Imperial College London

ELECTRICITY STORAGE IN FUTURE GB NETWORKS

—

A MARKET FAILURE?

Philipp Grunewald

Centre for Energy Policy and Technology

Imperial College London

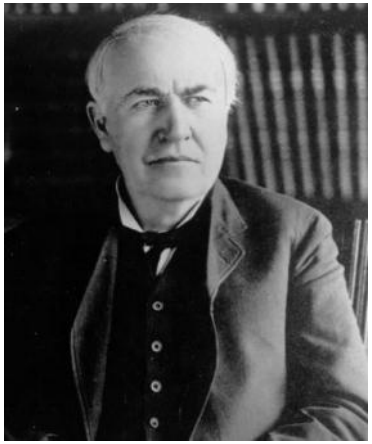
Imperial College
London

Just as soon as a man gets working on the secondary battery it brings out his latent capacity for lying. [. . .] Scientifically, storage is all right, but, commercially, as absolute a failure as one can imagine.

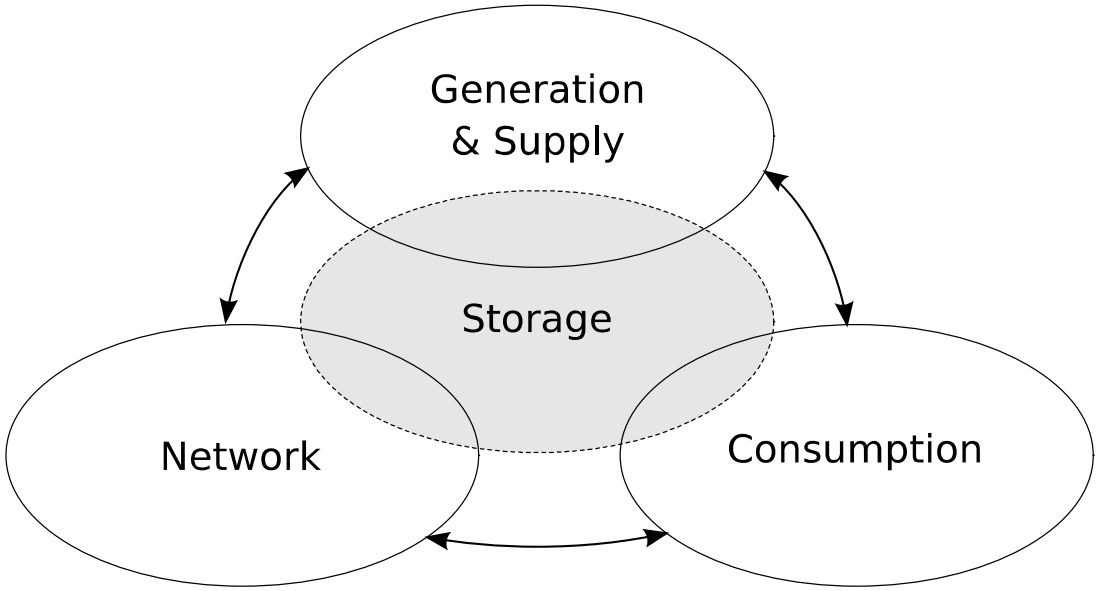
Thomas Edison, 2 February 1883

Inside of 15 years the entire vehicle traction in large cities in the United States will be done electrically & I am now manufacturing the battery that will permit this to be brought about commercially.

Thomas Edison, 6 May 1908

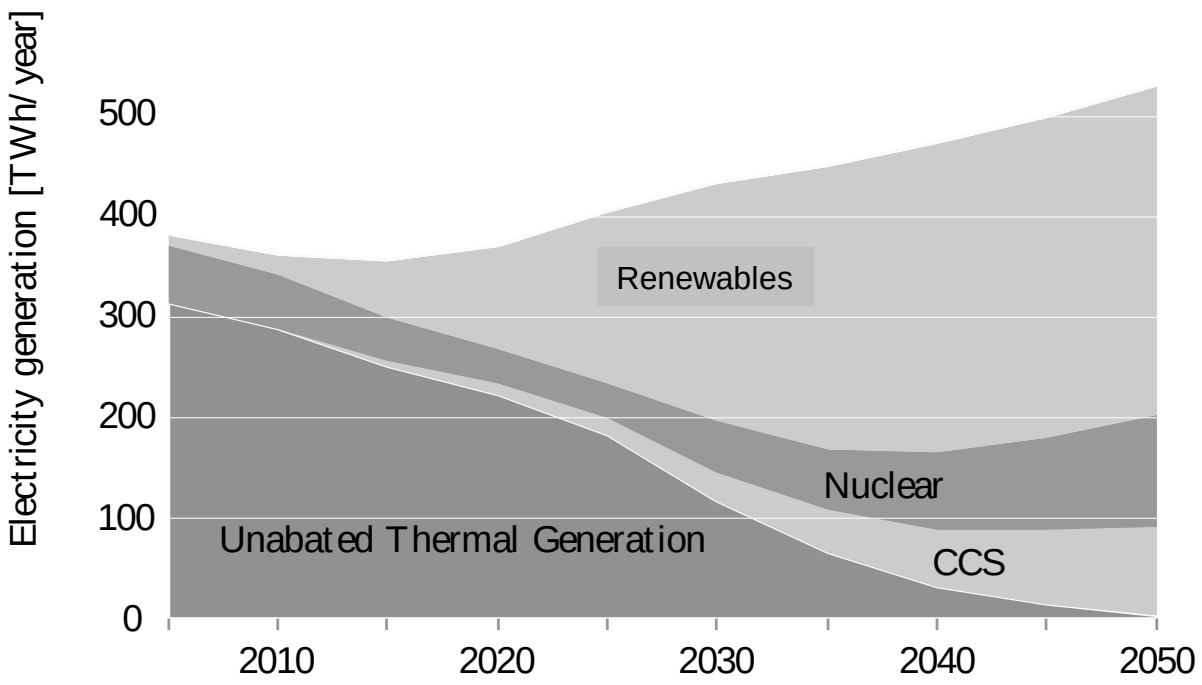


Culham lock (built 1809)


Generation
& Supply
Storage
Network
Consumption

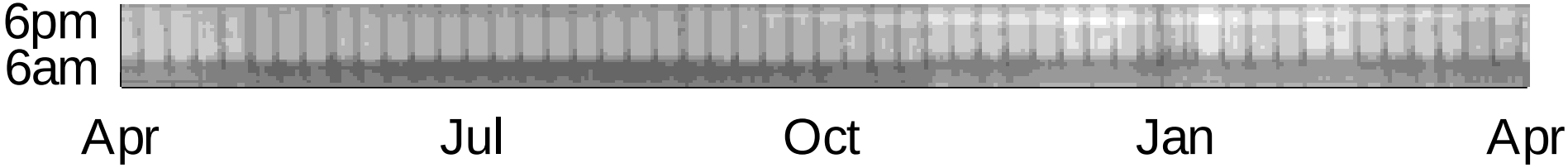
Imperial College London

DECC 2050 GRASSROOTS SCENARIO

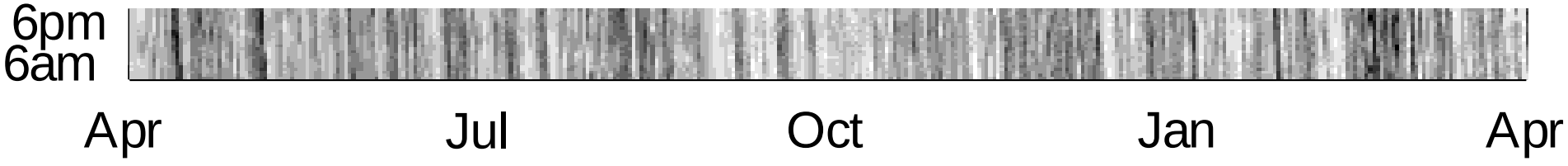


Imperial College
London

DEMAND

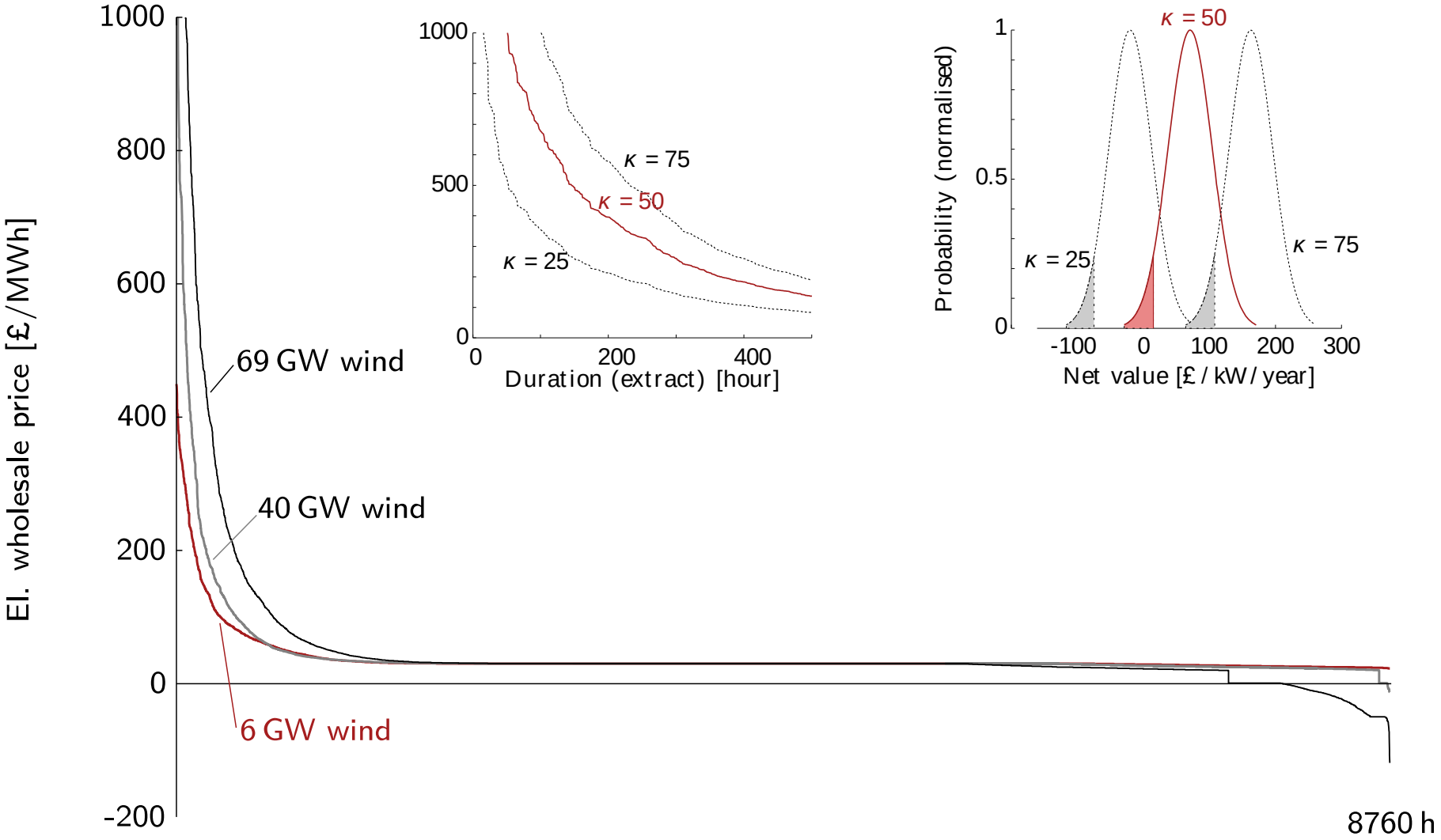


WIND



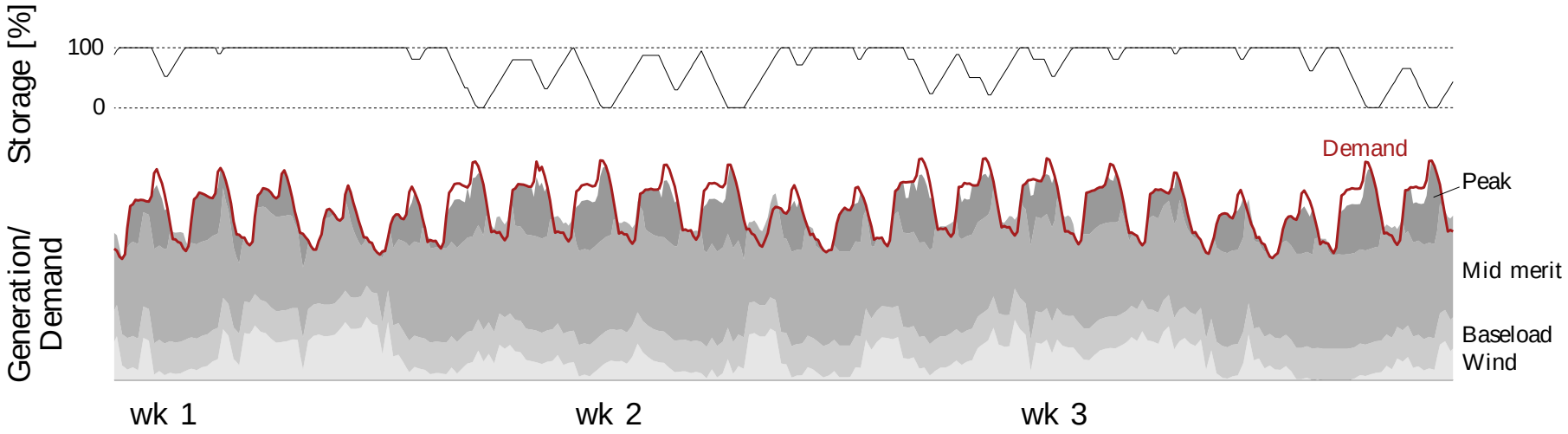
Imperial College London

PRICE VOLATILITY



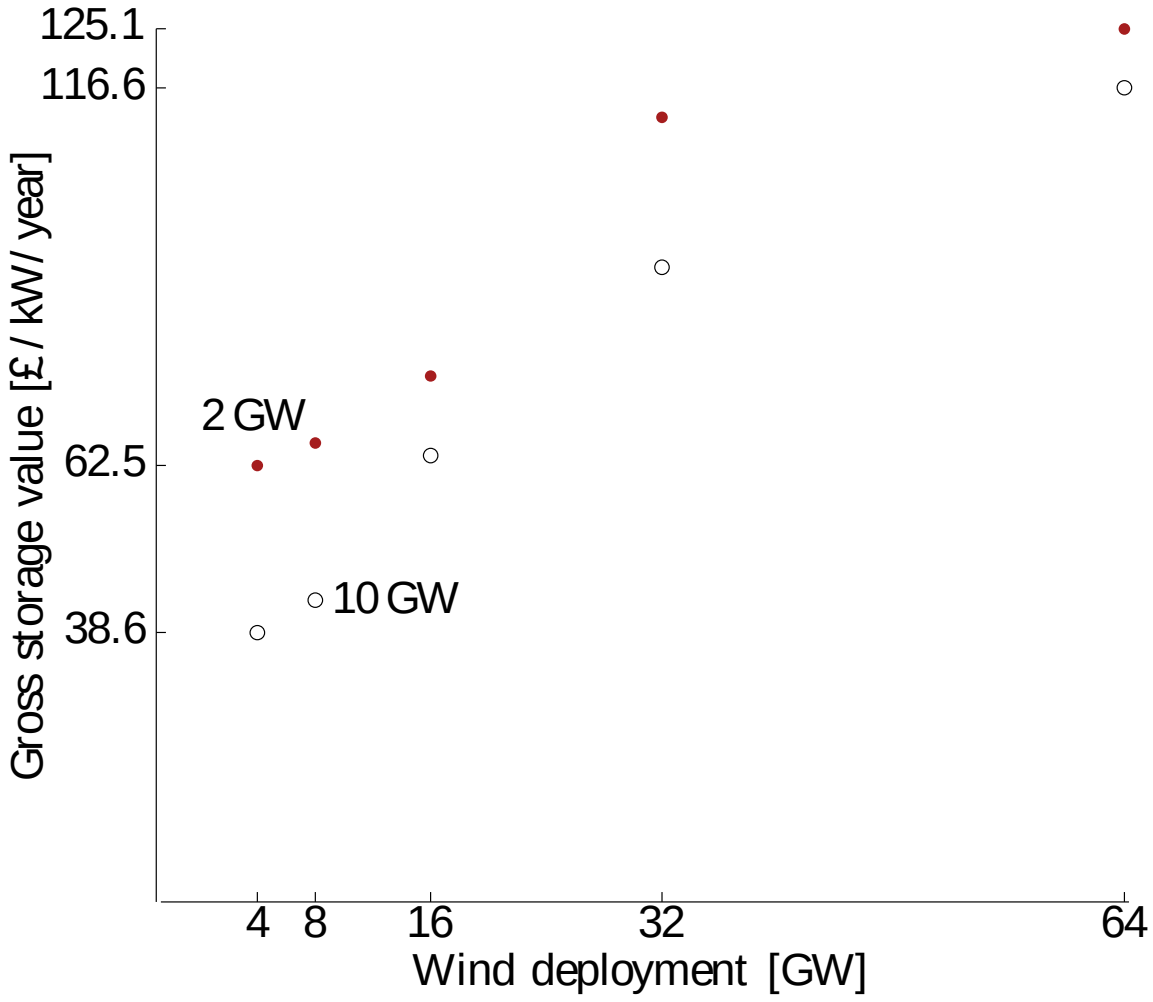
Imperial College London

STORAGE OPERATION



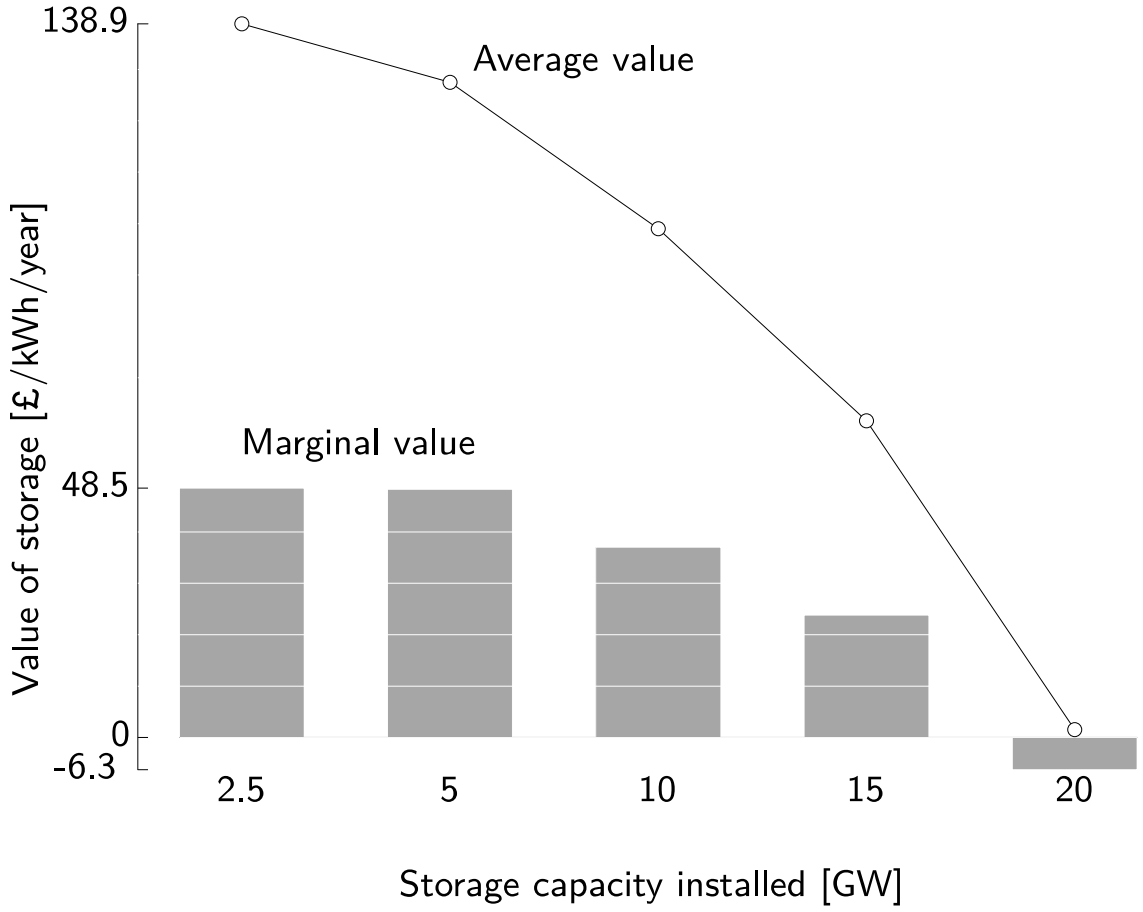
Imperial College London

STORAGE GROSS VALUE



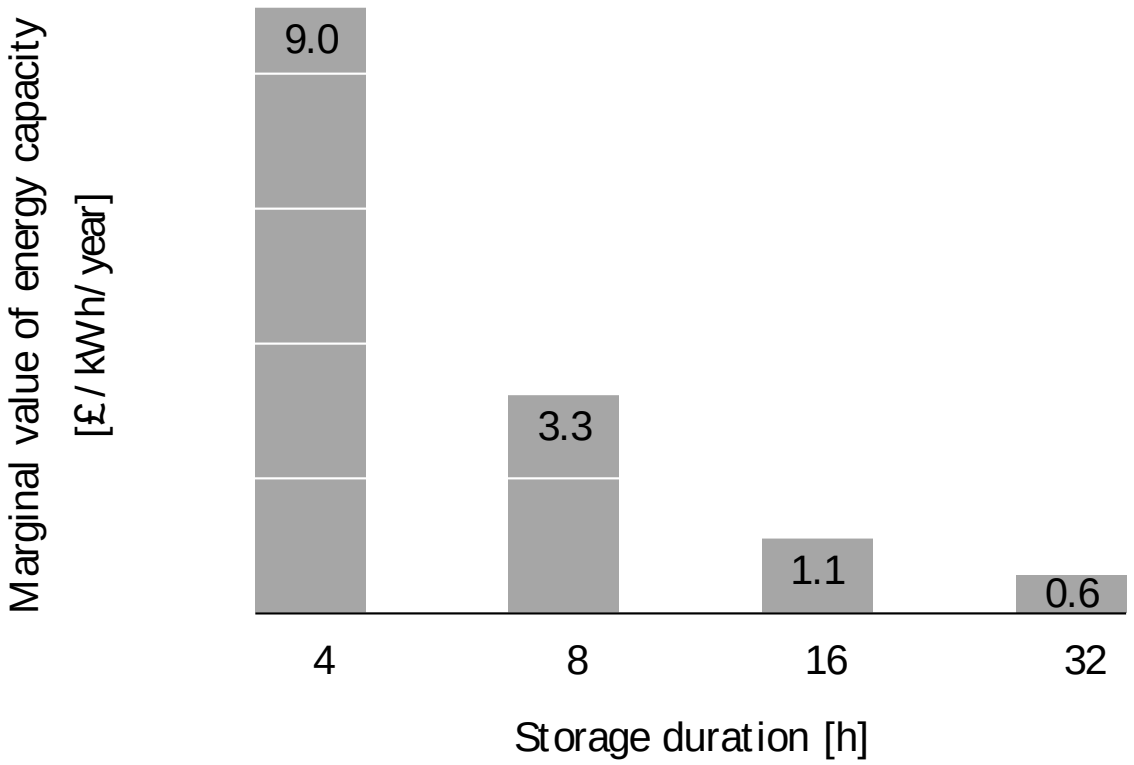
Imperial College London

Self Cannibalisation



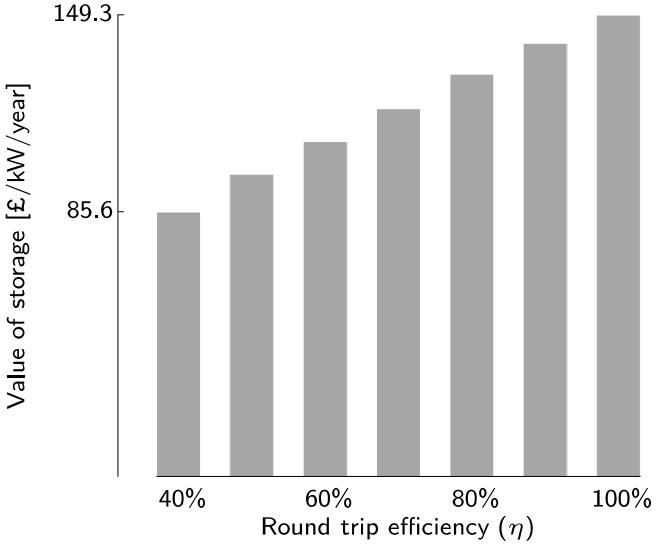
Imperial College London

STORAGE DURATION

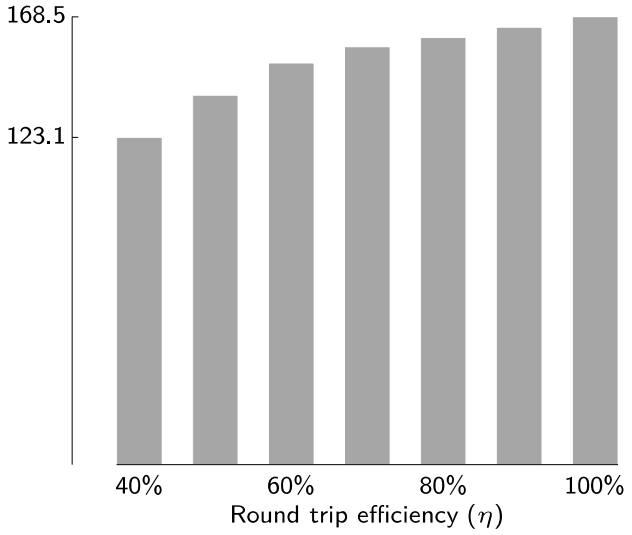


Imperial College London

EFFICIENCY



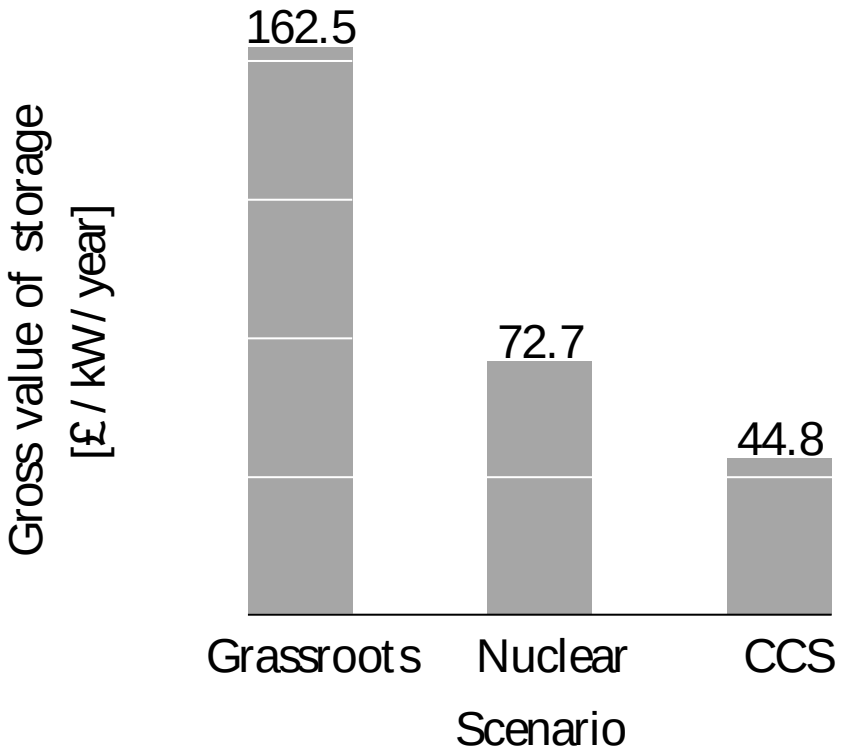
(a) *20 GW wind*



(b) *40 GW wind*

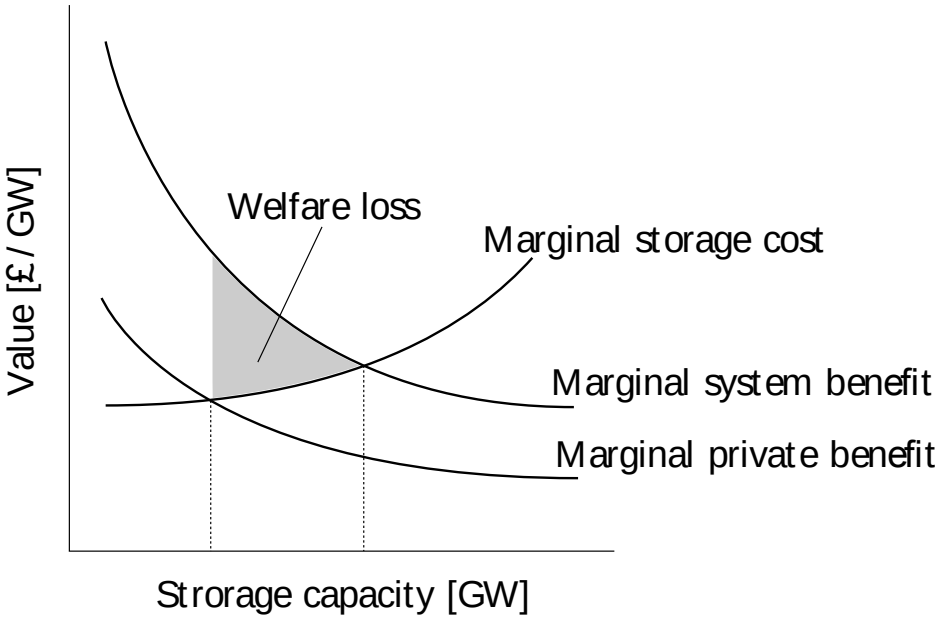
Imperial College London

SCENARIOS



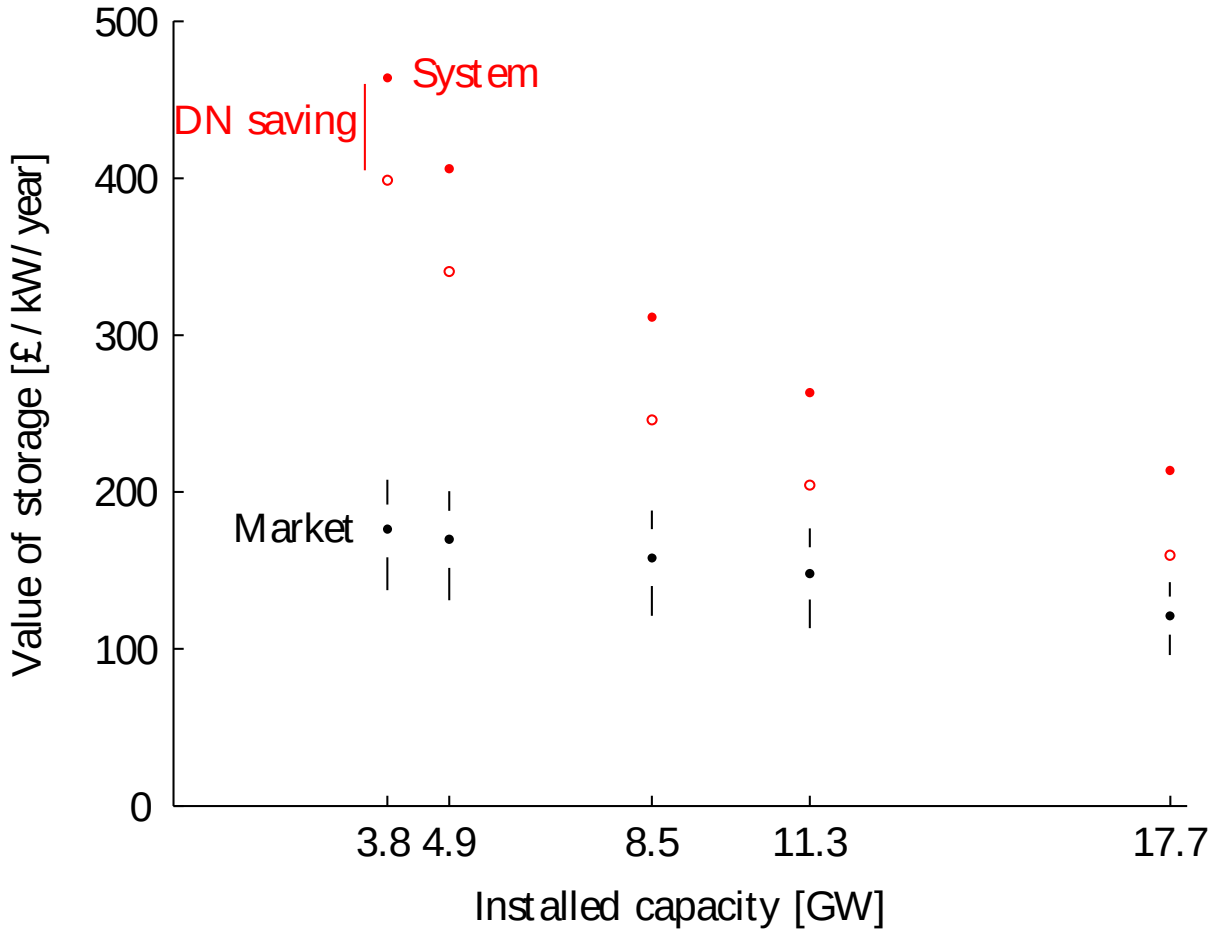
Imperial College London

MARKET FAILURE?



Imperial College London

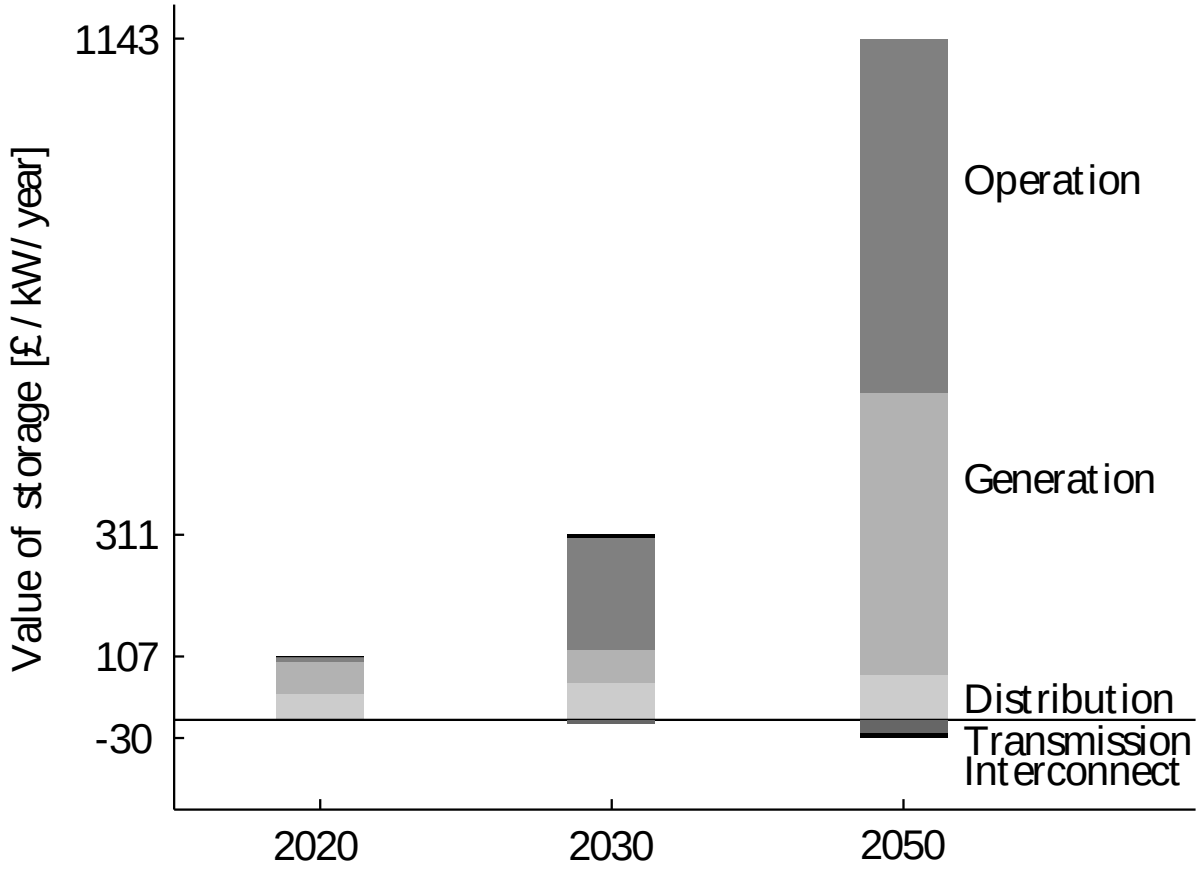
System and Market Value



System values: Strbac et al., Strategic Assessment of the Role and Value of Energy Storage Systems in the UK Low Carbon Energy Future. The Carbon Trust

Imperial College London

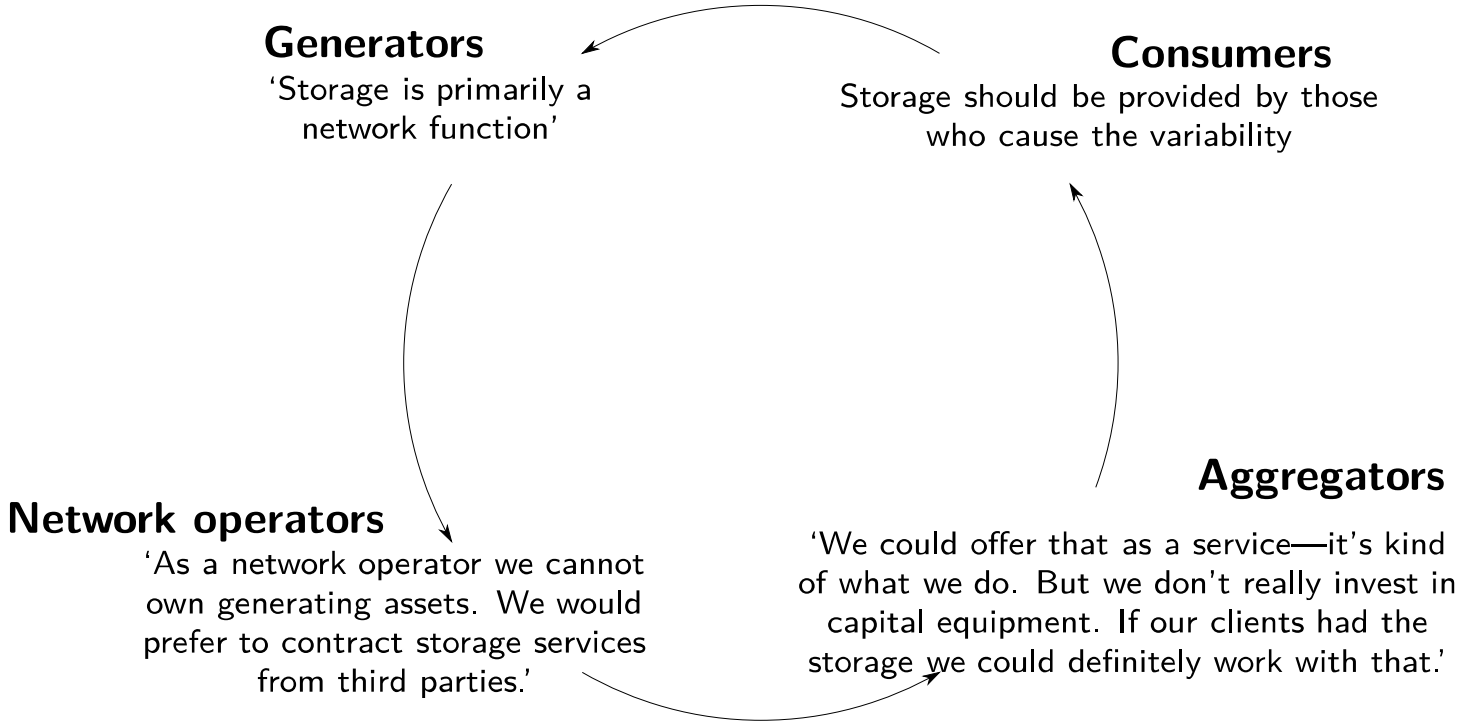
VALUE AGGREGATION



System values: Strbac et al., Strategic Assessment of the Role and Value of Energy Storage Systems in the UK Low Carbon Energy Future. The Carbon Trust

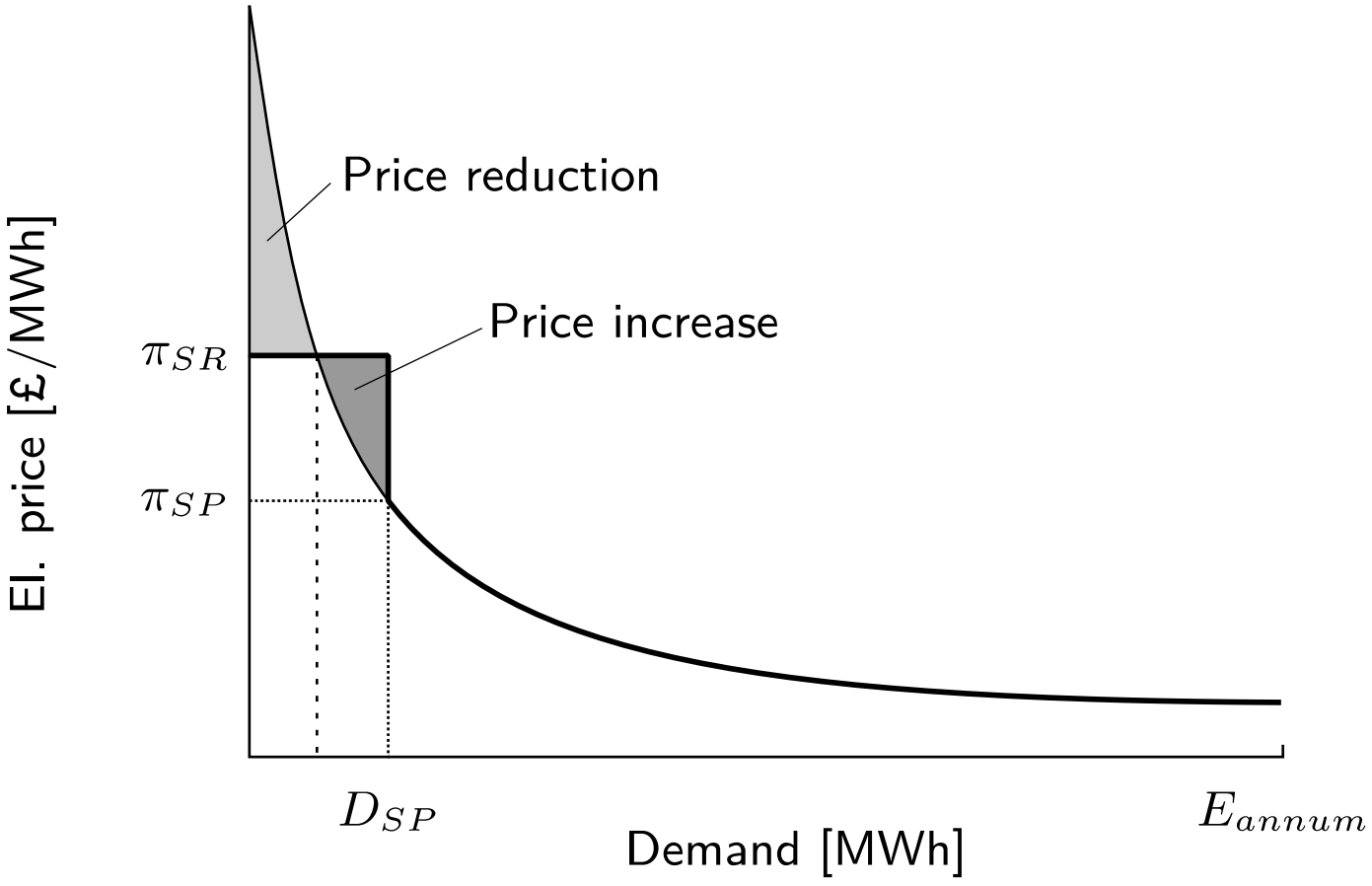
Imperial College London

Somebody Else's Problem



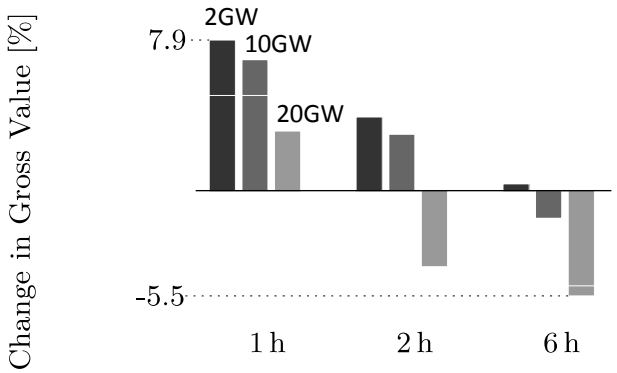
Imperial College London

Capacity Mechanism



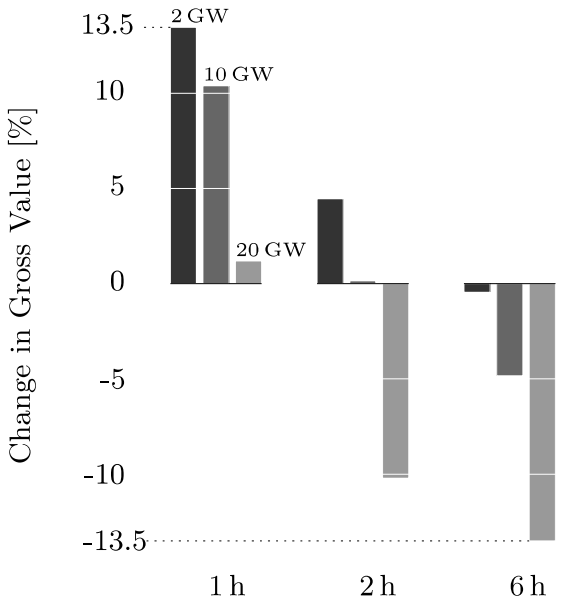
Imperial College London

Value Change in Capacity Mechanism

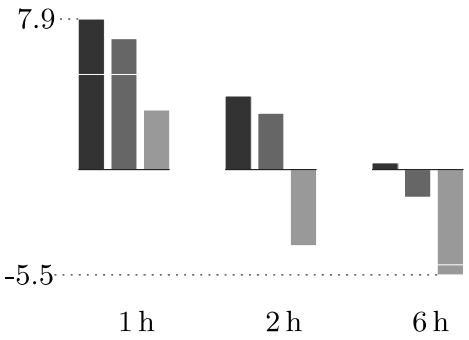


Imperial College London

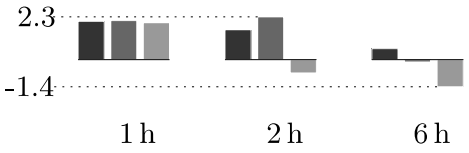
Value Change in Capacity Mechanism



(a) $\pi_{SP} = 200$



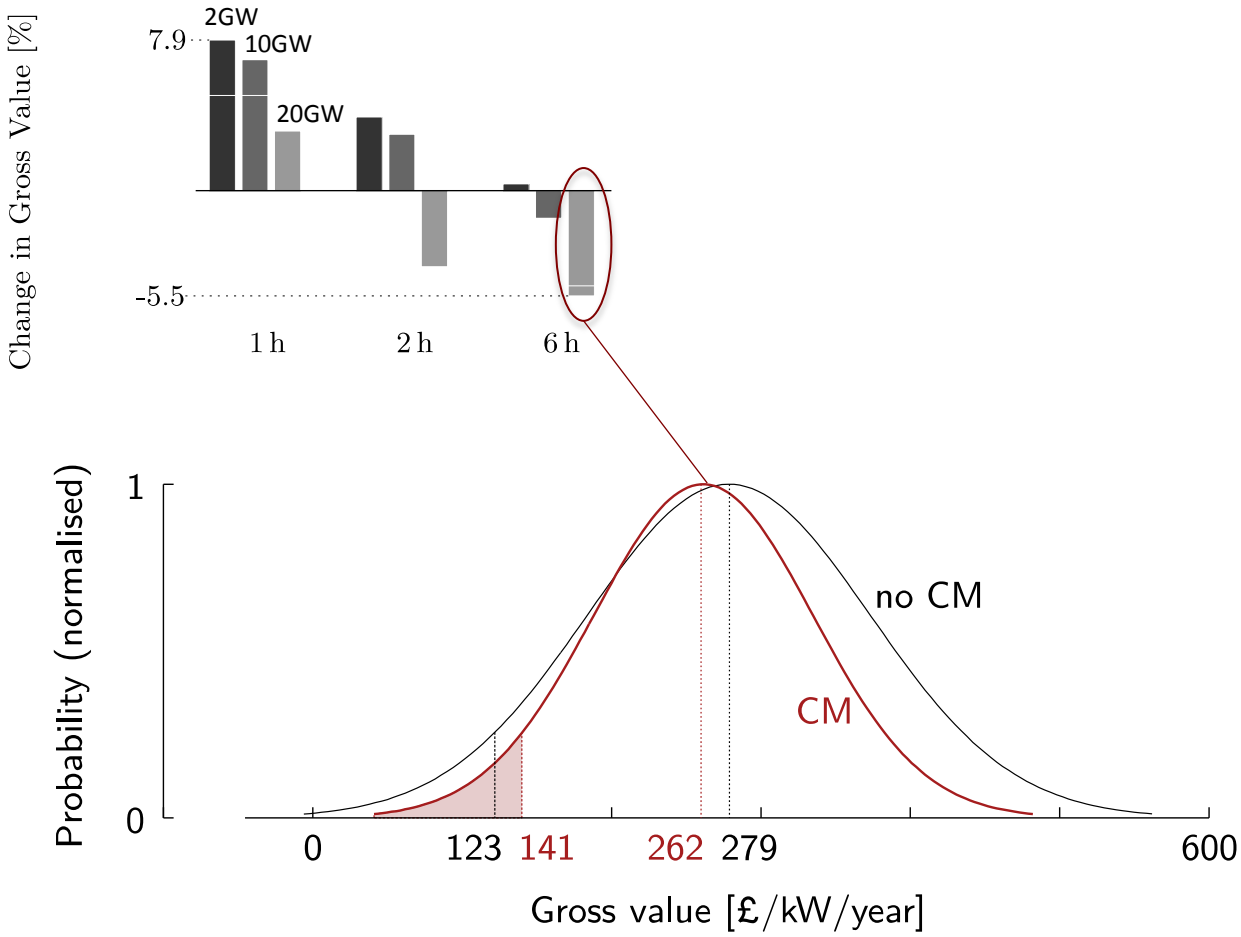
(b) $\pi_{SP} = 400$



(c) $\pi_{SP} = 800$

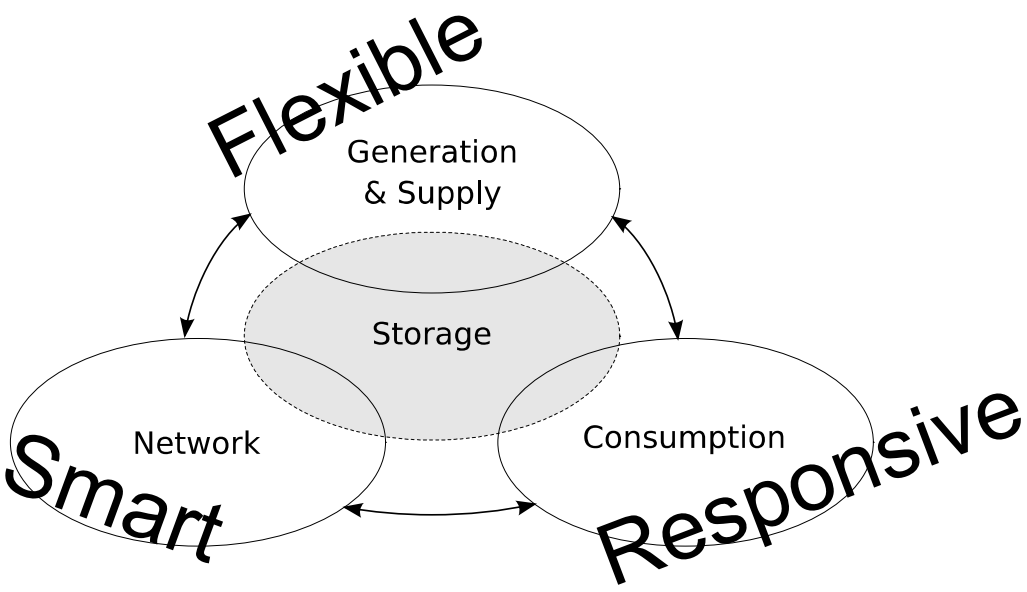
Imperial College London

VALUE DOWN – CONFIDENCE UP



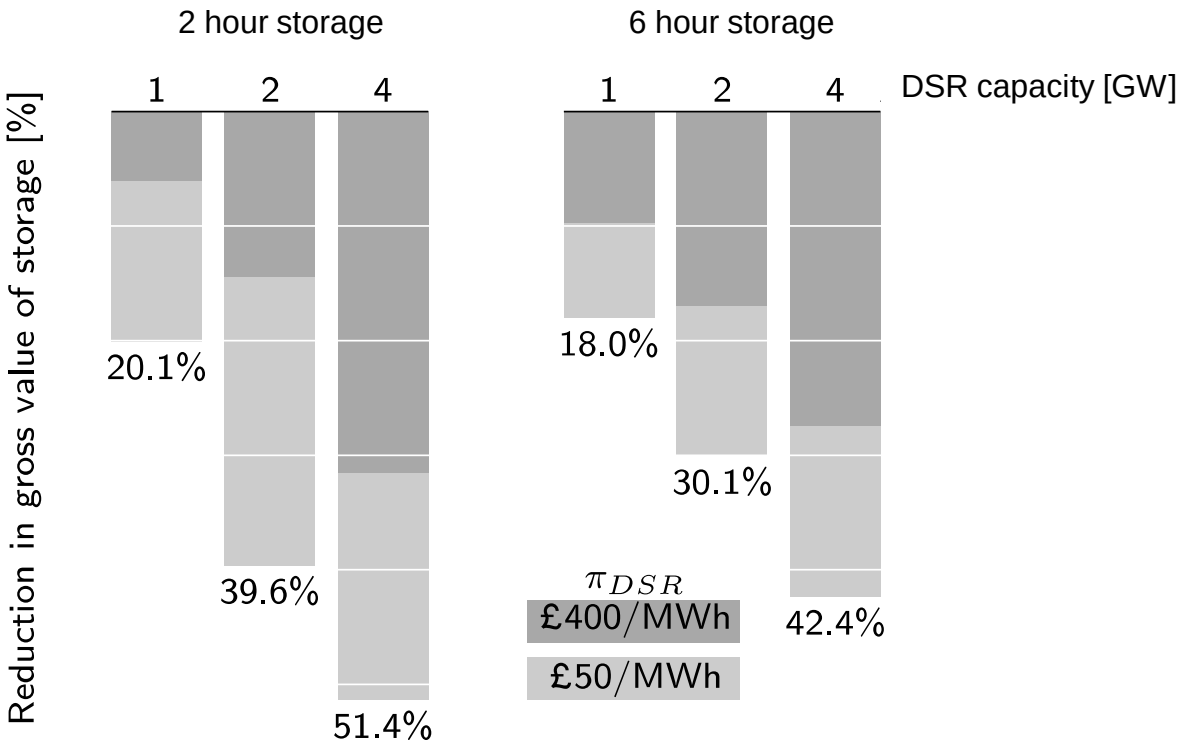
Imperial College London

Alternatives to Storage



Imperial College London

Demand Side Response



Imperial College London

CONCLUSIONS

- Value increase with high levels of wind
- Diminishing value with scale (GW / h)
- Efficiency becomes less critical
- System value > wholesale market value
- Value aggregation: somebody else's problem
- Capacity mechanism is no panacea
- Demand response is a serious compet

Imperial College London

THANK YOU

and UKERC and SUPERGEN HiDEF and Imperial EFL CDT