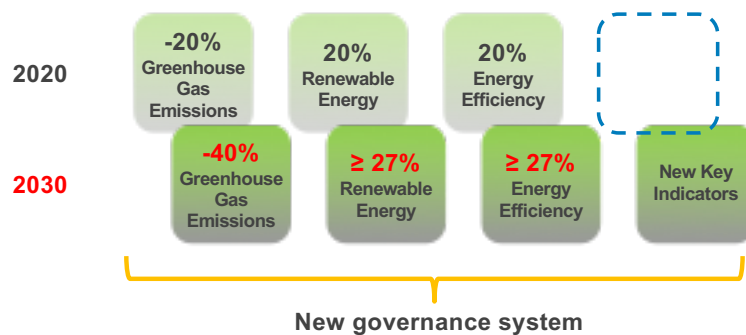


Clean energy package: Hoe kan energietechnologie hierop inspelen?

Vleeva/Mina sessie
19 Januari 2017

ENGIE

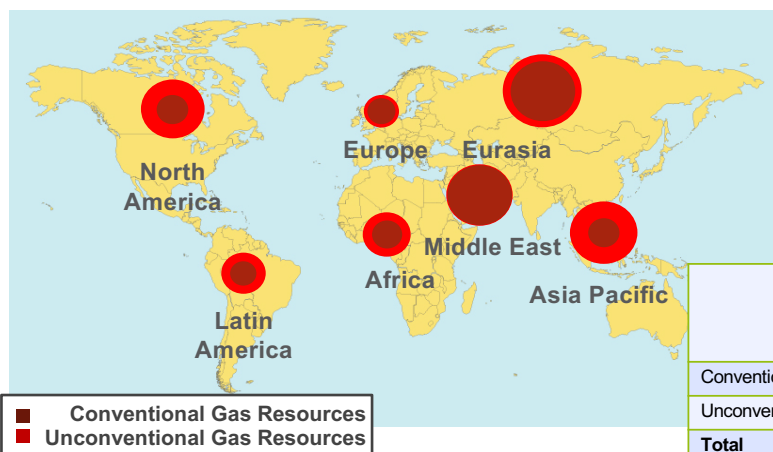
EU 2030 energy & climate objectives



How did it start?

Europe didn't stand on the first row when fossil energy resources were distributed between continents.

Gas resources



	Remaining recoverable resources (tcm)	Equivalent in years of current production
Conventional	404.5	130
Unconventional	380.5	123
Total	785	253

Source: IEA World Energy Outlook, WoodMackenzie Interpreted

European coal and crude oil resources



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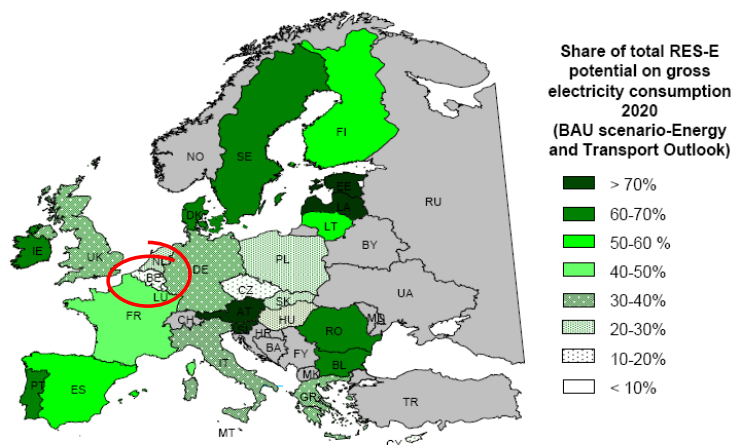
Europe's answer:

Let's develop renewable energy sources

- to secure our energy supply
 - to develop a new competitive industry
-

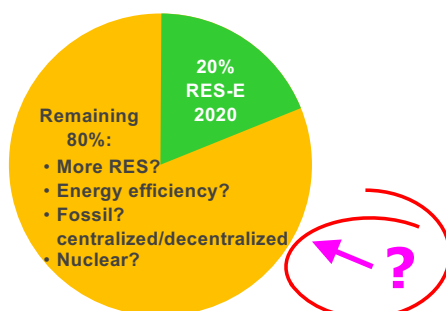
RES potential in Europe (ref FORRES 2020)

Mid-term realisable potential for RES-E on country level related to consumption



7

BE 2030 energy & climate objectives : quid Belgian energymix?



8

Wat hebben we geleerd?



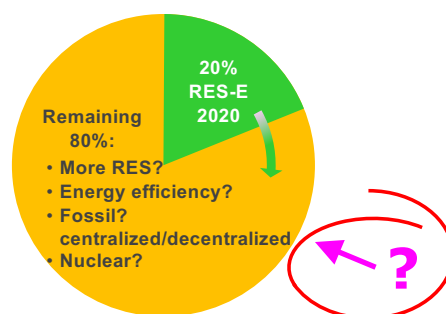
BE 2020 RES objectives: lessons learned

- Competitive advantage is a key success factor
 - Research & Innovation is a must
- RES cost must be affordable



BE 2030 energy & climate objectives : quid Belgian energymix?

- RES-E objectives are challenging
- Legitimate questioning on solution for remaining 80%, considering nuclear phase-out, abandon of coal due to environmental issues, high gas prices, low electricity prices
- There is no single unique solution but different solutions go hand in hand
 - Implement energy efficiency measures intensively?
 - Continue RES development on cost effective basis?
 - Take advantage of conventional gas features (e.g. flexibility)?
 - Give (clean) coal a chance?
 - Keep on line nuclear?



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Clean energy package: key words from a business / policy perspective

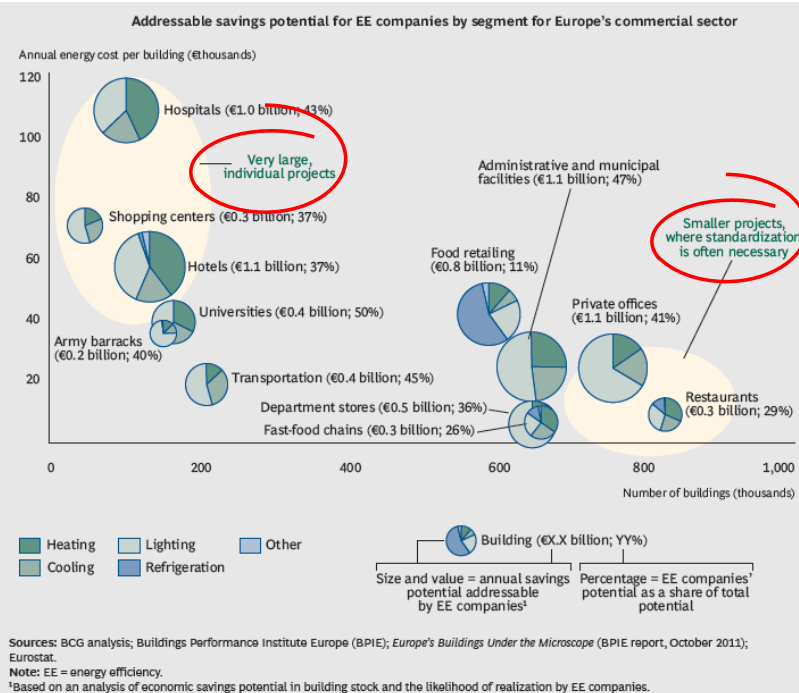
- Energy efficiency
- Flexibility
 - Storage
 - Demand response
- Digital / data management
- Capacity remuneration



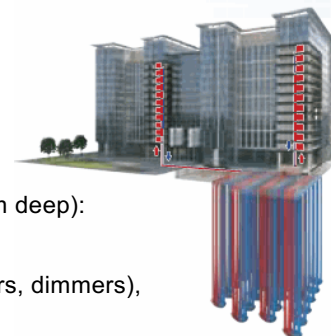
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Energy efficiency

Energy efficiency: Savings potential in tertiary sector



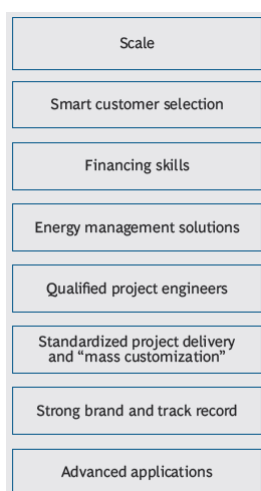
ENGIE Tower, showcase of the environmental know how of the group



- Innovative concepts:
 - Optimized **geothermics**: geothermal heating and cooling (189 wells, each 82m deep): about 50% of the heating and cooling demands are met.
 - Harnessed energy: solar power (120 kWp), efficient lighting (presence detectors, dimmers), a smart lift system and centralized technical management
 - **Ultra-modern climate control**: triple glazing, flexible air treatment, high-output coolers, free-chilling techniques on cold water circuits and condensation boilers with low levels of Nox
 - **Economic water management**: recovery and management of rainwater, waste-water treatment, and low-consumption sanitary installations
 - **Sustainable waste management**
 - saving of $\approx 31\%$ of primary energy consumption and 38% of CO2 emissions.
- A mobility plan Let's Choose has been installed to promote public transport

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Energy savings: key success factors



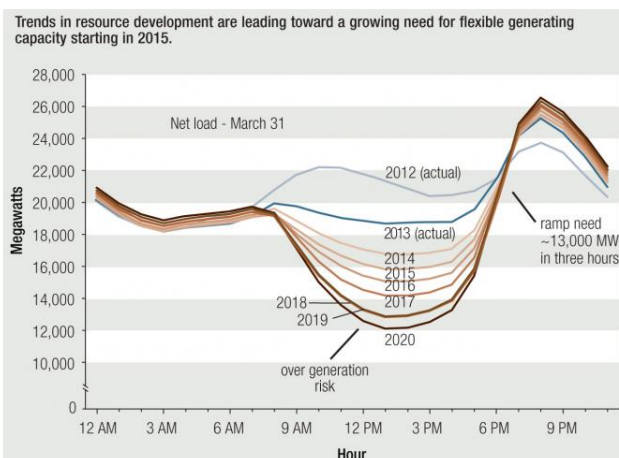
- Pilot projects
- Financing tools
- Innovative solutions

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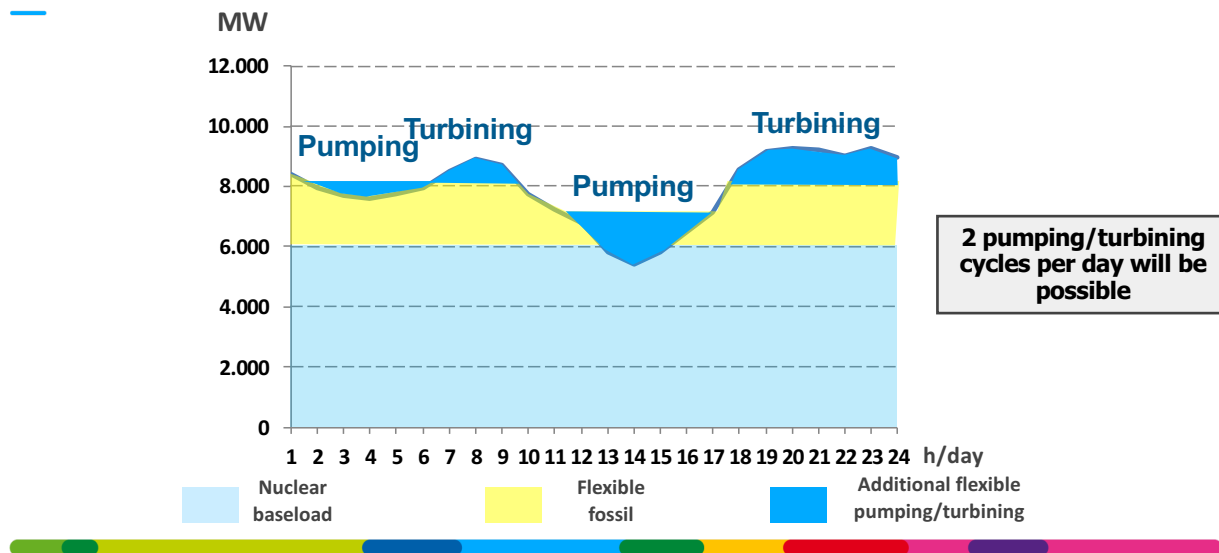
Flexibility needs

Flexibility needs: the Duck curve

California's duck curve



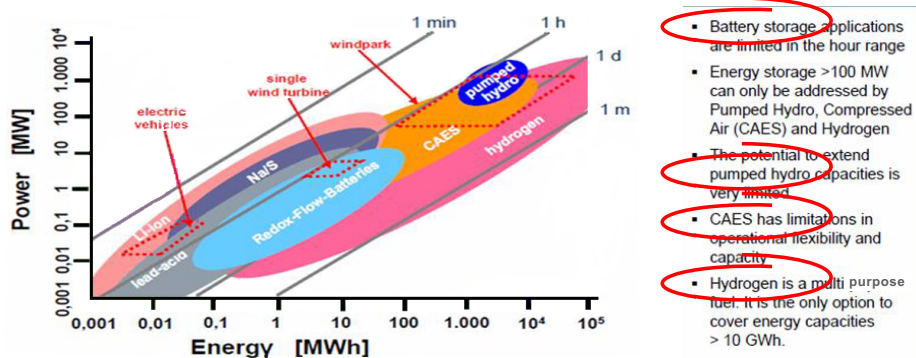
Flexibility providers: increased expected needs for storage



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Flexibility providers: storage

Different technologies are available, depending on their capacity (MW) and autonomy (MWh)



- Battery storage applications are limited in the hour range
- Energy storage >100 MW can only be addressed by Pumped Hydro, Compressed Air (CAES) and Hydrogen
- The potential to extend pumped hydro capacities is very limited
- CAES has limitations in operational flexibility and capacity
- Hydrogen is a multi purpose fuel. It is the only option to cover energy capacities > 10 GWh.

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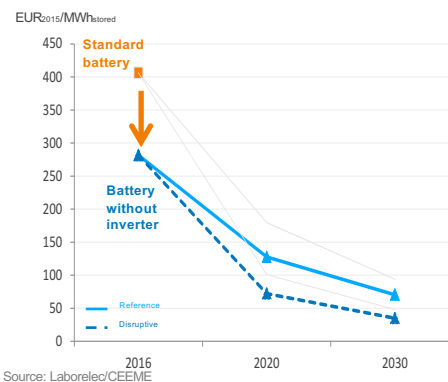
Technological evolution will reduce cost of decentralised as well as centralised low carbon solutions

Battery technology is moving fast:

- Reduced cost
- Increased lifetime
- Increased energy density

 new applications for electrification (EV, trucks...)

Battery: Levelized cost of storage*



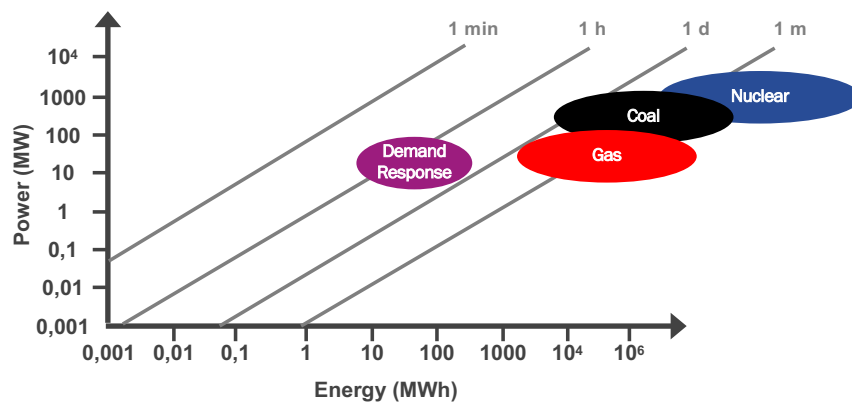
Source: Laborelec/CEEME

* Cost for storage only, not including electricity input cost; assuming 320 charging cycles per year, E/P ratio of 2, 4% WACC, 20% VAT

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Flexibility providers: storage (cntn'd)

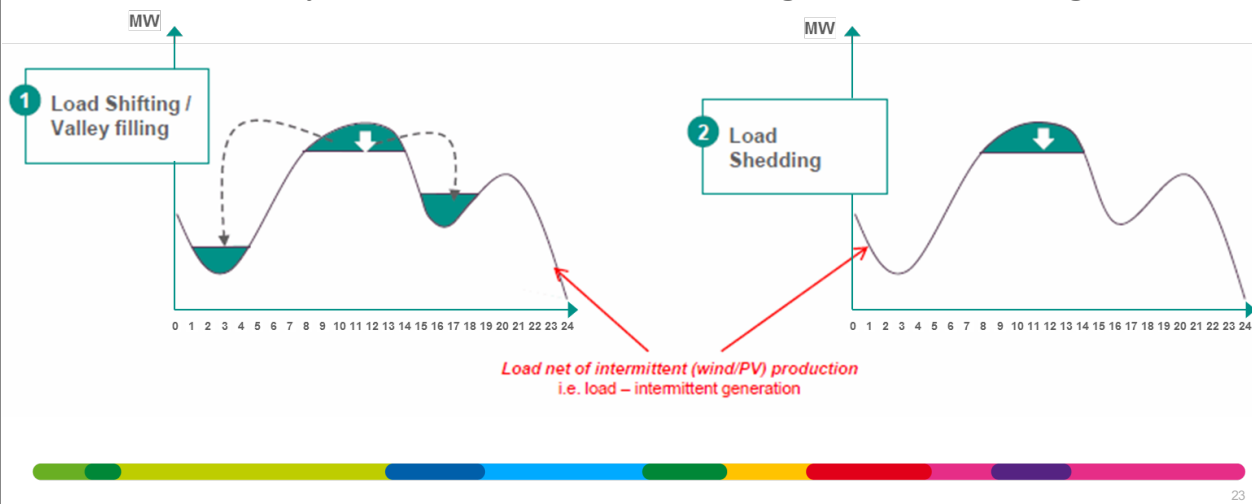
Conventional power plants & demand response as storage providers (fuel storage – heat or cold storage)



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Flexibility providers: demand response

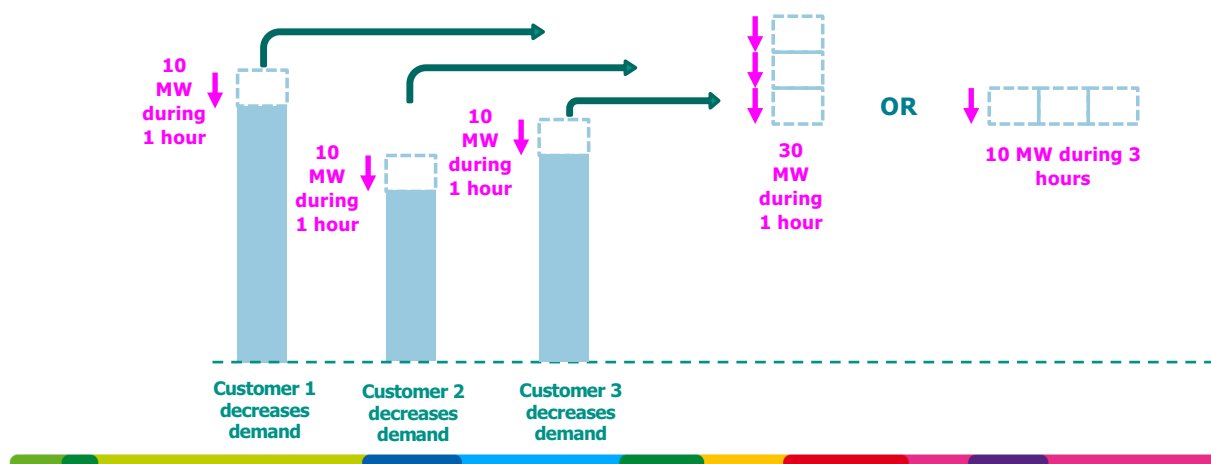
Flexibility at demand side via **load shifting** and **load shedding**



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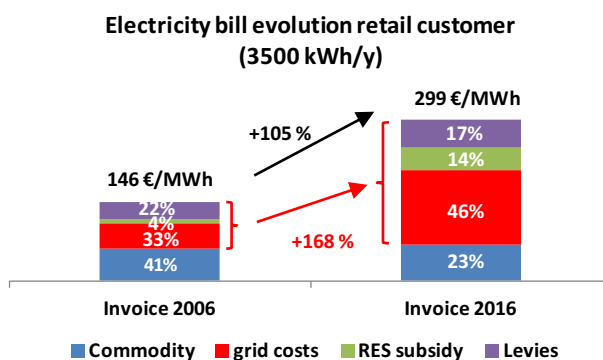
Flexibility providers: demand response (cntn'd)

Aggregation of different customers can be done vertically (at same moment) or horizontally (sequentially)



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Flexibility providers: demand response (cntn'd)



- Commodity cost represents only 23% of total bill to retail customer
- Dynamic grid tariffs required (ToU : Time of Use)

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Dynamic grid tariff roadblocks:

Long tariff periods (4 years)

Smart meter rollout for residentials

—

Digitilization / data management:

Key success factor : smart metering

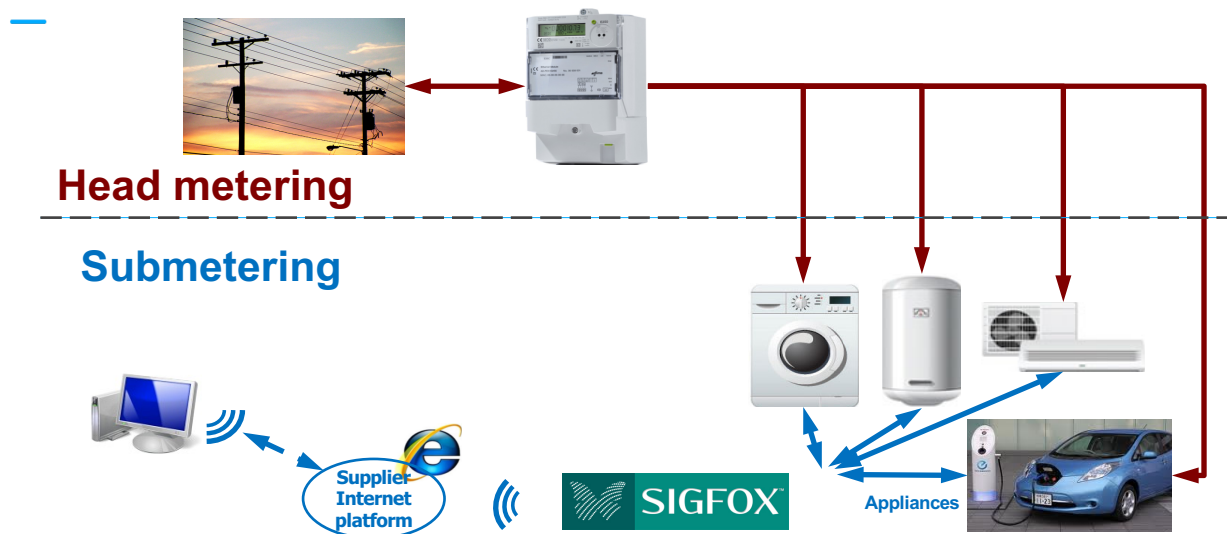
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Digital / data management : smart metering

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—
smart metering:

Will smart head meters be taken in speed by smart submetering?

—



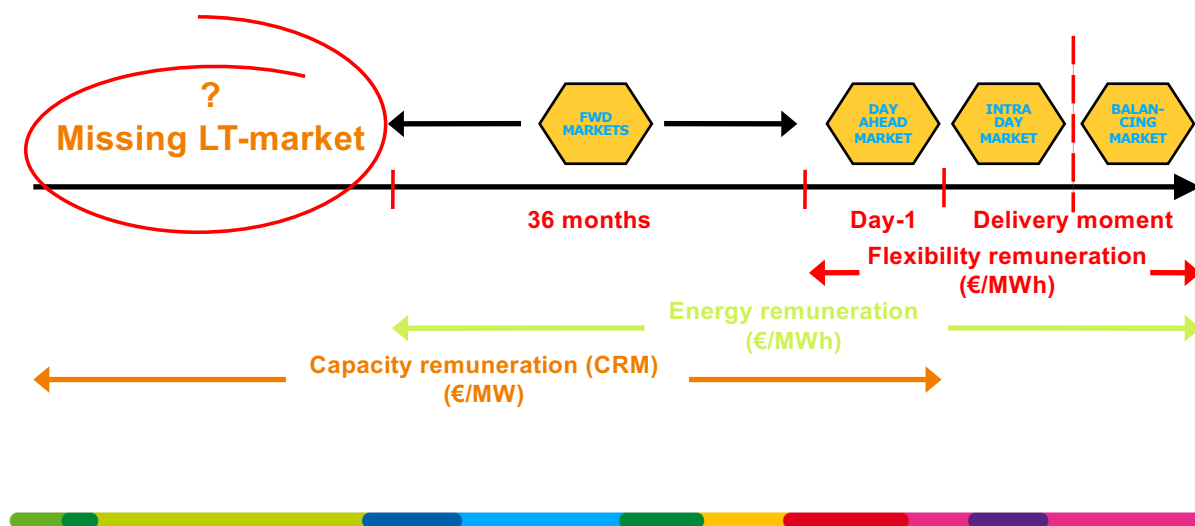
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Capacity Remuneration Mechanism:

Missing long term segment in current market model
required for long term investments

—



Capacity Remuneration Mechanism



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Capacity Remuneration Mechanism:

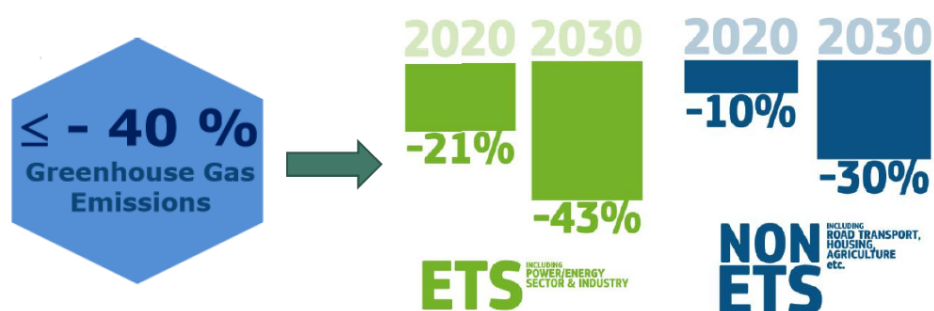
Next step in evolution to near zero variable cost system



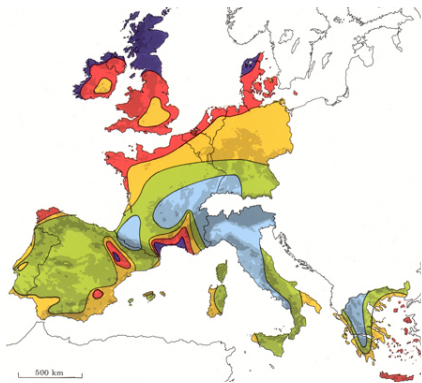
Questions



EU 2030 energy & climate objectives



Wind potential in Europe



Wind resources ¹ at 50 metres above ground level for five different topographic conditions									
Sheltered terrain ²		Open plain ³		At a sea coast ⁴		Open sea ⁵		Hills and ridges ⁶	
m s^{-1}	Wm^{-2}	m s^{-1}	Wm^{-2}	m s^{-1}	Wm^{-2}	m s^{-1}	Wm^{-2}	m s^{-1}	Wm^{-2}
> 6.0	> 250	> 7.5	> 500	> 8.5	> 700	> 9.0	> 800	> 11.5	> 1800
5.0-6.0	150-250	6.5-7.5	300-500	7.0-8.5	400-700	8.0-9.0	600-800	10.0-11.5	1200-1800
4.5-5.0	100-150	5.5-6.5	200-300	6.0-7.0	250-400	7.0-8.0	400-600	8.5-10.0	700-1200
3.5-4.5	50-100	4.5-5.5	100-200	5.0-6.0	150-250	5.5-7.0	200-400	7.0- 8.5	400- 700
< 3.5	< 50	< 4.5	< 100	< 5.0	< 150	< 5.5	< 200	< 7.0	< 400

