

Caplor, Renewable Energy Update & Batteries For the Cotswold Energy & Environmental Management Group



Knowing your destination is half the journey.

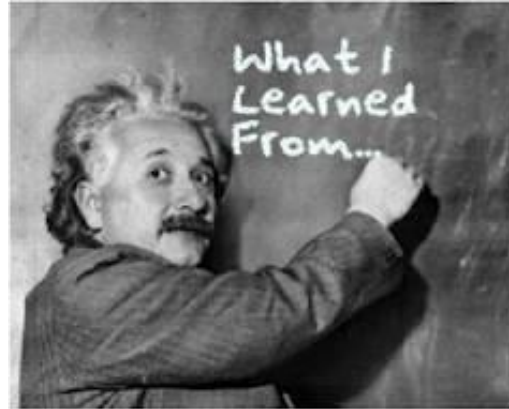
Anon

A top 10 UK solar installation company



Contents for perhaps the next 60 minutes

1. Introduction to Caplor
2. Update on Renewable Energy
3. Battery storage – Update, principle and an example



Who are We ?



Values - Inspired, Sustainable, Improvement



www.caplor.co.uk



Approach -Triple Bottom line



www.caplorhorizons.org

Some of our accreditations, awards and partnerships



ADVANCE
Solar Installer



Business Solutions Partner



APPROVED INSTALLER



Some of our Clients

Mkt share - 25% residential 35%+ commercial



Sugarswell Business Park

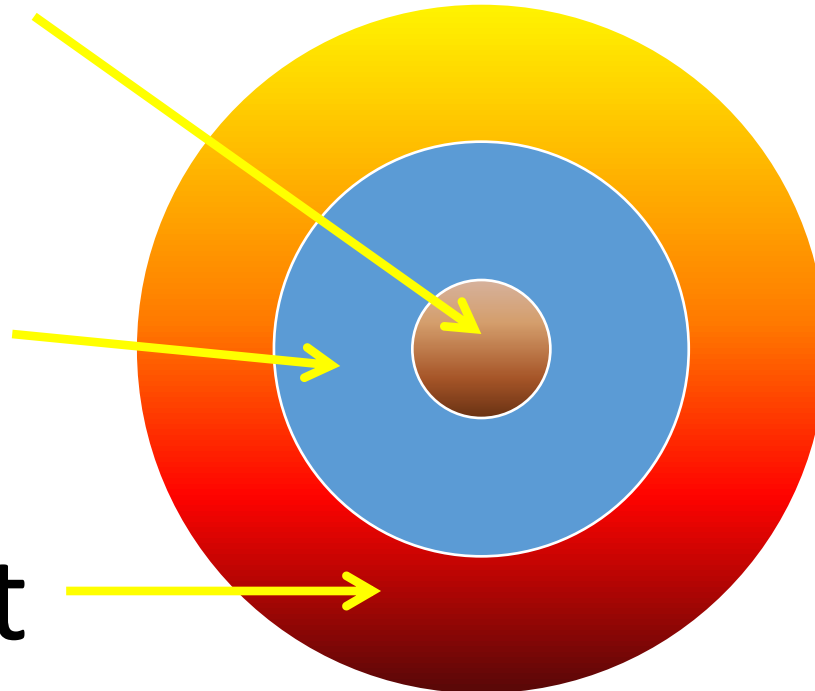




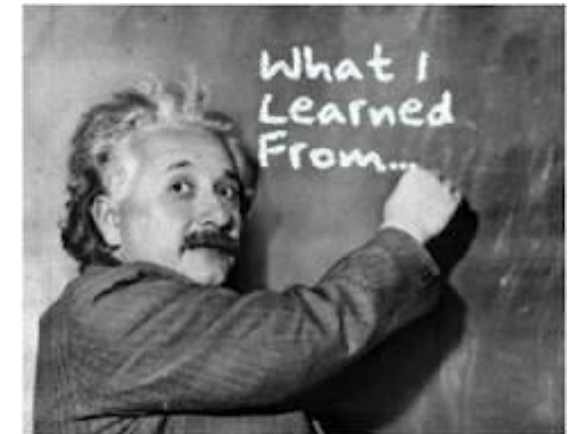
Why

How

What



Simon Sinek



Positive proof of global warming.



**18th
Century**

1900

1950

1970

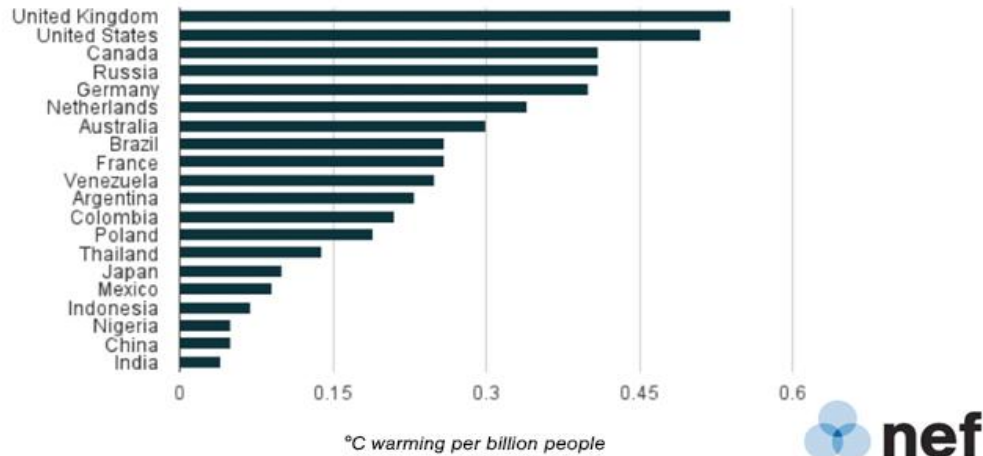
1980

1990

2014

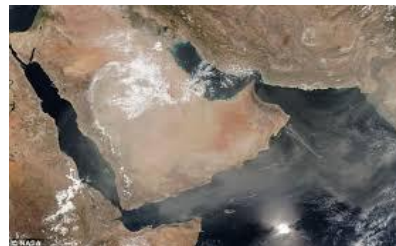
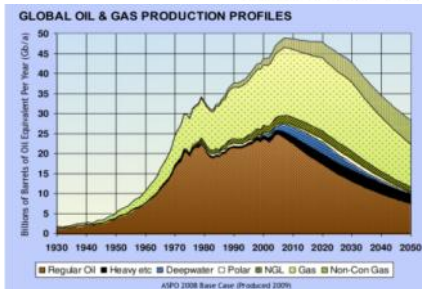
GLOBAL UPDATE SUMMARY

Historic contribution to climate change



Note: Data used from Table 3 in Matthews et al (2014) *National contributions to observed global warming*

*Displayed are cumulative historic emissions, converted to contribution to temperatures at 1 billion inhabitants for each country to allow for cross-country comparability



90% of new E power 2016



World invested more in solar power than fossil fuels in 2017 (\$280bn Vs 100bn)



SHARE OF NEW ELECTRICITY CAPACITY FROM RENEWABLE SOURCES IN 2016*

86%
EU
+ 21 GW

61%
United States
+ 16 GW

52%
China
+ 64 GW

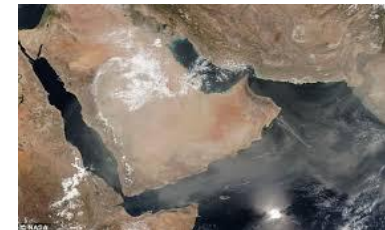
44%
India
+ 13 GW



Worldwide capacity added:
150 GW

*Data not yet available for Canada or globally.

Source: Wind Europe; U.S. Energy Information Administration; China Electricity Council; Government of India, Ministry of Power, Central Electricity Authority



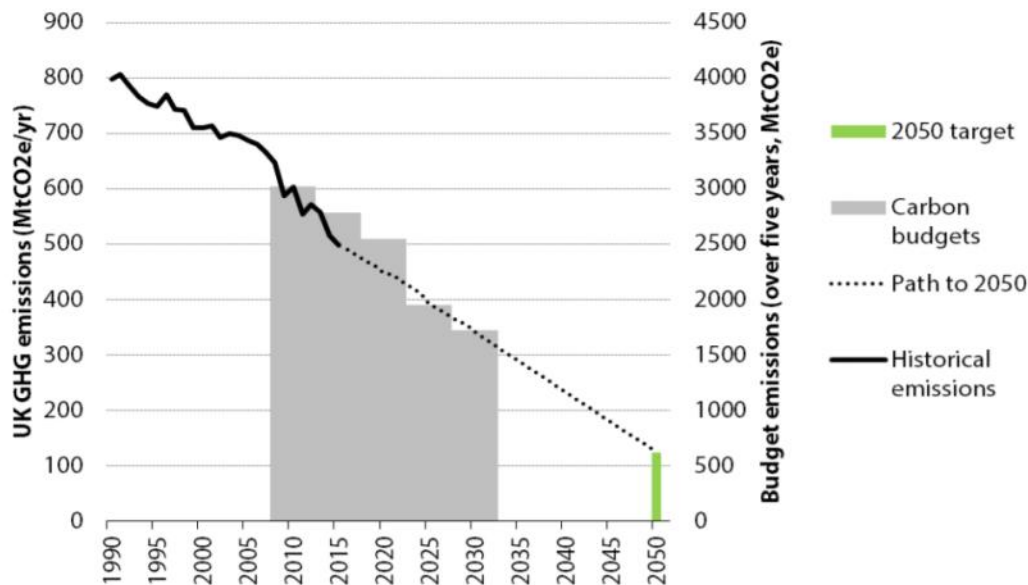
Mercedes-Benz



Microsoft

NATIONAL UPDATE SUMMARY

Carbon budgets provide stepping stones to the 80% 2050 target



Notes: 2050 target allows for emissions from international aviation and shipping, not currently in carbon budgets

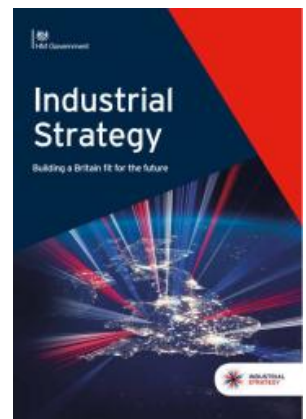
European Commission issues 'final warning' over air pollution breaches

Electric vehicle purchases rise by one-fifth in UK

UK Support 85% for Renewable (April 2018)

Approx. 29+% of Electric 2017

HM Government





Policy context.

Important recent Government publications

Industrial Strategy

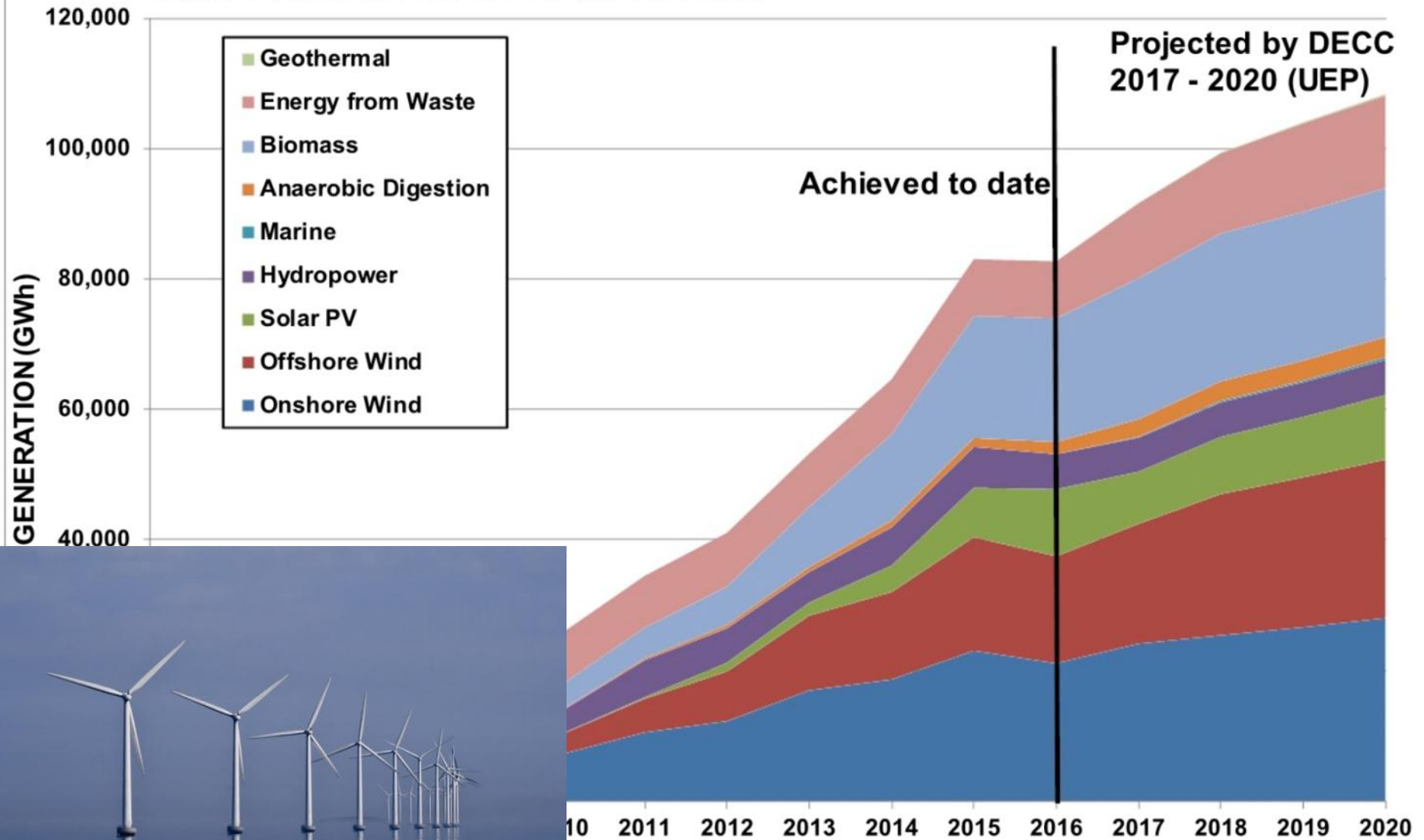
- Sets out *five foundations of productivity*
- Commits to investment in business-led innovation
- Aims to maximise the advantages for UK industry from the global shift to clean growth
- Commits to Local Industrial Strategies that build on local strengths and deliver on economic opportunities

Clean Growth Strategy

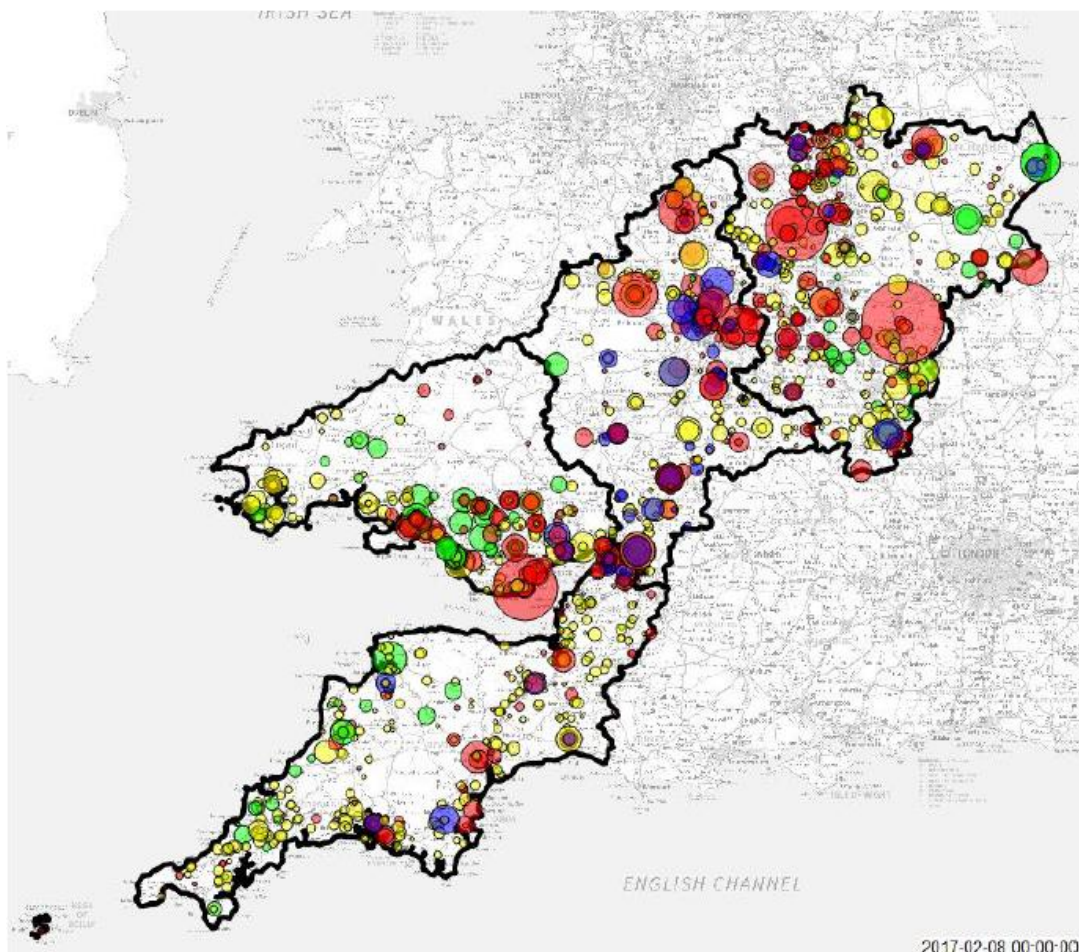
- Sets out a strategy to meet the UK's Carbon budgets
- Since 1990 emissions have been cut by 42%
- UK has committed to an 80% reduction on 1990 levels by 2050
- The document sets out domestic policies to keep the UK on track to meet these targets

BREXIT – Appears to be slowing anything other than





RENEWABLE ELECTRICITY GENERATION - ACHIEVED TO 2016 AND PROJECTED BY BEIS TO 2020



EMBEDDED GENERATION TODAY



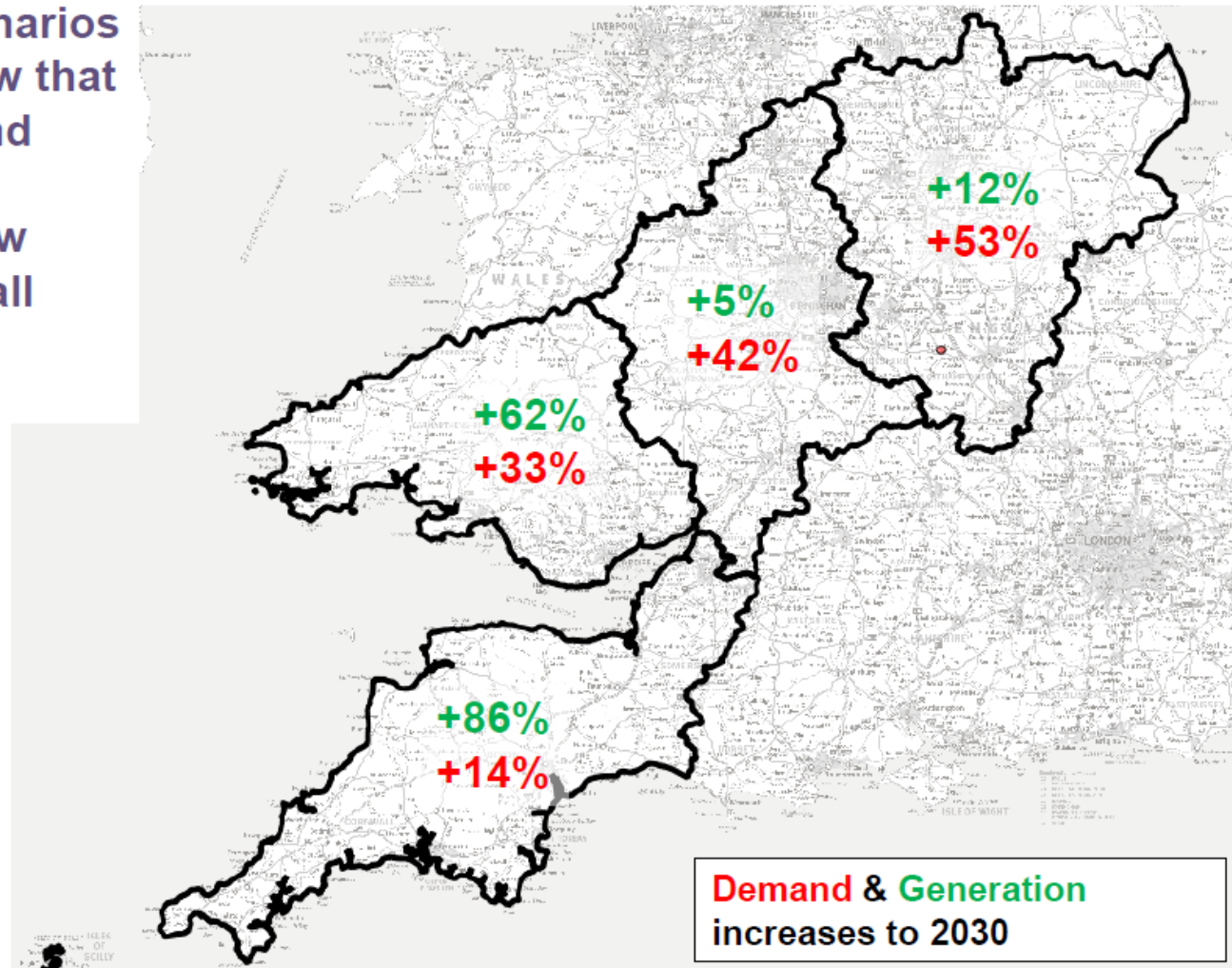
Within ten years, embedded generation has come to dominate the peak power flows on distribution networks

-  Solar Photovoltaic
-  Wind
-  Energy Storage
-  Other

WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

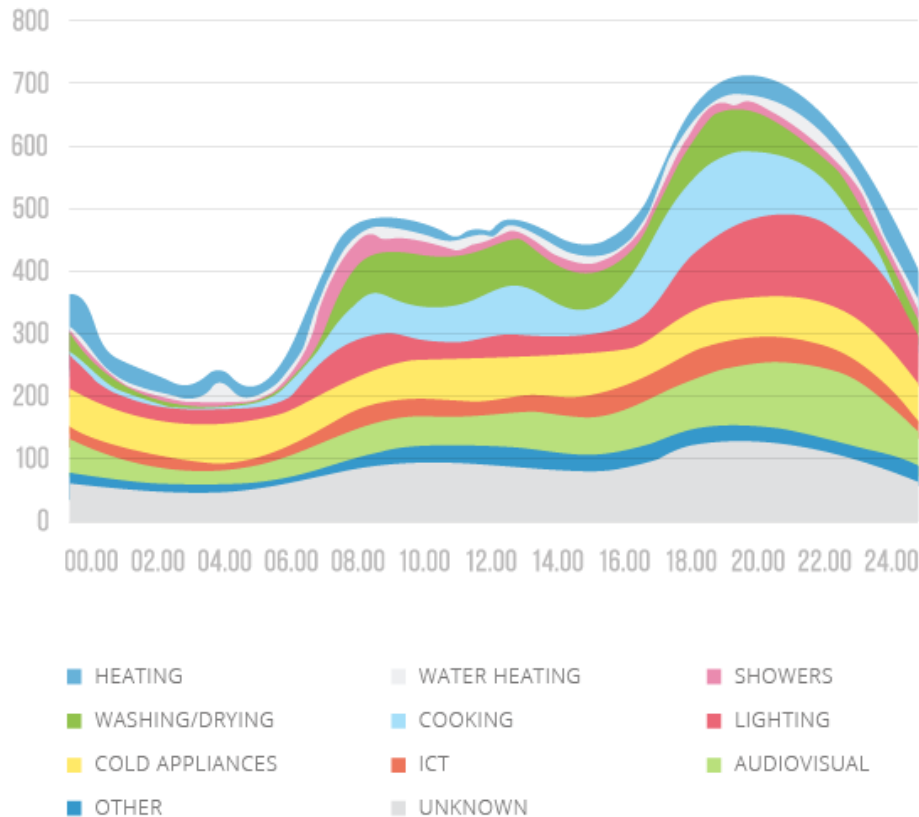
LOW CARBON IMPACT TO 2030

Our growth scenarios out to 2030 show that both demand and generation are expected to grow significantly in all regions

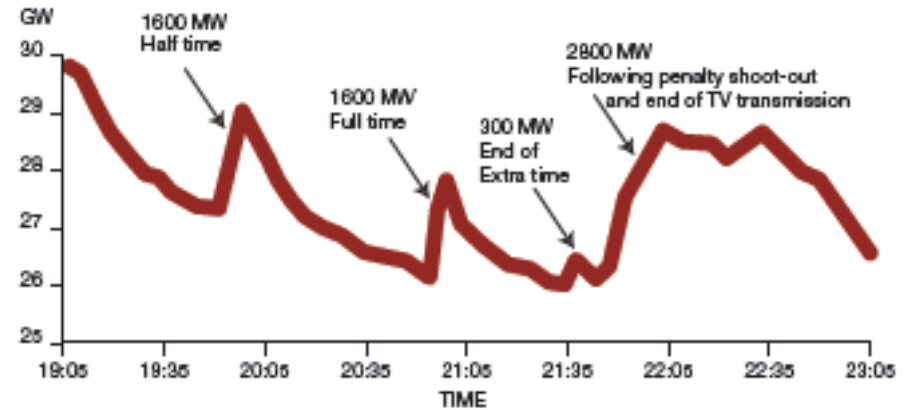


Normal and not so normal demand

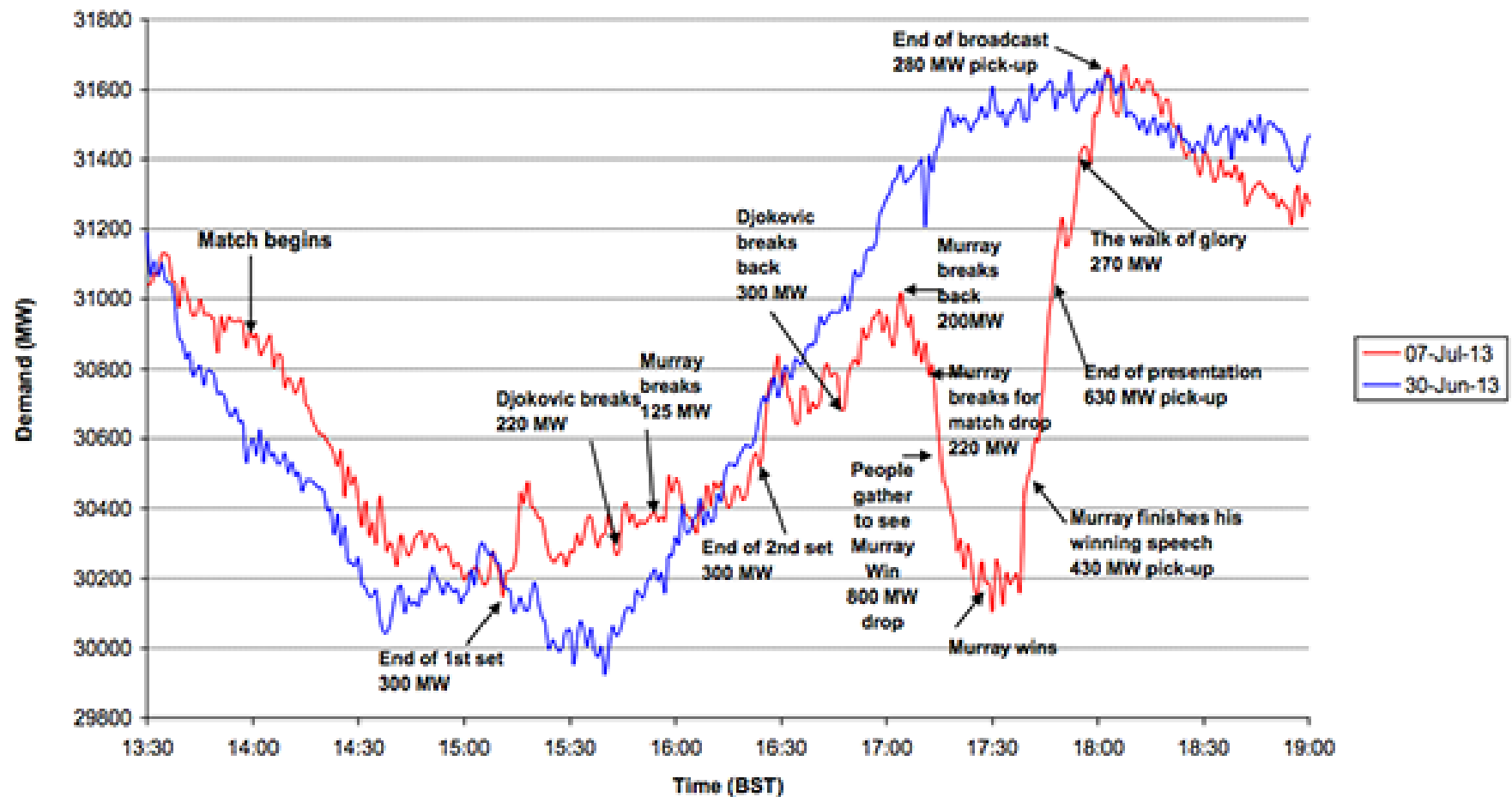
Average 24-hour electricity use profile for a typical UK home (watts)



England Vs Germany 1990, World Cup Semi-Final, Kick Off 19:00



Electricity generation **335.9 TWh**, UK electricity demand **350 TWh**



Tennis does the same thing !!

Will Batteries be part of the solution ?



**BATTERIES: GREAT FOR STORING ENERGY
FOR SHORT TIME PERIODS AND VERY
FAST RESPONSE – LOW SPACE**

Constant stream of Battery news

[GTM: Global energy storage market could reach 8.6GW / 21.6GWh by 2022](#)

'Virtual Power Plants'.

Another interesting plan to use batteries to avoid a grid upgrade. The utility covering Lebanon, a small New Hampshire town

[SA Water plans 152MW of solar and 35MWh of energy storage](#)

UK top-3 global markets for storage deployment

RWE plans 100MW battery at Tilbury UK

[WorleyParsons: Oregon battery EPC deal kicks off wave of distributed energy projects](#)

Batteries and grid reliability.

The world's largest battery, in South Australia, has proved its value in its first months of operation.

[US: ESA lays path for 35 GW of energy storage by 2025](#)

[Masdar partners with Costa Rica utility on solar, storage and smart cities](#)

BP to trial battery storage alongside Tesla at US wind farm

Spain vehicle charging. Utility Iberdrola said it would install 25,000 chargers, mostly in homes, by 2021.

[IEA-PVPS: Integration of solar requires improved forecasts, flexibility resources, more storage](#)

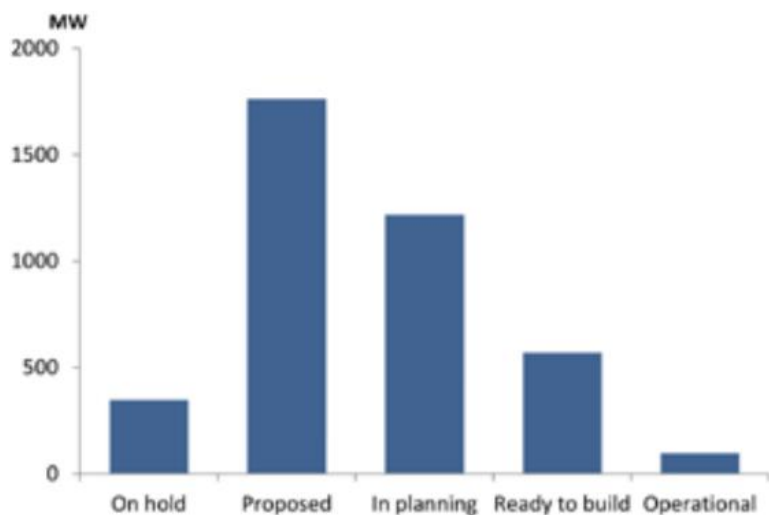
Varta Storage Top 3 in European Home Energy Storage Systems

UK Now Has 3.2 GW Of Energy Storage, With Much More On The Way

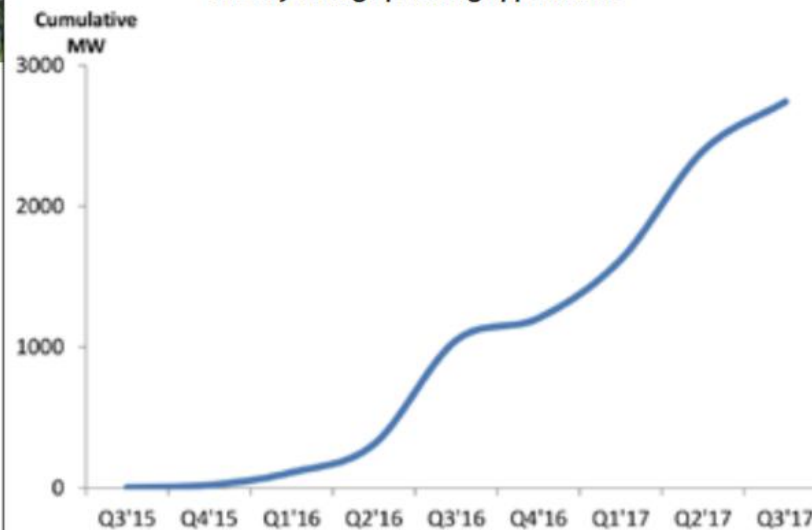
65MW / 130MWh South Korea solar-plus-storage contracts

Actual Activity in the UK March 2018

Project status (MW)



Battery storage planning applications



Already a huge amount available in the market

	Residential (<20 kW)	Commercial (20 kW to < 100 kW)	Utility (100 kW+)
Hybrid, Multi-Port Inverter	 		
Energy Storage PCS	 	 	
Off-Grid/UPS/Microgrid	 	 	

Lots of Battery types



	Lead Acid	NI-Cd	NI-MH	LI-Ion	LI-Poly	LiFe
Voltage	2V	1.2V	1.2V	3.6-3.7V	3.6-3.7V	3.3V
Energy Density (Wh/Kg)	35	45	70	167	110	100
Cycle Life	400	500-1000	400-1000	300-1000	300-1000	>1000
Life (Yrs) @ one charge/day	1	2	2	1+	1+	3
Self Discharge Rate (%/mo)	10%	30%	30%	3%	3%	3%
Charging Time	8 hrs	1.5 hrs	4 hrs	2-6 hrs	2-6 hrs	1-3 hrs
Safety	No BMS	Good	Good	Poor	Average	Good
High Temp Performance	Good	Good	Good	Average	Average	Good
Cold Temp (0°F) Charge	Good	Fair	Fair	0-45degC	0-45degC	0-45degC
Cold Temp (0°F) Discharge	Good	Good	Poor	Avg-Good	Avg-Good	Good
Memory Effect	No	Yes	Little	No	No	No

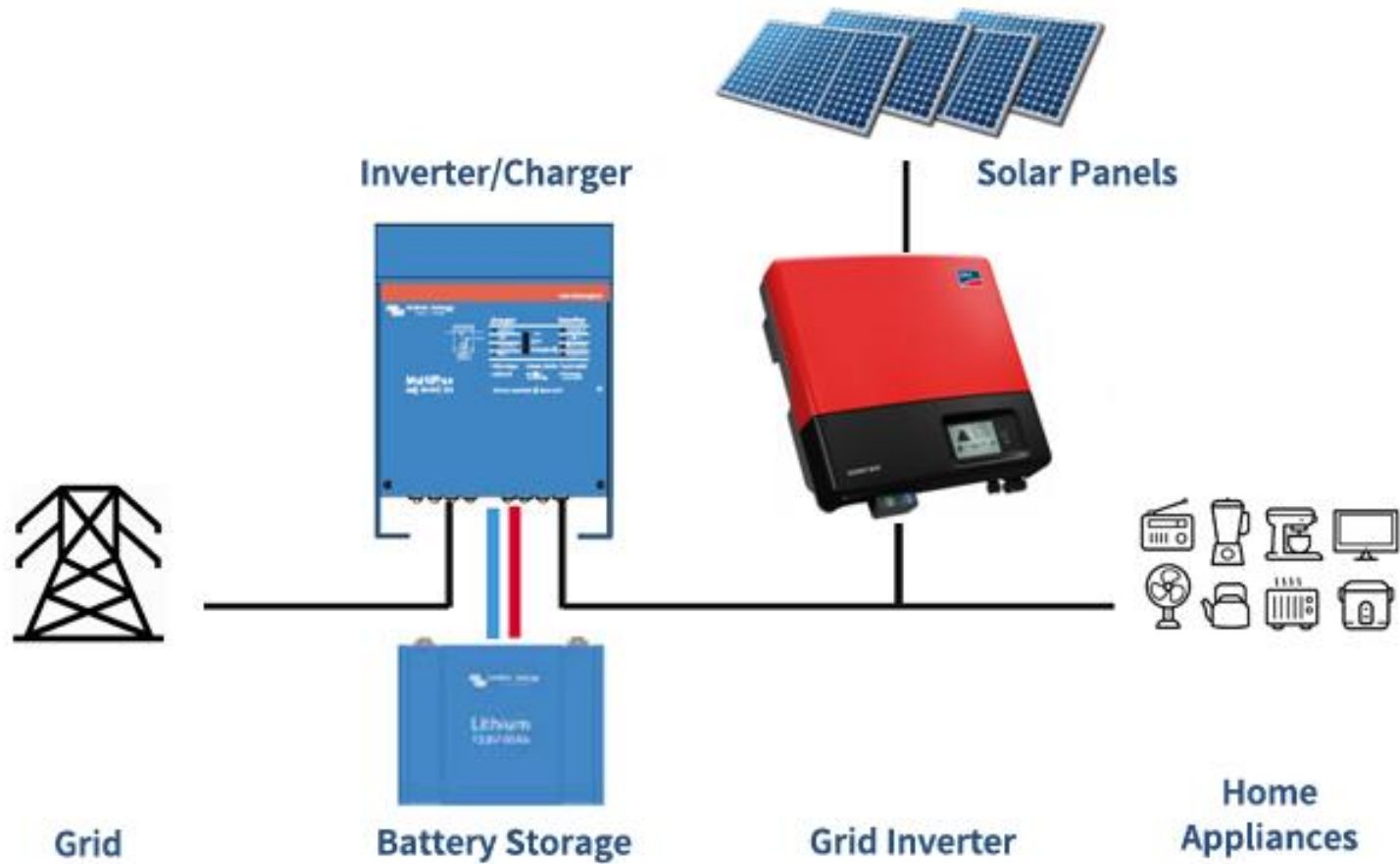


Tesla Powerpack Battery



Energy Capacity	155-210 kWh (1.2 – 4-hour system)
Weight	2,160 kg
Length	1,308 mm
Width	822 mm
Height	2,185 mm
Operating Temperature	-30°C - 50°C (outdoor) 0°C - 30°C (indoor)

How do they work ?



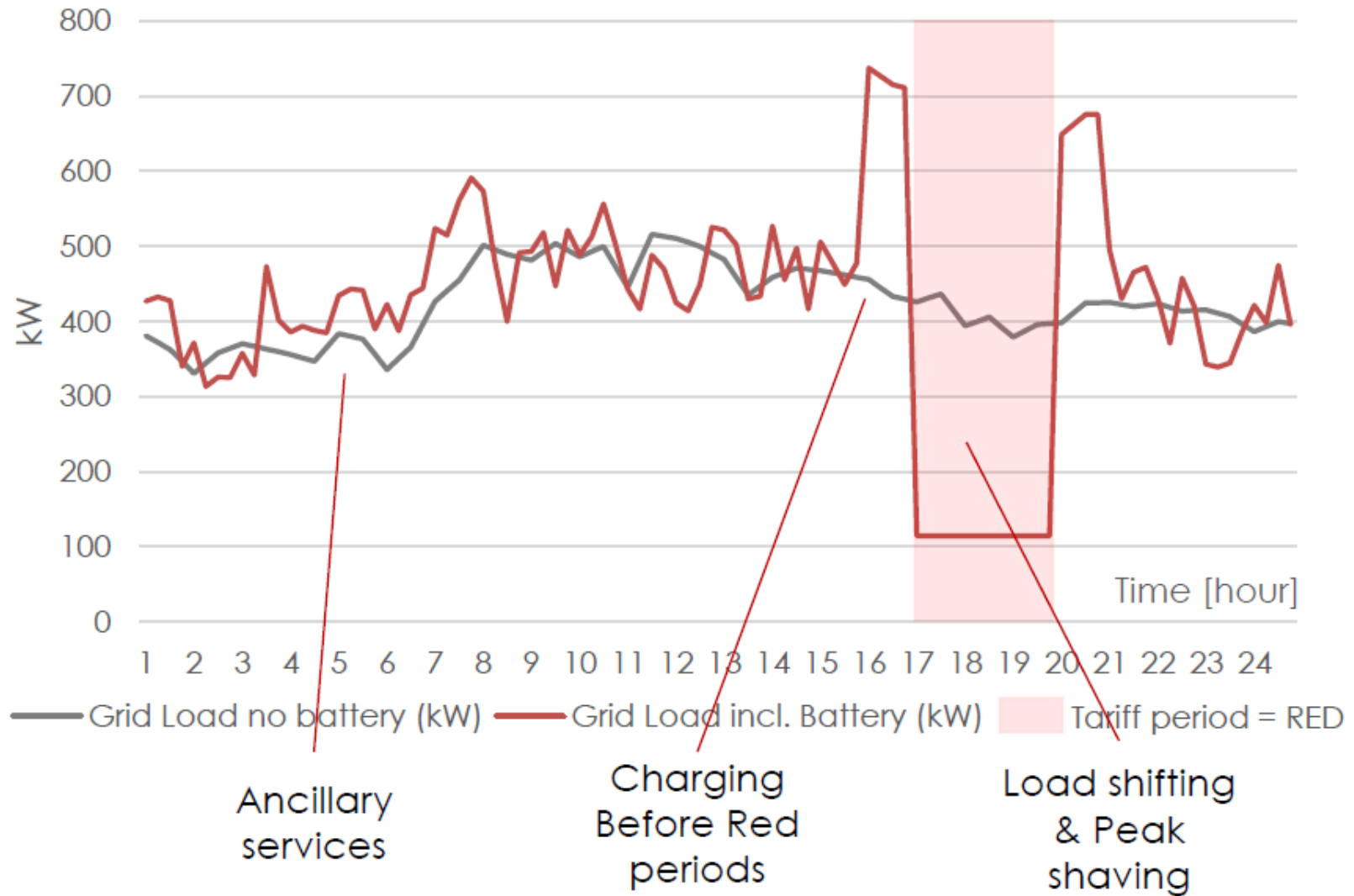
Will they ever pay ? - Potential Revenue Streams - Aggregators

- 1. Grid balancing services -**
Enhanced and Firm Frequency Response (EFR/FFR)
- 2. Capacity market –** annual auctions
- 3. Time Shifting –** to reduce consumption during red rates (DUoS Distribution Network Use of System charges)
- 4. Peak avoidance (TUoS** Transmission network Use of System charges)
- 5. Time Shifting –** maximise PV self consumption
- 6. Grid capacity support, eg STOR**



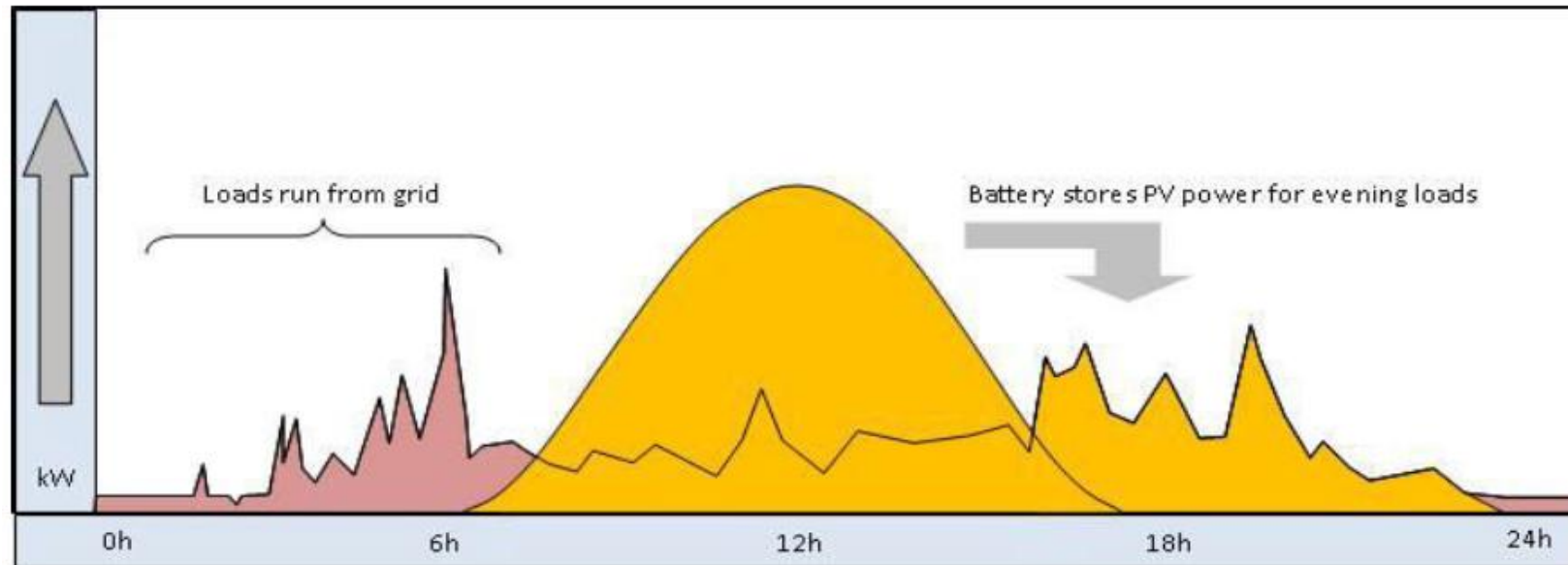
More on this if of interest

Power Profile with/without



Maximising self consumption from PV

‘Time-shifting’ PV energy from daytime surplus to meet evening demand



Capital Costs

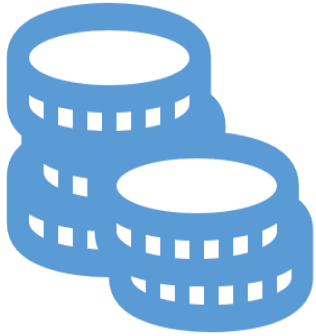
Power Rating (kW)	Capacity (kWh)	Equipment Cost	Installation Cost	Total Cost
100	169	£103,500	£18,000	£121,500
200	338	£180,000	£24,000	£204,000
300	507	£244,800	£30,000	£274,800
400	676	£316,100	£37,200	£353,300
500	845	£388,600	£45,000	£433,600



Typical Financial Analysis – without renewable

Item	105 kW 169 kWh	522kW 845 kWh
Annual DUoS+TUoS Cost Saving	£8,450	£24,900
Annual Capacity Market Revenue	£1,050	£6,150
Annual FFR/EFR Revenue	£7,700	£33,300
Annual O&M Cost	-£1,000	-£1,500
Annual Income (Revenue Less O&M Costs)	£16,200	£62,850
Capital Cost (Supply and Installation)	£125,000	£433,600
Payback Period	7.5 years	6.9y

SOME CONSIDERATIONS



BEWARE REVENUE RISK

No feed-in tariffs
... but some grants
are available



CONTROL SYSTEM CAN BE COMPLEX

Need to define
battery purpose



DON'T FORGET BATTERIES ON WHEELS!

Electric vehicles

Closing thought



146,000

Plug-in Cars

Reg. UK April 2018
(Approx)

5,200

Plug-in Vans

Reg. UK April 2018
(Approx)

62

Plug-in Models

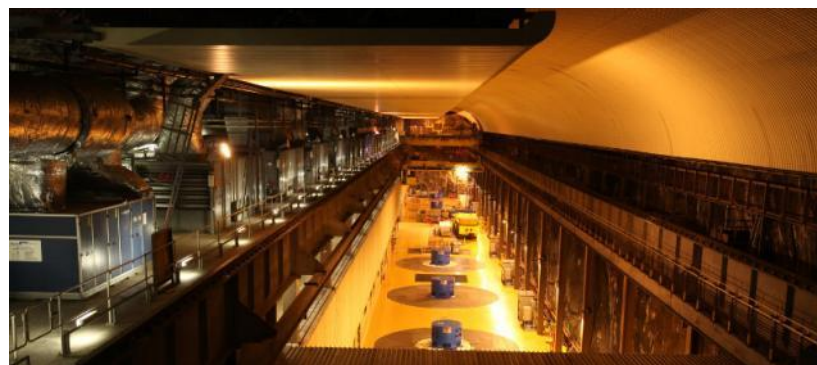
Available April 2018
(Plus variants)

15,847

UK Charge Pts

April 2018
(Zap-Map)

- 46,522 new electric and plug-in hybrid cars were bought in the UK in 2017
- Estimated - 60,000 low-emissions models to be registered in 2018



Thank you – “But maybe we could stick with Fossil !”

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