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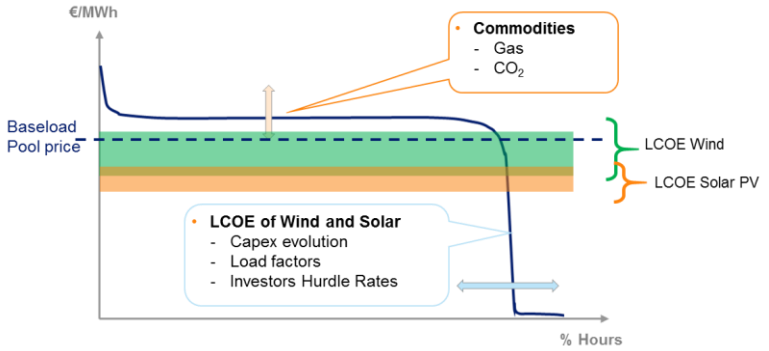
Outlook for Renewable Energies in Iberia in 2020-2030

A NEW CONTEXT OF ‘APPARENT GRID PARITY’

Capex and LCOE of both wind and solar have decreased to levels suggesting no need of subsidies

- RES average costs are around or lower than expected pool prices, which triggers merchant deployment (grid parity)

Illustrative future price duration curve of the Iberian power market



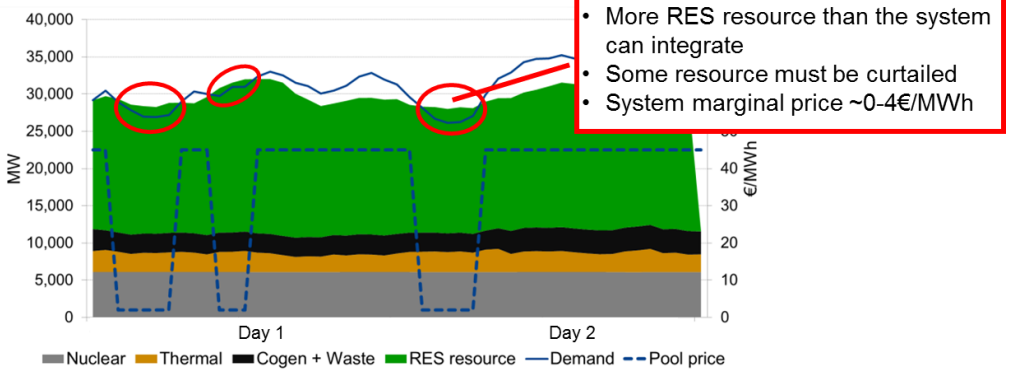
Is this grid parity sustainable? What are the risks?
How much RES capacity can be developed? What are the key factors for RES development?

RES PENETRATION – LIMITS AND CURTAILMENTS

High simultaneous RES resource leads to occasional RES curtailments, 'cannibalising' the RES captured prices

- Iberian RES curtailments started in 2009, depending on rainfall, pumped storage hydro, interconnections. Currently ~1-8% hours, typically in January to April.
- Future RES curtailments will depend on installed capacity of wind and solar, and development of other system elements (interconnections, storage, batteries, demand side management...)

Sample hourly RES curtailments in the Spanish market

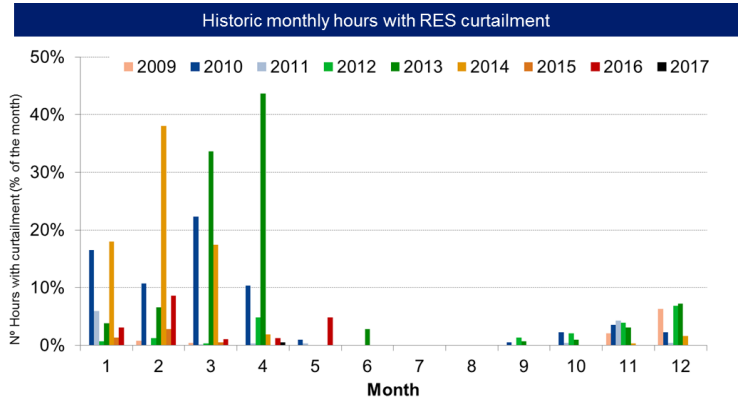


- More RES resource than the system can integrate
- Some resource must be curtailed
- System marginal price ~0-4€/MWh

RES CURTAILMENTS

Curtailments occur typically in Winter and Spring

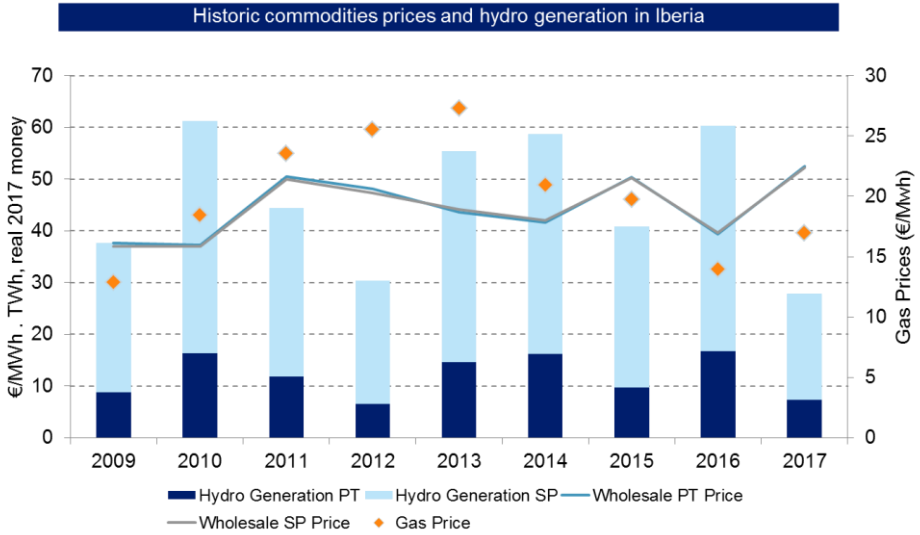
- Due to lower demand and high hydro and wind
- Monthly curtailments and consequent low pool prices will shift from windy nights during Winter and Spring towards sunny days at noon including summer periods



*Pöyry estimates

HISTORIC ELECTRICITY PRICES

Pool prices have been strongly influenced by gas, rainfall and frequency of curtailments



RES ENERGY POLICY OPTIONS IN IBERIA

The capacity mix can be left to the market fundamentals (bottom-up) or defined by political objectives (top-down)

- **Approach 1: Bottom-up system development**

✓ No intervention (target capacity, split PV vs Wind)	✗ May not reach a desired target
✓ CO_2 price will drive optimal European decarbonisation	✗ Higher hurdle rates and cost to develop RES
✓ No direct cost of subsidies	✗ Potential volatile market movements, target reached too late/early, difficult sector planning

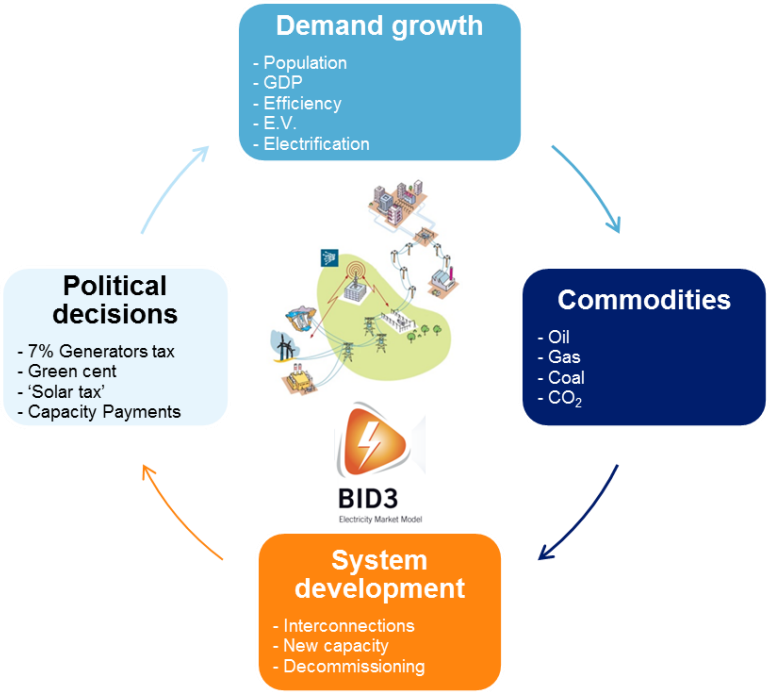
- **Approach 2: Top-down system development**

✓ Designed to reach a desired target	✗ Unknown cost of reaching a target and optimal pace
✓ Faster and cheaper development, easier financing, -5 to -8 €/MWh with stable Gov support	✗ Possible inefficient allocation of Capex in Europe
✓ Better sector planning	✗ Potentially high subsidy costs or major impacts on power market (re-regulation?)

- European and Iberian decisions for 2030
  - European target of 32% (potentially revised upwards in 2023)
  - Future Spanish commitment 34-35%? Possible Portuguese target around 40% up to 50%?
  - Support scheme? Fixed RES auctions vs. market monitoring?
  - Portuguese objectives for 2030, coordination within the Mibel stakeholders?

BUILDING CONSISTENT SCENARIOS

We develop within each scenario a consistent set of interdependent variables



Of the infinite potential futures, we plan for 3 consistent trends: Central, High, Low

Additionally, we model any future consistent with any specific assumption

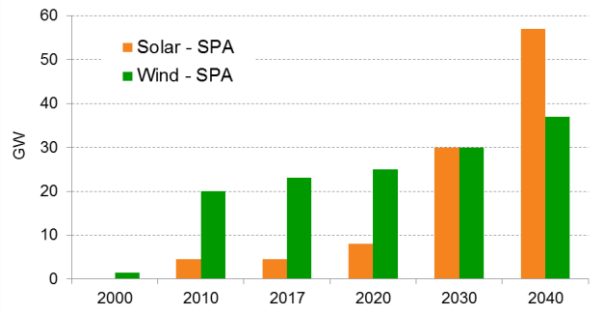
RES ENERGY POLICY OPTIONS IN IBERIA

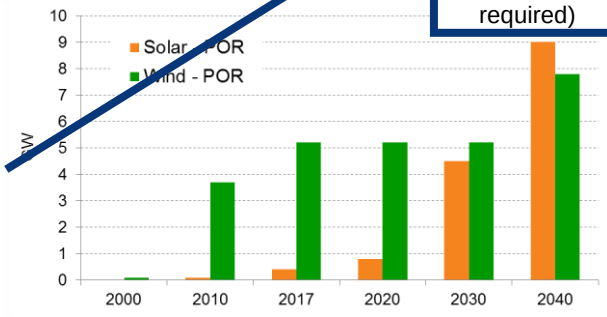
Approach 1 (Bottom-up): Pöyry Central foresees high merchant development

- High development of RES as a consequence of high commodities and low LCOEs of wind and PV
- Higher development of PV as a consequence of
- Lower LCOE projections for PV than for wind (except very windy sites)
- Initial lower market saturation and cannibalisation effect for PV
- High sensitivity of 2030 capacity mix to small changes in assumptions
- Demand evolution, capex, load factors, hurdle rates, commodities, EVs
- RES auctions? PPA market? Banks merchant appetite?

- Discounting RES curtailments, Pöyry Central reaches **by 2030**
  - **~60 %RES-E in Spain**
  - **~75% RES-E in Portugal**,

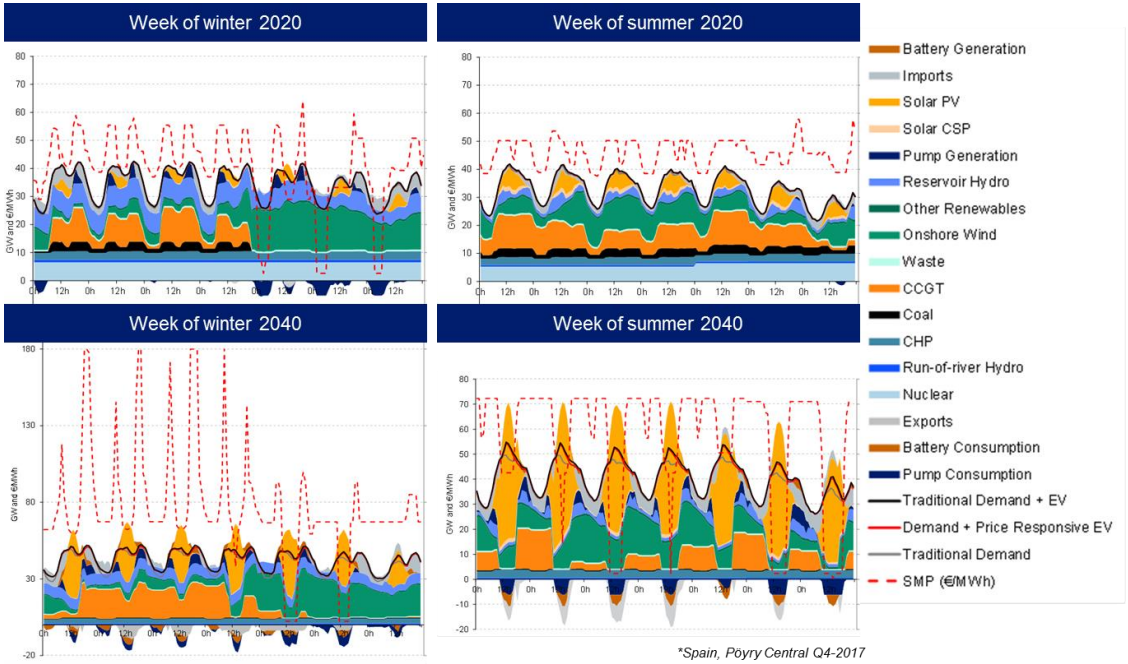
  without need of subsidies (eventually auctions to help financing and reduce WACC)
- >these levels → NO MORE GRID PARITY (subsidies re-required)





EVOLUTION OF GENERATION SCHEDULES AND PRICES

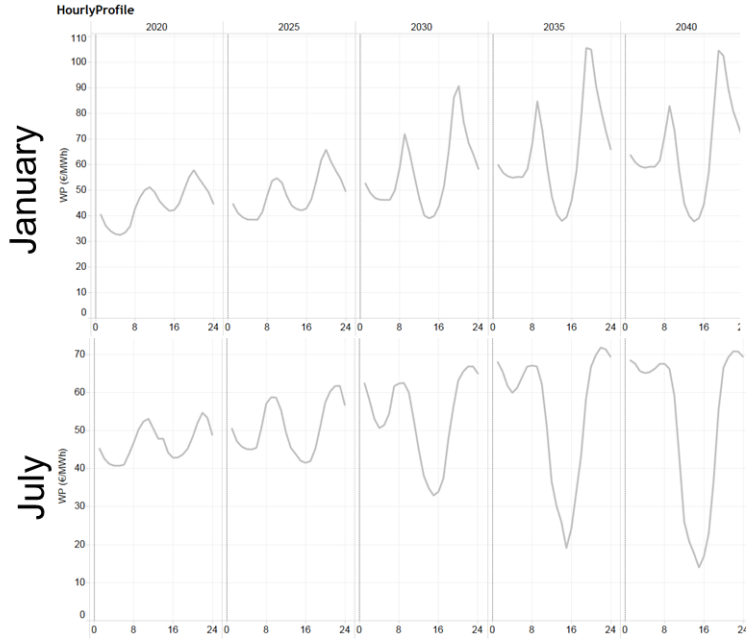
The Iberian market will evolve to more dynamic and volatile dispatching and prices



*Spain, Pöyry Central Q4-2017

EVOLUTION OF HOURLY PRICES

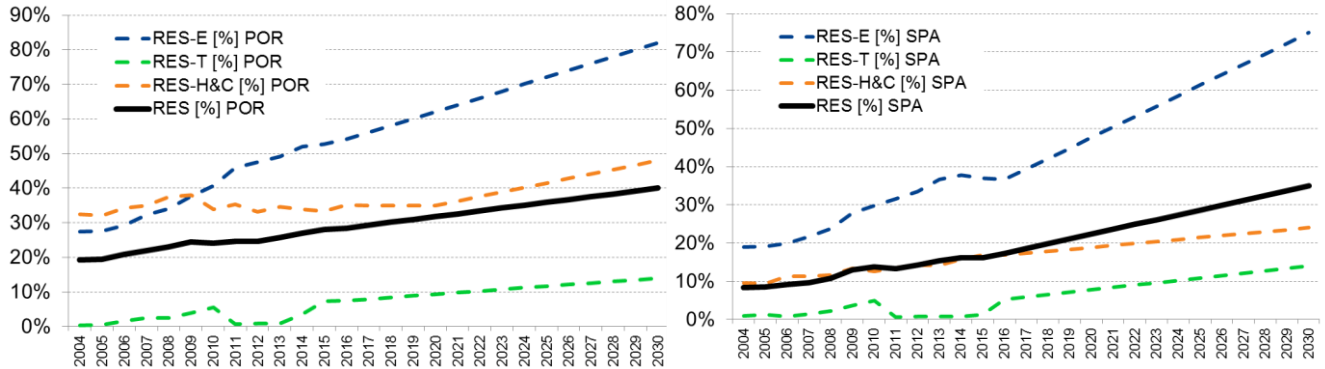
The Mibel hourly prices will be greatly cannibalised in hours of solar production



SPANISH&PORTUGUESE RES PENETRATION TARGETS

Most RES penetration effort will be on the electricity system

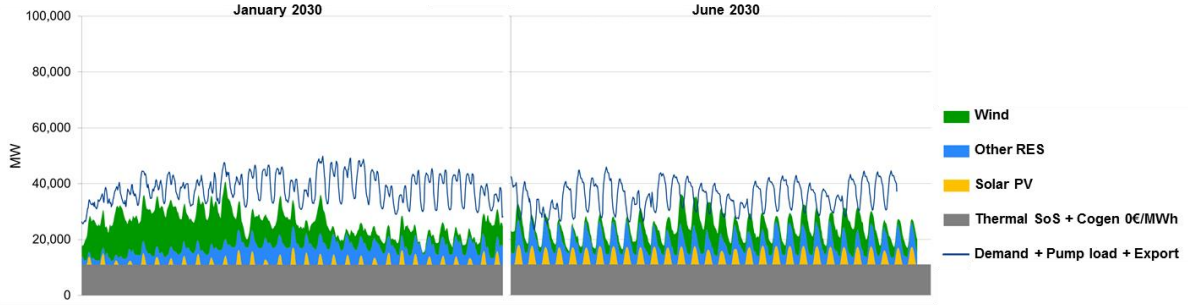
- %RES-Transport (depends on RES-E); 14% target vs. 6-7% in Spain-Portugal
- %RES-Heating&Cooling, ambitious EU target +1.3%/year in 2020-2030 (vs. 17% Spain, 35% Portugal)
- → Spain: 35 %RES-Final Energy → ~76% RES-Electricity (vs. 37% in 2016) or 67% with EU-H&C and Nuclear phase-out
- →Portugal: 40% RES-Final Energy → ~82% RES-Electricity (vs. 54% in 2016)
- Scenarios of H&C and evolution of respective demands drive different scenarios for %RES-E

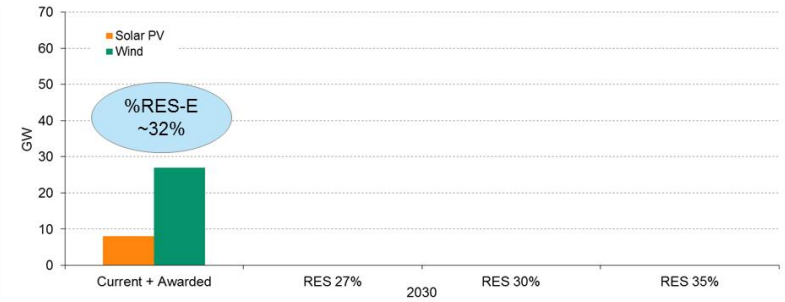


*Eurostat historic data, projections with linear interpolation for a 40% (Portugal) and 35% (Spain) target by 2030

RES PENETRATION TARGETS in SPAIN

Approach 1 (Bottom-up): Current capacity + Awarded in 2016&2017





Pöyry own assumptions for 2030: Transport – 2020 biofuel targets not increased + 20% penetration of EV; Heating&Cooling: %RES-H&C increased until 22% (vs. 17% in 2016)

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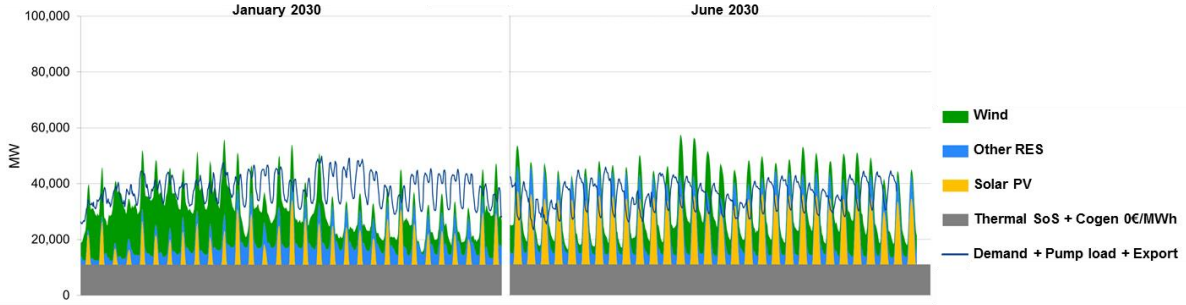

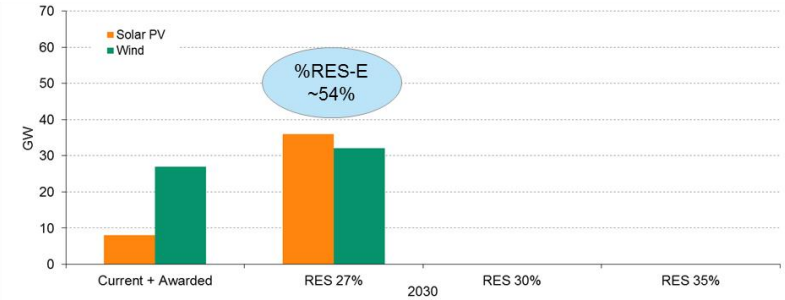

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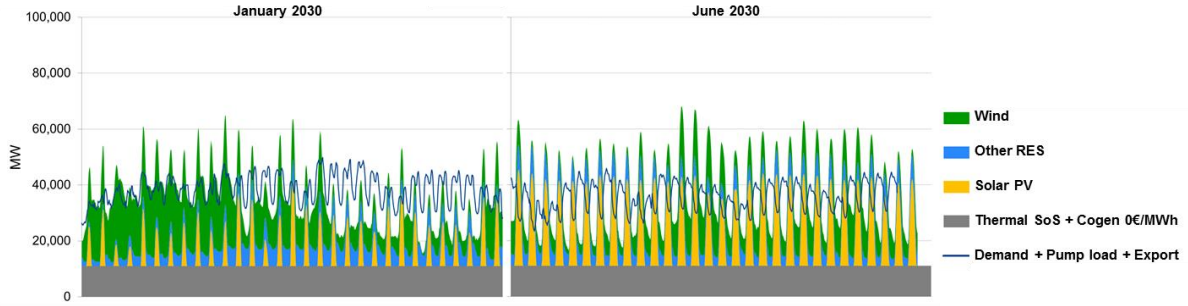

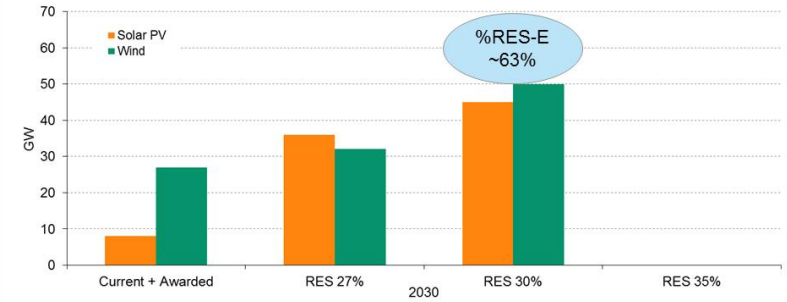

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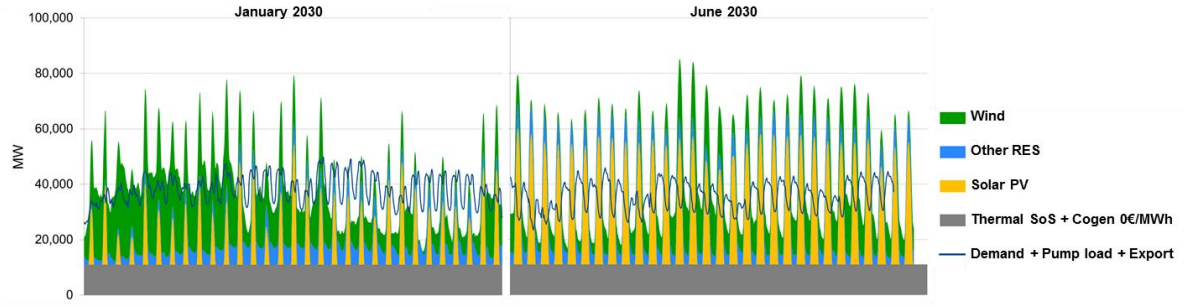
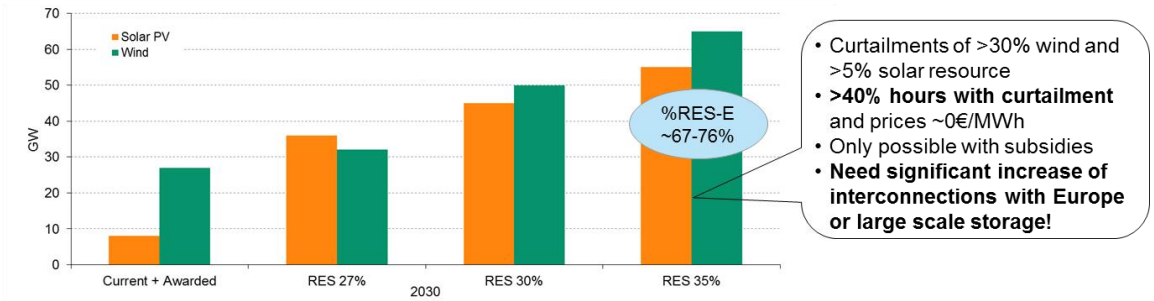




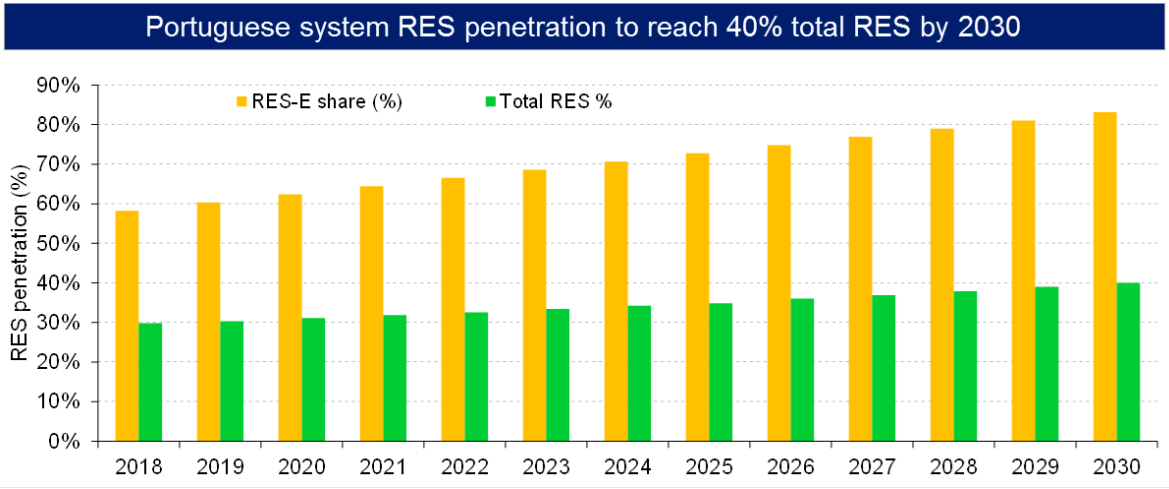
- Curtailments of >30% wind and >5% solar resource
- **>40% hours with curtailment** and prices ~0€/MWh
- Only possible with subsidies
- **Need significant increase of interconnections with Europe or large scale storage!**

**Pöyry own assumptions for 2030: Transport – 2020 biofuel targets not increased + 20% penetration of EV; Heating&Cooling: %RES-H&C increased until 22% (vs. 17% in 2016)*

RES PENETRATION TARGETS IN PORTUGAL

Approach 2 (Top-down): >40% RES

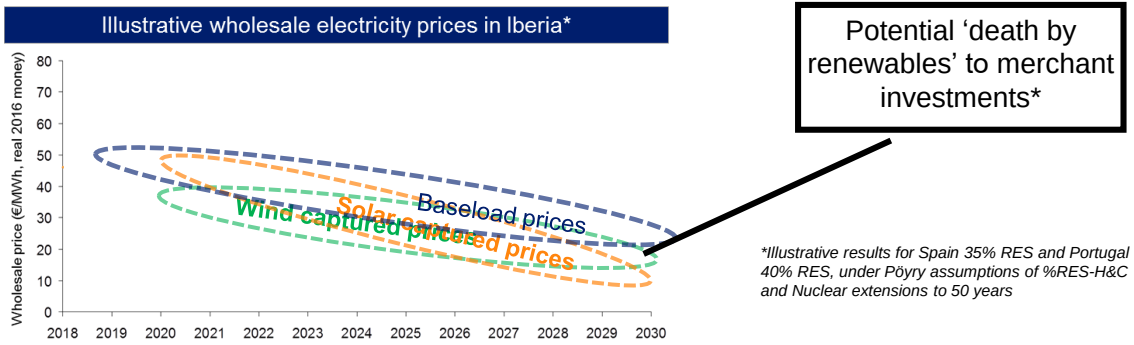
- Ambitious RES targets over final energy set in Europe from 20% (2020) to 32% (2030).
- Portugal increasing 31% (2020) to >40% (2030) likely to imply at least +13GW of wind and solar capacity depending on H&C contribution, and level of curtailments (storage, interconnections Spain-France, EVs, DSR etc.)



RES PENETRATION TARGETS IN IBERIA

Despite current ‘apparent grid parity’, very ambitious RES targets in Iberia are likely to imply Government intervention and support schemes

- Very ambitious RES targets depress the pool prices and the wind/solar captured prices greatly destruction of grid parity → Said objectives can only be developed with support schemes
- Spanish RES targets ←→ Portuguese targets mutually affect each other
- Mitigation of RES curtailments and cannibalisation effect: storage, smart demand response, interconnections, rise of power electronics, emulated inertia, participation of RES in ancillary services



High RES targets implies lower baseload and RES captured prices, and higher ‘regulated costs’ → Need of modelling total system behaviour and electricity bill

SOME TAKEAWAYS

- ‘Apparent grid parity’ for solar PV and wind (very windy sites) from 2018 sets a completely new context of merchant RES developments for developers, PPA off-takers, banks and governments
- **The political energy policy in 2020-2030:**
- Can kill merchant investments under very ambitious plans
- Must be coordinated in Iberia for a parallel development of RES in Spain and Portugal
- Will enjoy a context of cheap RES, or very cheap under support schemes reducing high risks
- Will face challenging regulatory changes to facilitate the ‘energy transition’: re-regulation vs. ‘energy only markets’?
- Should consider total energy costs and volatility: wholesale AND regulated costs (RES subsidies, grids, others)
- **The outlook for system costs is positive given low to very low cost of RES, demand growth, and progressive end of current subsidies, but still requires Government action and visibility**
- 2030 targets?
- Design of support schemes?
- Grid limits?

A secure, affordable and sustainable energy policy is possible in 2020-2030, but it will not happen alone...

Thank you!