

Intermittency and Cannibalisation

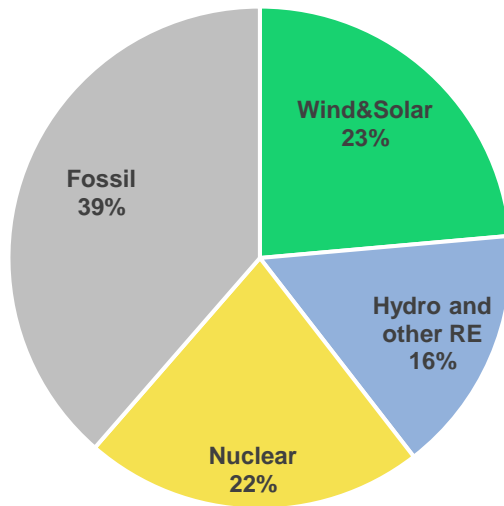
Finnish Energy Day 2023
June 15, Helsinki

Fortum Market Intelligence
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Where we stand today – EU view

EU 27 Power Mix 2022



40% of power production came from renewable sources.

60% of EU power production is fossil free

EU Targets 2030

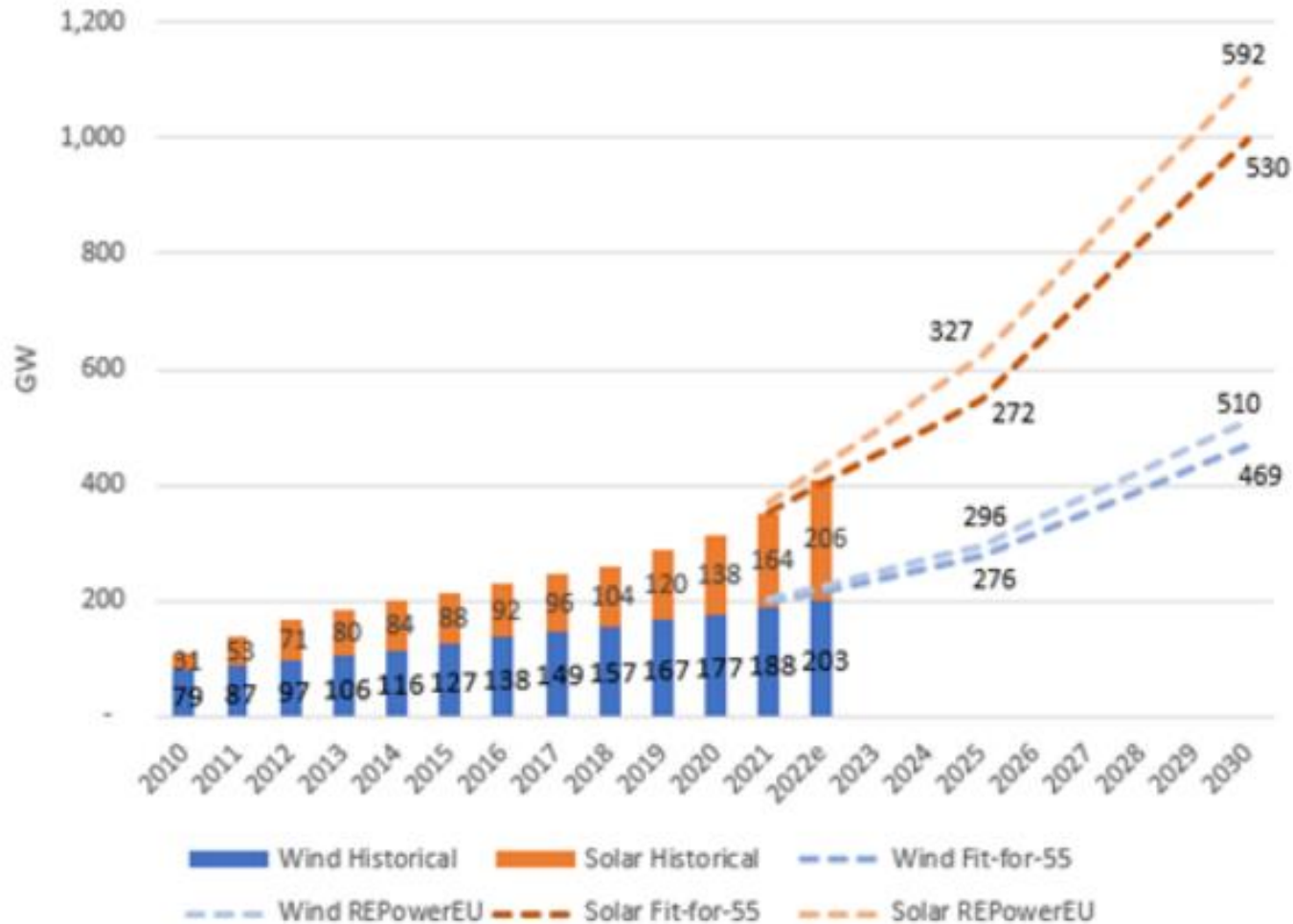
Existing overall targets:

- Climate-neutral by 2050 – an economy with net-zero greenhouse gas emissions
- Cutting greenhouse gas emissions by at least 55% (compared to 1990) by 2030
- 42.5% of the total energy consumption covered by renewables
- EU ambition is to produce 10 million tonnes and import 10 million tonnes of renewable hydrogen in the EU by 2030.

Regarding renewable energy targets (implication for electricity production):

- European Parliament and the Council have preliminary agreed on the 42.5% renewables target, scoped in both Fit-for-55 and REPowerEU packages
- 42.5% renewables of total energy consumption translates into ca 68% of renewables in power production
- 10 Mt hydrogen, assuming 4500 hours of annual operation, requires ca 100 GW electrolyser capacity

EU has an ambitious growth target for renewable energy



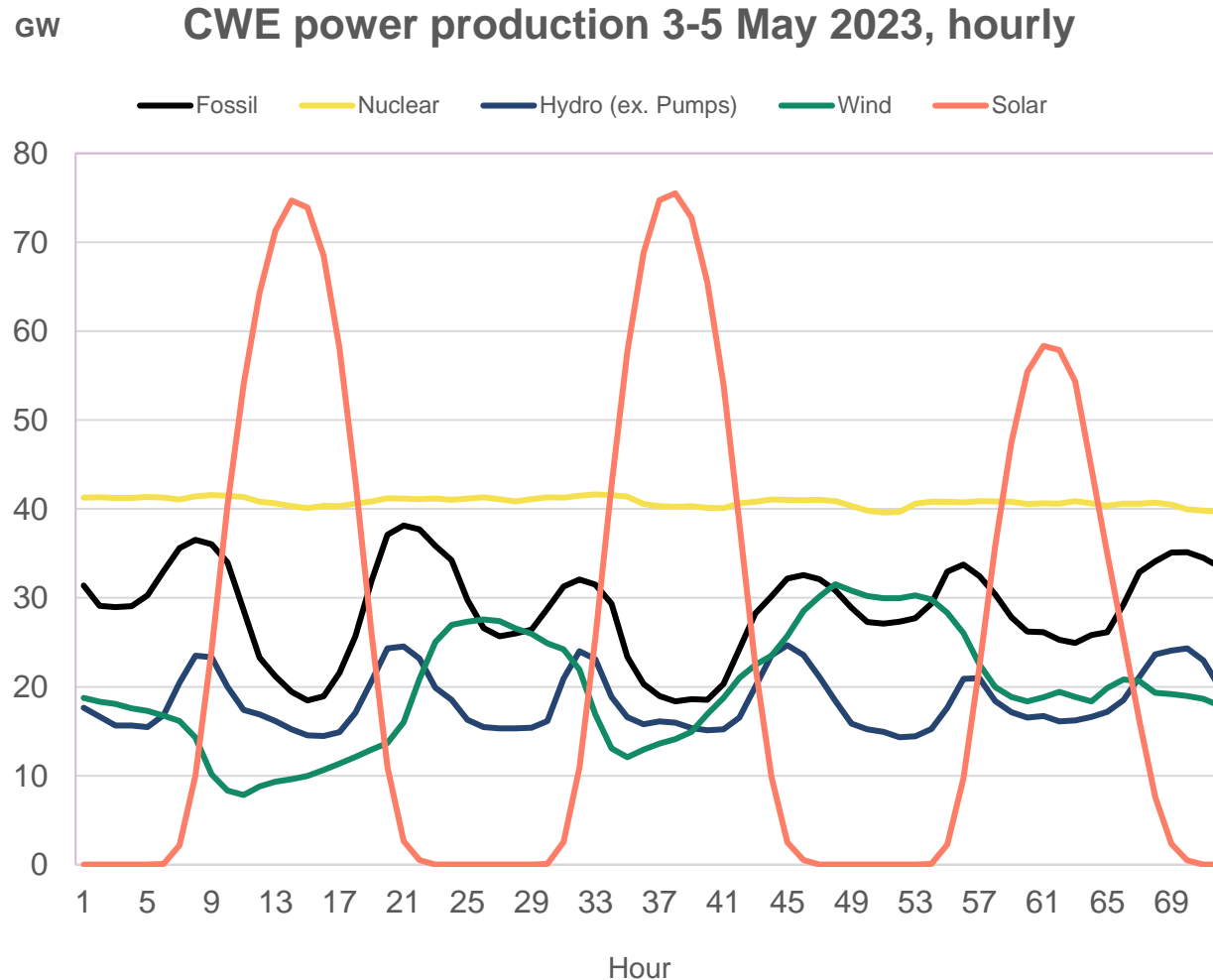
- Between 2018-2022, there were ca 37 GW annual installations of wind and solar capacity.
- According to a Commission staff working document (PRIMES modelling), the required deployment during 2025-2030 would be ca 93 GW annually
- 10 Mt of renewable hydrogen would require roughly 100 GW of electrolyzers

There are many challenges ahead:

- Land use and Permitting
- Grid connections
- Financing the investments
- System integration

Source: European Commission (2023) Commission staff working document -Reform of Electricity Market Design

EU targets in today's context



CWE = DE, FR, BE, NL, LU, AT, CH

Data source: ENTSO-E

TODAY

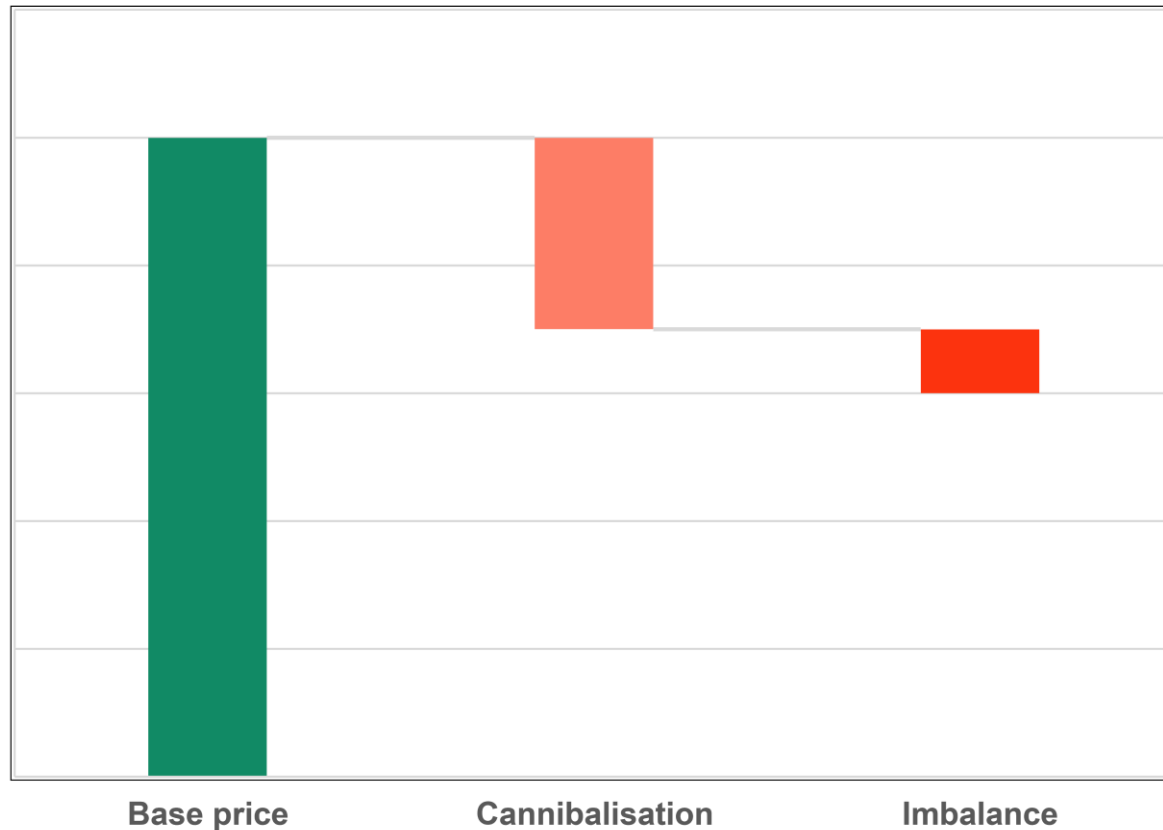
- CWE 2022 annual demand ca 1300 TWh
- Selected period: 3 May (Wed) to 5 May (Fri)
- Installed solar capacity ca 120 GW
- Installed wind capacity ca 105 GW
- Weekday demand 110...155 GW
- Weekend demand 100...125 GW
- Daytime wind & solar 90...100 GW
- Ramp-down fossil + nuclear + wind and full exports required during sunny summer weekends

2030 EU target

- Increase installed capacity by ca 2.5 times
- Assuming 20% increase in demand we move from current daytime Residual load of +/-0 GW to -70 GW
- Not impossible, but requires flexible demand in addition to batteries

System integration - Components for revenue forecasting

Basic components for revenue forecasting



Three components for price risk

- Base price
- Cannibalisation
- Imbalance (Intra-Day + Balancing cost)

Other relevant risks include

- Volume: unplanned outage or constant bias in production estimates,
- Counterpart risk (hedging)
- Collateral / Liquidity risk (hedging)

Cannibalisation – a simple way to define it

During the periods of high (wind or solar) production, power price declines due to increased supply

The more there is intermittent production and the less there is flexible production or interconnector capacity, the stronger the price impact

- Assume base power price for a given month = 50 €/MWh
- Assume the achieved price for production = 40 €/MWh

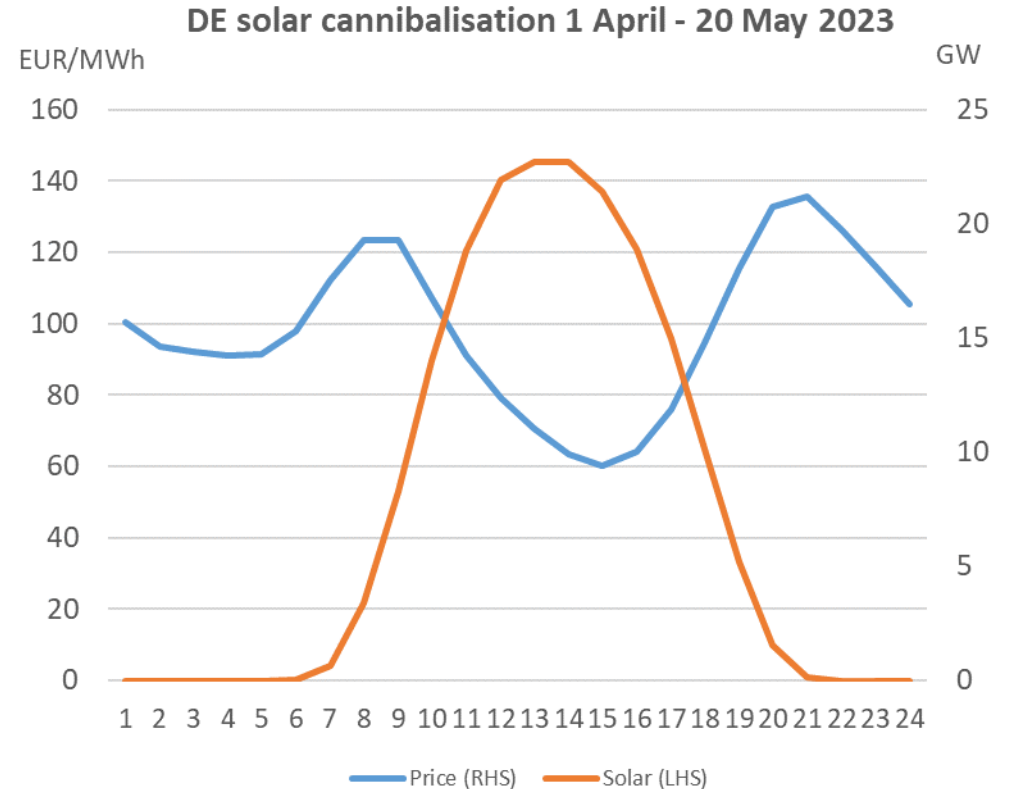
Cannibalisation =

$$1 - \frac{\text{Achieved Power Price}}{\text{Base Power Price}} = 1 - \frac{40 \text{ €/MWh}}{50 \text{ €/MWh}} = 20\%$$

Note:

Average of monthly cannibalisation over the year is not the same as annual cannibalisation. Annual cannibalisation is impacted by seasonal production profile which can cause certain “instability” in annual numbers.

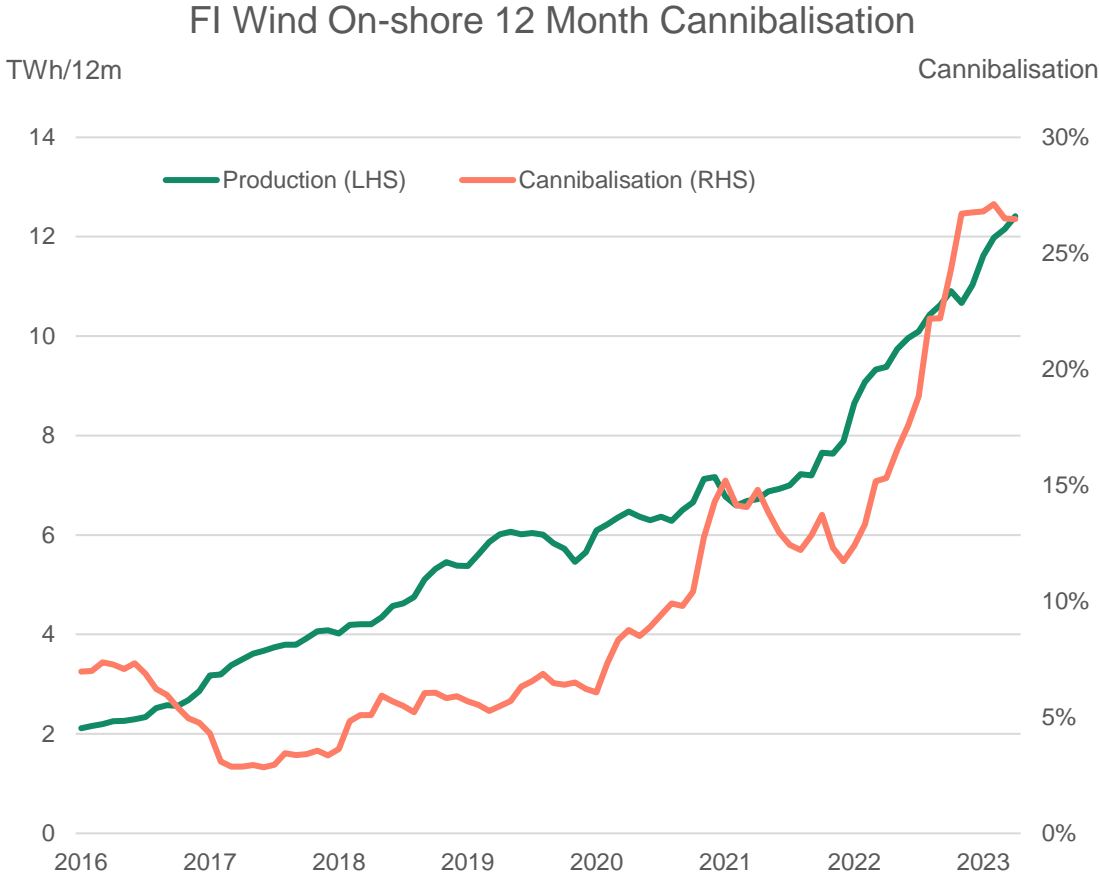
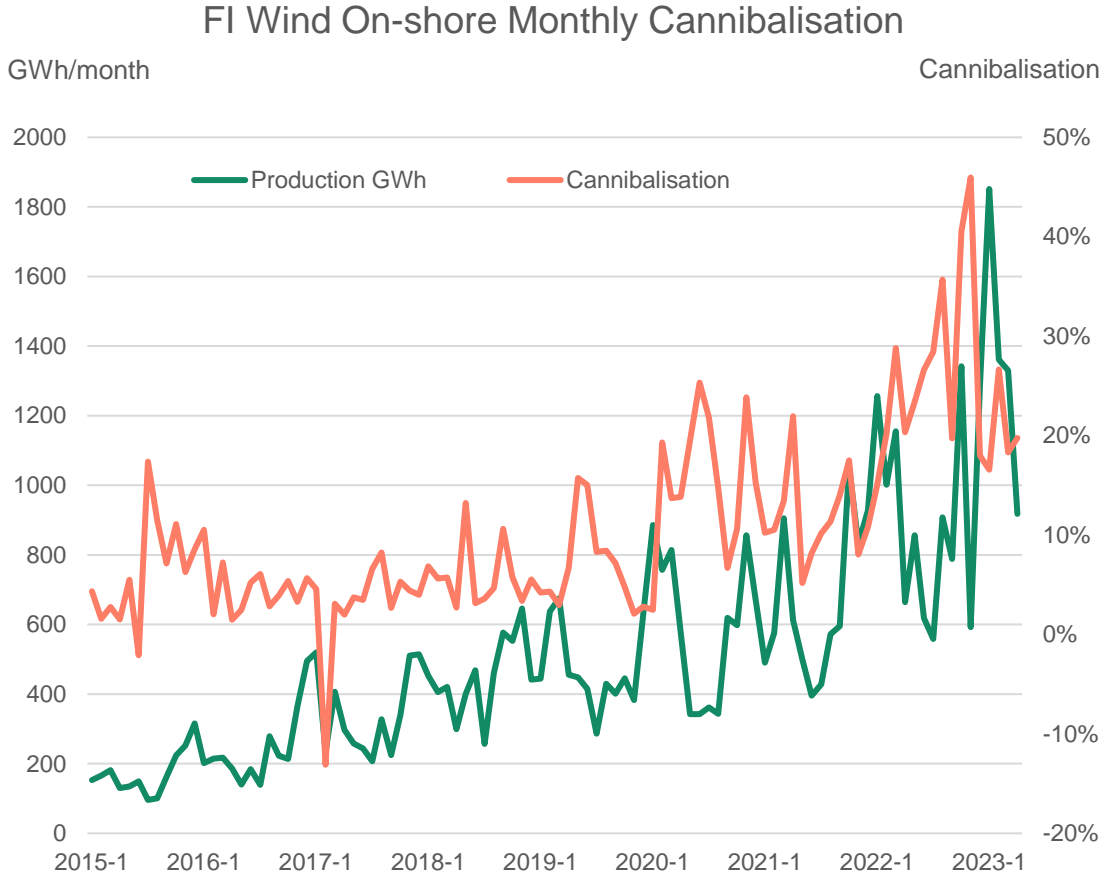
Cannibalisation (%) is independent of the absolute price level



1 Apr – 20 May 2023 average German spot price was 98 €/MWh while Solar achieved price was 81 €/MWh.

Cannibalisation for this period is $1 - (81/98) = 18\%$

Rapid increase was seen in Nordic Wind Cannibalisation during 2022

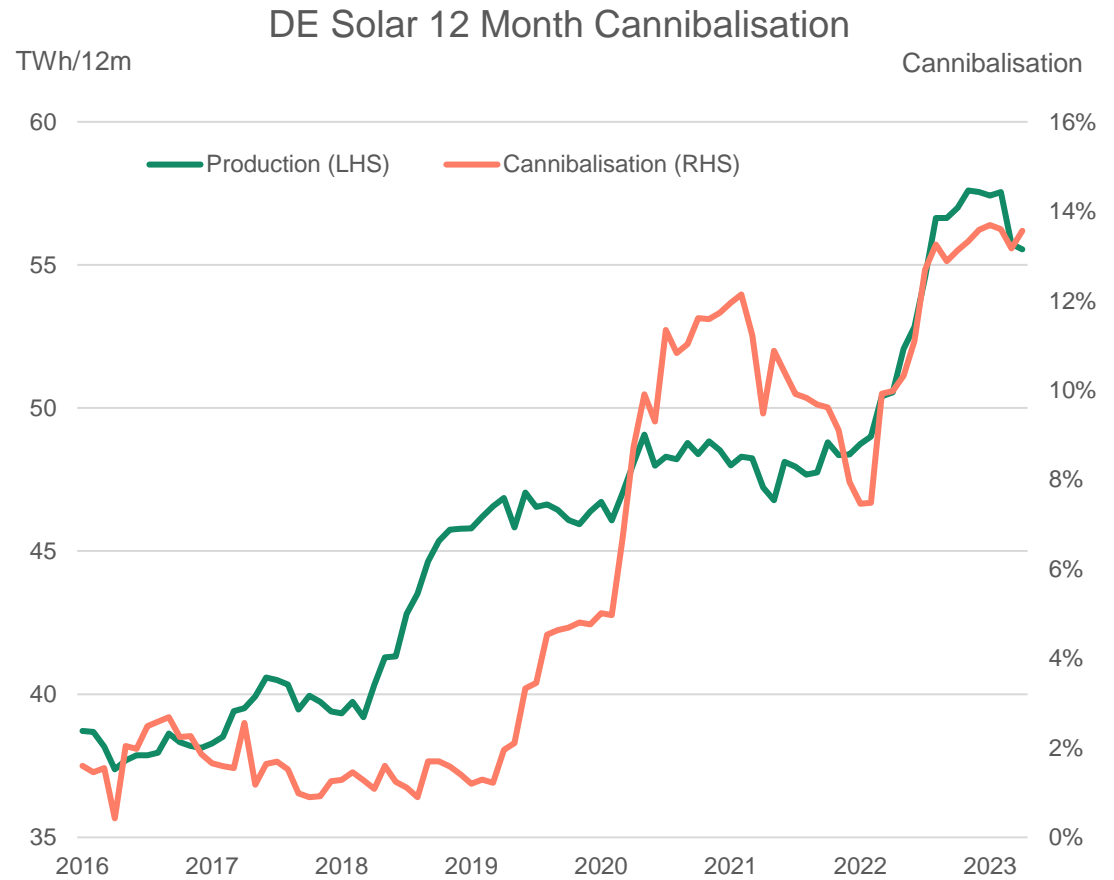
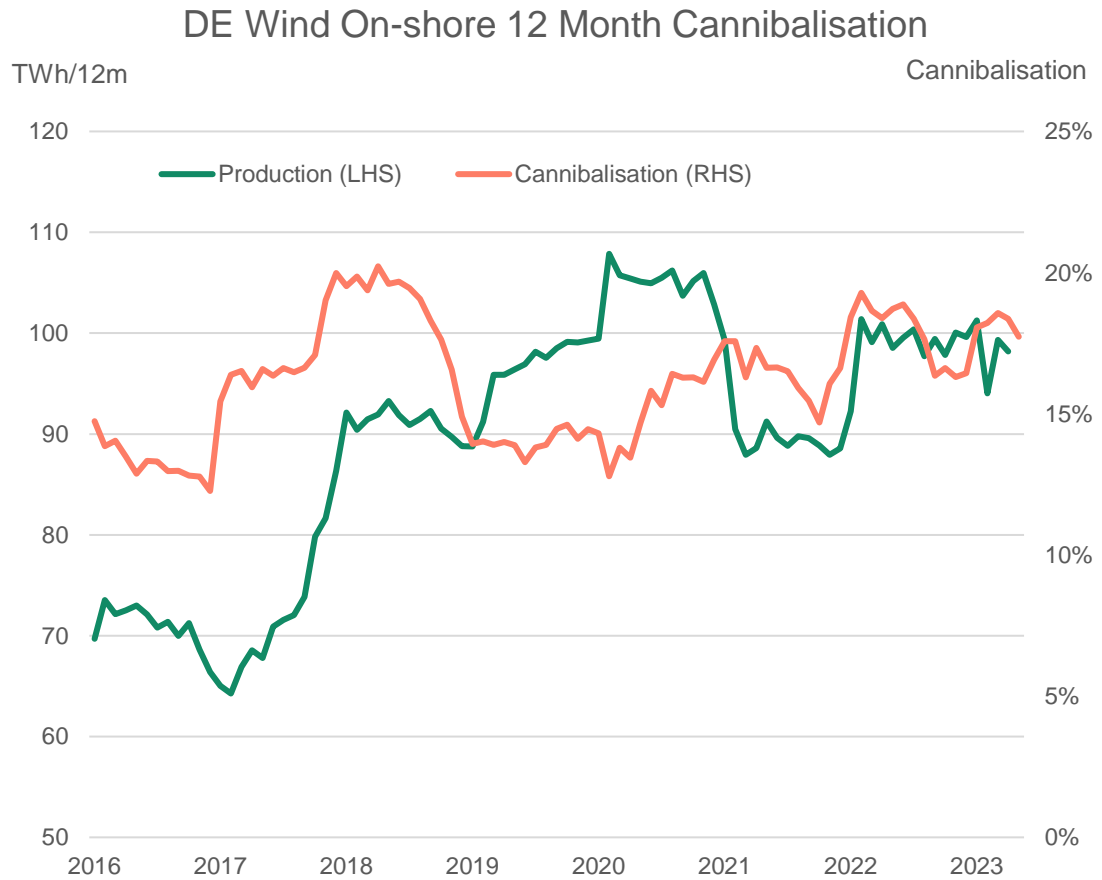


Note: Annual level cannibalisation is somewhat different than 12-month cannibalization that is calculated on monthly level

Source data: ENTSO-E, Nord Pool



Germany sees stable wind but growing solar cannibalisation



Note: German 2022 annual cannibalisation for wind on-shore 28% and solar only 5% due to summer price spike
 Source data: ENTSO-E, Nord Pool

Conclusions



The Challenge: Decarbonise Economy

Secure needed electricity for decarbonisation

The ultimate goal for power sector

Grow Solar and Wind capacity by 2.5 times

EU 2030 target shows the ambition

Secure the economics for needed investments

The problem of Cannibalisation

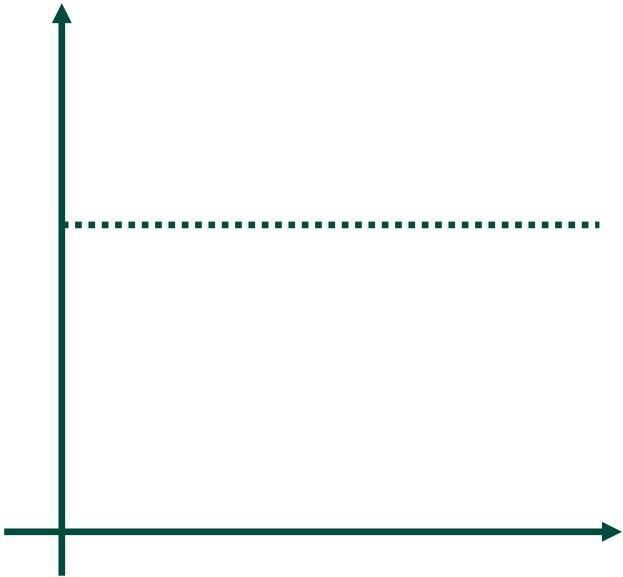
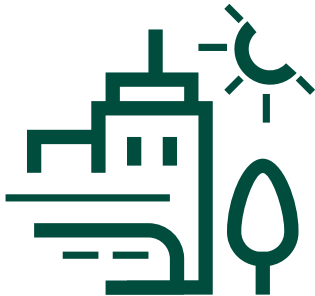
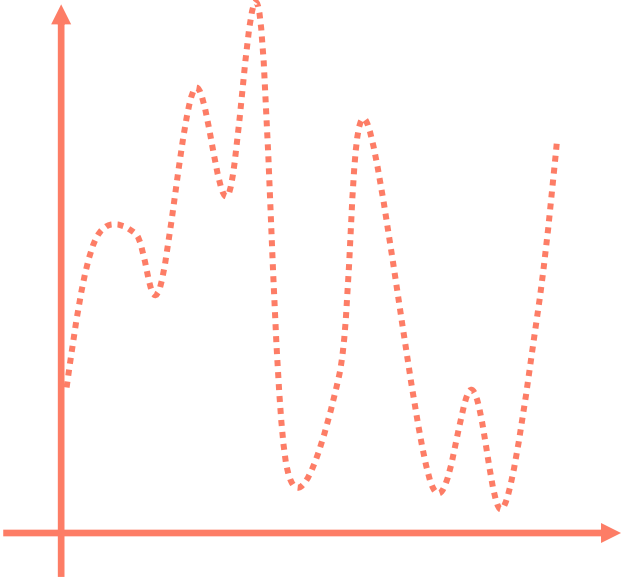
Incentivise flexibility

Power system needs flexible demand

Security of supply

Winter weeks with low wind and solar production

PPA market needs to evolve to provide the right signals



Security of Supply: from strategic reserve to full scale capacity markets?

SvK föreslår att Sverige inför en kapacitetsmarknad

(Montel) Svenska Kraftnät föreslår att Sverige på sikt behöver införa en kapacitetsmarknad efter år 2025, som ersättning till effektreserven som ska fasas ut, framgår av ett förslag som systemoperatören överlämnar till regeringen.

”Enligt de senaste nationella analyserna från Svenska Kraftnät och på europeisk nivå riskerar Sverige inom några år att inte uppfylla den fastställda svenska tillförlitlighetsnormen på en timme med effektbrist per år”, skriver systemoperatören.

Förslaget innehåller inga exakta detaljer om hur kapacitetsmekanismen ska utformas, men det framgår att Svenska Kraftnät vill se en geografisk uppdelning utifrån de svenska elområdena. Det framgår vidare att den nya mekanismen bör vara marknadsomfattande, snarare än riktad, vilket gör att nuvarande effektreserv är mindre lämplig.

”Mot bakgrund av att den förväntade elektrifieringen leder till ett stort behov av nyinvesteringar gör Svenska Kraftnät bedömningen att en strategisk reserv inte är långsiktigt ändamålsenlig för att möta de svenska kommande behoven. Svenska kraftnät bedömer därför att en marknadsomfattande kapacitetsmarknad på sikt bör införas i Sverige.”

Systemoperatören bedömer att det skulle ta 5-8 år att införa en kapacitetsmarknad. Eftersom effektreserven bara har tillstånd till mars år 2025 vill Svenska Kraftnät under en övergångsperiod se en förlängning av den strategiska reserven mellan år 2025 och fram till att den nya mekanismen är på plats.

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Thank You!



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