

**grid scale energy storage
do we need special regulatory (and thus
market) frameworks for storage?**

IPHE Workshop H2 energy storage

- **Systems with high RES penetration levels demand resources to provide: FIRMNESS + FLEXIBILITY + ANCILLARY SERVICES**
- **Conventional generation units (hydro and thermal) have been traditional providers of these services.**
- **But there are other means to provide flexibility and storage is one of them (Pumping hydro is the only mature technology of storage)**
- **Market should provide signals to choose the most efficient way to provide flexibility.**
- **In Spain, recent regulatory measures will reduce operating hours of hydro pumping storage.**
- **Endesa is being active in some R&D projects of storage in the Canary islands**

Firmness

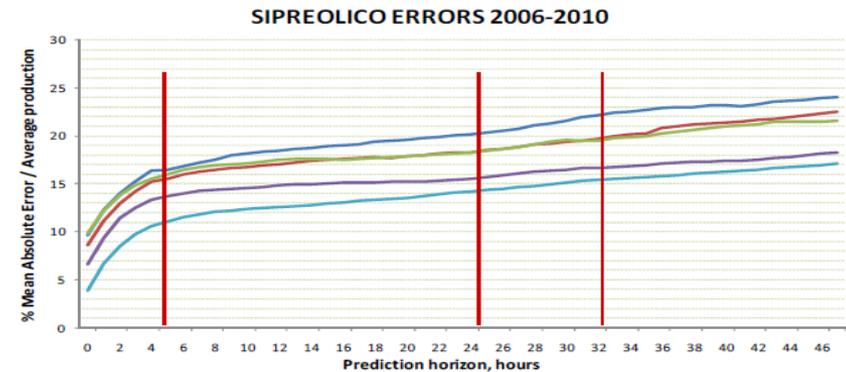
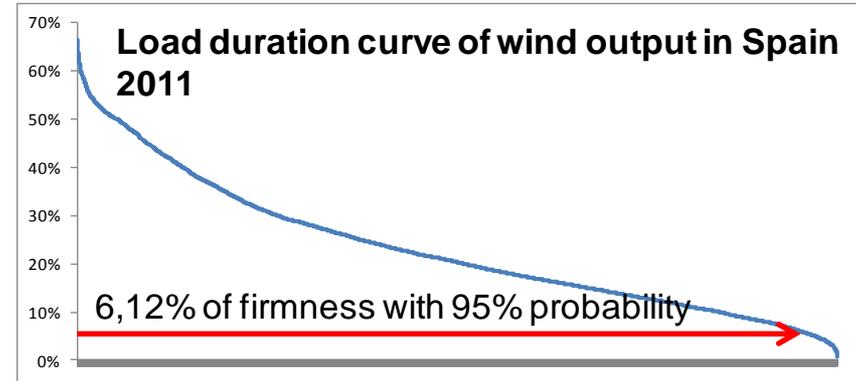
To cope with the absence of intermittent resources

Flexibility

To compensate variability of RES

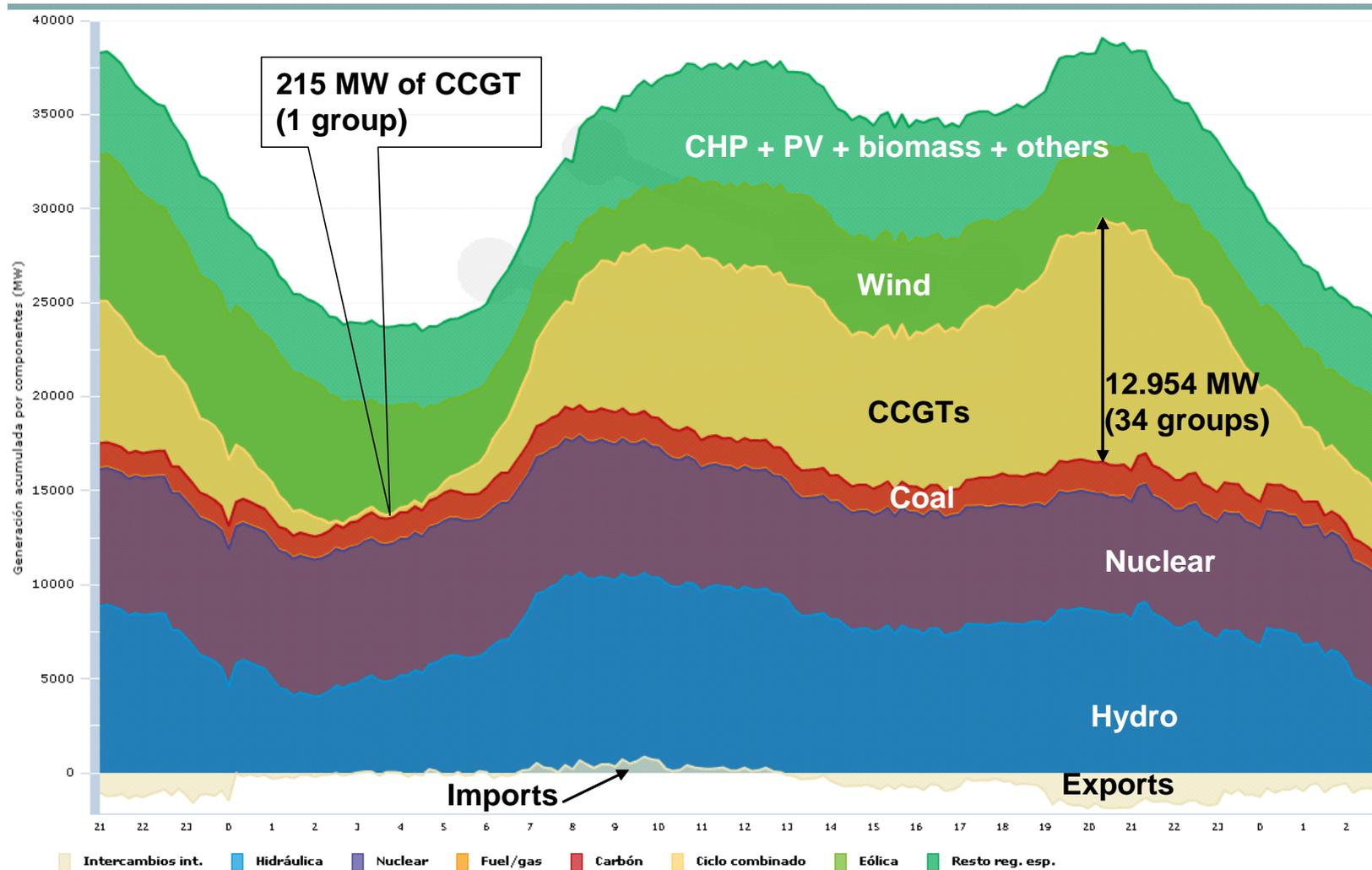
Ancillary services

Operating reserves to assist in generation, load balance and frequency control are needed to cope with unpredictability



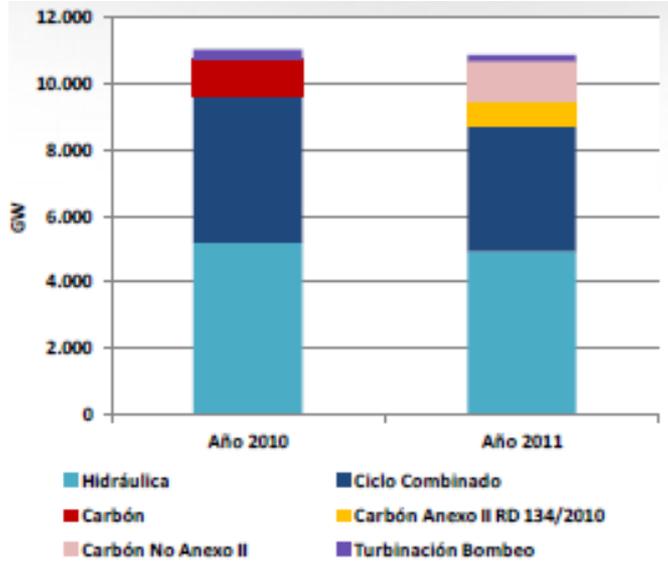
Conventional generation (hydro and thermal units) are providers of flexibility and ancillary services...

Breakdown of generation in Spain (3rd march 2010)

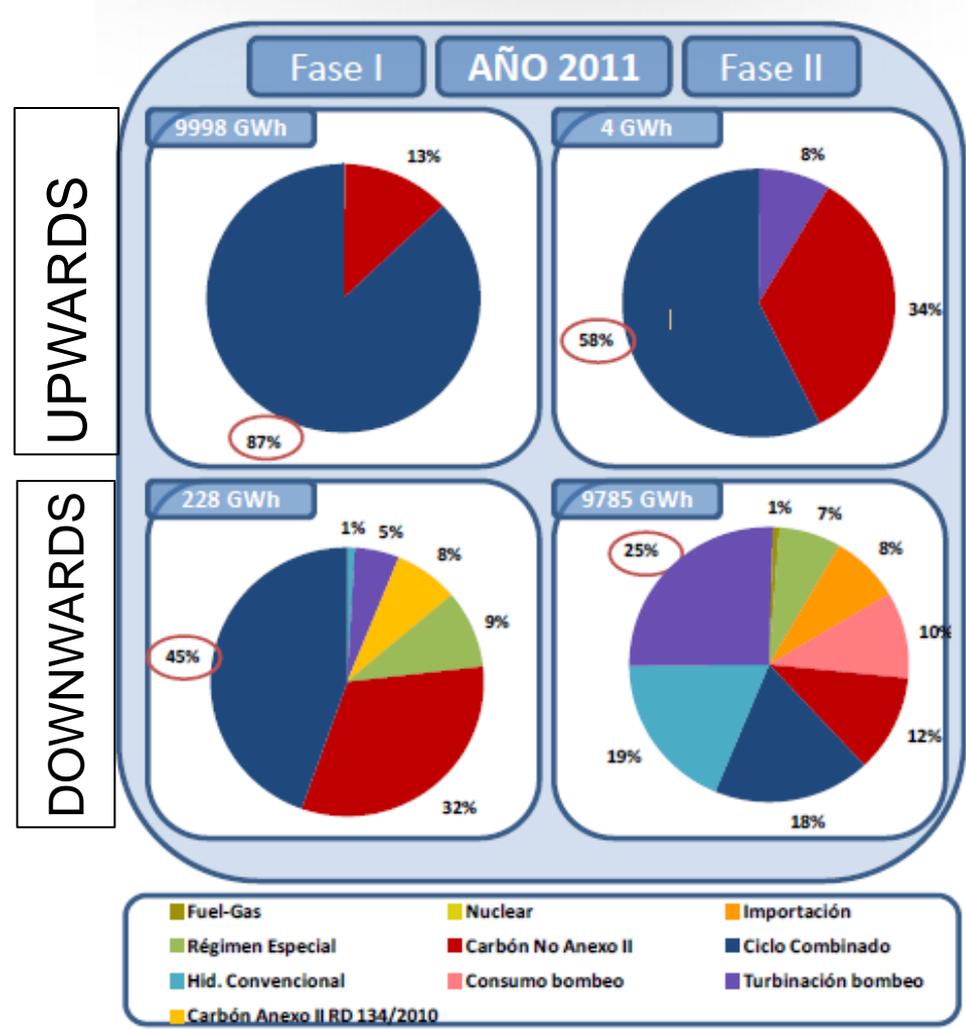


SECONDARY REGULATION

Band awarded in secondary regulation per technology



	Año 2010	Año 2011	Var % (2011 resp 2010)
Hidráulica (GW)	5.219	4.937	-5%
Ciclo Combinado (GW)	4.433	3.786	-15%
Carbón (GW)	1.079	1.958	81%
Carbón Anexo II RD 134/2010 (GW)	-	725	-
Carbón No Anexo II (GW)	-	1.232	-
Turbinación Bombeo (GW)	291	204	-30%
TOTAL (GW)	11.022	10.885	-1%
Coste Total (M€)	181	192	7%



- Fuel-Gas
- Régimen Especial
- Hid. Convencional
- Carbón Anexo II RD 134/2010
- Nuclear
- Carbón No Anexo II
- Consumo bombeo
- Importación
- Ciclo Combinado
- Turbinación bombeo

Technical improvements in conventional generation units

- Reduction of technical minimum of flexible plants.
- Ensure proper price signals to value flexibility and attract peaking units

Demand side management

- Tariff changes to shift demand from peak to off-peak hours
- Electric vehicles, smart grids

Interconnections

- The on going upgrade of Spain-France Interconnection with a new 2 x1000 MW DC underground line is a step ahead but still insufficient

T&D network developments

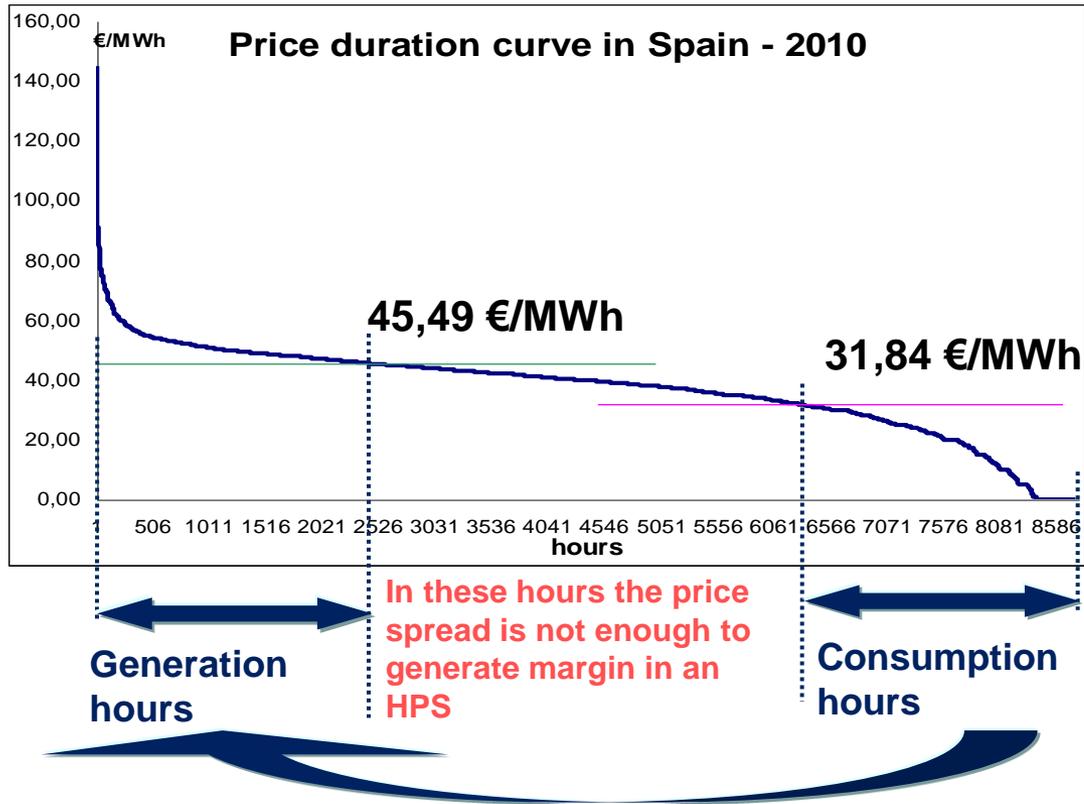
- Grid reinforcements to minimize congestions.
- Flexibility to cope with bidirectional flows.

Storage

- **Hydro pumping storage: the only readily available, large scale storage possibility**
- **Other storage techniques.**

Electricity storage is not considered as a regulated facility, subject to third party access, in the electricity Directive

Pumping storage facilities operate in the market buying and selling energy in competition with the rest of generation and consumption units.



If storage facilities were considered as regulated ones, controlled by TSOs, an unacceptable asymmetry would happen since a TSO-managed facility would be in direct competition with market participants, distorting the ancillary services markets.

Mature technologies



- **Market prices should deliver the adequate signals for investments in every generation technology .**
- **If investments are not carried out:**
 - **There is no economic sense**
 - **The market is distorted and in this case the focus should be to remove the distortion**

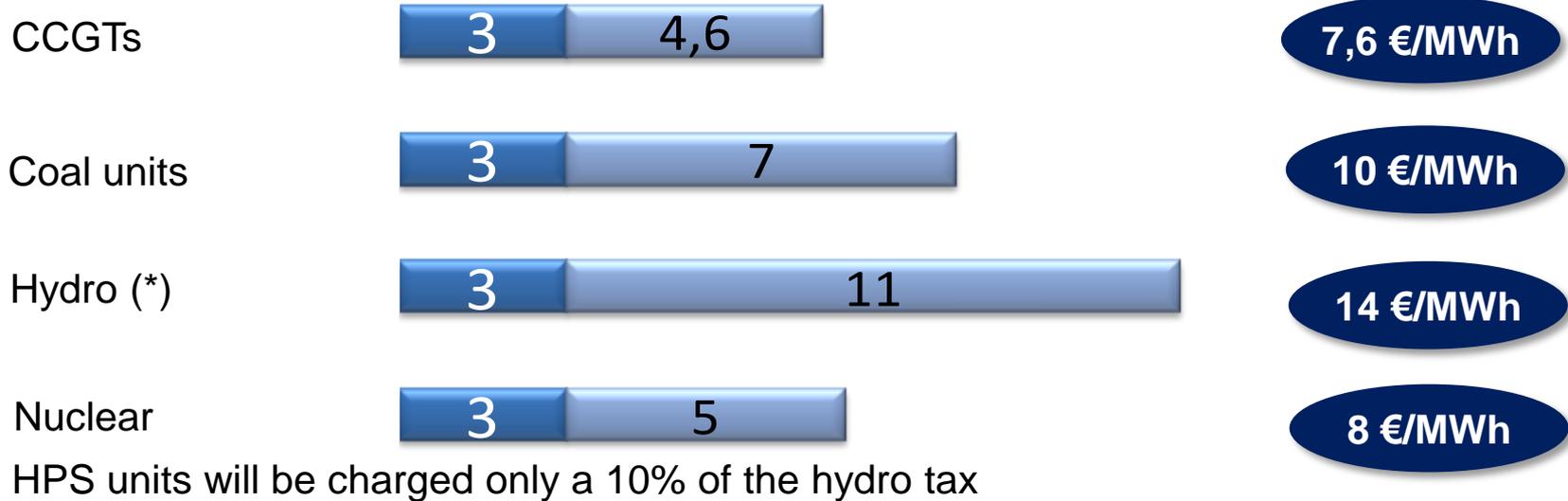
Research & development technologies



- **To be financed with specific budgetary funds external to the electricity costs of the system (Public Budget) until they reach maturity.**
- **Consumers should only pay the cost of the electricity service, not R&D projects.**
- **To avoid past errors in RES support schemes**

1. HPS units were subjected to grid tariffs access in 2011.
2. Draft of Energy taxation Law in Spain (to be implemented in 2013)

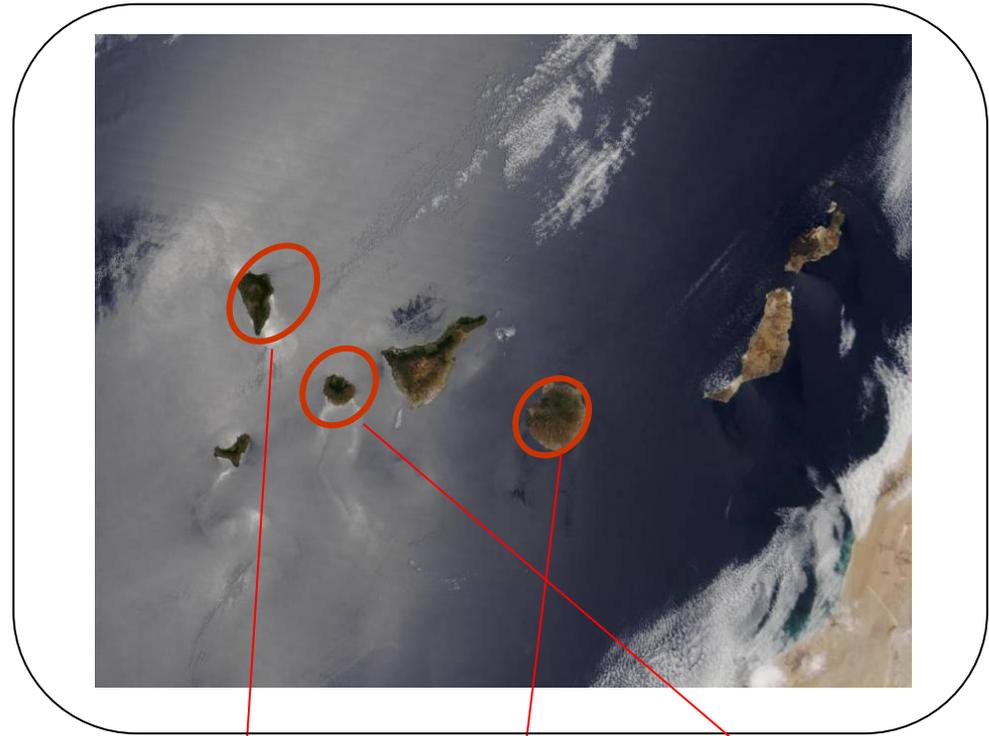
Generation tax + green tax + nuclear tax + hydro tax €/MWh



- New taxation framework will reduce at least 30% the operating hours of hydro pumping units.
- Ongoing projects might be abandoned.
- Operation of generation mix will lose efficiency.

Islas canarias

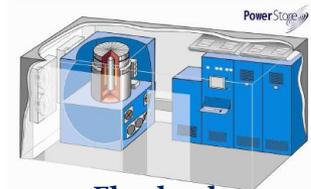
- **La Aldea de San Nicolas (Gran Canaria):**
Unit of 1MW/3MWh based on technology IonLi from SAFT. It operates in Anzofe circuit regulating the load of the line.
- **Playa Santiago (La Gomera):**
Flywheel (inertial element based on a rotating mass) from ABB of de 0.5MW/18MWs for frequency stabilization.
- **CD Los Guinchos (La Palma):**
Ultra capacitors of 4MW/20MWs to support load/generation imbalances in the island electricity system. It might contribute to maintain nominal voltage levels in the bus bar of the plant.



Module
Ultra condensadores
4MW/6sec



Baterias IonLi
1MW/3h



Flywheel
0.5MW/30sec



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