Carbon and Time

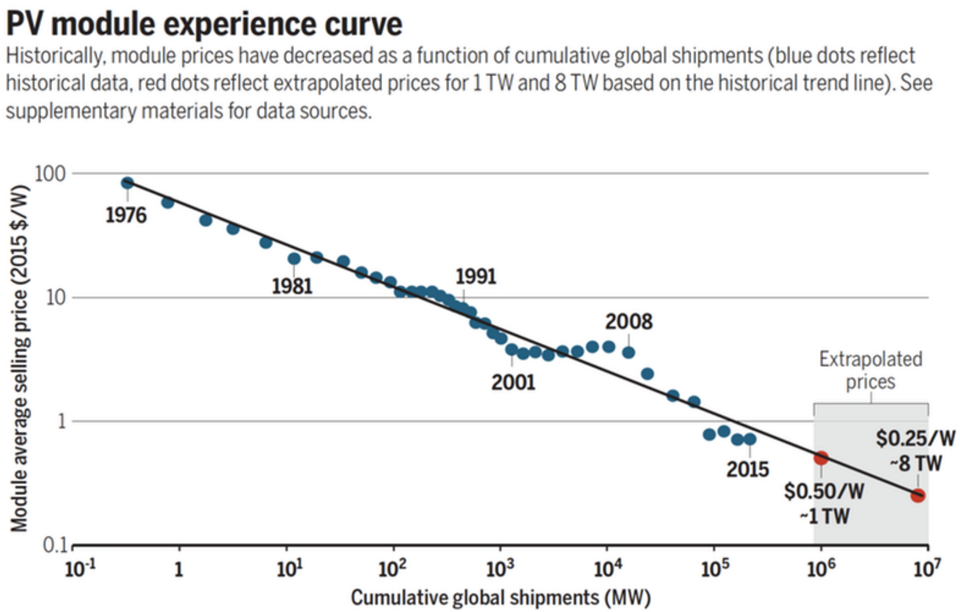
The latest on solar PV and battery storage

Dr Christian N Jardine

Technical Director, Joju Solar

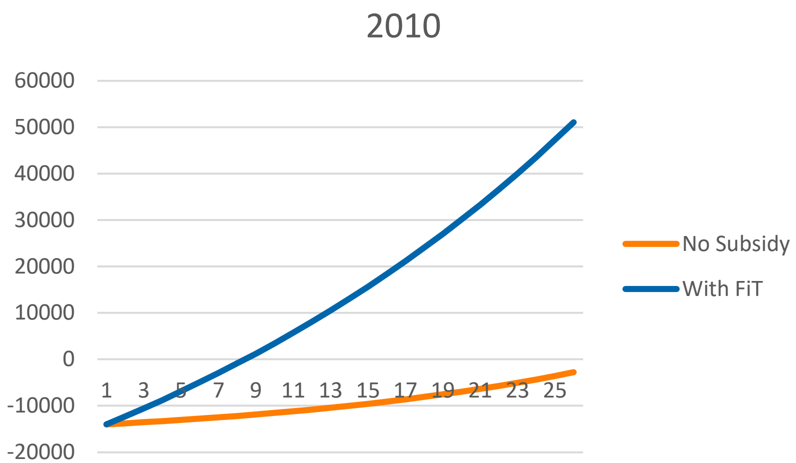
Senior Reserarcher, Environmental Change Institute, University of Oxford

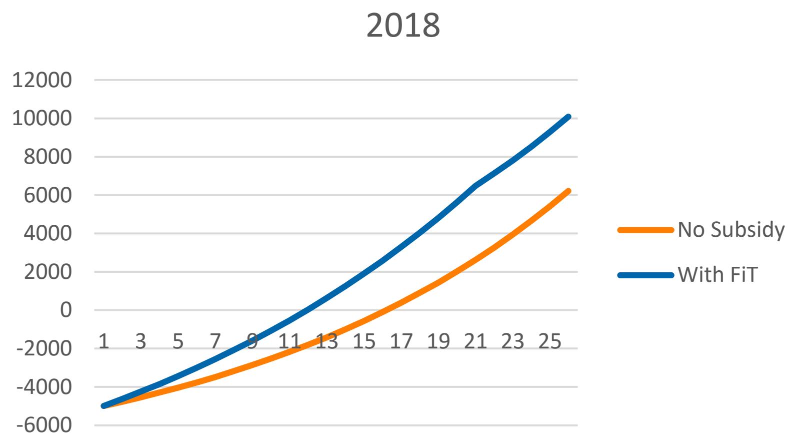
Price reductions in Solar PV



- Dramatic cost reduction seen in solar PV
- 10-fold price decrease over last 10 years
- Disrupting energy markets (but not the building industry?)

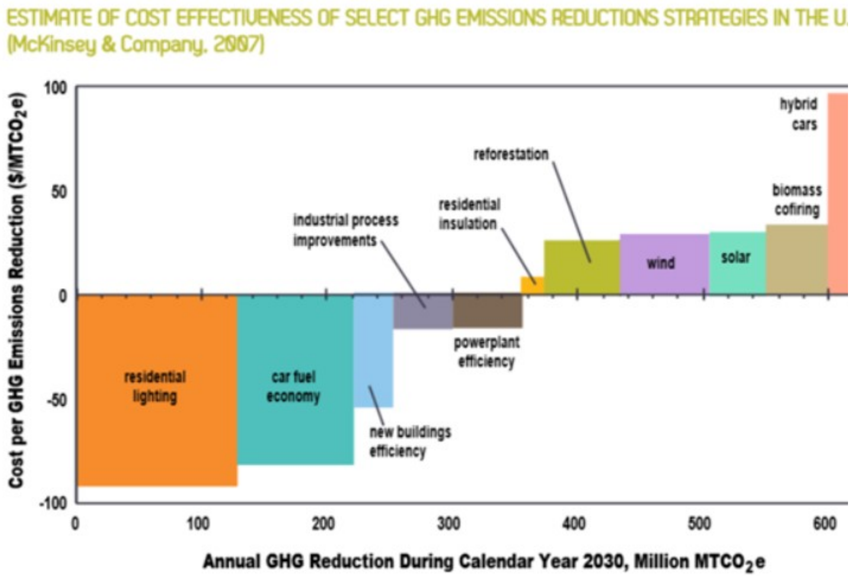
Economics of Solar PV

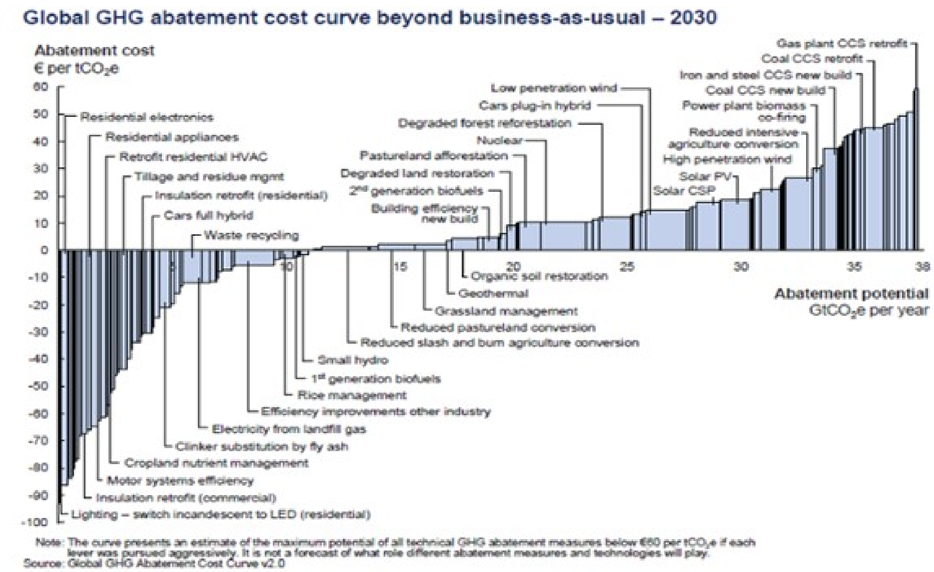




- 10 years ago solar PV didn't pay for itself and needed subsidy
- Today it is profitable without subsidy
- It is cost negative over its lifetime
- (Though some mechanism to bring paybacks earlier would be helpful)

Marginal Cost Curves





- Marginal cost curves are all out of date
- Implications for “energy ladder”
- PV shouldn’t be ‘the last’ thing you do

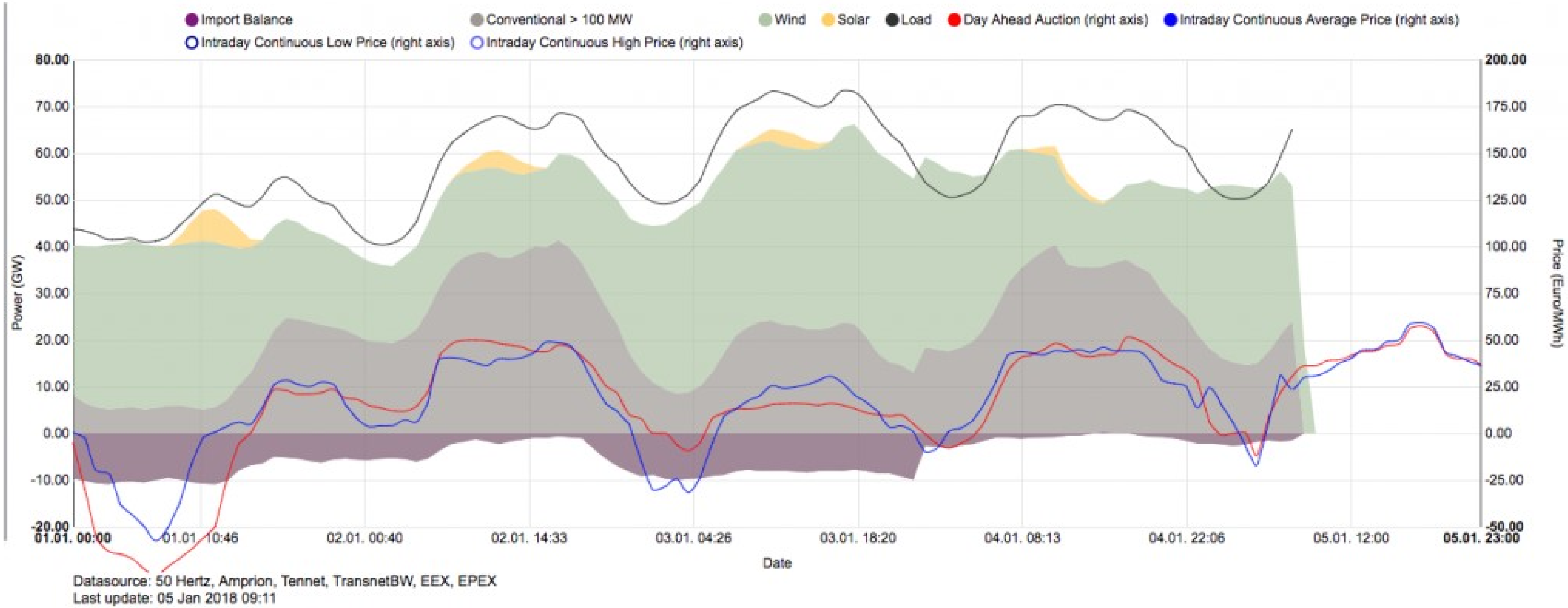
Carbon targets and perverse behaviour

- Often see small amount of solar needed to meet code
- Marginal cost to fill roof £1500
- To save an extra 1.5tC per annum.

Two types of developer

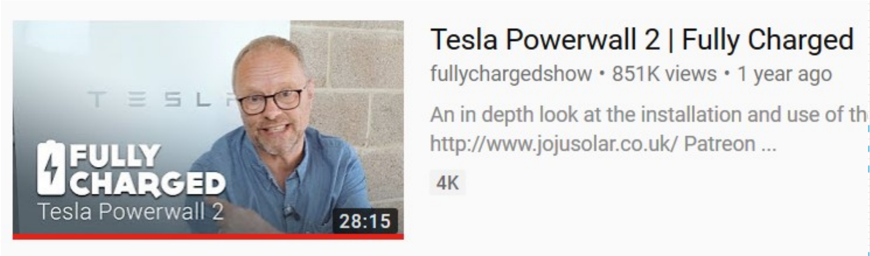
The bad guys ….	The good guys ….
Volume housebuilder./developers	Environmentally focussed architects
Work to just meet code, minimise cost	Prepared to go beyond code, cost less important
High unit price, inefficient use of capital and roof space	Low unit price, efficient use of capital and roof space
Should consider PV earlier in energy ladder	What impacts does low cost of solar have on ‘fabric first’ approach?
	Competition for south facing space? Or good synergies with prevention of overheating?

The issue of intermittency



- Electricity grids are decarbonising (and must to hit 1.5°C)
- Increased volumes of intermittent renewables
- Needs managing – implies storage will be required.

Behind the meter storage



- Lot of interest in behind the meter storage – maybe 5-10,000 units installed?
- Not a given that this is a technologically or economically sound strategy
- Not cost effective for householder yet
- Way of using more of own solar; the Tesla effect; holding for charging electric cars

Developer responsibility

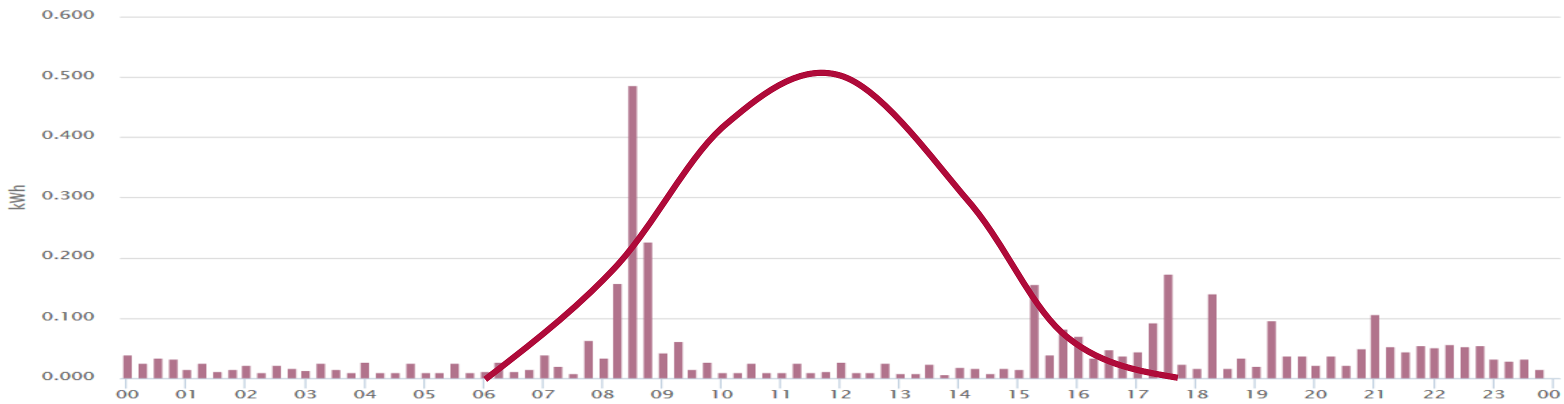
It's my job to reduce carbon. It's up to the grid operators to sort intermittency

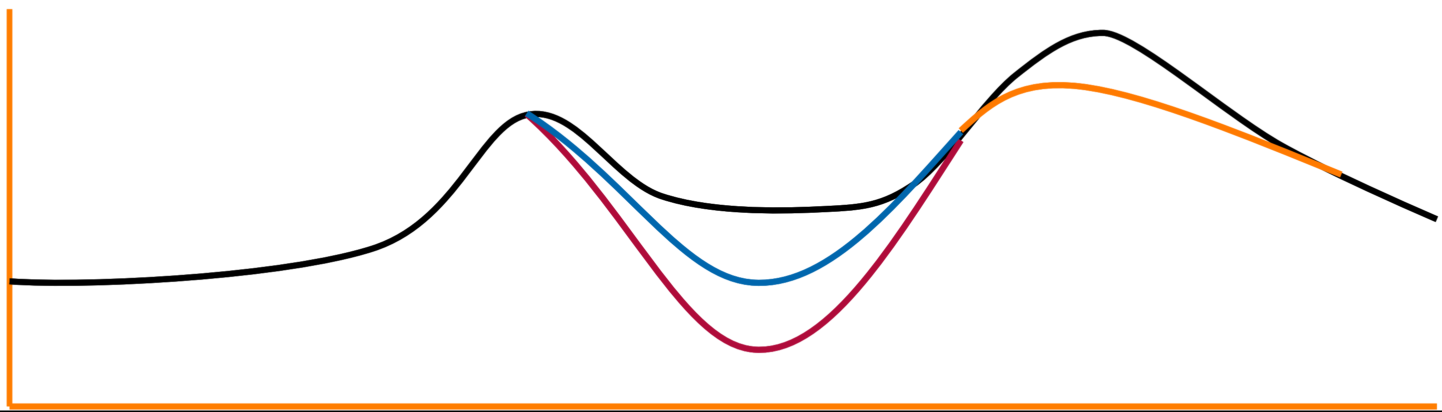
A battery is going to be broadly helpful, so I could look at including one

We should design houses to be self sufficient zero carbon entities

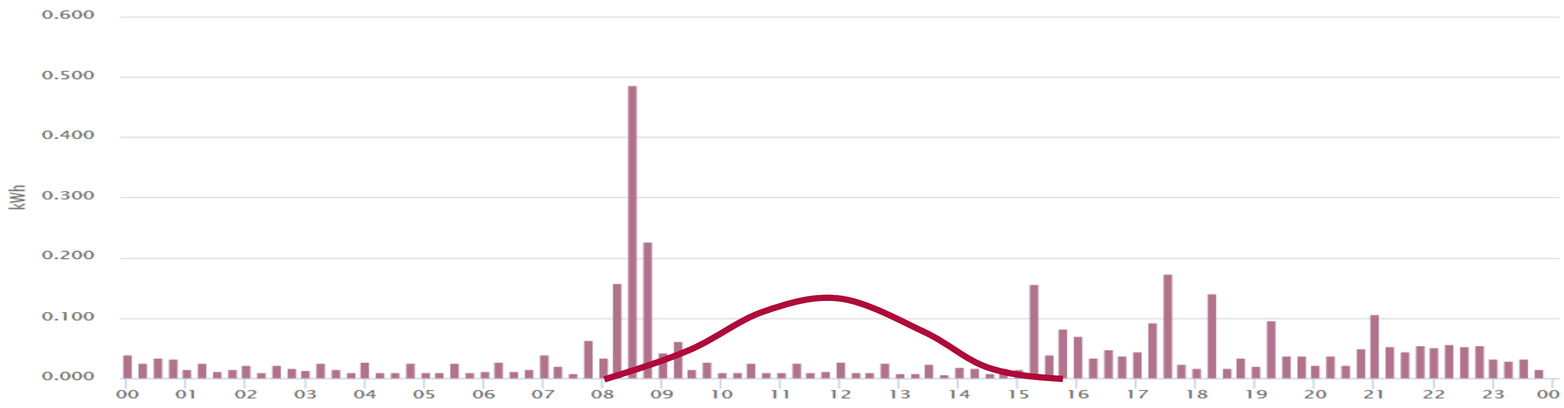
- Range of views from no engagement to perhaps over-engagement
- We get times as much solar energy in summer than winter
- Need huge PV system to be independent year-round.
- Off-gridding is capital and materially expensive, and bad for overall system

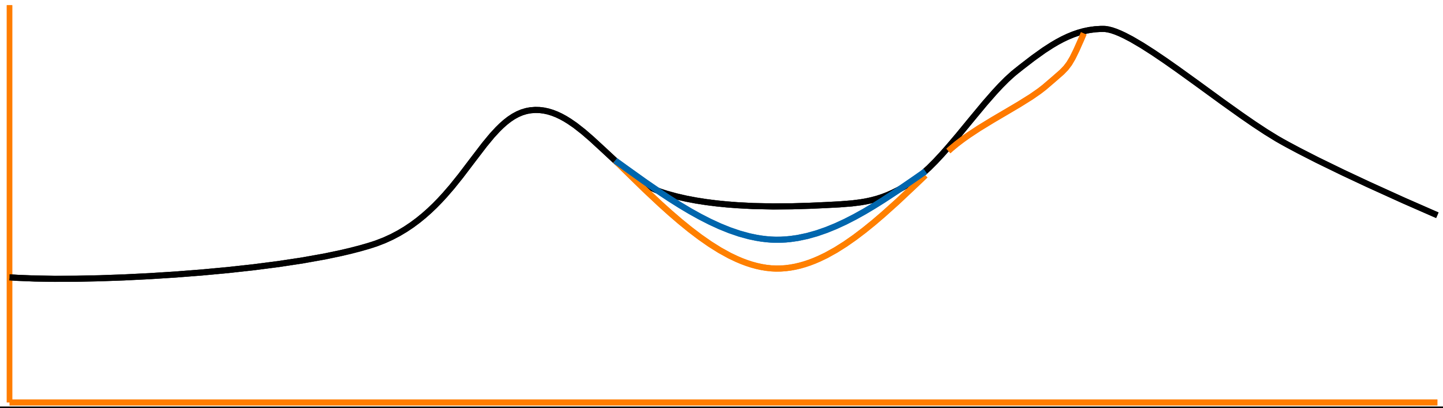
Classic load-shifting (autumn/spring)



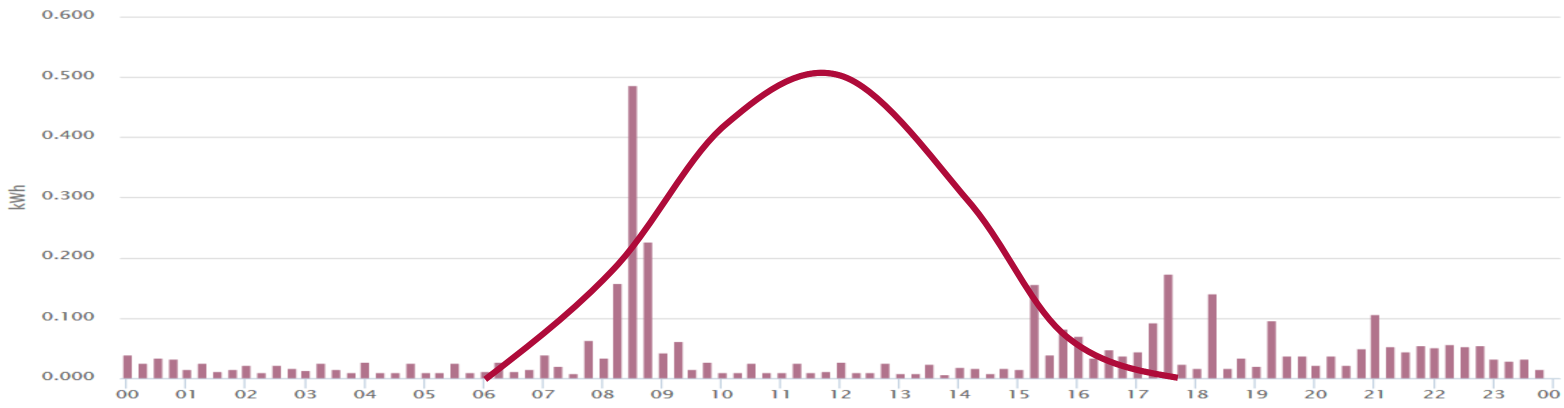


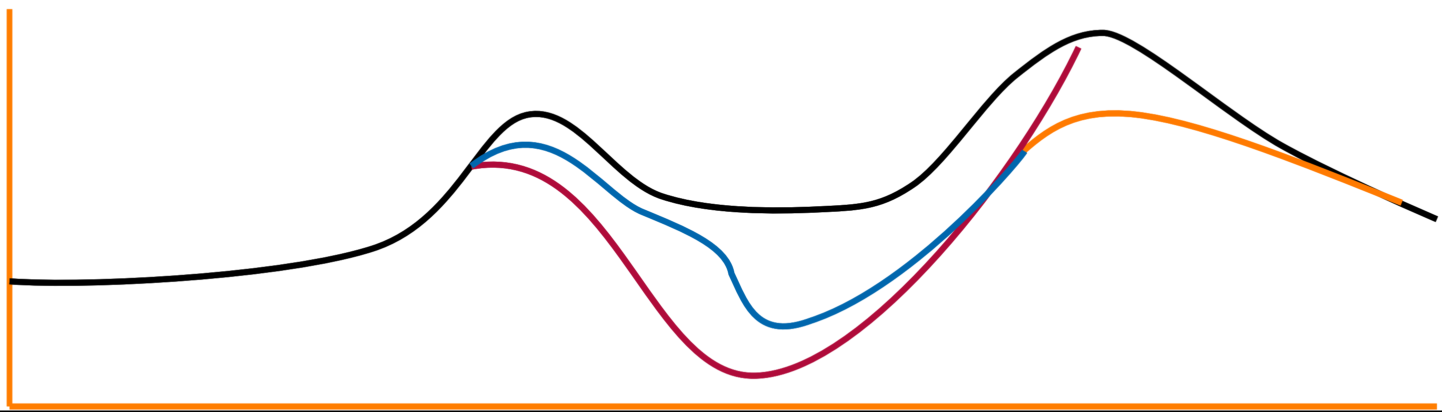
Load-shifting (winter)





Load-shifting (summer)





So, broadly 3 modes of operation

- Spring/Autumn
  - Broadly well balanced
  - Excess generation feeds battery
  - Discharges overnight
- Winter
  - Not enough excess generation to fill battery
  - A kettle can empty it
  - Won’t last into the evening peak
- Summer
  - Too much generation!
  - Battery can be full by mid morning
  - You end up exporting anyway
  - Damaging to grid = some smartness needed to control portfolios of batteries

- All means you can’t have 100% self consumption
- Clients need better understanding than just the classic model.

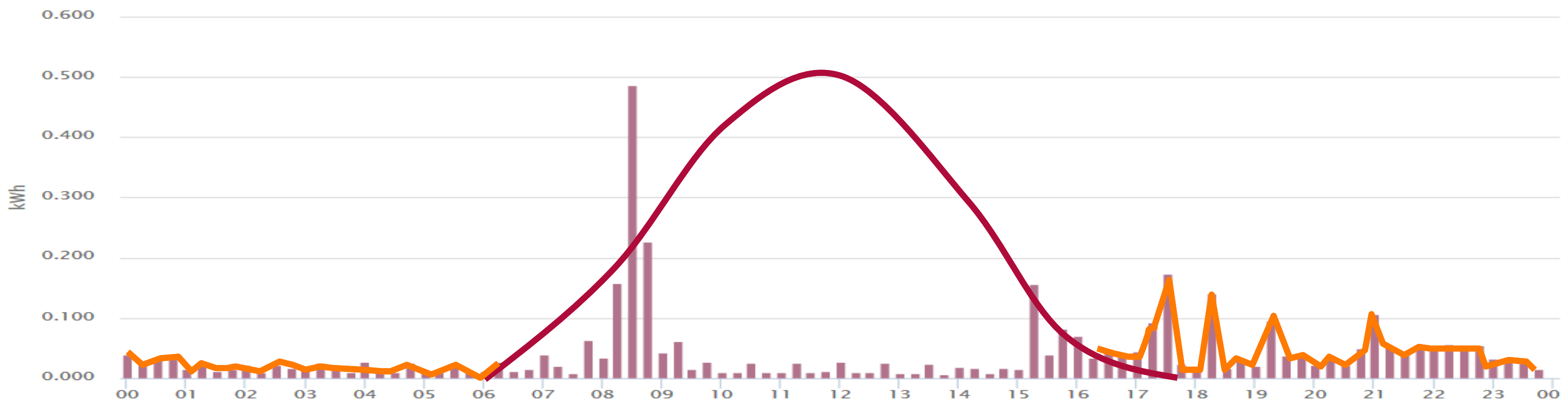
What about discharge?

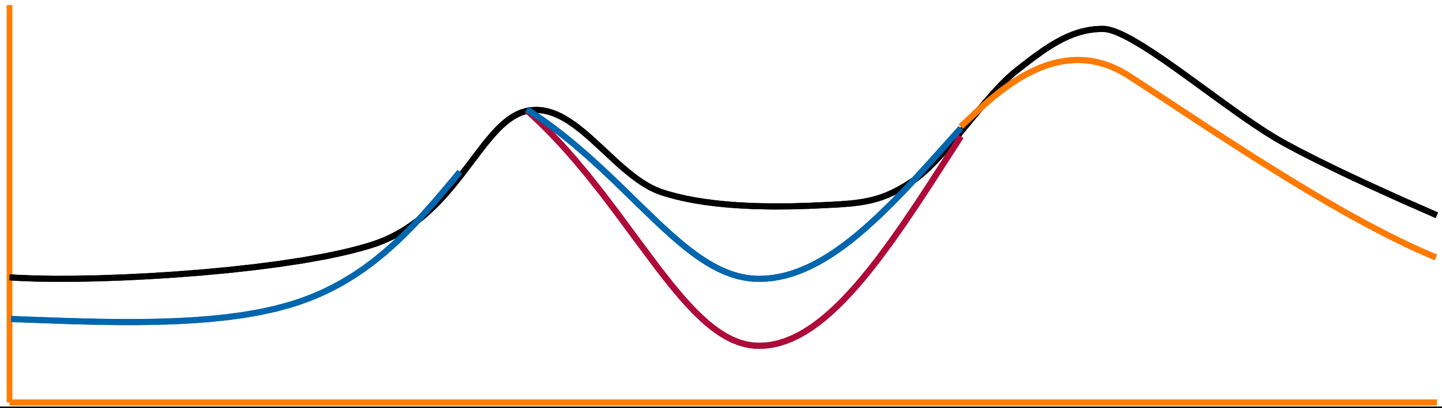
- Batteries are brilliant technologies for storing electricity
- They can soak up excess whenever it is available

- But less thought given to discharge
- This is when batteries are really valuable

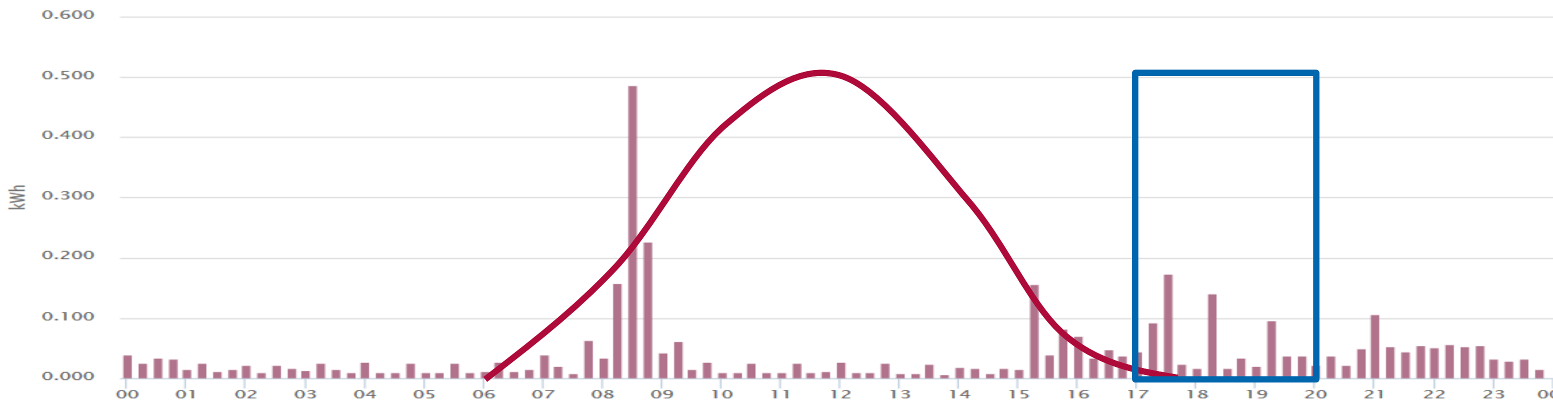
- Two broad models at present
  - Self-consumption
  - Peak shaving
- In future
  - Flexible charge/discharge based on grid-wide fossil generation needed
  - Or other ancillary services

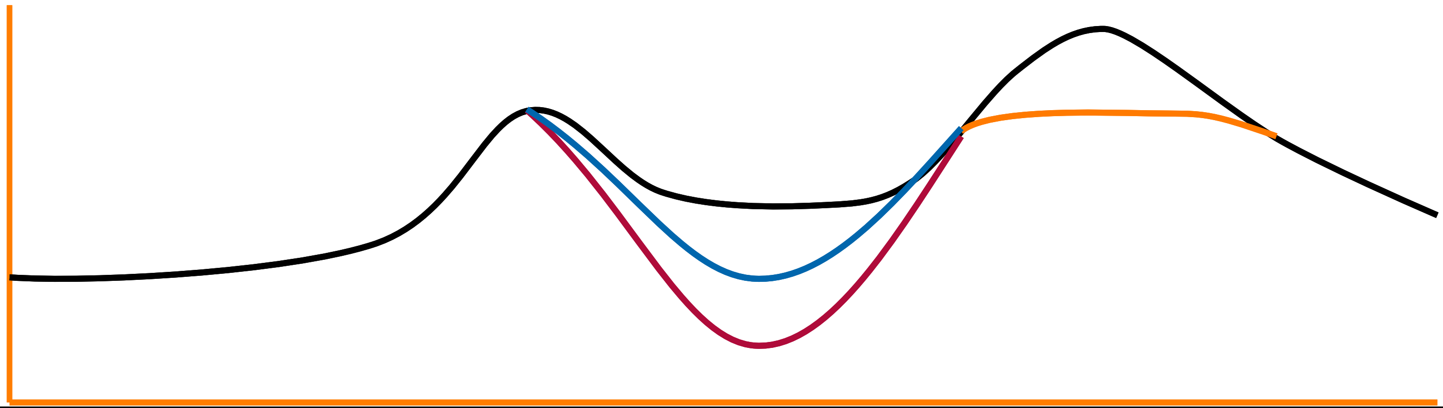
Self-consumption





Peak demand discharge





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Motivations

Self-consumption	Peak shaving
Use your own generation	Discharge when most useful to system
Lower utilisation (battery might not empty)	High utilisation (battery empties)
“use it, or lose it”	“help get more renewables”
Insular, isolationist	Part of a larger system
Take back control	Be the control!
Self-reliance	Resilience in networks

It’s all a bit Brexit-y

It’s all a bit Remain-y

Concluding thoughts ….

- Dramatic reductions in PV price have seen PV become cost negative over lifetime
- Repercussions for building design approach – what does this mean for 'fabric first'?

- Batteries do not save carbon *per se* – only if used to be helpful to grid management

- How are you accounting for carbon and at what timescale?
  - Do you draw boundaries around the property, or the UK?
  - And do you account on an annual of ½ hourly basis?
- This will impact design of PV/battery system, and its operating strategy.

Thank you

For further information:
@jojusolar   @DrChrisJardine
facebook.com/JojuSolar

Dr Christian N Jardine

01865 403336
chris.jardine@joju.co.uk