



Welcome

Coal phase-out: Alternatives and Solutions

Platform for Coal Regions in Transition

#CoalRegionsEU

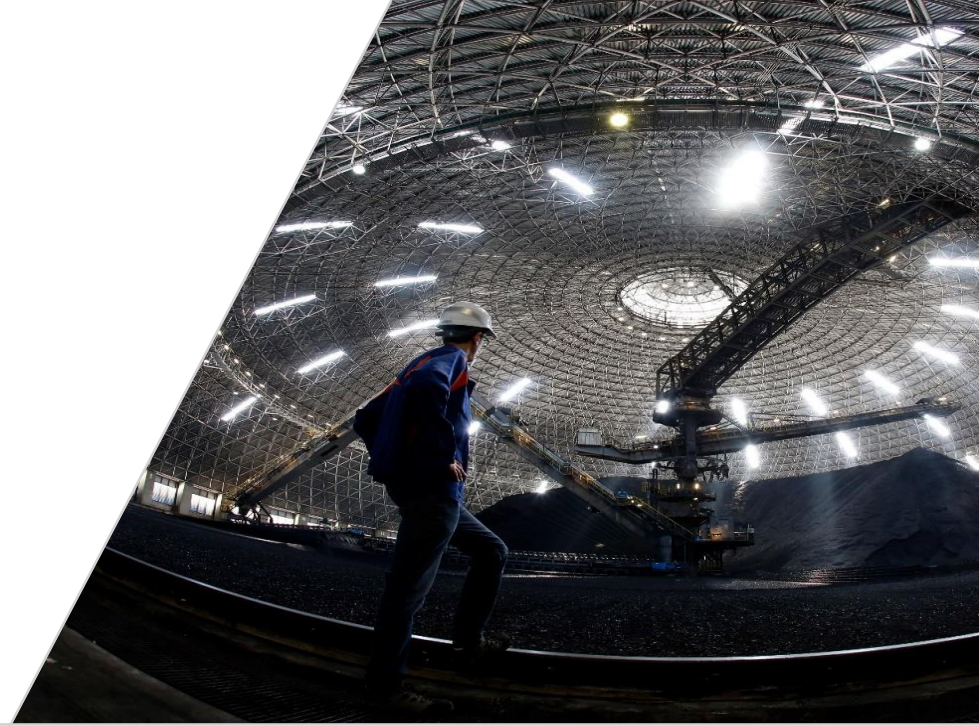
Energy

Coal Phase-out: Alternatives and Solutions

Platform for Coal Regions in Transition

Katherine Poseidon

October 17, 2019



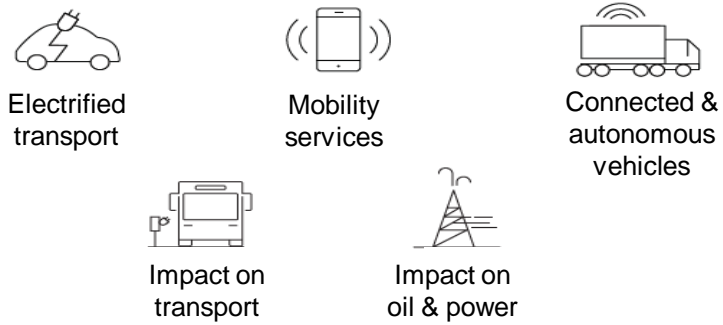
BloombergNEF

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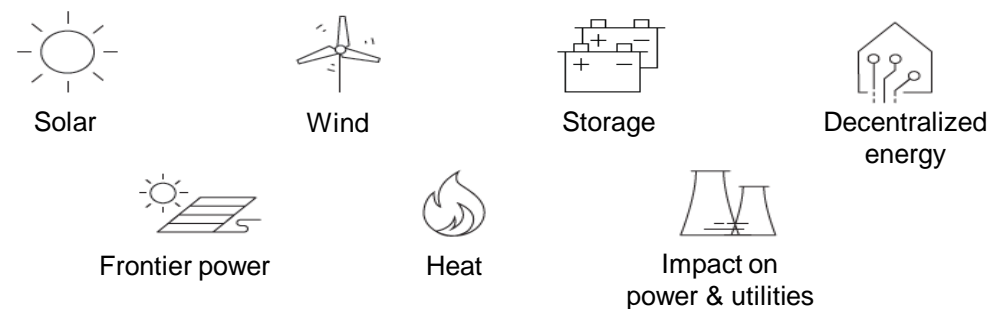
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Strategies for a cleaner, more competitive future

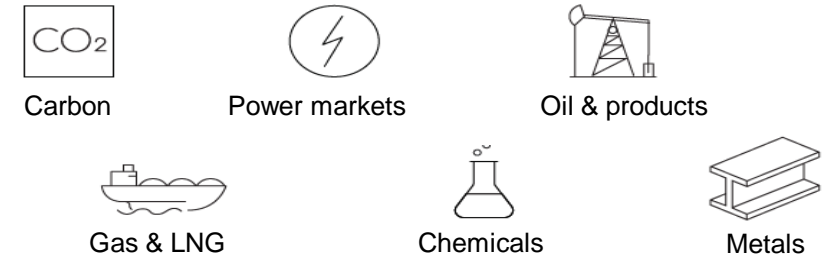
Advanced transport



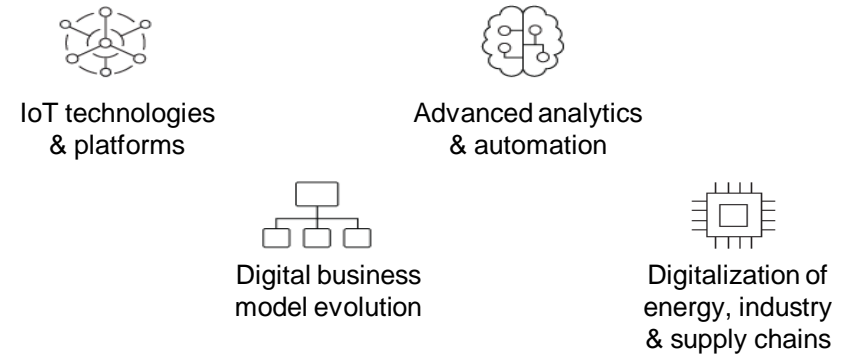
Clean energy



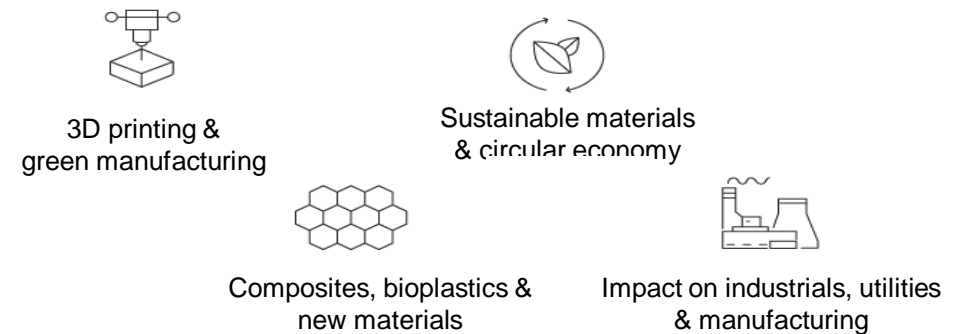
Commodities



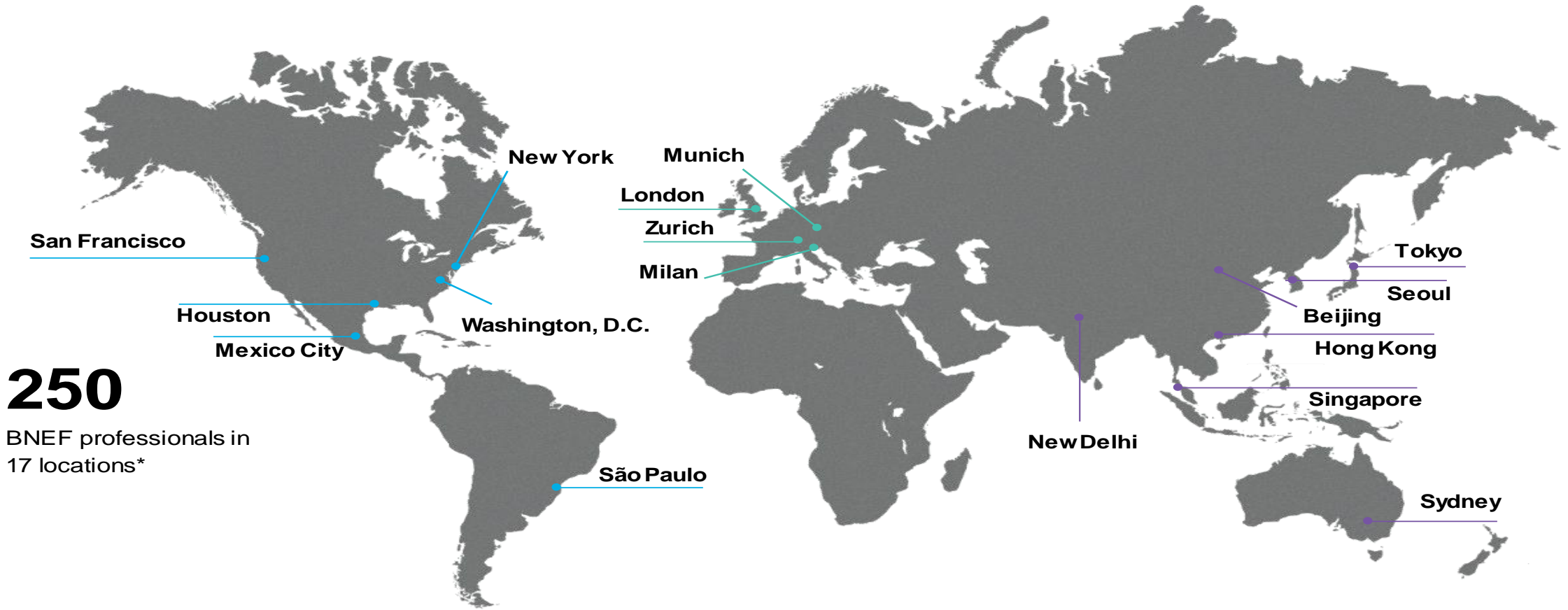
Digital industry



Advanced materials



With global expertise



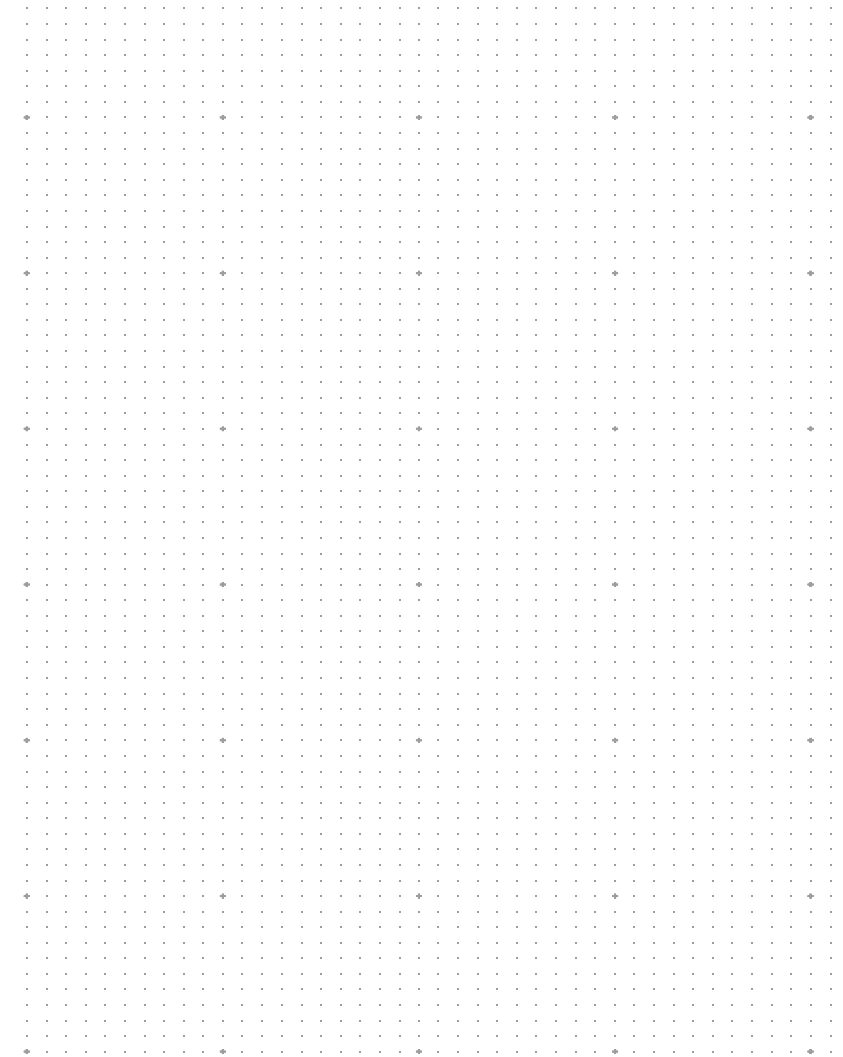
250

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17 locations*

* Part of the Bloomberg LP with
19,000 employees in 176
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Costs

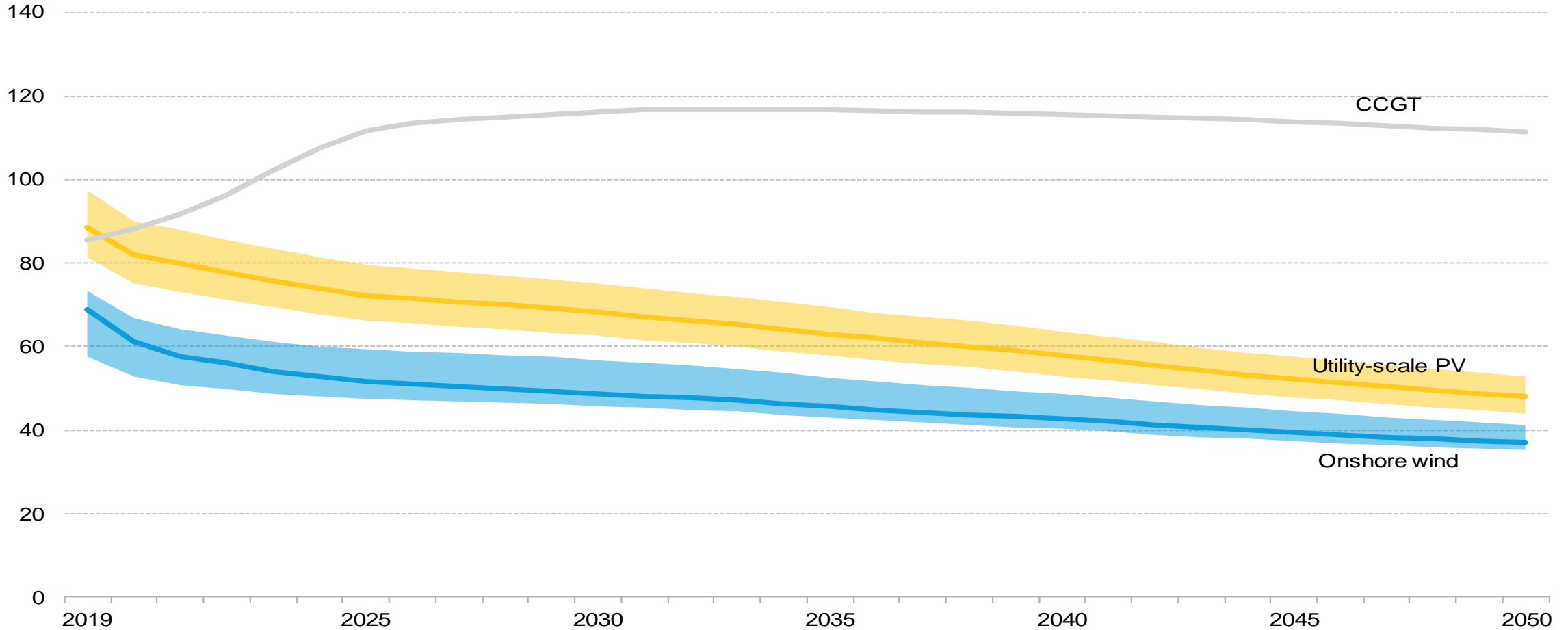
Wind, solar, and batteries beat fossil fuels in Europe



New vs new – a battle long lost

U.K. LCOE for new build solar, onshore wind, and combined cycle gas (CCGT)

\$/MWh (real 2018)

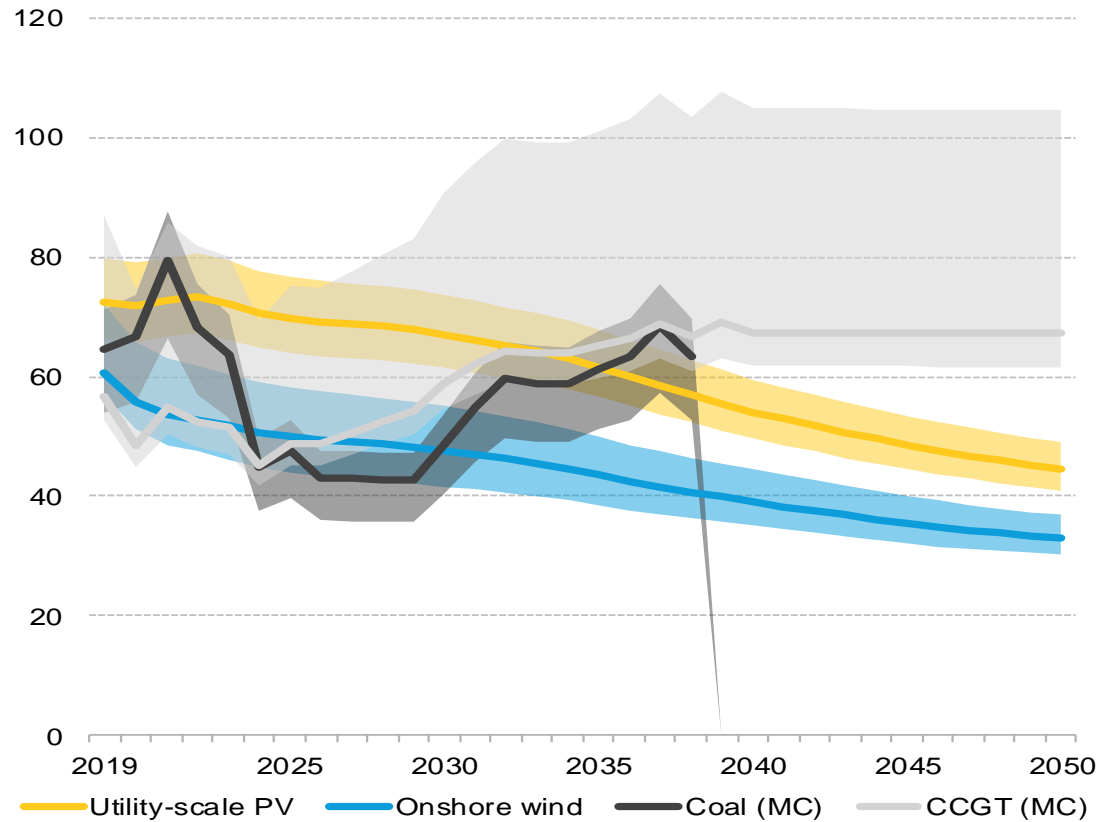


Source: BloombergNEF. Note: LCOE curves represent realized capacity factors

New vs old – closing the gap or already there

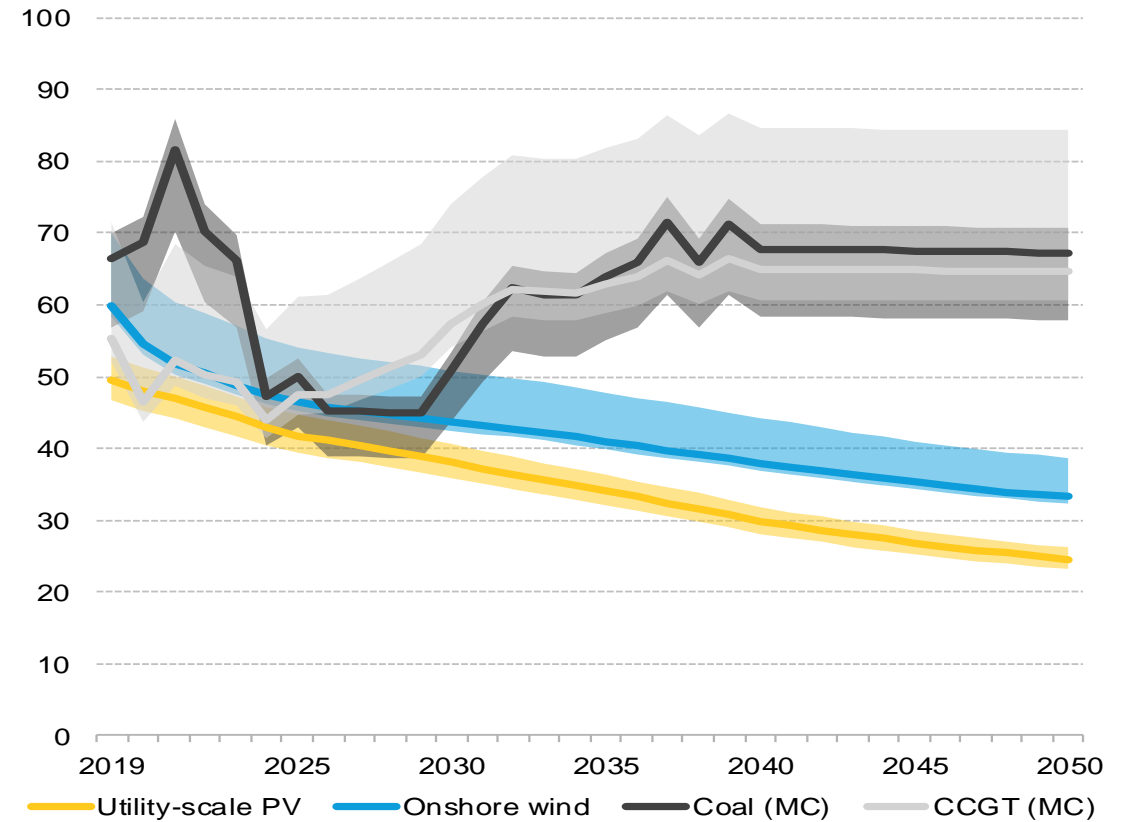
German LCOE of new solar and wind, and short run marginal cost of existing coal and gas

\$/MWh (real 2018)



Italian LCOE of new solar and wind, and short run marginal cost of existing coal and gas

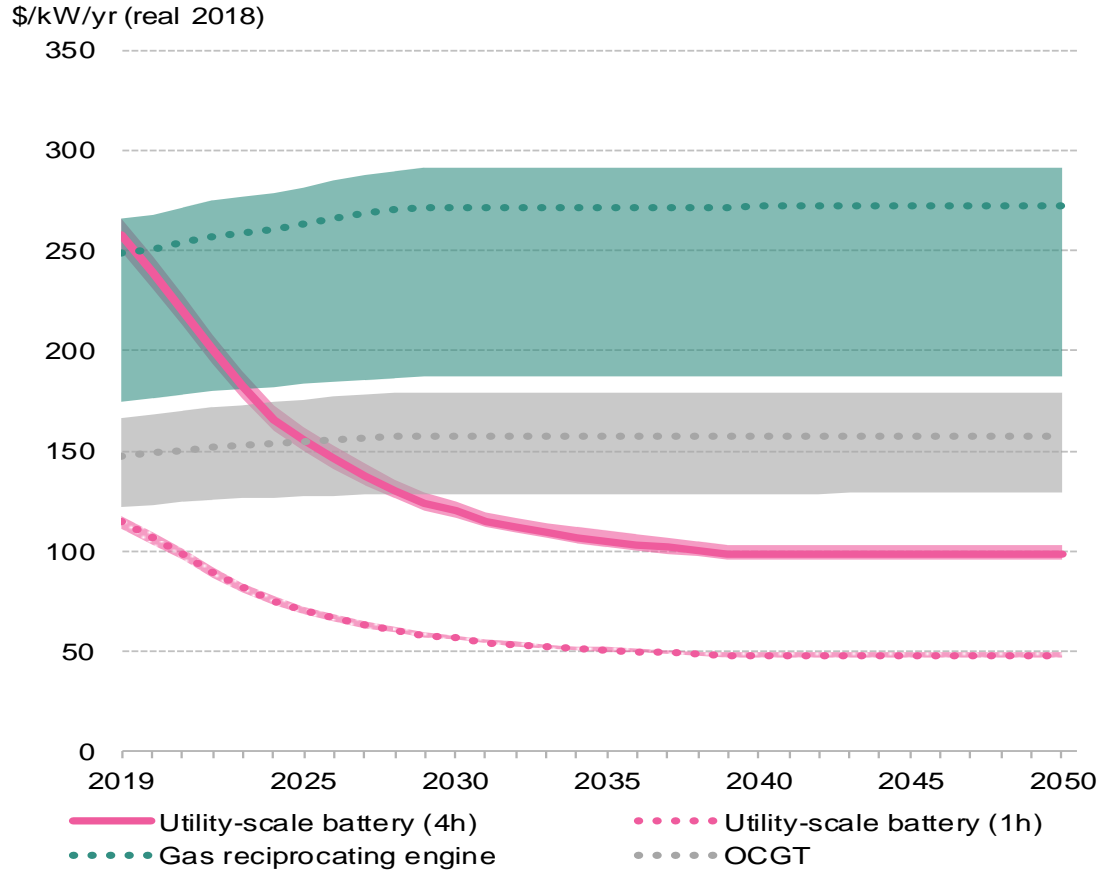
\$/MWh (real 2018)



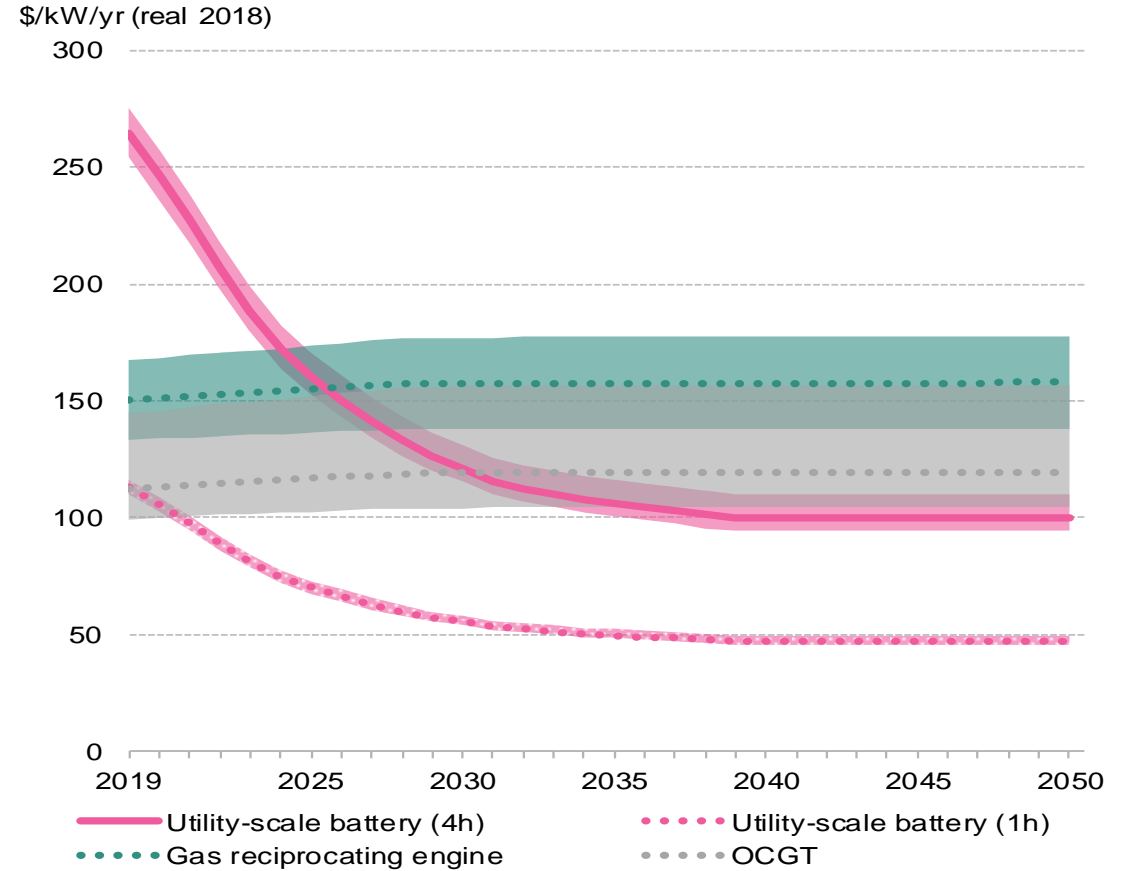
Source: BloombergNEF

Batteries are also getting cheaper

German levelized cost of capacity for peaking technologies



U.K. levelized cost of capacity for peaking technologies



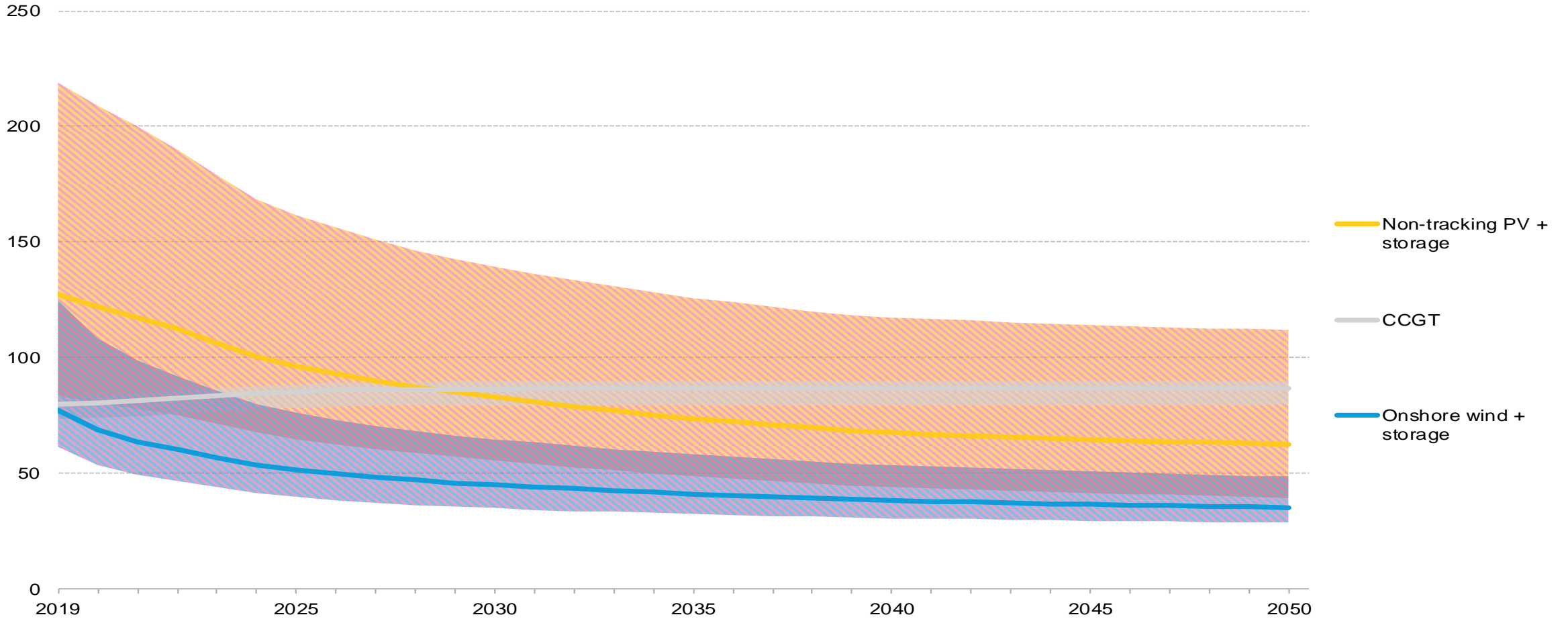
Source: BloombergNEF

Levelized costs

Renewables + storage – a competitive alternative

German LCOE of PV and wind coupled with storage, and a new combined cycle gas plant (CCGT)

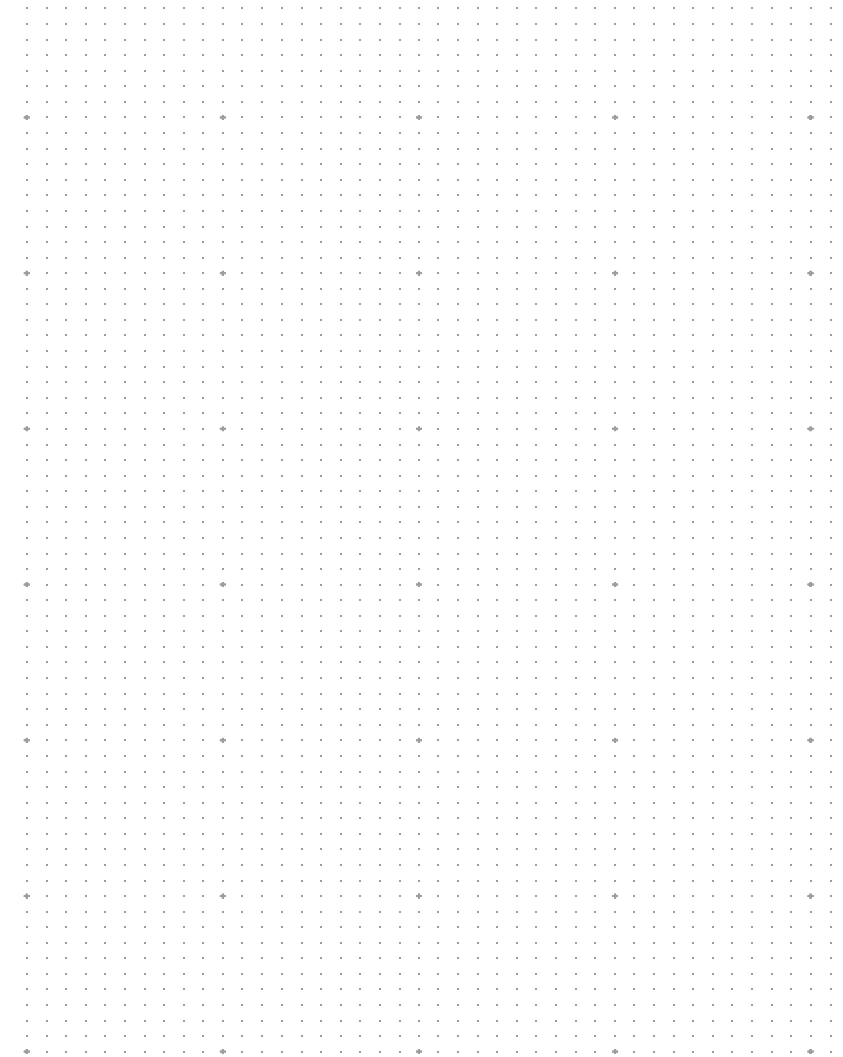
\$/MWh (real 2018)



Source: BloombergNEF. Note: The range of LCOE for wind and solar coupled with batteries represents different battery sizes

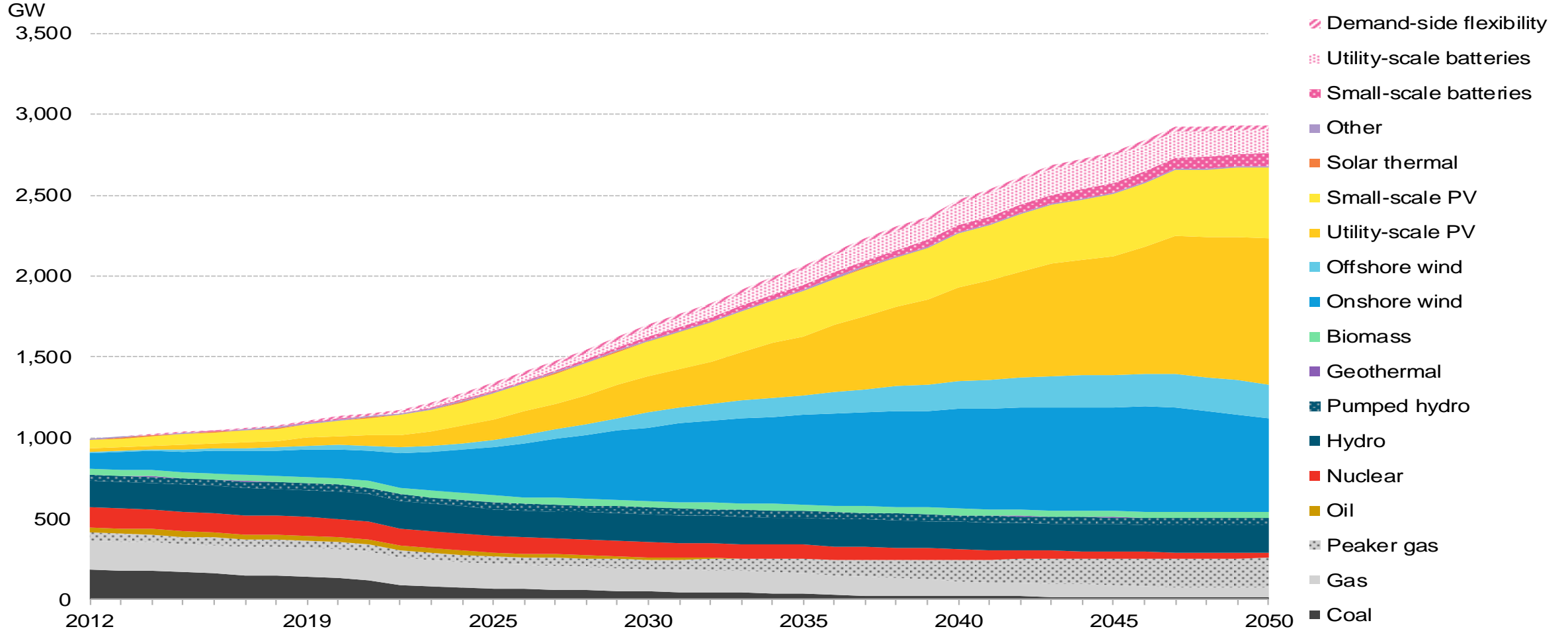
Opportunities

Capacity and generation outlook



Economic growth of wind and solar

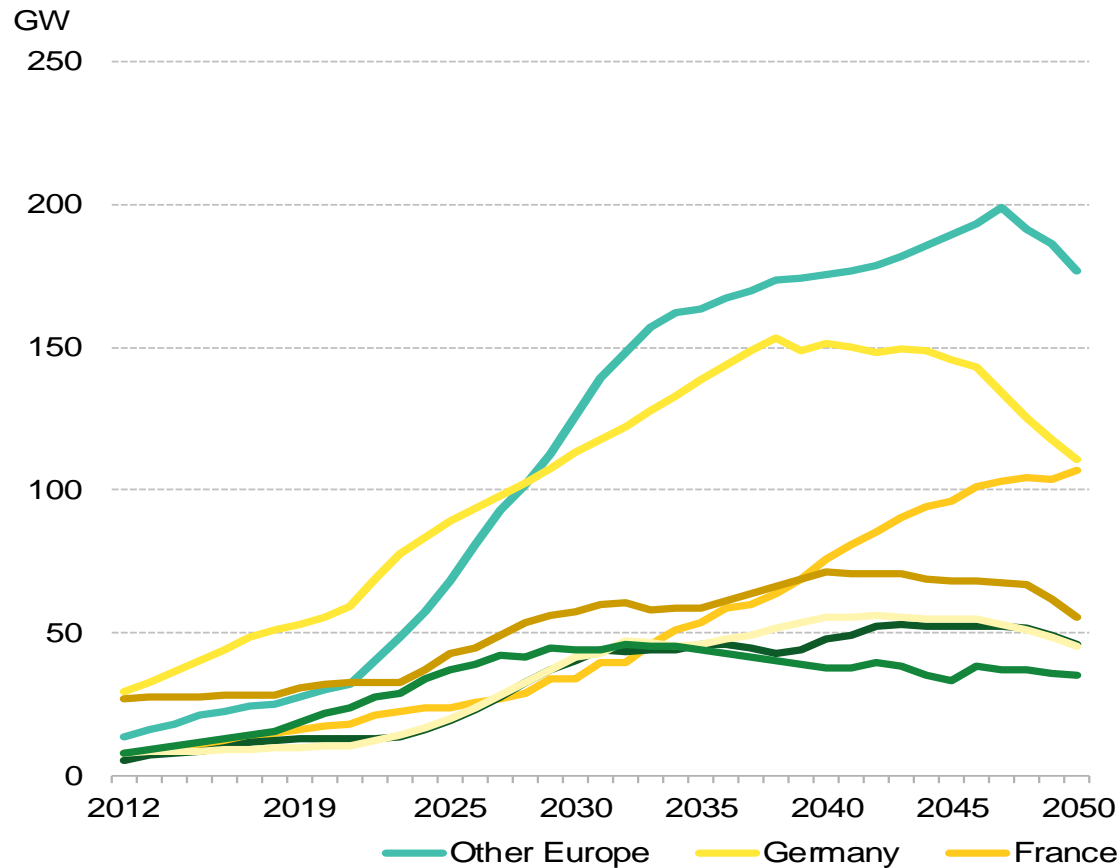
Cumulative installed capacity in Europe



Source: BloombergNEF

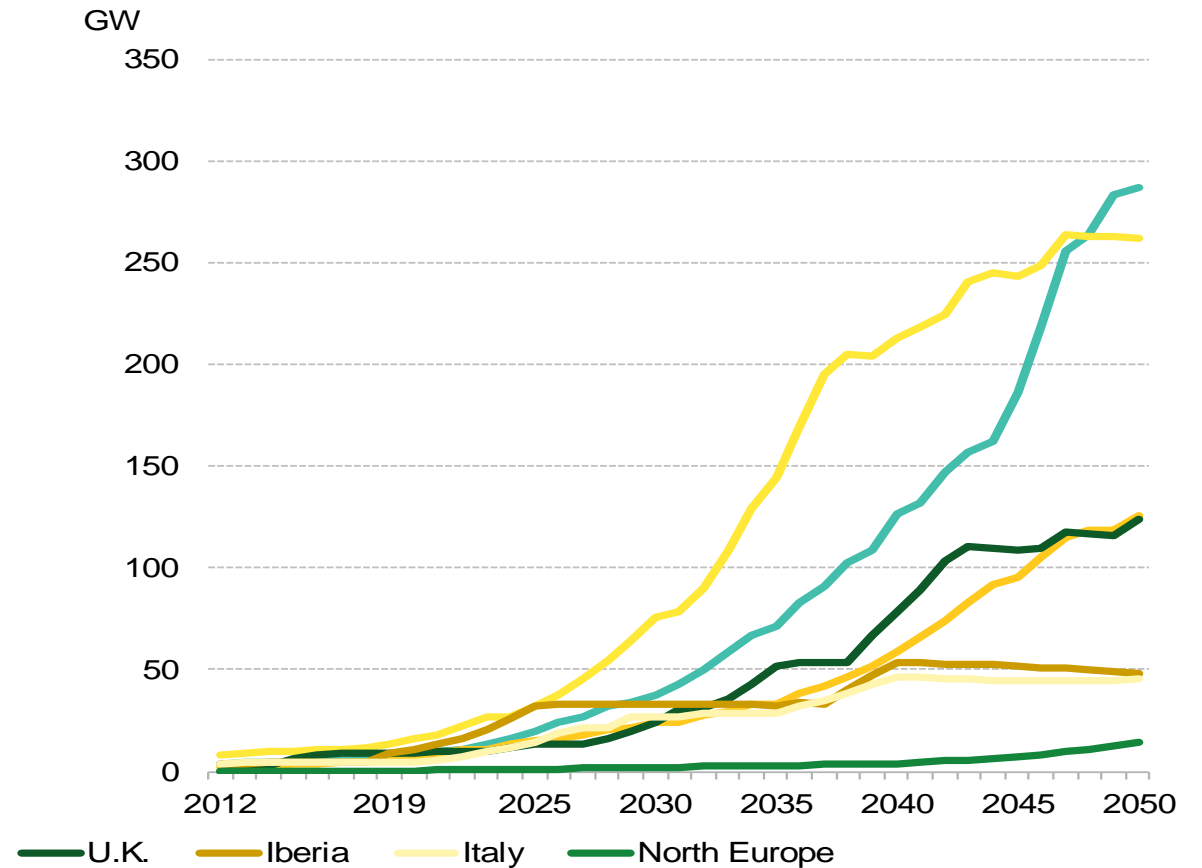
Growth comes everywhere but at a different pace

Cumulative onshore wind capacity



Source: BloombergNEF

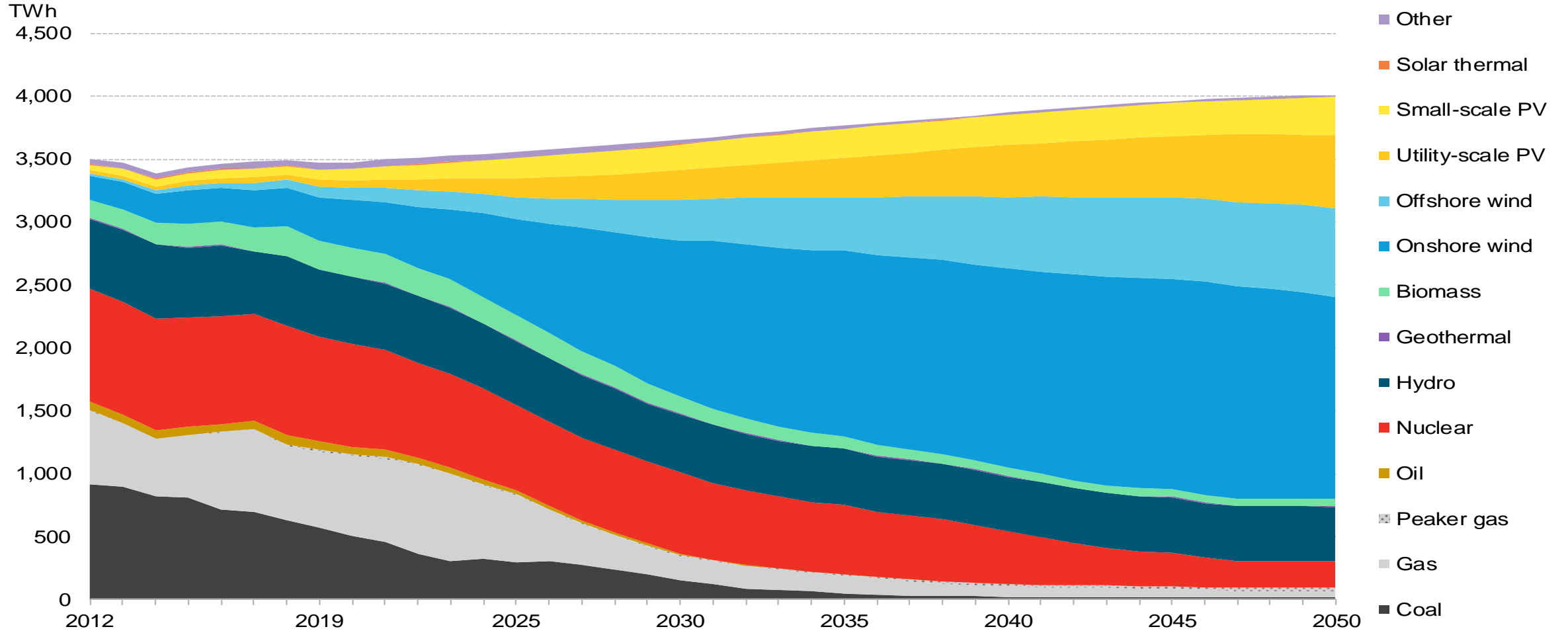
Cumulative utility-scale PV capacity



Source: BloombergNEF

The face of generation is permanently altered

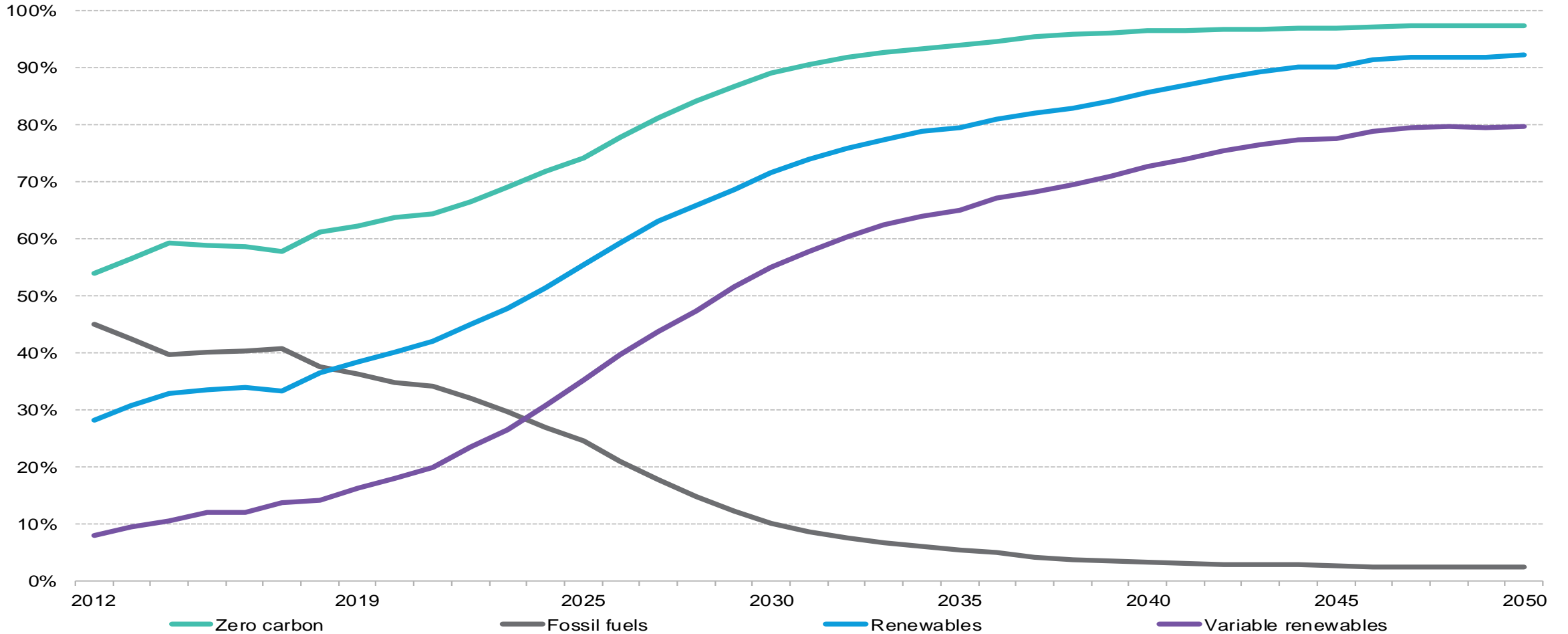
European generation by source



Source: BloombergNEF. Note: Does not include storage technologies as they consume more energy than they produce

The face of generation is permanently altered

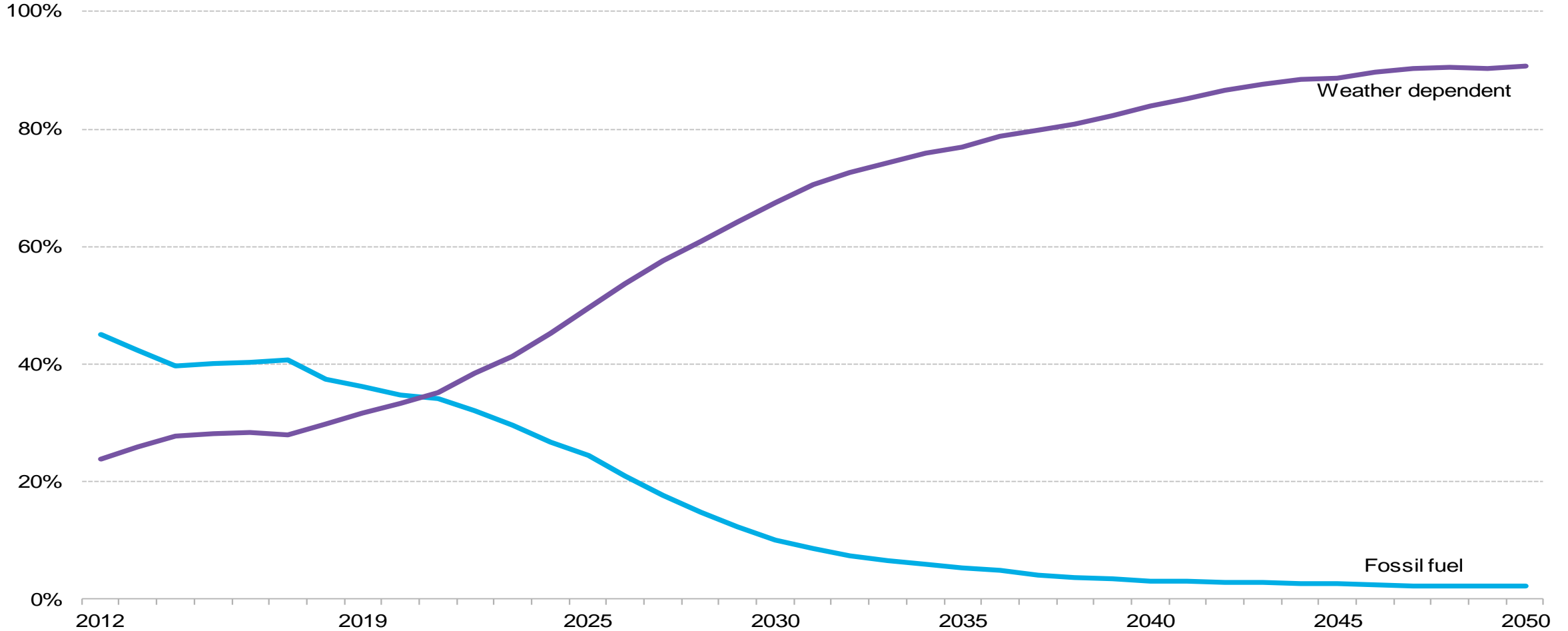
European generation indicators



Source: BloombergNEF. Note: Does not include storage technologies as they consume more energy than they produce

Risks will shift away from commodities

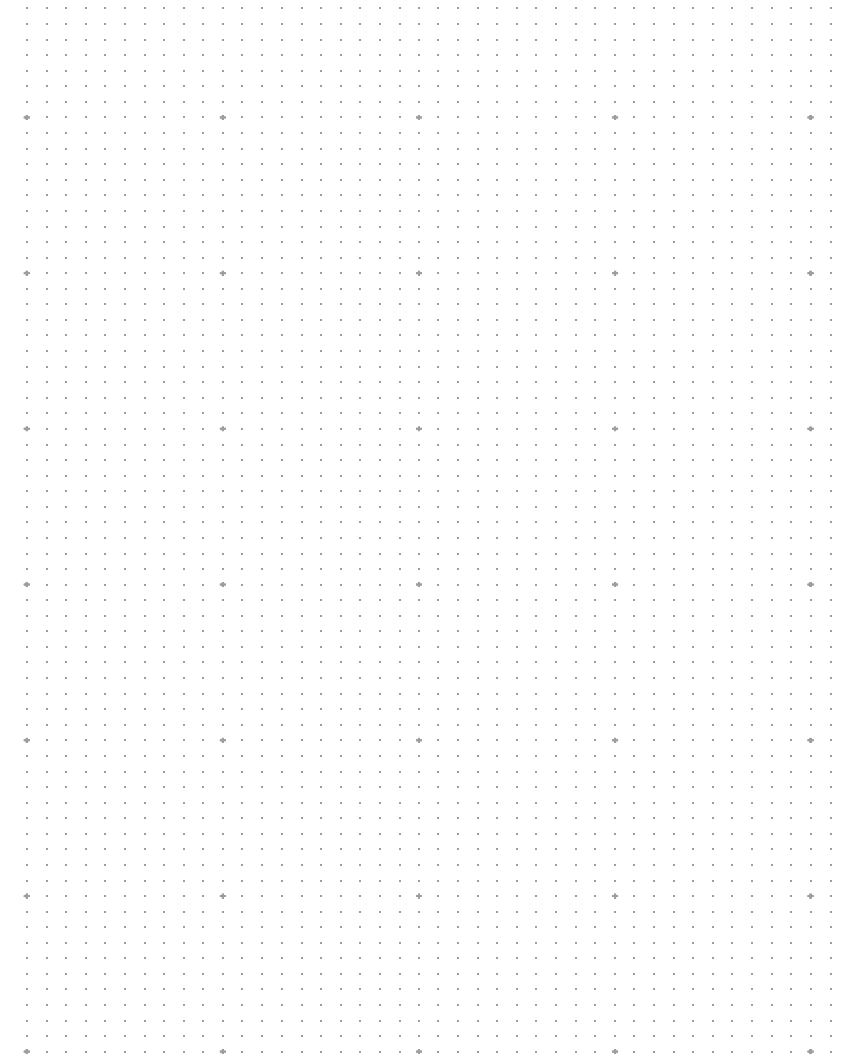
European generation by dependency



Source: BloombergNEF.

Challenges

Power markets struggle with high shares of renewables

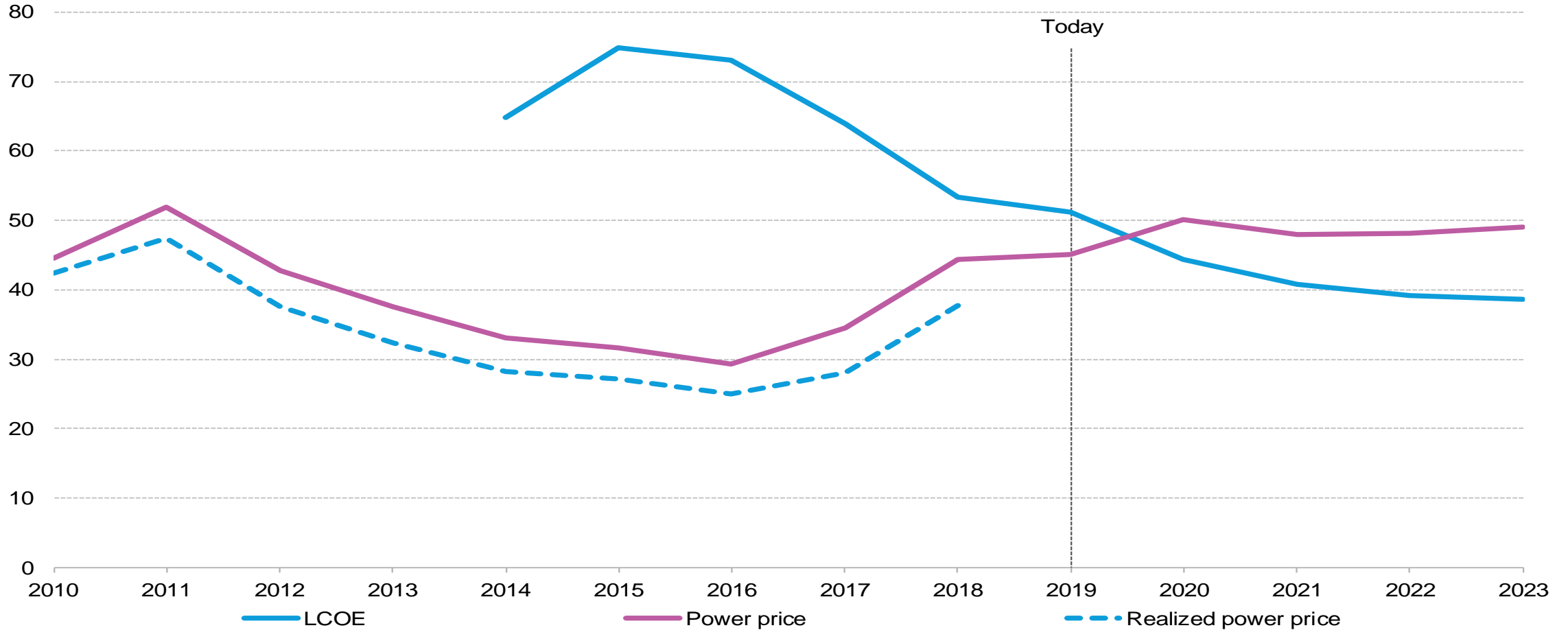


Market revenues?

Some technologies are already capturing a discounted price

German wind LCOE, historical and forward power price, and wind realized power price

EUR/MWh, nominal

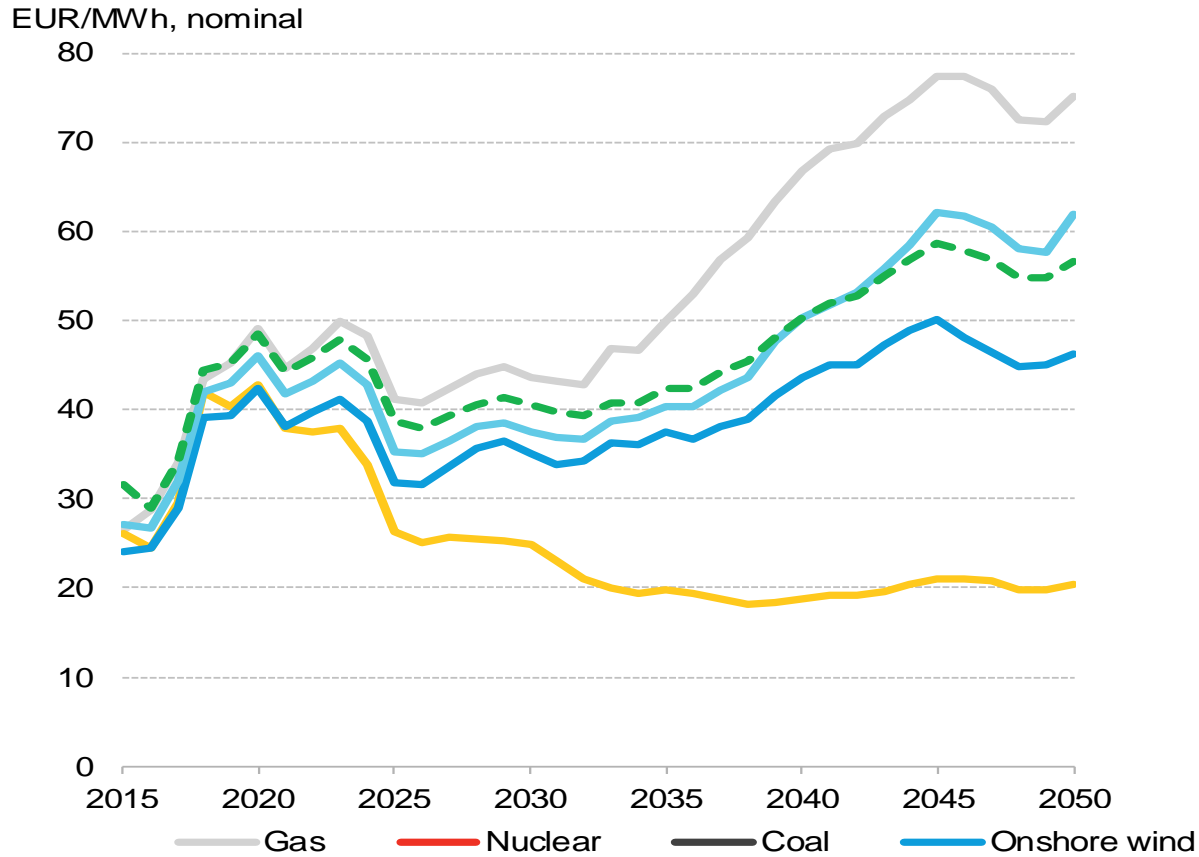


Source: Terminal, BloombergNEF. Note: Realized power price is also known as captured price, or generation weighted price. Future prices reflect the forward curve as of April 24, 2019

Market revenues?

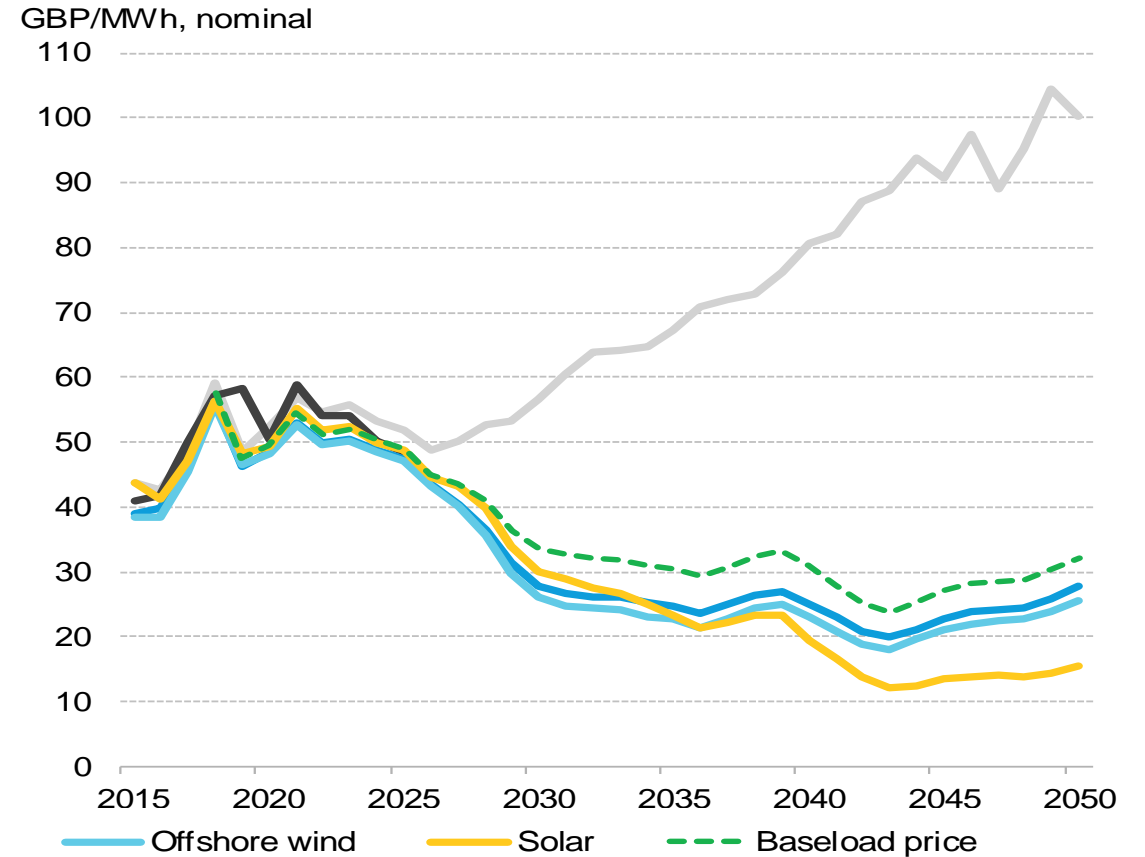
The cannibalization problem only gets worse

German baseload and realized power price outlook



Source: BloombergNEF

U.K. baseload and realized power price outlook

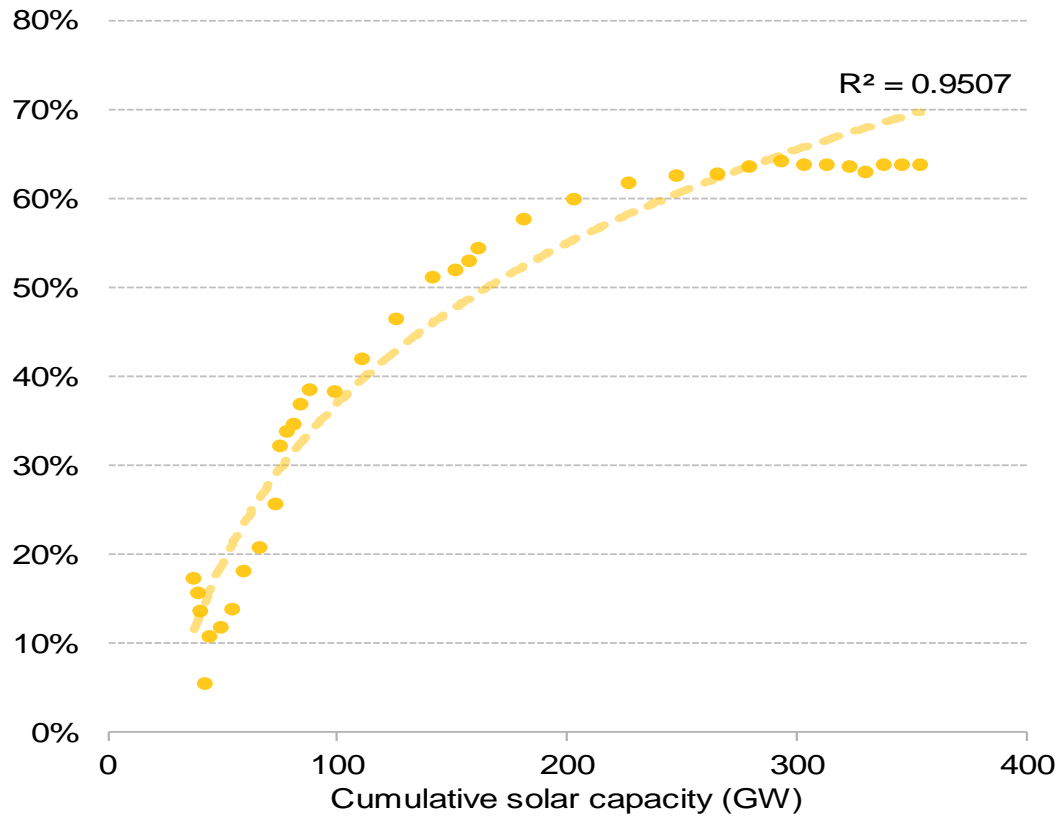


Source: BloombergNEF

The problem is directly related to capacity installed

German utility-scale PV discount as a function of PV capacity installed

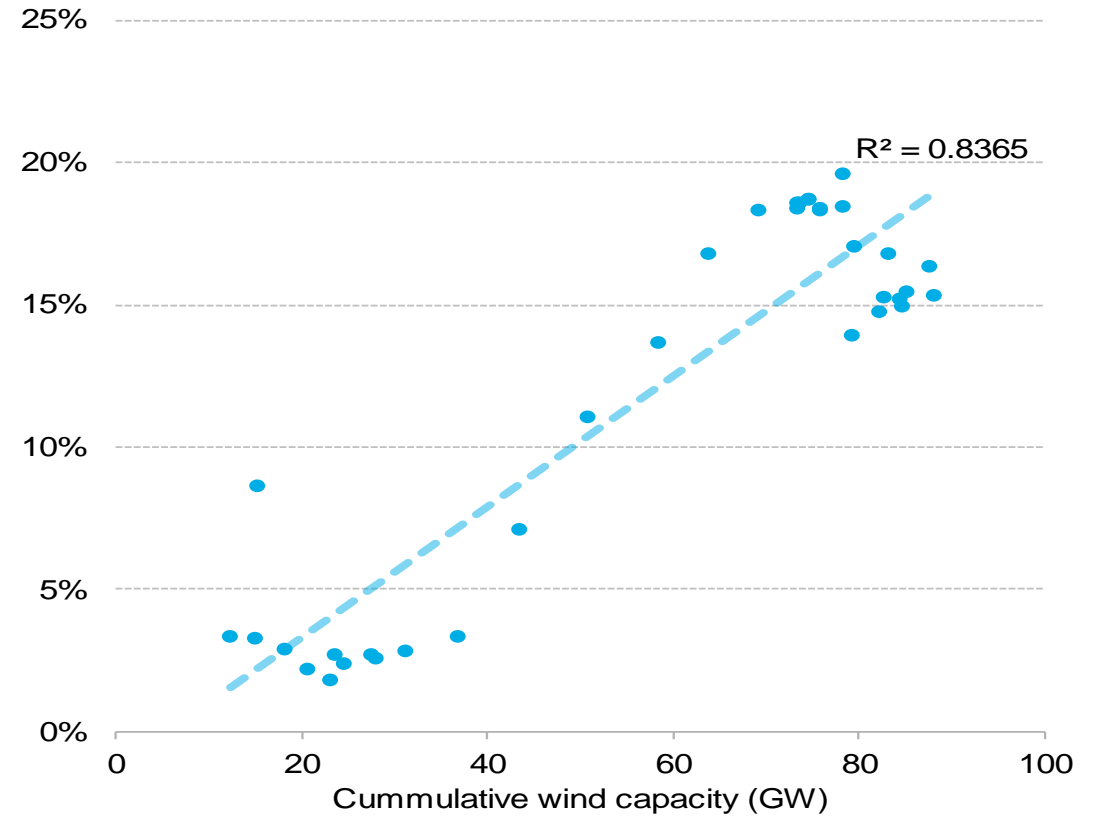
Discount on baseload power price



Source: BloombergNEF

U.K. onshore wind discount as a function of wind capacity installed

Discount on baseload power price

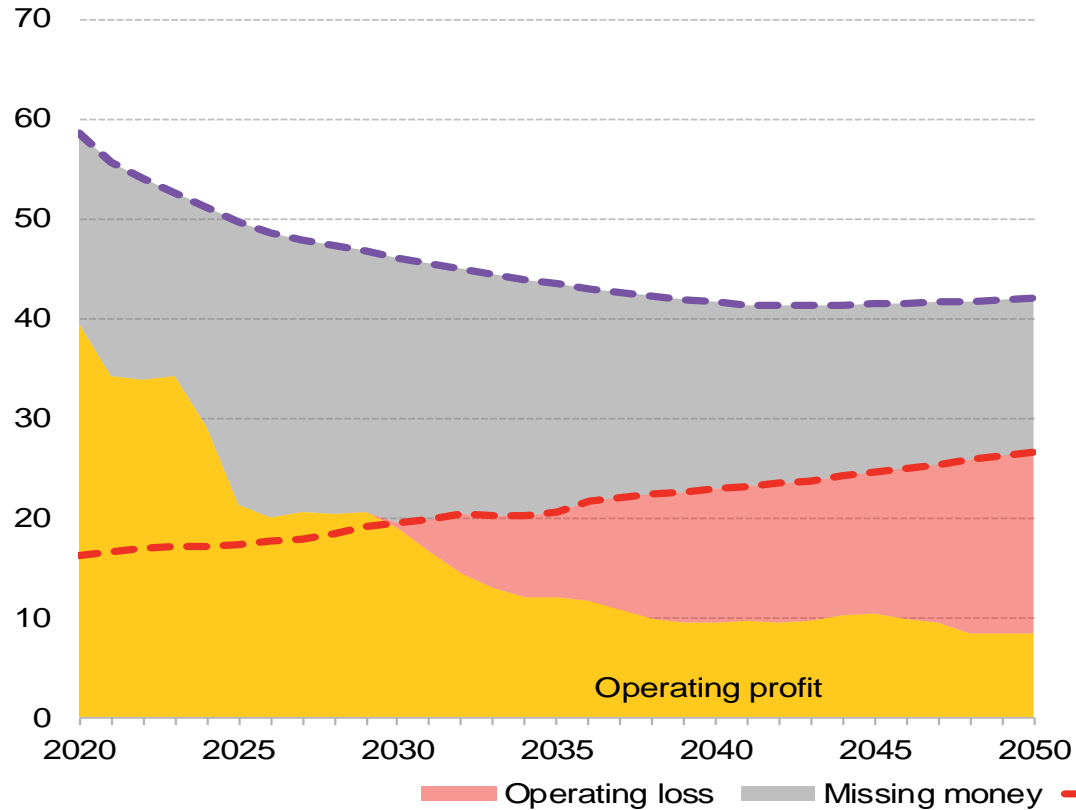


Source: BloombergNEF

Cannibalization dents the returns of projects

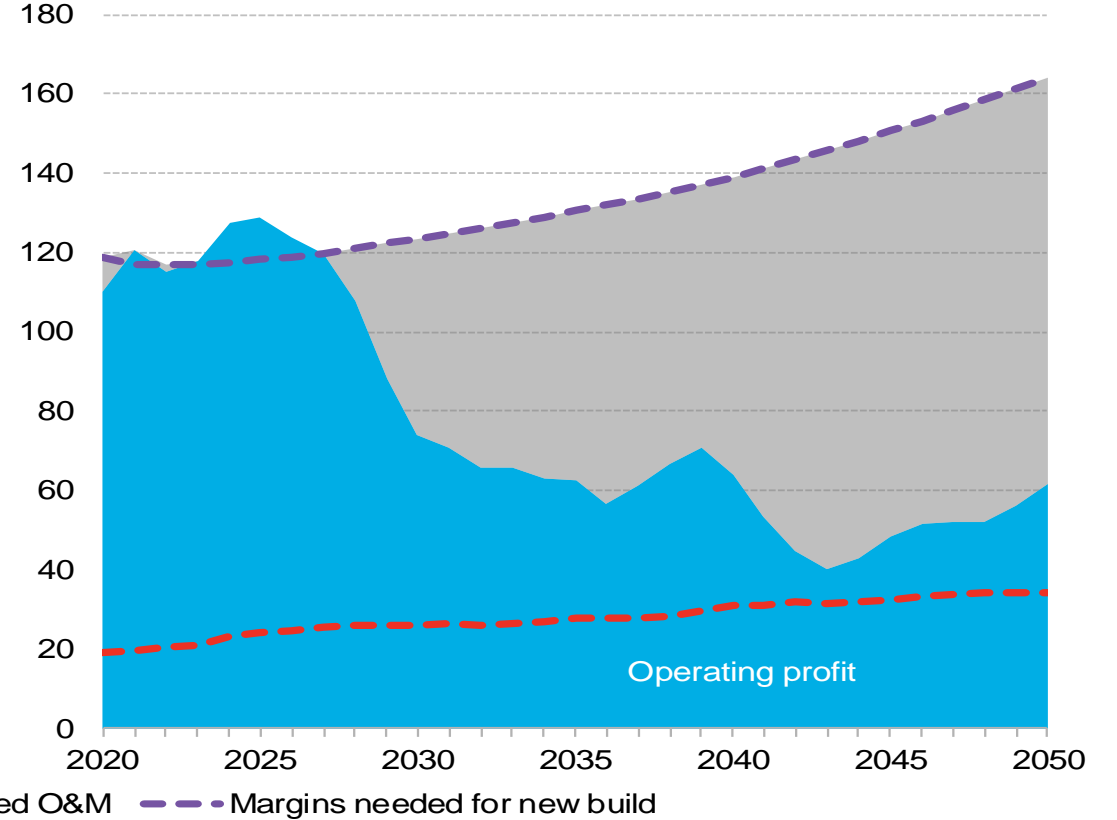
Operating profits for German utility-scale PV

EUR/kW/yr, nominal

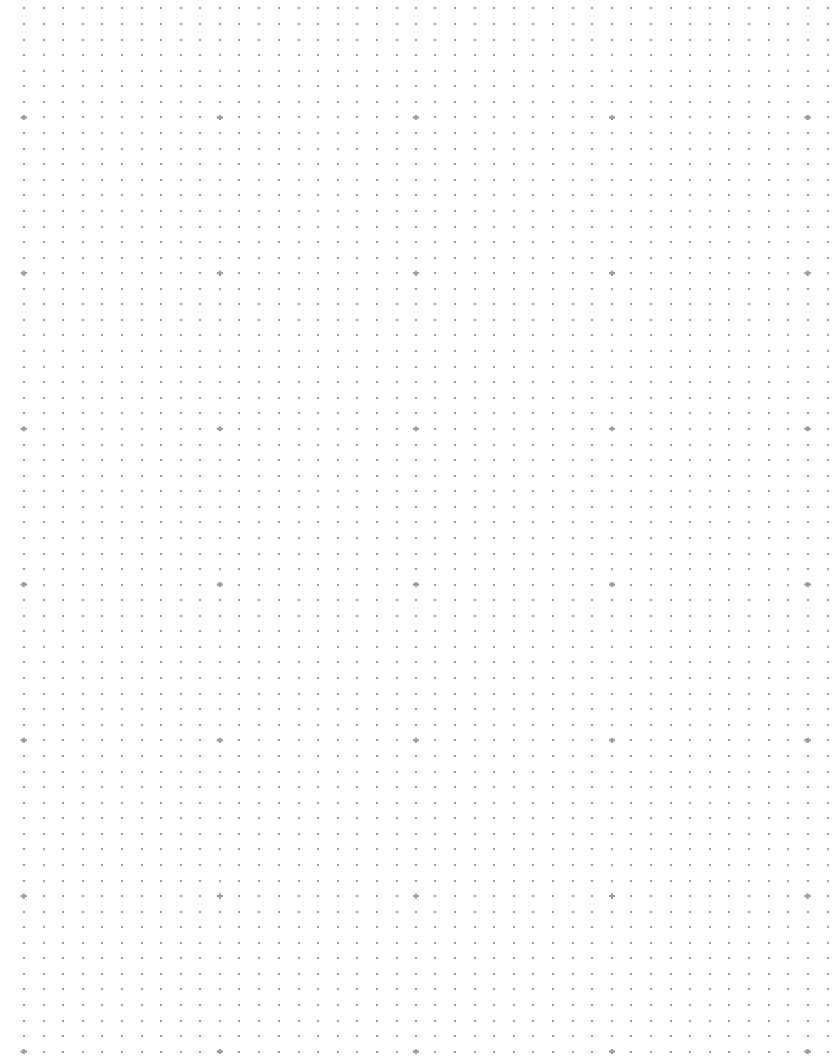


Operating profit for U.K. utility-scale PV

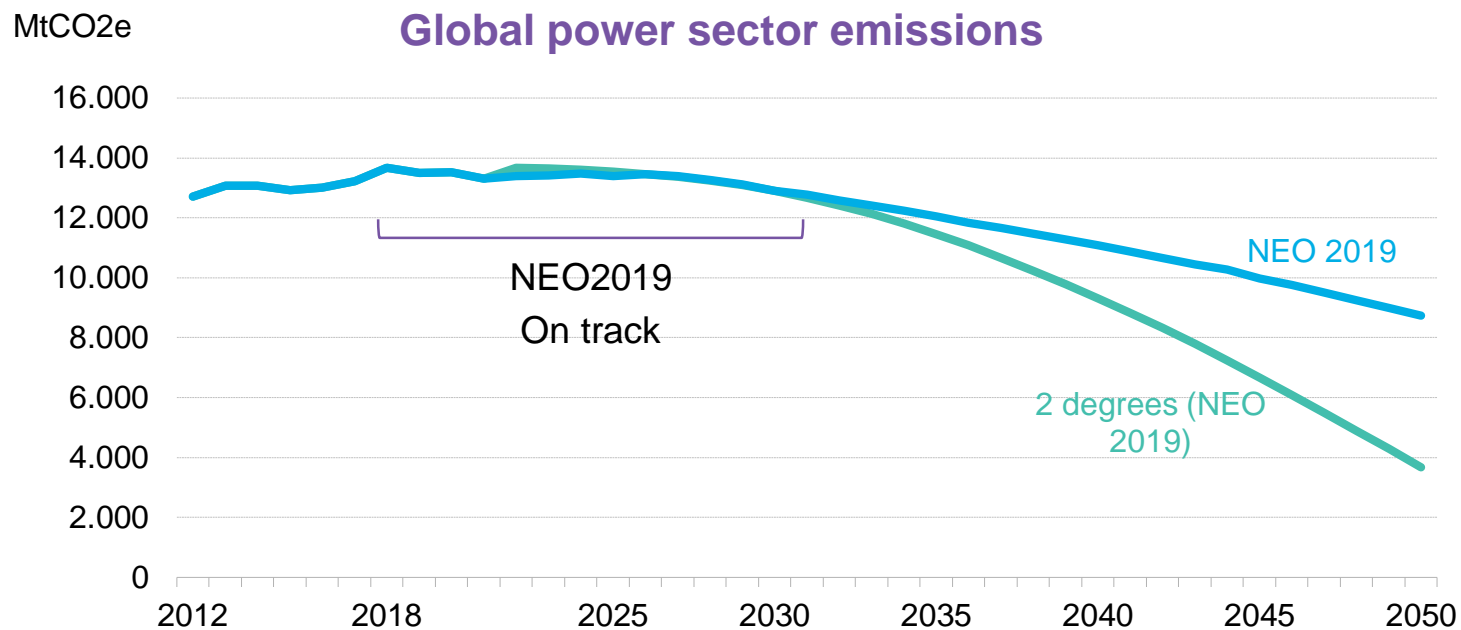
GBP/kW/yr, nominal



Appendix

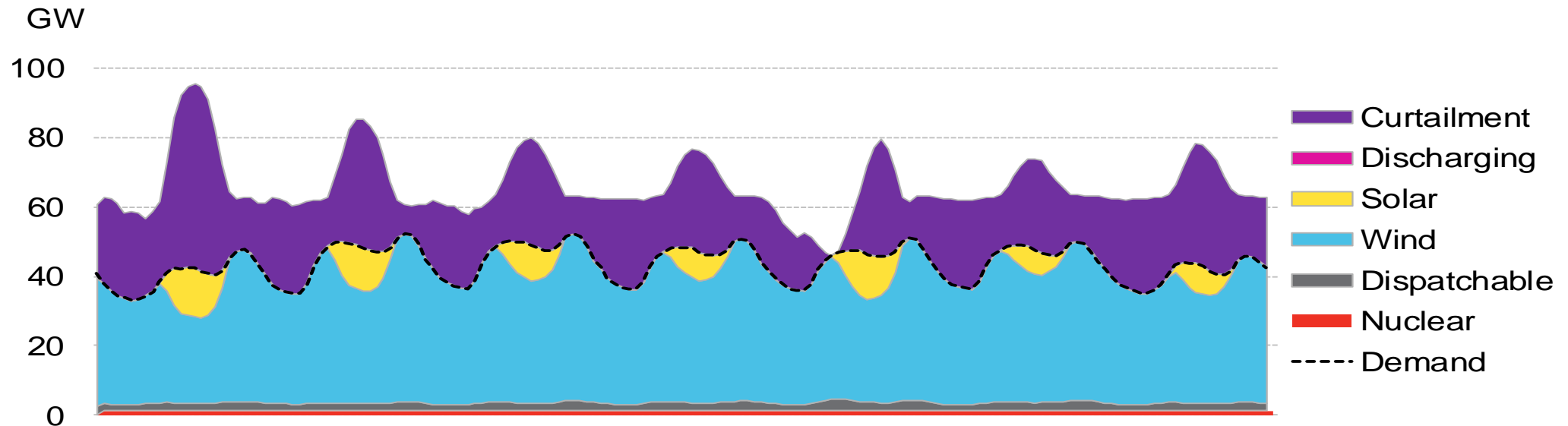


Keeping power sector on track for 2 degrees to 2030



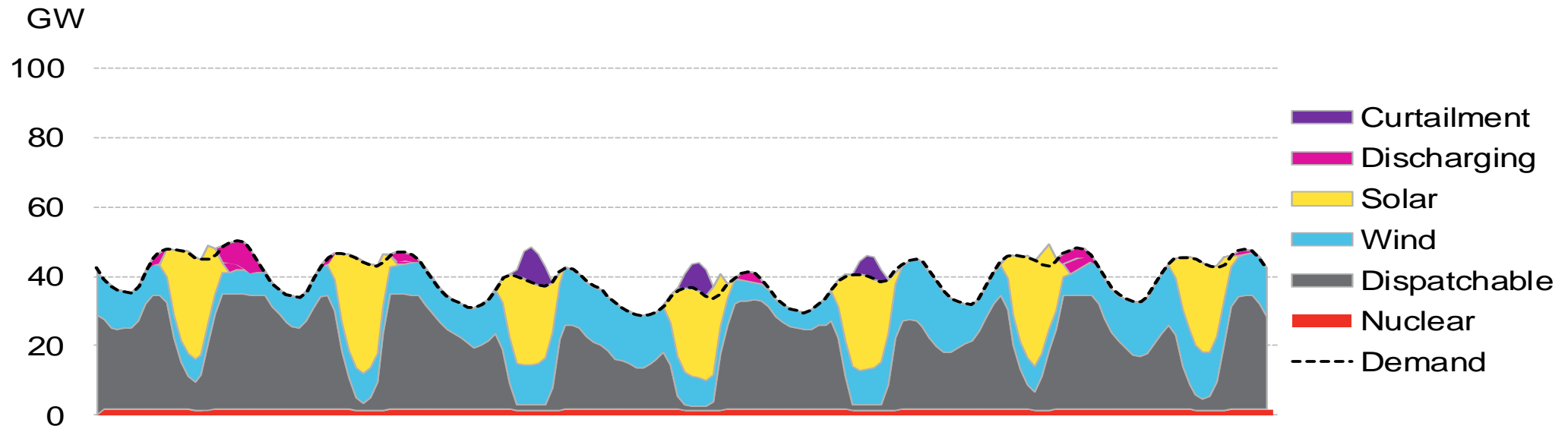
Source: BloombergNEF

High renewables week: 2035



Source: BloombergNEF

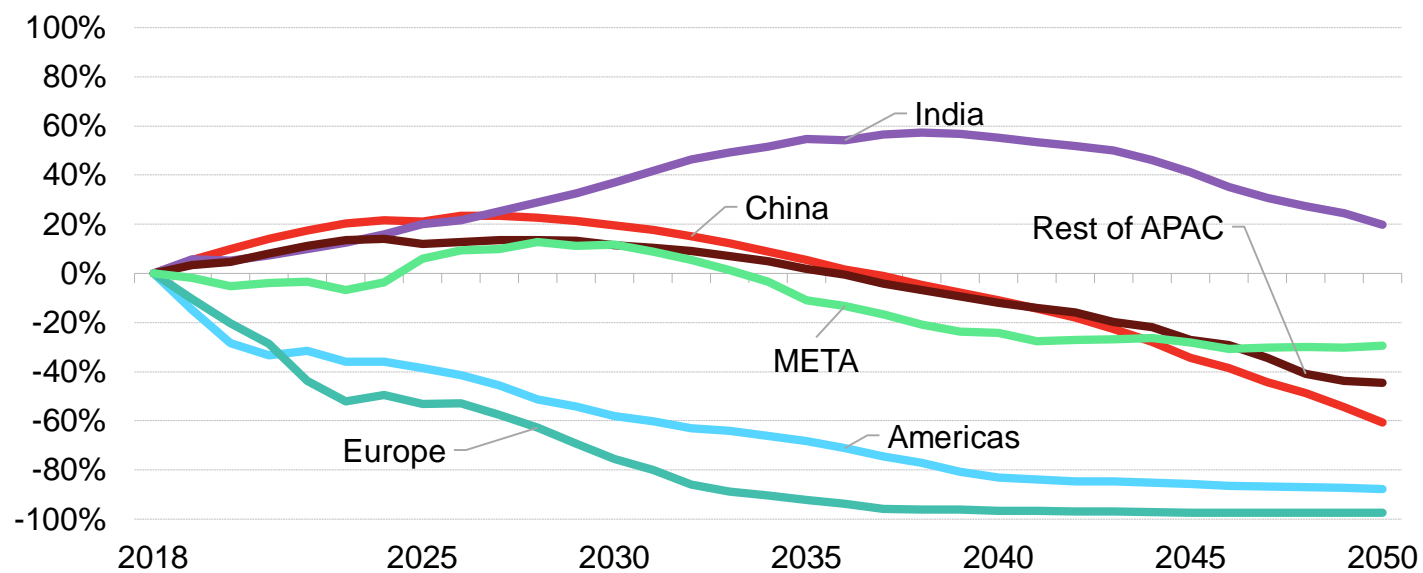
Low renewables Week: 2035



Source: BloombergNEF

Ageing coal gets squeezed by cheap renewables and flexible gas

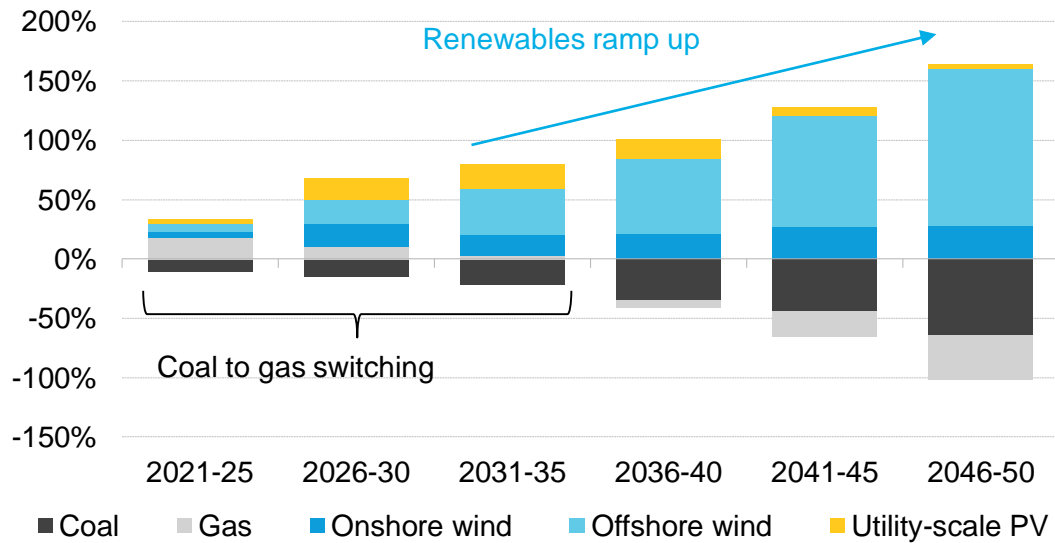
Regional growth profiles for power sector coal consumption, rebased to zero in 2018



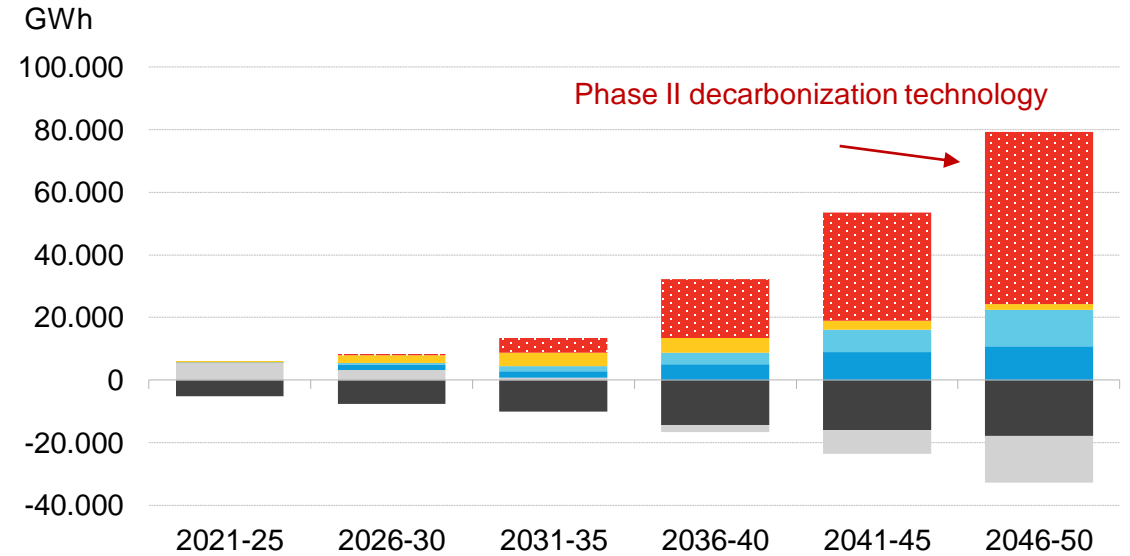
Source: BloombergNEF

Renewables expand by more than 150%...but it's not enough

Change in generation: NEO 2019 v 2 degrees scenario



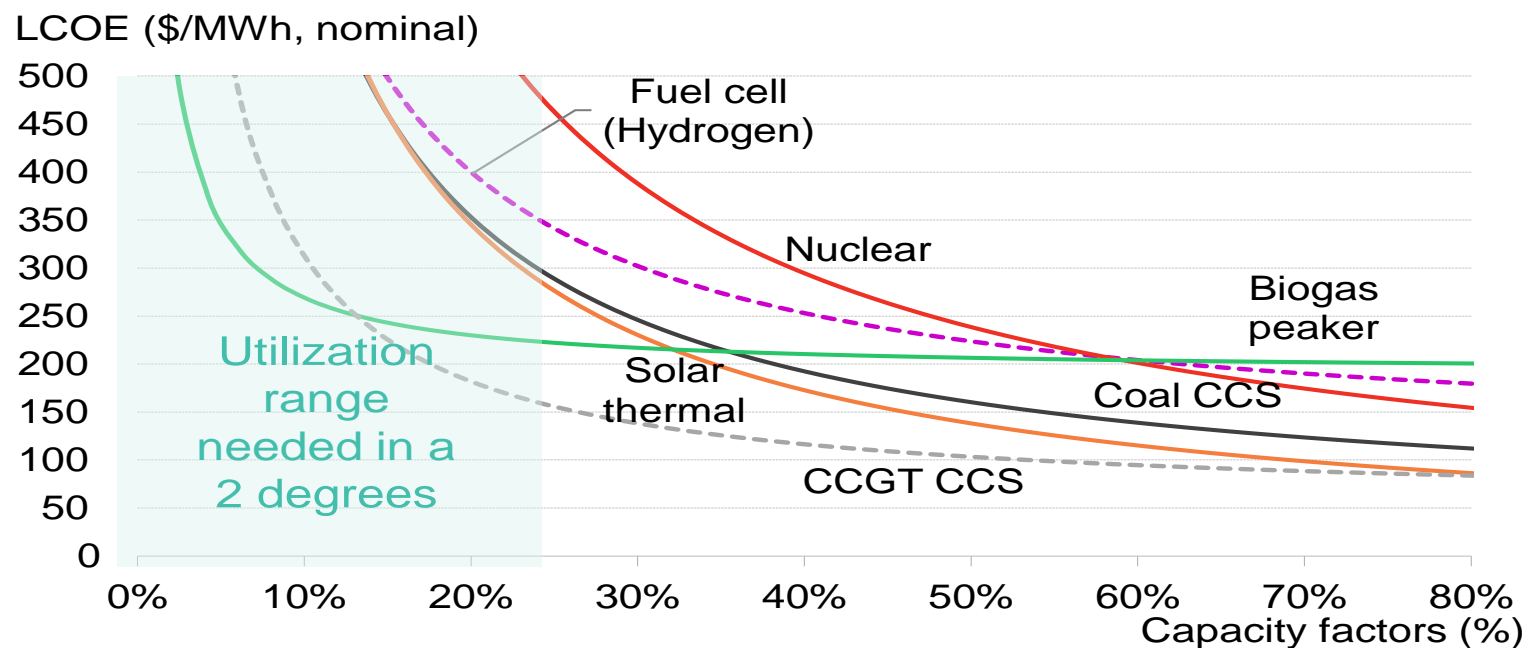
Phase II decarbonization technologies needed for 2 degrees



Source: BloombergNEF

Source: BloombergNEF

LCOE of Phase II decarbonisation technologies



Source: BloombergNEF

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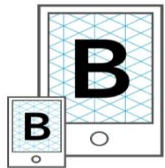
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Coal phase-out in the European Union – alternatives and solutions

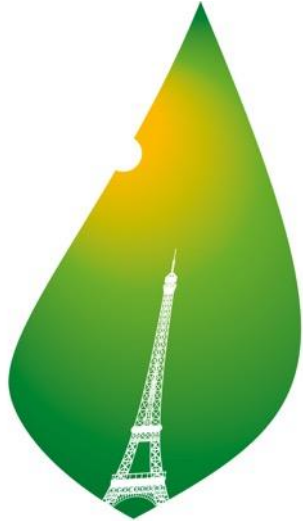
Sixth Working Group of the Platform for Coal
Regions in Transition

Paola A. Yanguas Parra, Climate Analytics

Brussels, 17 October 2019

1.5°C

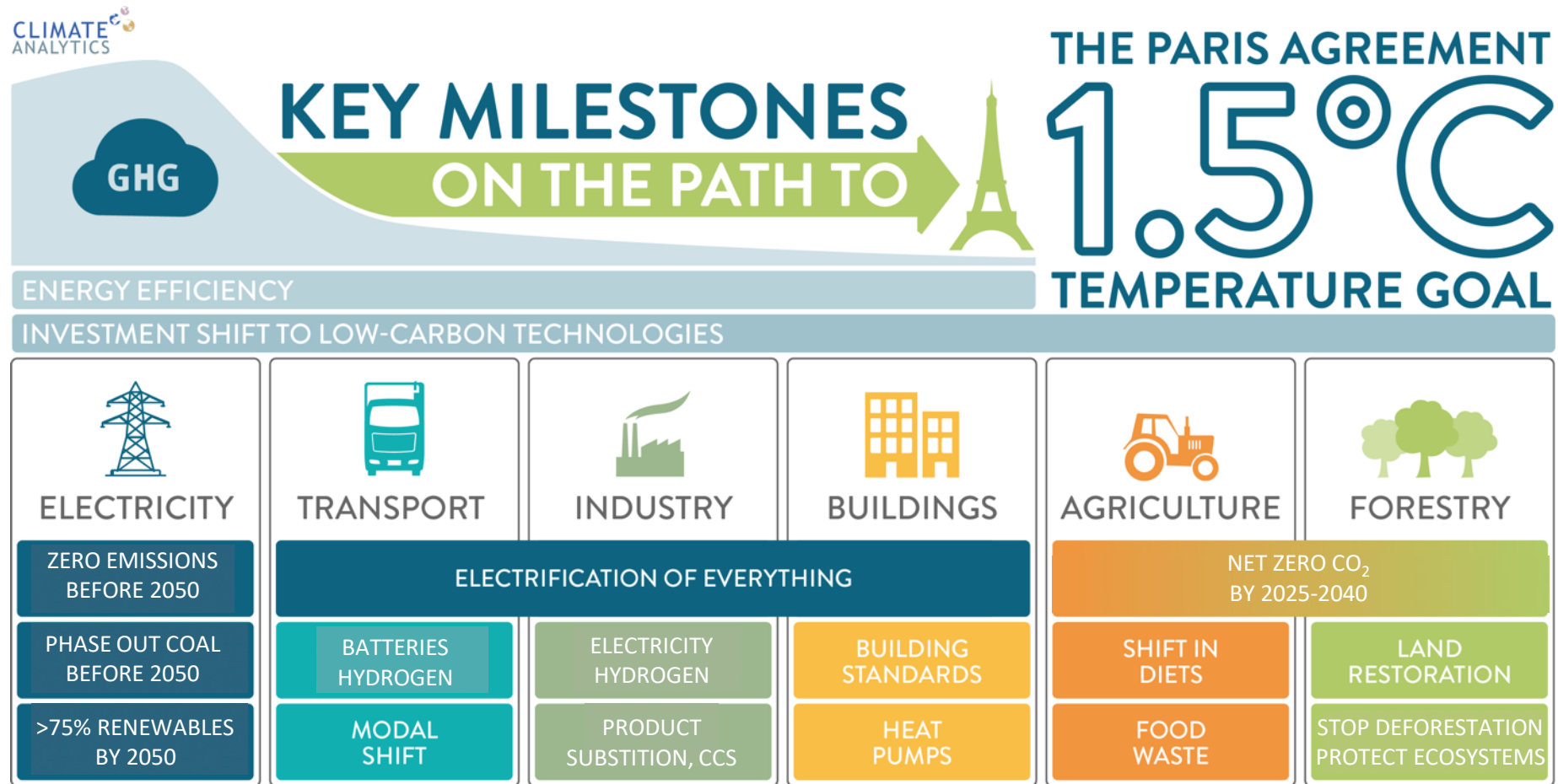
The long-term temperature goal of the Paris Agreement and the best available science



COP21 • CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

- Art 2: Paris Agreement long-term temperature goal: limit warming to “**well below 2°C** and pursuing efforts to limit the temperature increase to **1.5°C** above pre-industrial levels”
- Art 4: Parties aim to reach a **global peaking** as soon as possible ... and to undertake **rapid reductions** thereafter **in accordance with best available science**
- Substantial new data on 1.5°C is presented by the IPCC SR1.5

1.5°C sector transformations



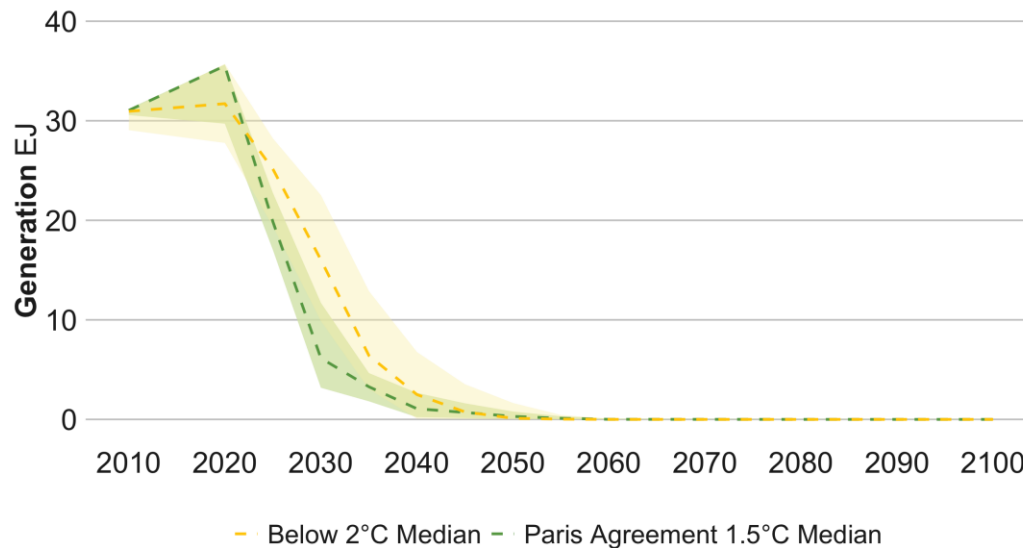
- With full transformation of energy-related sectors still strong push needed in land sectors
- By 2050, negative emissions in energy and land sectors need to be on a multi-Gigatonne scale

Source: Climate Analytics (2019); IPCC (2018)

Rapid Phaseout of Coal needed to get to 1.5°C ... and even to 2°C

Generation From Coal (w/o CCS)

Region: World



Source: Pathways from Huppmann et al. (2019) filtered with sustainability criteria

CLIMATE ANALYTICS Climate Analytics: Science-Based Policy to Prevent Dangerous Climate Change

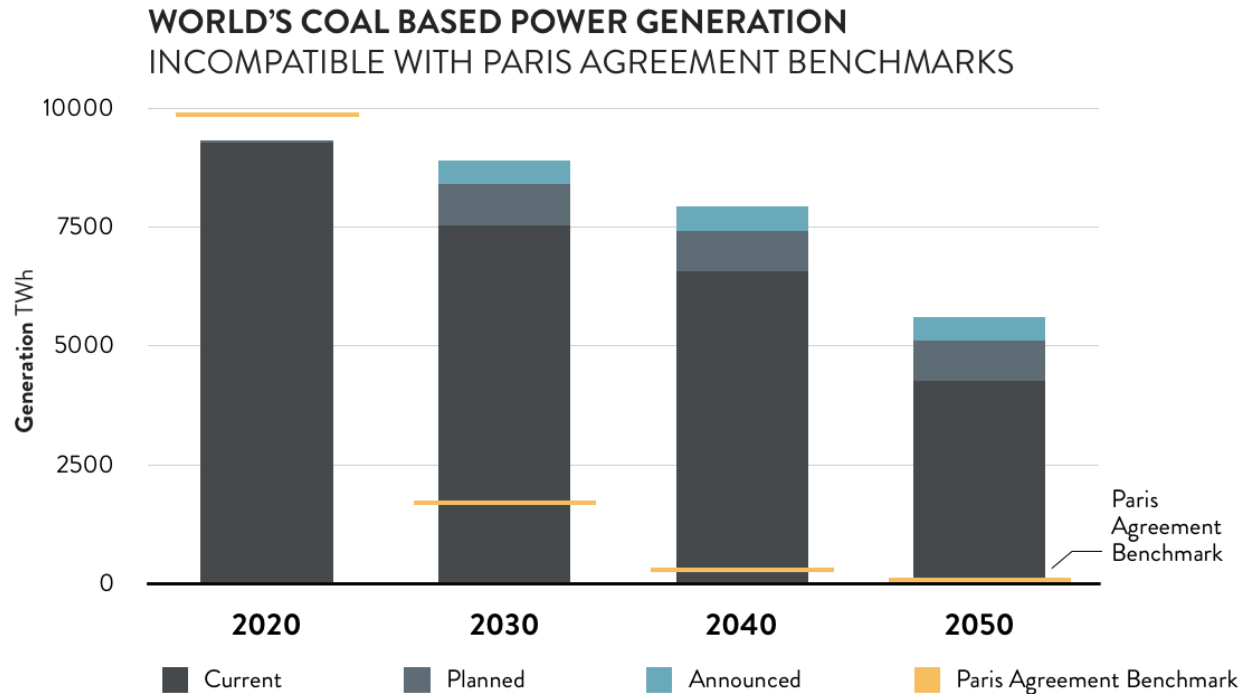
Region	Phaseout Date
OECD+EU	2031
ASIA	2037
LATIN AMERICA	2032
MIDDLE EAST AND AFRICA	2034
EASTERN EUROPE AND FORMER SOVIET UNION	2031

Coal power generation must:

- **Peak by 2020**, and
- Rapidly decrease to **80% below 2010 levels by 2030**, and
- Be **phased out by 2040** at the latest

Single most important step to keep the door open
for achieving the Paris Agreement

Large gap between Paris Agreement and current plans



Current **coal power generation incompatible with Paris Agreement**. Gap will be growing substantially in next decade.

No new capacity can be installed and operated over its full economic lifetime **anywhere**

Cancelling the planned expansion is a step in the right direction, but **far from enough**: Early retirements and reduced utilization needed

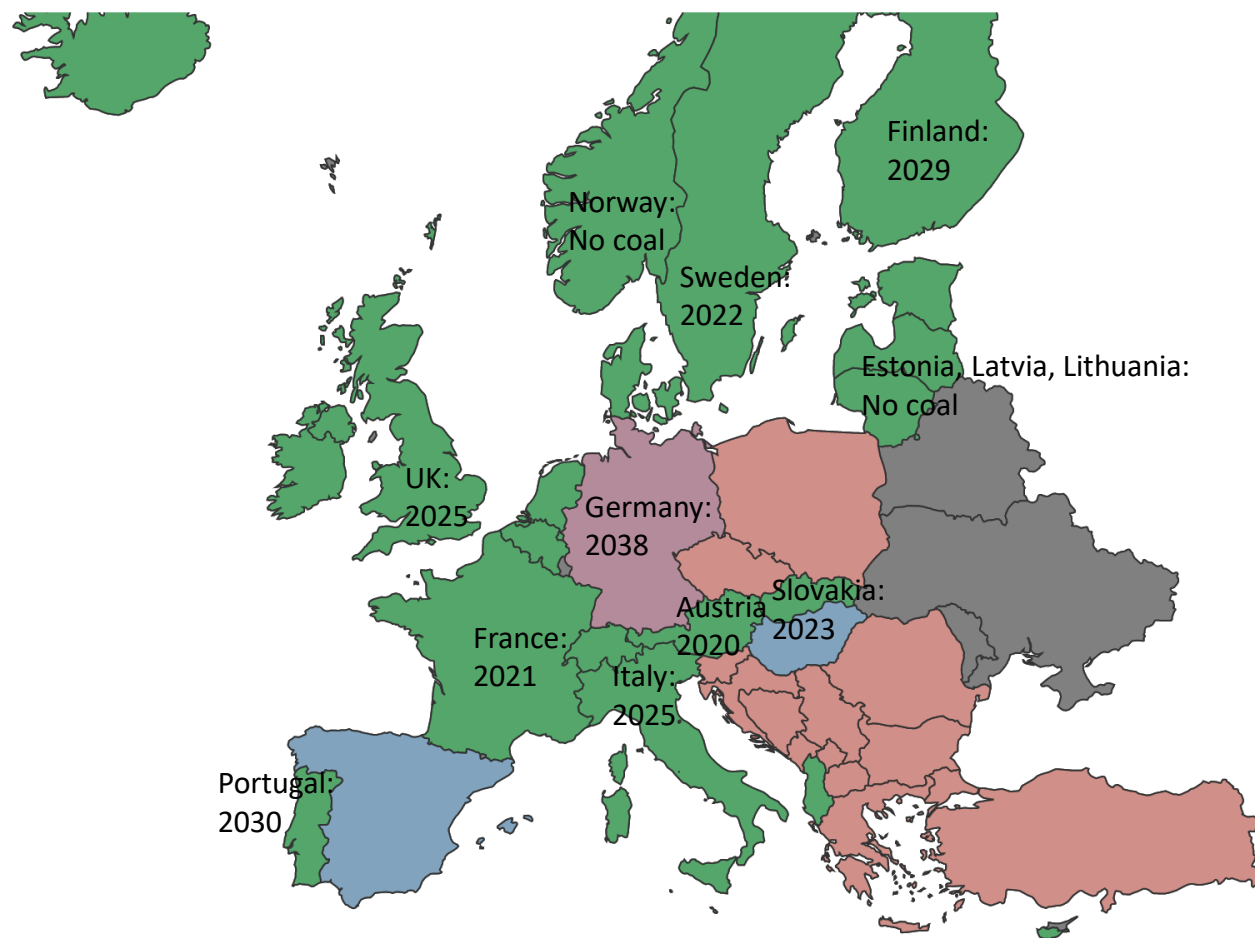


2040



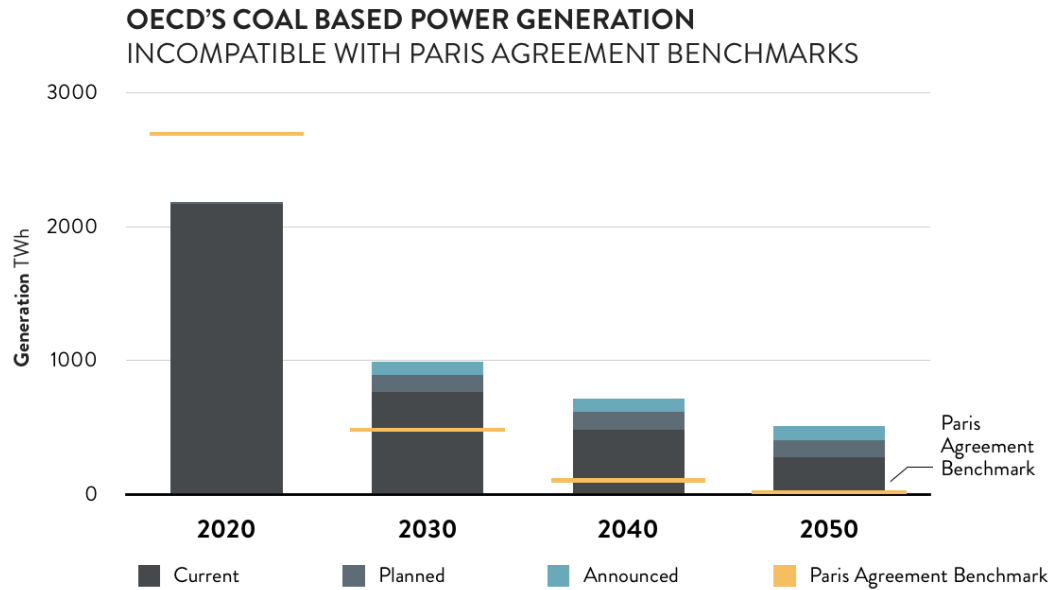
2030

Zoom-in: The European Union



Source: Europe Beyond Coal - Oct 2019

European Union pathway consistent with the Paris Agreement



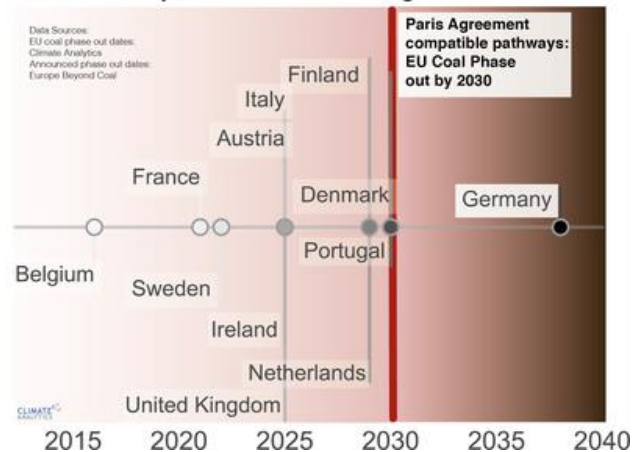
2030

No new capacity can be installed and operated over its full economic lifetime anywhere

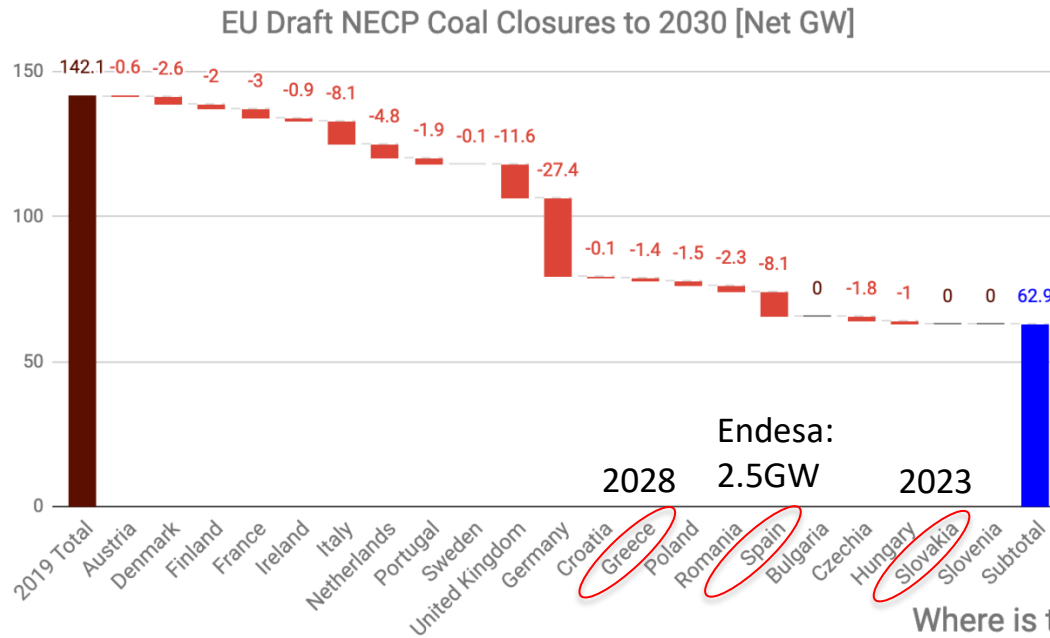
Retiring as soon as possible all capacity older than 40 years is important

Early retirements and **reduced utilization** of remaining fleet needed

Coal Commission proposal would make Germany only EU country to announce coal phase out date that is not compatible with the Paris Agreement

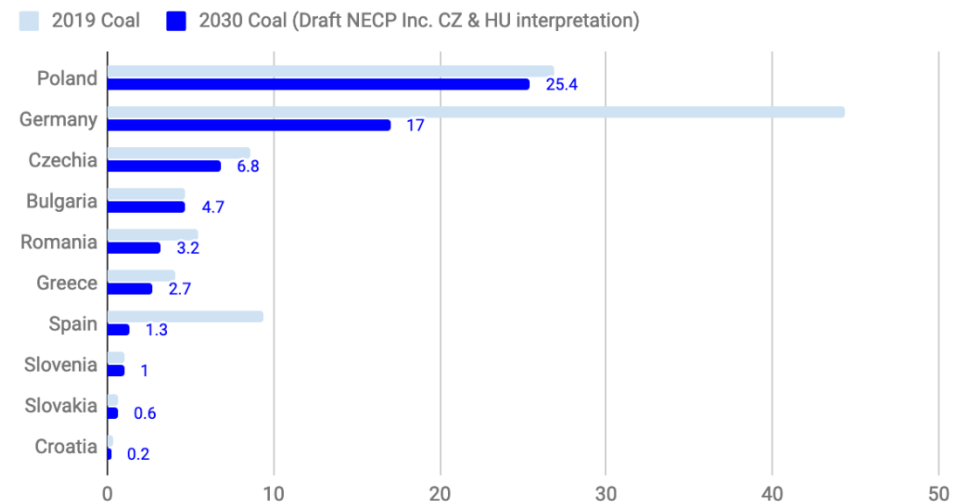


Coal plans under NECPs



Member States without a coal exit plan have a huge risk of **stranding assets** considering market trends and EU regulations

Where is the remaining coal capacity in 2030?





The United Kingdom

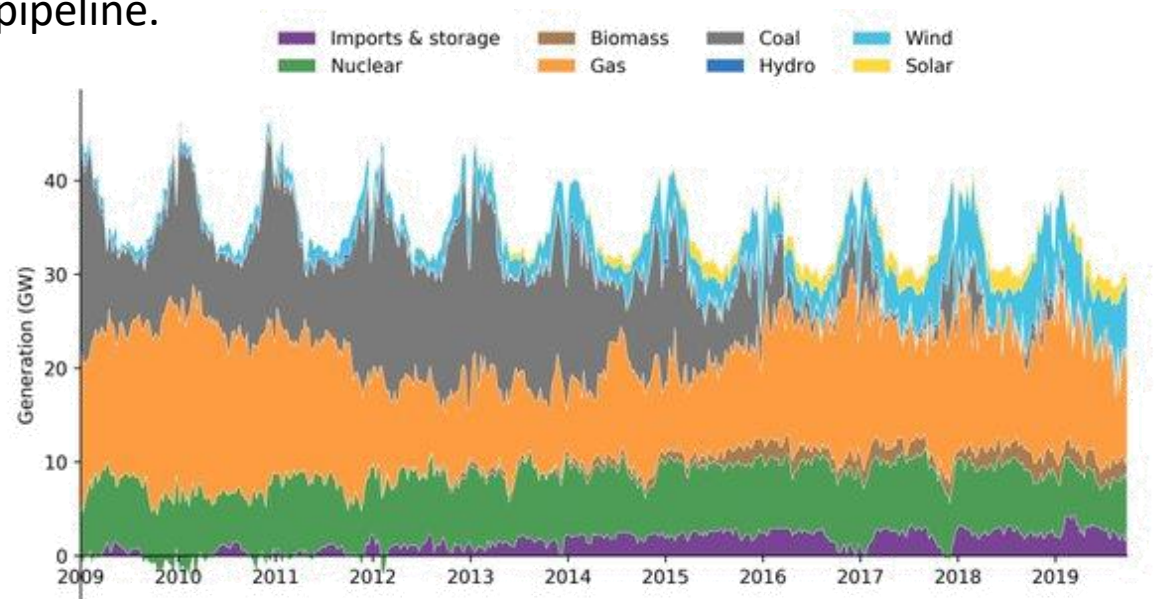
- **Only 4 coal power plants left**, after representing around 40% of generation one decade ago.
- Together with Canada, they launched the PPCA, an international alliance against coal in the power sector.
- Looking forward, there is the risk of natural gas over capacity, with 30GW on the pipeline.

11.9 GW
Fleet Size (0.49% of Global Fleet)

0%
Expansion of Coal Fleet

2025
Planned Phaseout Date

COAL FLEET IN UNITED KINGDOM
CAPACITY BY STATUS AND TECHNOLOGY



OECD **2030**

Coal exit plan aligned with PA

How to replace coal in the electricity mix?

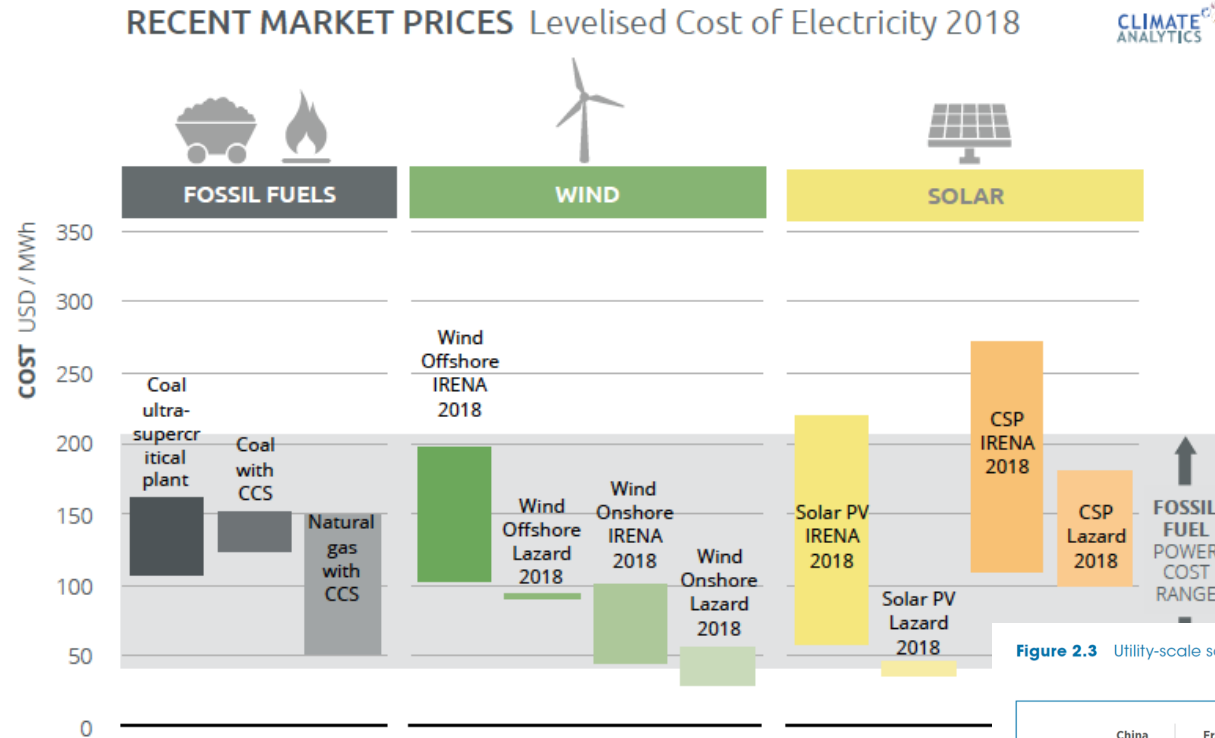
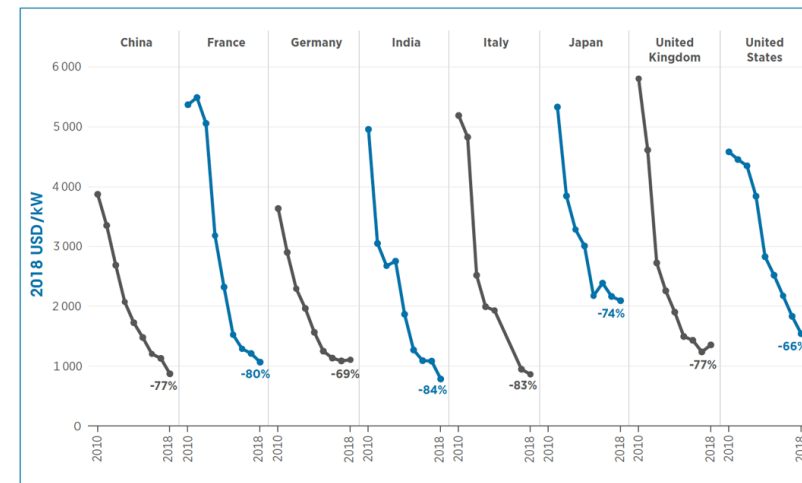


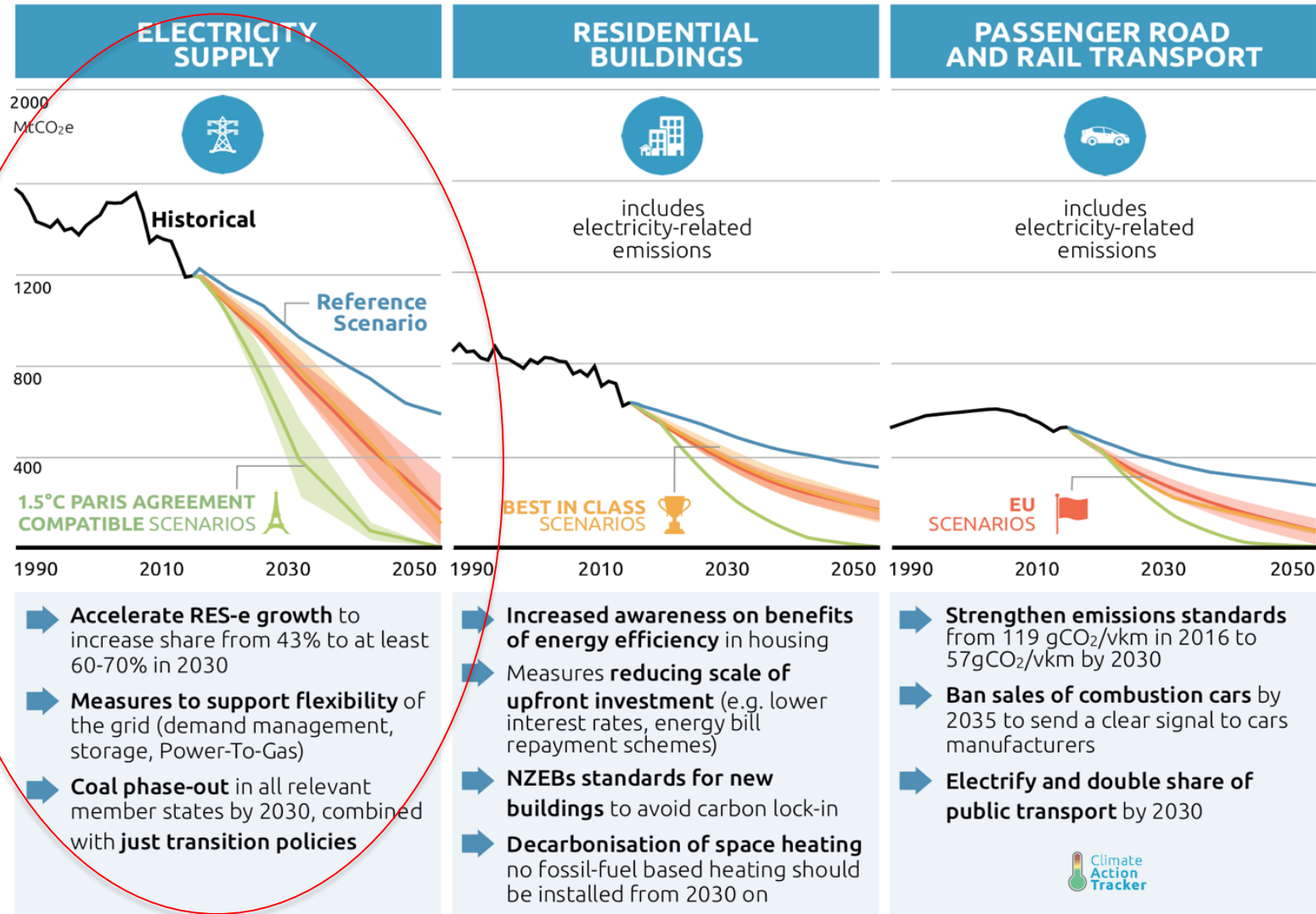
Figure 2.3 Utility-scale solar PV total installed cost trends in selected countries, 2010-2018



New fossil fuels electricity generation capacity – with and without CCS – is **not competitive** with renewable sources of electricity

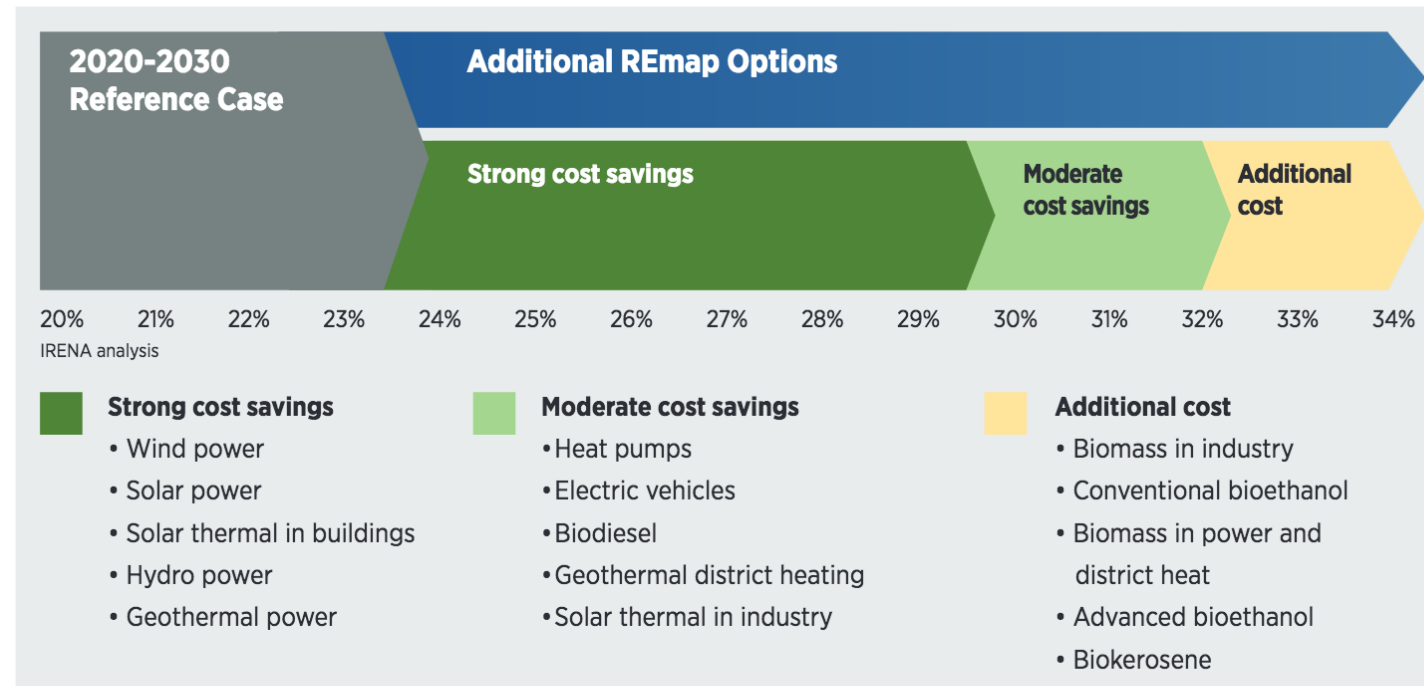
Need for accelerated action

SCALING UP CLIMATE ACTION IN THE EUROPEAN UNION POTENTIAL EMISSIONS REDUCTIONS IN THREE FOCUS AREAS BY 2050



Front runner in the global energy transformation?

Renewable energy options to exceed the 27% target for 2030



3. As part of the “Clean Energy for All Europeans” package of November 2016, the European Commission proposed a binding EU-wide target of 30% for energy efficiency by 2030 (European Commission, 2016a).

A long-term vision across all sectors is needed if the EU wants to continue being a front runner in the global energy transformation and maintain competitiveness in international markets.

- In particular shift to **renewable energy** electricity and **electrification of mobility**
- Other **social and technical innovations** transforming **urban and transport** infrastructure underway
- These transformations need to be **accelerated**
- **Challenges** for other transformations need to be **addressed early**, e.g. industry, aviation
- Need for **coherent long-term planning**

Thank you !

For additional information about our work on coal phase-out:

<https://climateanalytics.org/briefings/coal-phase-out/>



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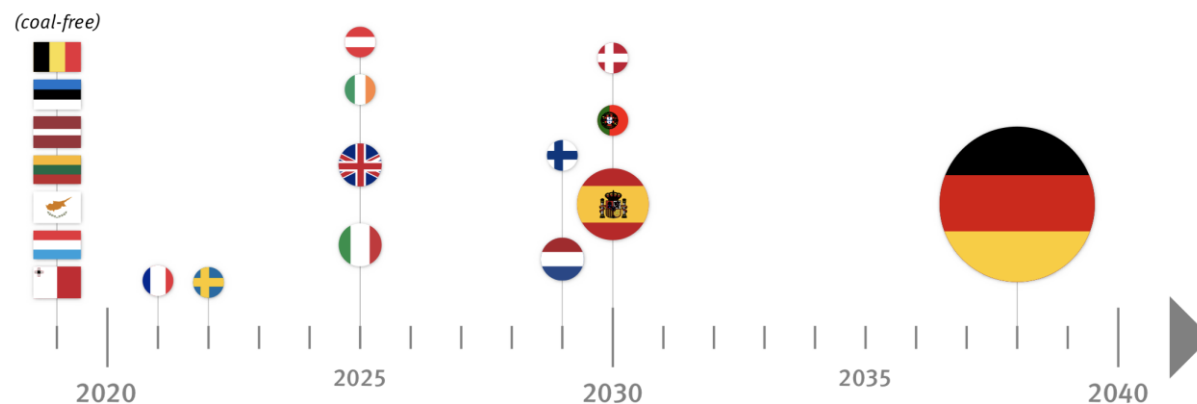
ClimateAnalytics



company/climateanalytics-ggmbh

Adequacy of coal phase-out policies in the EU

EU national coal phase-out plans



The size of each bubble is proportional to the country's emissions from coal.

COUNTRIES WITHOUT A SCHEDULED COAL PHASE-OUT



Source: Carbon Market Watch (2019); Climate Analytics (2018)



RETIRED



ANNOUNCED TO RETIRE



LEFT TO GO



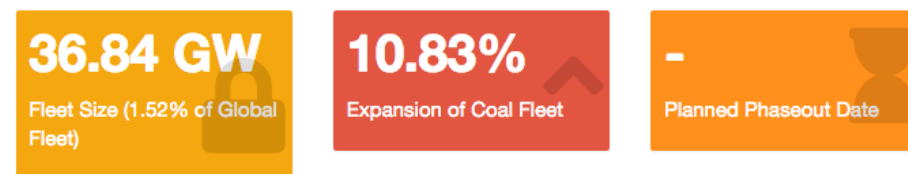
PLANNED PROJECTS



- **Over 80% of electricity from coal** (decrease from 90% in 2010 and 98% in 1990)
- Since 1990 **employment in the hard coal mining** fell from 388.000 to 82.717.
- The lignite mining employs **fewer people than the hard coal** but these are strongly concentrated with few alternatives (e.g. 10.000 in Belchatow).

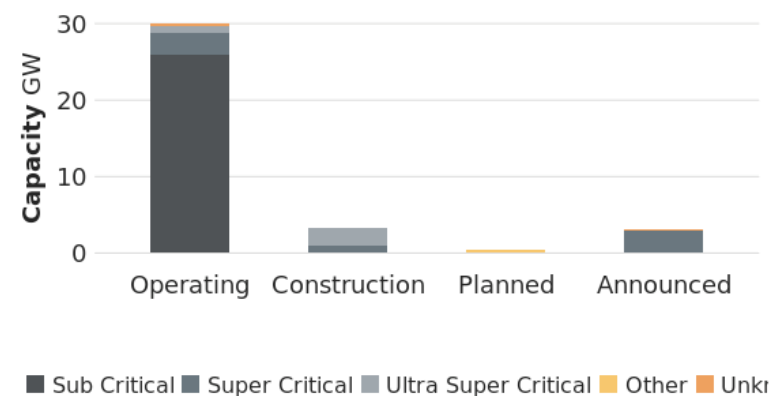
Factors decreasing the role of coal in Poland

- Increasing electricity imports
- (Slowly) increasing role of renewables
- EU climate policy – especially the EU ETS
- Discussion around air pollution



COAL FLEET IN POLAND

CAPACITY BY STATUS AND TECHNOLOGY





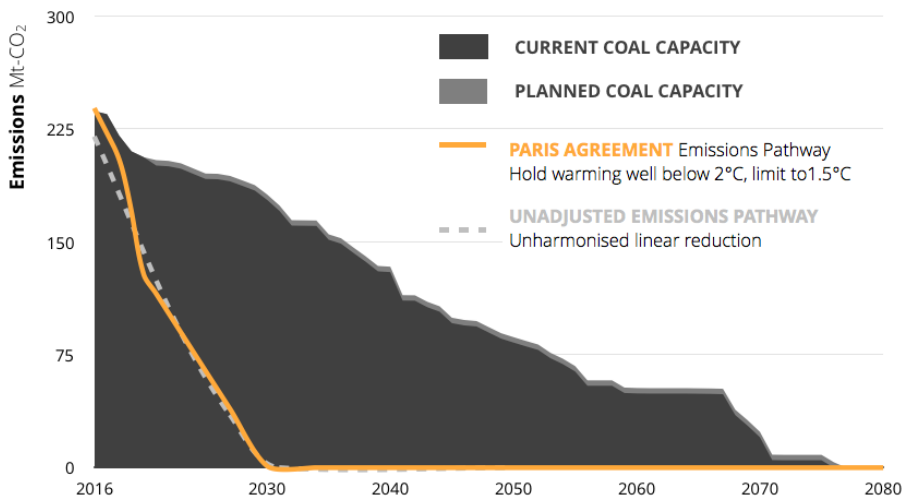
Germany

Germany potential CO₂ emissions from existing and planned coal capacity against benchmark pathways.

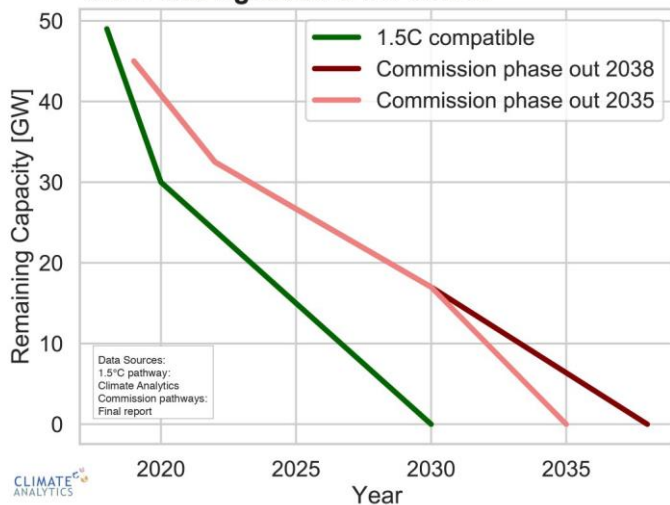


2030

Coal exit plan not aligned with PA



German coal phase out proposal incompatible with Paris Agreement 1.5°C limit




For Germany: reducing emissions from coal power generation plays a key role in closing the gap for the 2020 emissions reduction target and achieving the 2030 national emissions targets.



The United Kingdom

- **Only 4 coal power plants left**, after representing around 40% of generation one decade ago.
- Together with Canada, they launched the PPCA, an international alliance against coal in the power sector.
- Looking forward, there is the risk of natural gas over capacity, with 30GW on the pipeline.



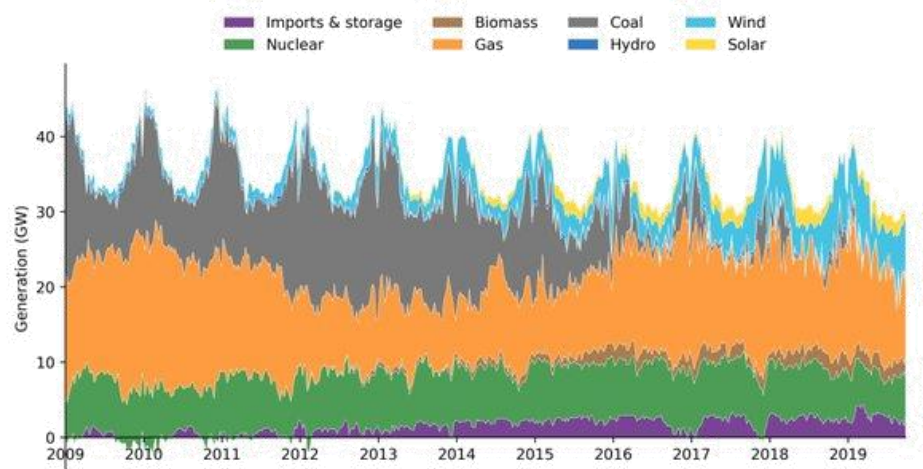
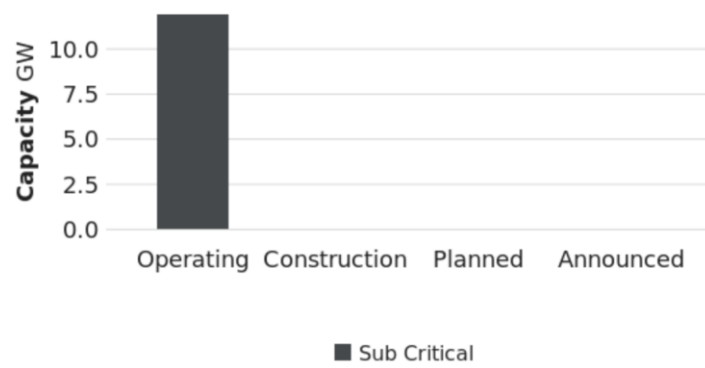
2030 Coal exit plan aligned with PA

11.9 GW
Fleet Size (0.49% of Global Fleet)

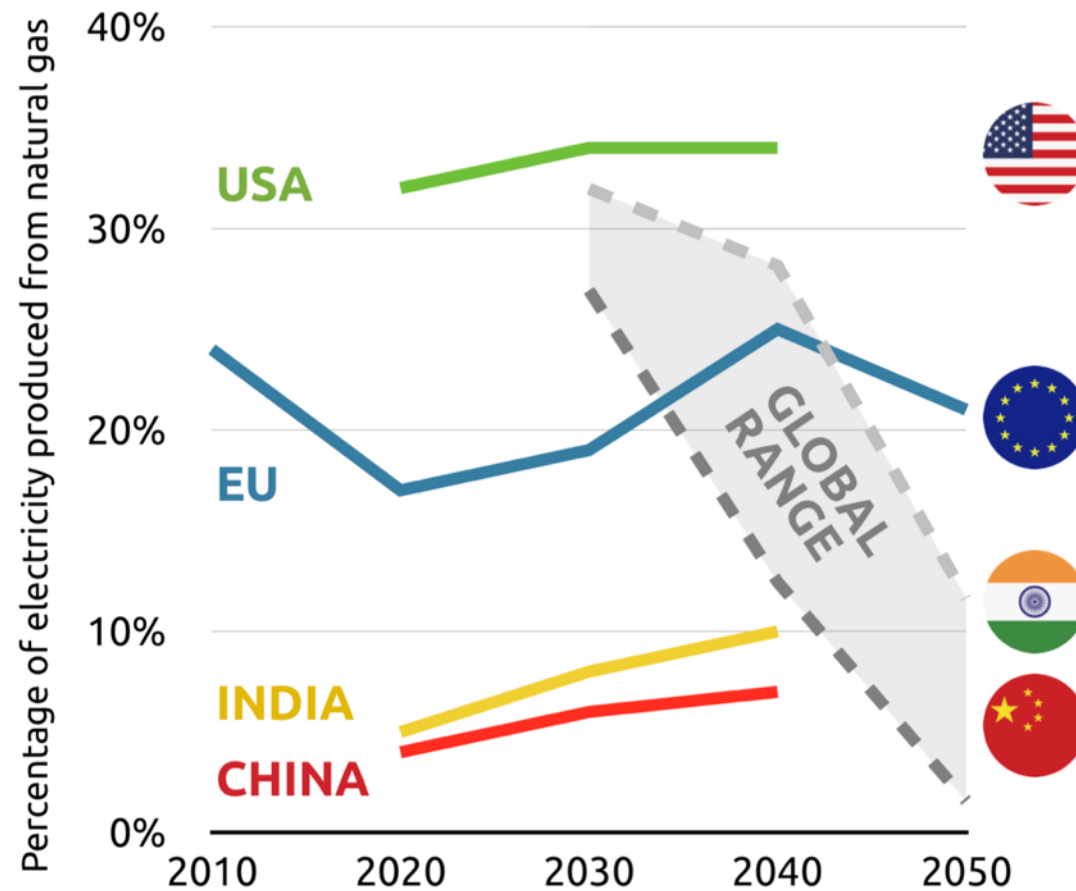
0%
Expansion of Coal Fleet

2025
Planned Phaseout Date

COAL FLEET IN UNITED KINGDOM
CAPACITY BY STATUS AND TECHNOLOGY



Natural gas in electricity generation will need to peak in next 10-15 years and then decline rapidly



IPCC SR1.5: even with CCS, the share of gas in the fuel mix of the power sector is limited globally to 8% by 2050

- - Global % of natural gas without CCS in a 1.5°C scenario
- . - Global % of natural gas without CCS in a 2°C scenario
- EU % of natural gas in electricity mix
- India % of natural gas in electricity mix
- China % of natural gas in electricity mix
- USA % of natural gas in electricity mix

Sources: Climate Analytics (2017); IEA (2016); E3G Lab (2016); IIASA (2016)

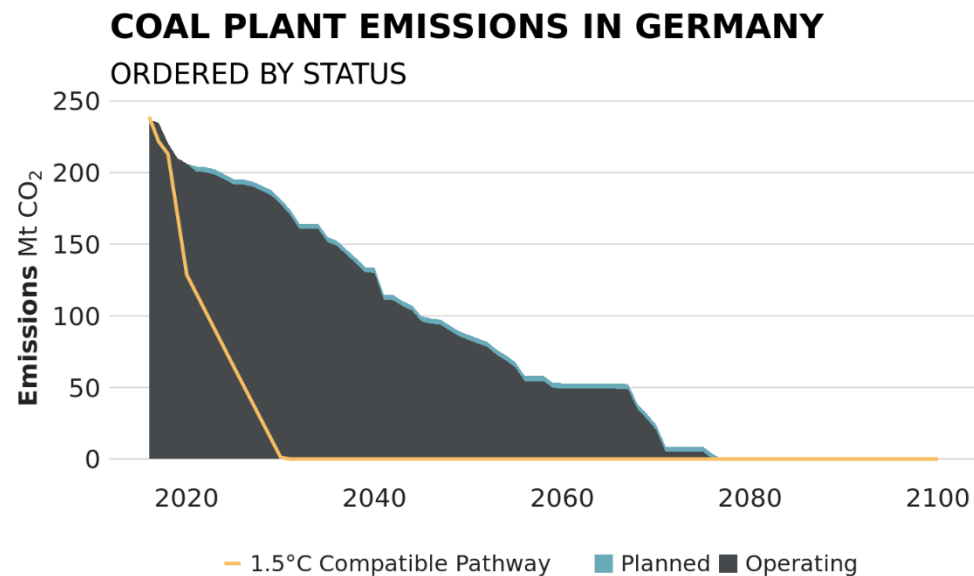
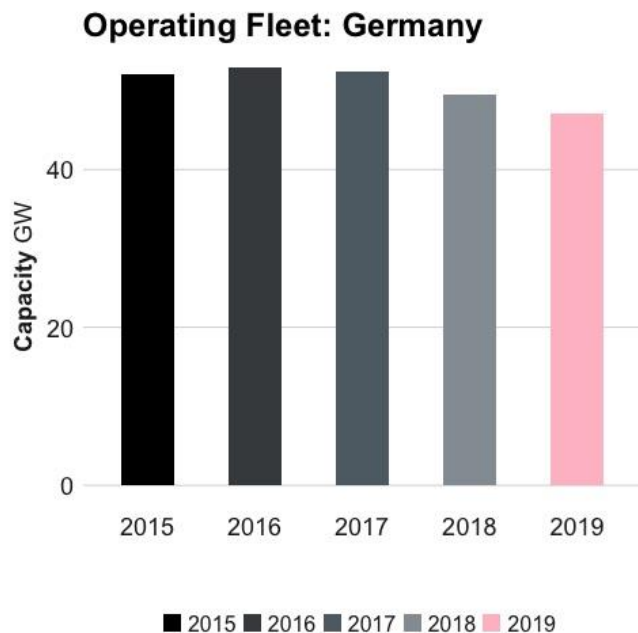


The Lowdown: an interactive tool to track the global coal pipeline

The Lowdown

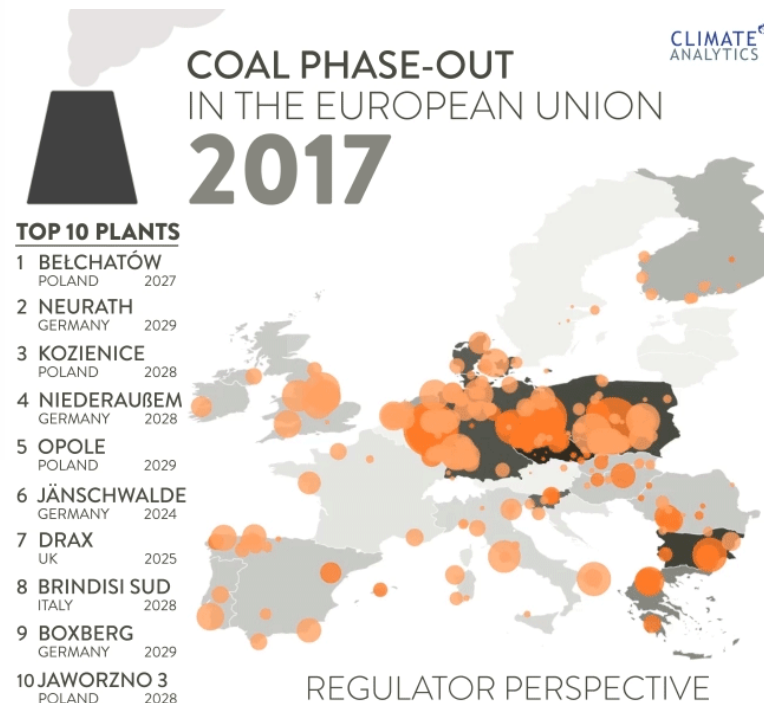
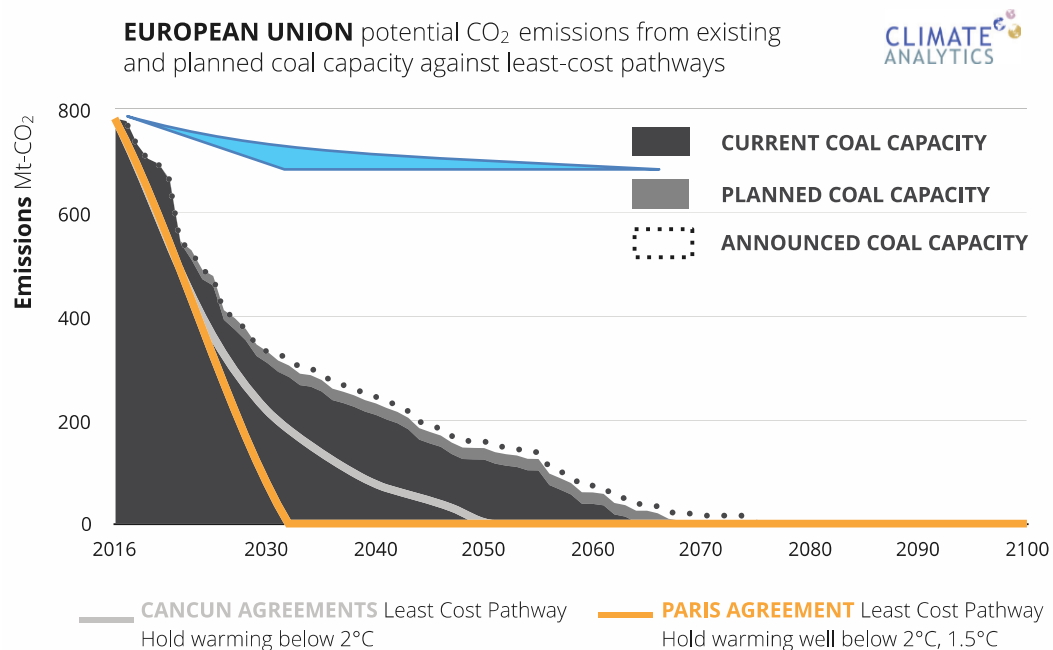
- Coal pipeline at the country level and changes since 2015 for all countries.
- Emissions implications and PA benchmarks for a smaller set of countries (to be expanded).
- Based on data from the “Global Coal Plant Tracker” by Global Energy Monitor, version July 2019.

<http://tools.climateanalytics.org/lowdown/>



[Read the report!](#)

Which plants retire when?



The main question is which plants to retire first?

- Regulator perspective
- Market perspective

- Achieving the Paris Agreement requires **transformative action in all sectors**.
- **Coal power** generation is the **single most important sector** we need to address to keep the door open for the Paris Agreement goal.
- **Current plans** in many countries **in the European Union** are not in line with Paris Agreement: **great risk of stranded assets**
- **No new capacity** can be installed **anywhere and** additional efforts required to **retire early** operating coal plants, and **reduce their utilisation rate** substantially.
- **Timing** of phase-out **is key** for planning the transition out of coal
- Coal phase-out needs to be accompanied by **renewable energy phase-in** to be in line with the Paris Agreement.
- Need for **coherent long-term planning** and acceleration of climate action.



Government of the Netherlands

Next generation

Ruud de Bruijne – Netherlands Enterprise Agency - RVO

16 October 2019, Brussels

Ban on use of coal for electricity production

- **Act, awaiting approval by Senate**
 - **1 coal power plant to be closed in 2020**
 - **Other coal power plants to be closed in 2024**
- or**
- in 2030 if efficiency >44%**



Climate agreement



- **>100 parties jointly worked on a set of proposals to achieve the carbon reduction target in 2030.**
- **The result is the Climate Agreement. A package of measures to achieve the political reduction target of 49% in 2030.**
- **Climate Agreement = social pact**
- **Covers 5 sectors & cross sector coherence**

**Build environment
Mobility
Industry
Agriculture and land use
Electricity**



Climate agreement

Electricity

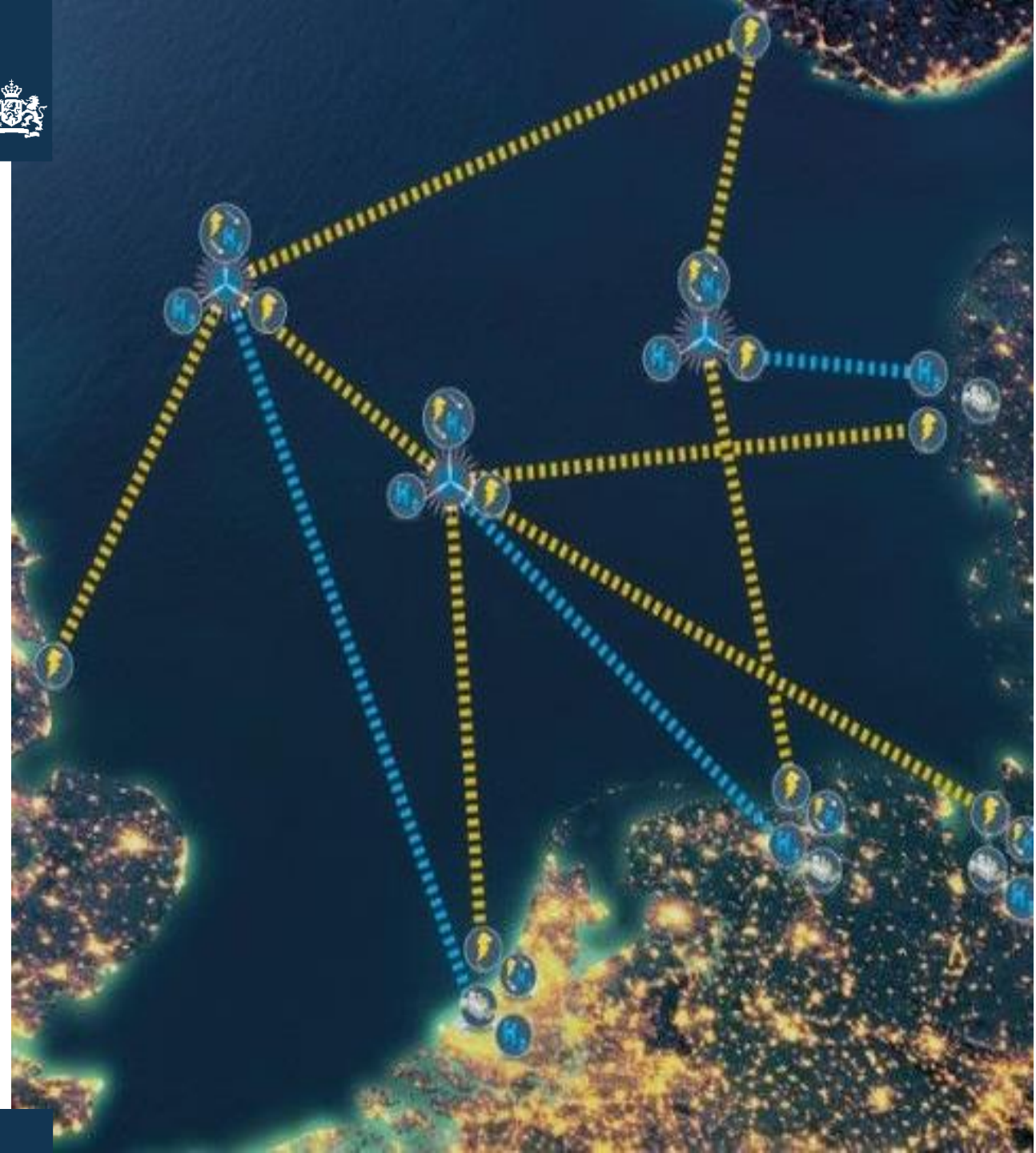


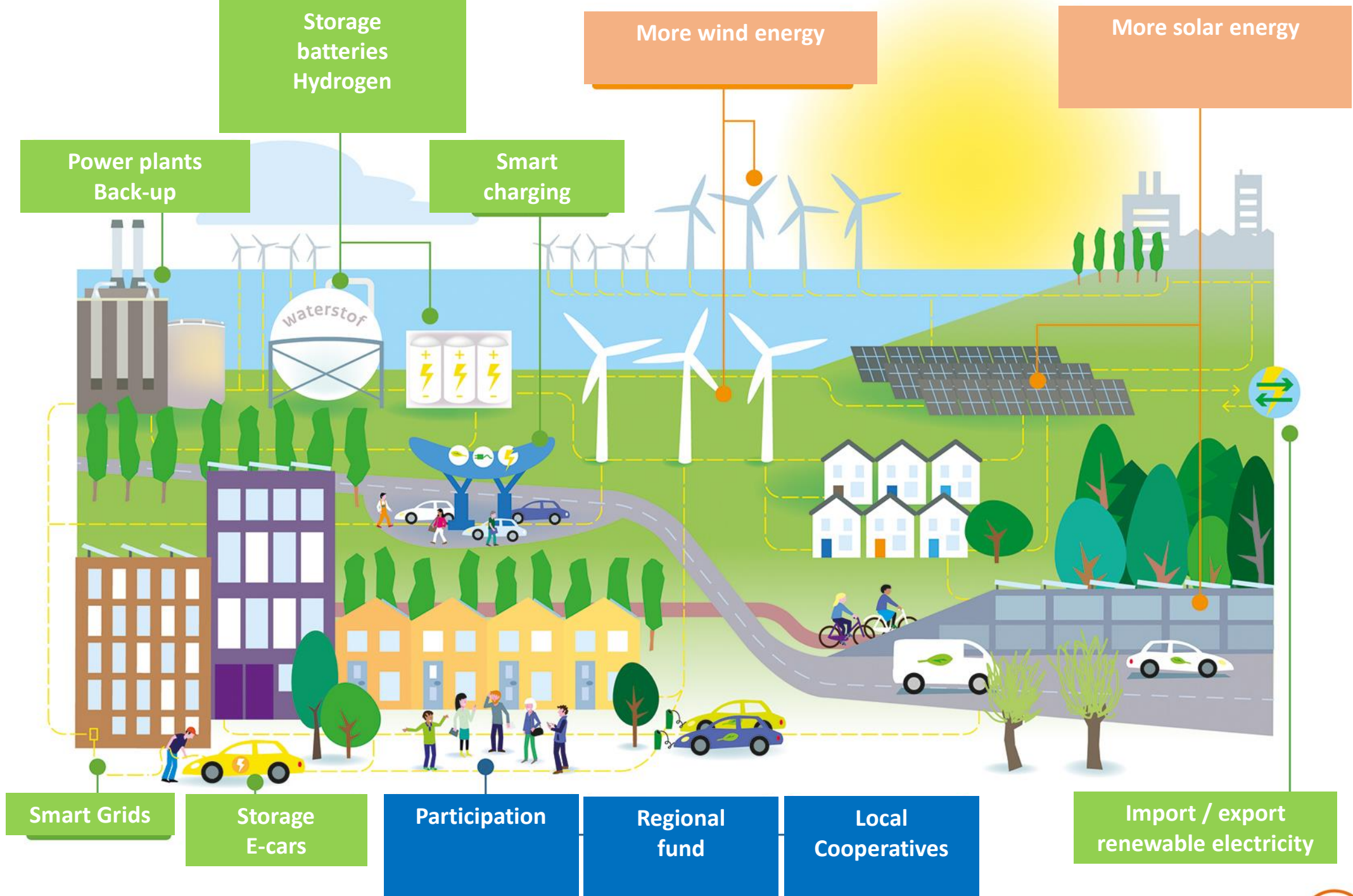
Now - 2030: 84 TWh/a from renewables (=70% demand)

- Offshore wind: 49 TWh/a
- Land based wind & solar PV: 35 TWh/a
- Others: PM

2030 - 2050: North Sea & local

- Green North Sea Powerhouse
Up to 60 GW wind *possible*, growth to follow demand and system integration
- Distributed generation
districts, public authorities, public institutions,
network operators, businesses and civic
organisations collaborating on an extensive web of
local and regional, renewable sources of electricity





Next step: system integration

- Beyond 2030: renewable electricity generation => demand driven
 - Build environment:
Transition gas to all electric (heat pumps)
 - Mobility:
Transition to e-vehicles (& hydrogen)
 - Industry:
Electrification & hydrogen
- Storage
 - Batteries
 - P2G
 - Combination with hydropower
 -?
- Market architecture (PPA-market, regulatory framework)

