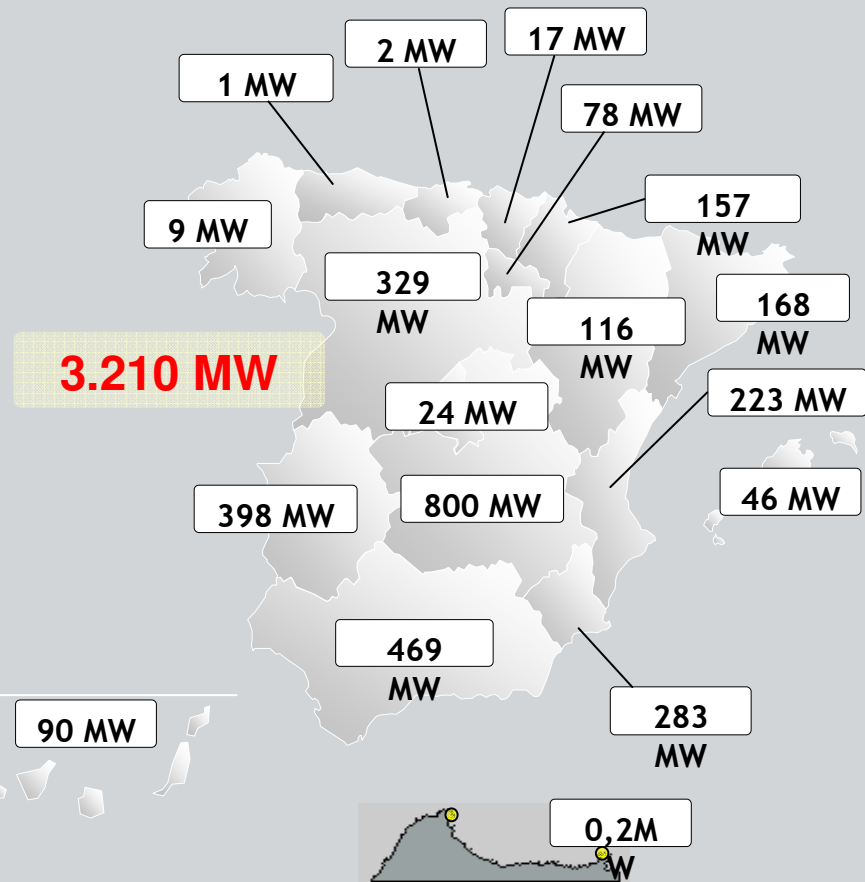


# PHOTOVOLTAIC SECTOR

Accumulated Power (MW)



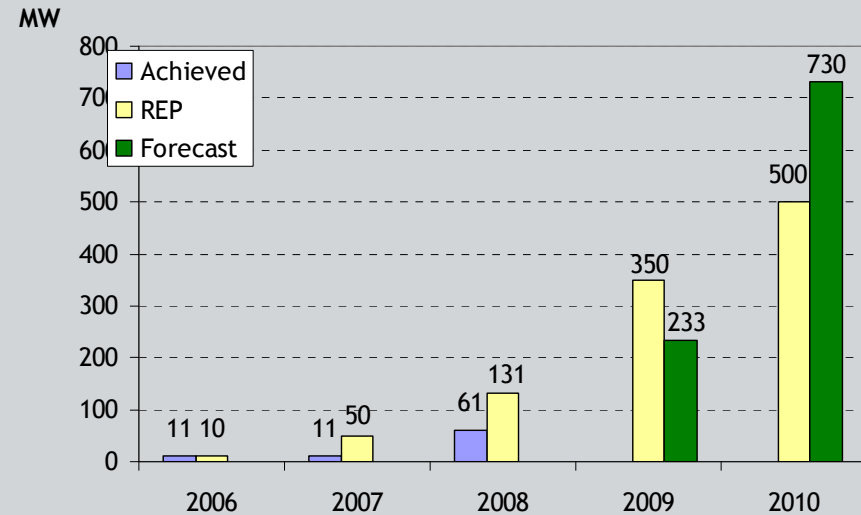
Annual Power Installed (MW)



- World leadership in solar trackers
- 7% world's production in photovoltaic generators

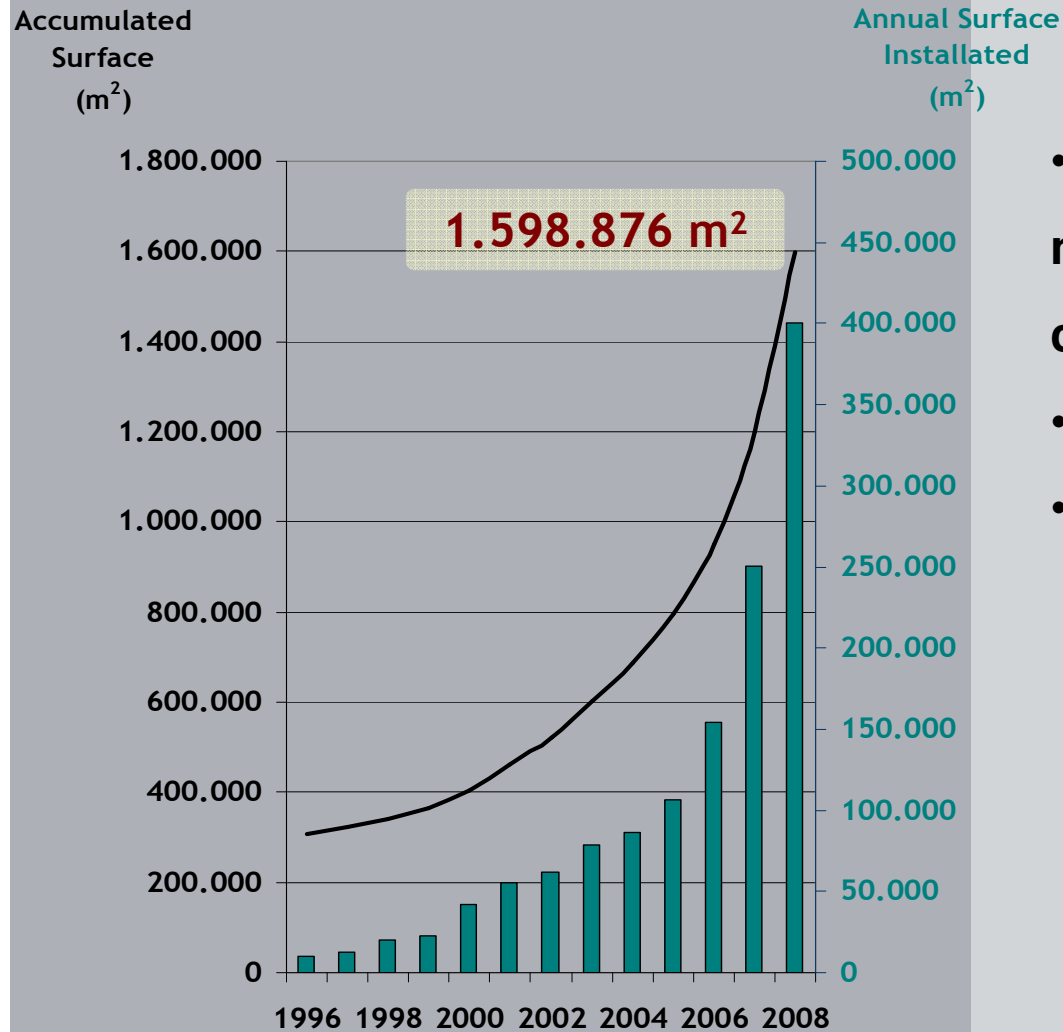
## THERMOELECTRIC SECTOR

- **World leader:** 4 operating plants (131 MW) & 12 under construction (233 in 2009 & 730 MW in 2010)
  - 1<sup>st</sup> commercial plant in the world central tower technology (PS-10)
  - 1<sup>st</sup> commercial plant EU using molten salt storage technology (Andasol)
  - 1<sup>st</sup> commercial plant EU parabolic-cylinders without accumulation (Puertollano, 10% owned by IDAE)
- **Business dynamism.** Property development company, basic technology and manufacturers - heliostats, reflecting surfaces, tracking systems





## SOLAR THERMAL SECTOR



- 1,300 companies, 35 manufacturers: production capacity 1,900,000 m<sup>2</sup>/year

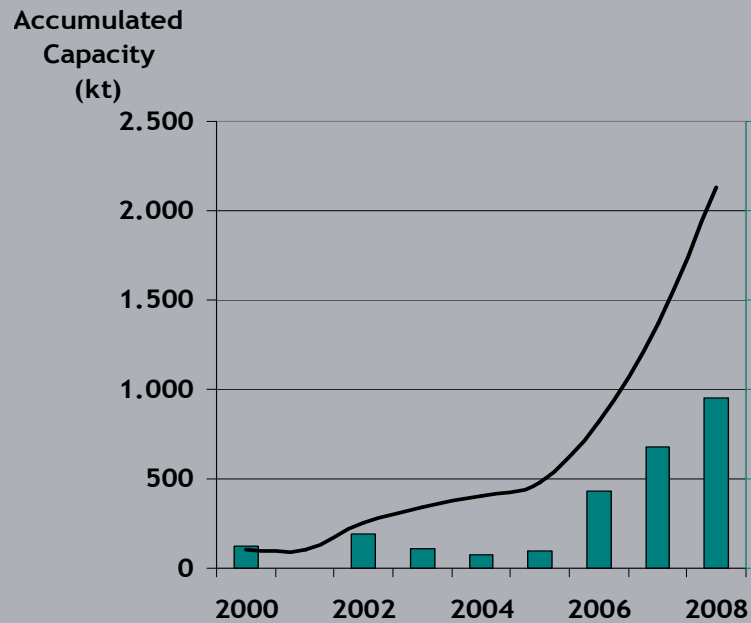
- Turnover > 260 M€/year

- Employment:

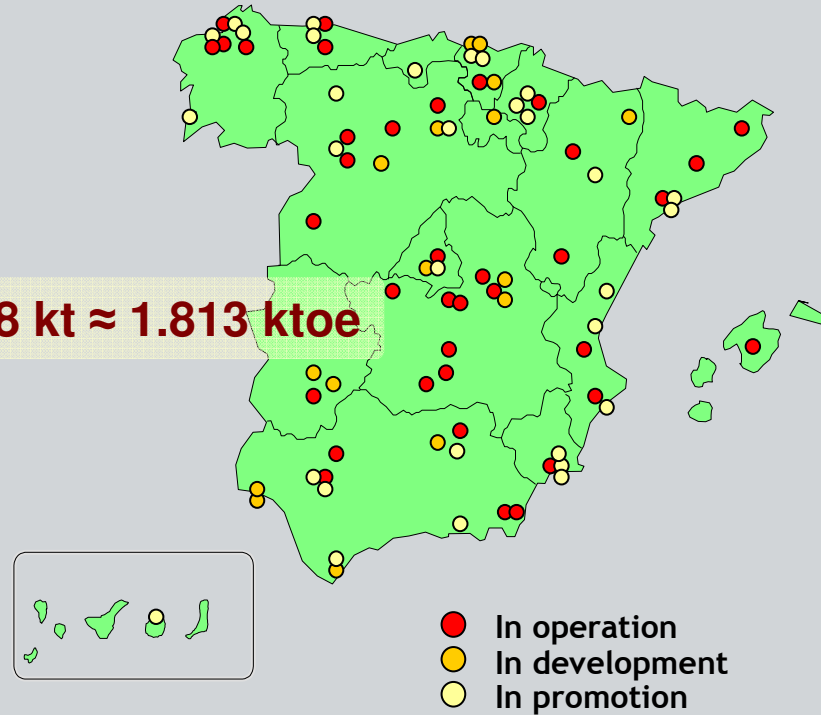
**Direct: 4.300**

**Indirect: 6.470**

## BIOFUELS SECTOR

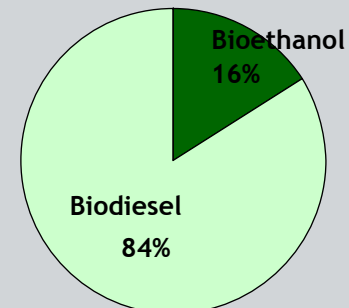


2.128 kt  $\approx$  1.813 ktoe



- In operation
- In development
- In promotion

- Third manufacturer of EU of bioethanol and seventh of biodiesel
- Important business presence in USA and EU



## OTHER RENEWABLE ENERGIES

### Biomass

- “Pellets”: production x 10 in 3 years (600.000t)
- Growth of ESCOs: domestic installations
- Gasification and cogeneration
- Co-firing: Positives prospects. Testing plants with increasing substitution of coal.

### Geothermal

- Important resources and imminent development;
- Increasing industrial sector low temperature
- Medium temperature geothermal energy: advanced projects for district-heating.
- High temperature resources in evaluation.
- Technological Platform (11/05/2009)

### Wave Power

- R&D&I Sector
- Under development projects:
  - CALMA Project (Asturias). National technology
  - Marine Energies of Cantabria. Boya 40 kW
  - Mutriku ( País Vasco). 300 kW with 16 turbines
- Development of Tester Technological Centers (País Vasco, Cantabria y Canarias)

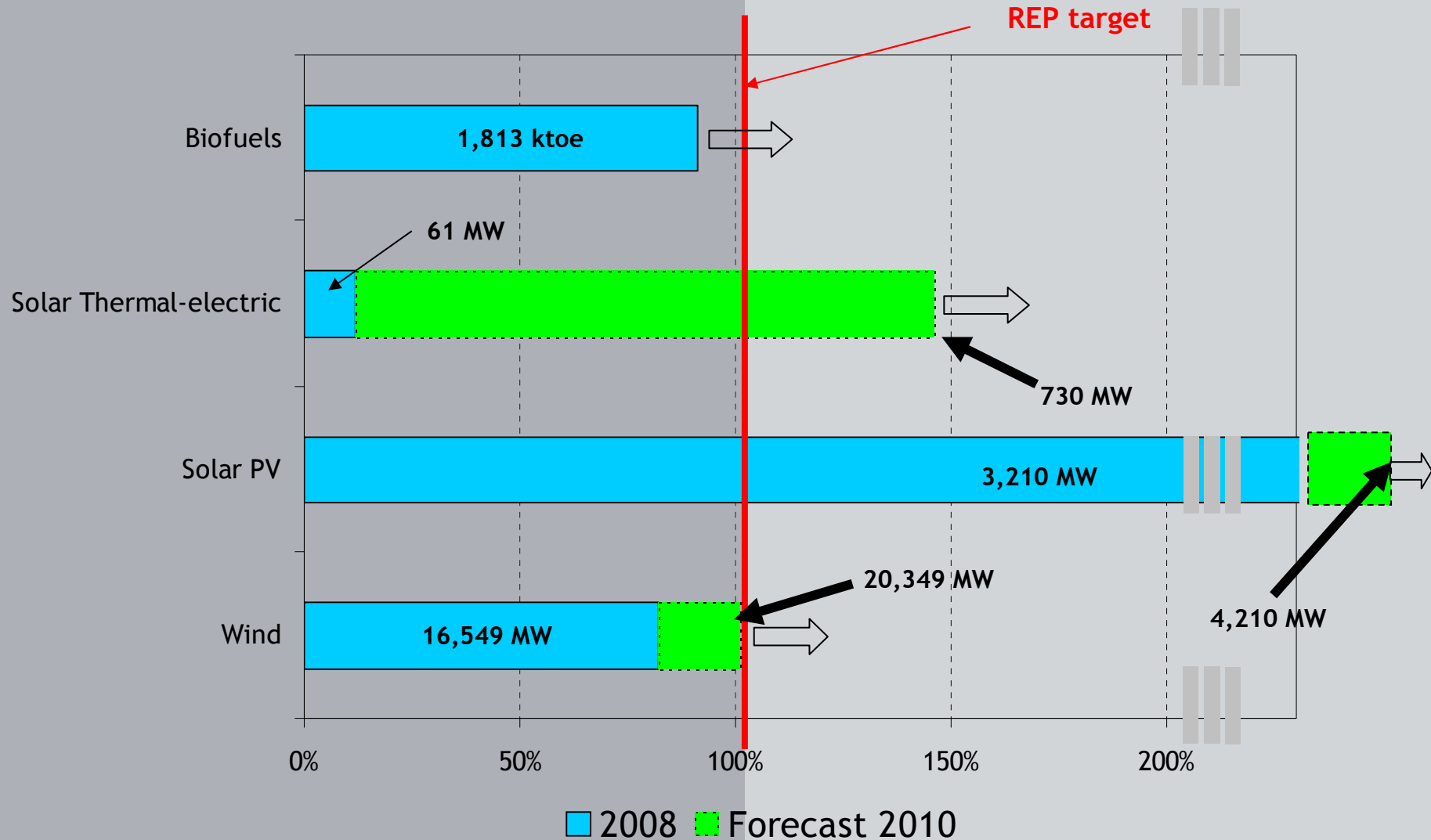
### Mini-Hydro

- 3rd EU country in installed power
- 150 companies: equipments manufacture 100% national
- High national technology development
- Future interest in energy storage

## PUBLIC SUPPORT

PERIOD 2005 - 2010	(Figures in thousands of Euros)			
TECHNOLOGY AREA (Type of energy)	INVESTMENT	PUBLIC AID	PREMIUM	TAX INCENTIVES
	TOTAL		TOTAL FOR PERIOD	EXEMPTION SPECIAL TAXES
HYDROELECTRIC	950.063	0	189.062	0
WIND	11.756.391	0	2.598.870	0
BIOMASS Industrial Thermal	54.577	0	0	0
BIOMASS Domestic Thermal	710.097	284.039	0	0
BIOMASS Electricity applications	1.964.596	0	1.059.922	0
BIOFUELS	1.156.830	0	0	2.855.095
BIOGAS Electricity applications	119.658	0	49.425	0
SOLAR THERMAL	2.684.611	348.078	0	0
SOLAR THERMOELECTRIC	2.162.500	6.200	559.514	0
SOLAR PHOTOVOLTAIC Standalone facilities	165.107	36.324		0
SOLAR PHOTOVOLTAIC Grid-connected facilities	1.874.211	6.299	499.415	0
	<b>23.598.641</b>	<b>680.939</b>	<b>4.956.208</b>	<b>2.855.095</b>

## FULFILLMENT OF OBJETIVES OF REP



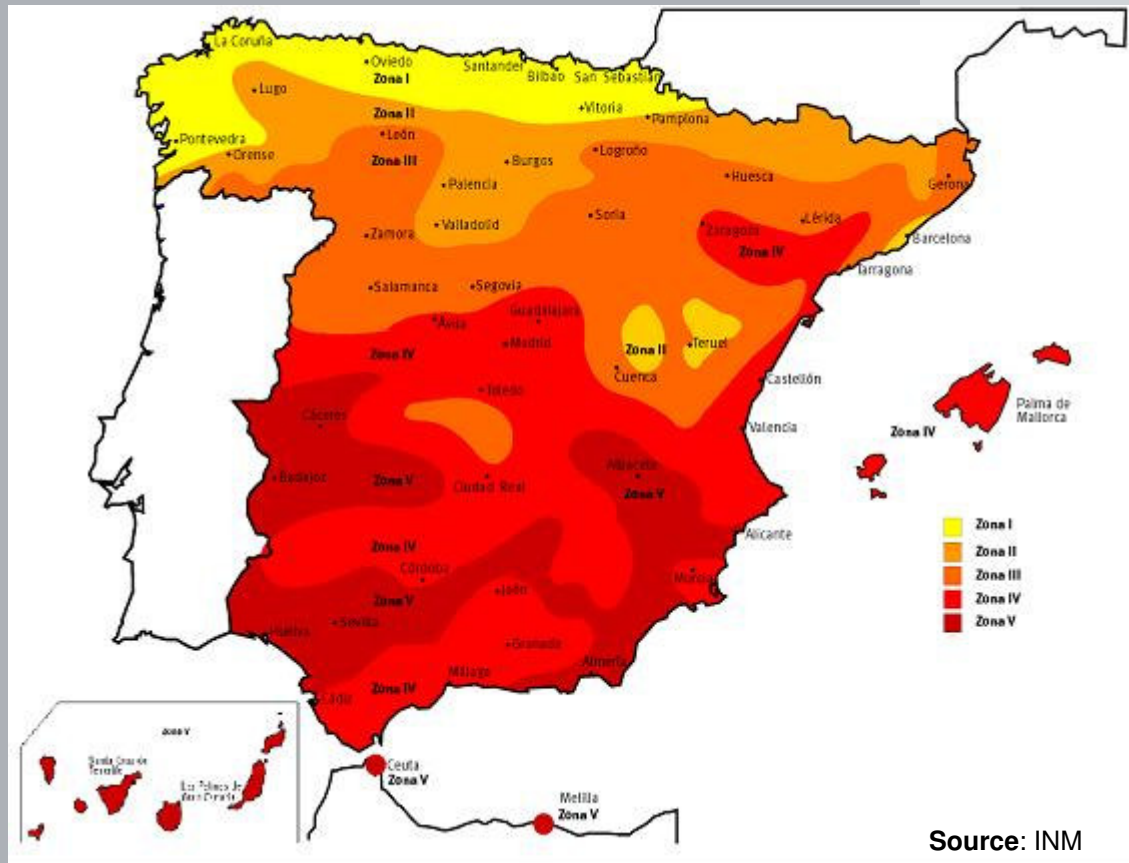
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## SPANISH LEGISLATION

- **Biomass for heating**
  - Regulation on Indoor Heating/Air-conditioning Systems (**RITE, RD 1027/2007**)
- **Solar thermal**
  - Regulation on Indoor Heating/Air-conditioning Systems (**RITE**)
  - Technical Building Code (**CTE**)
- **CTE (**Royal Decree 314/2006**)** establishes the requirements that must be fulfilled by buildings in relation with basic requirements of safety and habitability established in the Law of Building.
  - Limit energy demand
  - Increase efficiency of the heating equipment
  - Increase efficiency of the lighting equipment
  - Introduce solar thermal
  - Introduce photovoltaic

## CTE, RD 314/2006: Solar thermal promotion



### CLIMATIC ZONES

Zone 1:  $H < 3,8$

Zone 2:  $3,8 \leq H < 4,2$

Zone 3:  $4,2 \leq H < 4,6$

Zone 4:  $4,6 \leq H < 5,0$

Zone 5:  $H \geq 5,0$

*H in kWh/m<sup>2</sup>*

- For each climatic zone and annual consumption a contribution or annual minimum solar contribution is set between 30 % and 70 %.

## SPANISH LEGISLATION (biofuels)

- **Act 12/2007, 2<sup>nd</sup> of July:** established mandatory use of biofuels in transport
  - Modifies the Hydrocarbons Act
  - Includes the target of 5.83% in 2010
  - Mandatory blending to be developed (Ministerial Regulation)
- **ORDER ITC/2877/2008, 9th of October,** which establish regulations for the promotion of the use of biofuels and other renewable fuels in the transport sector
- **New EU Directive on renewable energy and biofuels.**
  - 10 % target for RES in transport in each Member State (2020)
  - 10% ethanol petrol (E10) and 7% biodiesel content (B7) by volume
  - Binding targets minimum consumption: 2,5 % in 2009 & 3,9 % in 2010.
  - Set sustainability standards for biofuels (land use)
  - Certification system in 2010. Cultivation will be considered sustainable if the overall GHG savings from the use of the biofuel are at least 35%

## SPANISH LEGISLATION

- **Act 40/94 on national electric system first defined “Special Regime”**
- **Electric Power Act 54/1997**
  - ↪ **Main target: Liberalization of the electricity market**
  - ↪ **Establishes:**
    - “Special Regime” for electricity from RES (< 50MW)
    - Grid access guarantee
    - Premium for electricity from RES
- **Royal Decree 661/2007. Feed-In Tariff for electricity production from RES**
  - ↪ **Two sale options: Regulated tariff or free market sale**
- **Royal Decree 1578/2008. Redesign of payment for PV electricity production. Power quotas**
  - ↪ **Two groups: in buildings & in land.**
  - ↪ **Pre-assignment of remuneration is established.**
  - ↪ **Decreasing tariffs, for new facilities. Increasing quotas, as tariffs decrease.**
  - ↪ **500 MW/year, with increases of 10 %/year (> 4.000 MW accumulated in 2010)**
- **Royal Decree Act 6/2009**
  - ↪ **Establishes a register called pre-assignment register. To be awarded with the feed-in tariff it is necessary to be included in the register**

## Royal Decree 661/2007 on Special Regime

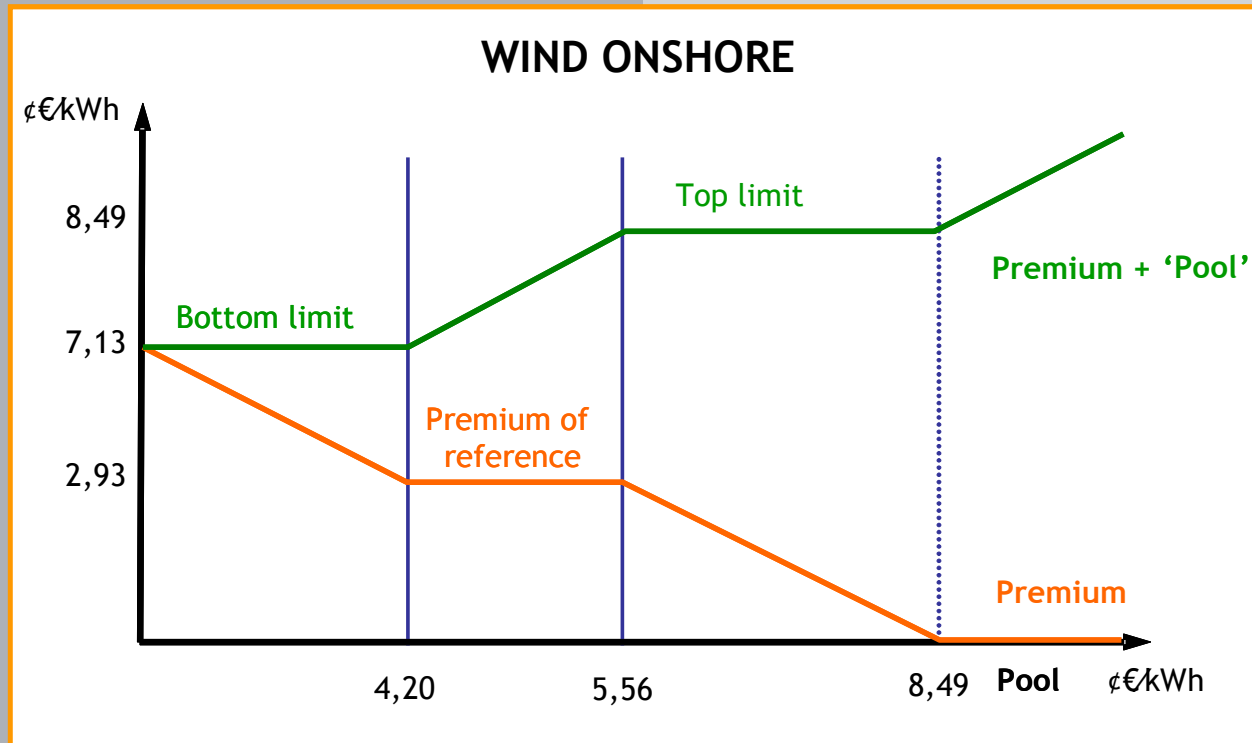
- **Objective:**
  - Legal and economic scheme for the Special Regime.
  - Consolidate the regulatory framework, offering stability and predictability to the system.
- **Characteristics:**
  - Feed-in tariff system.
  - Guaranteed throughout the life-time of RES installations
  - Adapted to development level of each renewable area.
- **Methodology:**
  - Two options for kWh remuneration (periods 1 year min):
    1. **Regulated price:** independent of capacity and year of commissioning.
    2. **Open sale in the market:** 'Pool' + Premium + Complements.  
Upper and lower limits for the total (pool'+premium)

### SCOPE:

- **Category a)** cogeneration or other electricity production from waste energy
- **Category b)** renewable energies, biomass or any biofuel as primary energy, whenever titleholder do not carry out production activities under ordinary scheme
- **Category c)** Power plants that use waste with energy recovery not stated in category b) as primary energy

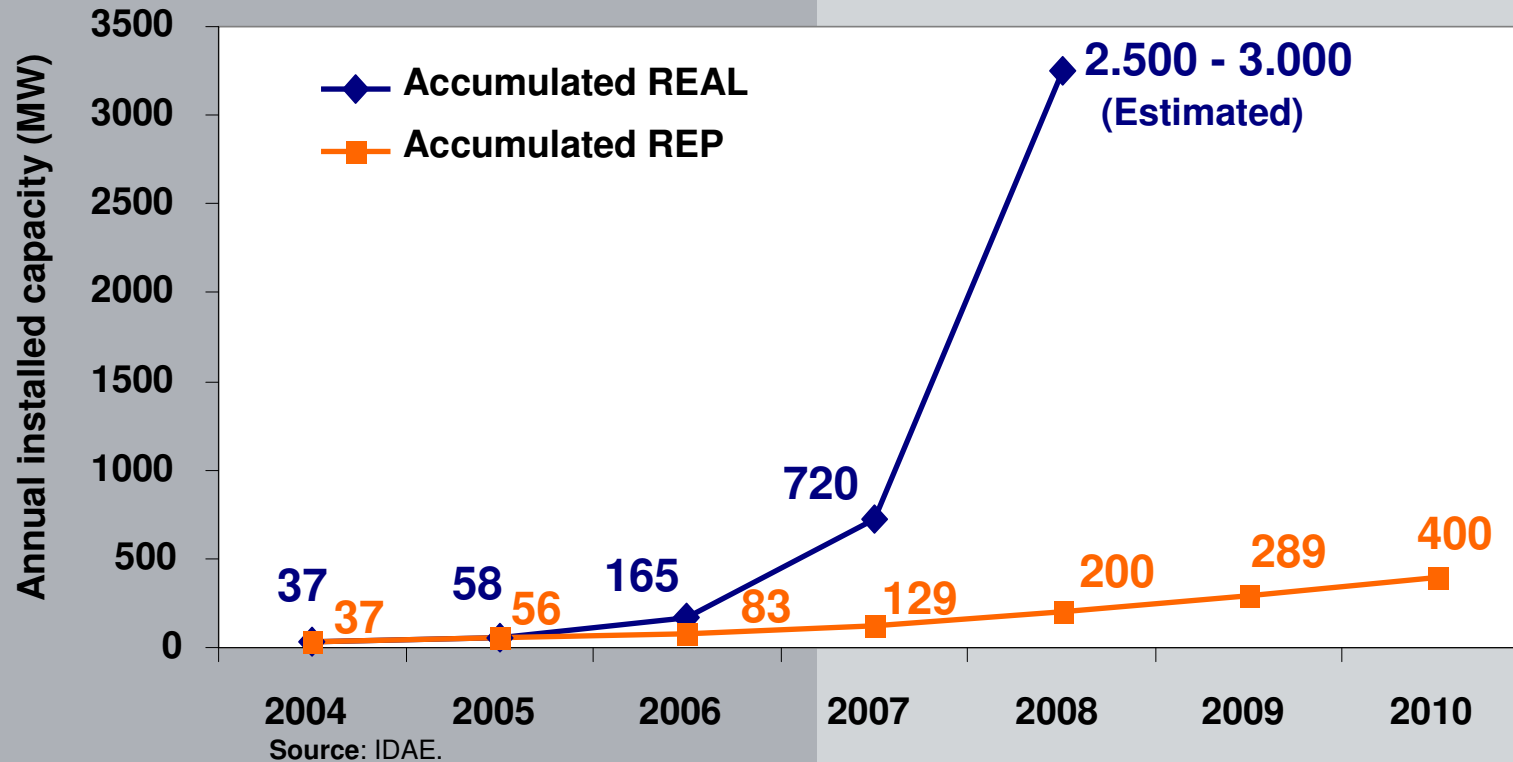
## SPANISH LEGISLATION

### *Royal Decree 661/2007. Feed-In Tariff*



This new system **protects the promoter when the income derived from the market price is too low, and removes the premium when the income is high enough to ensure breaking even**, leaving out the irrationalities in the payment of technologies whose costs are not directly linked to oil prices on international markets.

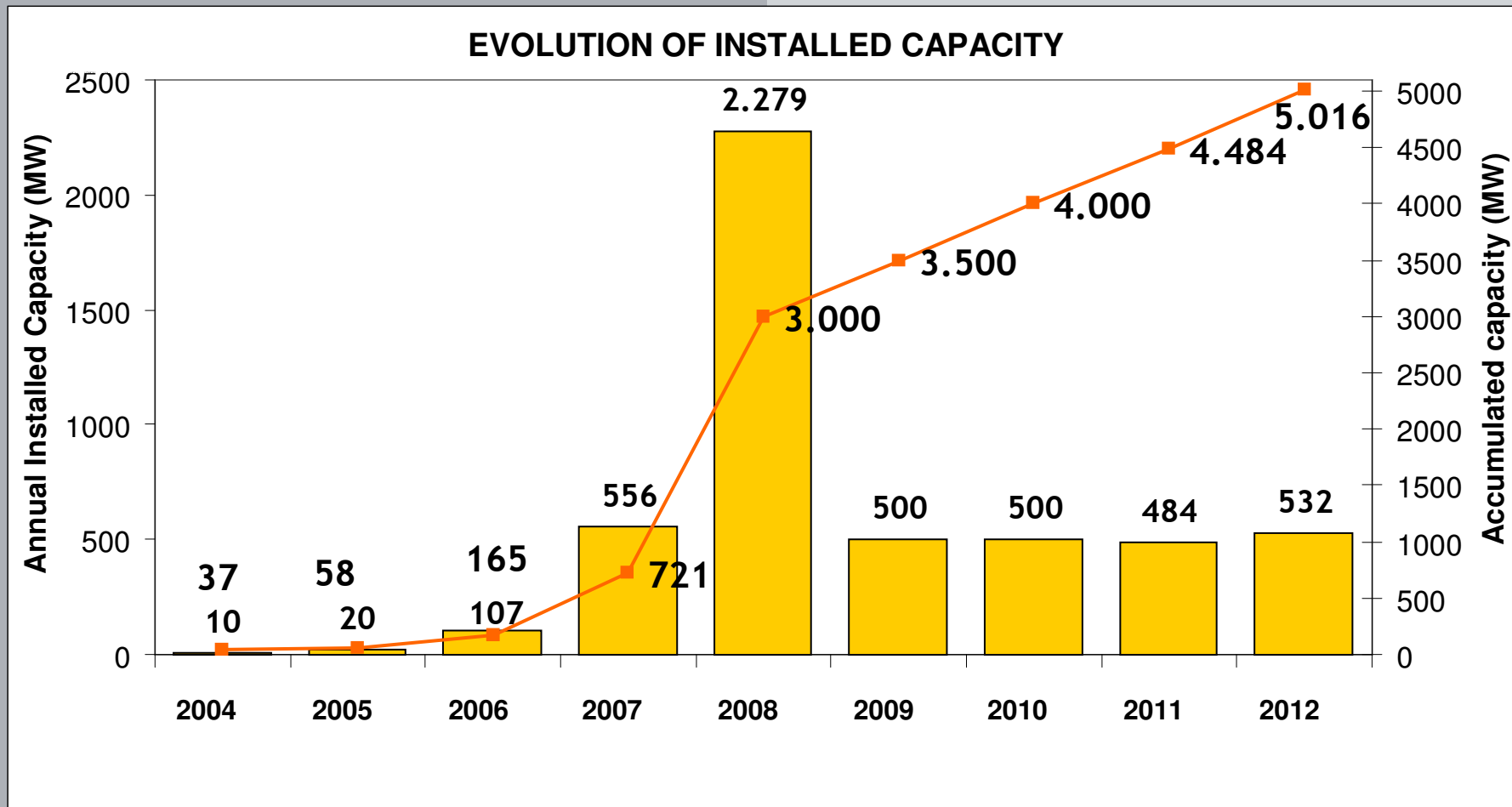
## PLANIFICACION REP vs. REAL



**The goal for PV sector defined in REP 2005-2010 was reached in 2007 (3 years of anticipation)**

# SPANISH LEGISLATION

## *Royal Decree 1578/2008. Feed-In Tariff PV*



## RD 1578/2008 MAIN ASPECTS

TYPOLOGY OF FACILITIES		CAPACITY	TARIFF (c€/kWh)
Type I. Roofs or walls (residential, services, commercial, industrial, farming, parking)	Type I.1	$P \leq 20 \text{ kW}$	34
	Type II.2	$20 \text{ kW} \leq P \leq 2 \text{ MW}$	32
Type II. Rest not include in Type I		$P \leq 10 \text{ MW}$	32

- **Higher support to architectural integration:** higher quota & tariff
- **Pre-assignment of remuneration is established (four calls/year):**
  - ✓ Administrative, access and connection authorizations.
  - ✓ License for civil works.
  - ✓ Bank guarantee.
- **Decreasing tariffs for new facilities**
- **Increasing quotas, as tariffs decrease: 500 MW/year, 10 % increase/year (> 4.000 MW in 2010)**

## RD 1578/2008 EVOLUTION OF THE TARIFFS

- ✓ If 75 % of the quota is covered, TARIFF DECREASES:

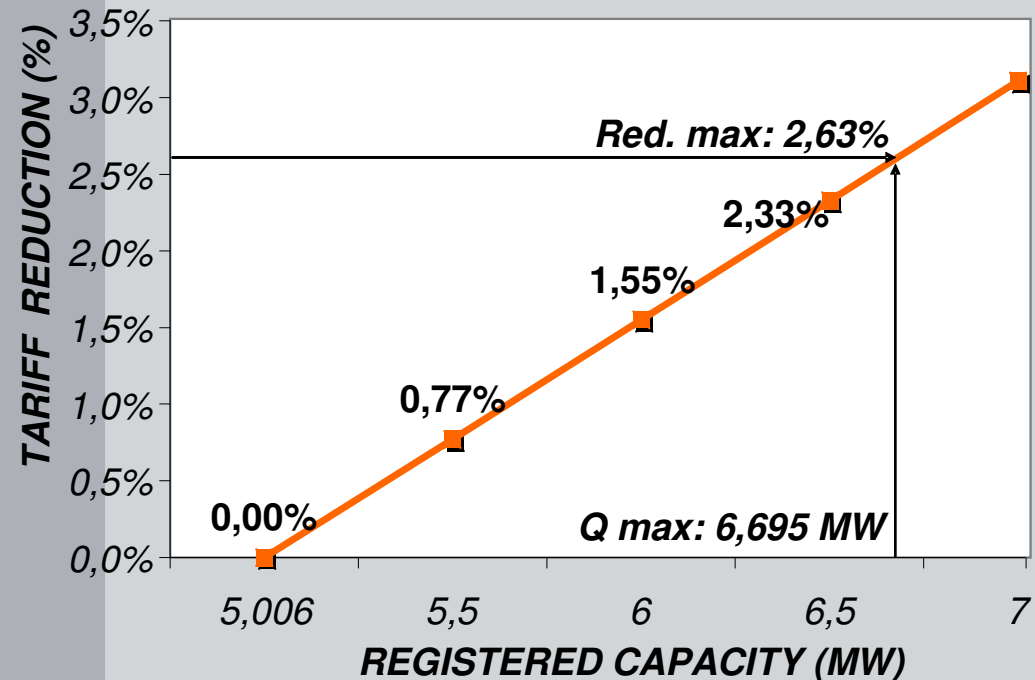
$$T_n = T_{n-1} [ 0,974 + 0,026 \times (Q_0 - Q) / (0,25 \times Q_0) ]$$

$Q_0$  = Quota of power for the call n-1, without including transfers of capacity

$Q$  = Quota really registered in the pre-assignment register in the call n-1

- ✓ If 75 % of the quota is not covered, TARIFF IS KEPT

### EVOLUTION OF TARIFFS: TYPE 1.1



## Summary (1/2)

- **High degree of dependency on fossil fuels (85%)**
- **Thus, two basic targets of the energy policy:**
  - ✓ **Reduction of CO<sub>2</sub> emissions (need to comply with Kyoto commitments)**
  - ✓ **Guaranteeing security of energy supply (80% imports)**
- **New decreasing trend in energy consumption**
- **Important role of RES to attain energy policy targets (new target of 20% final energy consumption in 2020)**
- **RES accounted for 7.6 % of primary energy and nearly 20% electricity demand in 2008**

## Summary (2/2)

- **2010 RES objectives:**
  - ✓ **12.1% primary energy, 30.3% electricity demand and a 5.8% contribution of bio-fuels to the transport consumption**
- **2020 new target of 20% final energy consumption and 10% substitution in transport fuels**
- **Spanish leadership in some RES technologies (thermoelectricity, PV and wind energy)**
- **Feed-in tariff system main incentive to attract private investors**
- **Technical Building Code provides for good opportunities for solar energy and for Energy Efficiency**

**Thanks for your attention**

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