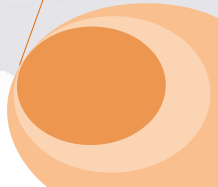





TIMES-Spain model and scenarios

H.Cabal, Y.Lechón and D.García (CIEMAT)
M.Labriet, GC. Tosato, M.Gargiulio and A.Kanudia (ASATREM)

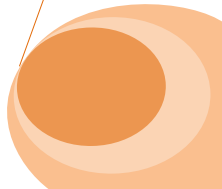


 GOBIERNO DE ESPAÑA
 MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD
 **CIEMAT**
Centro de Investigaciones energéticas, medioambientales y tecnológicas

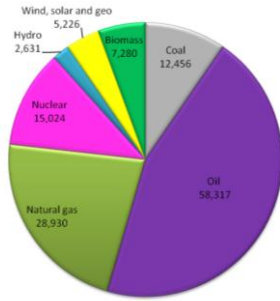
ETSAP workshop, Cape Town 22nd June 2012



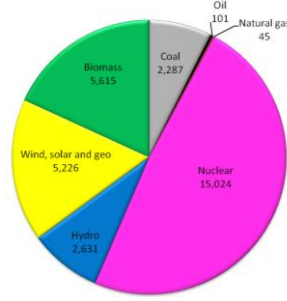
CONTENT

1. Main characteristics of the Spanish energy system
 2. TIMES-Spain
 3. Scenarios
 4. Preliminary results
 5. Conclusions
- 

1. Spanish energy system Energy 2011



Primary energy consumption: 129,339 ktoe



National production: 30,929 ktoe

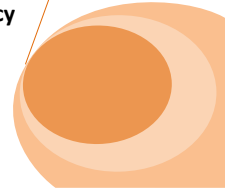
Self-consumption: 24% → Very high fuel dependency

Source: Energy Secretariat
Ministry of Industry, Energy and Tourism

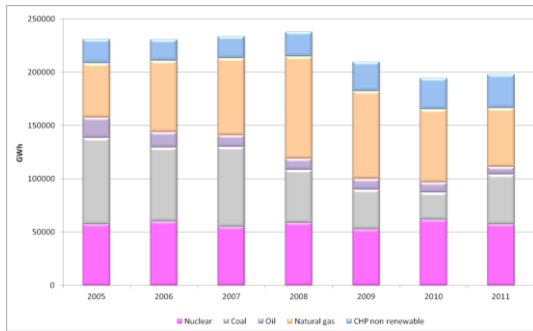


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1. Spanish energy system Gross electricity generation 2011



Fossil fuels and nuclear

198,308 GWh in 2011

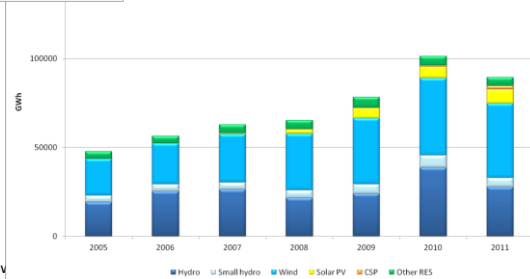
Renewable
89,447 GWh in 2011

Source: Red Eléctrica Española
(Spanish Electricity Network Operator)



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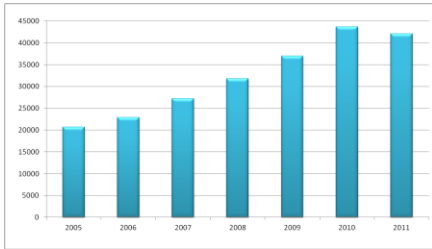
ETSAP workshop, Cape Town



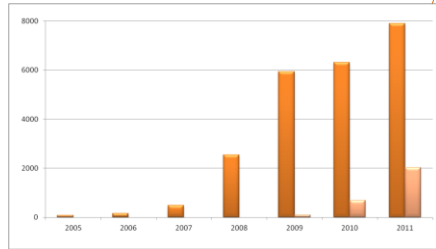
1. Spanish energy system Gross electricity generation 2011



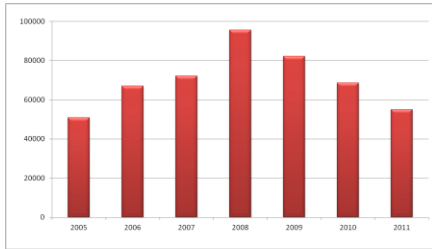
WIND POWER



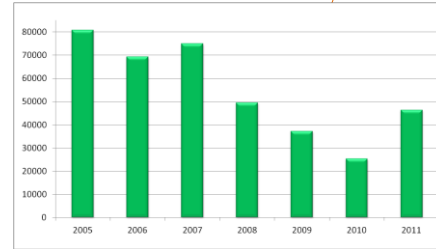
SOLAR



NGCC



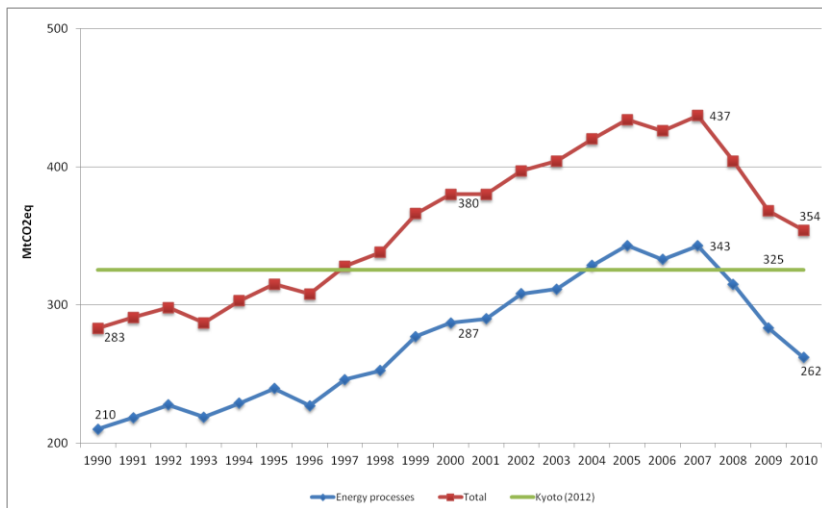
COAL



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Source: Red Eléctrica Española

1. Spanish energy system GHG emissions

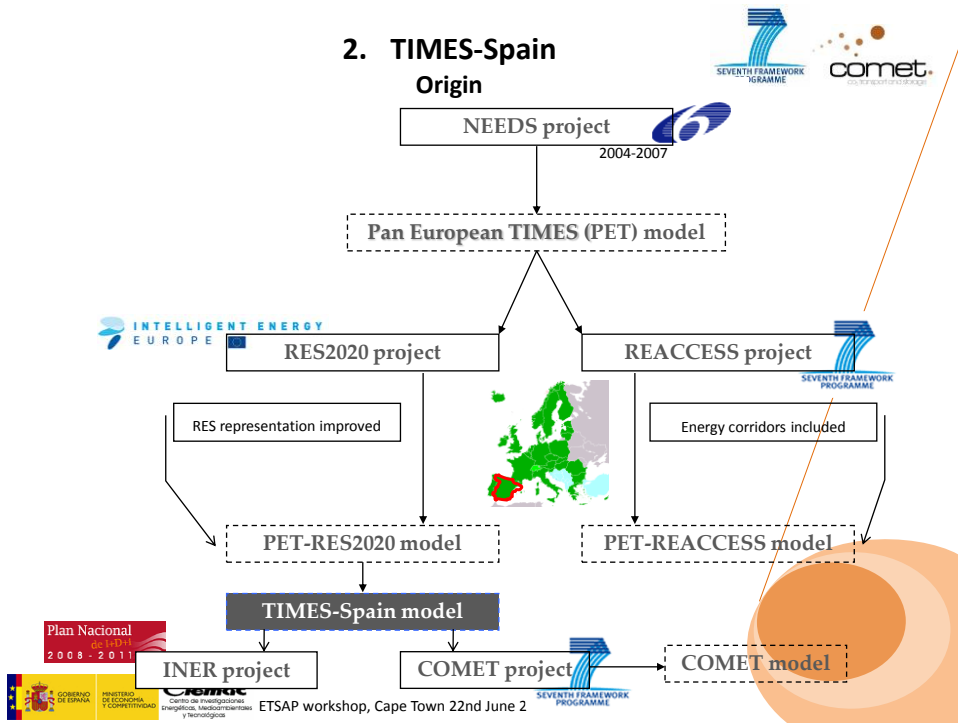


Source: Ministry of Agriculture and Environment



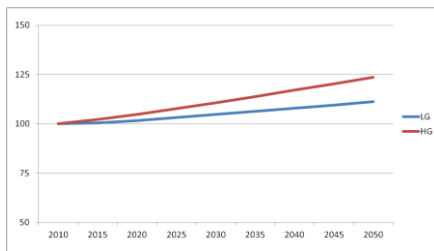
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2. TIMES-Spain Origin

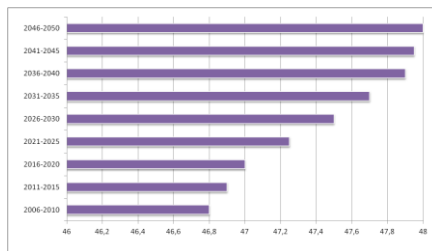


2. TIMES-Spain Data

Demand driven model \Rightarrow energy demand projections



GDP projections
Sources: National statistics and IMF



Population
Source: National statistics

- Techno-economic model \Rightarrow technical and economic data
- Calibration year 2005 (IEA, Eurostat, national data)
- Energy trade with PT and MO (Spanish electricity network operator)
- Fuel import prices (IEA-WEO 2011 scenarios)
- Energy resources available (renewable potentials from international and national literature)
- Future technologies

3. Scenarios



Economic Growth: Low demand (LD) and High demand (HD)

CO2 capture and storage: available (CCS) and not available (NCCS)

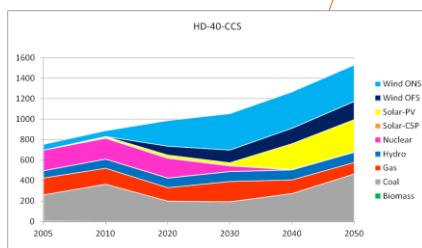
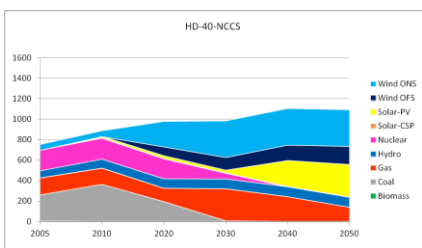
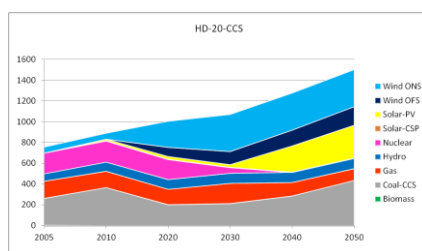
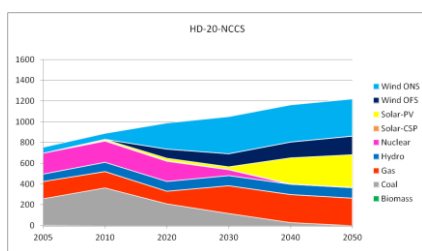
CO2 mitigation objectives: 20%, 40% and 80% CO2 reduction by 2050

| | | | | | |
|-----------|------------|-----------|------------|-----------|------------|
| LG-20-CCS | LG-20-NCCS | LG-40-CCS | LG-40-NCCS | LG-80-CCS | LG-80-NCCS |
| HG-20-CCS | HG-20-NCCS | HG-40-CCS | HG-40-NCCS | HG-80-CCS | HG-80-NCCS |



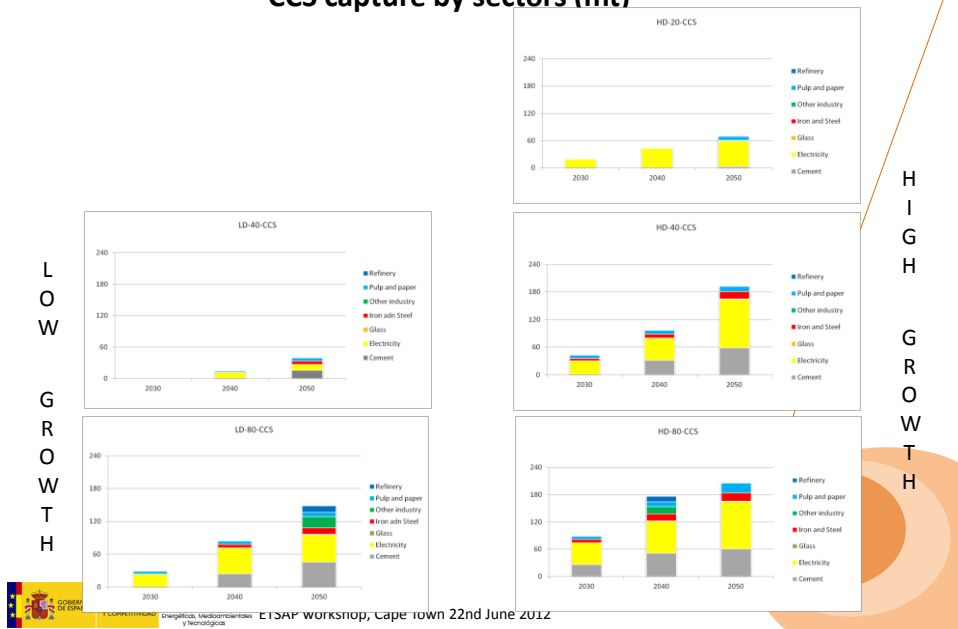
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4. Preliminary results Electricity generation (PJ)



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4. Preliminary results CCS capture by sectors (mt)



5. Conclusions

CCS is an option in all the scenarios except in a low demand growth (20%)

The main sector for capture is the power sector followed by the cement sector

Electricity production is higher in the scenarios with CCS, mainly due to an increase in the electrification of the other sectors

Renewables mean 50% or more of the share in the electricity production in all the scenarios

The possibility of CCS does not affect the power generation with renewables technologies

THANK YOU!

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