

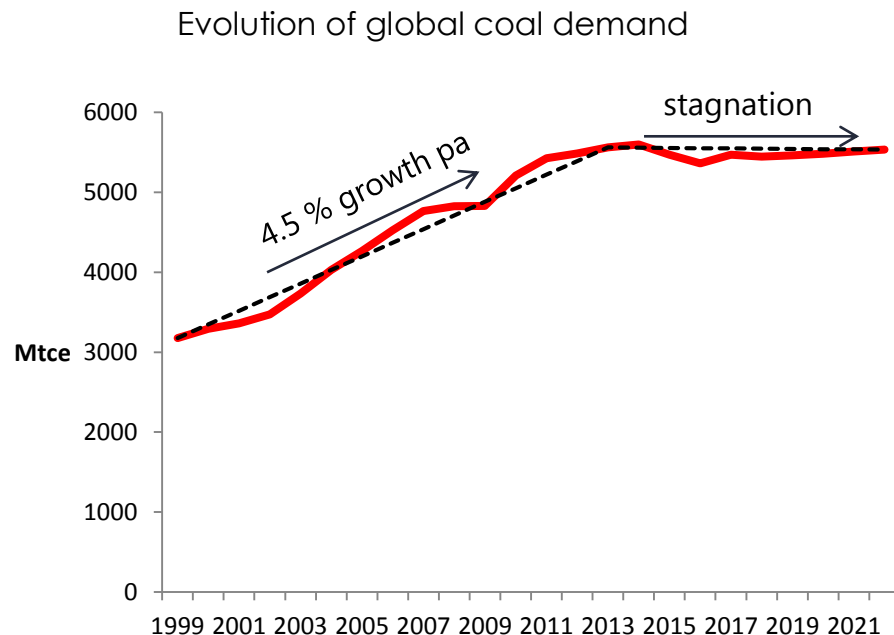


Una visión global sobre el papel del carbón

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Santiago de Chile – Mesa para la descarbonización de Chile. 20 de agosto 2018

Two different trends define global coal demand



Data from 1999 to 2016 are IEA statistics. From 2017 to 2022 are IEA forecast (Coal Report 2017)

After a decade of outstanding growth, global coal demand has entered a decade of stagnation

Global stagnation masks different regional patterns

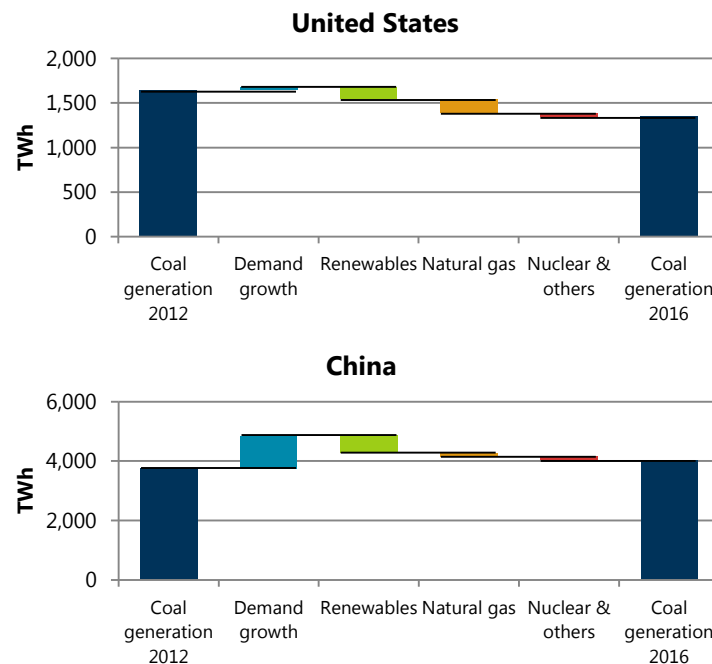
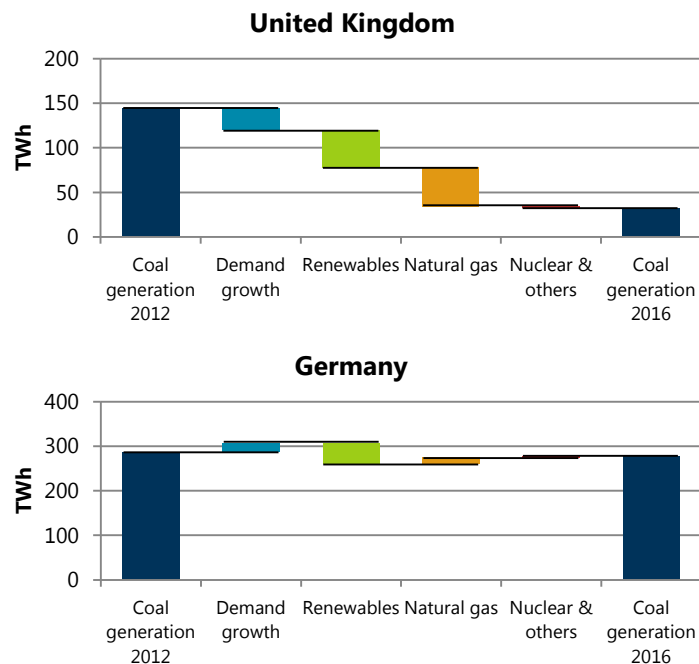


This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

Asia, currently consuming 75% of global coal, will be the main area of growth

Power systems are in transformation

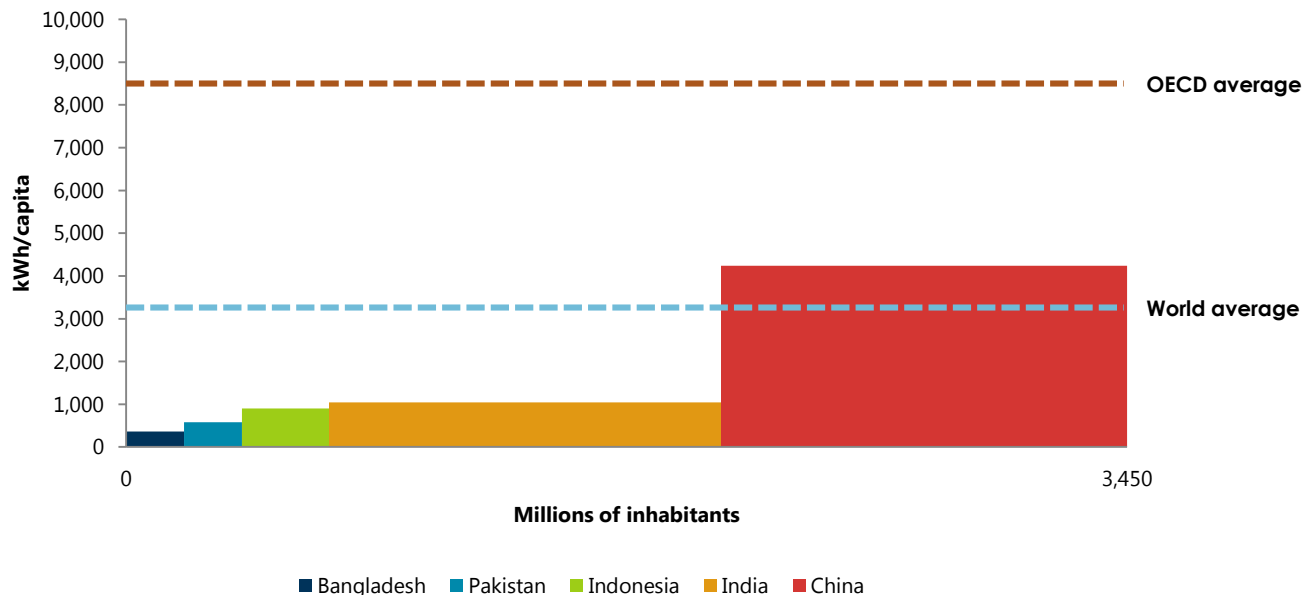
Change in coal power generation, 2012-16



Whereas power dynamics are country-specific, sluggish power demand, cheaper gas and renewables expansion are squeezing coal in many countries across the globe

But power demand growth is not over

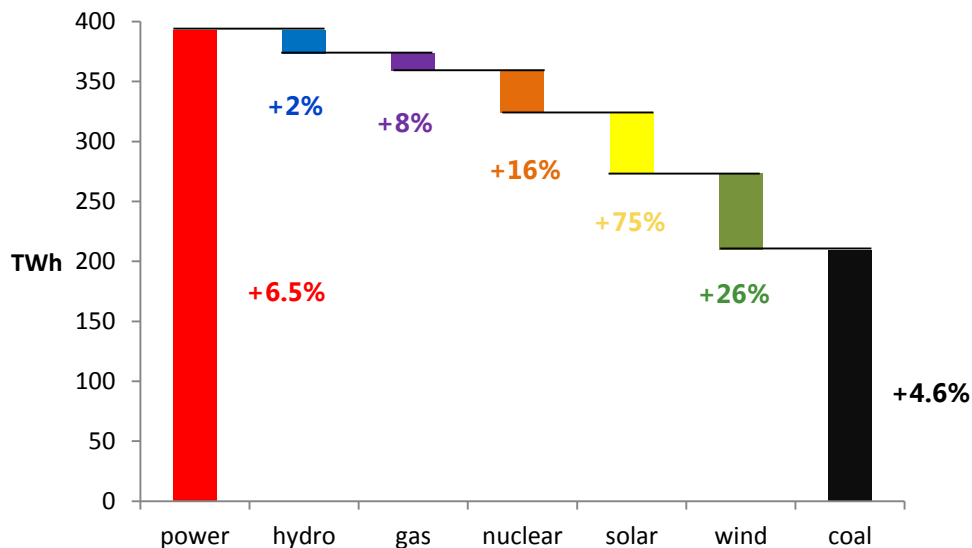
Per capita power demand in select countries compared with OECD and world average



**Some populated countries with low per capita power consumption will ramp up power generation.
Coal will provide a good share of the additional electricity**

China's power sector, the world's largest coal consuming sector

Difference of power generation by sources in China (2017 vs 2016)

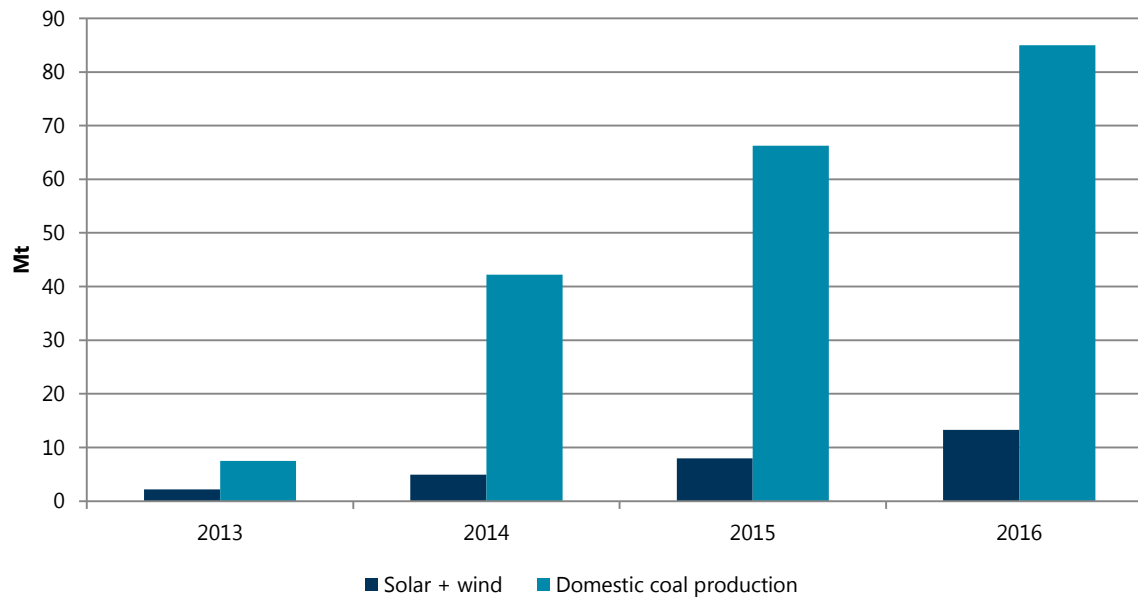


Source: NEA, preliminary data

Coal is the marginal supplier of electricity in China.
When electricity consumption growth is strong, coal power generation will grow

Increasing production in India is impacting international markets

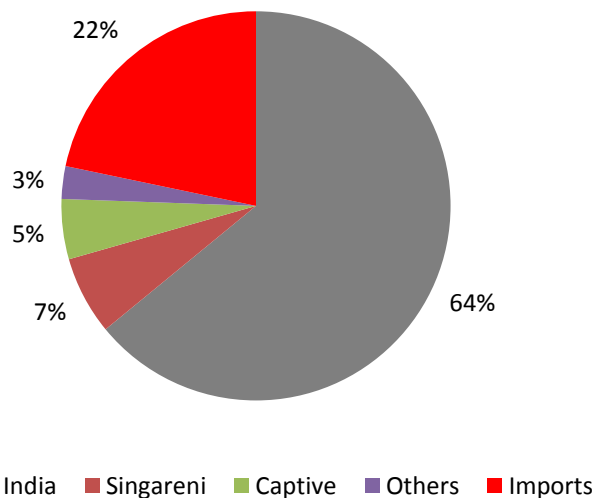
Coal imports avoided since 2013



Looking ahead, performance of Coal India is key

The end of coal monopoly in India is going ahead

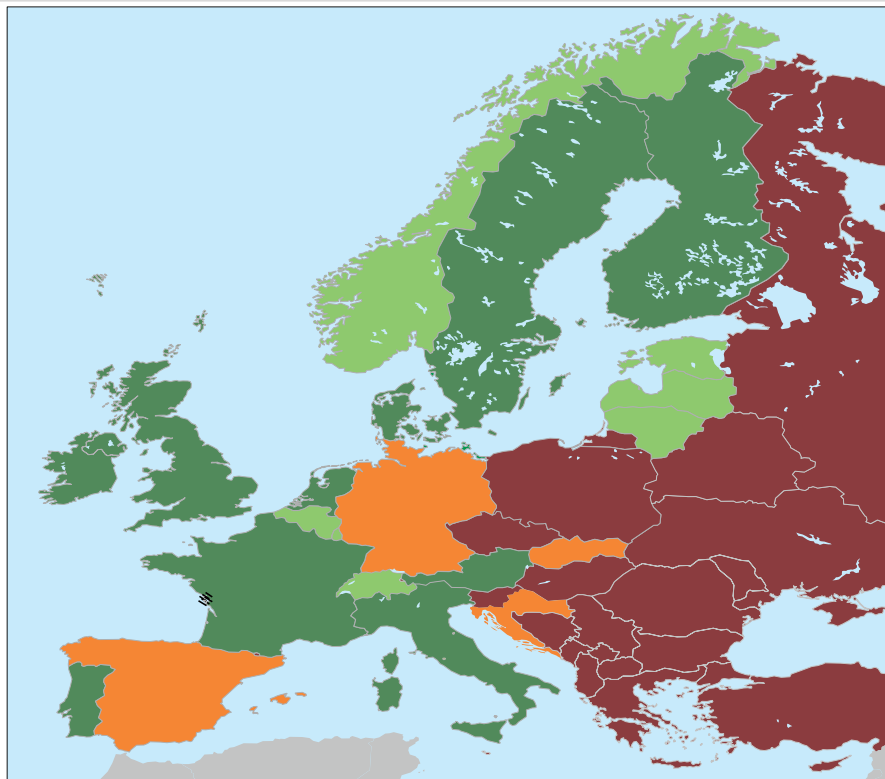
Breakdown of the coal supply in India (2017)







Source: estimates from several sources

Potential benefits of market opening are multiple, however it is too early to assess its impact

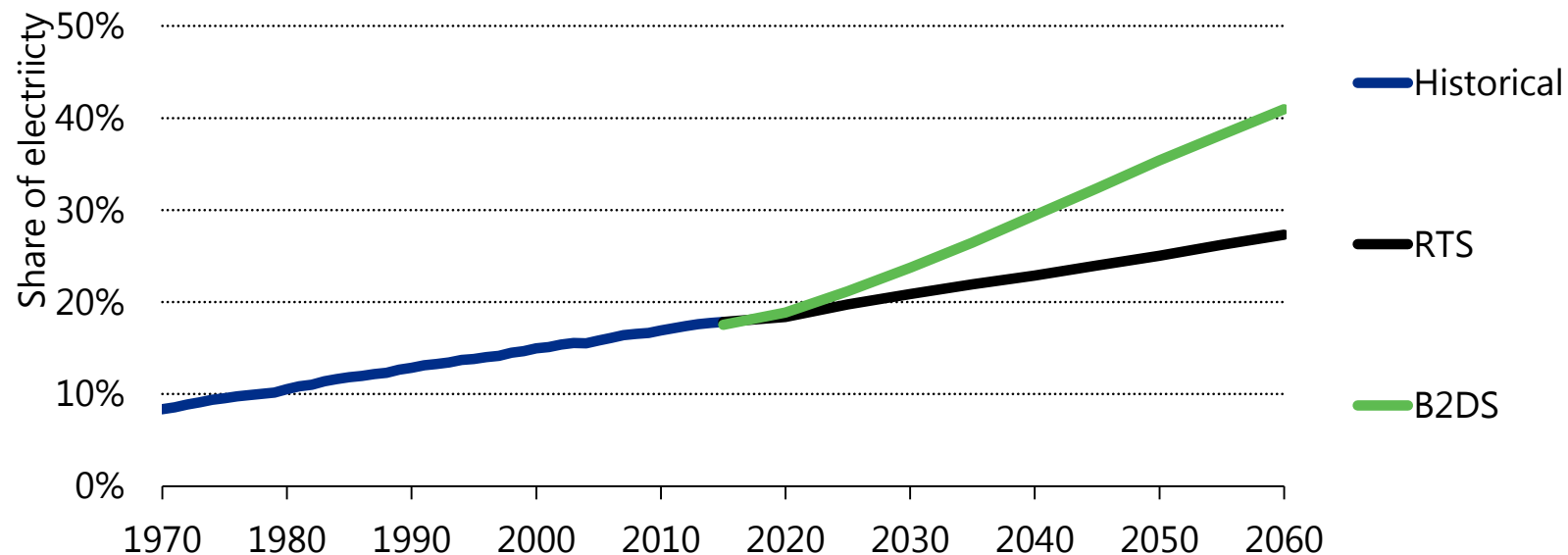
A farewell to coal in Western Europe



-  No coal power generation
-  Announced phase out
-  Phase out under discussion
-  No phase out policy

**Most countries in Western Europe will phase out coal power plants by 2030.
This will lead to a constant decline of coal consumption in Europe**

Climate policy strongly accelerates the historical trend of electrification



Rapid decarbonization of electricity opens new opportunities on a well-below 2° path.

Imagine an alternative universe where



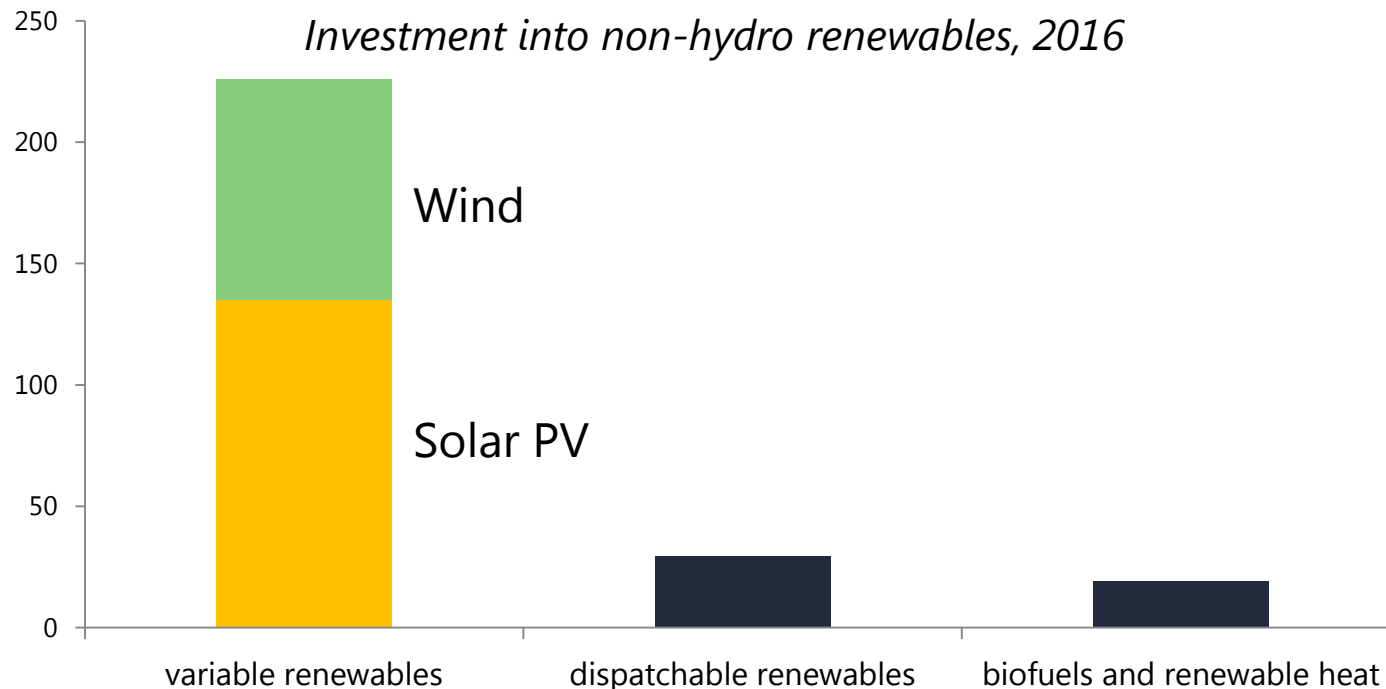
Large scale deployment of baseload geothermal replaces baseload coal



Rapid progress with biogas provides low carbon CH₄ for gas turbines

In this case we would have a “copy paste” transition without needing to rethink grid operations

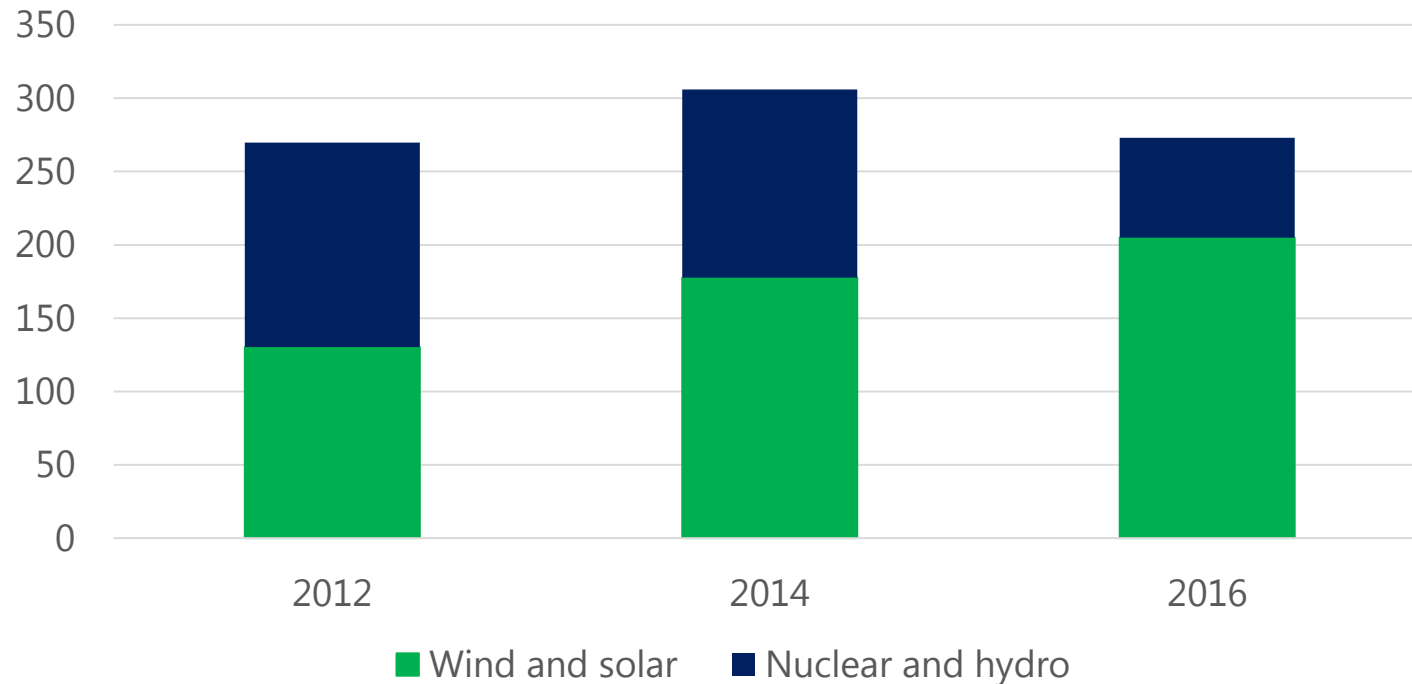
Instead, low carbon investment is increasingly dominated by wind and solar PV



Asymmetrical technological progress with wind and PV is driving electrification and necessitates a system transformation

The headwind of the hydro and nuclear slowdown

Expected annual production from facilities starting construction



New low-carbon investment covers only around half of the global electricity demand increase.

The four pillars of a successful renewable integration



Transmission interconnection



Demand response



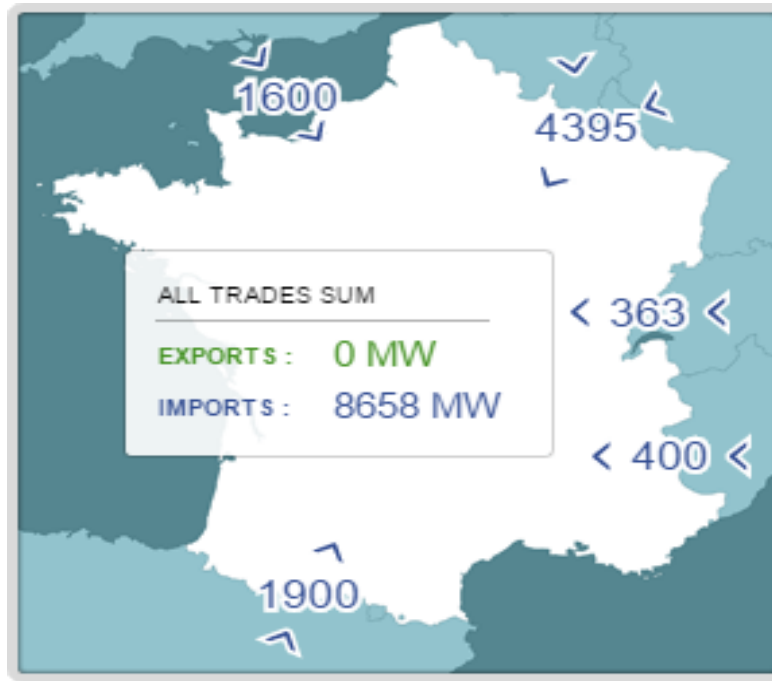
Storage



Dispatchable generation

Efficient, competitive markets help unlocking flexibility

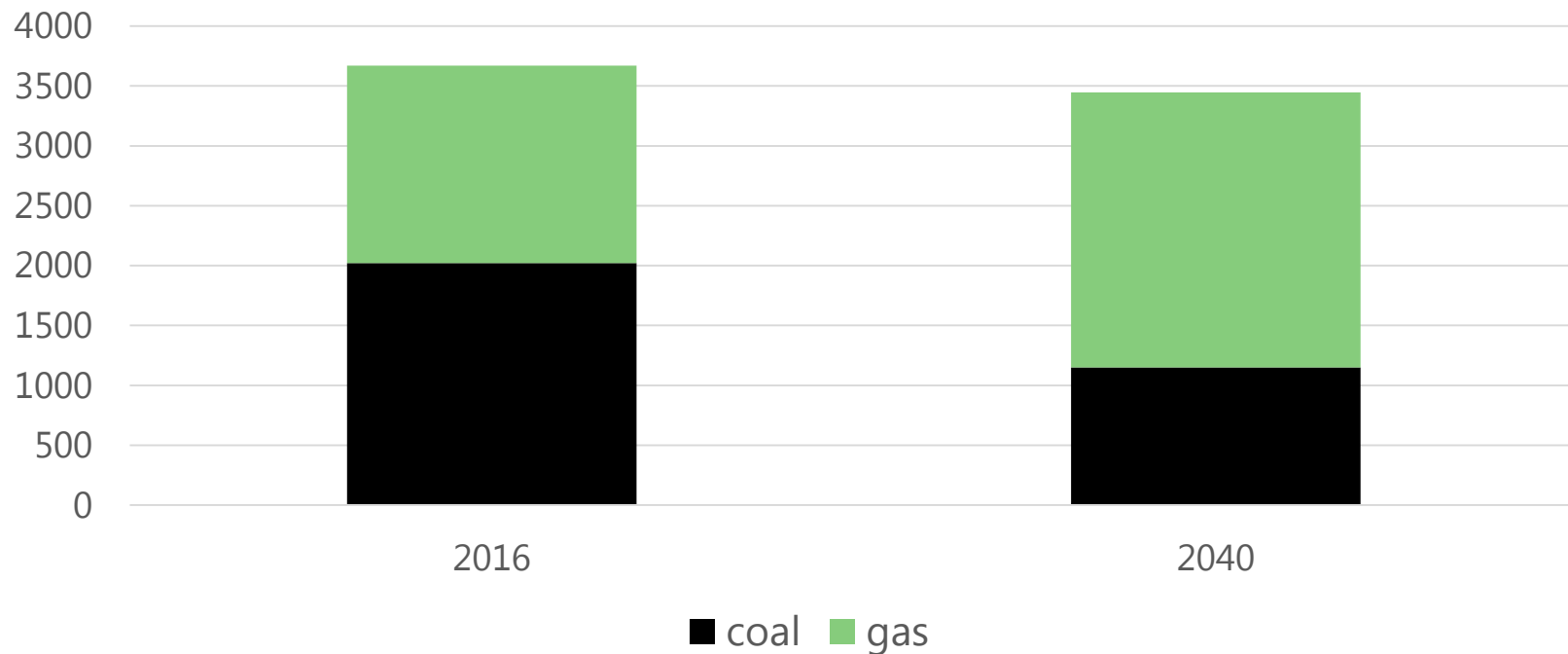
France as a net importer during a cold spell
(08/11/2016 at 07:00)



Markets create incentives for close to real time redispatching reacting to supply-demand developments

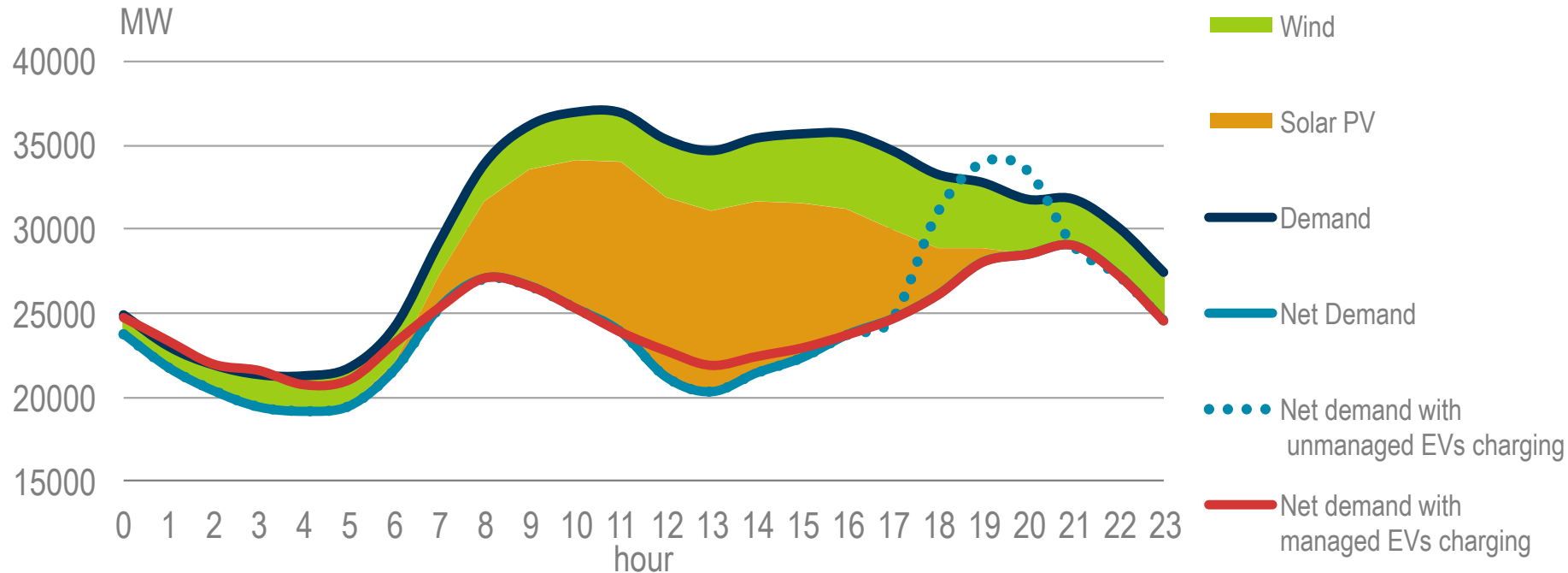
Conventional capacity remains essential for supply security

Conventional capacity in the WEO sustainable development scenario



Batteries and digital demand side solutions don't fully replace conventional capacity

Renewables and EVs transform the need for demand flexibility



Smart sector coupling will need to take VRE deployment into account to avoid exacerbating net demand load changes

Conclusions

- Despite the extended view that coal days are numbered, our analysis suggests that this is not the case yet
- With a variety of near zero carbon sources available, electricity can lead the way to a low carbon future
- Grid interconnections, demand response, storage and flexible generation are the four pillars of a successful integration of variable renewables



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