Enerdata intelligence + consulting

WEBINAR

February 2022

Are Power Generation Companies' actions aligned with the Paris Agreement?

Introduction

Enerdata

Methodology

Generation companies = GenCos

2015: Paris Agreement as the reference year

Metadata

- Data are taken from the most recent companies' official publications, therefore are validated by specialized audit firms,
- Companies' data focus on electricity, i.e., exclude gas and heat utilities' related-data,
- For the purpose of comparison, some data have been estimated using the best international standards,
- Data are controlled and harmonized to allow comparability between companies and across years.

Technical considerations

- The companies' data correspond to their full scope of operation, including both their domestic and overseas operations.
- Some companies consolidate their whole thermal assets into one single item (called "Thermal"), i.e., not giving the split between the various energy sources burnt (oil, gas, coal/lignite, biomass). Therefore, the data are presented as such to stick with d ata published by companies.

CO_2 emissions data

- CO_2 emissions data correspond to the Scope 1 (direct emissions),
- The carbon factor (also called the carbon intensity of the power generation) is computed as follow:

$$\mathrm{gCO_2/kWh} = \frac{\text{Company's total } \mathrm{CO_2} \text{ emissions (MtCo2)}}{\text{Company's total power generation (TWh)}}$$

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Coverage

Coverage rate of installed power capacities by the 60 selected GenCos in 2020

	Number of GenCos	GenCos' capacity (GW)	Coverage rate (%)
Asia	11	1,330	37%
Europe	25	680	53%
CIS	5	150	37%
North Am.	10	330	24%
Latin Am.	2	100	19%
Middle East	4	100	29%
Africa	3	110	46%
World	60	2,790	36%

EnerGreen Scenario

- Our EnerFuture service provides unbiased energy forecasts and country benchmarks with projections going up to 2050 through 3 scenarios:

  EnerBase, the business-as-usual scenario

  EnerBlue, a scenario based on countries' NDCs (close to 3°C)

  EnerGreen, a scenario exploring how to contain global warming under 2°C

- Our scenarios provide different information including power generation forecasts by years and by energy (which have been used in this analysis).

EnerGreen explores the implications of **more stringent energy and climate policies**, with countries fulfilling their NDC commitments and then regularly revising their emissions goals. These changes lead to significant improvements in energy savings and a strong deployment of renewables. In this trajectory, **global temperature increase is limited to 2°C.** This **scenario** now takes into account **Covid-19 impacts.**

Agenda

- **Worldwide GenCos' trends**
- **Trends in China**
- **Trends in Europe**
- **On road to Paris Agreement**

Worldwide GenCos' trends

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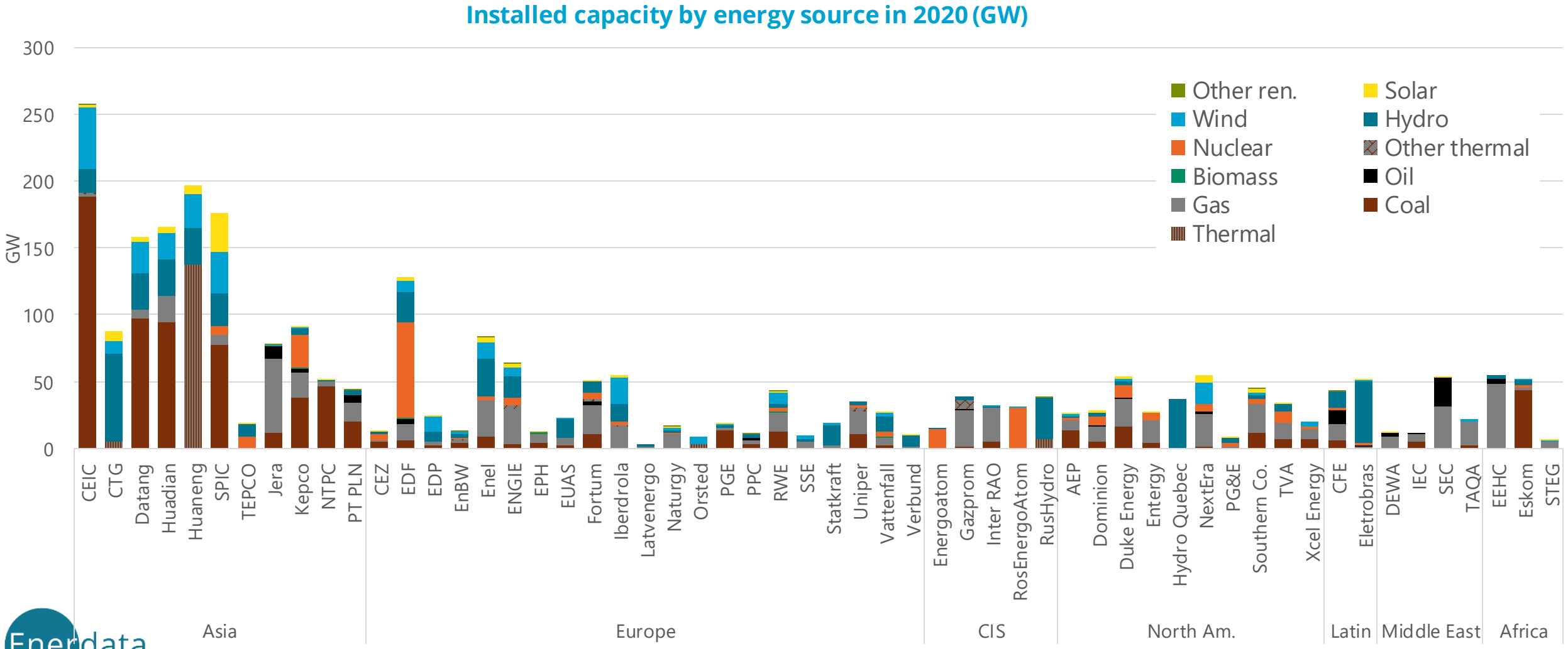
State-owned Chinese companies are giants

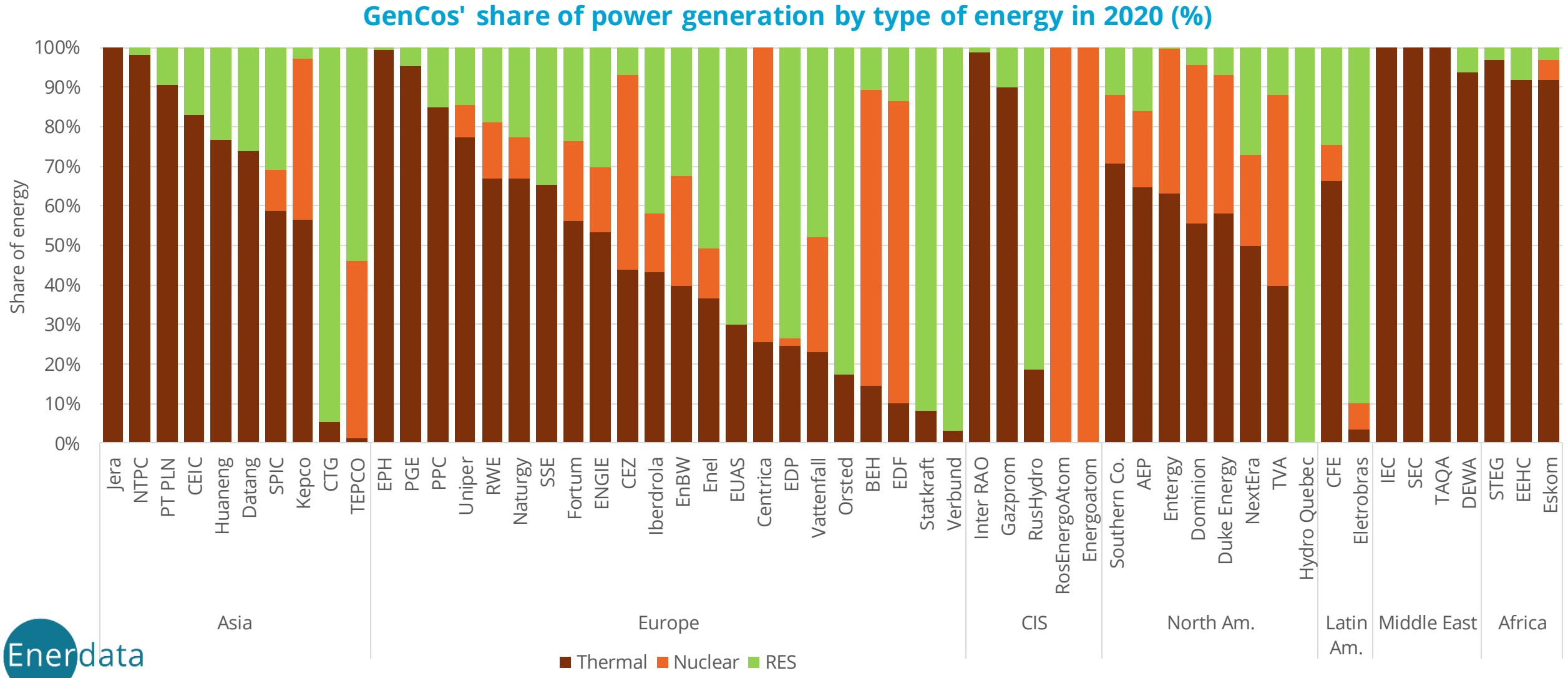
GenCos' installed capacity mix in 2020



Source: Enerdata

Fossil fuels are still the dominant input in most GenCos

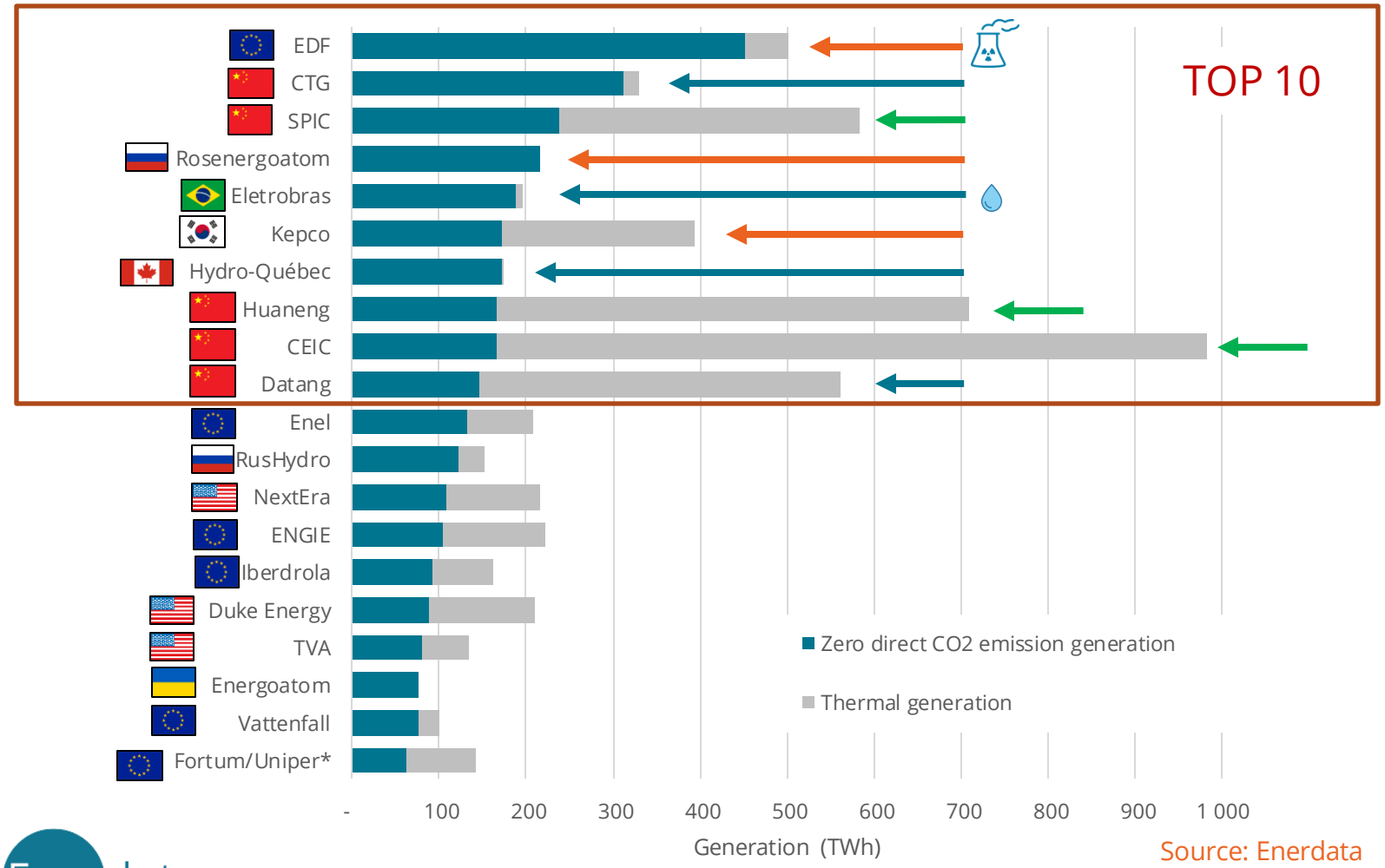
GenCos' power generation mix in 2020



Source: Enerdata

Carbon-free and thermal power generation

Zero direct CO_2 emission producers in 2020 (TWh)



Source: Enerdata

** Fortum/Uniper: Fortum raised ownership in Uniper to >75% in 2020; i.e. data fully consolidated in 2020.*
*** Thermal generation includes biomass.*

Largest emission-free generators produce either via:

Nuclear

- EDF (77%), TOP emission-free generator
- Rosenergoatom (100%)
- Kepco (41%)

Hydro

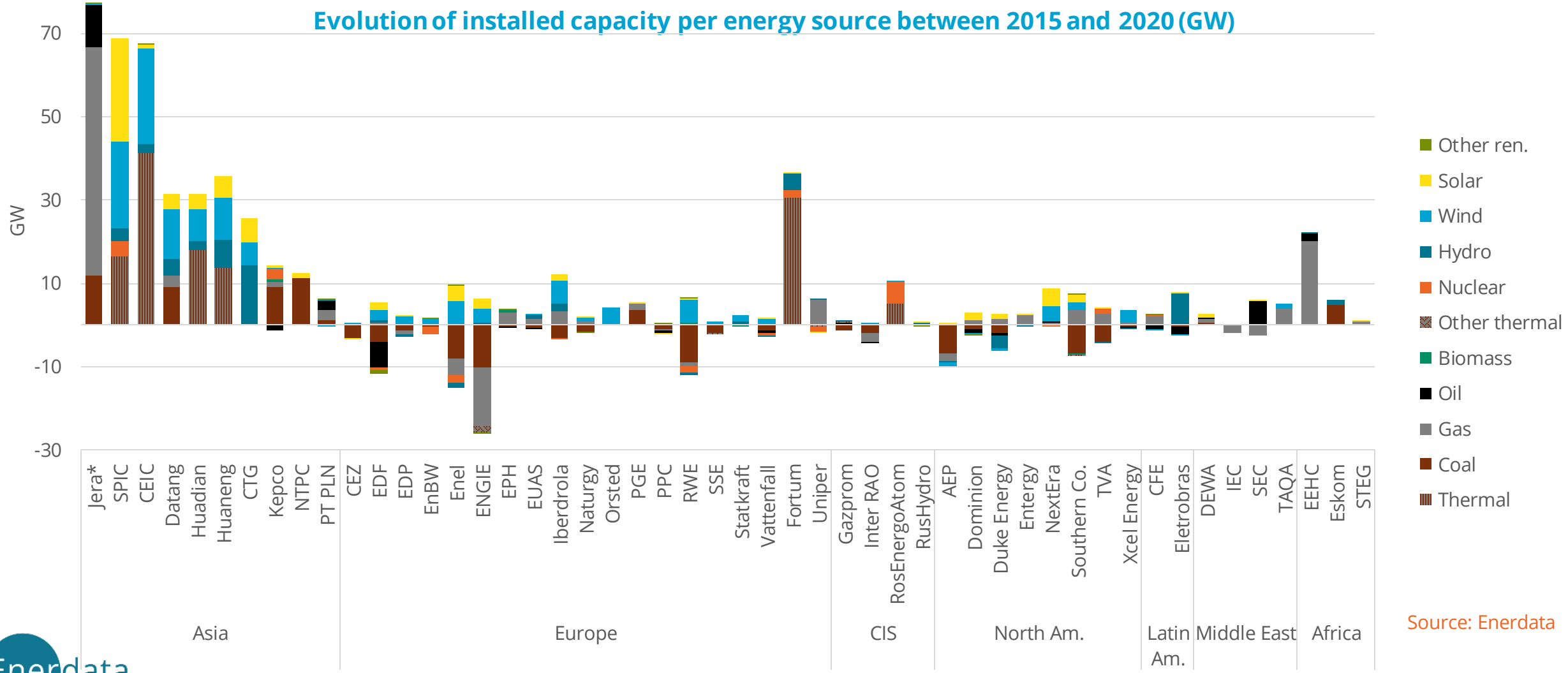
- CTG (95%), Eletrobras (91%), HydroQuébec (100%), Datang (70%), Rushydro

All RES (hydro, solar, wind)

- Chinese companies

Coal phase-out is noticeable in Europe & the US

2015-2020 installed capacity evolution



Source: Enerdata

Enerdata

Jera: Data covering 2016-2020*

GenCos trends in China

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Key energy data for Chinese GenCos in 2020

GLOBAL GENERATION FOR THE 6 GENCOS

2020
3,800 TWh

31% from RES*
2% from nuclear*
67% from thermal*

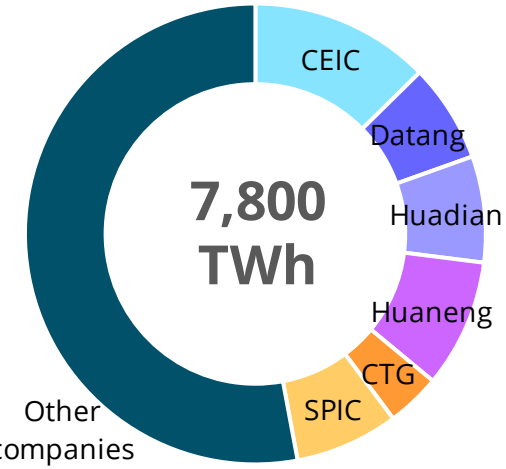
Of which

2020
3,700 TWh

GENERATION BASED IN CHINA

47% Chinese coverage

Total 2020 generation in China reached 7,800 TWh



国家电投 SPIC

Capacity added since 2015:

Solar : + 28 GW
Wind :+ 21 GW

国家能源集团 CHN ENERGY

Power generation increase since 2015

+ 289 TWh

中国华能集团公司 CHINA HUANENG GROUP

Carbon intensity of power generation since 2015

-10%

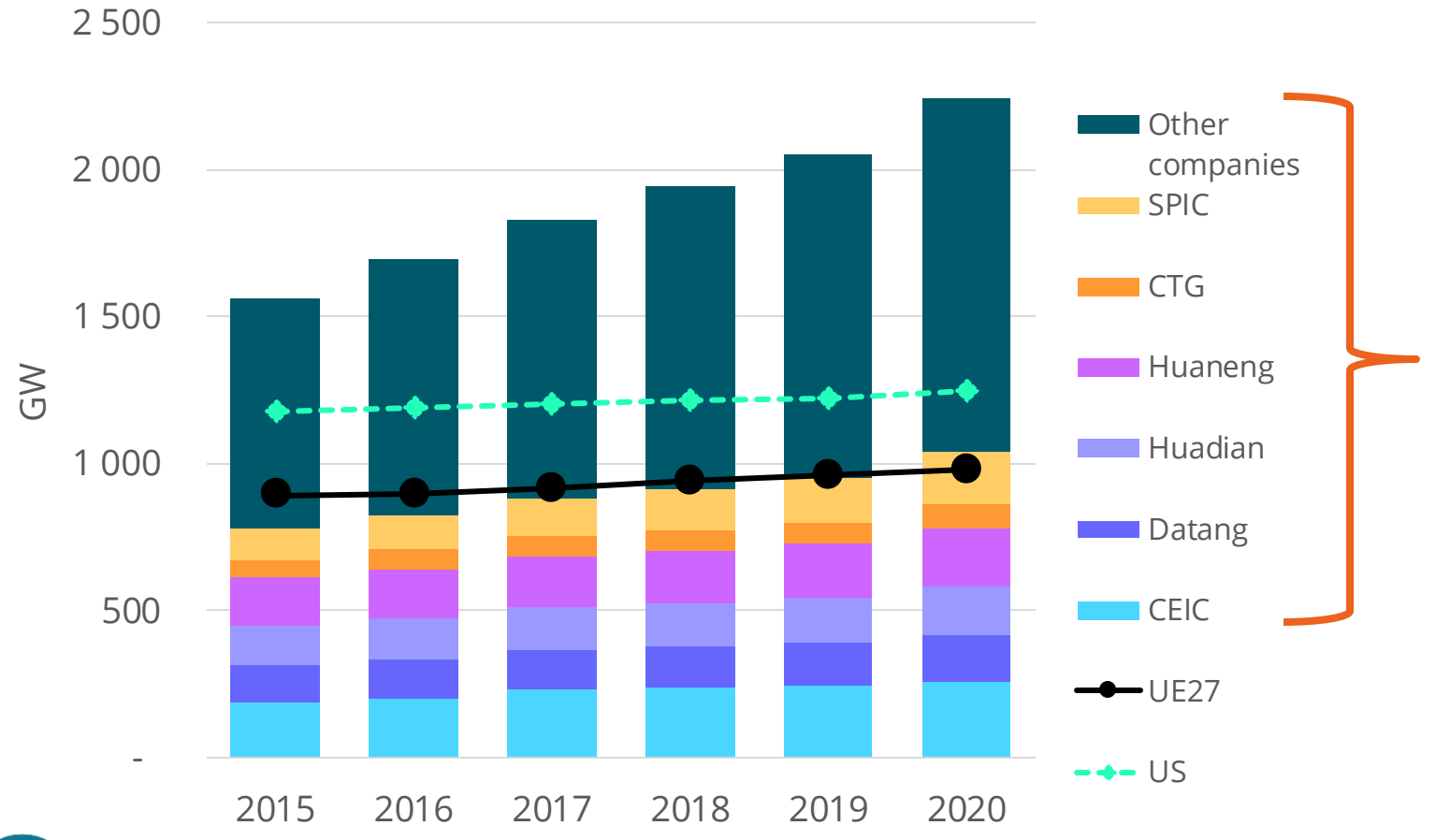
TWh produced by Chinese GenCos in 2020
= Europe as a whole !

*: Does not include China huadian in shares as generation by energy were not disclosed by the company.

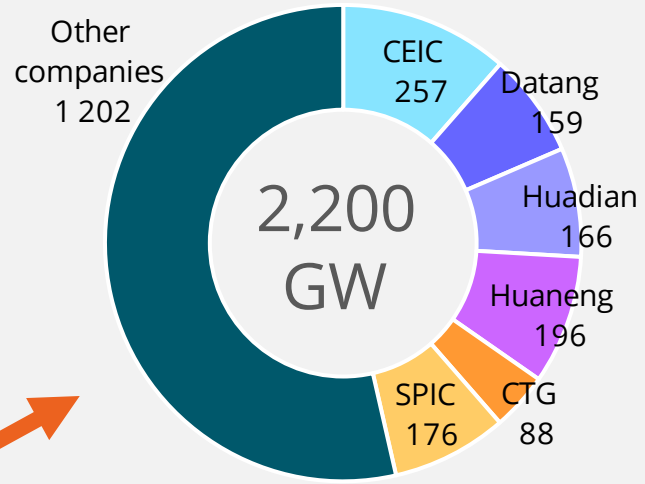
Source: Enerdata

6 largest Chinese GenCos exceed the EU27 installed capacity

Total installed capacity in China, all energy included (GW)



Share of companie's installed capacities in China in 2020 (GW)



In 2020, the 6 Chinese GenCos

- Covered 46% of the total Chinese capacities

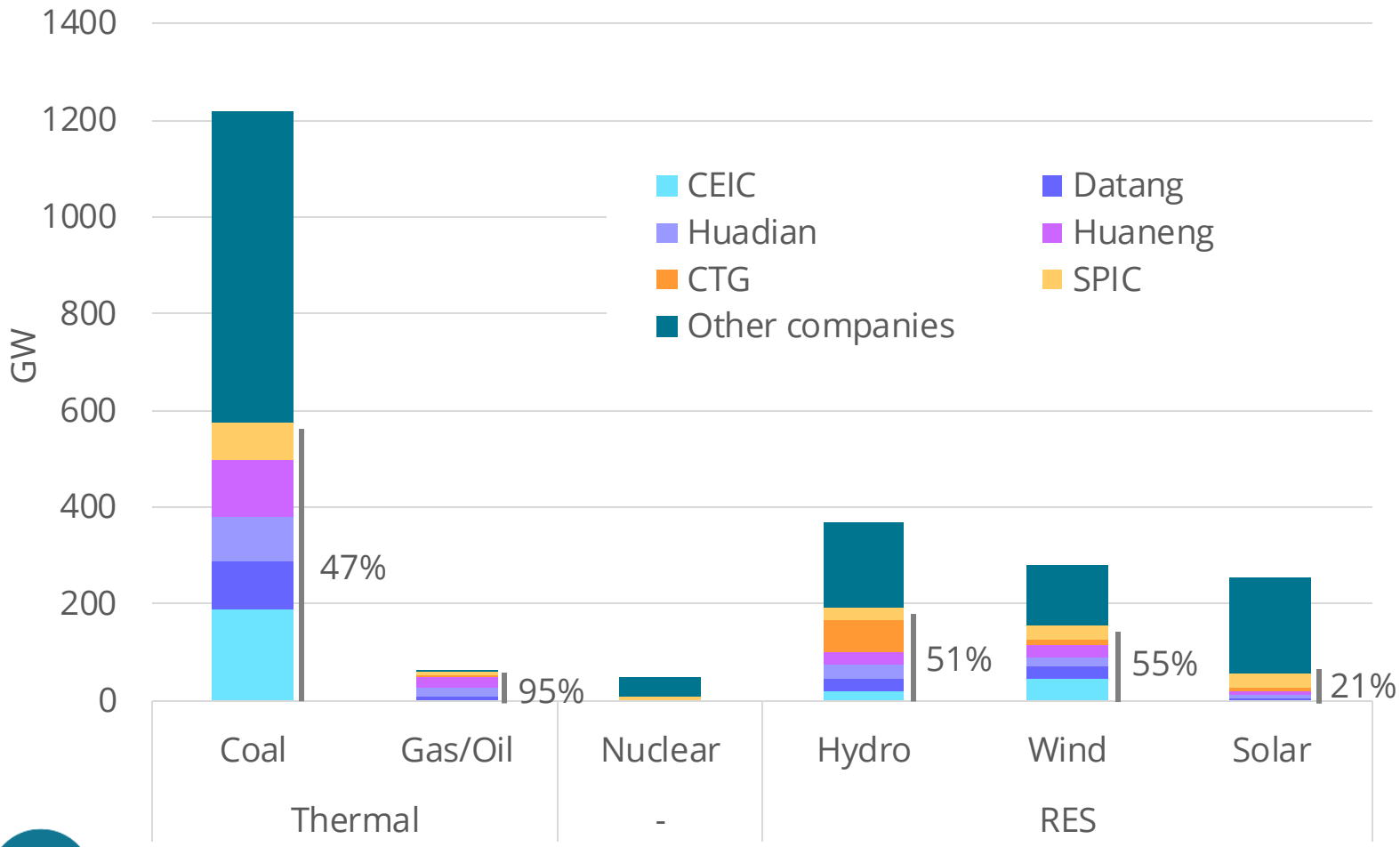
The 6 Chinese GenCos reached EU27 capacities in 2019

- In 2019, the 6 Chinese GenCos held 950 GW, and reached 1,050 GW in 2020

Source: Enerdata

GenCos in China

Relative shares of 6 GenCos in China's capacities in 2020 (GW)



Source: Enerdata

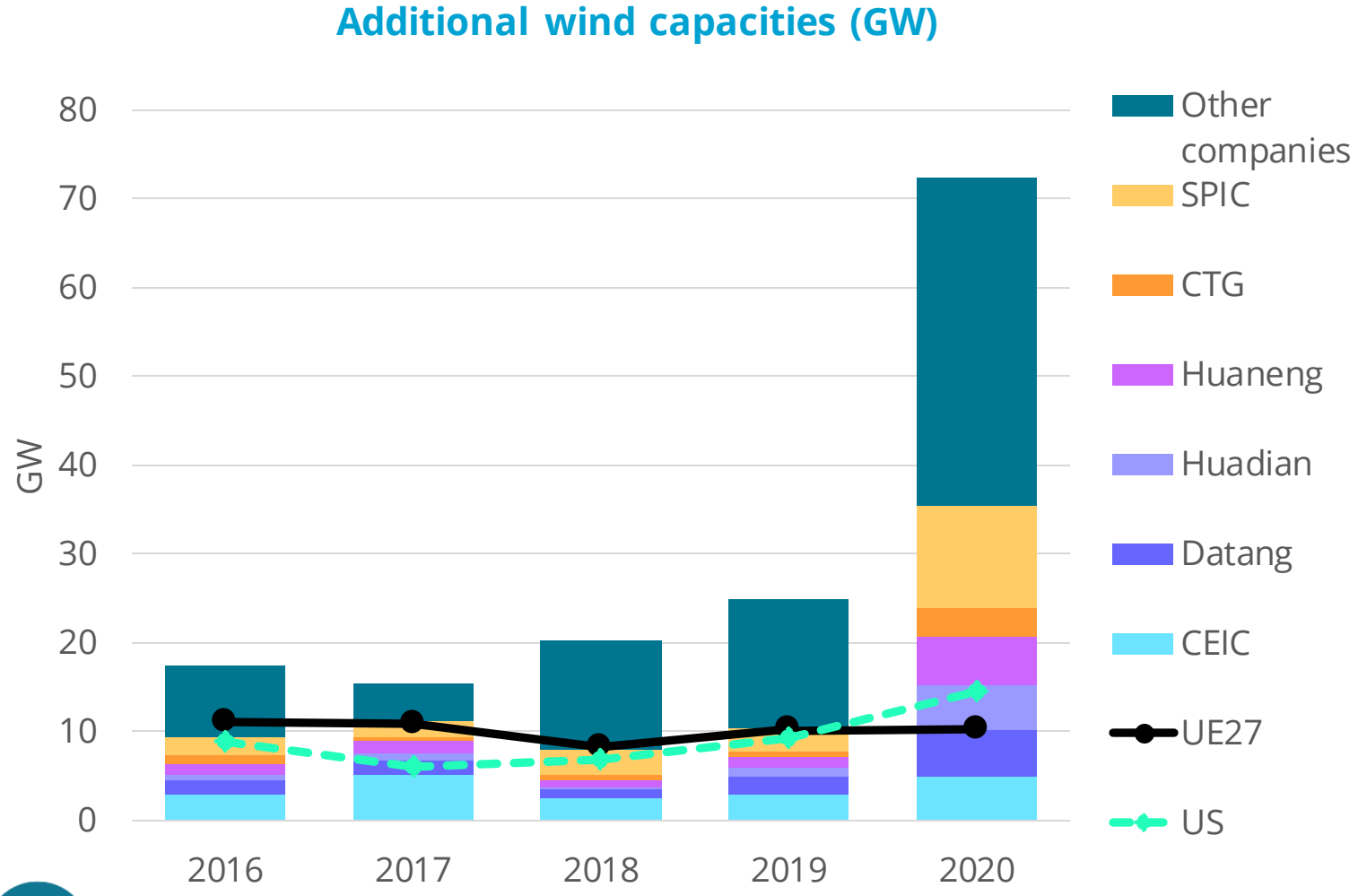
In 2020, the 6 Chinese GenCos

- Covered 46% of the total Chinese capacities, including:
- 49% of China's thermal fleet (~25% coal world capacity),
- 5% nuclear,
- 51% of hydro,
- 39% of total other renewables

Average annual additional capacity since 2015		
6 Chinese GenCos	Thermal	20 GW/y
	Nuclear	1 GW/y
	Hydro	6 GW/y
	Wind	16 GW/y
	Solar	9 GW/y
UE27	Wind & solar	20 GW/y
US	Wind & solar	20 GW/y

Wind addition surged since 2020

Annual wind newly installed capacity



Source: Enerdata

2015-2019

- GenCos installed +9 GW/y
- China installed +16 GW/y

2020

- GenCos installed +35 GW
- China installed +72 GW

2021

- China installed +48 GW, of which 17 GW of wind offshore

To reach Paris Agreement objectives*:

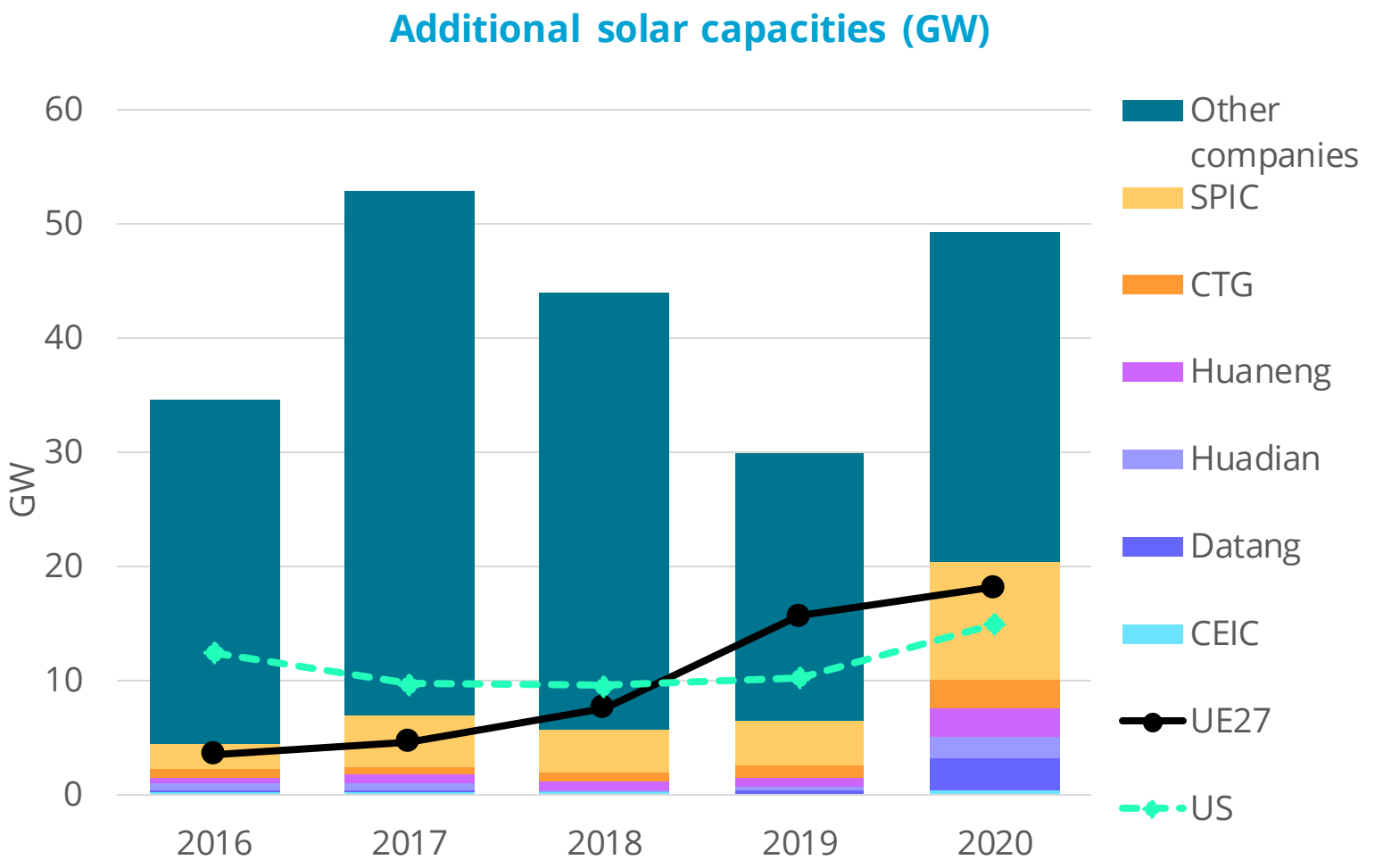
For 2020-2025: +27 GW/y
For 2025-2030: +56 GW/y

** According to EnerGreen scenario*

Enerdata

Solar addition in line with Paris-A.

Annual wind newly installed capacity



Source: Enerdata

Big 6 in solar

- smaller share in wind market

2015-2020

- GenCos installed +9 GW/y
- China installed +42 GW/y

2021

- China installed +53 GW solar

To reach Paris Agreement objectives:

For 2020-2025: +50 GW/y
For 2025-2030: +60 GW/y

** According to Energreen Scenario*

GenCos trends in Europe

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Key energy data for European GenCos in 2020

2015-2020

Renewables: +22% (120 TWh)

Thermal: -26% (-280 TWh)

GLOBAL GENERATION FOR THE 25 GENCOS

2020
2,200 TWh

32% from RES
30% from nuclear
37 % from thermal

Of which

2020
1,600 TWh

GENERATION BASED IN EUROPE

43% of Europe power generation

Total power generation in Europe in 2020 = 3,700 TWh

EDF

Carbon-free share in power mix in 2020

90%

Ørsted

Carbon factor reduction since 2015

- 74%

enel

Solar + wind since 2015

+9 GW
+20 TWh

ENGIE

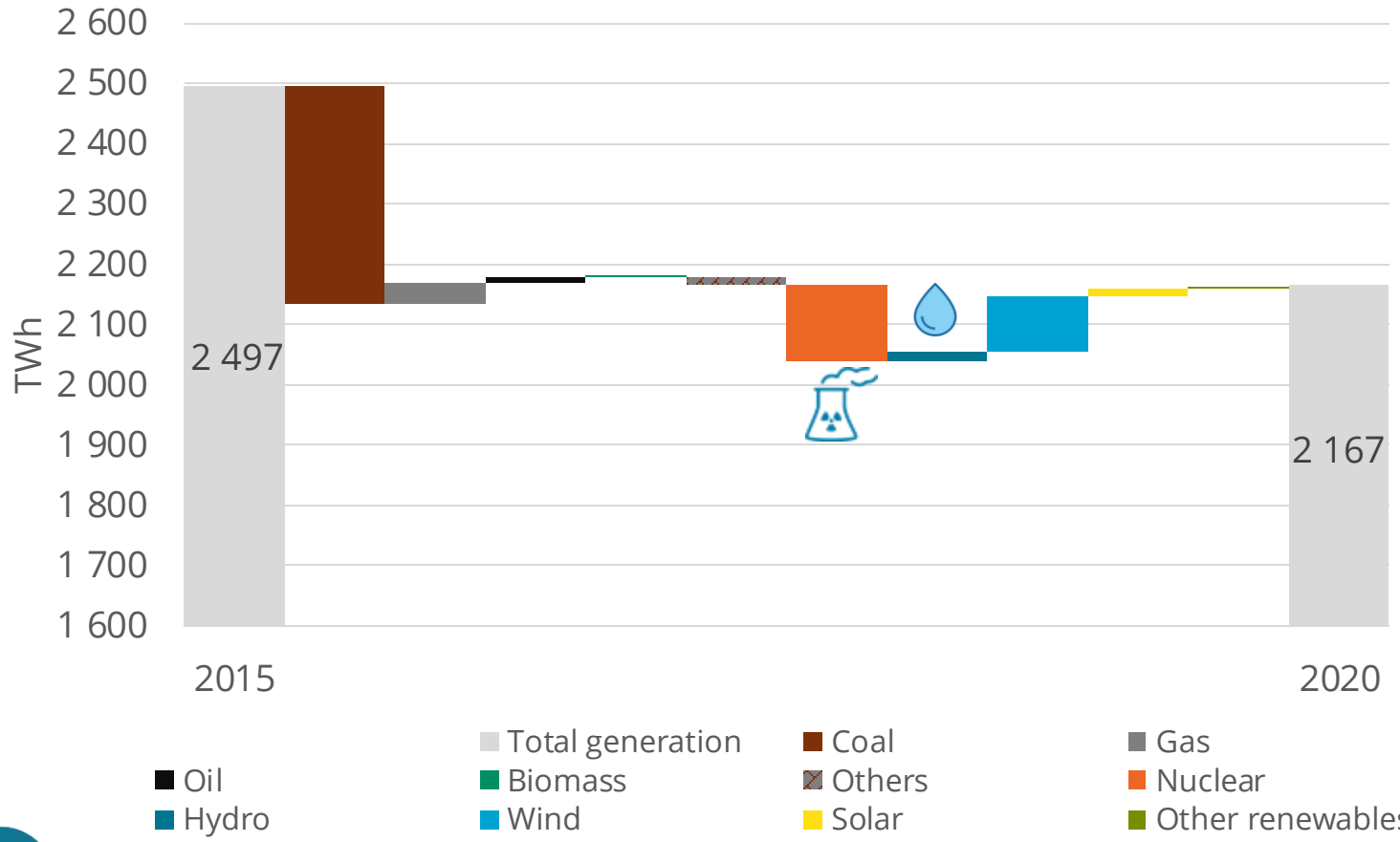
Thermal capacity disposal since 2015

-26 GW

Source: Enerdata

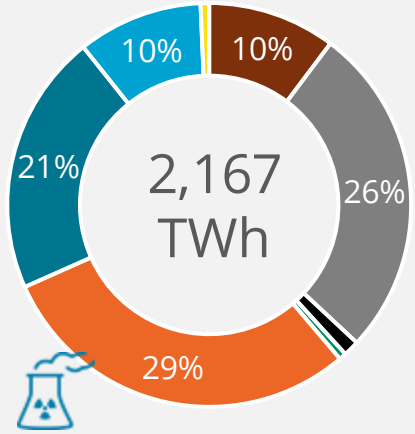
European GenCos have chased-out coal from their mix

Power generation evolution for the 25 selected European GenCos since 2015 (TWh)



Source: Enerdata

European GenCos Power mix in 2020 (TWh)



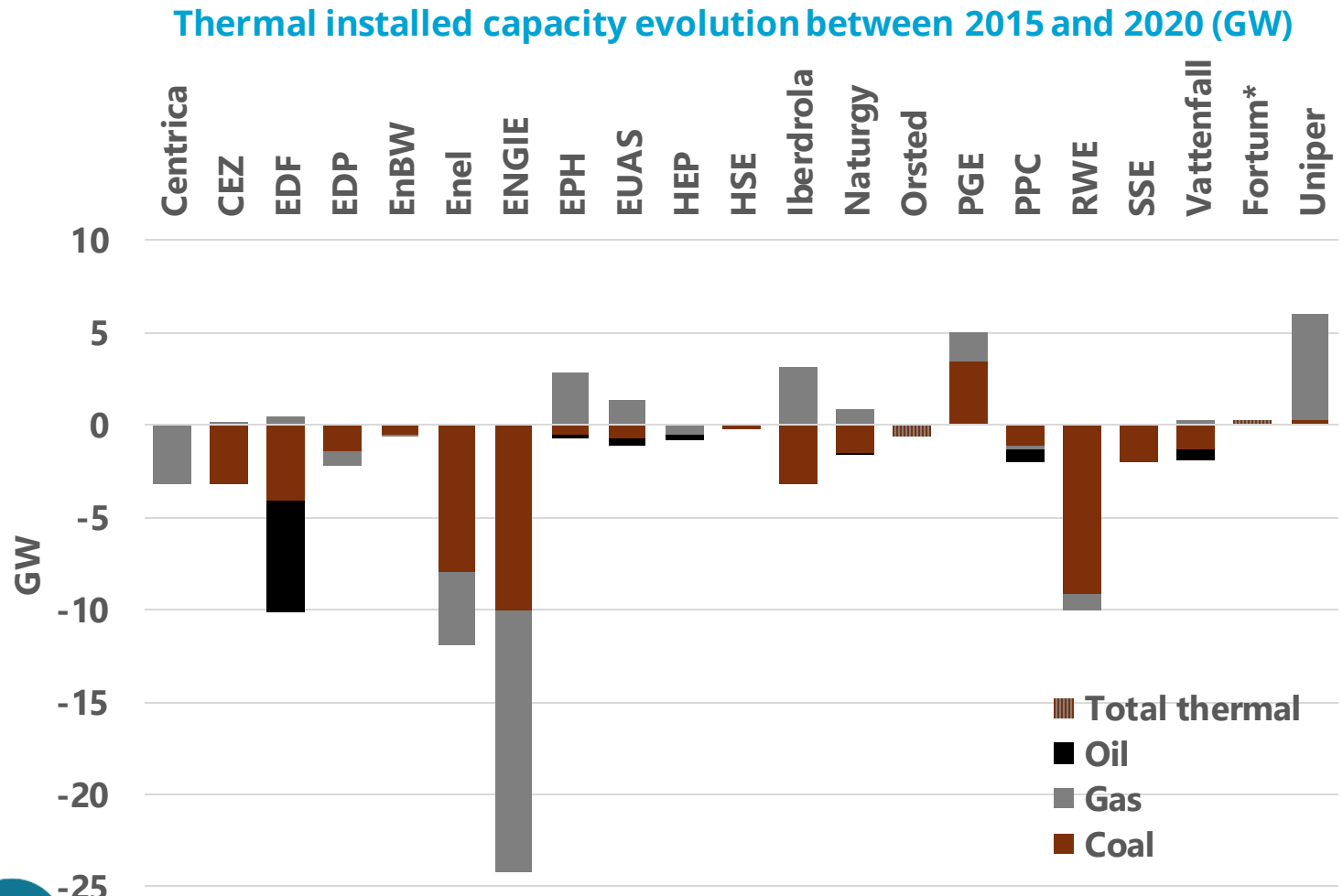
Thermal generation evolution

- The whole thermal share drop from 47% in 2015 to 39% in 2020
- Coal-fired generation dropped by 13% percentage points since 2015
- Share of gas increased to 27%
- Nuclear: closures and outages

Wind's share is growing

- Rapid penetration of wind in GenCos power mix, including offshore wind, reaching 10% in 2020.
- Limited growth for solar power from 3 TWh in 2015 to 15 TWh in 2020.

Over 50 GW of thermal assets cleared-out by European GenCos since 2015



*: Fortum between 2015 and 2019, i.e. internal evolution only, excluding the acquisition of Uniper

Source: Enerdata

More stringent climate policies since 2015 in Europe

- Higher climate ambitions
- Paris Agreement
- Third period of the ETS with reduced CO_2 emission quotas

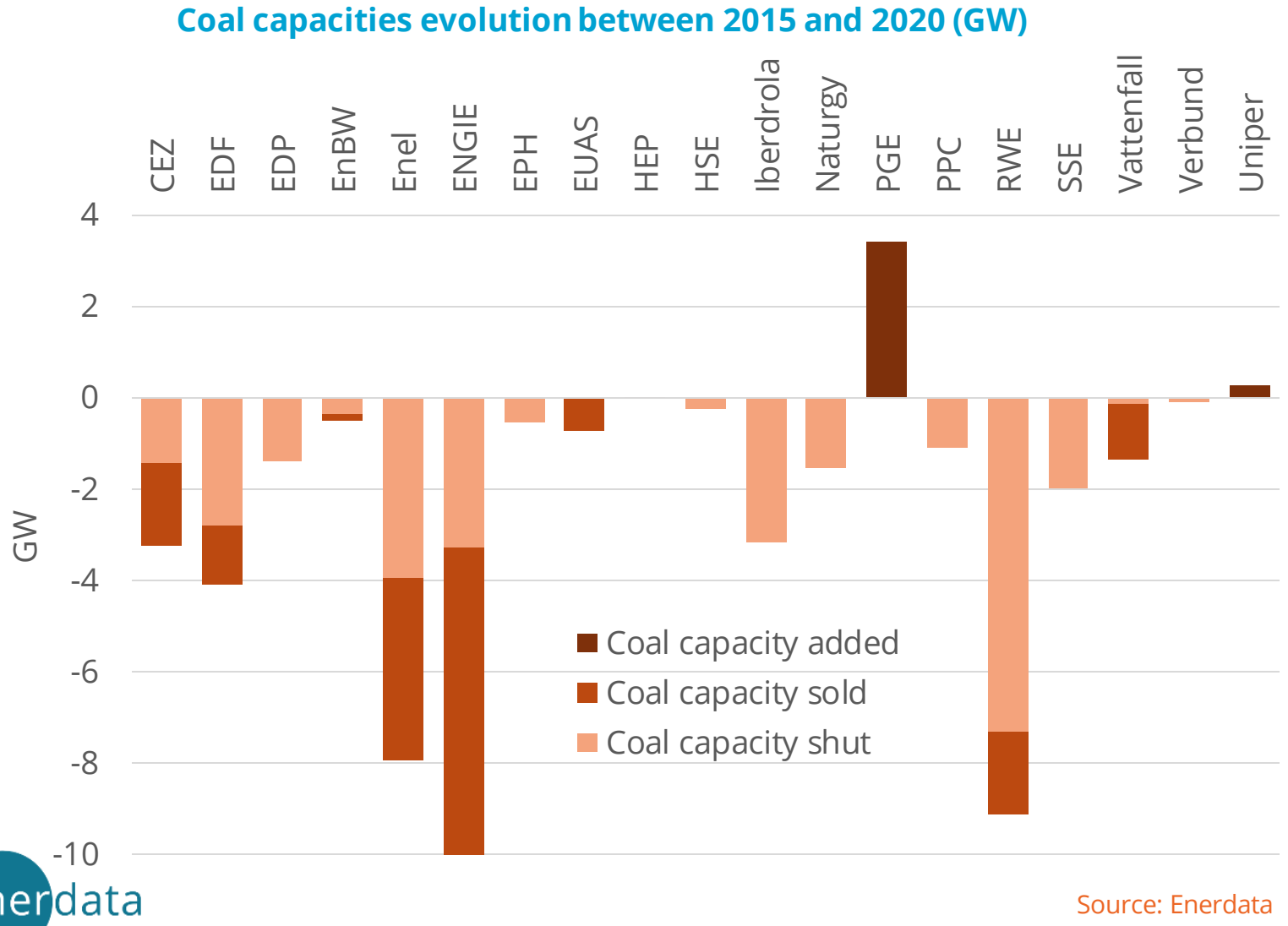
Thermal acquisitions

- Fortum: Uniper acquisition (~25 GW)
- EPH: acquisition of ageing and distressed thermal-fired power plants

Thermal Disposals

- Different strategies regarding gas:
  - disposals by Engie (-14 GW), Enel (-4 GW), Centrica (-3 GW);
  - and developments for those betting on gas as a transition fuel (Iberdrola +3 GW, Naturgy +0;8 GW).
  - Companies exiting from coal assets

Most of the coal-based assets where closed



Source: Enerdata

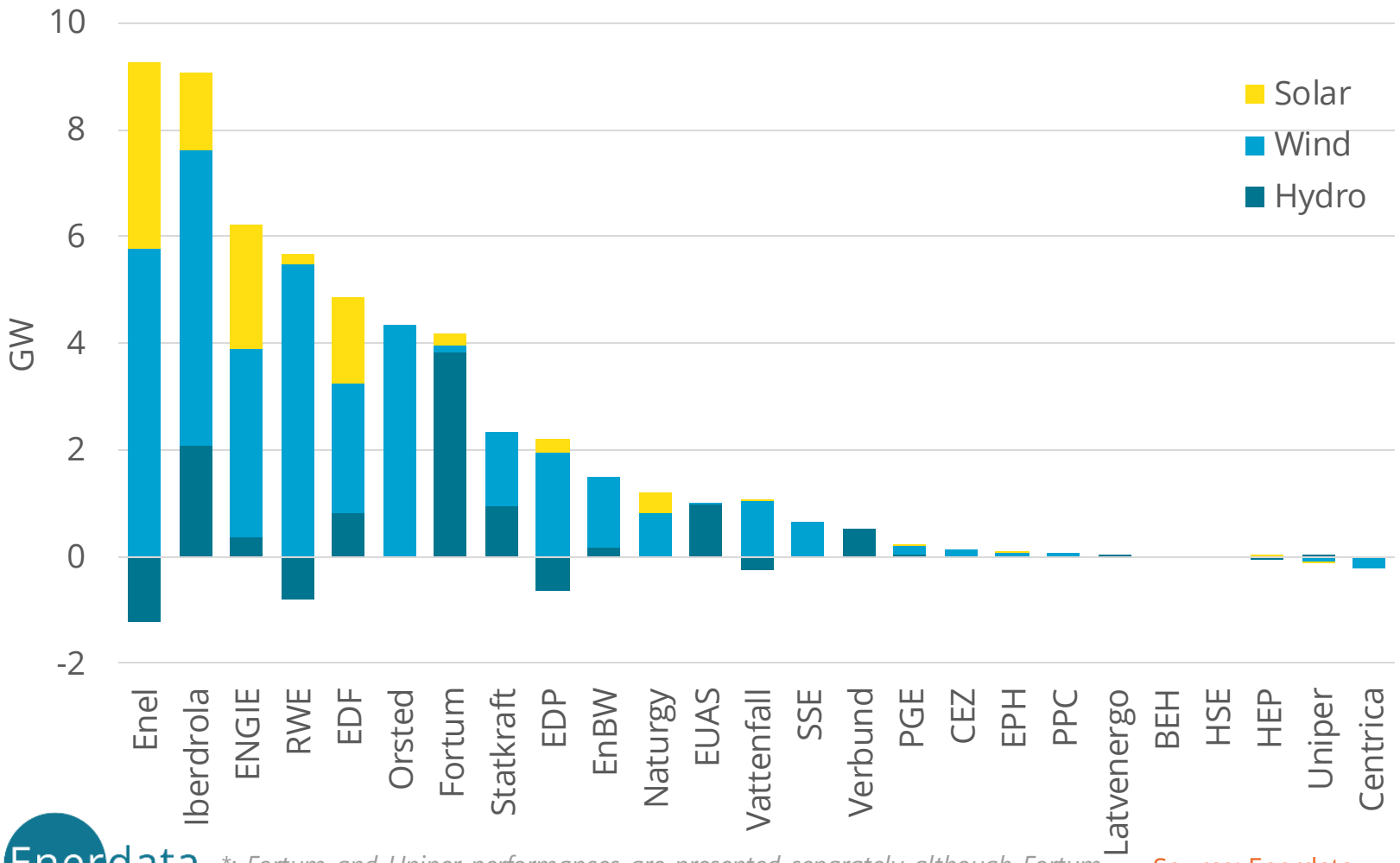
Disincentive policies to coal

- Before 2015: LCPD and IED accelerating coal-fired plant closures,
- ETS change in 2013 with end of free CO_2 allocations
- Since 2015, public and market pressure, profitability issues
- Lastly: surge of CO_2 allowances price

Coal withdrawal strategies

- Very few thermal assets commissioned since 2015, except for already committed investments (PGE).
- Strategies dominated by asset disposals by ENGIE (-10 GW), Enel (-8 GW), CZE, and Vattenfall; closures and conversion to biomass in a lesser extent
- Coal exit mainly based on power plant closures by RWE (-9 GW), EDF (-4 GW & -6 GW oil-fired plants), Iberdrola (3 GW)

Wind is the preferred technology



Source: Enerdata

*: Fortum and Uniper performances are presented separately although Fortum acquired Uniper in 2020.

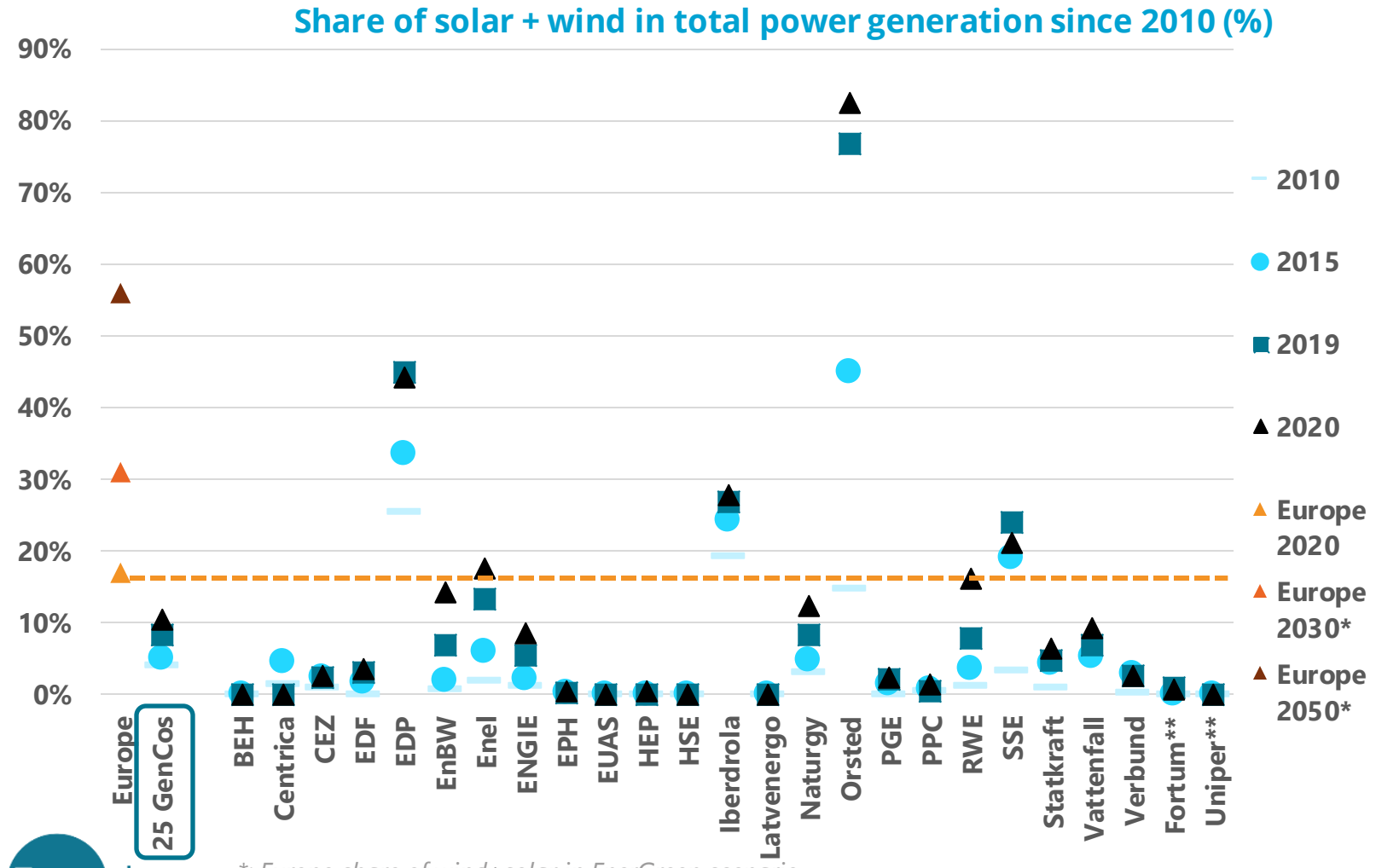
Wind drives the growth

- Wind capacity addition by European GenCos' (34.5 GW) since 2015 = 50% of Europe newly capacity (70 GW), only 15% for solar
- Northern-based (Ørsted, RWE through Innogy, Iberdrola through SSE) GenCos have massively developed offshore wind
- Solar growth for South European GenCos in home markets and Americas

Market leaders

- Enel and Iberdrola added 9 GW of renewables capacity since 2015
- Ørsted strongly promotes offshore wind technologies al across the world
- Enel, ENGIE, Iberdrola: strong growth in Latin America and the USA
- Acquisition of Innogy has accelerated RWE transition to renewables
- Hydropower assets are subject to asset swaps (EDP, EDF/Edison, Enel)

Solar+wind: few GenCo's exceed Europe average



*: Europe share of wind+solar in EnerGreen scenario
**: Fortum and Uniper performances are presented separately although Fortum acquired Uniper in 2020.

Source: Enerdata

EU average

- 25 GenCos' share of solar + wind in total power gen. reached 11% in 2020, much lower than Europe average of 17%.
- Most of the utilities have a lower share of solar + wind than the EU average
- Only EDP, Enel, Iberdrola, Ørsted and SSE have RES shares above the EU average

Various trends in RES growth

- Noticeable growth for Ørsted, EDP, Enel, RWE (Innogy acquisition) and EnBW, and to a lesser extent for ENGIE, Naturgy and Vattenfall
- Numerous utilities have not yet engaged a transition toward solar and wind technologies

Scenario EnerGreen

- Solar + wind to reach 31% of total of power generation in Europe in 2030, and 56% in 2050
- Ørsted & EDP already exceeded EnerFuture Europe 2030 milestone in 2020

On the road to Paris Agreement ?

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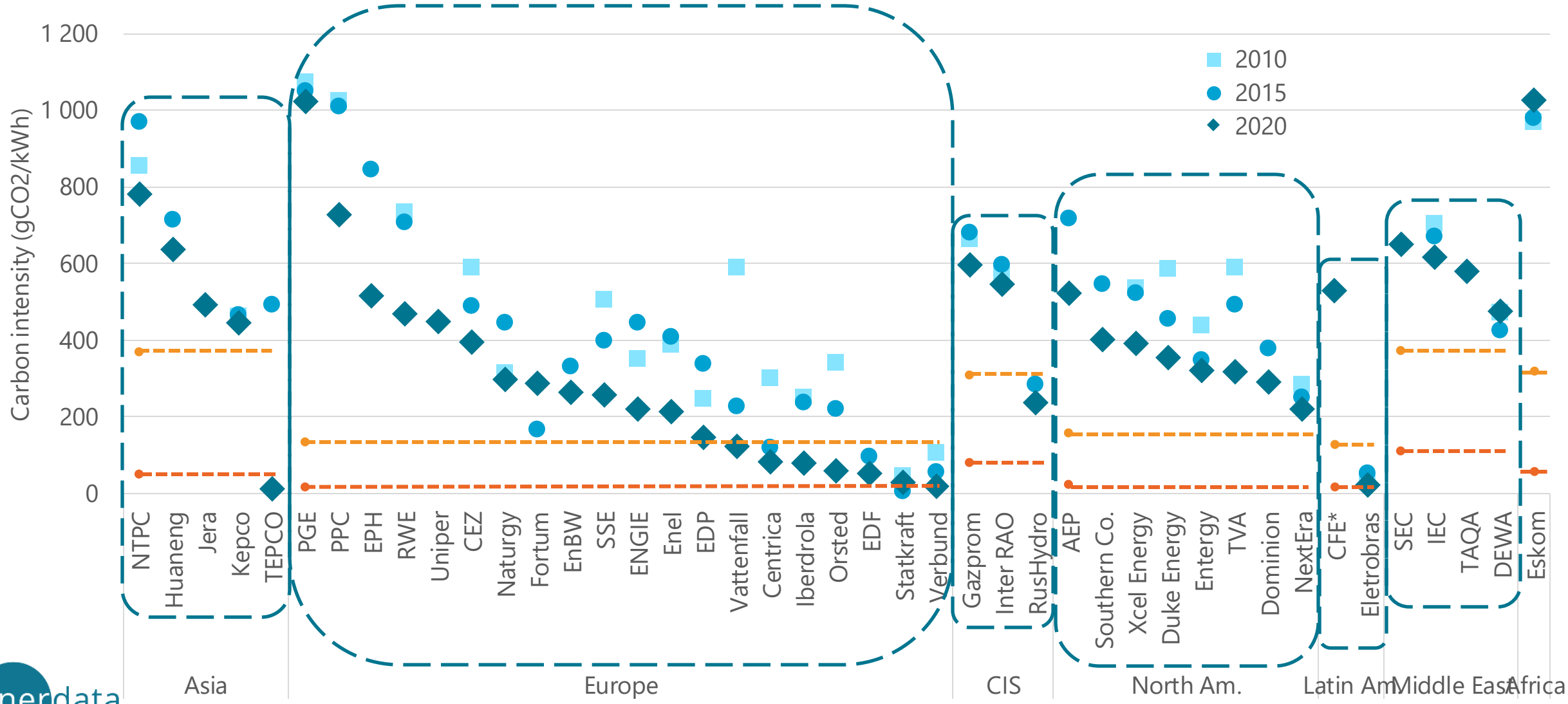
GenCos' carbon intensity path to Paris



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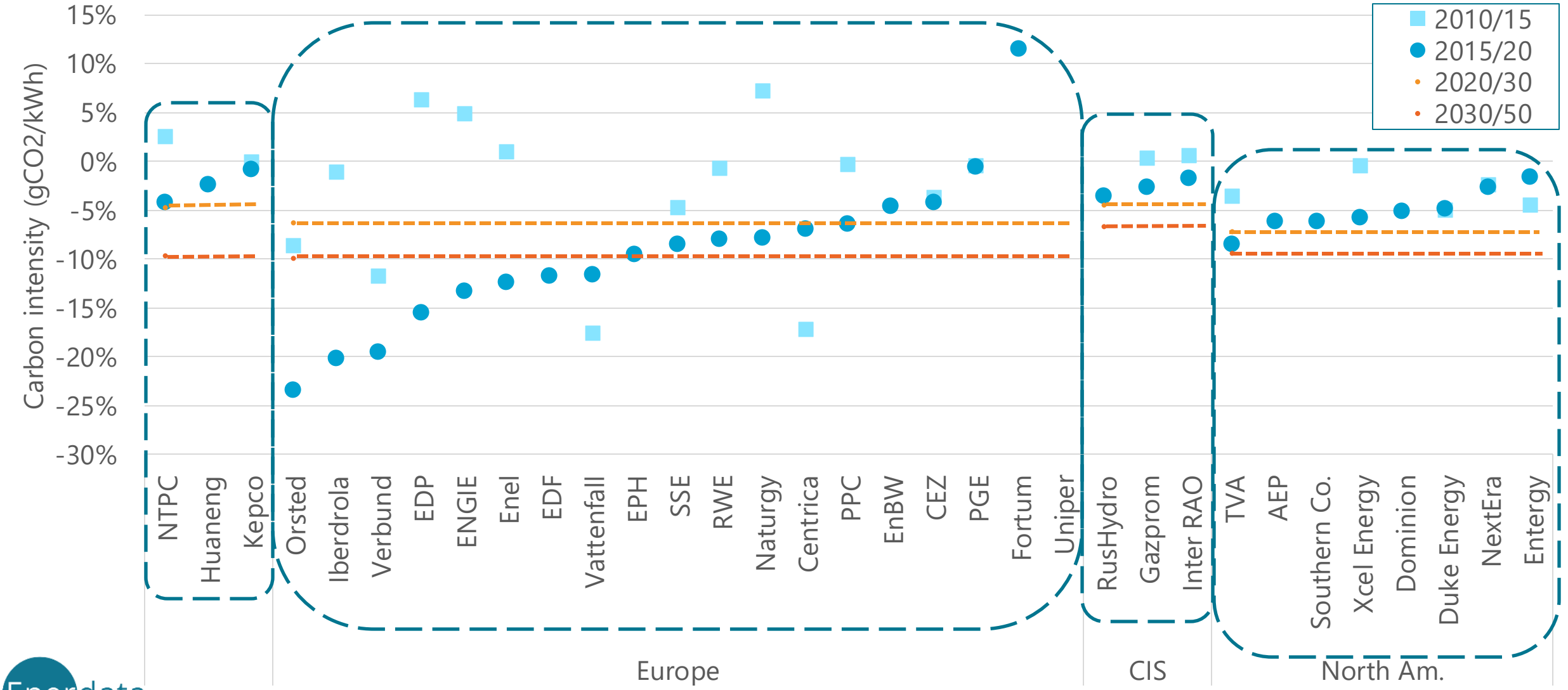
Carbon intensity reduction speed



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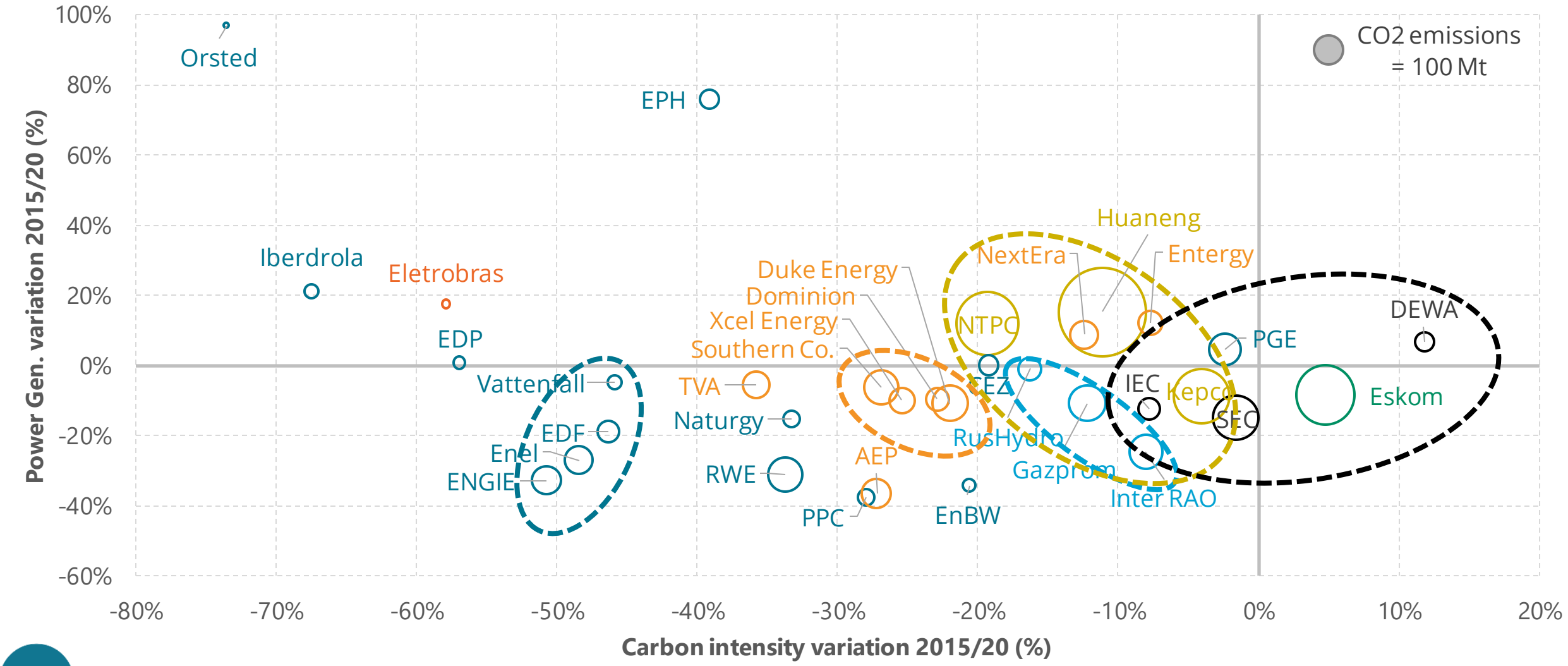
Power generation & carbon intensity: 2015 vs 2020



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Conclusion

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Wrap-up

Chinese GenCos are by far the largest in the world and have reached **unprecedent levels of renewables installations** within these last 5 years (+23 GW/y wind & solar). According to those, Chinese GenCos and China are showing their willingness and abilities to comply with the Paris-Agreement BUT will need to cut their coal generation accordingly.

Most of the European GenCos have deployed **low-carbon strategies** since the beginning of the 2010's, including **coal phase-out strategies,** either through the sales of their fossil fuels-fired power plants or by closing such assets.

The drop of GenCos' carbon factor recorded since 2015 vary according to the continent:

- **European** GenCos have mainly engaged **coal phase-out strategies**;
- **Asian** GenCos strive to cope with rising electricity demand by adding **renewables capacities**;
- **American** GenCos are improving the carbon intensity thanks to the **coal-to-gas switch** of their power mix;
- **CIS** GenCos bet on their **power plants efficiency improvement programmes** of the power generation fleet;
- **Solar policies** recently launched by **Middle-East** GenCos will reduce their carbon factor in the coming years.

Although noticeable carbon factor improvements have been accomplished by GenCos over the past five year –over the past decade for some of them- further significant effort will have be realised over the next decades to align with Paris Agreement goals.

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