



Energy Transition and Utility Disruption

European Utility Week, Vienna

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'Smart energy' in 2009



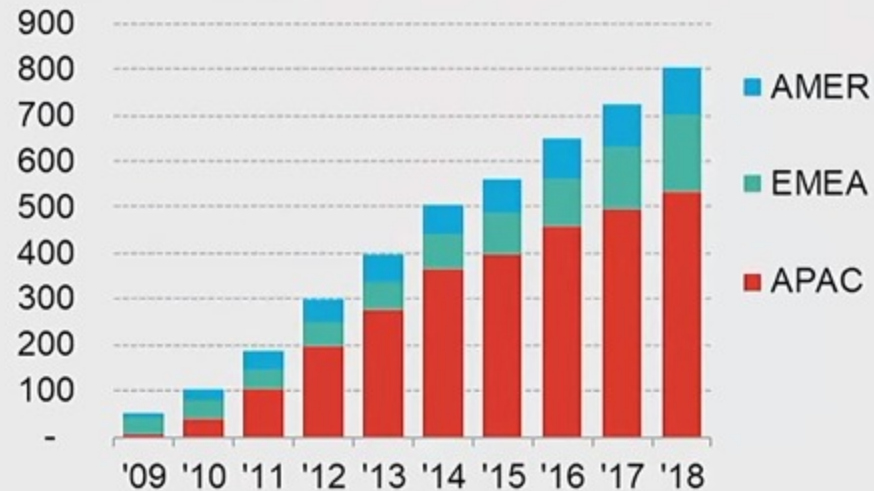
Key issues

- EU Directive
- Standards
- Privacy and security
- Customer engagement

Smart energy took off

Smart meter installations, global

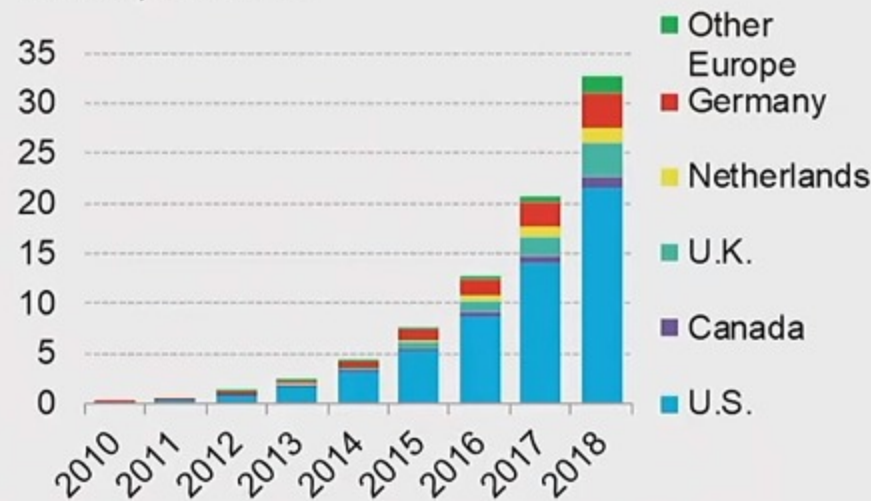
Millions, cumulative



Source: BloombergNEF

Smart thermostat installations, Europe and North America

Millions, cumulative



Source: BloombergNEF



Diamond Partner

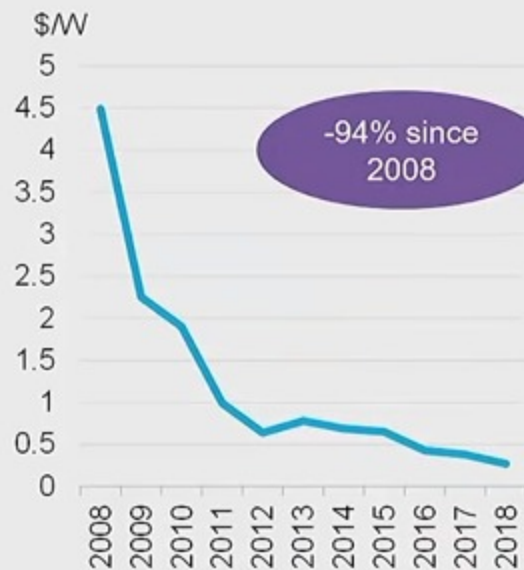
SIEMENS
Ingenuity for life

Organised by



Clean energy costs plummeted

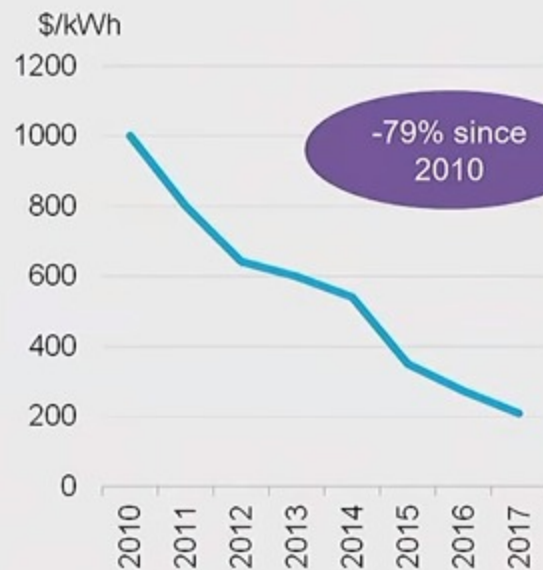
Solar PV module prices



Onshore wind turbine prices

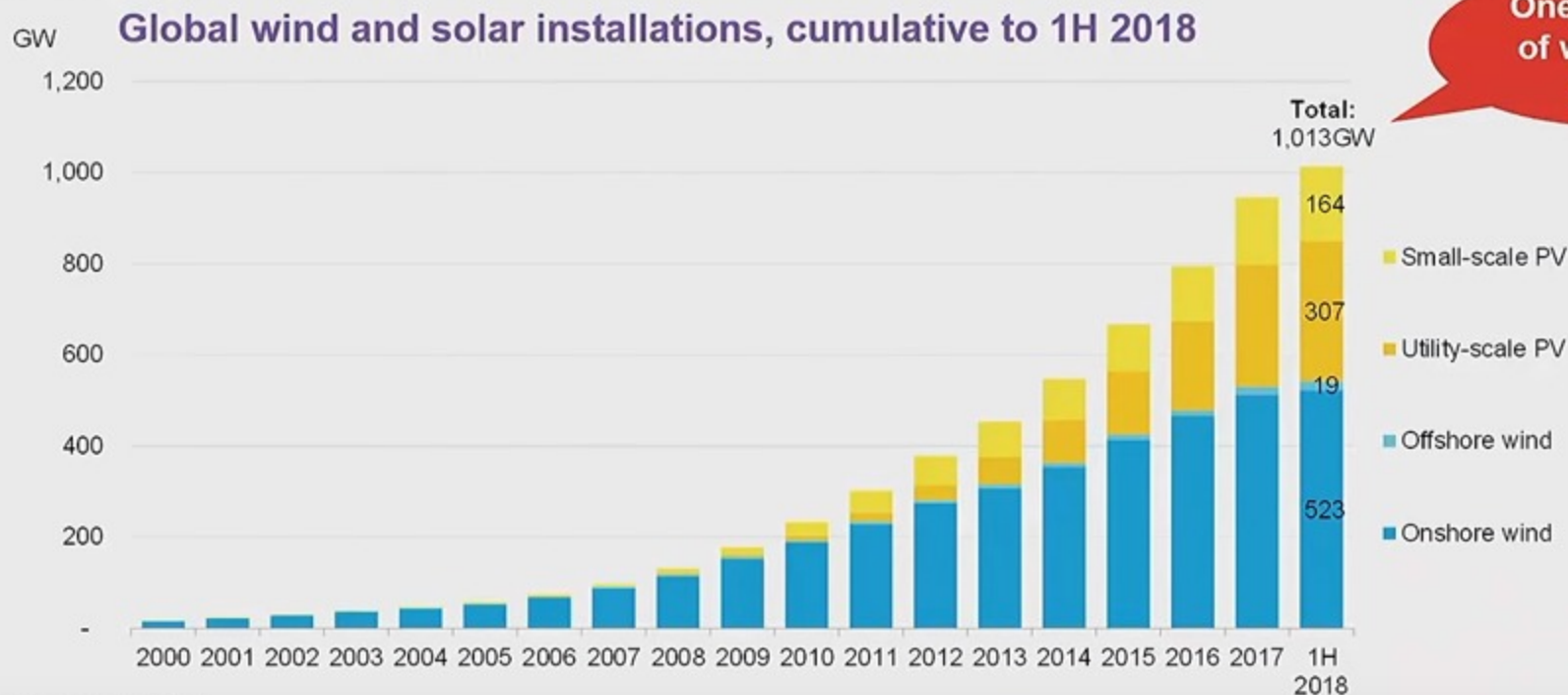


Lithium-ion battery prices



Source: Bloomberg NEF.

Wind and solar achieved terawatt scale



One terawatt
of wind and
solar

Source: Bloomberg NEF.

Zero-subsidy renewable projects in Europe

Offshore wind

~2.8GW

By 2025

Onshore wind

~9.2GW

Installed and pipeline capacity

Solar PV

~700MW

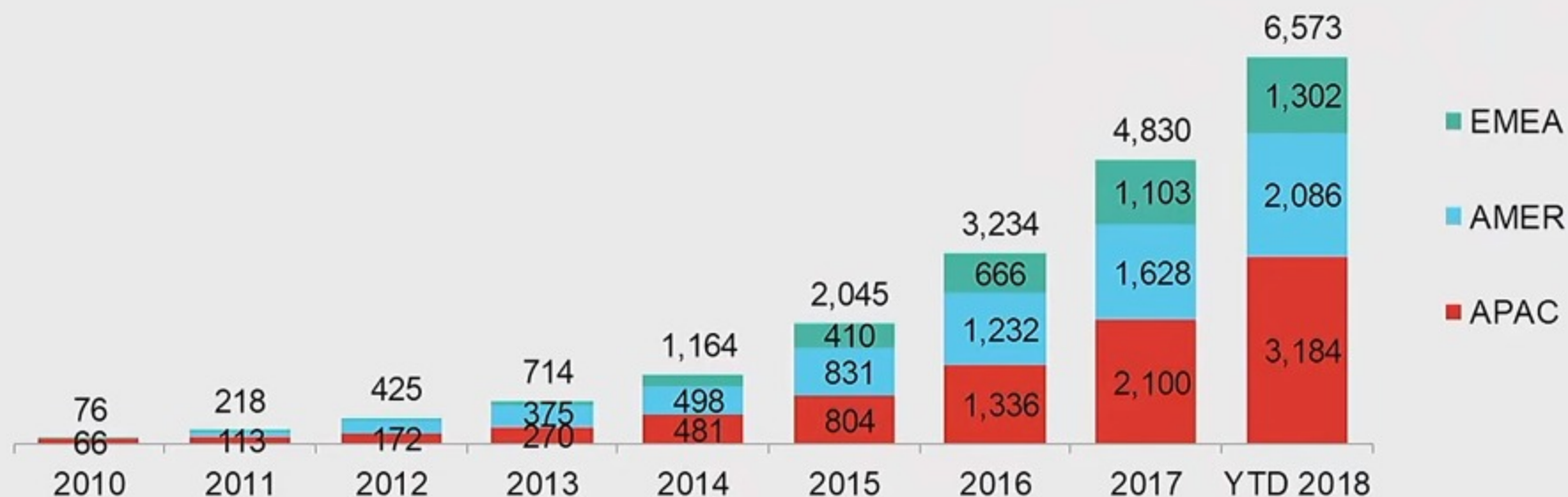
Installed or under construction

Source: Bloomberg NEF. Note: right-hand figure is subsidy-free PV built or under construction in EU as of 1Q 2018.

Energy storage is accelerating

MW

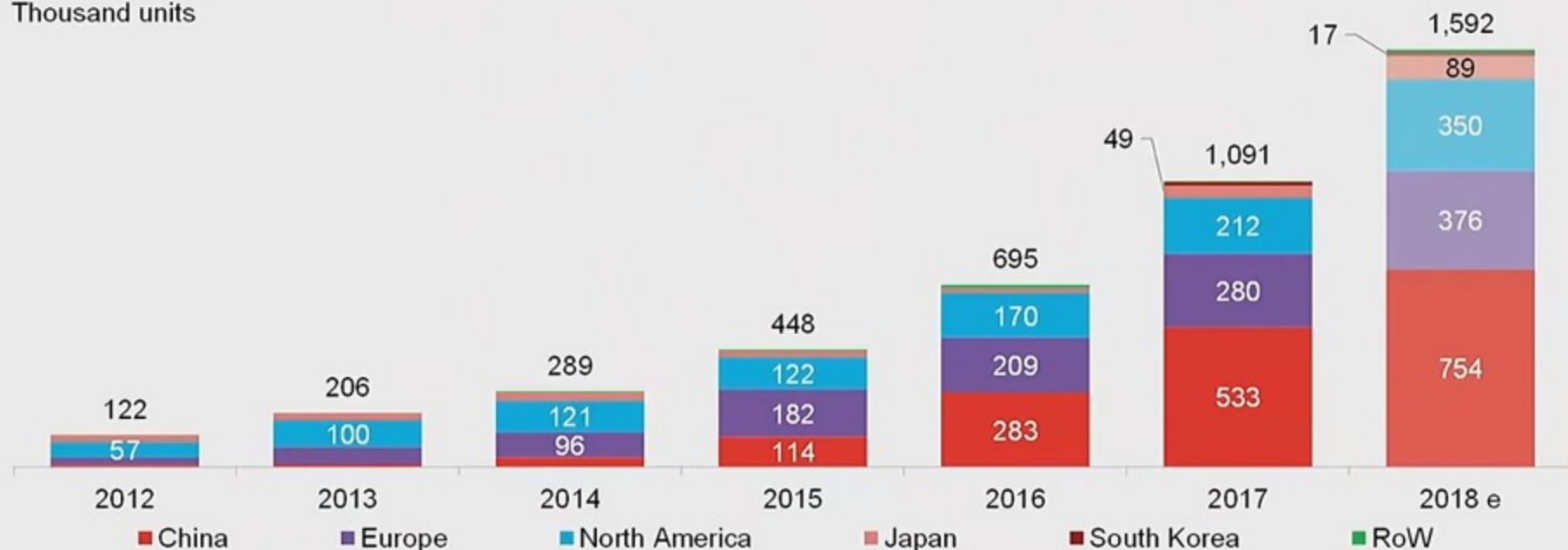
Global energy storage installations, cumulative to 1H 2018



Source: Bloomberg NEF. Note: Excludes pumped hydro. Includes utility-scale and small-scale/behind-the-meter energy storage.

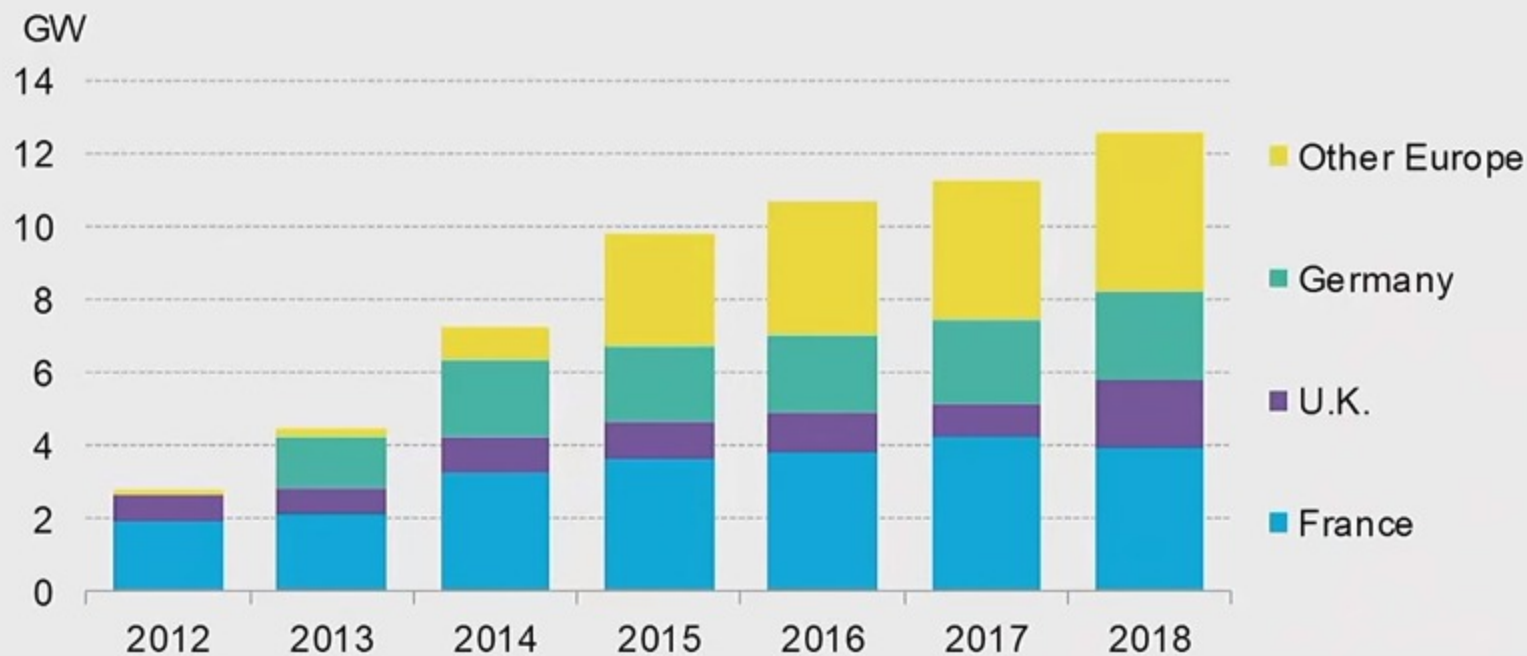
Global passenger EV sales by region

Thousand units



Source: Bloomberg NEF

European demand response capacity



Source: Bloomberg NEF

Carbon markets died, and rose again

EUA prices, 2010 to 2018



Source: Bloomberg. Note: EUA latest price as at 24 October 2018.

And some other stuff happened too...



PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11



Have utilities been disrupted?

Top 10 western European power companies by market cap, 2008



Still in the top 10 today?

Top 10 western European power companies by market cap, 2008



e-on



But Innogy is 7th



endesa



enel



centrica



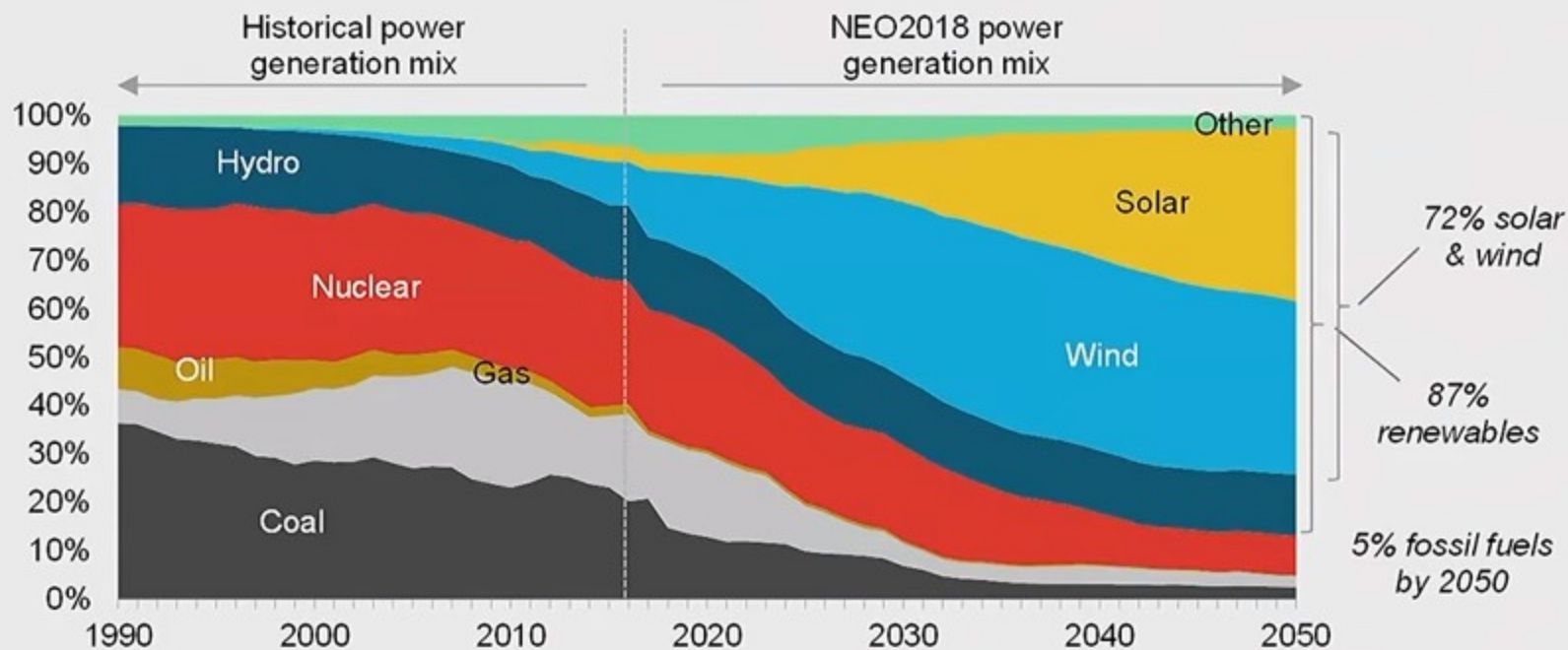
Fortum



VEOLIA

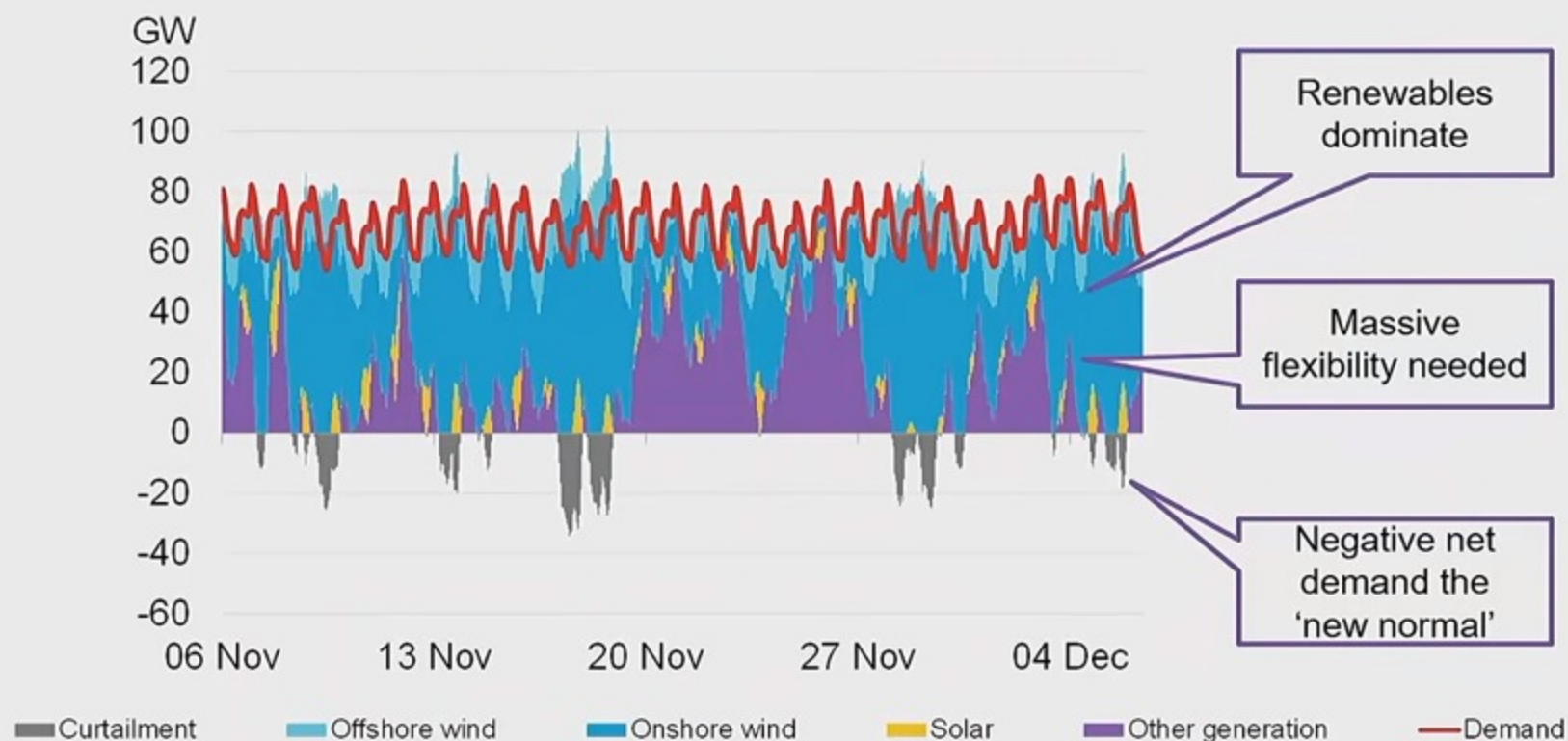


New Energy Outlook 2018: European generation forecast



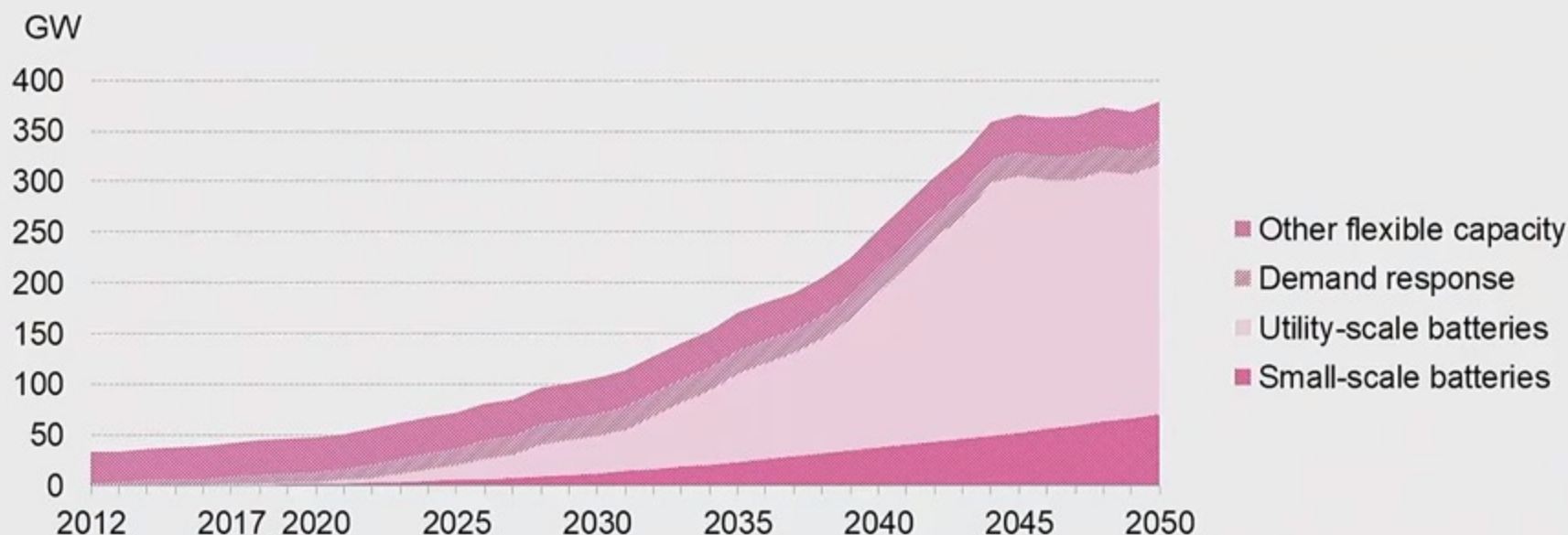
Source: Bloomberg NEF

A high-wind month in Germany, 2030



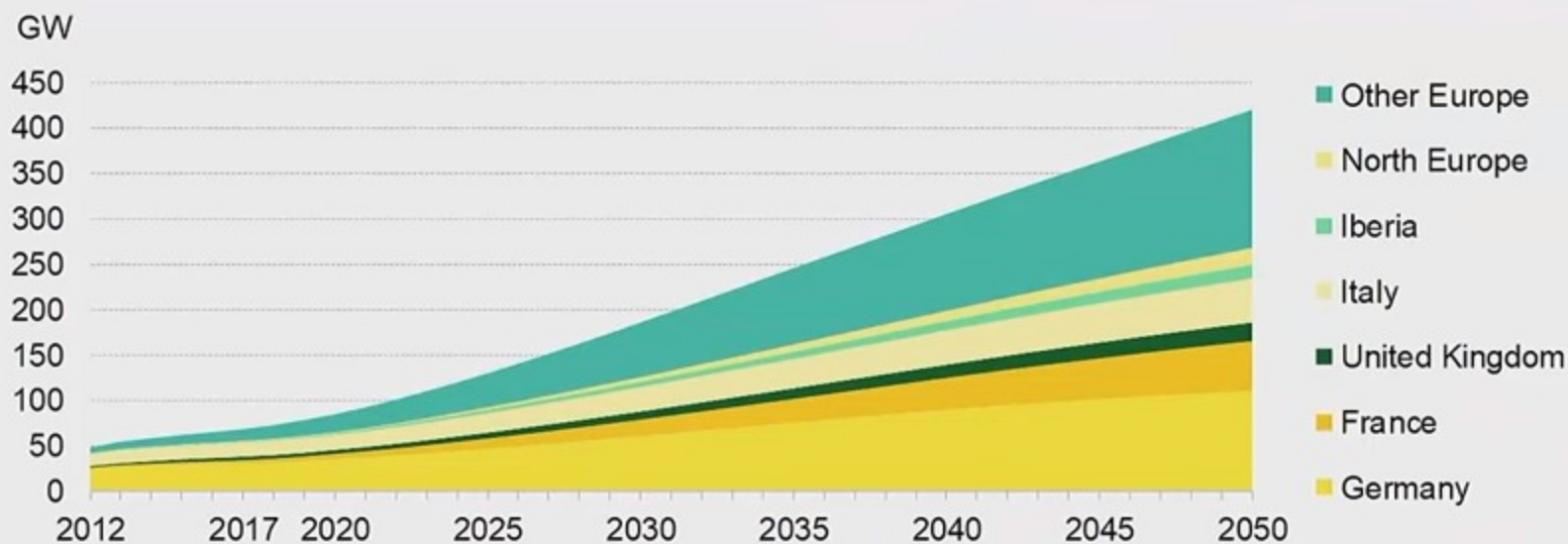
Source: Bloomberg NEF.

Flexible capacity forecast, Europe



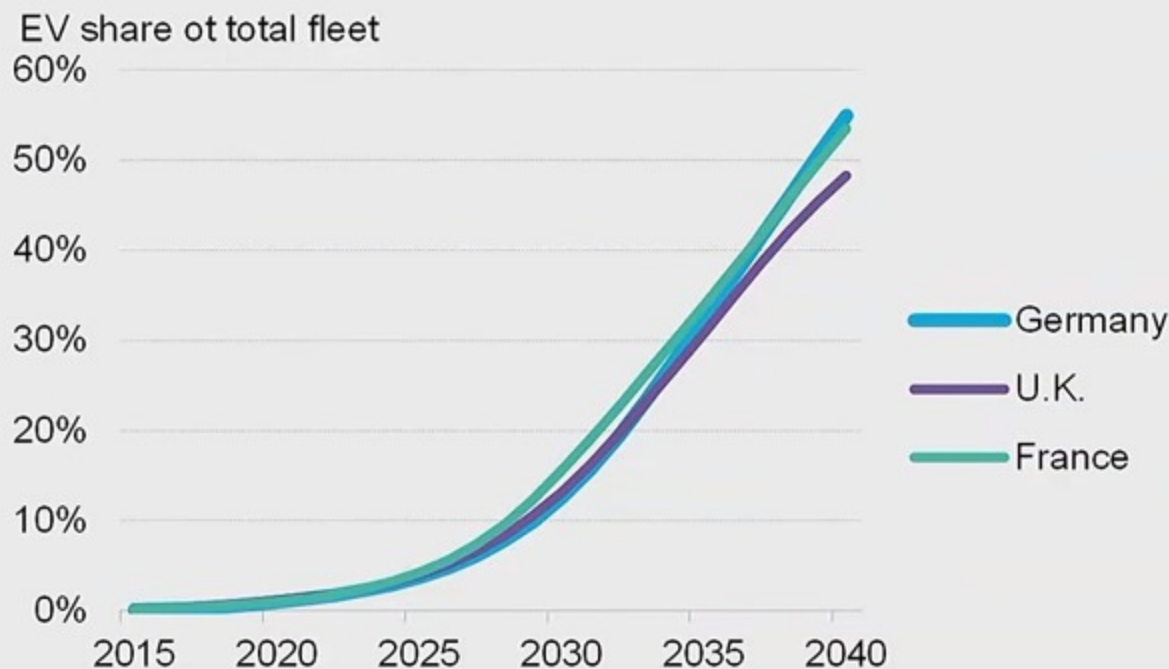
Source: Bloomberg NEF

Small-scale solar capacity forecast, Europe



Source: Bloomberg NEF

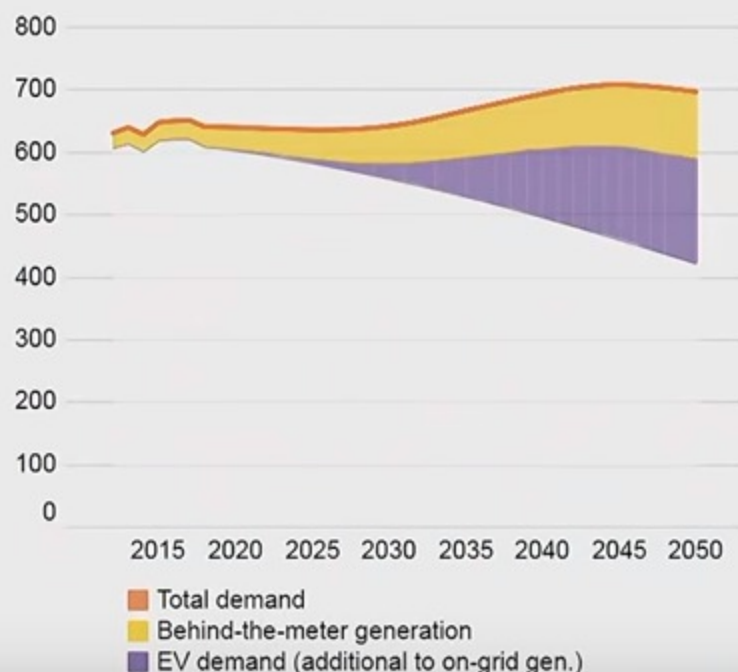
EV fleet penetration in selected EU countries



Source: Bloomberg NEF

Impact of EVs and behind-the-meter generation on power demand, Germany

Total electricity demand (TWh)



- EVs and small-scale PV account for ~one-third of demand
- Massive load shifting need / opportunity
- Need for distribution-level flexibility markets
- Digital platforms for trading and optimisation

Disruptive vs. sustaining innovation

Disruptive innovation



Sustaining innovation

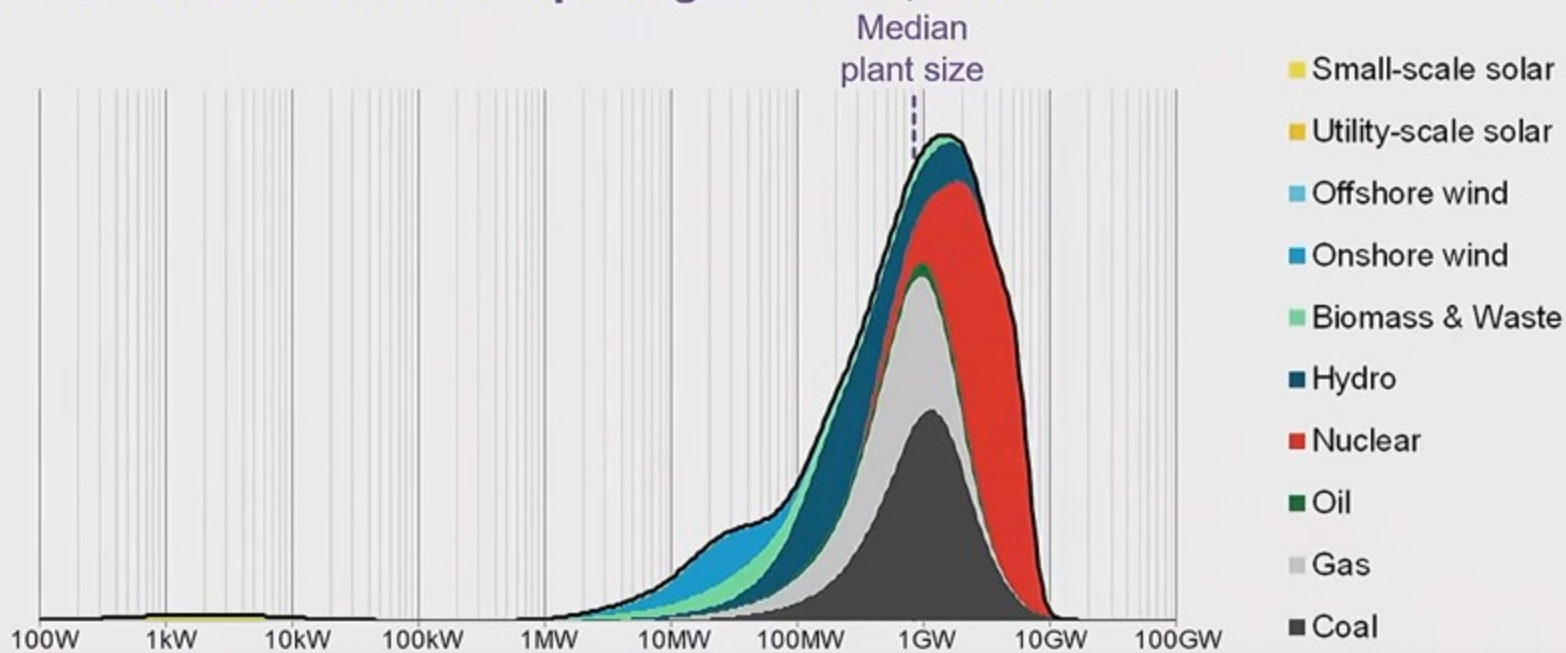


Disruptive innovations change the basis of competition, so that:

1. The things you're good at don't really matter any more.
2. There's a new thing that matters, and someone else is structurally better than you at it.

Decentralized energy

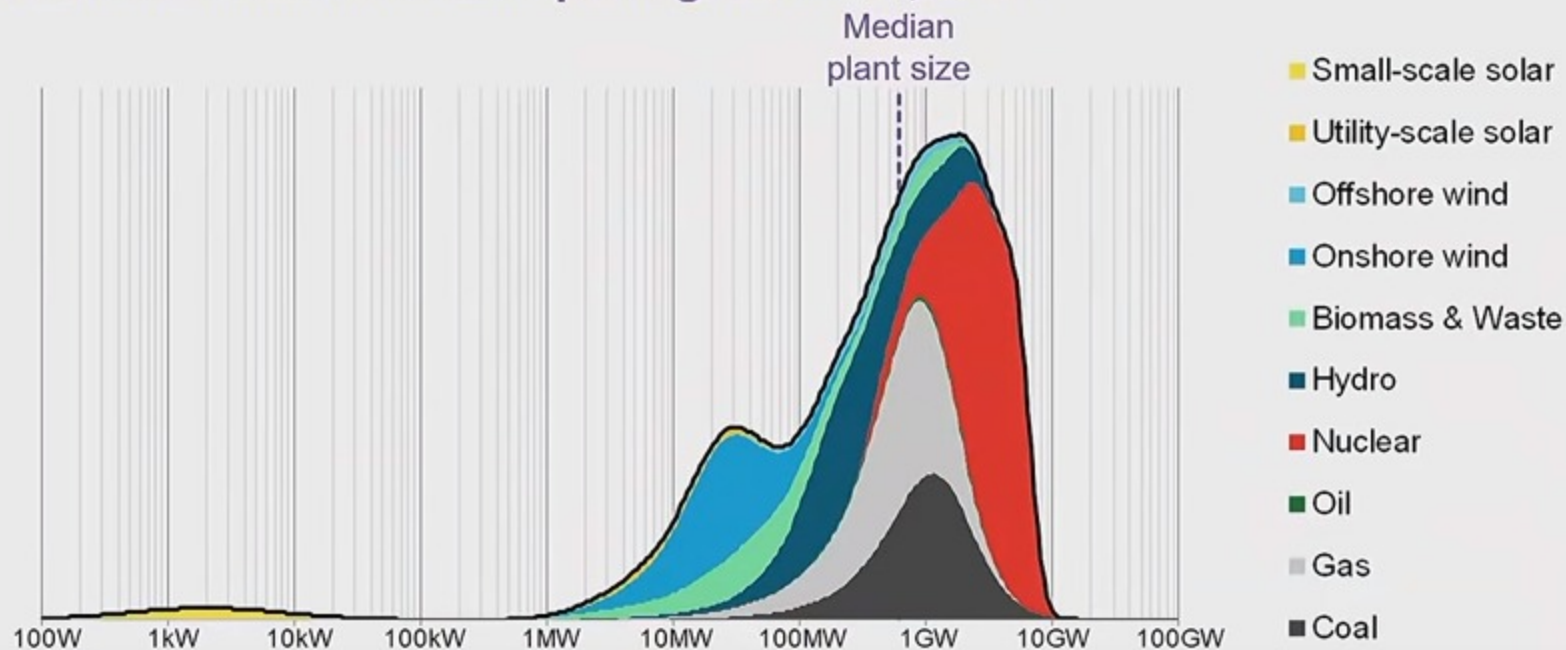
Scale distribution of European generation, 2012



Source: Bloomberg NEF

Decentralized energy

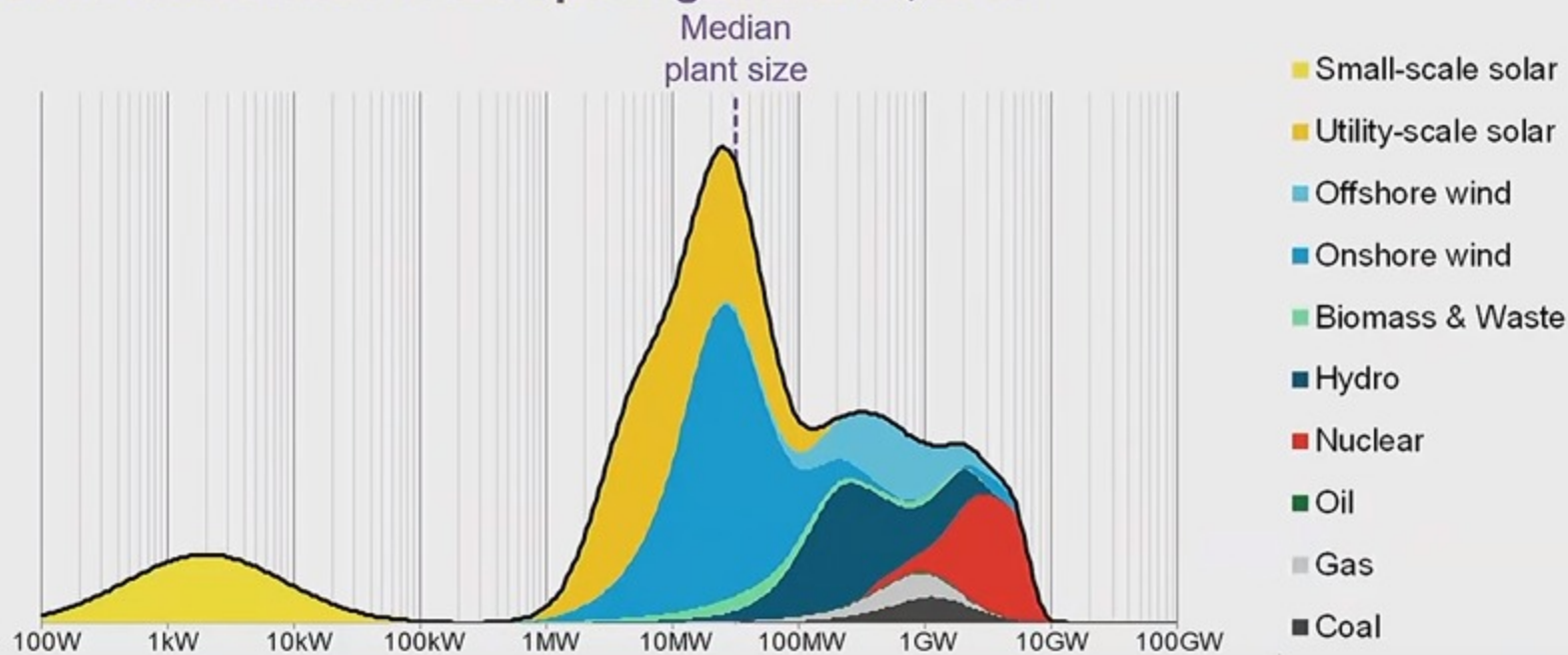
Scale distribution of European generation, 2018



Source: Bloomberg NEF

Decentralized energy

Scale distribution of European generation, 2050



Source: Bloomberg NEF

To win at decentralized energy, what will really matter?

Probably not:

- Building, owning and operating large-scale power plants reliably, efficiently in the market
- Large balance sheet, low cost of capital

Perhaps:

- VPP software and analytics
- IoT, connectivity
- AI for forecasting and optimisation



Disruptive to utilities?

Perhaps:

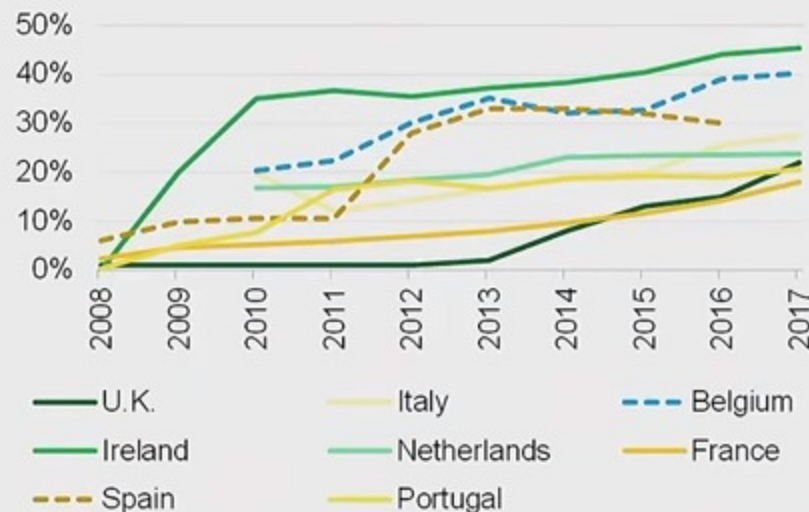
- Deep understanding of power markets
- Trading expertise
- Large asset portfolio, market depth
- Network expertise / operation



Sustaining for utilities?

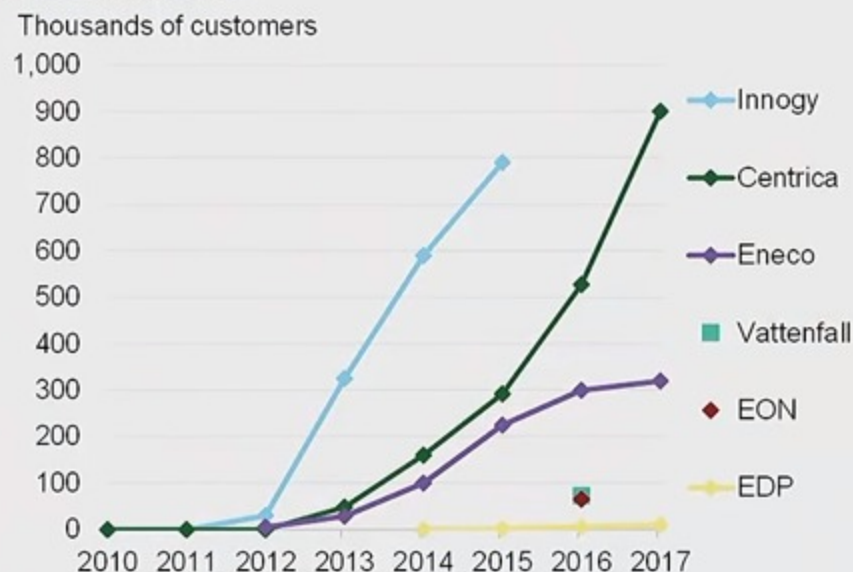
Challenges and opportunities in retail

New-entrant market share



Source: Bloomberg NEF, companies. Dashed lines indicate all retailers except the "largest" players, as defined by the market regulator, are included. Solid lines indicate all non-incumbents are included.

Connected home hub cumulative installations



Source: Bloomberg NEF, companies. Note: EDP includes mobile app downloads for re:dy. Innogy and Eon include all connected products. Eneco is Netherlands only.

To win at energy retail, what will really matter?

Probably not:

- Legacy customer base
- Generation business / vertical integration

Perhaps:

- Data, data, data
- Near-zero customer acquisition costs
- Cross-subsidisation from other businesses (ads, search, online shopping)



Disruptive to utilities?

Perhaps:

- Regulatory resilience
- Operational efficiency, low margin tolerance
- Reliable, effective customer service and trust

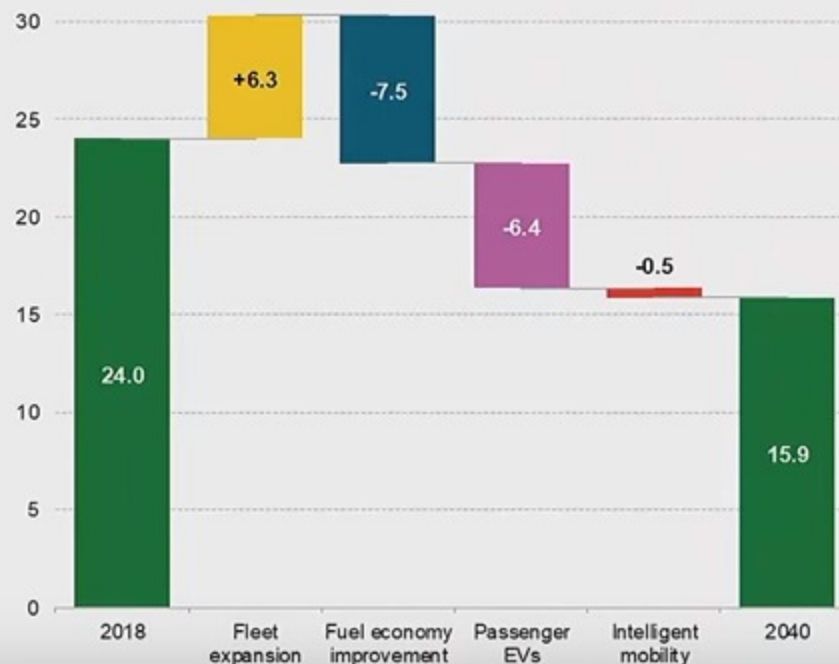


Sustaining for utilities?

EV disruption

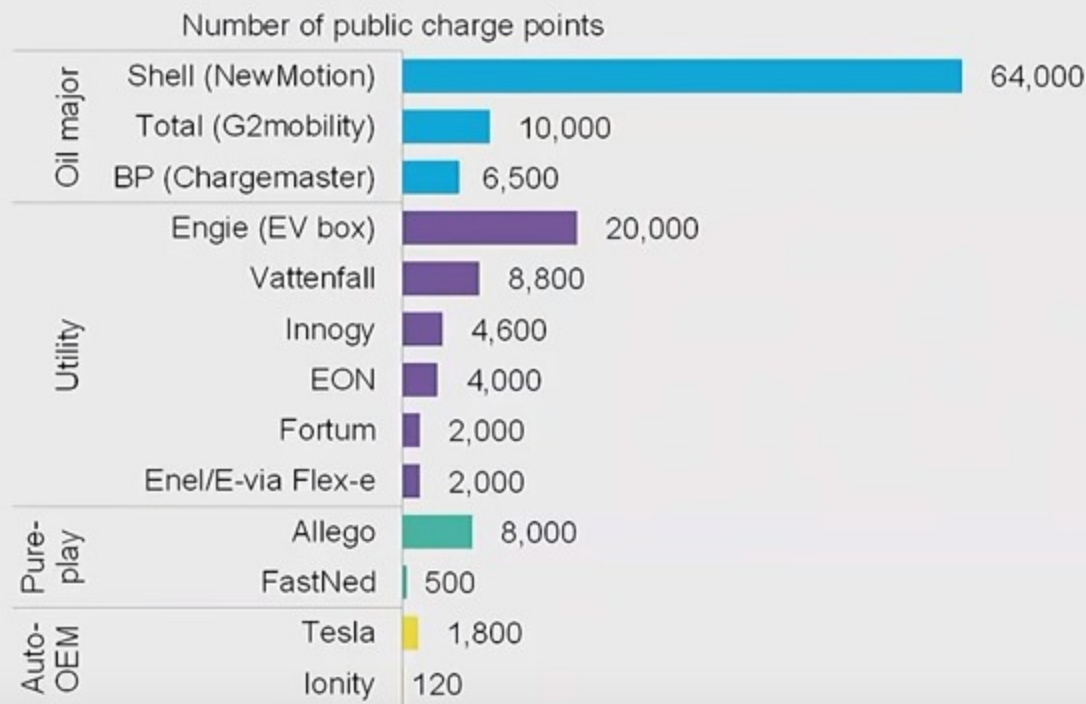
Passenger vehicle oil demand 2018-40

mbpd



Source: Bloomberg NEF

Selected EV charging network operators in Europe



Source: Bloomberg NEF

To win at EV energy, what will really matter?

Probably not:

- Upstream oil & gas prowess
- Power plant operations excellence
- Auto manufacturing expertise

Perhaps:

- Real estate / optimal rapid charging sites
- Retail site management
- Cross-subsidisation from other businesses (coffee, cigarettes, the Daily Mail)



Sustaining for oil & gas?

Perhaps:

- Deep understanding of power markets
- Power network expertise / operation
- Generation and demand portfolio, vertical integration



Utilities disrupt oil companies?

Energy transition and utility disruption

1. What are the things we're good at that won't really matter any more?
2. What's the new thing that matters, and is someone else structurally better than us at it?
3. What are we going to do about it?

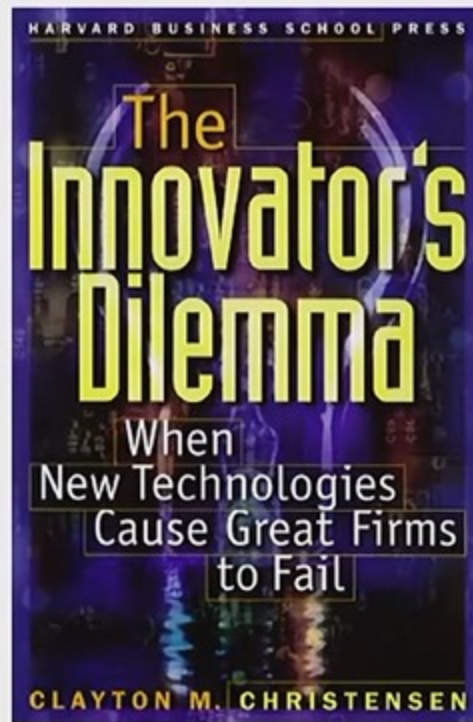


Image from Harvard Business School Press