

# Beyond electrification

Marcia Poletti,  
Head of European System Change

May 2025



octopusenergy

We use **technology** to drive the global green energy revolution – making it **cheaper and faster** for citizens and the planet.



# Since 2016, we've been building the first fully integrated post-transition energy company

**27**

countries

**8.8m**

customers

**10,000**

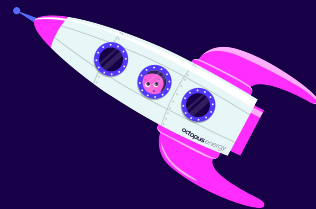
employees

**54m**

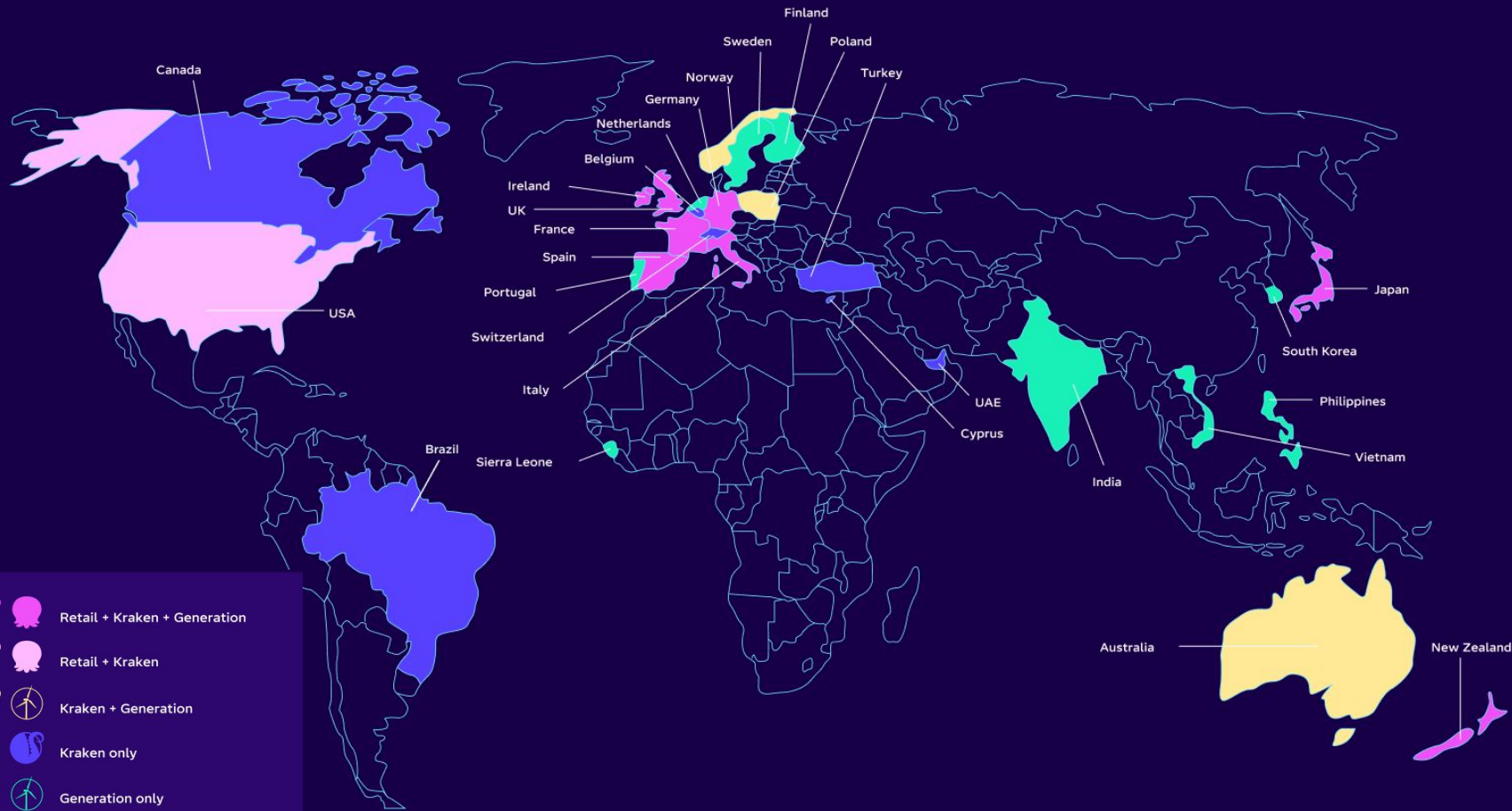
accounts  
contracted to  
Kraken  
platform

**\$7bn**

renewable  
assets under  
management



# Active in 27 countries across 5 continents





# Within each of our countries, we're going beyond pure retail



Generation



Solar PV & batteries



Heat Pumps



Home EV charging



EV Leasing



Public EV charging

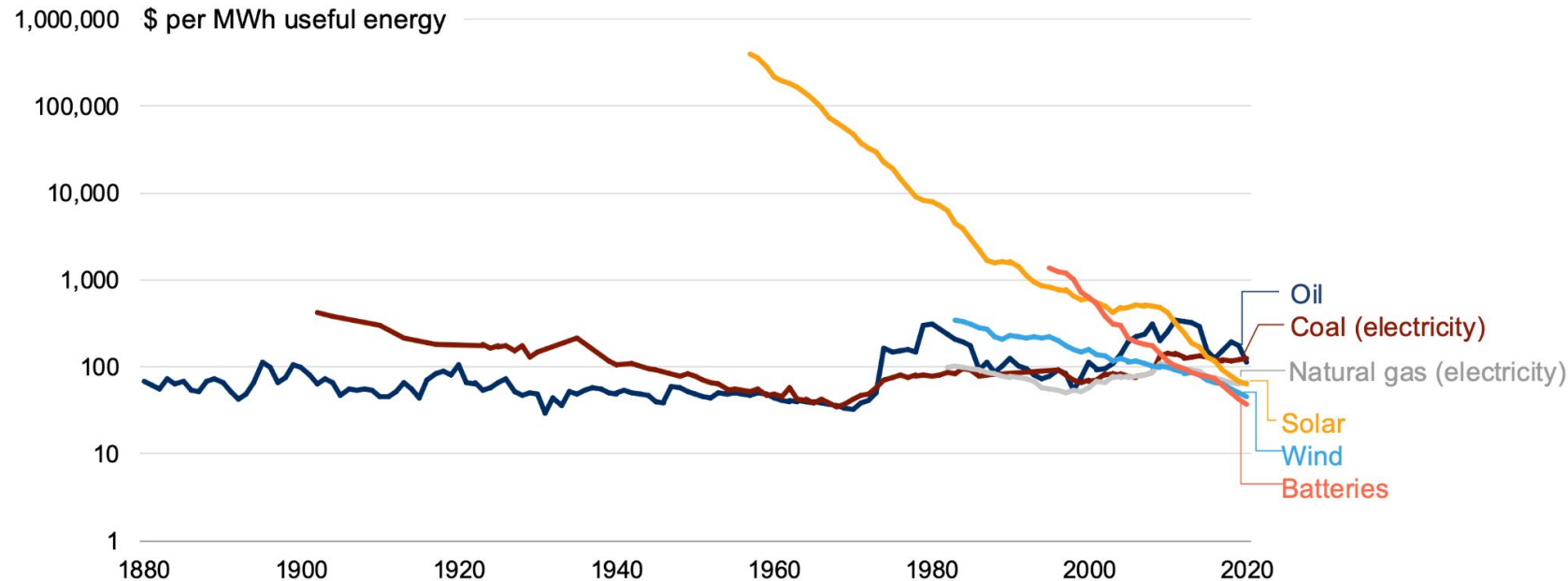


**Global  
electricity  
systems are  
changing fast**

**Renewables** are getting  
**cheaper and cheaper...**

# Clean energy is the cheapest in history

## Historical costs of energy sources

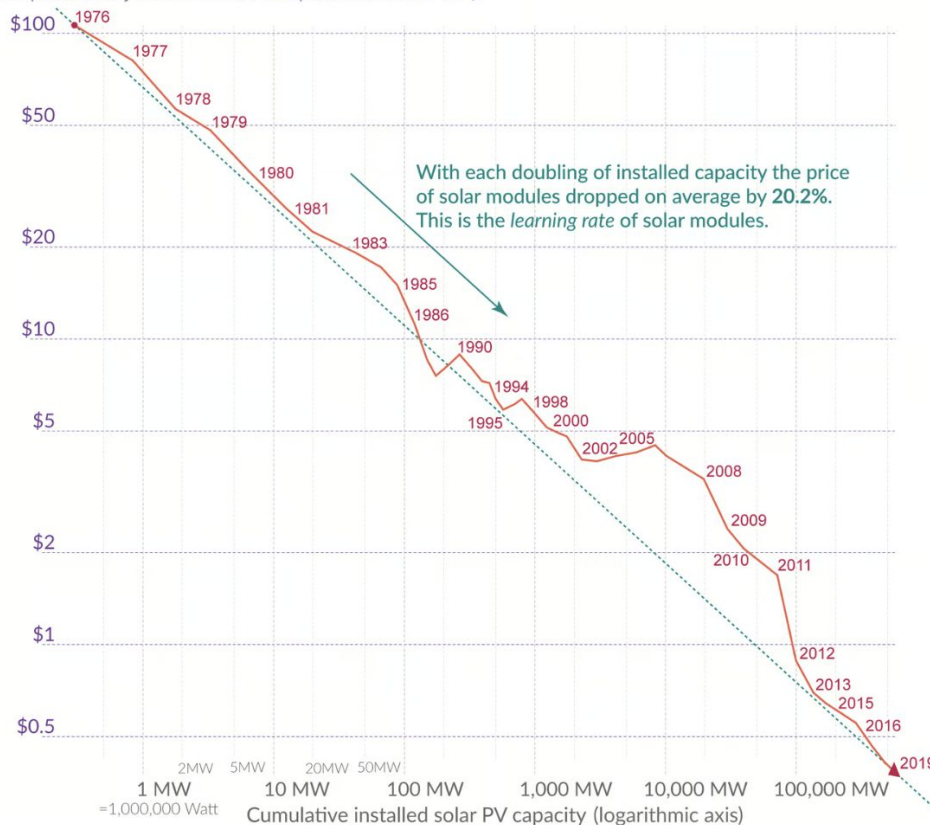


## The price of solar modules declined by 99.6% since 1976

Our World  
in Data

Price per Watt of solar photovoltaics (PV) modules (logarithmic axis)

The prices are adjusted for inflation and presented in 2019 US-\$.



Data: Lafond et al. (2017) and IRENA Database; the reported learning rate is an average over several studies reported by de La Tour et al (2013) in Energy. The rate has remained very similar since then. OurWorldinData.org – Research and data to make progress against the world's largest problems.

Licensed under CC-BY  
by the author Max Roser

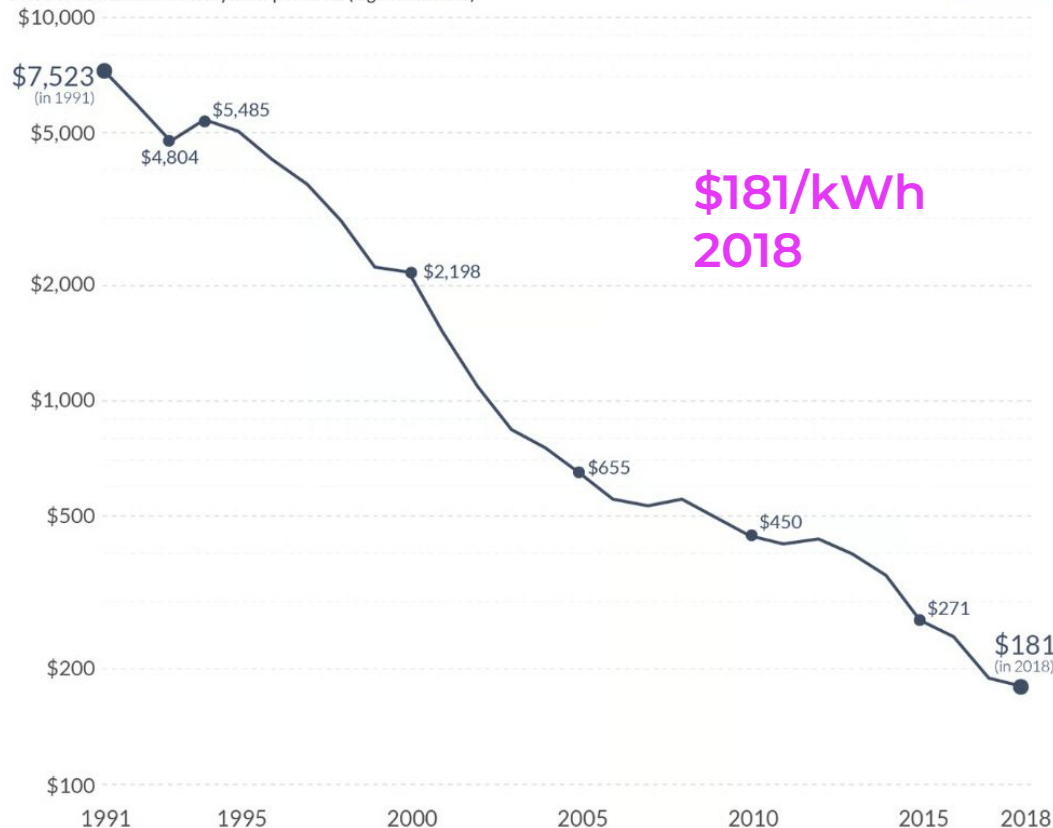
**Solar PV costs  
driven by  
economies of  
scale - with  
each doubling  
of installed  
capacity the  
price of solar  
modules  
reduce by 20%**

**Similar story  
with LI-ON  
batteries -  
cost declines  
of 97% since  
1991**

## The price of lithium-ion batteries fell by 97%

Our World  
in Data

Price of lithium-ion battery cells per kWh (logarithmic axis)



Prices are adjusted for inflation and given in 2018 US-\$ per kilowatt-hour (kWh).

Source: Micah Ziegler and Jessika Trancik (2021). Re-examining rates of lithium-ion battery technology improvement and cost decline.

OurWorldinData.org - Research and data to make progress against the world's largest problems. Licensed under CC-BY by the author Hannah Ritchie.

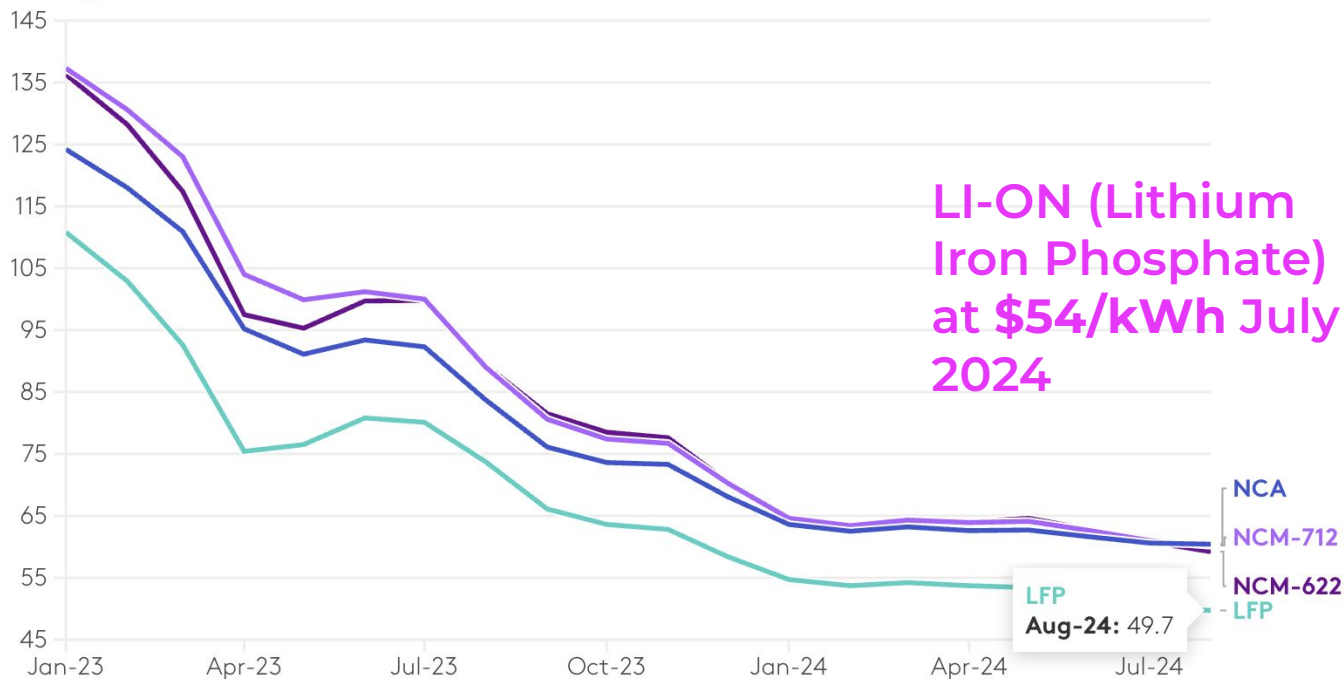
And these  
astonishing  
declines  
are  
continuing

## Average cell cost trend, China\*

NCM-622 (pouch), NCM-811 (prismatic), NCA (cylindrical), LFP (prismatic)



Average cell cost, \$/kWh

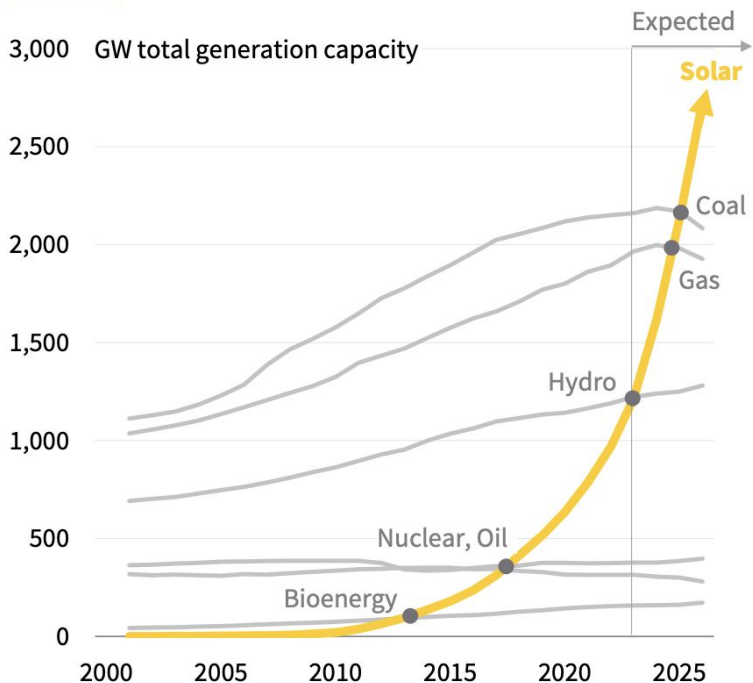


Source: [Fastmarkets](#) • \*Excluding profit margins and assuming 10 GWh/yr production rate with 5% cell scrap rate

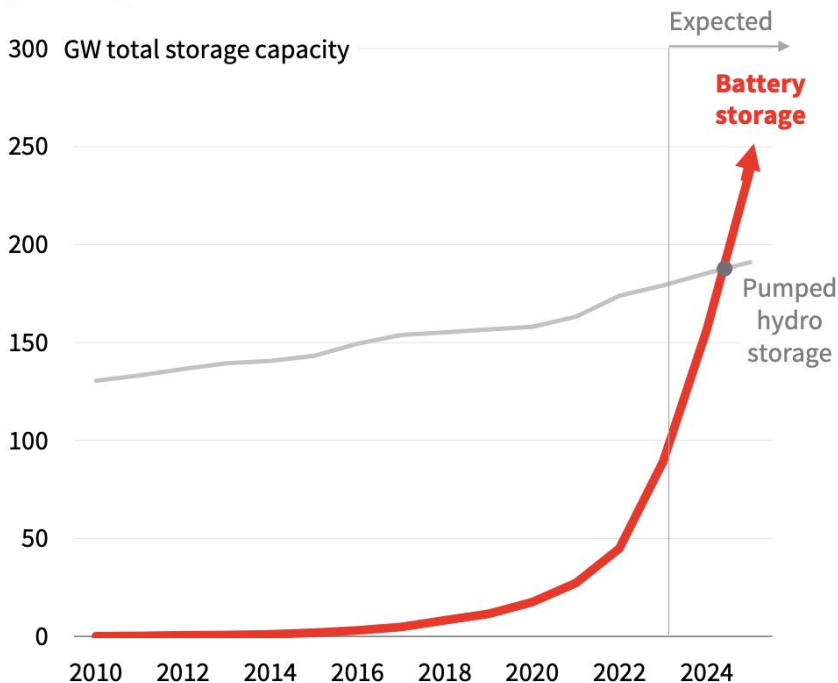


# Batteries and Solar are taking over

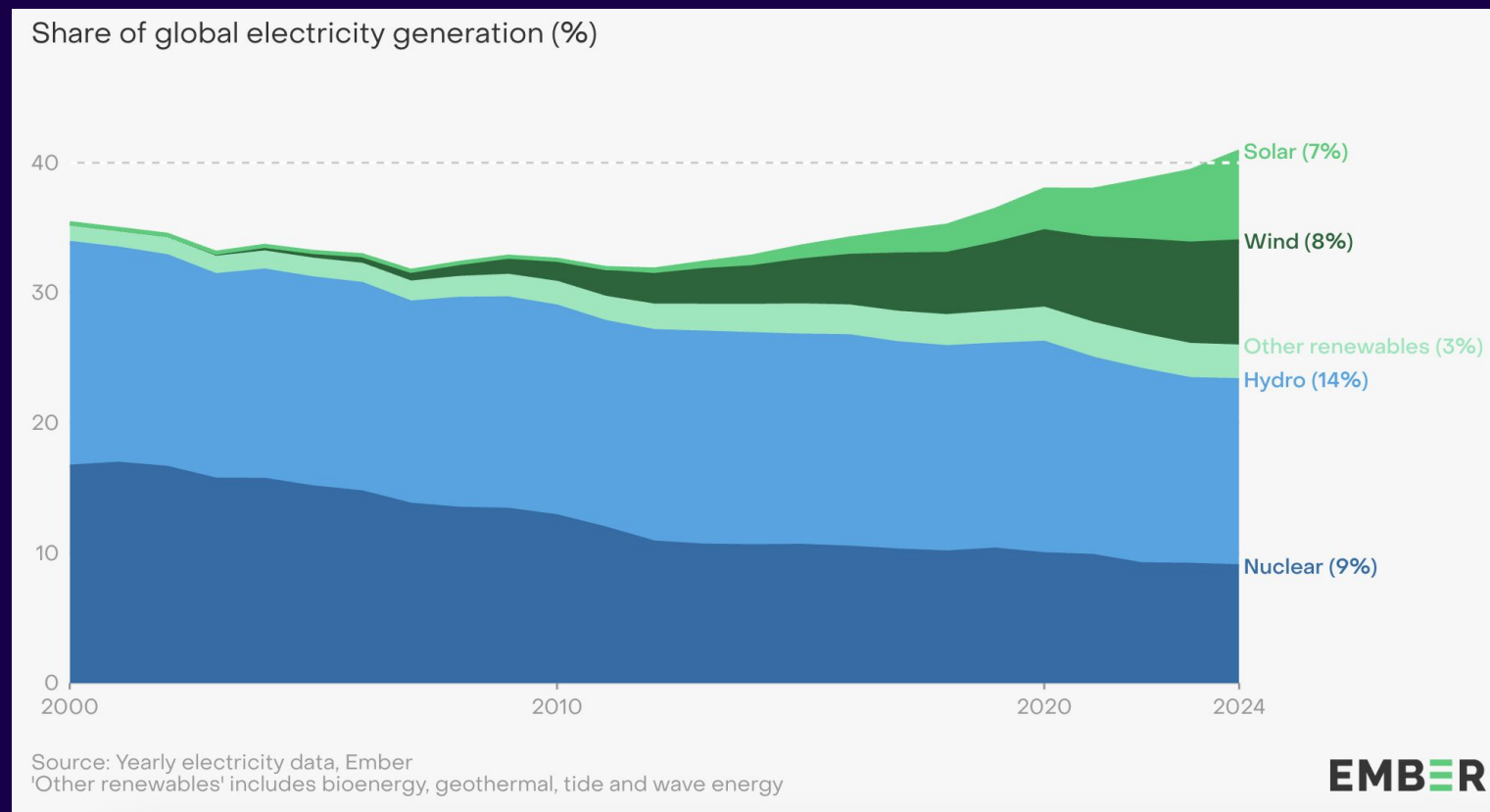
## Solar



## Batteries

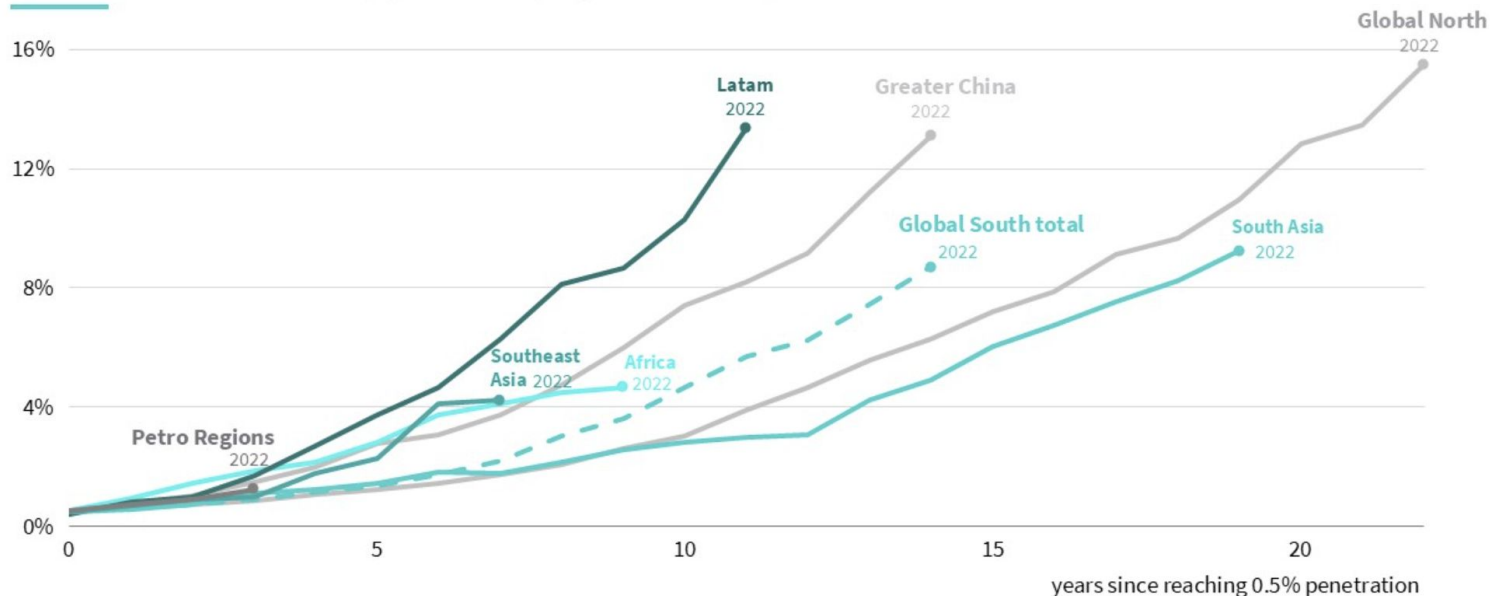


# Clean energy made up more than 40% of global generation in 2024



# Its growing everywhere, and not just in the Global North

Solar & wind share of electricity generation by region and sub-region



**Electrification is also  
accelerating...**

# Low carbon technologies are growing fast

2023-30  
device growth



8x

5x

6x

5x

9x

7x

4x

8x



7x

7x

5x

5x

2x

4x

15x

7x



2x

3x

2x

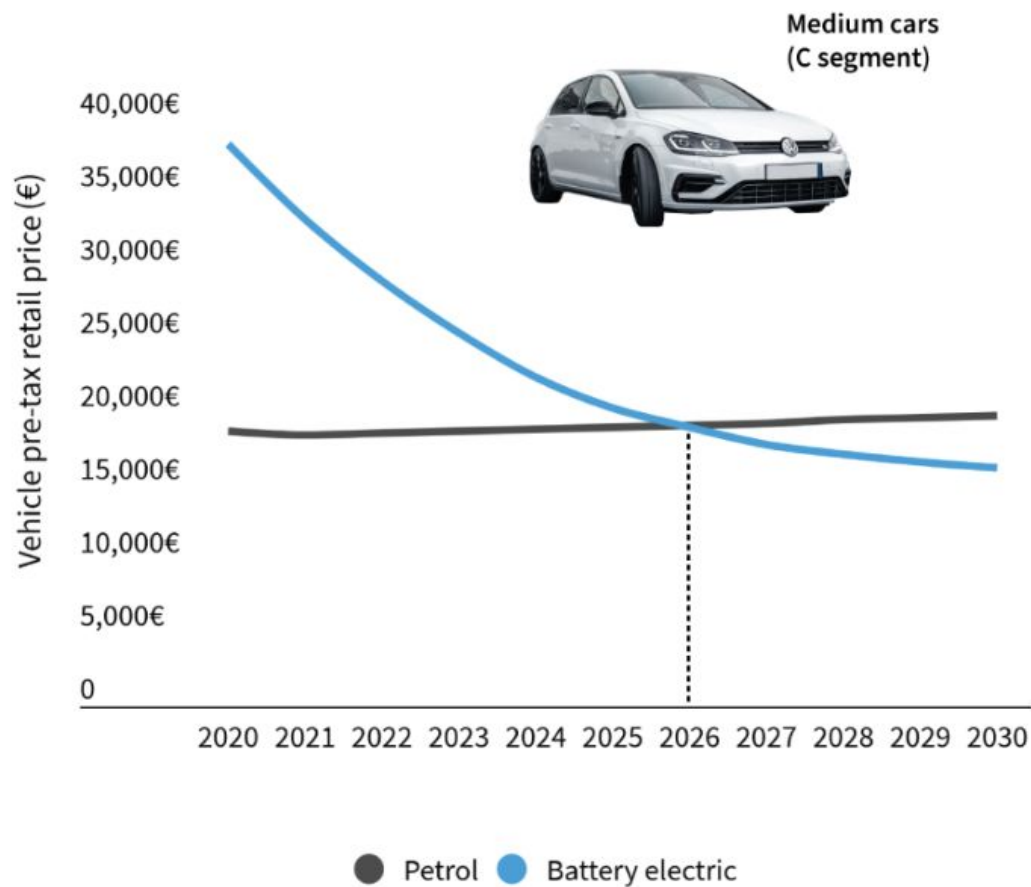
2x

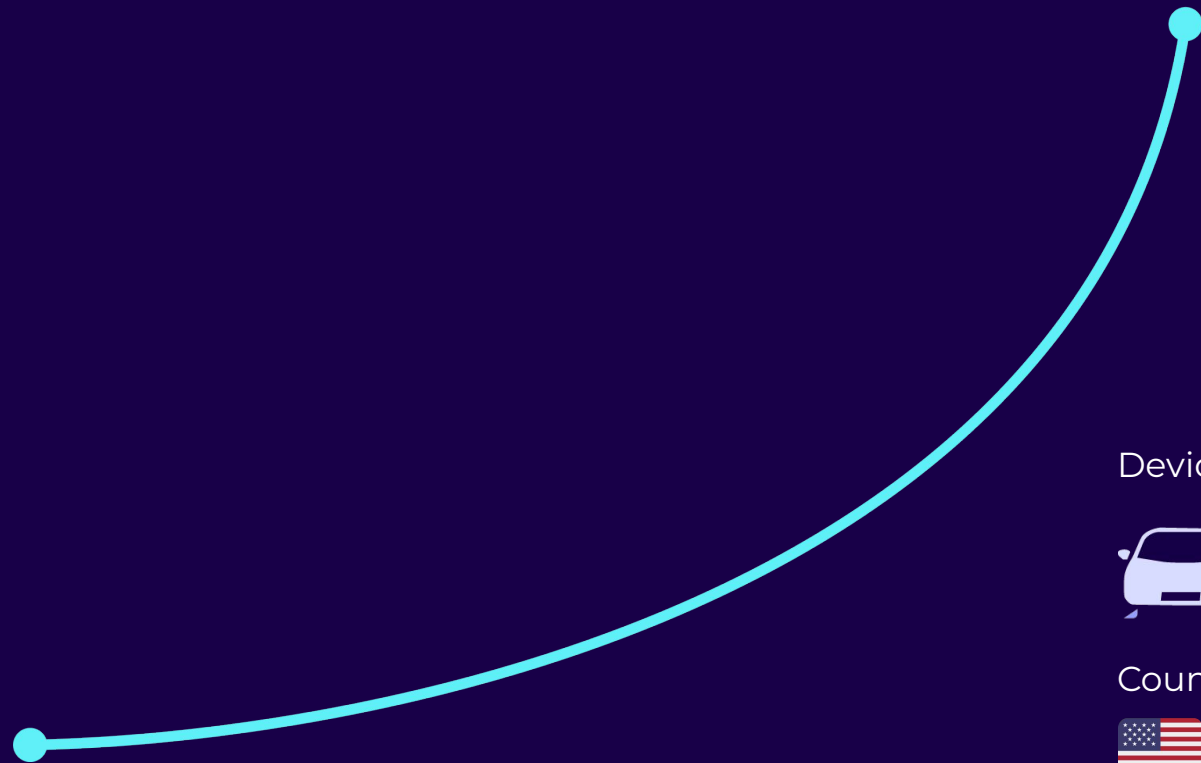
2x

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4x

2x

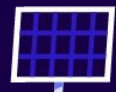




10 million today

200 million new  
devices by 2030

Devices



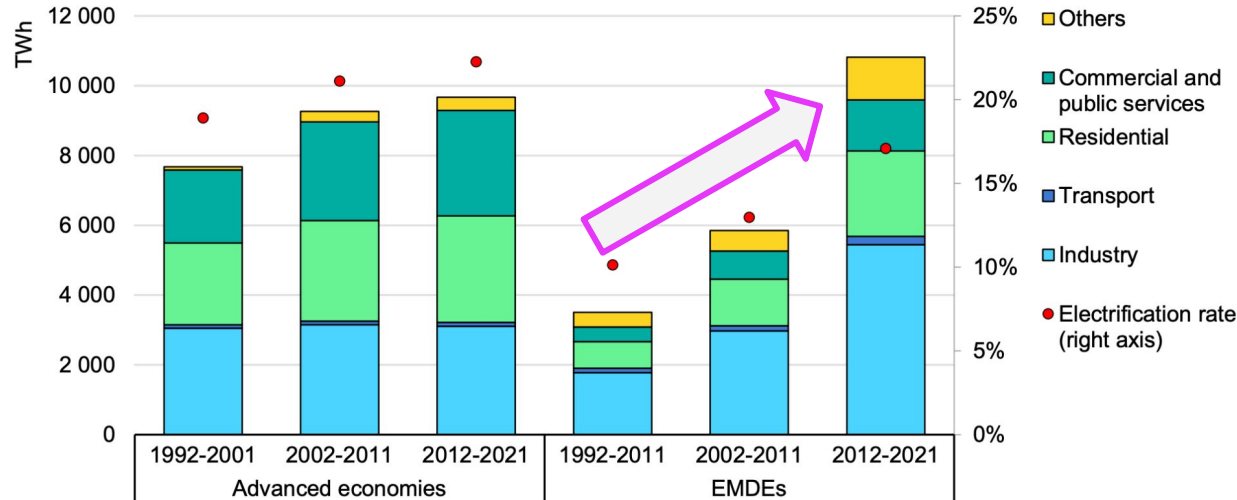
Countries





# And not just in the global North

Global final electricity consumption by sector and electrification rate, 1992-2021



EMDE: Emerging Markets and Developing Economies

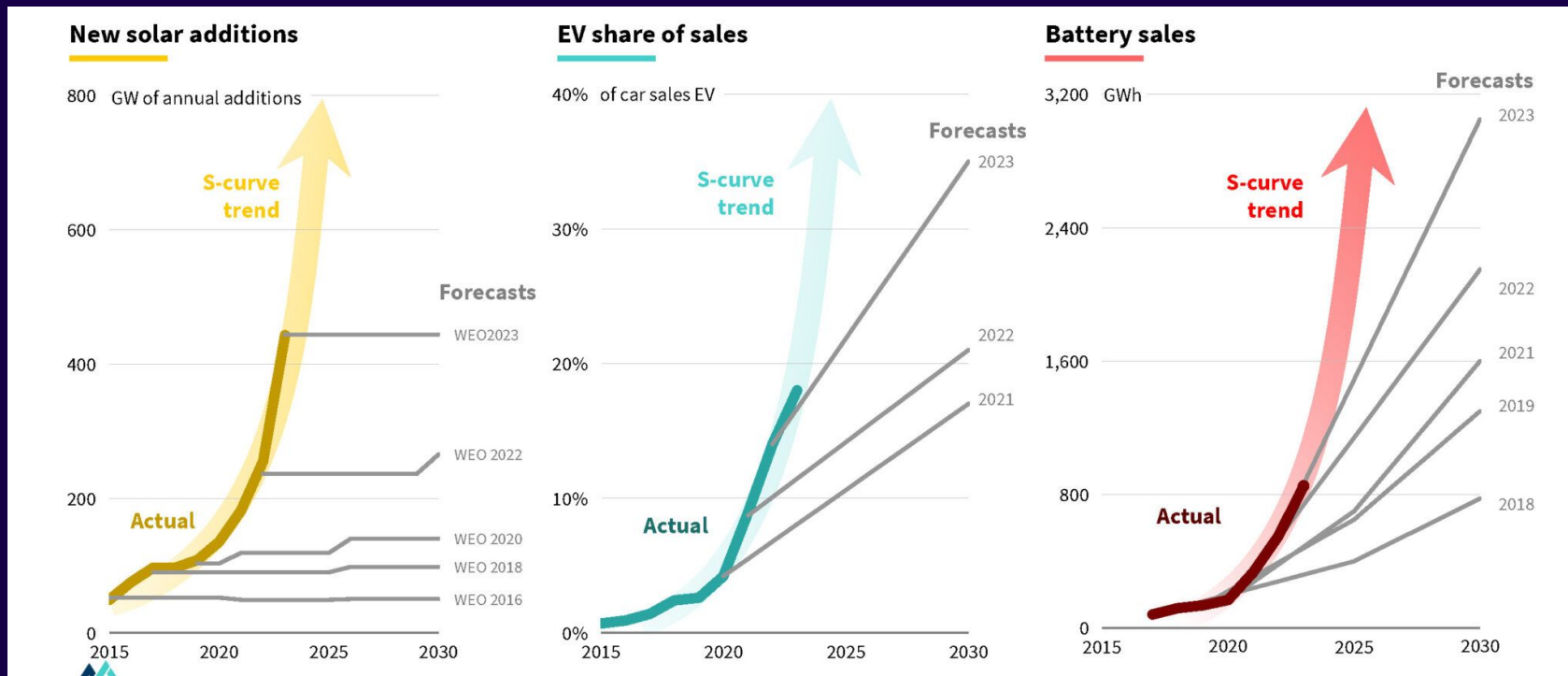
Note: "Others" includes agriculture/forestry, fishing and final consumption not specified elsewhere.

Source: IEA (2023), [World Energy Statistics](#).

IEA. CC BY 4.0.

EMDE  
electrification  
rates are set to  
overtake

# And we are probably underestimating just how fast things will change



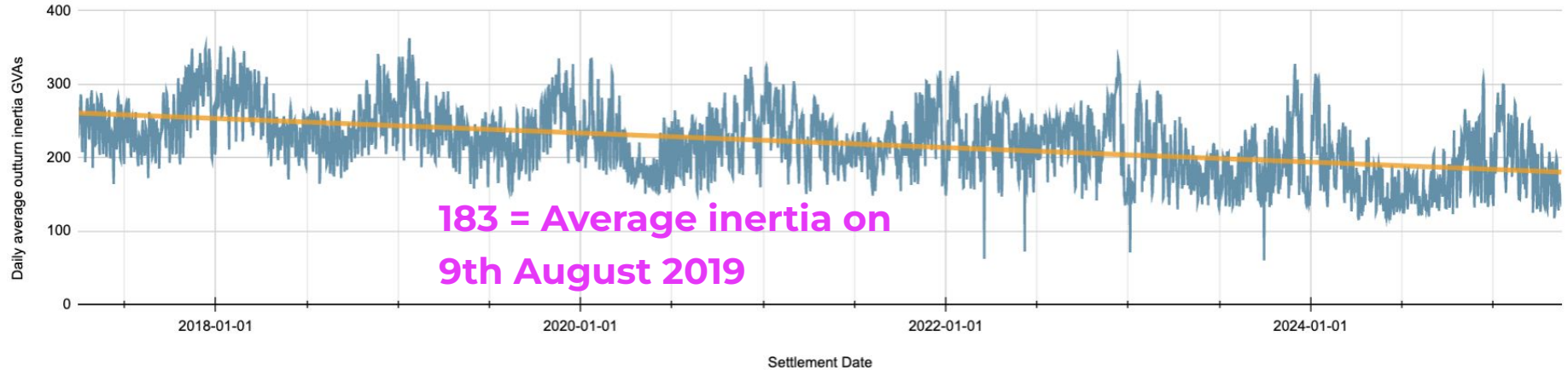
**Combined, these trends  
are creating new  
challenges...**

# Our electricity systems are becoming lighter

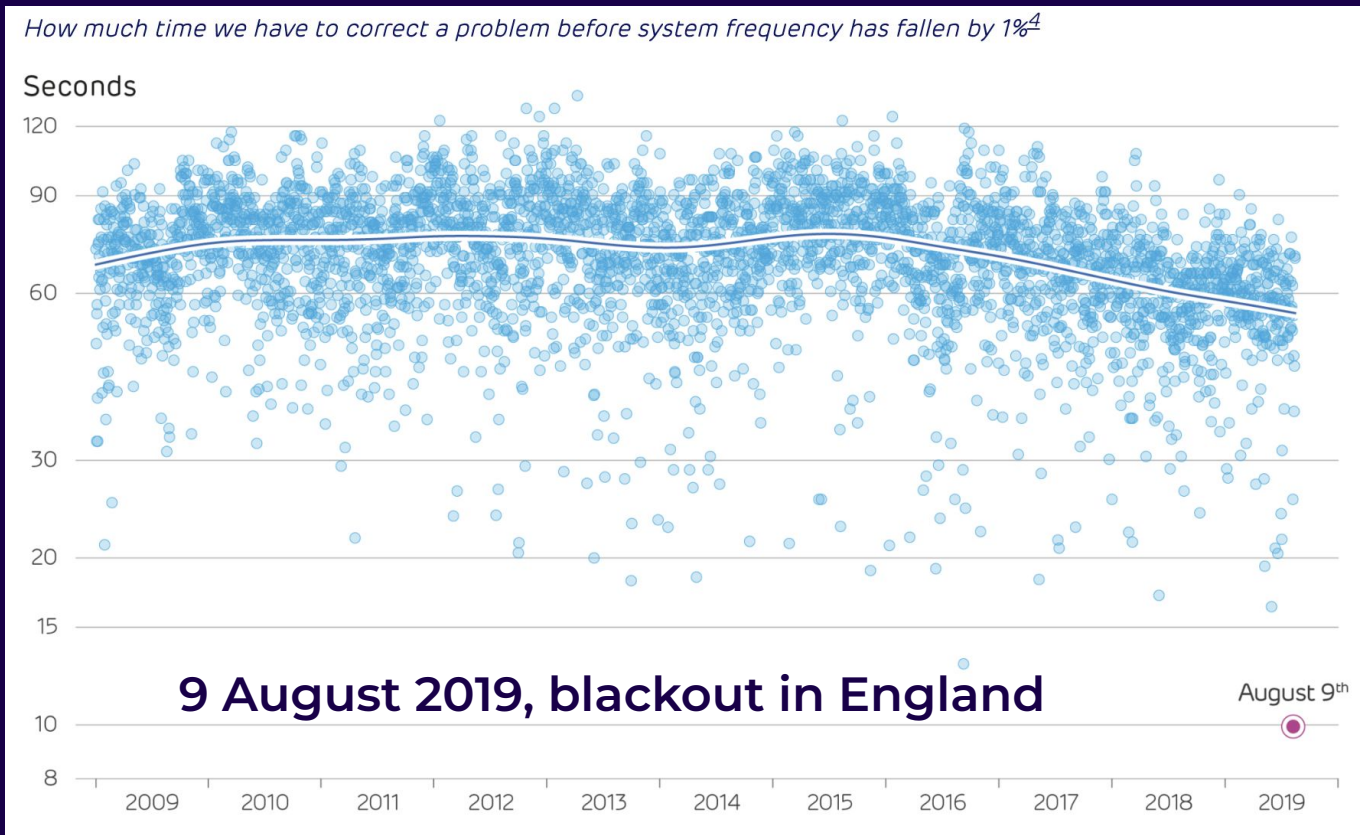


# Inertia is falling as synchronous generation is displaced by cheaper renewables

Outturn Inertia in the GB Electricity System over time

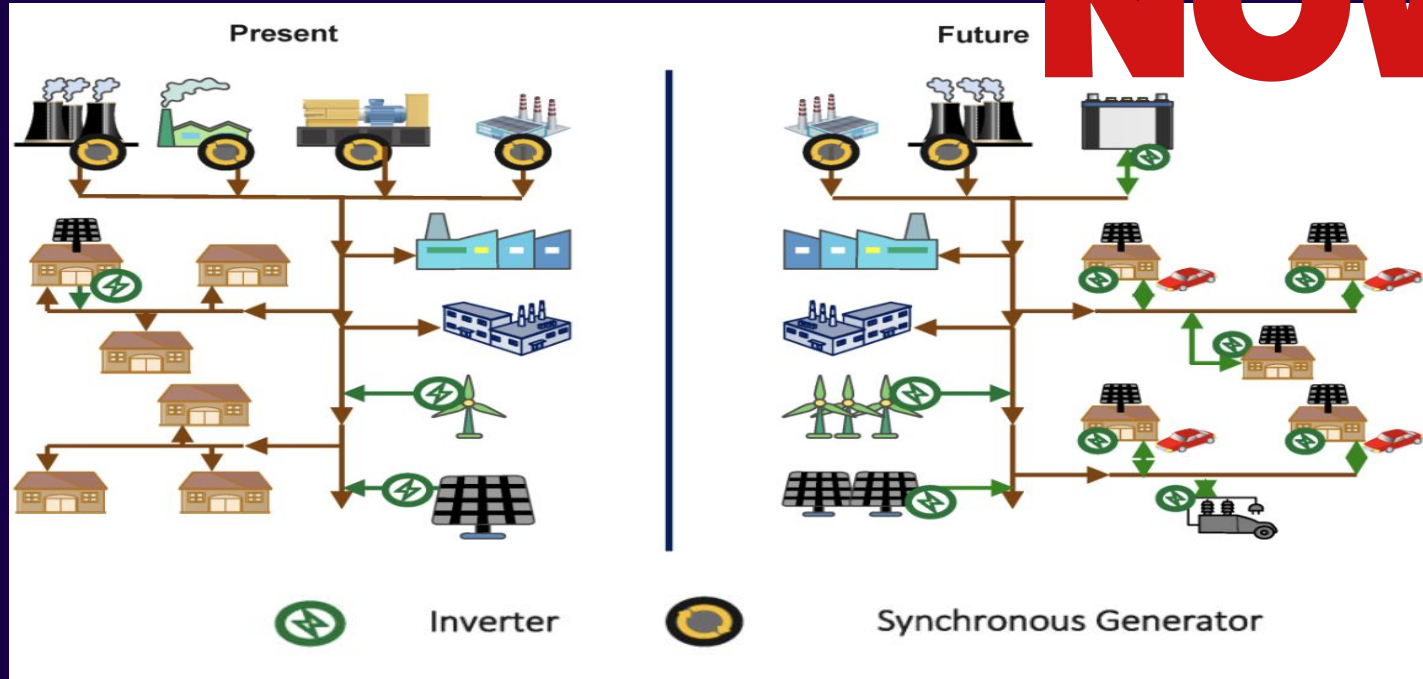


# There is less time to fix problems



# Inverter based generation now dominates many electricity systems

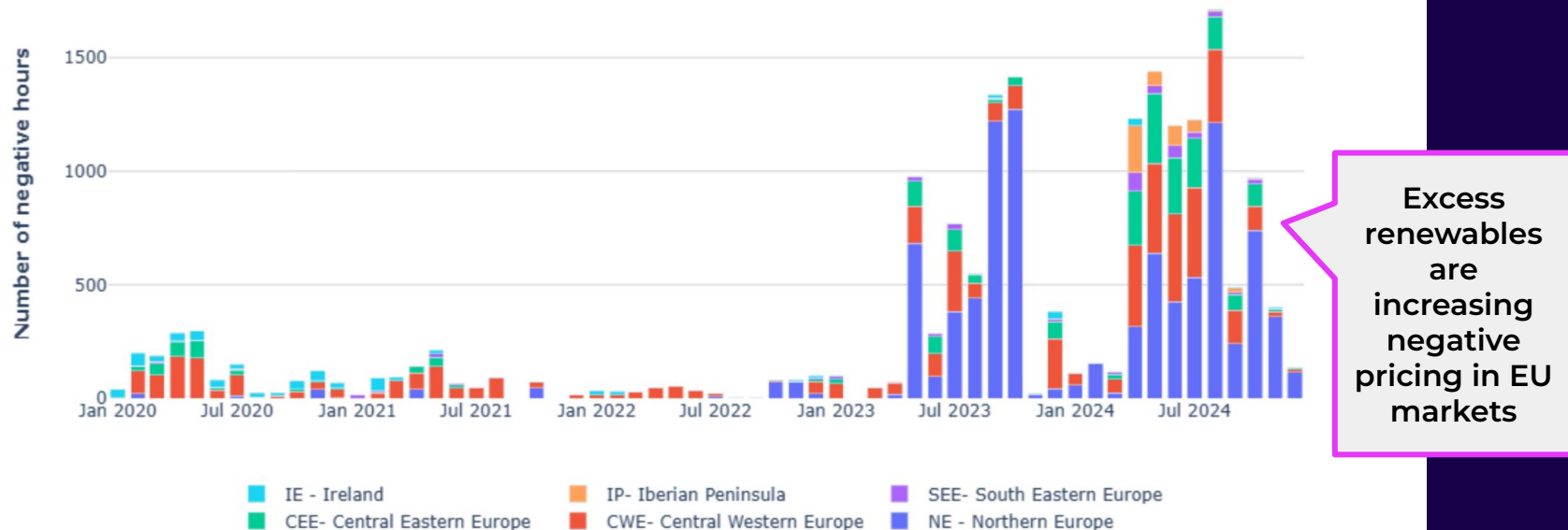
# NOW





# Sometimes we have a surplus of clean electrons...

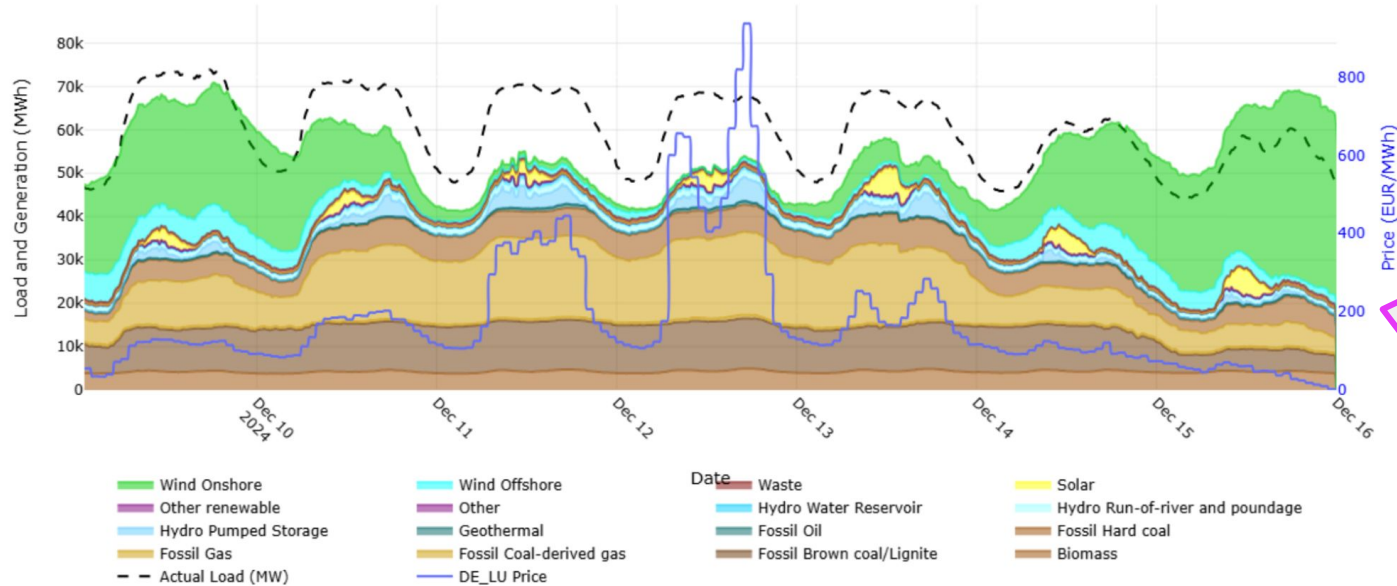
Figure 26 – Number of negative hourly wholesale prices on selected day-ahead trading platforms in Europe.



Source: ENTSO-E.

# Other times we have a shortage

**Figure 14 – Evolution of wholesale price, load and generation in Germany during 9 to 15 December 2024**

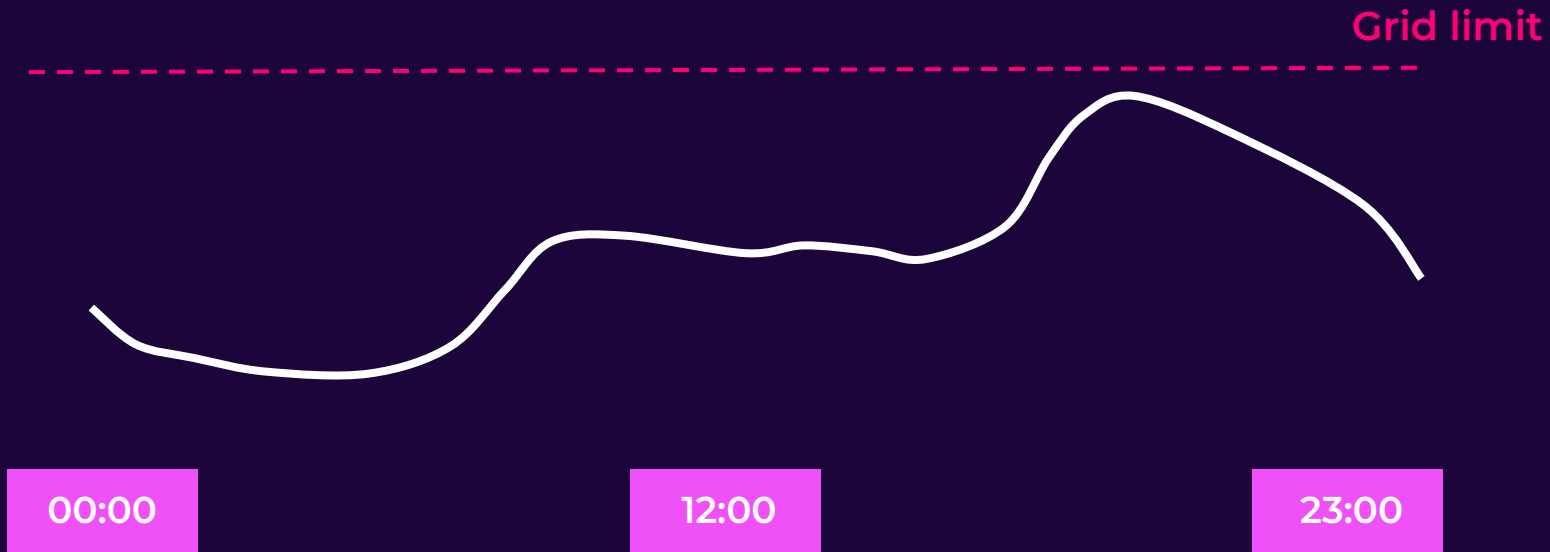


In the same systems, prices can spike under certain conditions (e.g. low wind + outages)

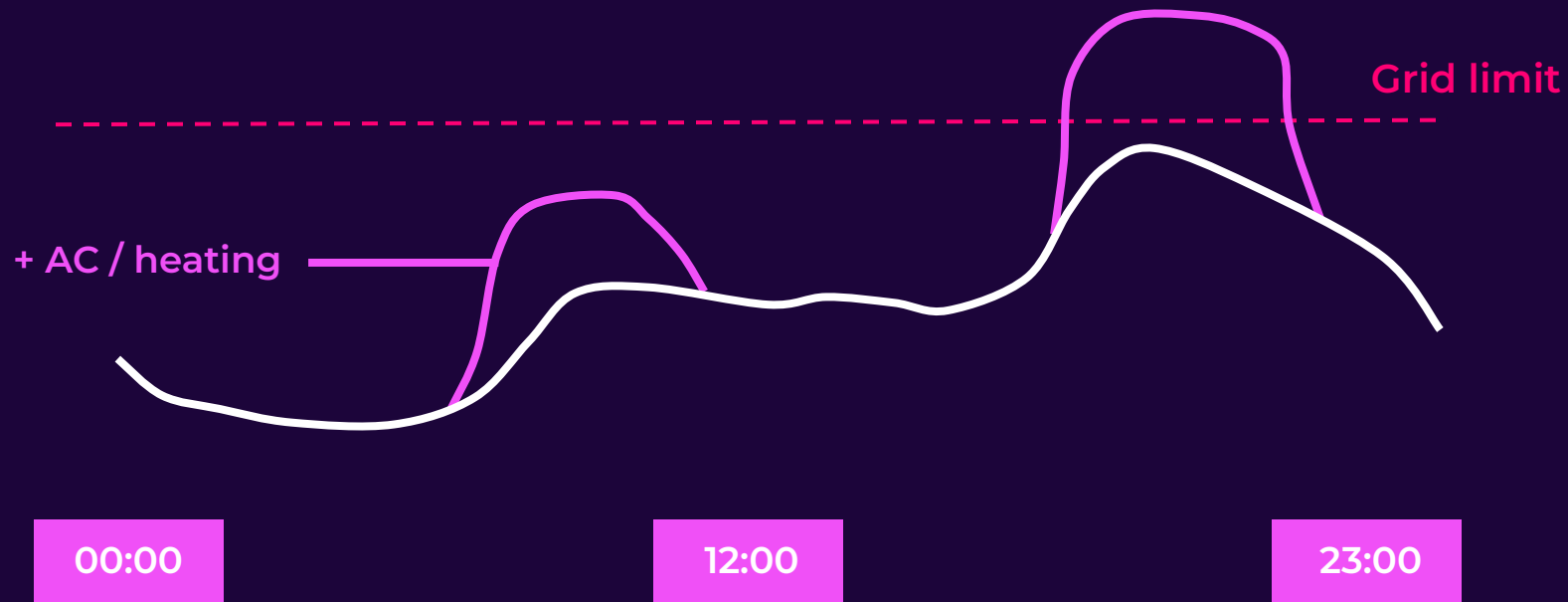
Source: ENER based on ENTSO-E

# Energy use is changing

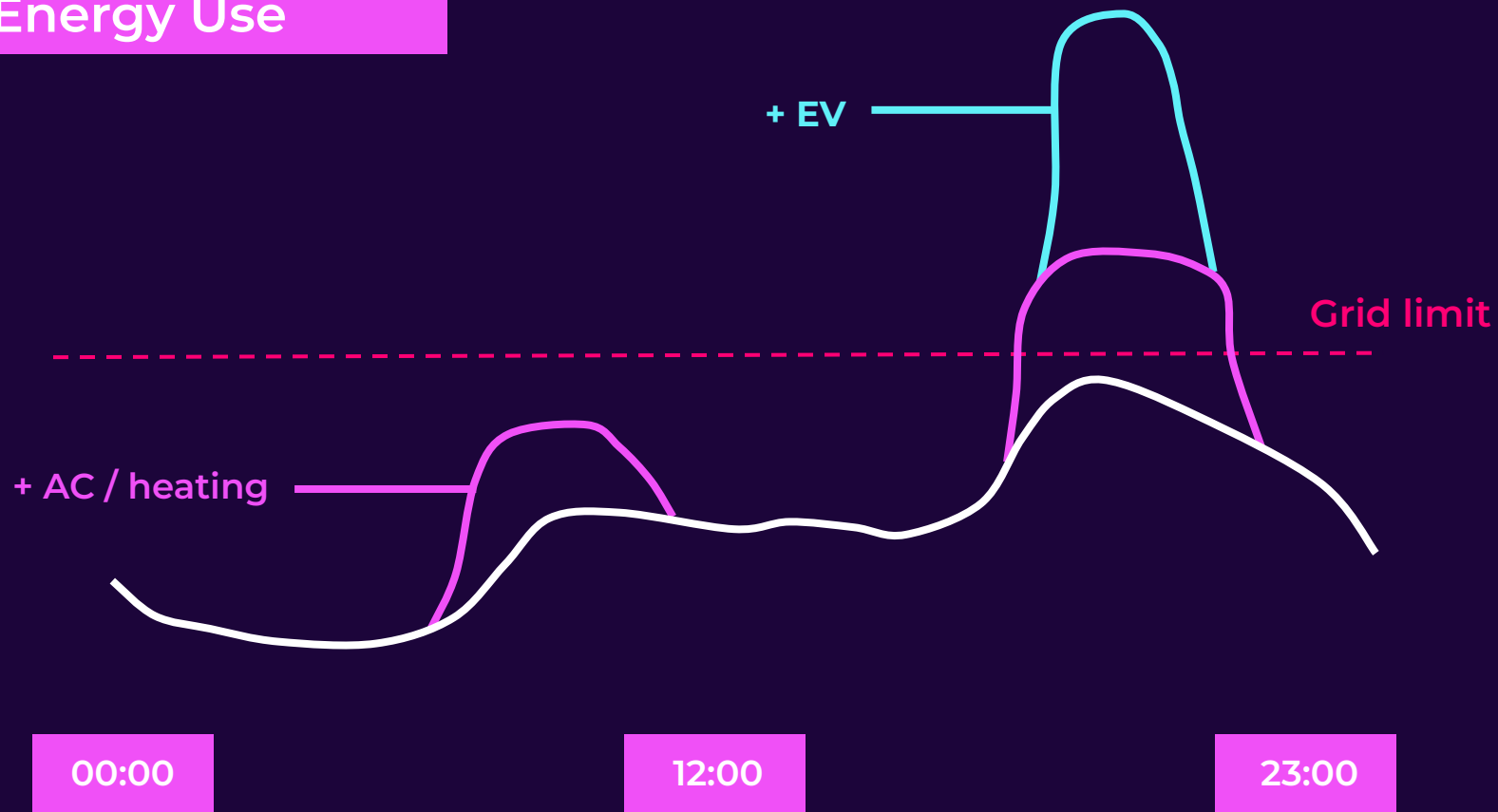
Energy Use



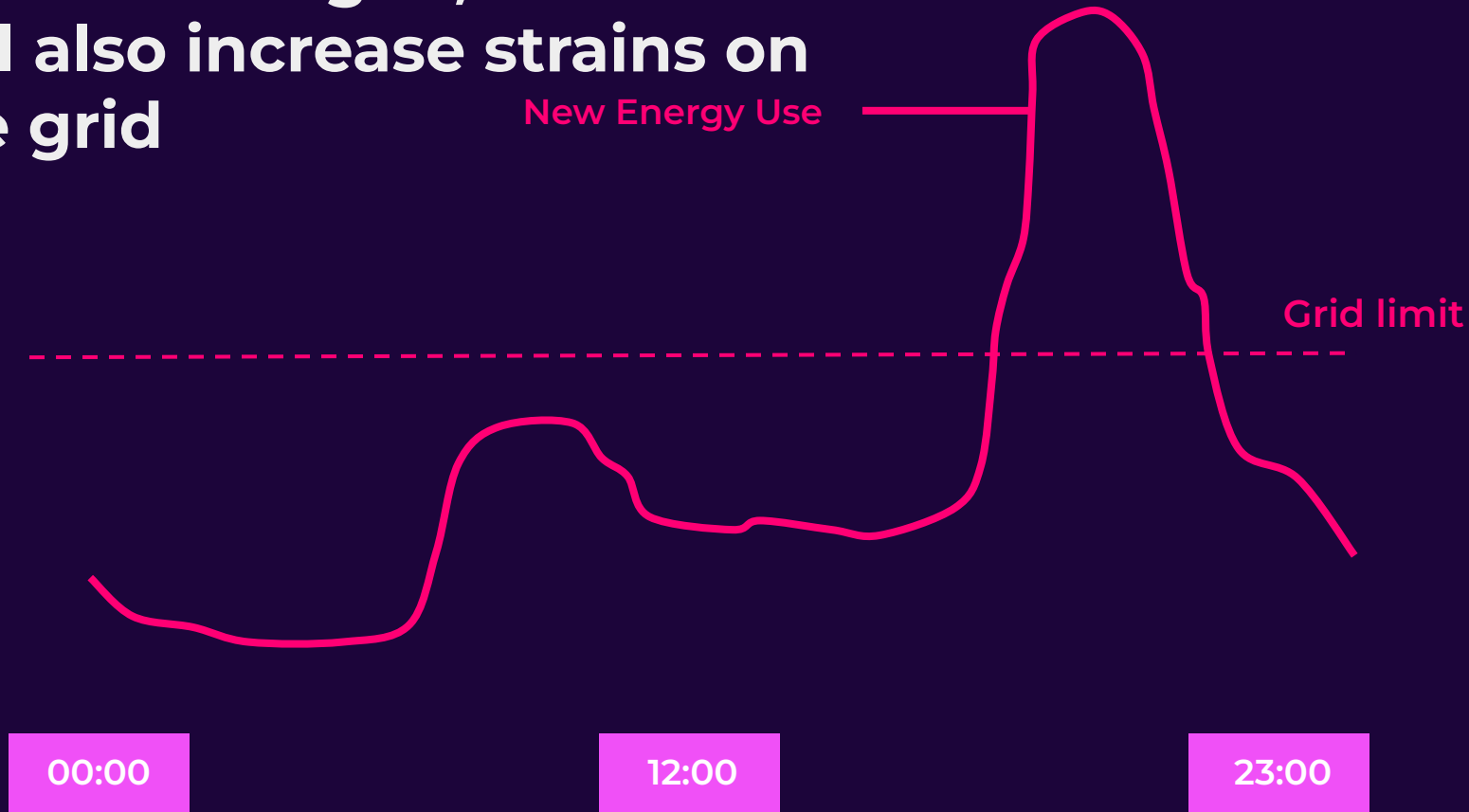
# Energy Use

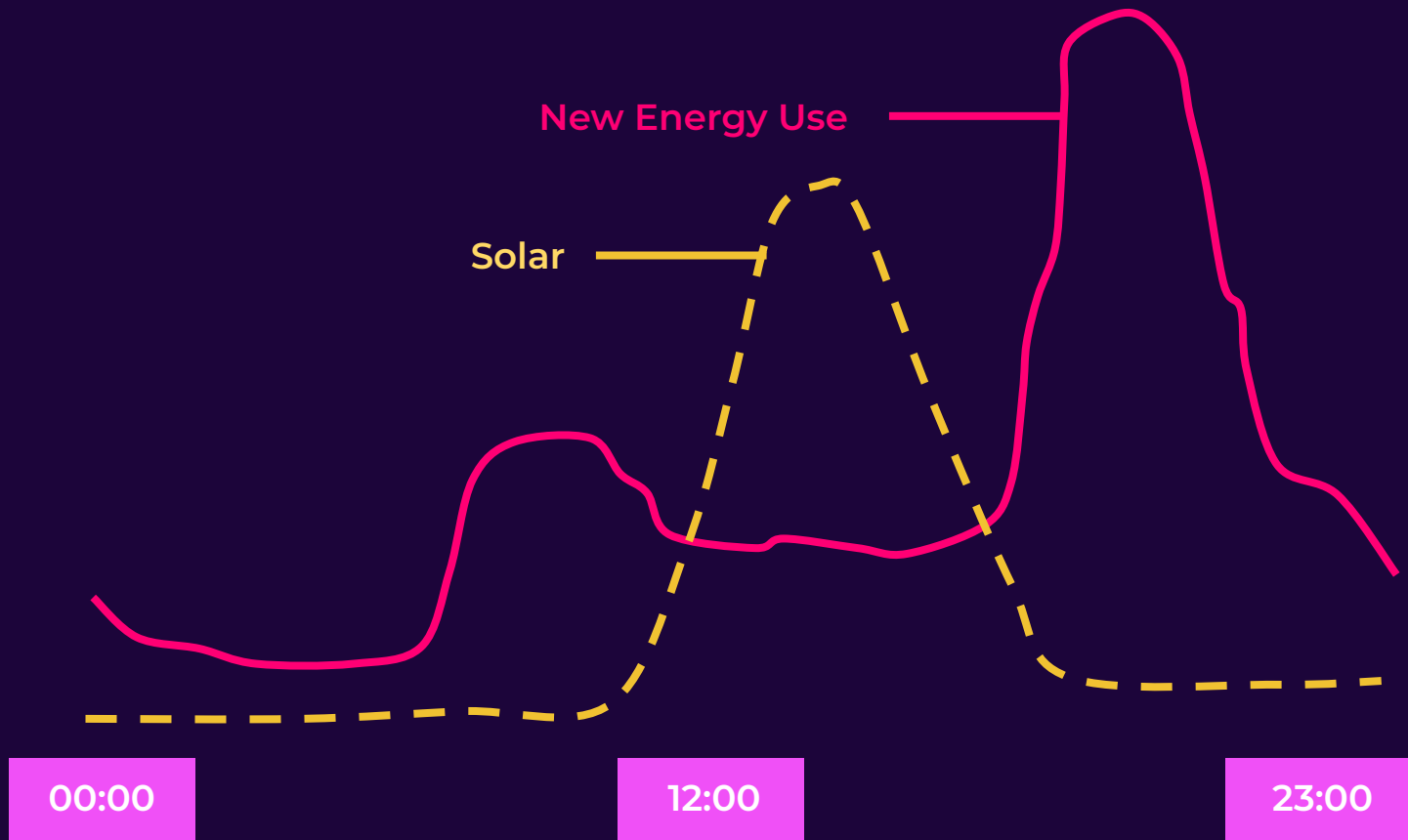


# Energy Use

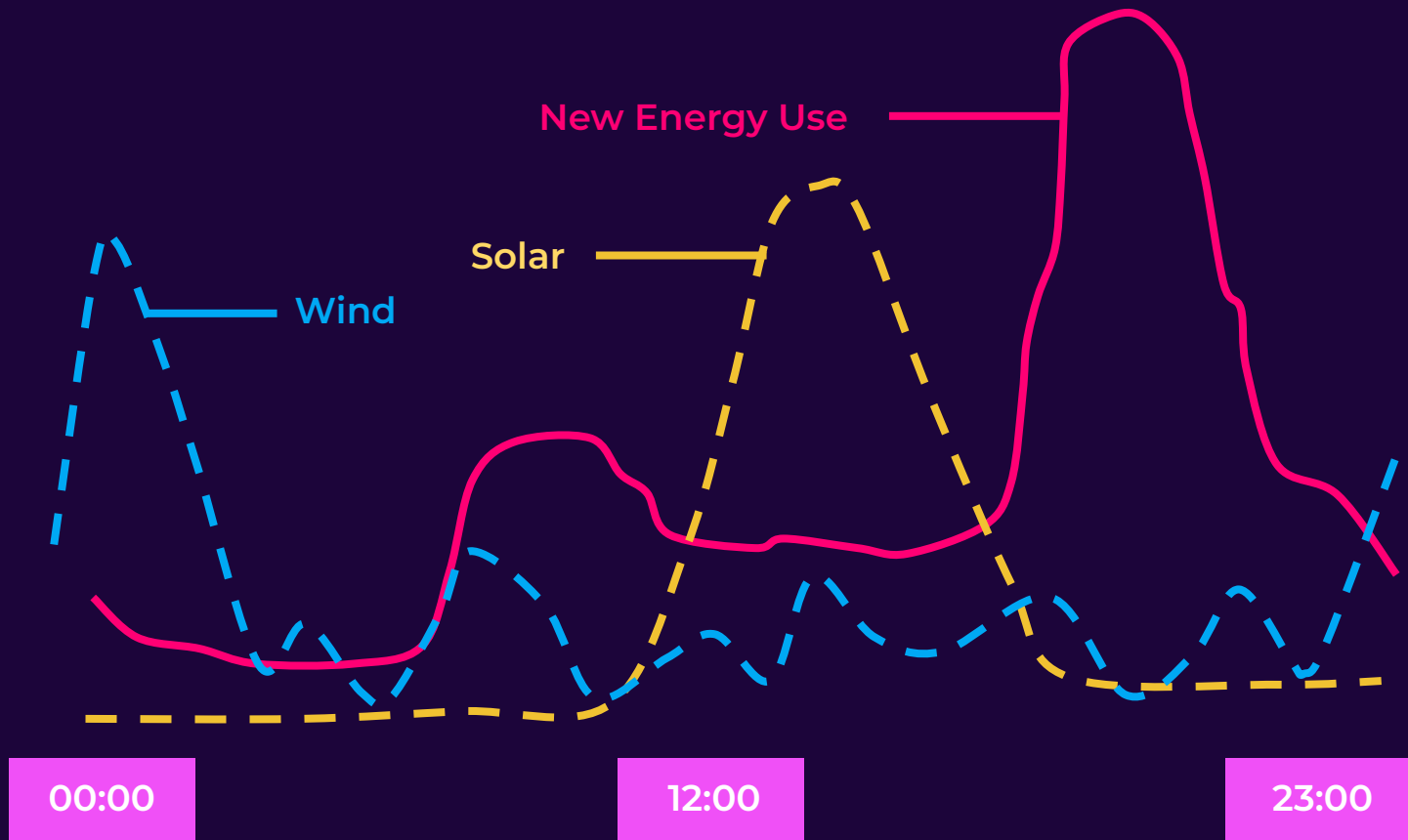


**Left unmanaged, new load  
will also increase strains on  
the grid**









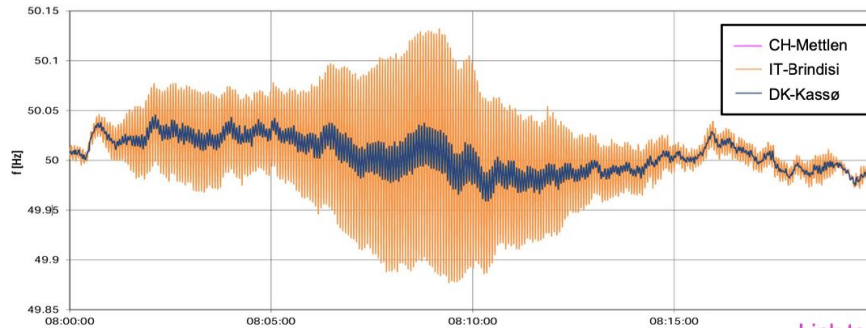
# We have created systems complex system of systems

Currently, there is only a reactive approach to combating oscillations on the network and no real-time monitoring or control is in place. Instability risks related to new phenomena are not underpinned by normal practices/analysis and not covered by existing industry classifications, codes and standards, **therefore the networks do not have enough understanding or the correct tools to react effectively to new instabilities and reduce their impact.**

# We have created systems where the interplay creates effects we can only respond to..

1 February 19<sup>th</sup> and 24<sup>th</sup>, 2011

## Interarea Oscillations (North vs South) of frequency $f=0.29$ Hz



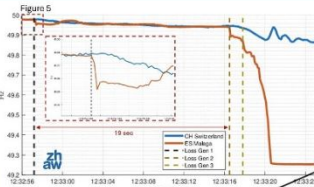
[Link to s](#)

- **Triggering Location:** Italy
- **Duration:**  $\approx 15$  minutes
- **Max oscillations amplitude:**  $\pm 100$  mHz
- **Main Reason:** No clear reason, possible triggered by standard generation patterns
- **Solution:** Real-time Redispatch
- **Lessons learned:** Reinforcement of PSS in Italy and recommended to do the same in the CE power system

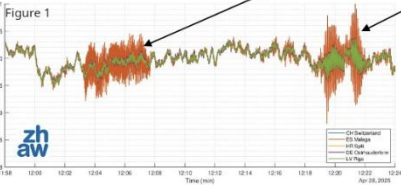
9

April 28<sup>th</sup>, 2025

## Iberian Blackout



[Link to source file](#)



- **Source:** Unknown
- **Duration:**  $\approx 16$  hours
- **Main effects:** The power system of Portugal and Spain suffered a total blackout.
- **Reason:** Unknown
- **Solution:** Gradually restore elements according to their response possibilities: lines between France and Spain, interconnection with Morocco, and start up operation of hydro power plants in Spain and Portugal (black start).
- **Lessons learned:** See the next slide

# We need new tools, technologies and approaches:

**FAST**



Very fast frequency  
products  
(sub-second)

**STABLE**



Grid forming  
inverters  
Synthetic inertia

**FLEXIBLE**



Demand  
Flexibility



**Flexibility**

# Demand flexibility as an ornament?



# Currently we have lots of flexibility

Flexibility is required on a second by second basis to balance complex electrical systems

In traditional (pre-transition) systems, the flexibility comes from gas-fired and coal-fired generation that vary output to meet demand: **supply flexibility**



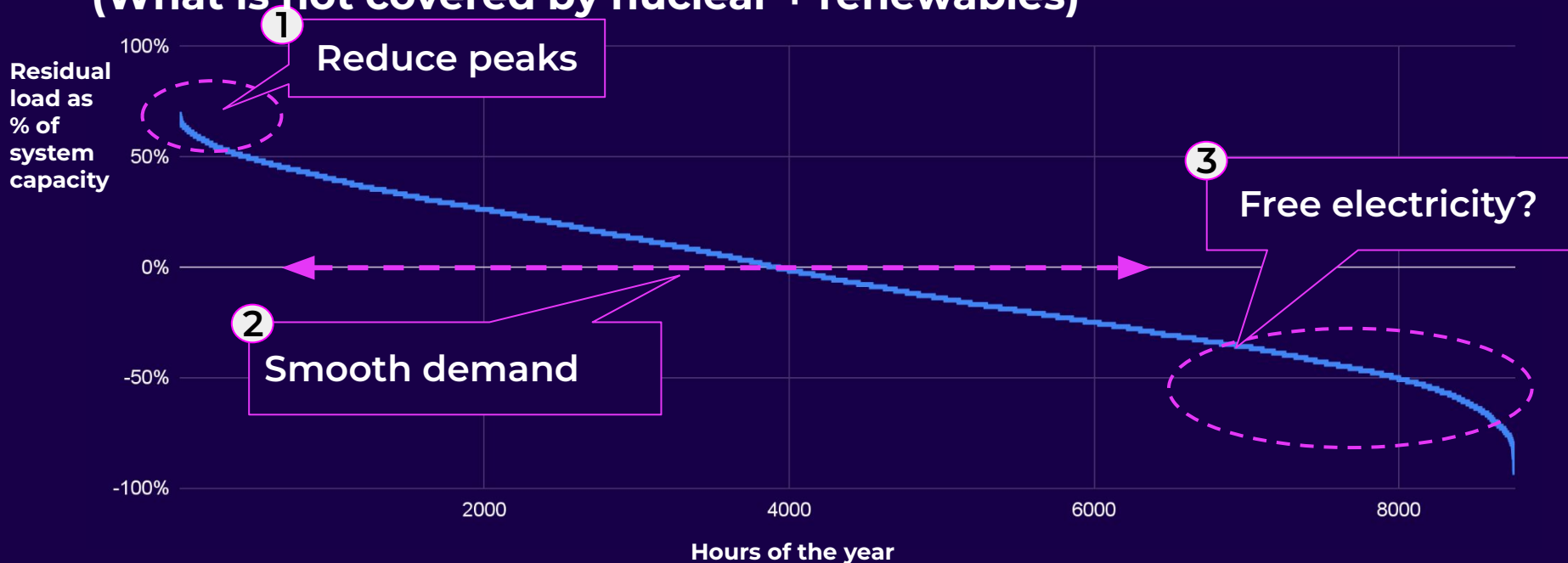
**In post-transition electricity markets,  
flexibility needs to be embedded in  
demand**



# Flexibility can create value for the wholesale system in different ways

Modeled residual load curve in 2035<sup>1</sup>

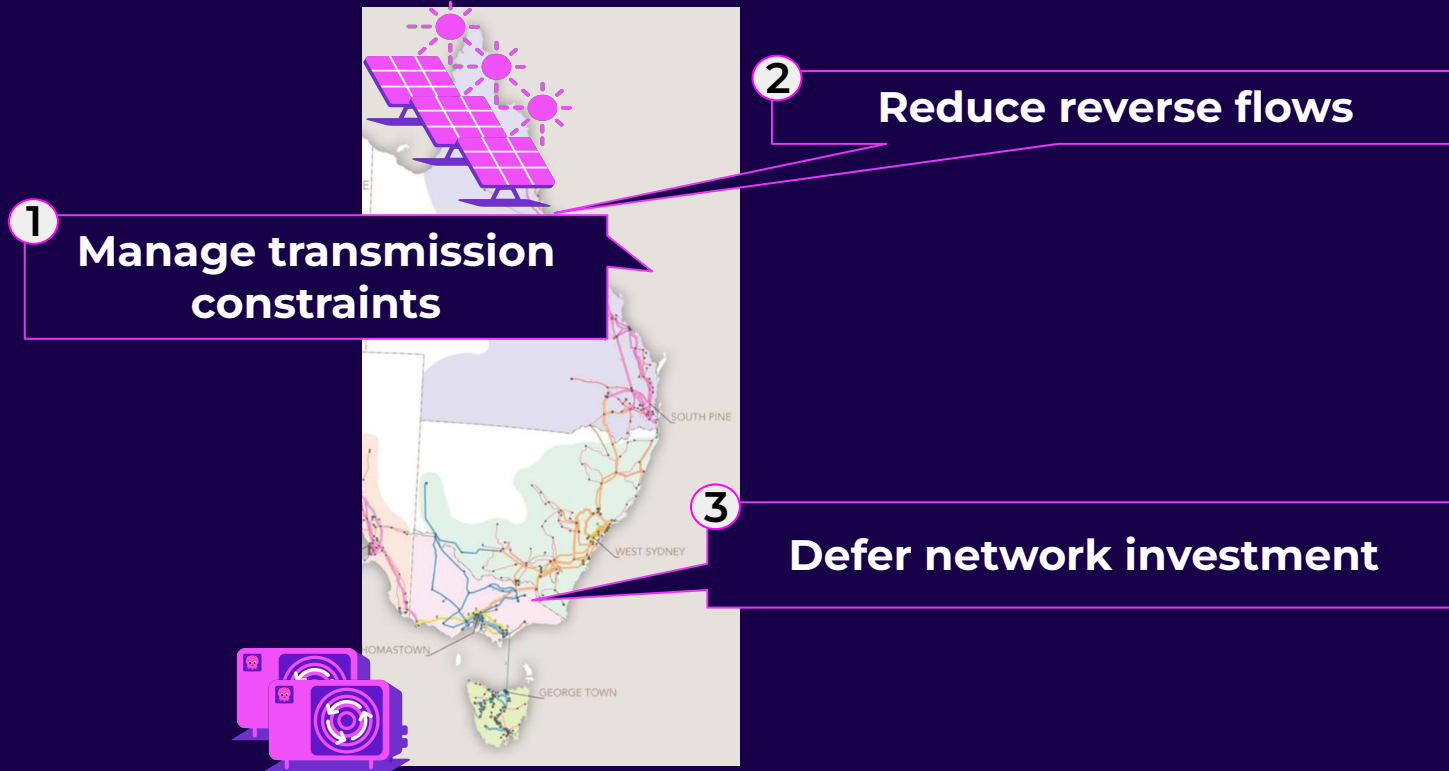
(What is not covered by nuclear + renewables)



1 - Climate Change Committee modelling, 2023

Note - Positive residual load = % of demand unmet by renewables + nuclear

# Flexibility can also create value for the networks





**How do we get  
effective demand  
side flexibility**

# Three flavours of activating intelligent demand

Tariff-led



Time of use  
tariffs (Cosy,  
Flux, Agile)

Campaigns



Saving  
Sessions,  
Power Ups,  
Free  
Electricity  
Sessions

Automated



Intelligent  
Octopus



Dr Peter ISP



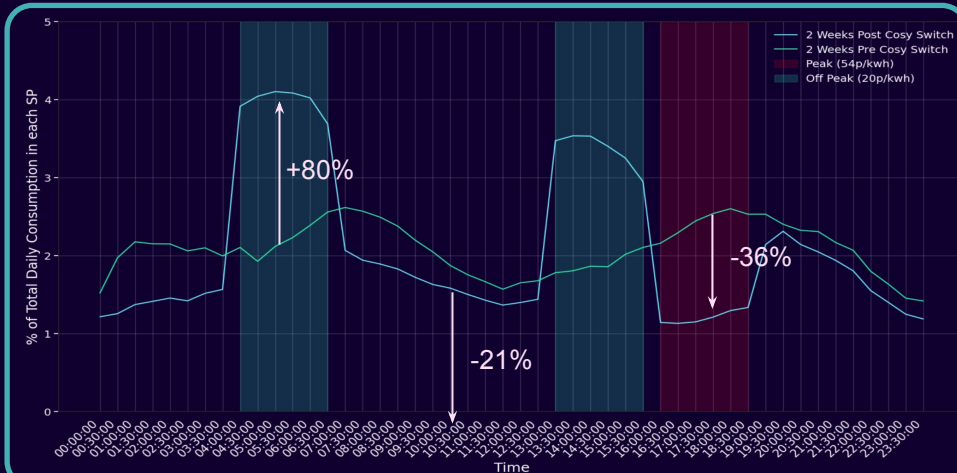
@WingsEcosse

## Tariff-led

@OctopusEnergy I'm on track to almost halve my BG bill on your Cosy tariff which lets me schedule HW & Heat for low usage times.

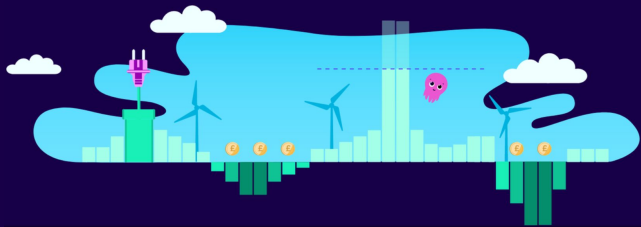
Thank you, why didn't I do this sooner?

### Agile Octopus




An energy company that pays  
you to use energy

# Agile Octopus



## Tariff-led

 **Has he gone yet?**  
@jas\_mic

@OctopusEnergy agile plunge price from 12.30 until 16.00 so let's make bread. Maybe half will become pizza? My wife is out picking raspberries for the next batch of jam.

 **Ev-Claire and Scott (EV family)**  
@EClaire.scott

Thanks @OctopusEnergy our home mini arrived today. Perfect day for it to arrive and set up showing the #agile price plunge



 **Octopus Energy**  
@OctopusEnergy · Follow

Replying to @vocnorth and @LeeAndersonMP\_

Can confirm 😊 Agile customers paid nothing (and sometimes, we even paid them) to use power over the weekend. [x.com/tomwarren/stat...](https://x.com/tomwarren/stat...)

 **Tom Warren**  
@tomwarren

Replying to @tomwarren

🌊 overnight on Octopus Agile. A solid 1.5 hours of being paid to use electricity

02:30 – 03:00	0.00p/kWh	🔵
03:00 – 03:30	0.00p/kWh	🔵
03:30 – 04:00	0.00p/kWh	🔵
04:00 – 04:30	0.04p/kWh	🟢
04:30 – 05:00	0.22p/kWh	🟢
05:00 – 05:30	0.22p/kWh	🟢
05:30 – 06:00	0.22p/kWh	🟢
06:00 – 06:30	0.00p/kWh	🔵
06:30 – 07:00	2.31p/kWh	🟢
07:00 – 07:30	0.22p/kWh	🟢
07:30 – 08:00	0.44p/kWh	🟢

2:33 PM · Mar 25, 2024

♥ 44    💬 Reply    🔗 Copy link

[Read 9 replies](#)



**Matt Wilson**  
@nottmpm · Follow

I'll take that! Negative price for using electricity right now 🙌🙌

Price plunge this morning for @OctopusEnergy Agile customers. The reason being a surplus on the @nationalgrid from sunny and windy conditions thanks to renewables #Electricity

09:30 – 10:00 0.21p

10:00 – 10:30 0.47p

10:30 – 11:00 0.00p

11:00 – 11:30 0.00p

**-0.63p/kWh**

CURRENT PRICE

**48.66p/day**

STANDING CHARGE

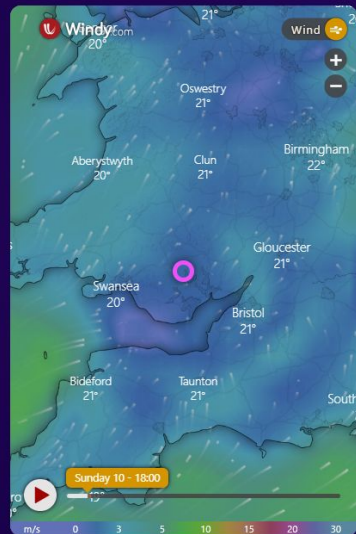
8:05 AM · Mar 23, 2024

♥ 3    💬 Reply    🔗 Copy link



Tariff-led

## #2 Fan: Caerphilly

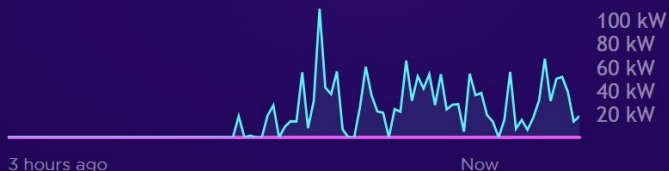


REALTIME DISCOUNT

**20% off**

For homes in CF81, NP24 postcodes

GENERATION



CURRENT CONDITIONS

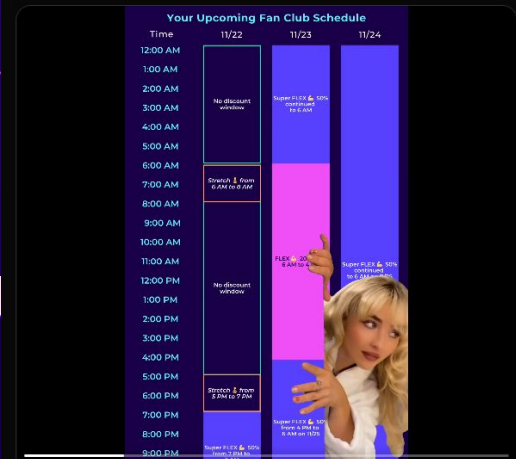
Wind speed

↑ 4 m/s

Power output

18 kW

**Octopus Energy US** @OctopusEnergyUS · Nov 22, 2024  
The **Fan Club** discounts this weekend have us feeling ✨ light as a feather ✨ because our customers are saving 50% off all the energy they use 🙌  
  
The **Octopus Fan Club** is one of the only plans available that pays Texans to use more energy when the wind energy is dominating the



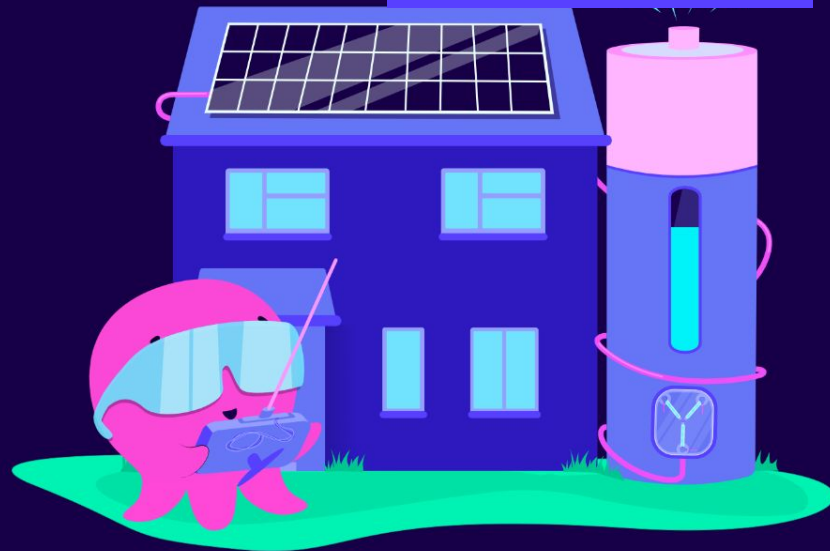
Tariff-led

# Introducing Octopus Flux

Unleash the potential of solar  
and storage to reduce your bills

## Octopus urges customers to act now for £420 off their energy bill

Sunsave, Octopus' partner, has explained 7,000 households have joined 'Sunsave Plus' waiting list in just over nine months - and are cutting bills.




Where the Wild Things Tweet  
@WildGCTweets



I'm on Intelligent Octopus Flux, so I import and export at the same rate, and the price per KWh varies between 22 and 29p. I use my battery to import at 22, and export at 29. Last year I net exported 277 kWh, so profit of £61 plus I used 1400 of solar so saved £308.



# Campaigns



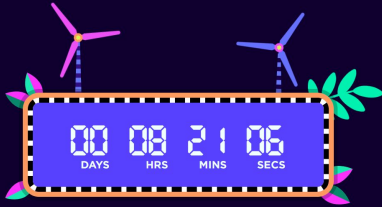
## SAVING SESSIONS

Use less power tomorrow for 2 hours between 16:30 - 18:30

☒ You've opted in [More info](#)

Menu octopusenergy Log out

### SAVING SESSIONS




The next Saving Session:

Today for 1 hour between 17:30 - 18:30 GMT

Earn 1800 OctoPoints - worth £2.25 - for every unit of power you cut down ☺

Opt in now to earn rewards

☒ You've opted in



So far you've earned 6432 OctoPoints (or £8.04) over 7 Saving Sessions

Last updated after the Session on January 30th

So far in Saving Sessions, Octopus customers have saved

804,320 kWh ☺


That's the equivalent of

boiling the kettle 3,574,755 times

This saves as much CO<sub>2</sub> as

96,856 trees ☺

absorb in a year



Stats calculated on January 24th

13:51 5G

< Saving Sessions al... 453K followers

Sat, 2 Mar

**SURPRISE SAVING SESSION** alert, 6:00PM TODAY ⚡ Opt in online or via the app

14/3/24 6:00PM-6:30PM 14th March

Use less power 6:00PM-6:30PM and earn 1400 Octopoints (£1.75) per kilowatt hour for anything you save compared to normal

This one's on us: Customers in Saving Sessions are powering the energy transition. They deserve fair payment.

National Grid ESO has set the price for the last few Sessions too low. This time, once again, we're choosing to pay for our customers so you can still take part for a fair reward.

One random customer will win 800,000 Octopoints (£1,000) prize

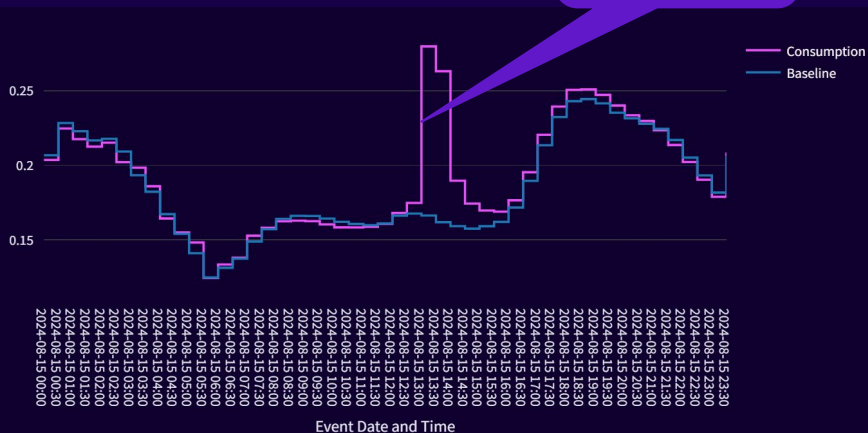
**STREAK BONUS:** If this is your second (or more) session in a row - you'll get 100 bonus Octopoints for just opting-in and 8 more chances to win the prize.

**STRUGGLING TO OPT IN?** Go make a cuppa and check back in a bit. There's usually an initial rush that dies down quickly.

# Campaigns



**Consumers  
increase  
consumption**



**Power-ups: Opt in to Power up for free at 7:00 pm - 11:00 pm, Sunday 21/01/2024**



Hi

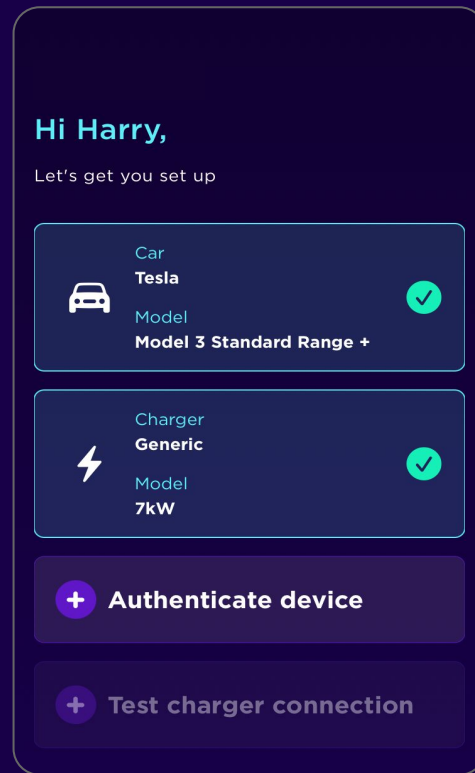
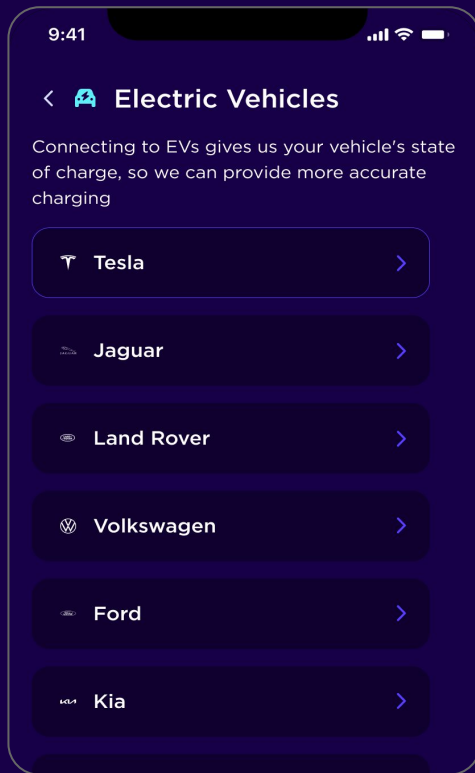
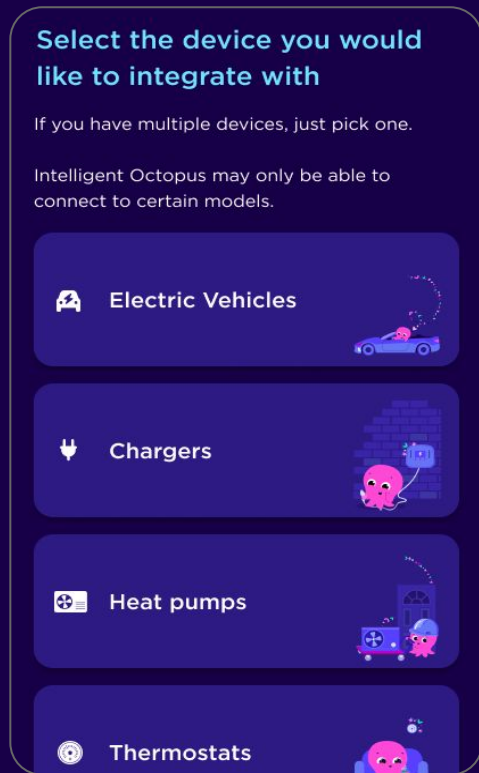
We'll make your electricity free at [REDACTED] between **7:00 pm - 11:00 pm** on Sunday 21/01/2024. Get ready to Power up!



**Automated  
flexibility =  
dispatchable  
demand**

# Intelligent Octopus - ultimate simplicity for users

Automated



Automated

Cut your EV charging costs by up to 70%

## Intelligent Octopus Go: the UK's most popular EV tariff

Automatically charge your car when it's cheapest and get **super low smart charging rates** plus 6h of cheap energy for your whole home every night.

Will it work for me?



Charge for only 7p/kWh  
up to 70% less than price cap rates

# Snug Octopus for storage heaters

Automated



**Octopus Energy** @OctopusEnergy · Nov 18, 2024

Octopus customers have saved over £100m by shifting their energy use with smart tariffs & schemes.

Our latest smart tariff – Snug Octopus – helps homes w/ storage heaters save ~£140/yr while keeping cosy this winter.

Find out more and join: [octo.ps/snug](https://octo.ps/snug)

## Introducing Snug Octopus

octopusenergy



### Cheap power for 6 hrs a night plus an afternoon boost



#### Pay less to keep cosy

Automatically charge your storage heaters at the cheapest and greenest times of the day.



#### Making tea-time toasty

Our afternoon boost gives you an hour of cheap heating to keep you snug all evening.



#### Easy control comfort

Tell us how warm you want to be each day, we'll set your bespoke schedule.

🏠 > Lifestyle > Money > Fuel Bills

## New Octopus Energy smart tariff can help people with a storage heater save £139 each year

'Snug Octopus' could save the average customer almost £140 a year on energy bills.





# POWERPACK



Automated



## The first Vehicle-to-Grid tariff has launched

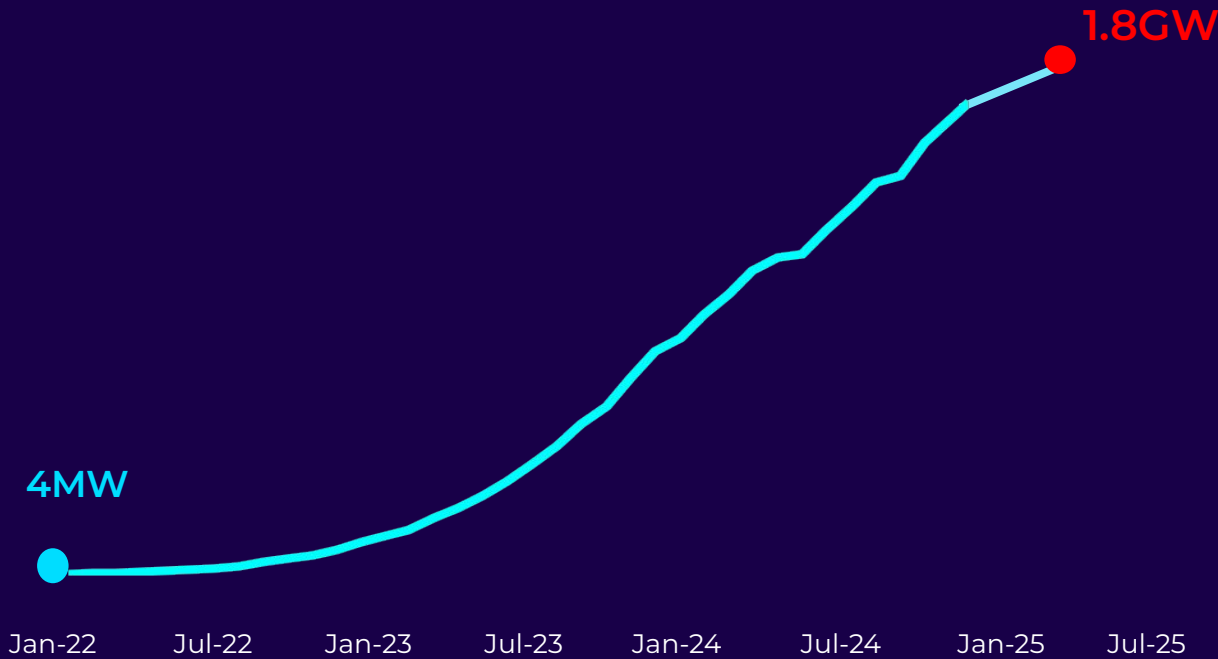
## Providing ZERO cost charging for V2G EV Drivers

Been an Octopus customer for yrs - both [@OctopusEnergy](#) & [@OctopusEV](#) on [#Powerloop](#) V2G trial, will be sticking with them.

Now with a [@GivEnergy](#) home battery 🏠 we're only using grid power at night, and sending a small amount back to the grid in the day 👍

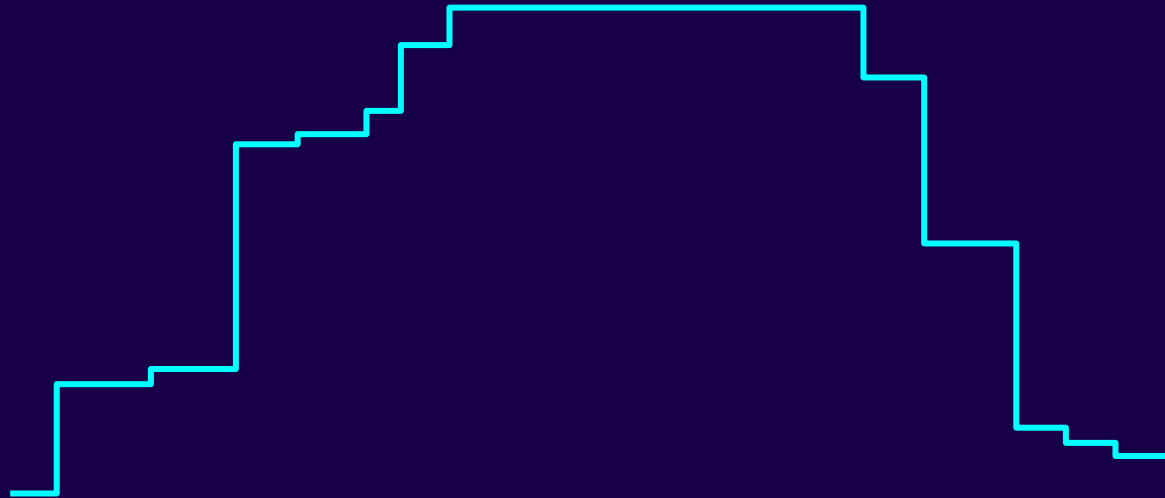
# Consumers love it

Assets on Intelligent Octopus



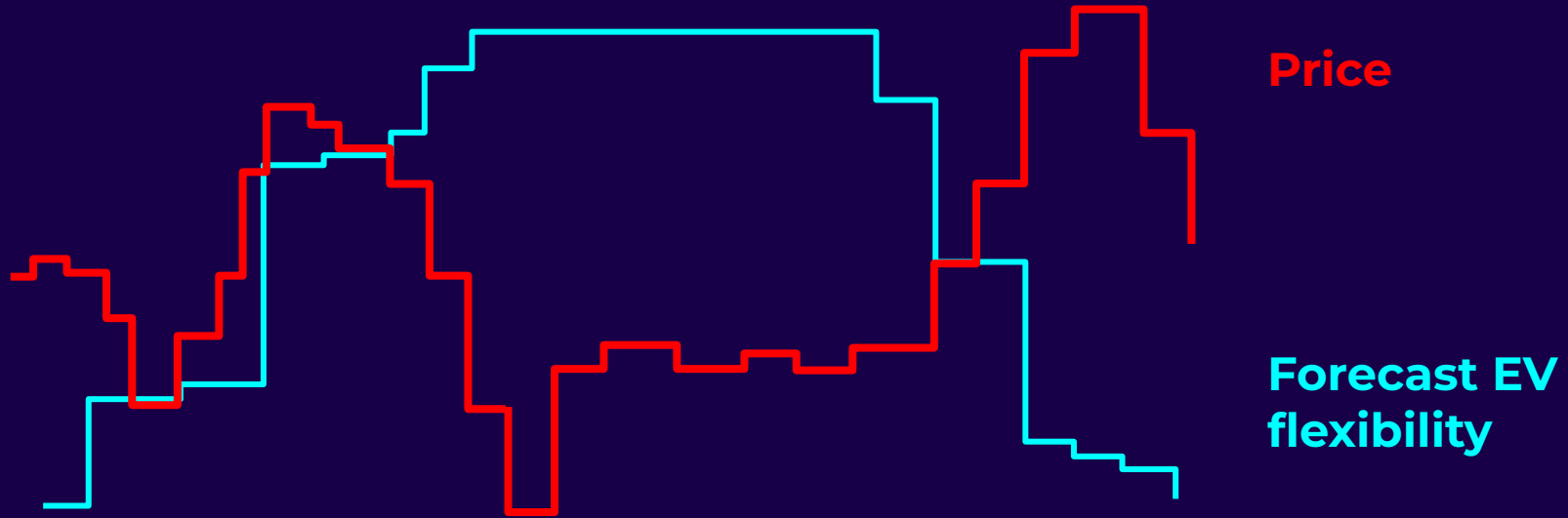


**We manage devices on behalf of consumers and  
get them to consume when electricity is cheap**

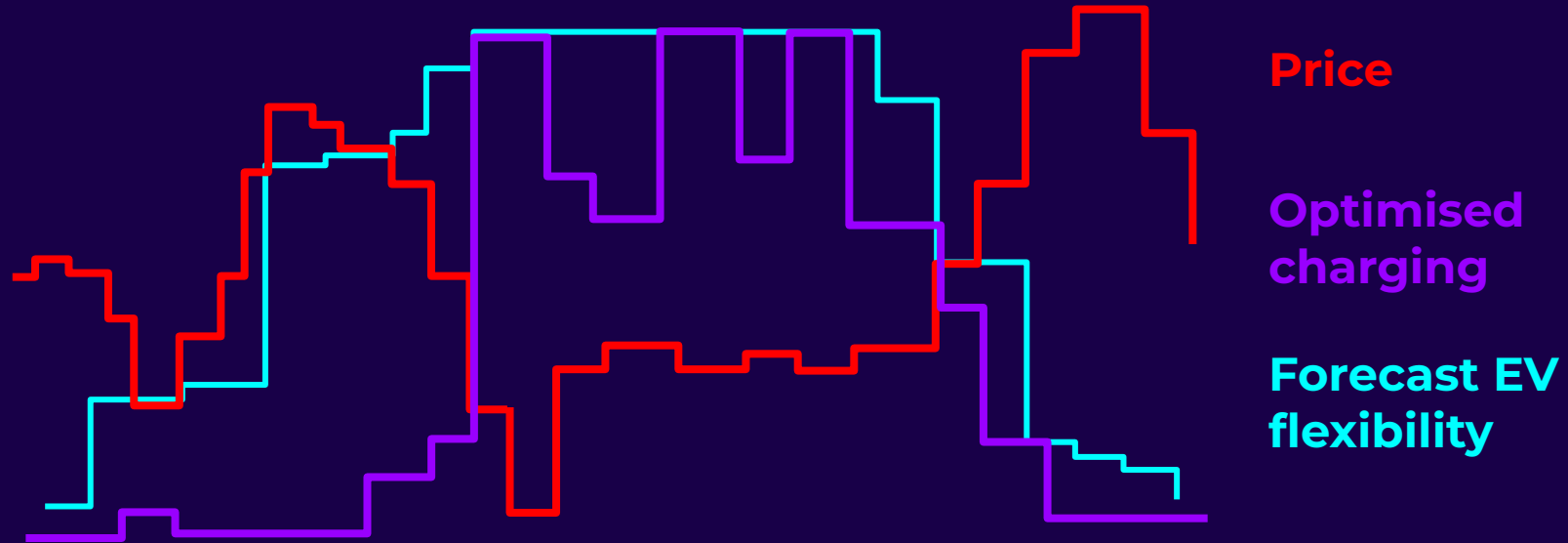


**Forecast EV  
flexibility**

**We manage devices on behalf of consumers and get them to consume when electricity is cheap**



# We manage devices on behalf of consumers and get them to consume when electricity is cheap



# Intelligent Octopus

Standard rate

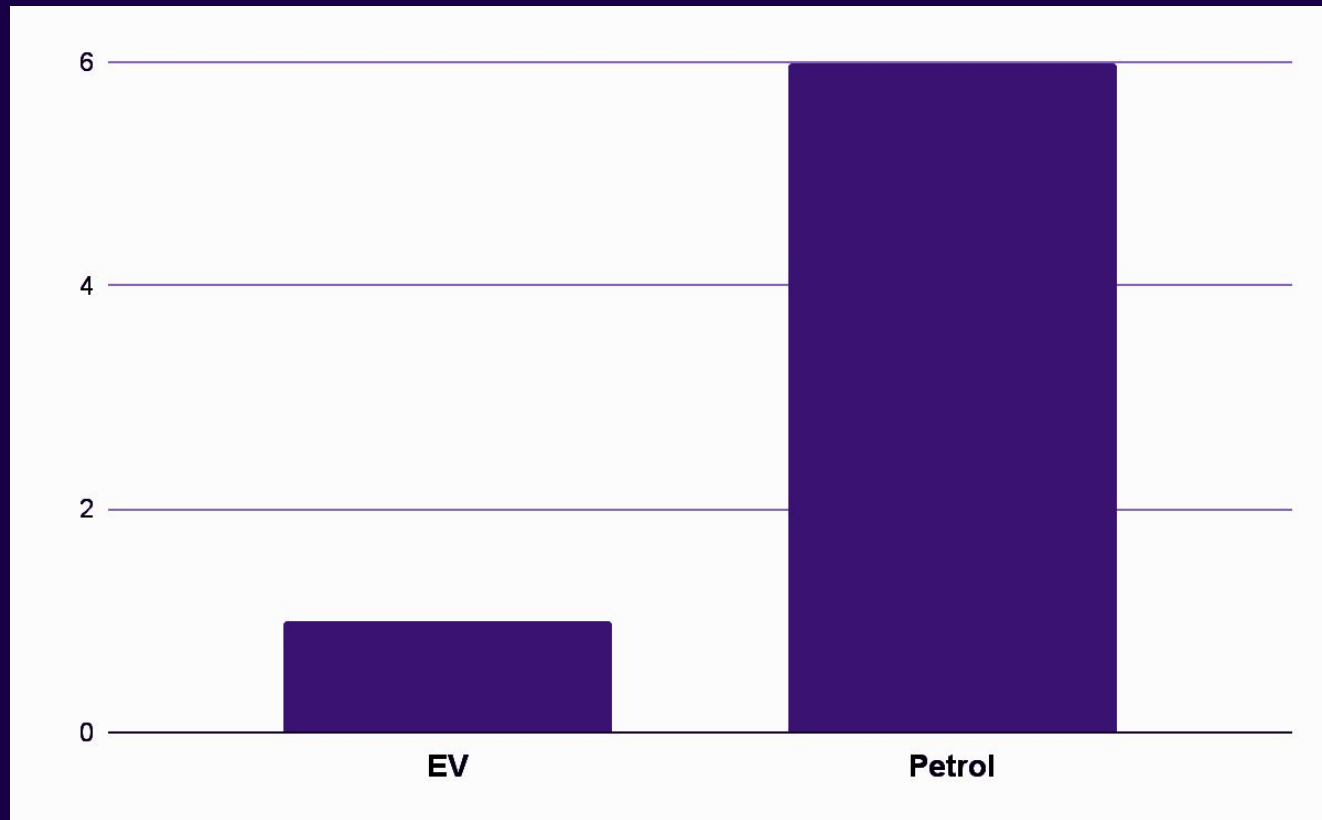
£0.26  
per kWh

Smart charging rate

£0.07  
per kWh

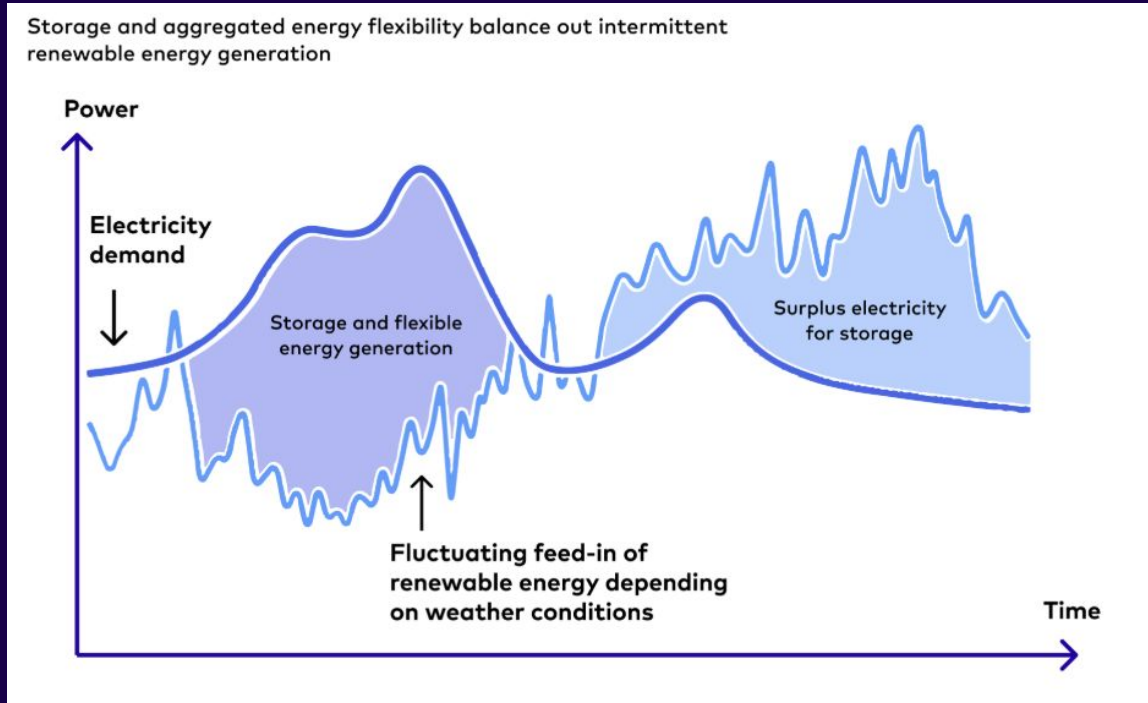
# Six times cheaper to run than petrol vehicle

Save up to £1600 per year compared to a petrol vehicle



**Dispatchable demand is  
transformative, and key to a lower cost  
electricity system**

# Flexibility reduces the cost of integrating renewables

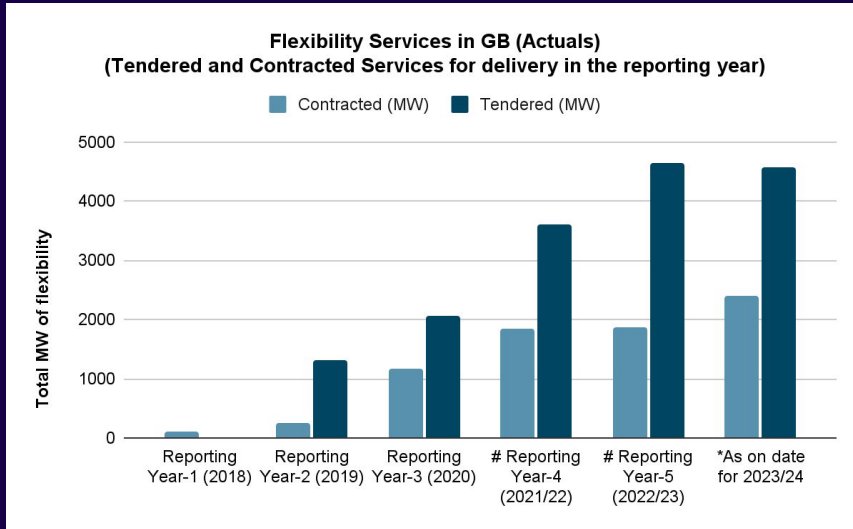


(Source: LichtBlick AG)

# Dispatchable demand reduces the cost network costs

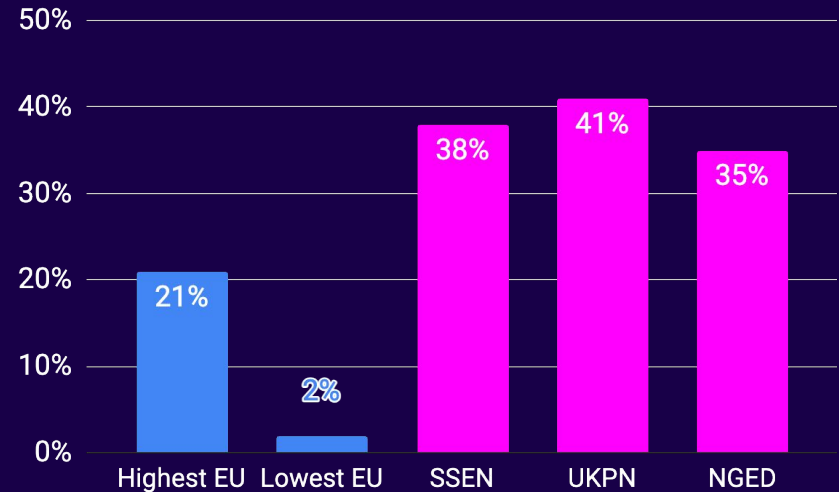
Through deferral of investment....

**2023/34 disclosed reinforcement deferral via flex procurement (£m)**



**Source:** DSO performance reports

...and increasing asset utilisation



**Source:** GB DSO data portals, JRC DSO Observatory 2018



# Flexibility reduces system costs

## Redispatch costs



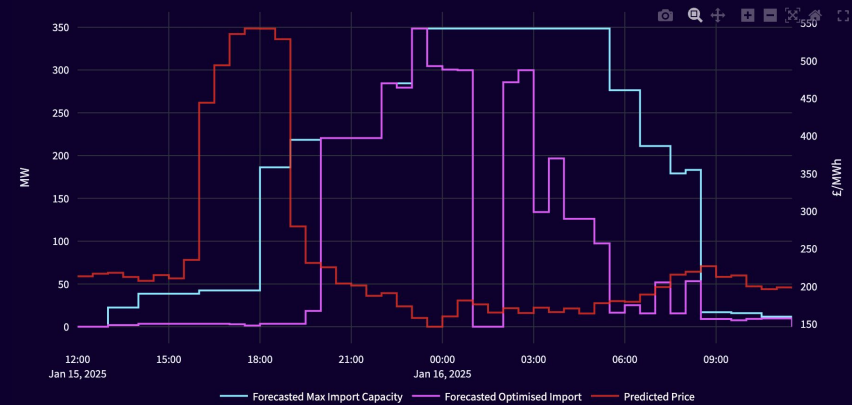
## Capacity Markets

### Optimisation

Please Select Optimisation Date

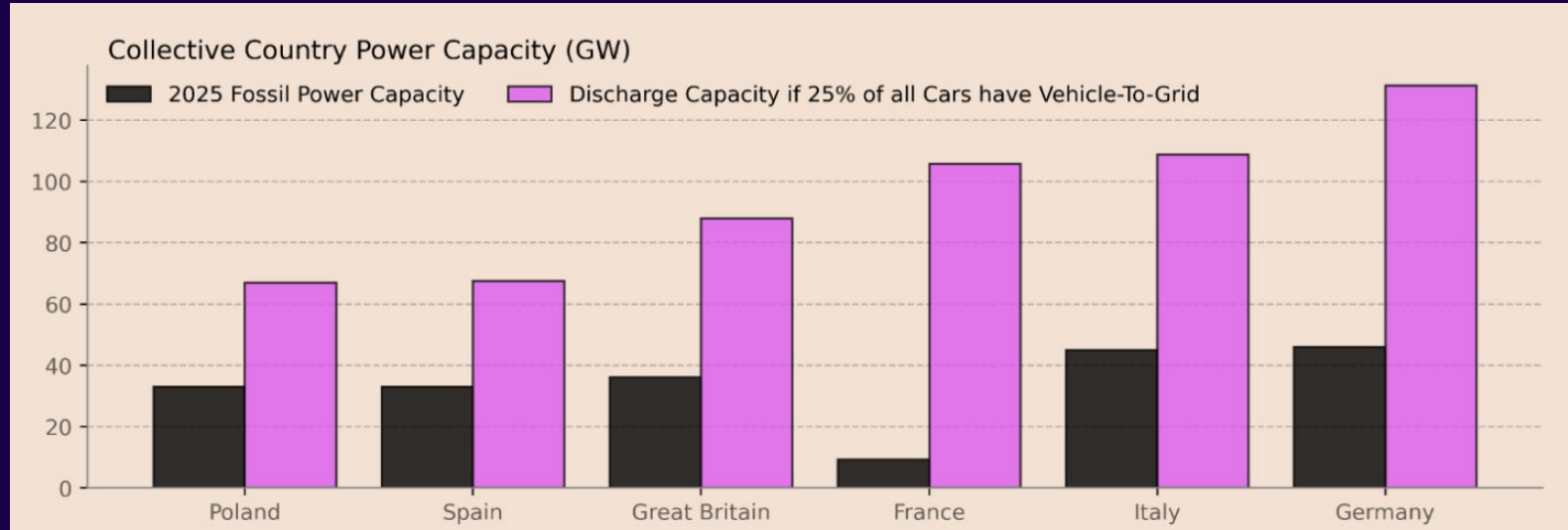
2025/01/15

Show Price



# When V2G scales up - it will be transformative

## Modelled V2G Capacities 2035





**How does it all  
work?**

# Nudge consumers and devices with price

Increasing network congestion

The diagram features a large blue arrow pointing right, representing 'Increasing network congestion'. Below it is a smaller white arrow pointing right, representing a 'Dynamic price signal (co-optimisation of wholesale + network)'. To the left of the white arrow, a blue arrow points down from 'Causer pays, low SO intervention' to 'Network pays, high SO intervention'.

Causer pays,  
low SO  
intervention

Dynamic price signal (co-optimisation of  
wholesale + network)

Network pays,  
high SO  
intervention

# Make sure DSOs have the tools for faults

Increasing network congestion

The diagram features a dark blue background. At the top, a large blue arrow points to the right, containing the text 'Increasing network congestion'. Below this, on the left, is the text 'Causer pays, low SO intervention'. To its right is a light blue arrow pointing right, containing the text 'Dynamic price signal (co-optimisation of wholesale + network)'. A large blue arrow points down from the 'Causer pays' text to the text 'Network pays, high SO intervention'. Below this, a horizontal dashed line separates the middle section from the bottom section. At the bottom left is the text 'Permanent “security” products/ requirements'. To its right is a light blue arrow pointing right, containing the text 'Pre-fault and post fault local flexibility markets (Reservation and activation)'.

Causer pays,  
low SO  
intervention

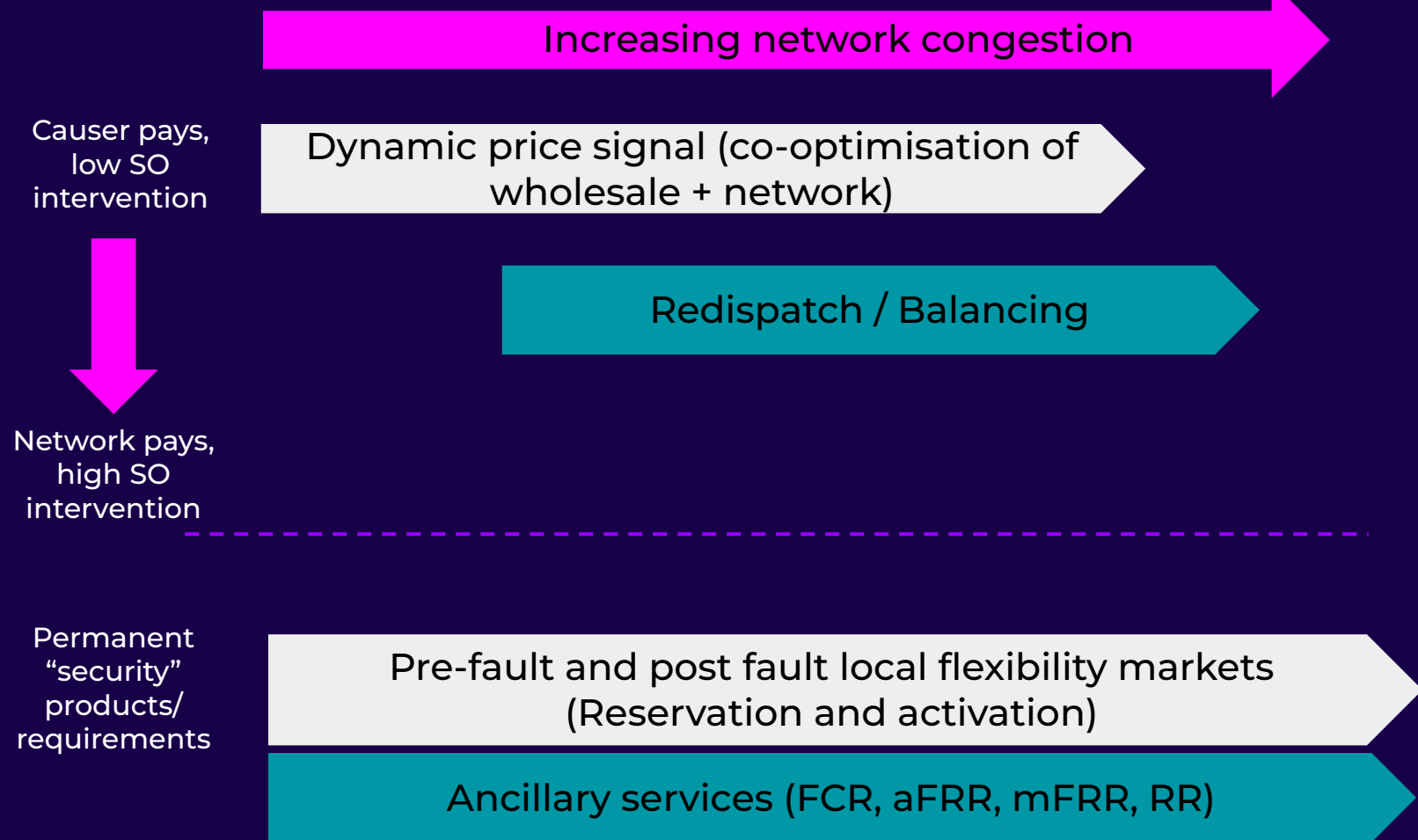
Dynamic price signal (co-optimisation of  
wholesale + network)

Network pays,  
high SO  
intervention

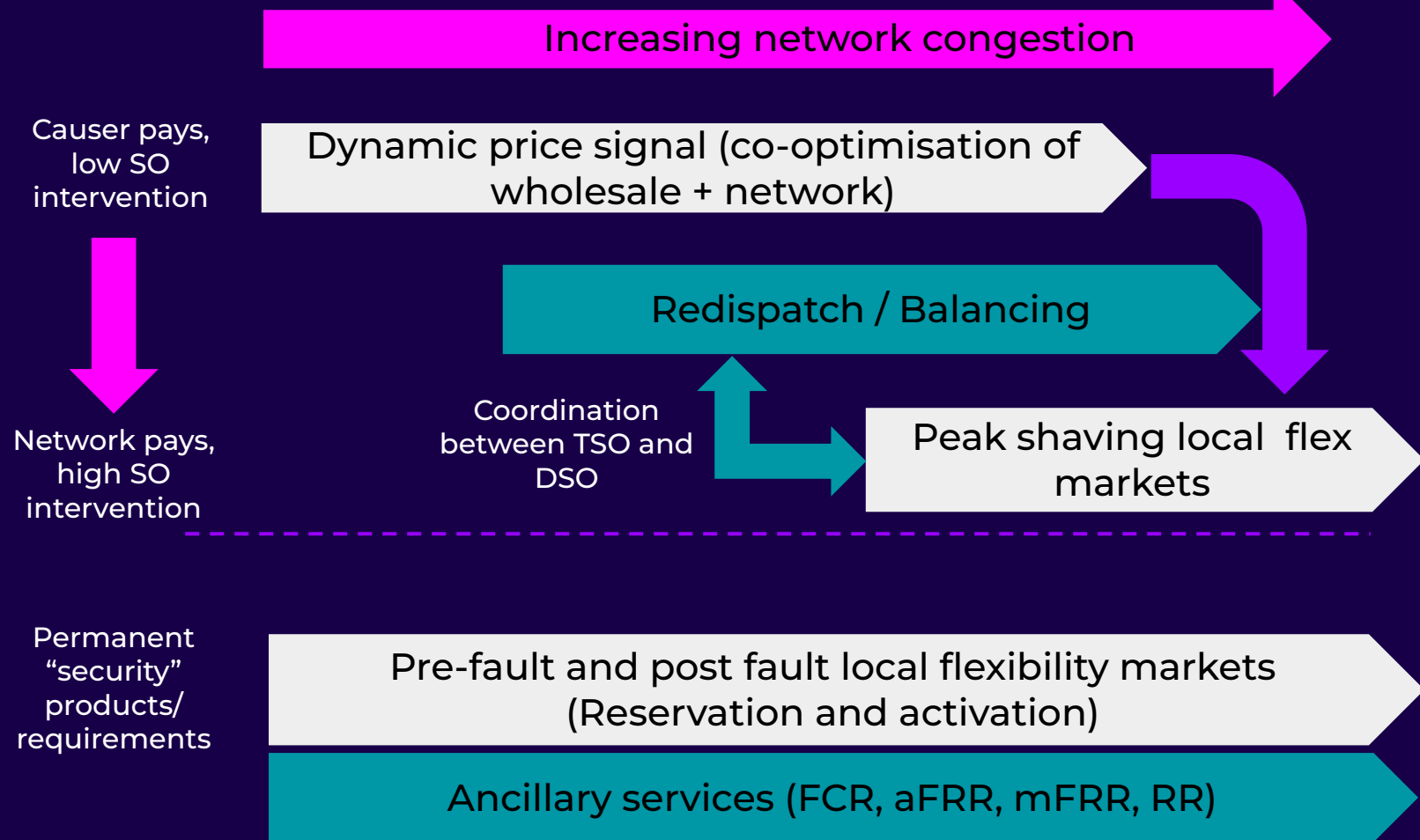
Permanent  
“security”  
products/  
requirements

Pre-fault and post fault local flexibility markets  
(Reservation and activation)

# And TSOs can use consumer flexibility..



# As congestion increases, use peak shaving





**Some  
conclusions**



# **We need post-transition electricity markets**

- **Power systems are changing rapidly in a way we are not expecting (RES+IBG, electrification), and are becoming more complex**
- **Electrification is providing a range of really useful resources**
- **We need to be actively building these markets if we are to keep the cost of the energy transition down**

# **We need new tools, technologies and approaches that leverage these new assets**

- **Grid scale batteries providing cheap fast frequency response (new markets and products for sub-second response)**
- **Markets for synthetic inertia (ensuring efficient deployment of grid forming inverters, repurposing existing assets)**
- **Flexibility embedded in demand => reduce costs, integrate renewables**

A satellite night view of Europe, showing the continent's outline and the dense network of city lights across the landmass. The lights are concentrated in major urban centers and along coastlines, creating a glowing pattern against the dark background of the oceans and the night sky.

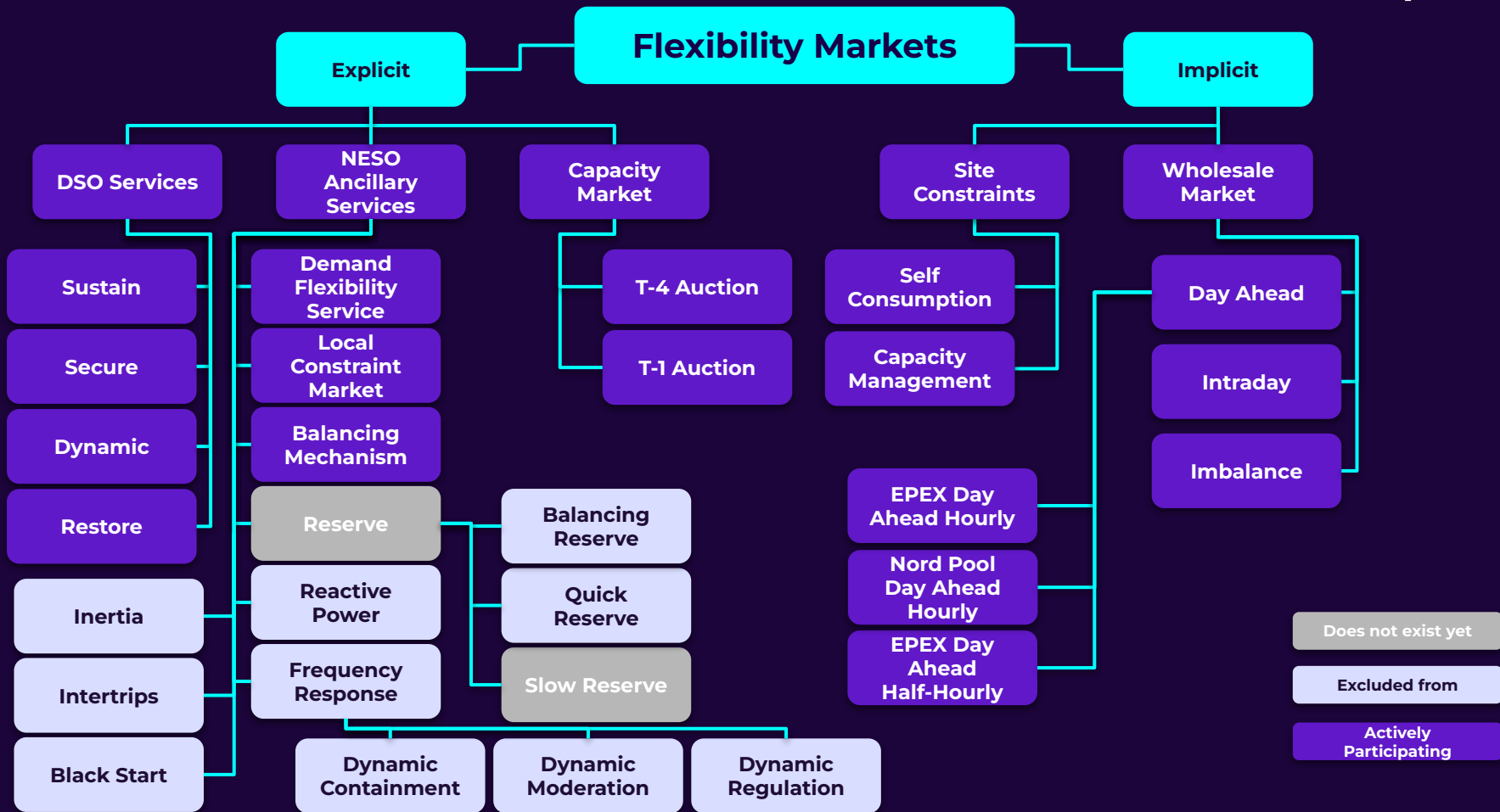
# Thank you

[marcia.poletti@octoenergy.com](mailto:marcia.poletti@octoenergy.com)

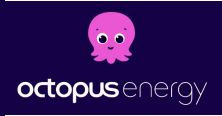


# Examples of flexibility in markets

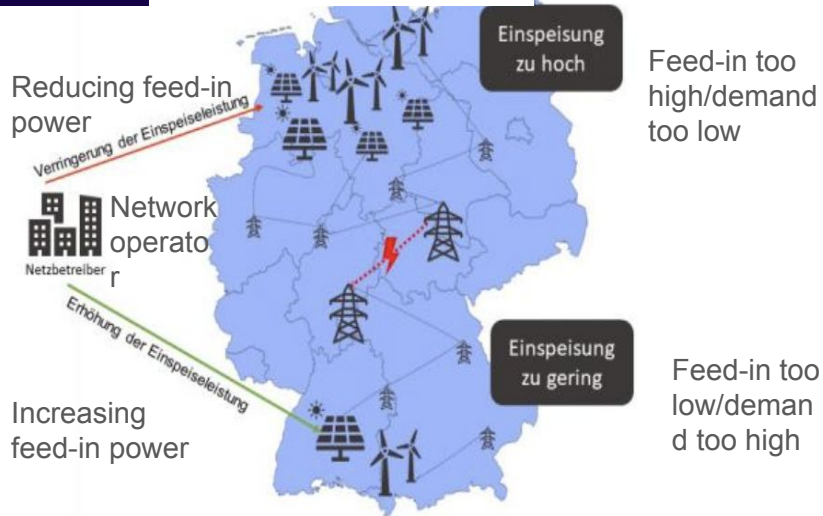
# Markets Available to Demand Side Flexibility



# Flexibility can bring down redispatch costs



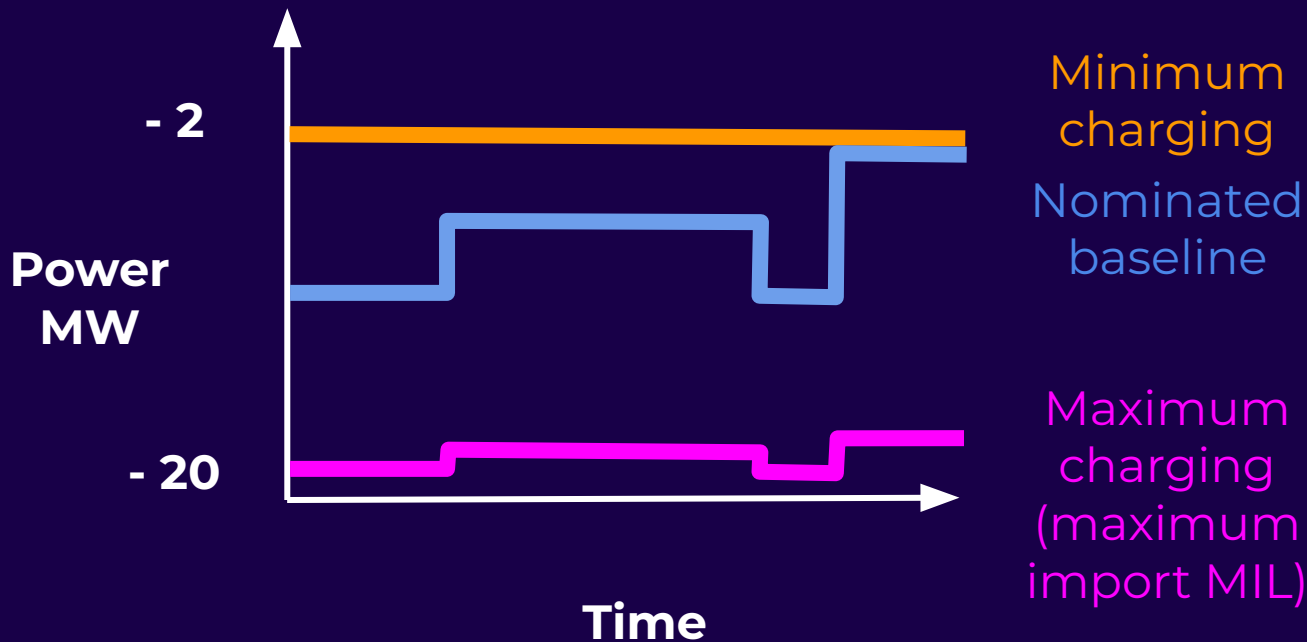
TRANSTNET BW



- TransnetBW and Octopus is using consumer flexibility in Redispatch
- NESO in GB uses consumer flexibility in the Balancing Mechanism
- Requires asset control, forecast schedules and precise control

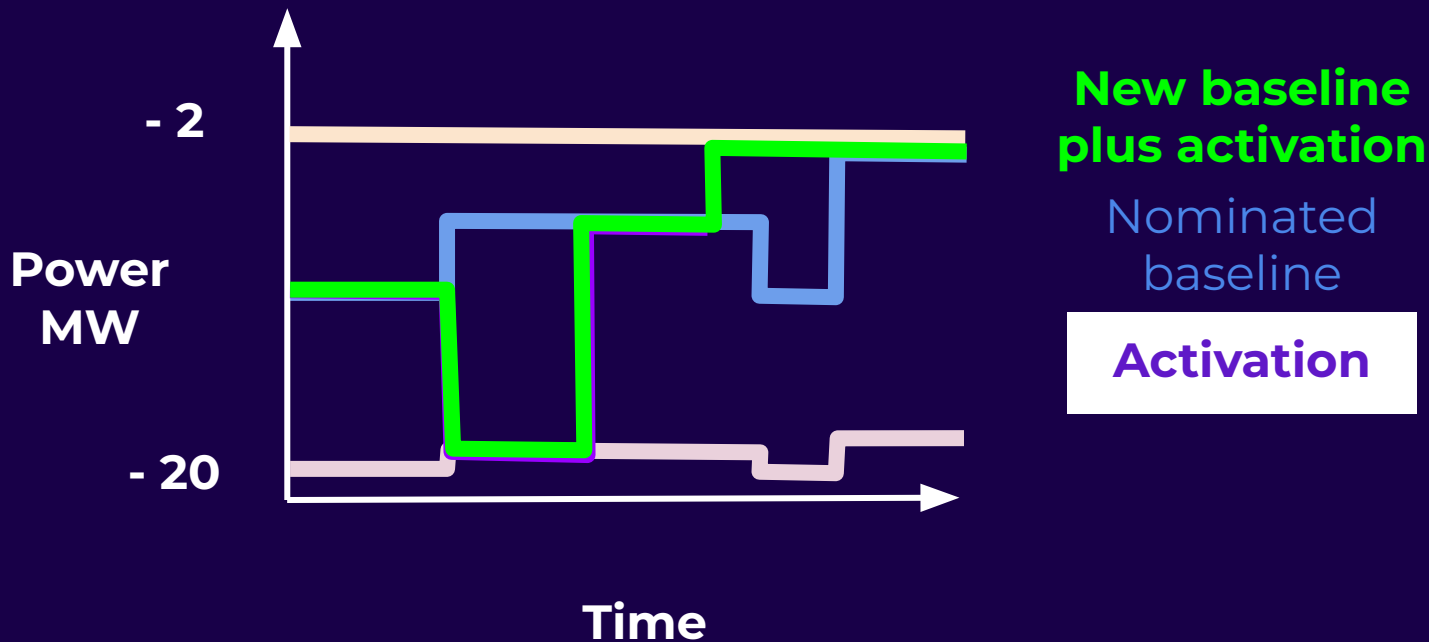
# Redispatch 3.0 uses consumer flexibility

Step one: Octopus provides operating information to TransnetBW



## Redispatch 3.0 uses consumer flexibility

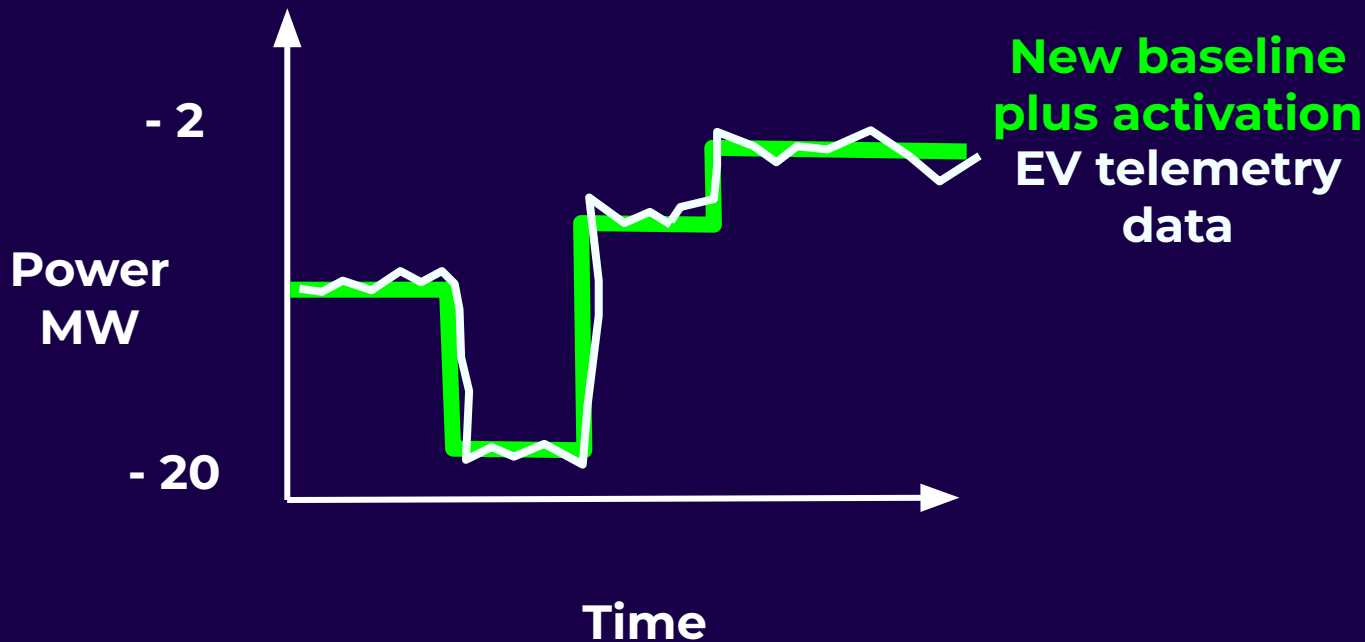
Step Two: TransnetBW sends through an activation, and Octopus responds with a revised forecast, taking into account the activation



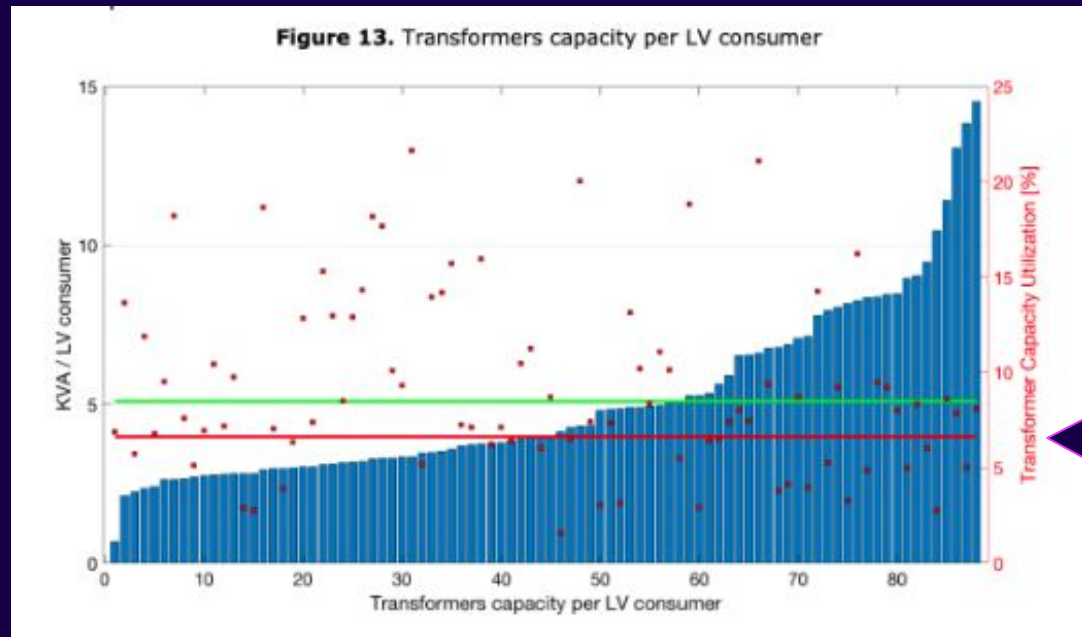


# Redispatch 3.0 uses consumer flexibility

Step Three: Octopus sends instructions to the EV fleet, and the fleet responds



# Flexibility can create value for networks at low voltage level

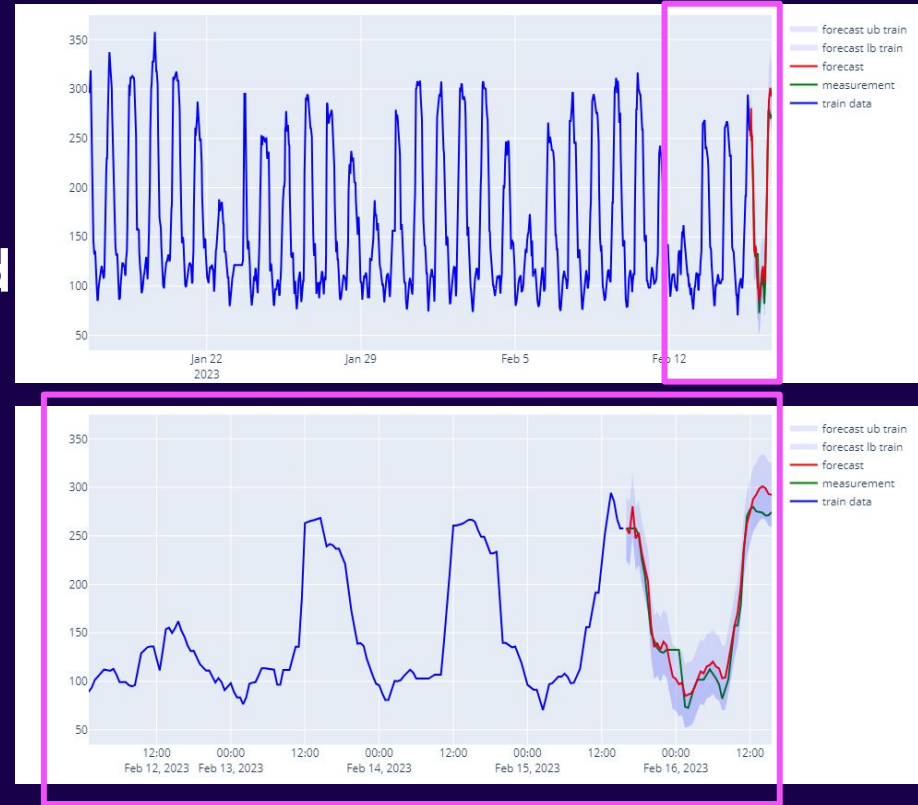


Low voltage networks are dimensioned to meet maximum loading, as a result in Europe utilisation at LV level is between 2 - 21%

Source: 2018 "Distribution System Operators observatory 2018", JRC

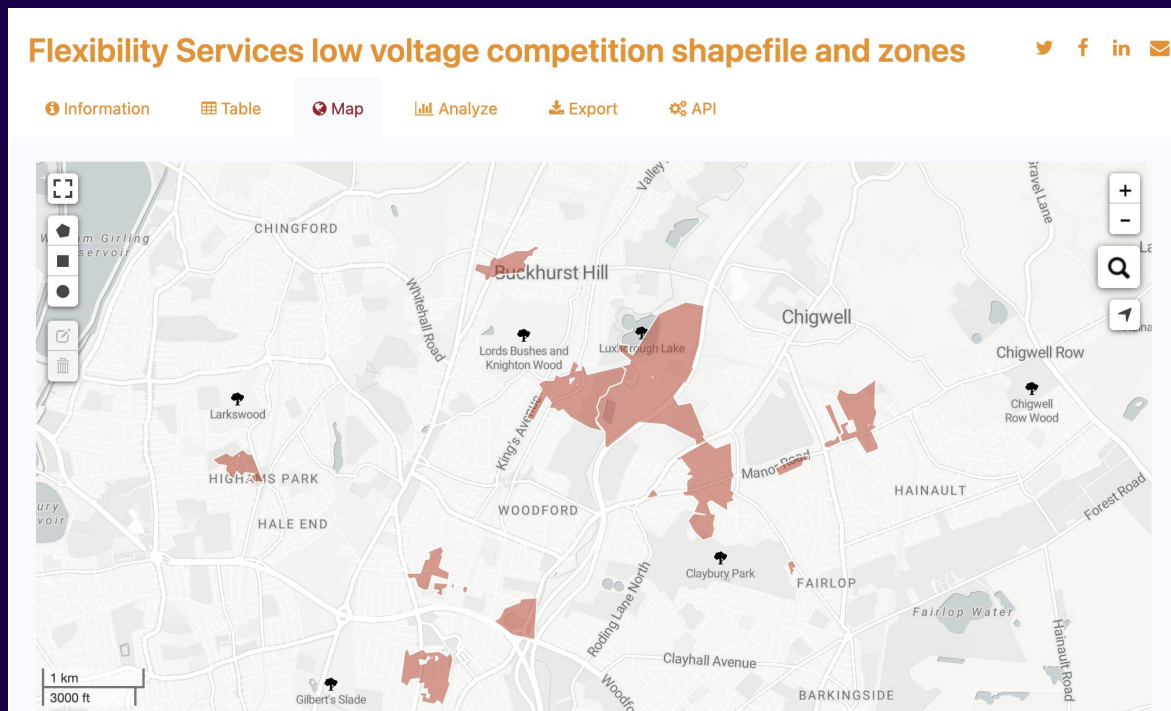
# Flexibility allows LV network investment to be deferred

Flexibility can defer the need for investment by shifting demand out of peaks, or discharging batteries and V2G at congested times



# Licence obligations – “must use flexibility when economically advantageous”

Where upgrade cost is bigger than deferral cost, use flex



UKPN example: annual flexibility cost of £30,000 postponed a £2 million network reinforcement project for four years.

# Clear transparency on flexibility

Demand		Long Term Scheduled Utilisation														
Flexibility Zone	DNO	Maximum connection voltage (kV)	Total MW Requirement						Hours of Utilisation required						Utilisation fee - lower range (£/MWh)**	Utilisation fee - higher range (£/MWh)**
			Summer 2025	Summer 2026	Summer 2027	Winter 2025/26	Winter 2026/27	Winter 2027/28	Summer 2025	Summer 2026	Summer 2027	Winter 2025/26	Winter 2026/27	Winter 2027/28		
Abberton Coggeshall circuits	EPN	33	0.00	0.00	0.00	0.00	0.00	0.32	0	0	0	0	0	110	34.3	49
Aldreth	EPN	11	0.00	0.00	0.00	0.00	0.00	2.17	0	0	0	0	0	220	45.5	65
Alresford	EPN	11	0.00	0.00	0.00	0.00	0.00	1.66	0	0	0	0	0	275	109.2	156
Amphill	EPN	11	0.00	0.00	0.58	0.00	0.00	0.00	0	0	436	0	0	0	100.8	144
Angmering	SPN	11	0.00	0.00	0.00	0.00	0.00	1.08	0	0	0	0	0	165	470.4	600
Austin Canons Primary	EPN	11	0.00	0.95	1.95	1.25	2.56	3.66	0	436	436	267.5	270	330	40.6	58
Barsham	EPN	11	0.00	0.30	0.74	0.00	0.00	0.00	0	436	436	0	0	0	244.3	349
Beresford Avenue	EPN	11	0.00	0.81	2.06	0.94	2.46	3.94	0	436	436	428	432	440	17.5	25
Bow	LPN	11	0.00	0.00	0.00	0.00	0.00	1.52	0	0	0	0	0	440	62.3	89
Bramford Diss Thetford	EPN	132	4.49	6.51	16.78	0.00	0.00	0.00	436	436	436	0	0	0	7.7	11
Brington	EPN	11	0.31	0.41	0.76	3.28	3.39	3.86	436	436	436	2568	2592	2640	5.6	8
Brockenhurst Mill Hill	EPN	11	0.00	0.56	1.13	3.99	4.67	5.49	0	163.5	272.5	428	432	440	9.8	14
Caistor	EPN	11	0.00	0.10	1.17	0.00	0.00	0.17	0	272.5	436	0	0	110	61.6	88



**If useful/required**

# We have created systems where the interplay creates effects we can only respond to..

9

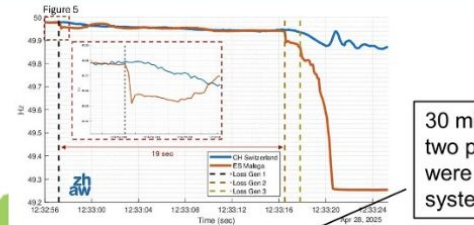
April 28<sup>th</sup>, 2025

Zürch University  
of Applied Sciences

zhaw

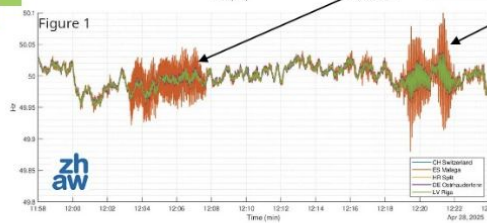
School of  
Engineering  
IEFE Institute of Energy Systems  
and Fluid Engineering

## Iberian Blackout



[Link to source file](#)

30 min before the incident, two periods of oscillations were observed in the CE system



- **Source:** Unknown
- **Duration:**  $\approx 16$  hours
- **Main effects:** The power system of Portugal and Spain suffered a total blackout.
- **Reason:** Unknown
- **Solution:** Gradually restore elements according to their response possibilities: lines between France and Spain, interconnection with Morocco, and start up operation of hydro power plants in Spain and Portugal (black start).
- **Lessons learned:** See the next slide

# Some Solutions

- PMU-based wide-area monitoring systems are already in place
  - more and better on-line & off-line tools to support the operation of the power system are necessary
- We will need more stabilizing power sources providing also “inertia” and short-circuit power (such as a synchronous condenser with flywheels).
- Power electronics is still behind requirements/standards, including the tuning of power system stabilizers and all grid forming control loops.
- The bureaucracy is enormous. It takes too much time to build a single transmission line (decades).
- We all are in a learning stage regarding the operation of modern hybrid power systems which include HVDCs, volatile renewable energy sources and other power electronics driven technologies (which all make the operation more complex and hardly deal with uncertainties)



# Renewables + flexible electrification = cheap, clean energy for all

**Octopus urges customers to act now for £420 off their energy bill**

Sunsave, Octopus' partner, has explained 7,000 households have joined



Hi Tessa,

It looks like there will be plenty of green energy in the system tomorrow, so we're back on for another **Free Electricity session**.

**Fill your boots on Wednesday 21 August: 1-2pm.**

**Octopus**  
**SAVING**  
**SESSIONS**



**Thousands of new homes will pay £0 energy bills with Octopus Energy - here's how it works**

The i Paper

**Octopus Energy launches new trial offering reduced energy bills**

Octopus Energy is offering its smart meter customers free electricity this month, as part of a new trial that aims to get consumers using less energy during...

10 Feb 2022



# Valuing Flexibility: UKPN

Worked example: £112,400 savings (doesn't include optionality)

Cost/Benefit Category	Deferral Option (£) (Illustrative)	Upgrade Option (£) (Illustrative)	Notes/Assumptions
Year 0 Capex	£0	-£1,800,000	Assumes upgrade is immediate if chosen.
PV of Flexibility Costs (Years 1-3)	-£84,600 (approx. £30k * 2.83 PVIFA @3.5%, 3yrs)	£0	Illustrative flexibility costs discounted.
PV of Reinforcement Capex (End of Year 3 for Deferral Option)	-£1,623,000 (approx. £1.8m discounted for 3 yrs)	£0	Reinforcement occurs after 3-year deferral.
PV of Net O&M (Years 1-45 for Upgrade; Years 4-45 for Deferral)	-£175,000 (approx. for Yrs 4-45)	-£195,000 (approx. for Yrs 1-45)	Net O&M of £8k/yr discounted.
Illustrative Total NPV (Simplified)	~ -£1,882,600	~ -£1,995,000	Based on these illustrative figures and simplifications, deferral shows a marginal NPV benefit.

# In response to falling inertia, NESO in the UK is taking action

- **Stability Market:** developing competitive market for stability services, including inertia
- **New and Modified Assets:** exploring use new assets or existing infrastructure that has been modified to create inertia by drawing energy from the grid
- **Technology for Accurate Inertia Measurement:** working with Reactive Technologies to deploy a system that uses pulses of power for real-time monitoring of inertia levels
- **Inertia Forecasting:** developing improved inertia forecasting capabilities to better predict and manage inertia levels.