UNIVERSIDAD PONTIFICIA ICAI ICADE COMILLAS MADRID
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Distributed Generation in Spain Situation in year 2005

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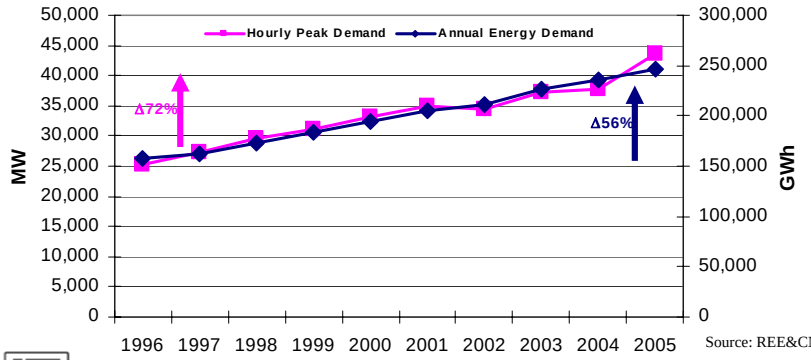
Contents

- Basic data on the Spanish Electrical System
- Regulatory framework
  - Objectives
  - Policy framework
- Successes and flaws
  - Renewable energy sources evolution

Spanish evolution: last 10 years

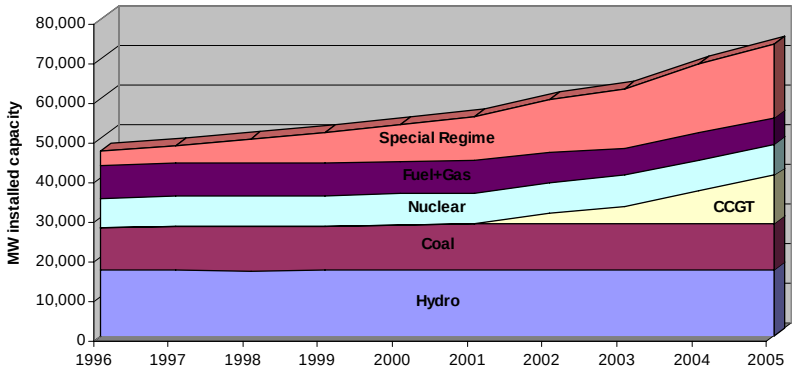
- 10% population growth (mainly immigration)
- 44% GDP growth (average of ~4%/year)
- 56% energy consumption growth (average of ~5%/year)
- 72% hourly peak demand growth (average of ~5.5%/year)



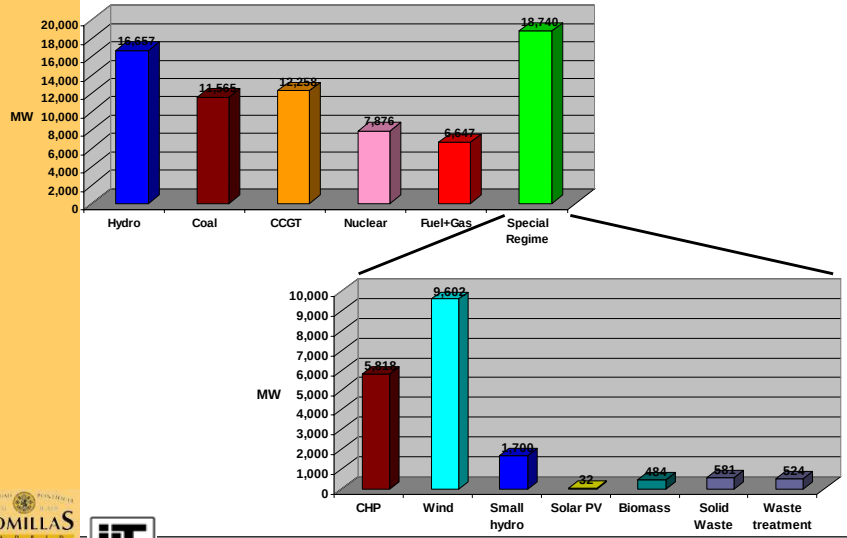
Source: REE&CNE

Evolution of installed capacity

- CCGTs and Wind are almost the only ones being installed:
  - >12 GW of CCGT and >9 GW of wind out of 27 GW growth

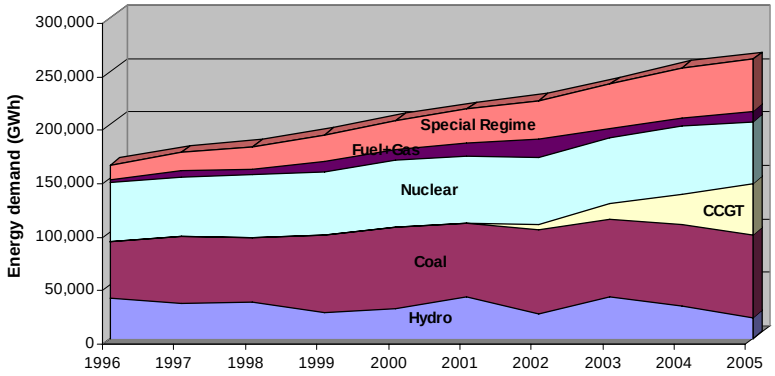


Installed capacity December 2005

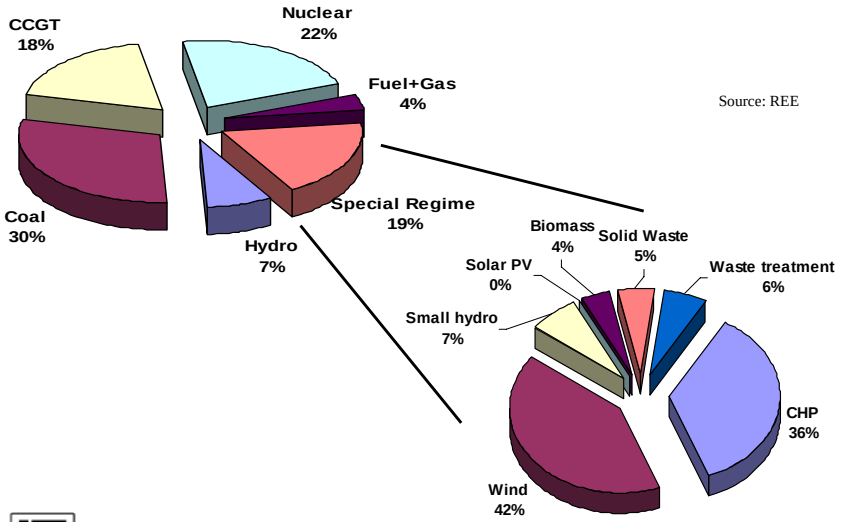


Electrical energy production mix evolution

- Due to demand growth and droughts, coal-fired generation is not really reducing its output



Electrical energy mix today (year 2005)



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Spanish drivers for renewable energy sources support

- Spain has a dependency of more than 80% in energy imports
  - This includes nuclear energy as "local"
  - All oil and gas is imported
  - Local coal is expensive and low quality
- Spain has signed the Kyoto protocol and is part of the EU
  - Spain has been allocated a 15% growth of CO_2 emissions over 1990's emissions level, for 2012
    - Today, Spain has increased by 45% its emissions
  - Spain has committed to have a 12% of its primary energy needs coming from renewable sources by 2012
    - This implies a 29% of electricity generated from renewable sources

Spanish objectives for renewable energy sources (i)

- Spain has decided that they could not afford to develop each technology sequentially
  - Any possible renewable energy source is needed to fulfil overall objectives
- The IDAE (public Institute for Diversification and Energy Efficiency) has published two National Plans for Renewable energy sources expansion (2001-2010 & 2005-2010)
  - Based on actual situation of each available technology (development status, local resources, Spanish infrastructures, etc.) and its costs
  - The second plan (2005-2010) has taken into account the successes and flaws of actual policies to tighten their objectives, besides having to review the expected energy growth

Spanish objectives for renewable energy sources

- National Plan for electrical generators from renewable sources

RES	Targets set by the National Plan to support RES for the year 2010 (MW)	
	Published in 1999	Revision in 2005
Wind	13,000 (initially 8,974)	20,155
Photovoltaic	115	400
Solar Thermal	200	500
Hydro < 10 MW*	720	2,199
Hydro 10 - 50 MW*	350	3,257
Biomass	1,708	2,039
Solid Wastes	168	189

Policy tools to reach such objectives

- Creation of the Special Regime (SR)
  - Non-supported generators are considered ordinary regime
  - Characteristics of the SR
    - Size < 50 MW
    - Renewable sources or co-generation (high efficiency solutions)
      - Closed list of technologies (there is no category such as "any renewable source technology")
    - Have specific technical rights & obligations
      - Lower requirements than to ordinary regime
    - Have specific economic support
      - Feed-in-tariff or premium above market price

SR Legal Framework (i)

- First stage:
  - SR is marginal. Doesn't have any impact of the system
  - Need strong supporting mechanism to begin its development
- Regulation: RD 2818/1998
  - Feed-in tariff model
  - No market participation: right to be dispatched
  - Limited technical obligation

SR Legal Framework (ii)

- Regulation: RD 2818/1998
  - Feed-in tariff
    - Guaranteed fixed price for each kWh produced
    - Specific to each technology
    - Revised every 4 years
    - Priority for generation: SR generation can only be disconnected or limited due to security reasons
  - Limited technical obligation
    - Basically fulfilment of technical connection requirements
    - Power factor equal to 1
    - Don't have to forecast their production, don't participate in any ancillary services and don't have to pay for them, etc.

SR Legal Framework (iii)

- Today, SR is not anymore marginal
  - Wind explosion is driving all the changes
  - Need of a better integration in the system to allow for a greater growth
- New regulation: RD 436/2004
  - Add a few technical constraints to SR installations
  - Offers as an alternative a full access to the wholesale market through economic incentives
  - Give an economic incentive to cope with dips (specific for wind parks)

SR Legal Framework (iv)

- Today regulation: RD 436/2004
  - General changes added to the feed-in-tariff option:
    - Obligation of production prediction for generators > 10MW
      - partial assumption of deviation costs
    - Revision every 4 years for new installations only: greater income stability
    - Modulated reactive energy incentive (applicable to any option)
  - Alternative option:
    - Participation in all the electricity markets
    - Full assumption of deviation costs
    - Possibility of aggregation of different installations
    - Premium + incentive on top of other incomes/costs

More on the Legal Framework

- Connection Standards
  - Specific standards for photovoltaic < 100kVA connected to LV network (year 2000)
  - Out of date standards for other technologies (1985)
- Licensing procedures
  - Very long and complicated: several authorities and market agents
  - Regulated contract with the Distribution Company
- Administrative requirements to access the market
  - May be a barrier to small generators
  - Possibility of avoiding most of the requirements by using a broker

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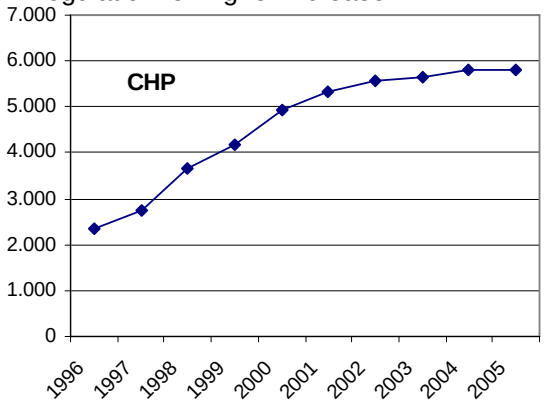
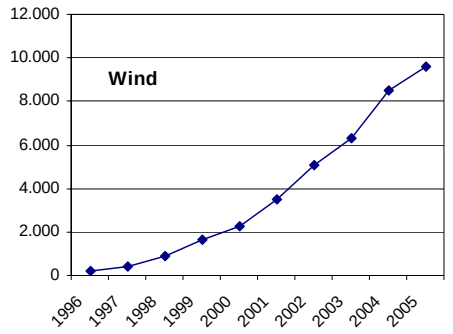
SR Installed Capacity over time (i)

- CHP technology
  - Gas dependent, has to self-consume part of its production, EU directive not yet transposed
  - Need some change in regulation for higher increase
  - Big uncertainties for the future



SR Installed Capacity over time (ii)

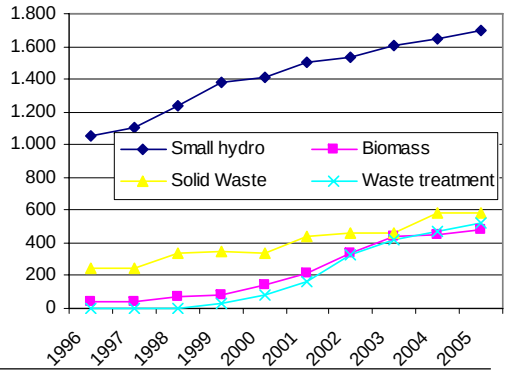
- Wind technology
  - Spectacular increase
  - Has to double to reach new objectives for 2010
  - Problems to evacuate their energy, technical limits of the system, local and regional administrative processes
  - Figures
    - 20 GW as Government
    - 30 GW as regions
    - 60 GW as promoters
    - 95 GW as Greenpeace



SR Installed Capacity over time (iii)

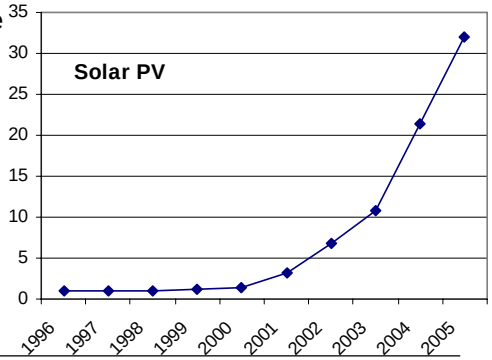
Small hydro, biomass, solid waste & waste treatment

- Steady increase
  - Small hydro: better than expected
  - Biomass: much lower than expected
    - If biomass does not increase its uptake, the overall objectives won't be reached



SR Installed Capacity over time (iv)

- Solar technology
  - PV
    - High increase, but far away from objectives
    - Since the change in regulation (year 2004)
      - 6 GW of petitions but…
      - …only 9 MW increase in 2005 < 2004
  - High temp. thermal
    - 150 MW already being built
    - > 450 MW being claimed



Market & system integration

- More than 90% of wind installations have switched to the market option
  - Better market integration
  - They feel the economical signals: deviation costs
    - But the premium on top of the market price does not allow them to really valuate correctly the equilibrium point between energy costs and deviation costs: signals are not strong enough for them to change their behaviour, just to better forecast…
- Network integration
  - No location signals
  - Local integration is completely absent
  - DNSP regulation is not adapted to
    - Plain high penetration of Distributed Generation
    - Future Active Networks

Main barriers to a further development

- Technical barriers
  - Connection standards
  - Market, system and network integration, necessary for higher level of penetration
- Administrative processes
  - Too long and complicated, too many authorities involved
- Economic support uncertainties
  - Future society support to increasing costs is not clear
- Network uncertainties
  - DNSP regulation is not adapted to a high penetration of DG
  - There are now problems to evacuate the generated energy from DG in several areas
  - There is no place in the actual regulation framework for Active Networks

Technical barriers

- Connection standards
  - A connection standard adapted to the new reality is urgent
  - Actual one has been published in 1985
  - Only LV Solar PV (<100kWp) have their own standard
- System and network integration
  - Several steps have been made for a better technical integration, but it has to be greatly improved to allow for a higher penetration
    - Reactive power control has been enhanced, but it is not enough
    - Dips are still a problem
    - Frequency-power control has been enhanced through market participation, but it is not definitive and has yet to be improved
    - There is no possibility for the moment for an Active Management of the Distribution Network

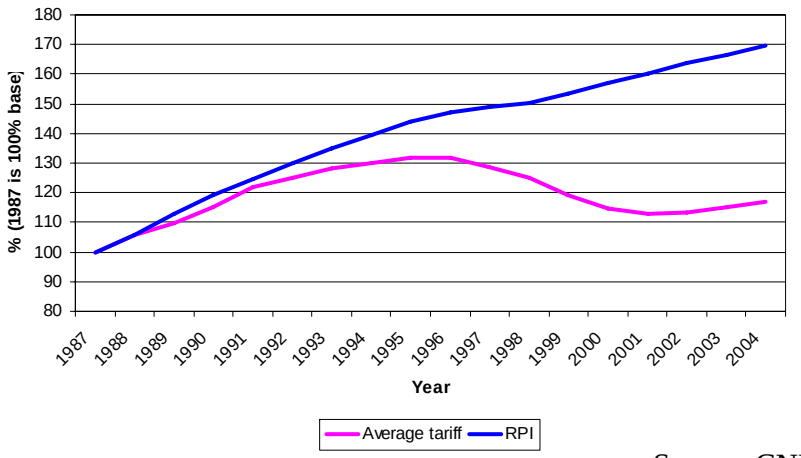
Administrative processes

- Too many authorities and entities
  - Political an environmental approval from
    - Central government
    - Regional government
      - Local plans based on land use management
      - Several regions have freeze their wind expansion plan till now
    - Local authorities
      - Possible new income
  - Technical approval from System Operator (and Market Operator)
  - Access to the network (capacity and PCC)
  - Contract with the DNSP

Economic support uncertainties

- Costs associated to the subsidies to the SR are increasing, and expected to increase much more in the future
- Today, this cost is 8.8% of total Electrical System costs
  - 1.5 b€ of subsidies vs. 17 b€ total costs
- Customers have accepted this cost because they are not aware of it
  - Electrical tariff has decreased in real terms over the past 10 years

Regulated tariff



Source: CNE

Lessons learned

- Economic support is only a part of the supporting mechanism
  - Connection standards
  - Administrative permits
    - Actually, this other aspects might not allow to evaluate correctly the impact of the economic support, and may lead to wrong decisions
- Different types of rules for small penetration and high penetration levels
  - Wind generation might die due to its own success
    - Technical integration failure
    - High economic support might backfire in the future

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Thank you for your attention

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