Market Outlook to 2030

Session 5

Martin Wilcox, Michael Clark, Alastair Martin and Goran Strbac
UK Power Networks, Flexitricity and Imperial College London

Low carbon LONDON
Energising change

UK Power Networks
Delivering your electricity

In Partnership with:

flexitricity
Unlocking smart grid revenue

Imperial College London

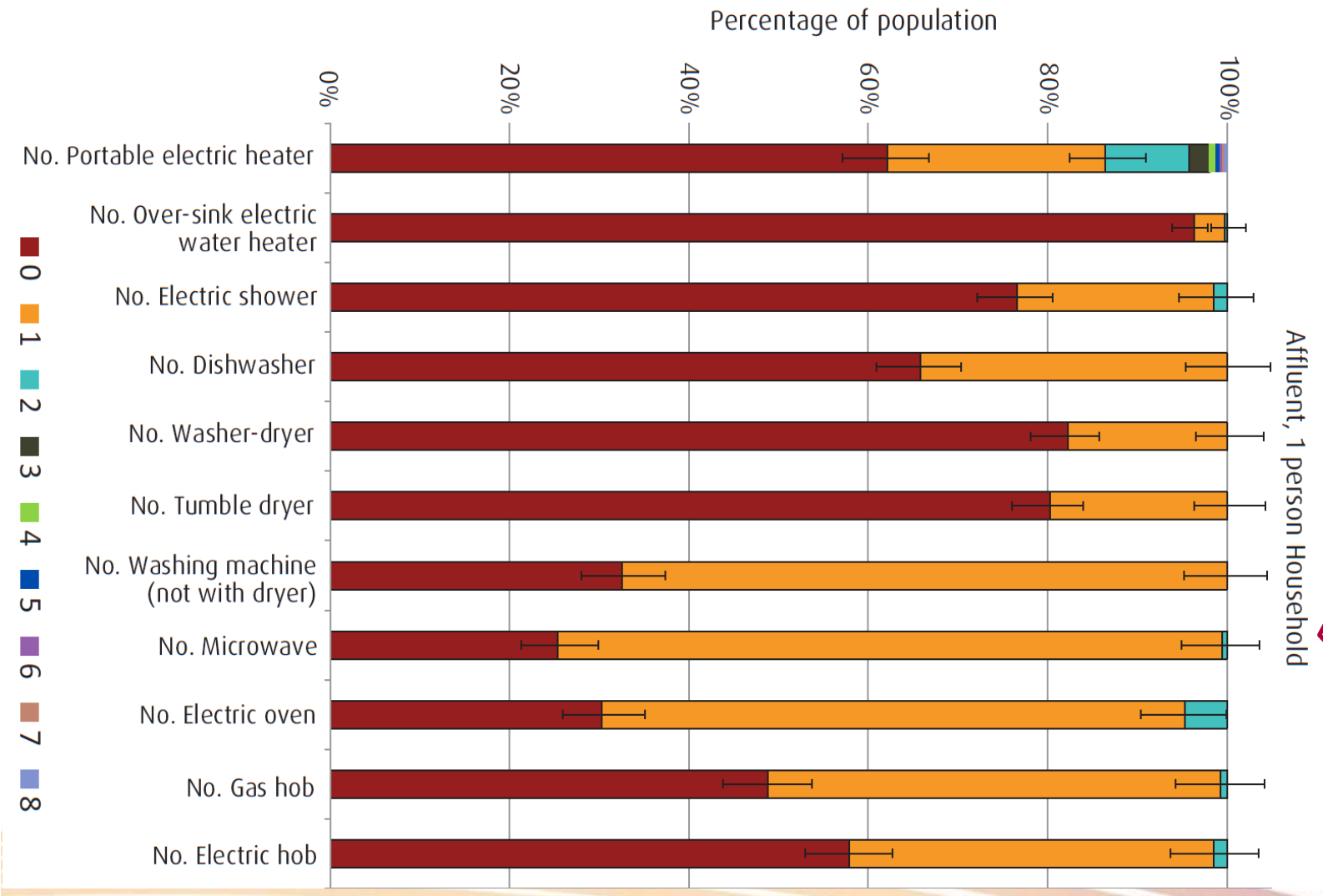
Agenda

- The prospects for energy efficiency out to 2030
- The potential benefits that could be achieved by working with responsive domestic and industrial customers
- The interaction between the players and likely size of the Demand Side Response market out to 2030
- Methods for the DNOs and wider industry of increasingly making investment decisions on the balance of probabilities

What enabled this work

- Survey of 2,830 people who told us about their household appliances
- Measurements of EV charging profiles
- Measurements of responsiveness to domestic ToU tariffs
- Prices and volumes of I&C Demand Side Response achieved by Low Carbon London
- Models of the GB balancing market (Imperial College London and Poyry), of the LPN Distribution network (Imperial College London and UK Power Networks), and models of the peak demand (Element Energy and UK Power Networks)
- Flextricity's proof of concept of wind-twinning
- Investment decision tools developed by Imperial College London

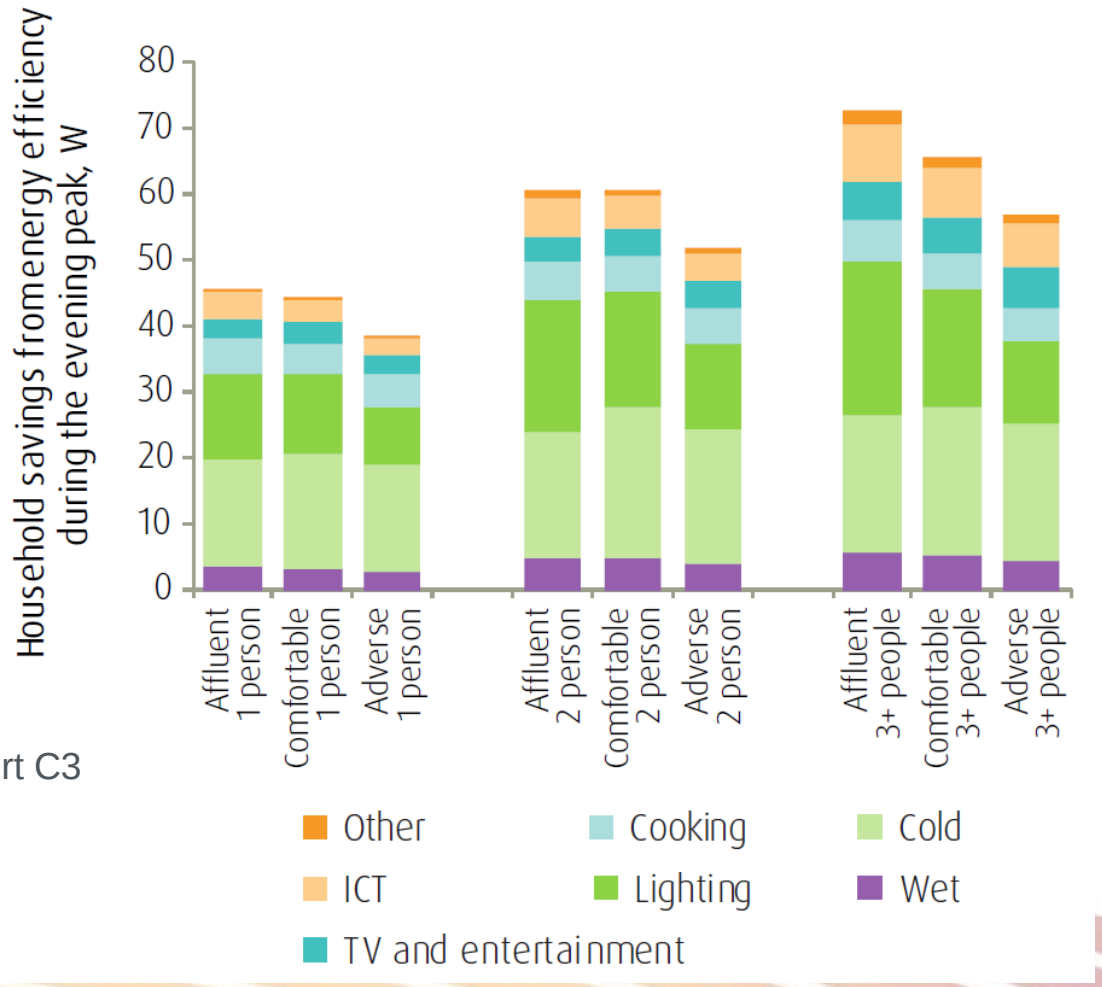
Example of household survey



We can say with 95% confidence that three-quarters of affluent singles own a microwave

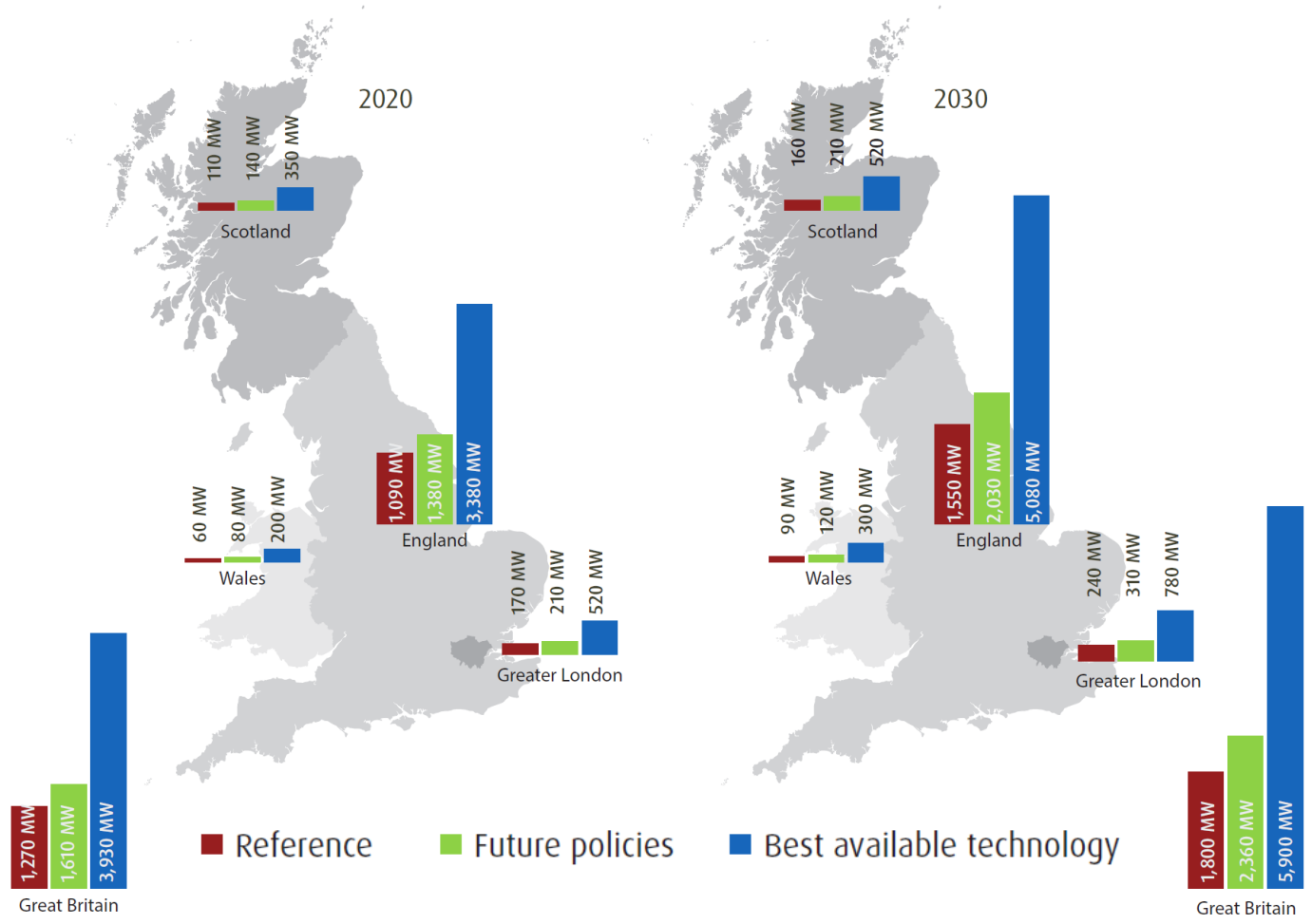
Source: LCL Report C3

Lighting and cold appliances offered the greatest efficiency savings potentials



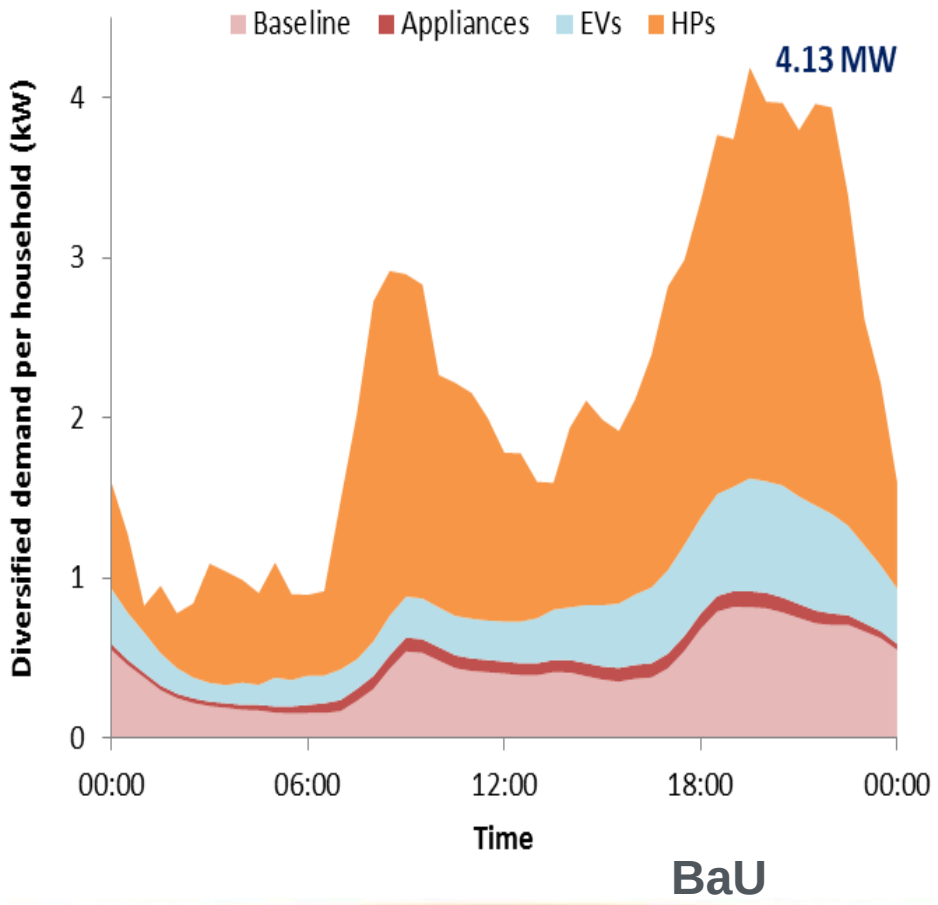
Source: LCL Report C3

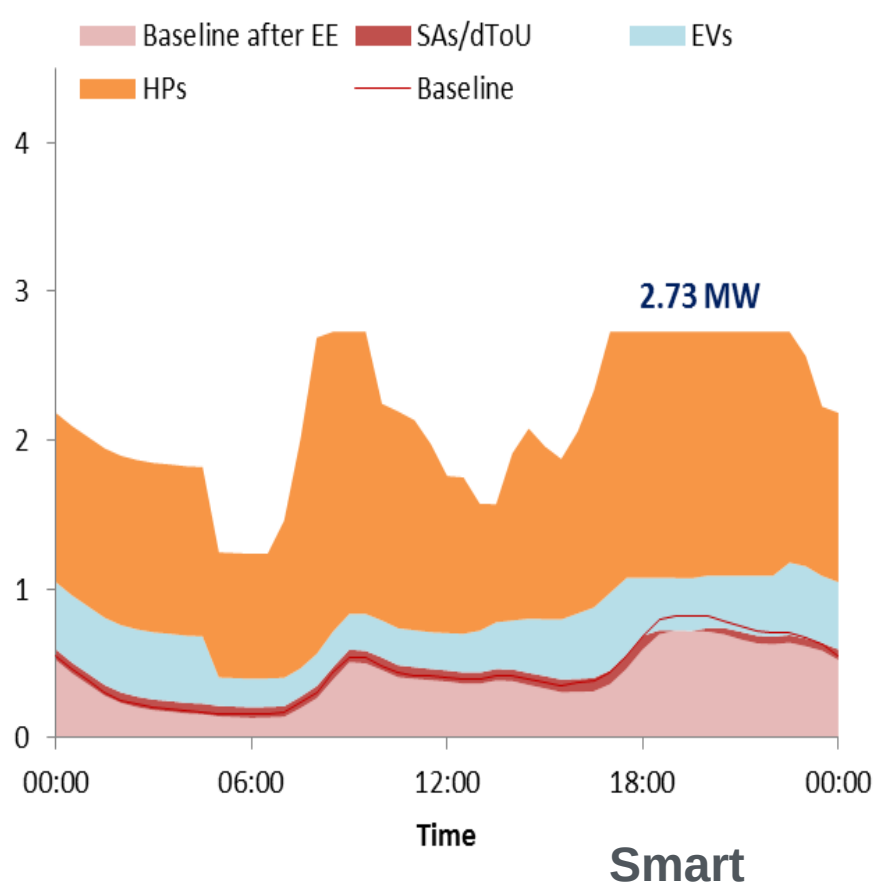
The corresponding energy savings amount to 10TWh by 2020, equivalent to approximately 9% of consumption



Source:
LCL Report C3

Aggregate demand profile per household

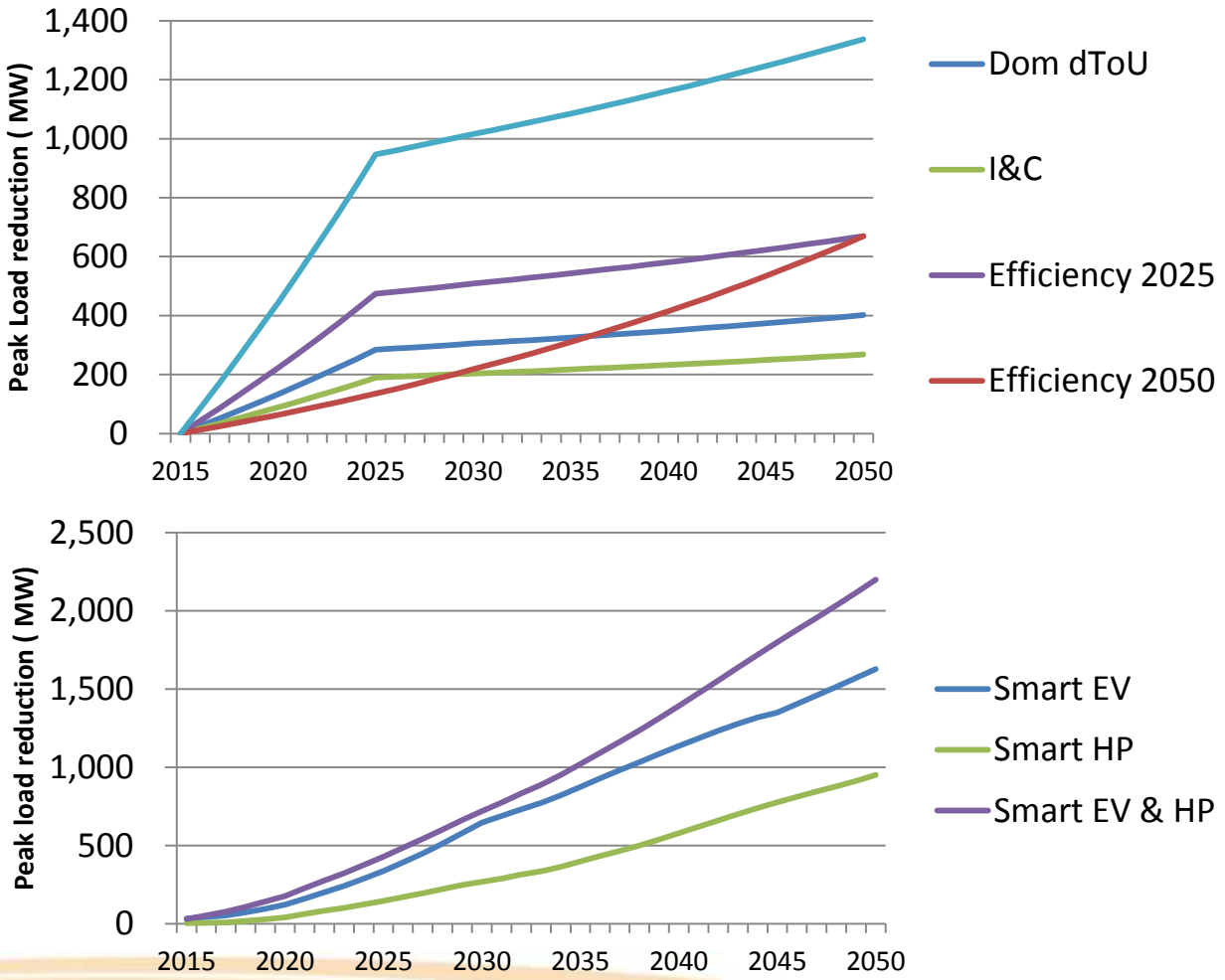




Source: LCL Report D3*

*P. Djapic, M. Kairudeen, M. Aunedi, J. Dragovic, D. Papadaskalopoulos, I. Konstantelos, G. Strbac, "Design and real-time control of smart distribution networks", Report D3 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

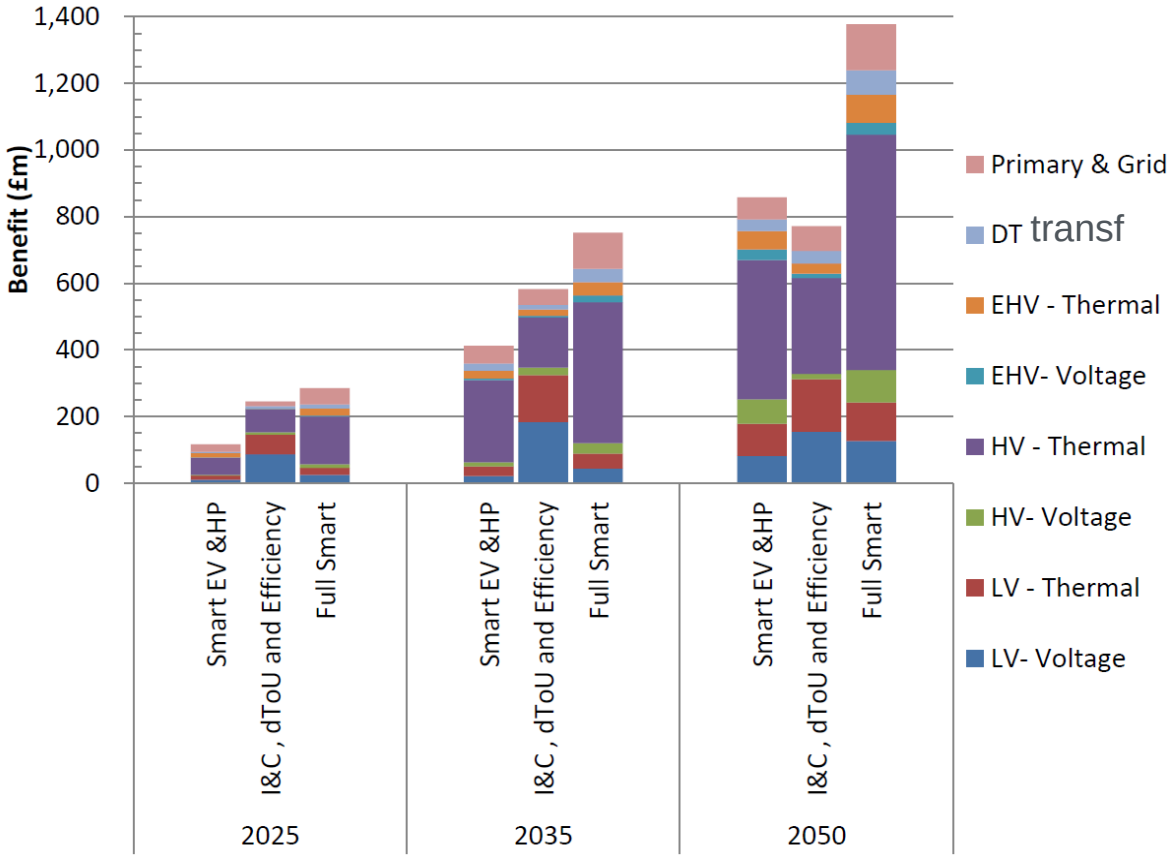
Peak demand reduction



Source: LCL Report D3*

*P. Djapic, M. Kairudeen, M. Aunedi, J. Dragovic, D. Papadaskalopoulos, I. Konstantelos, G. Strbac, "Design and real-time control of smart distribution networks", Report D3 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

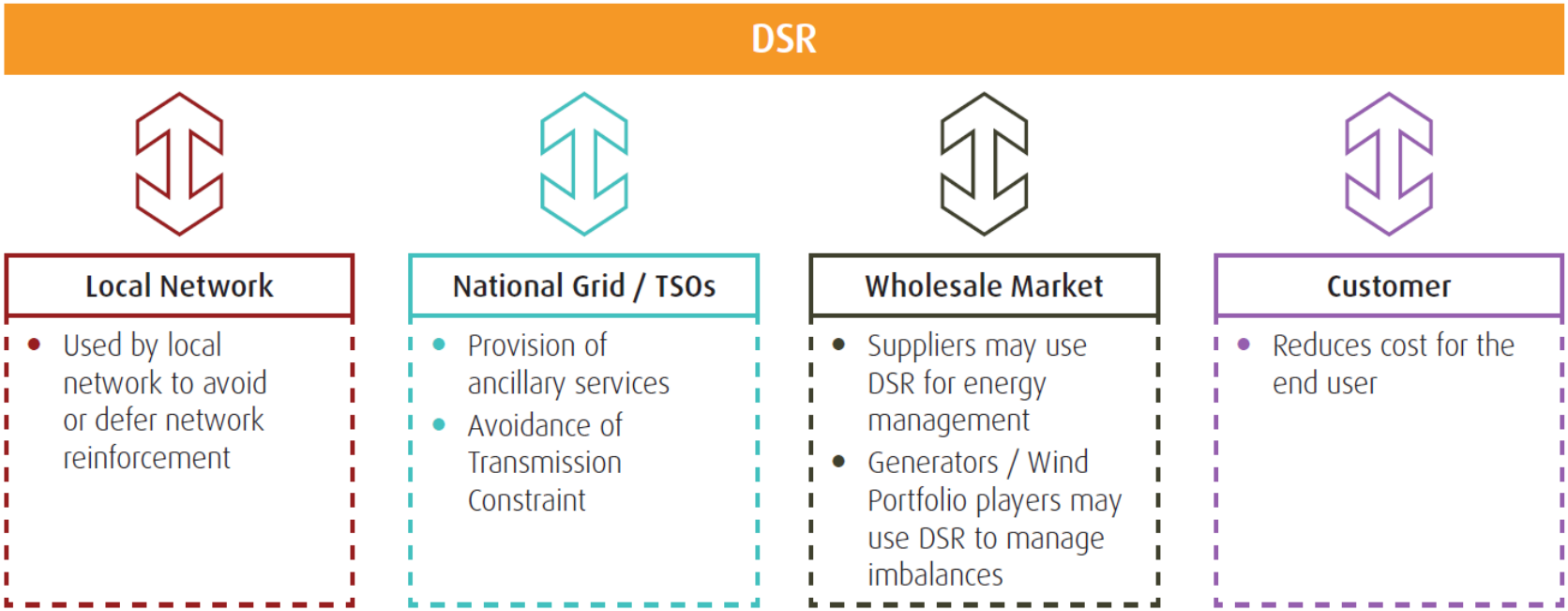
Benefits of combined mitigation measures



Source: LCL Report D3*

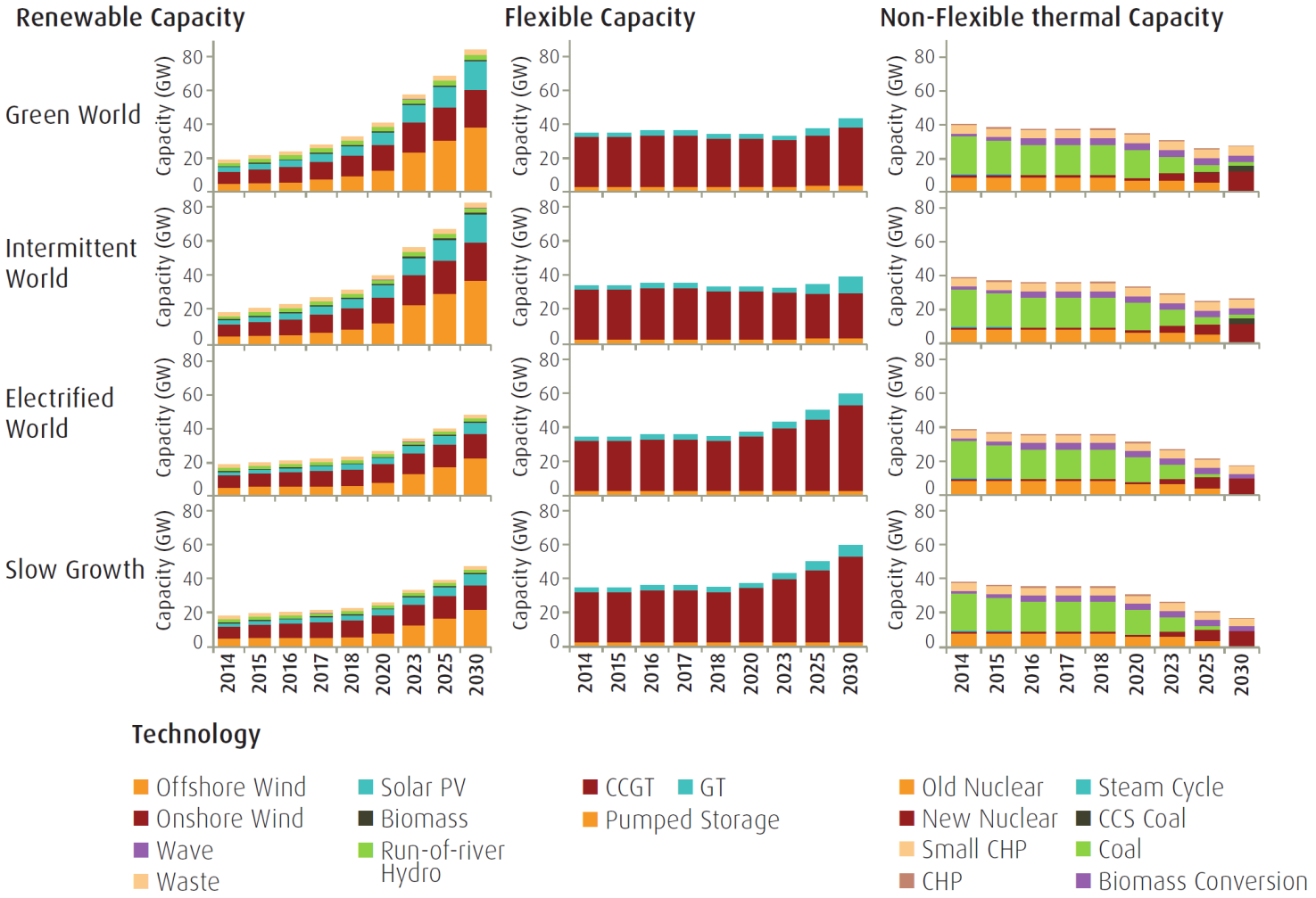
*P. Djapic, M. Kairudeen, M. Aunedi, J. Dragovic, D. Papadaskalopoulos, I. Konstantelos, G. Strbac, "Design and real-time control of smart distribution networks", Report D3 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

DSR value chain interactions



Source: LCL Report A5

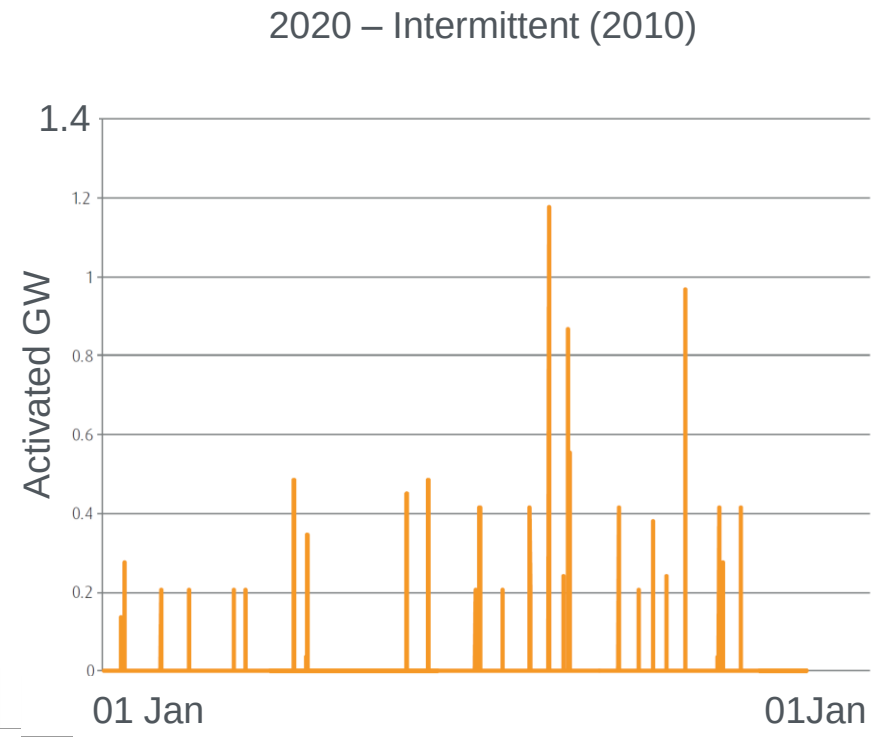
GB electricity capacity mix in the four main scenarios

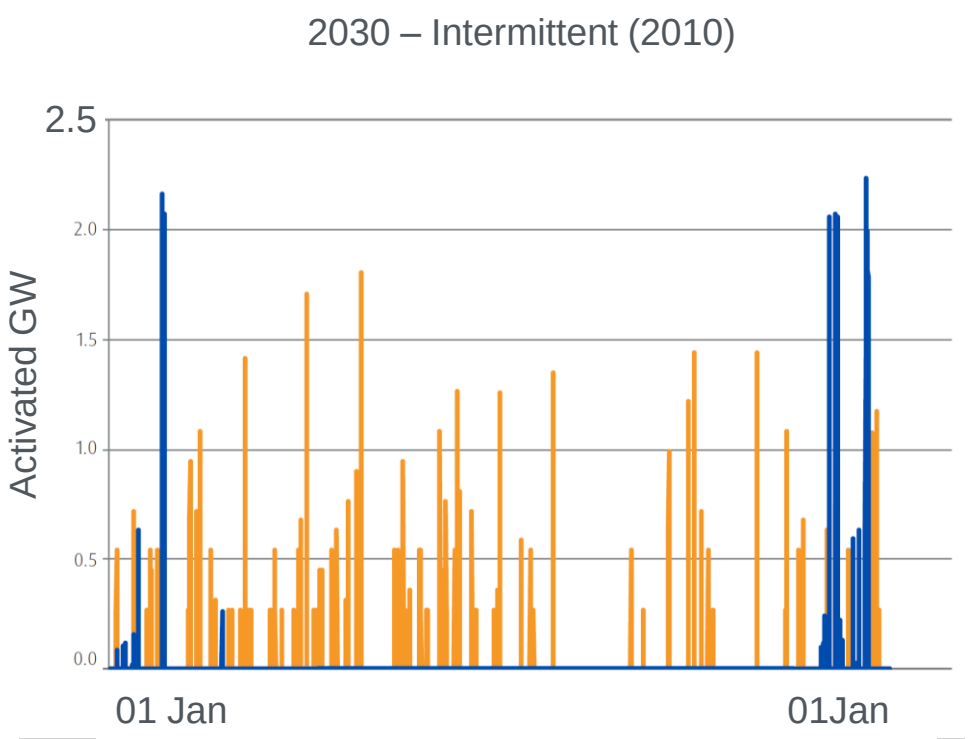


Source: LCL Report A5

Use of DSR nationally

Intermittent World, 2020 and 2030



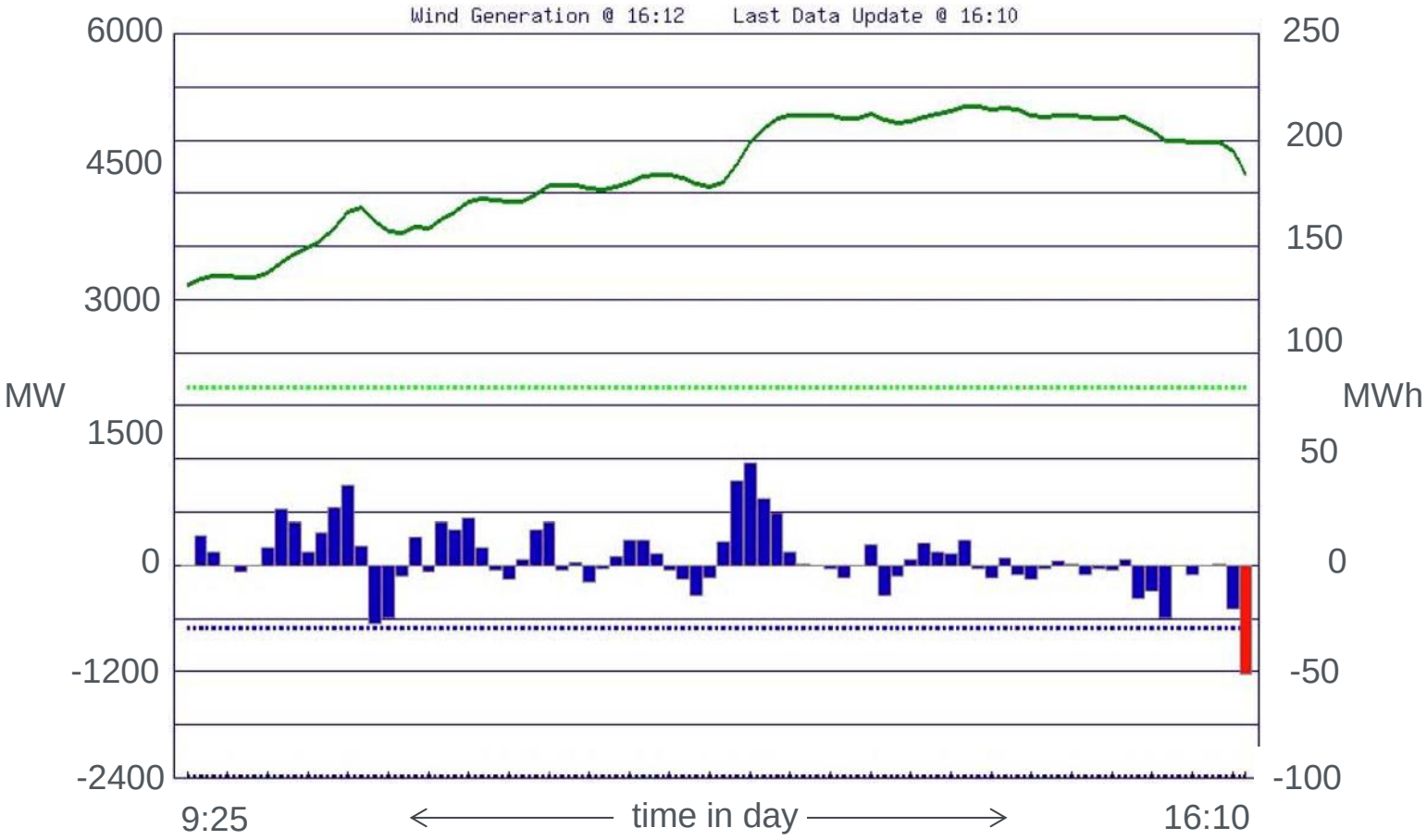


Scenario (DSR use)

Intermittent (STOR) Intermittent (Supplier)

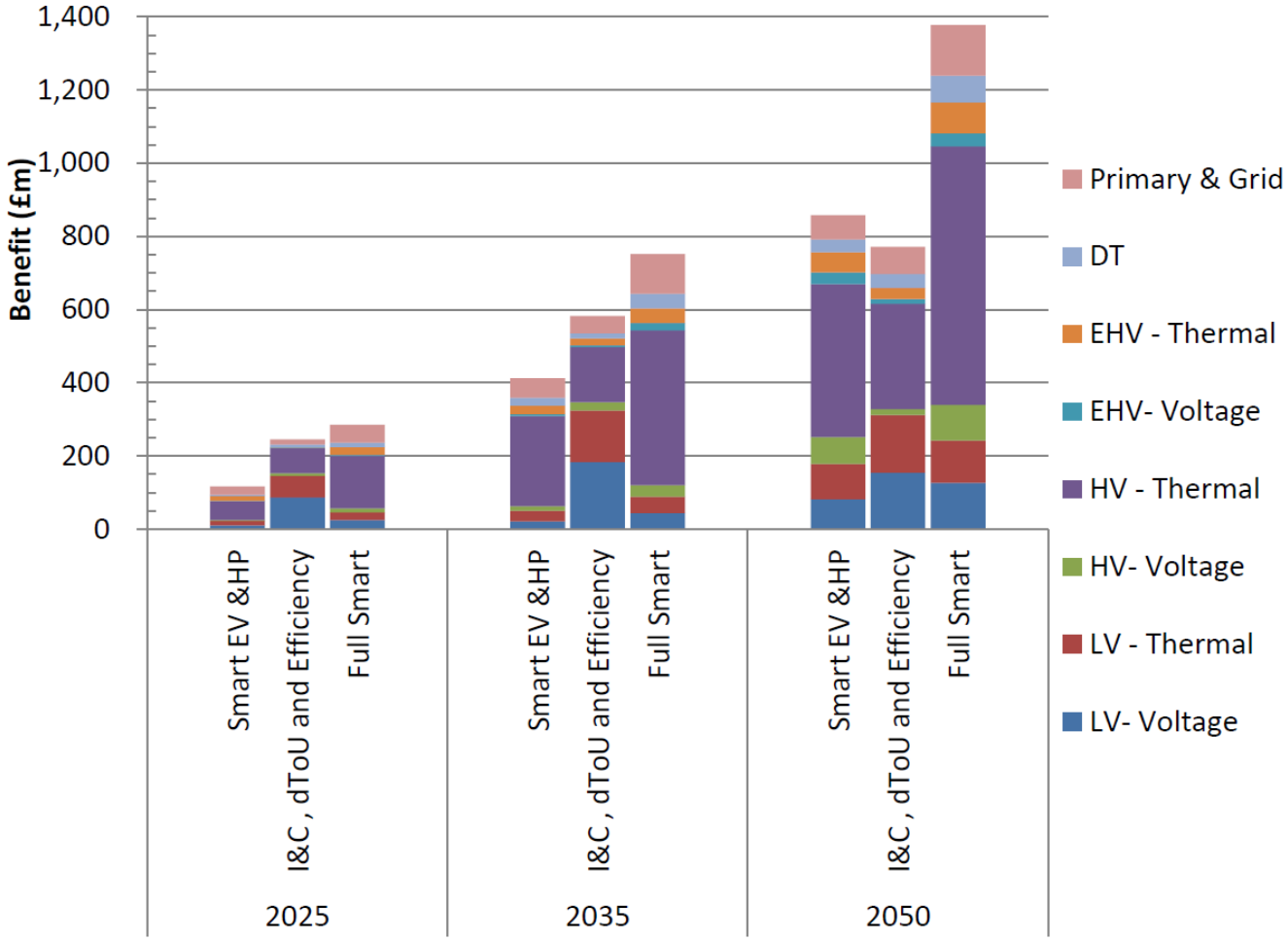
Source: LCL Report A5

I&C ‘Wind-Twinning’ Trial



Source: Flexitricity, ‘Wind-Twinning’ Trial Data

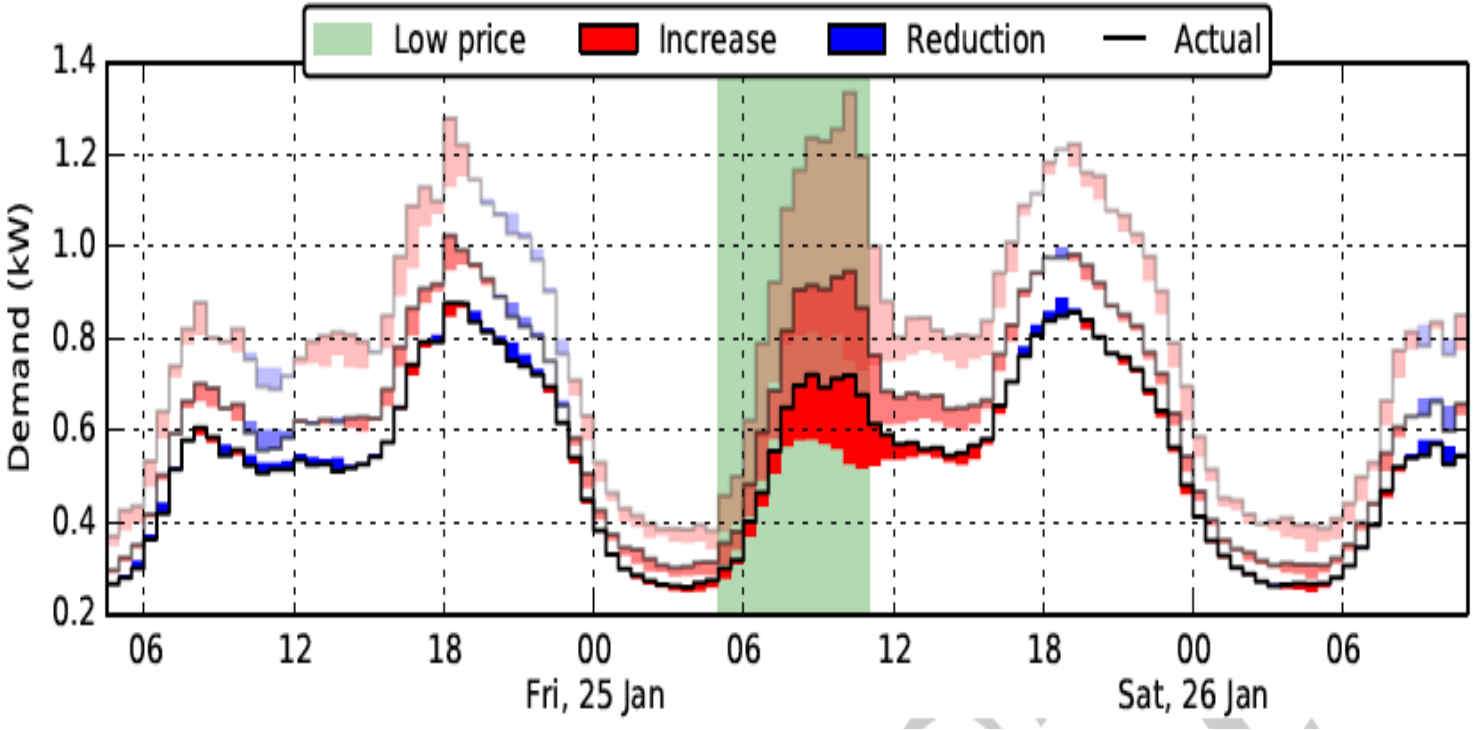
Network benefits of mitigation measures



Source: LCL Report D3*

*P. Djapic, M. Kairudeen, M. Aunedi, J. Dragovic, D. Papadaskalopoulos, I. Konstantelos, G. Strbac, "Design and real-time control of smart distribution networks", Report D3 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

Potential conflicts between local network and national objectives



Demand Response to low energy prices

Source: LCL Report D5*

*I. Konstantelos , D. Papadaskalopoulos, D. Pudjianto, M. Woolf, G. Strbac, "Novel commercial arrangements for smart distribution networks", Report D5 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

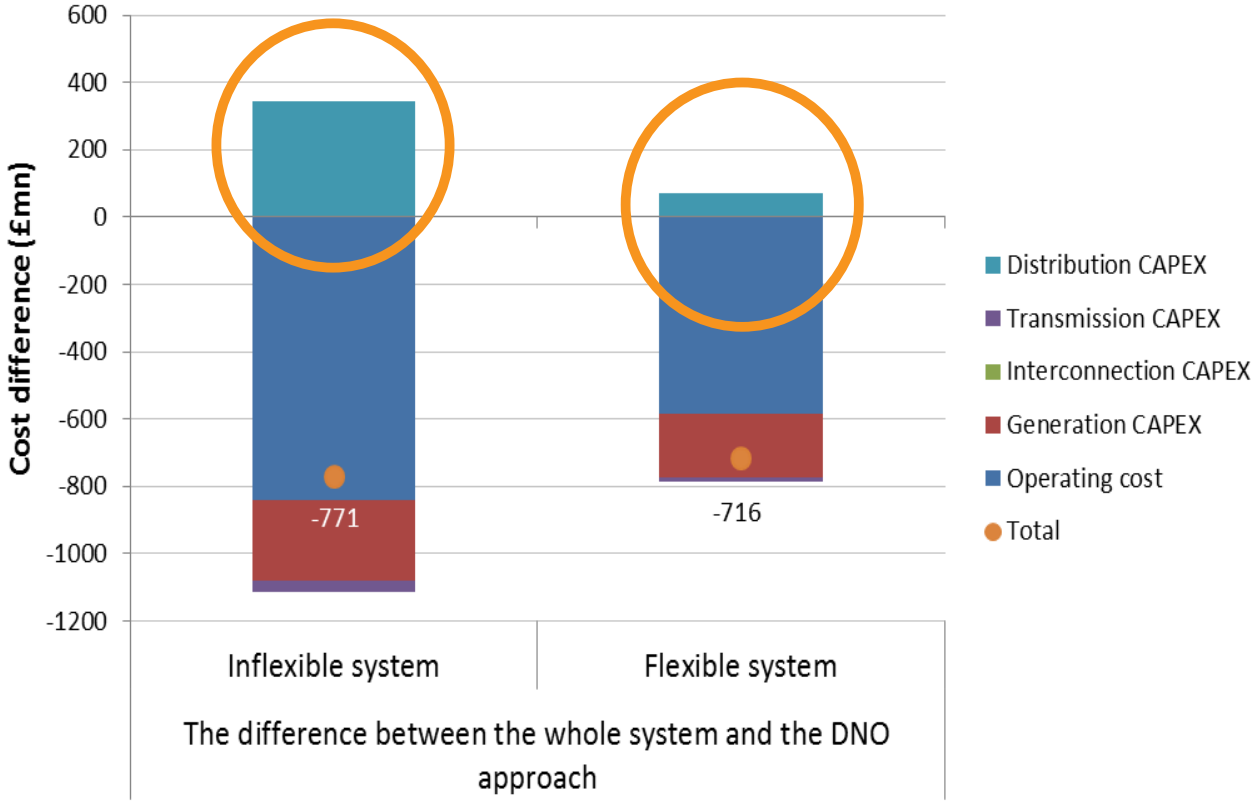
Future network investment decisions

Importance of Whole-System approach

Allocation of DSR resource?

National Balancing Services

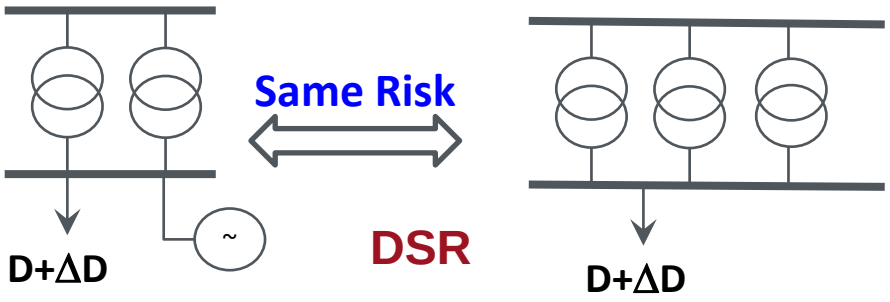
Local Network Control

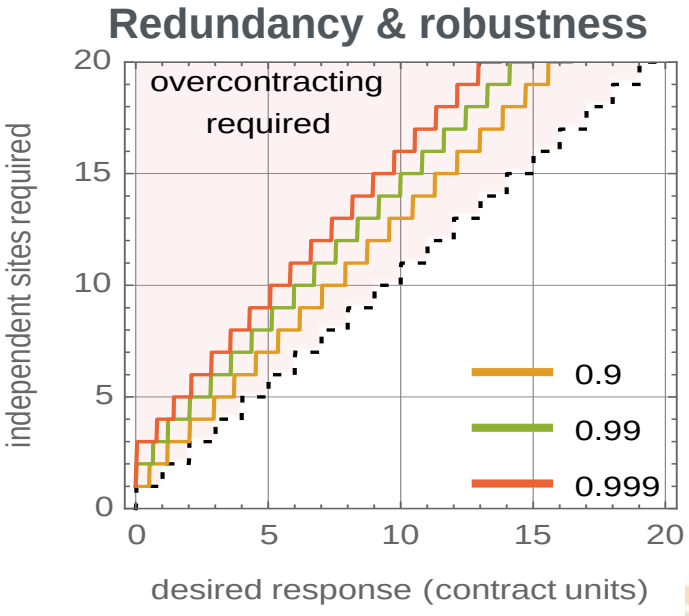


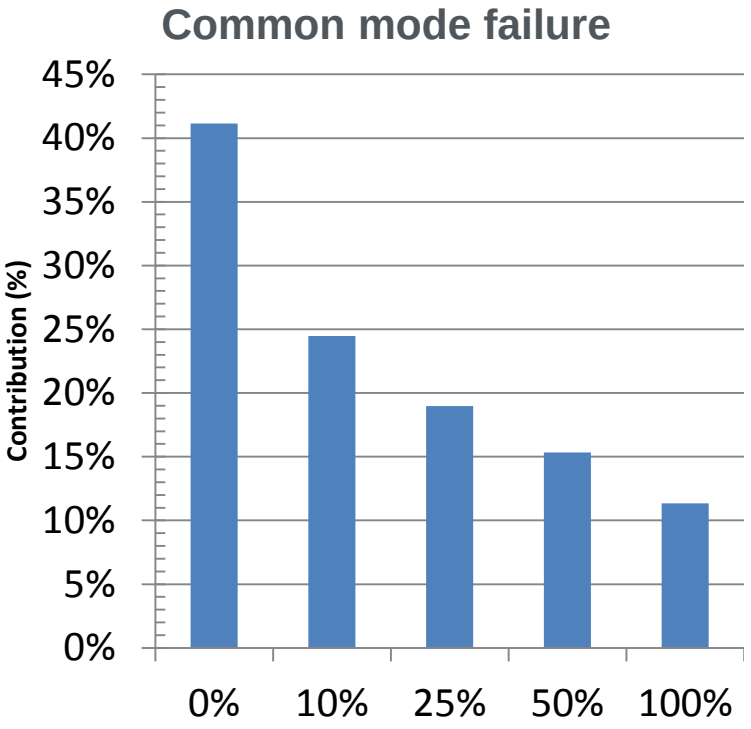
Source: LCL Report D5*

*I. Konstantelos , D. Papadaskalopoulos, D. Pudjianto, M. Woolf, G. Strbac, "Novel commercial arrangements for smart distribution networks", Report D5 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

Can you trust smart when it comes to security?





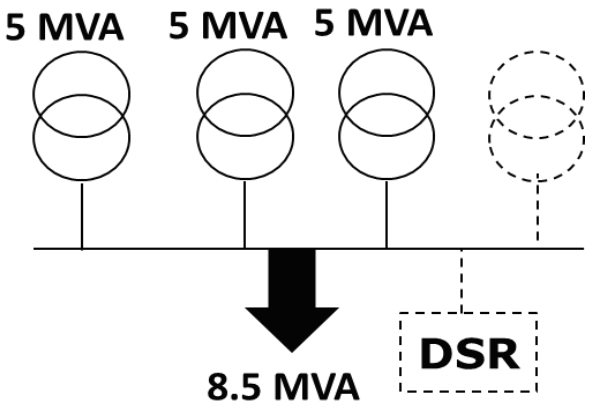


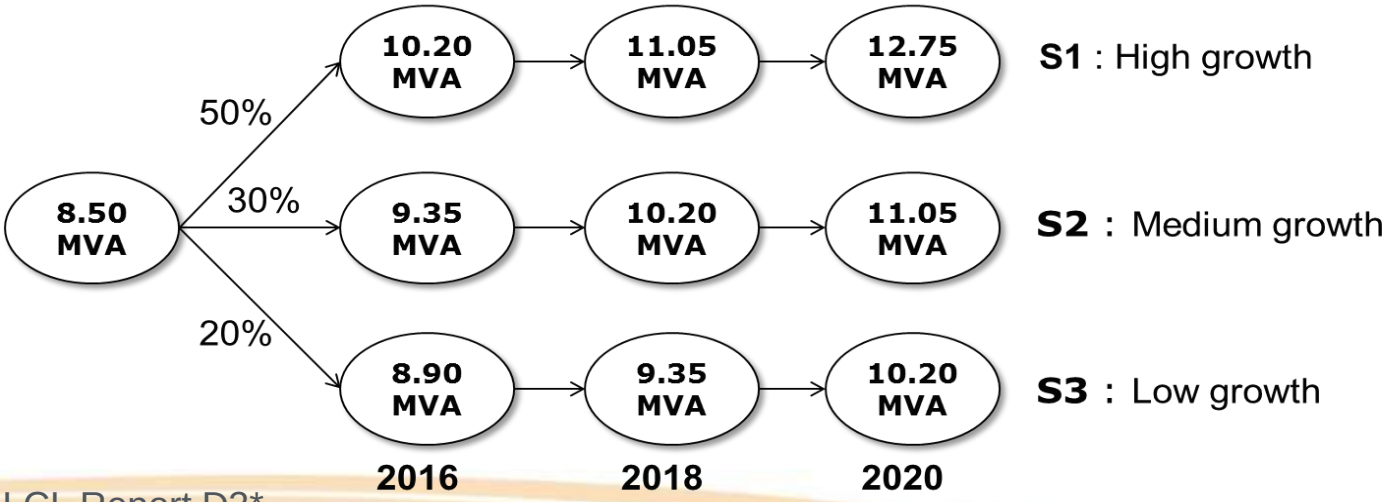
Source: LCL Report D4*

*S. Tindemans, P. Djapic, J. Schofield, T. Ustinova, G. Strbac, "Resilience performance of smart distribution networks", Report D4 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

Investment under uncertainty

Flexibility to deal with uncertainty



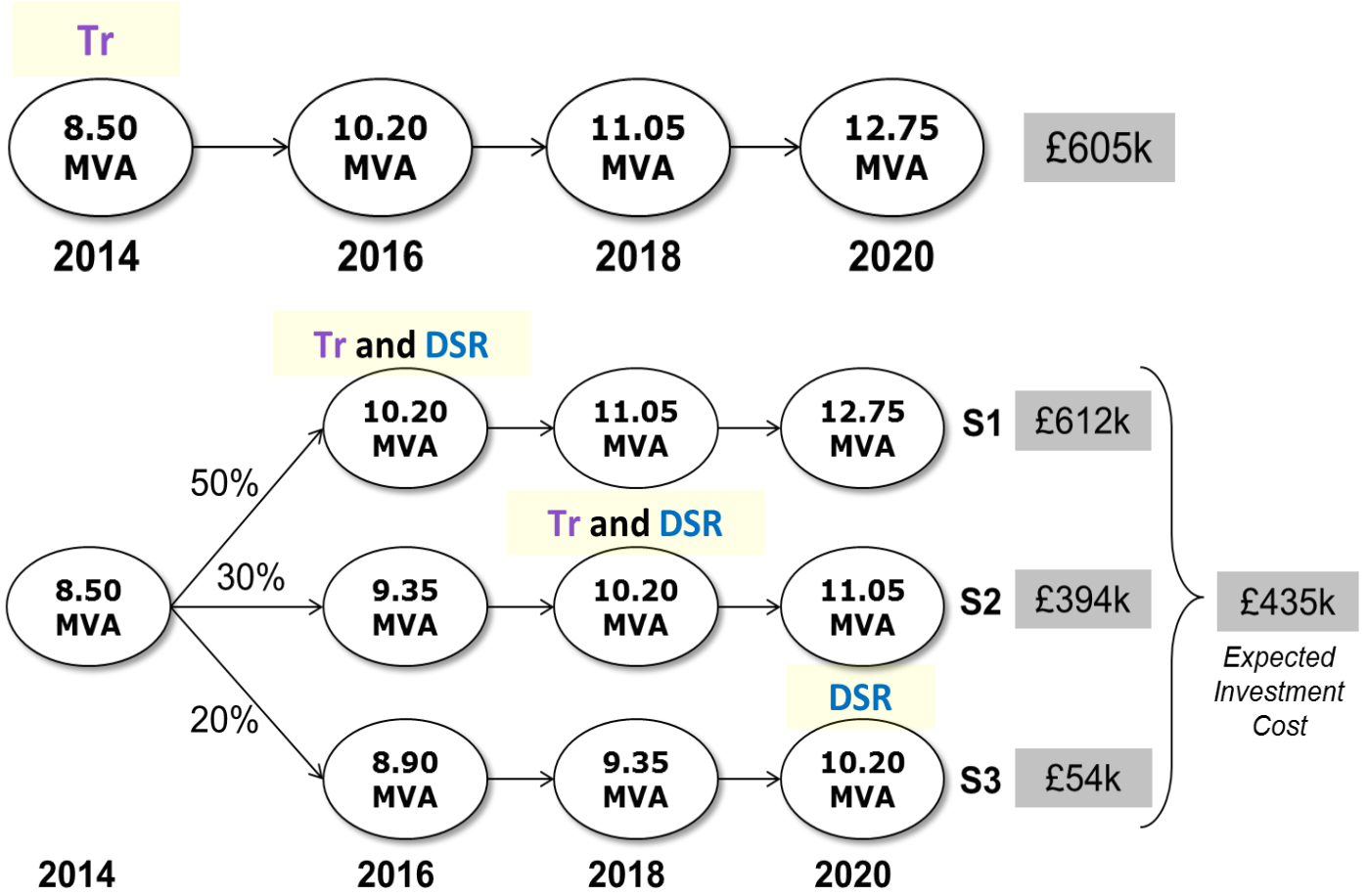


Source: LCL Report D3*

*P. Djapic, M. Kairudeen, M. Aunedi, J. Dragovic, D. Papadaskalopoulos, I. Konstantelos, G. Strbac, "Design and real-time control of smart distribution networks", Report D3 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

Investment Decisions

Here & now or wait & see?

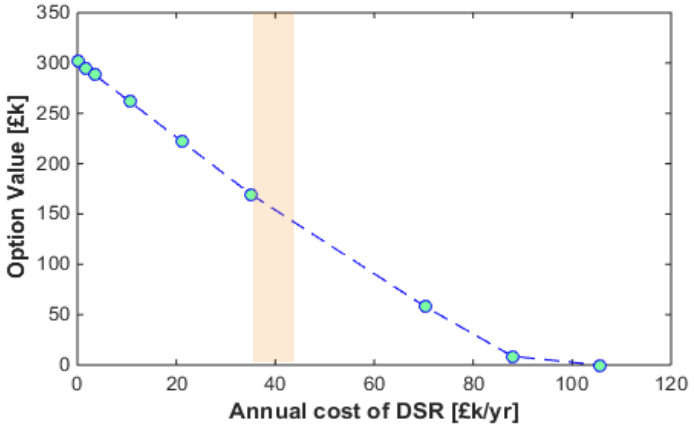


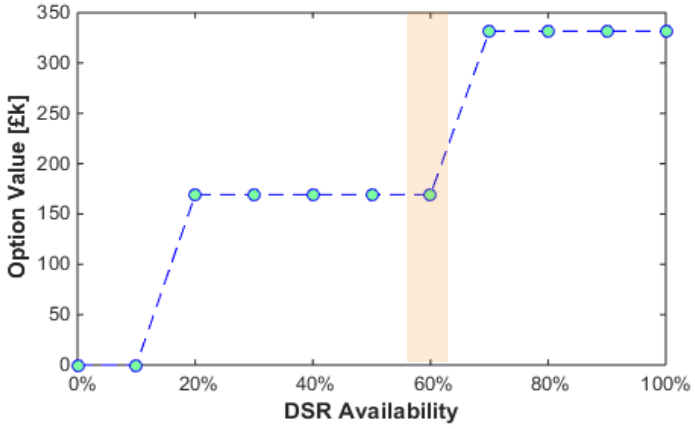
Source: LCL Report D3*

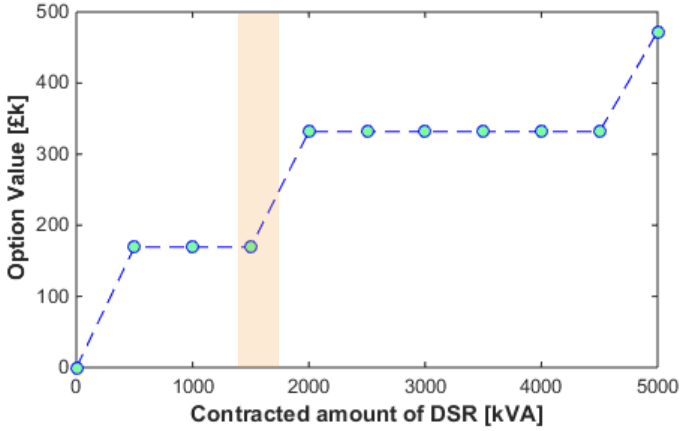
*P. Djapic, M. Kairudeen, M. Aunedi, J. Dragovic, D. Papadaskalopoulos, I. Konstantelos, G. Strbac, "Design and real-time control of smart distribution networks", Report D3 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

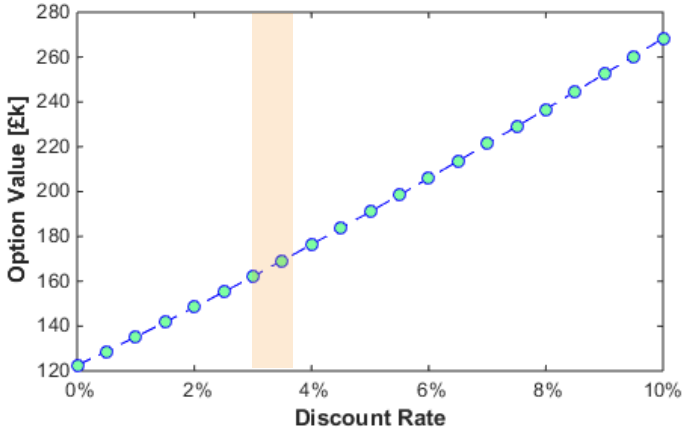
Flexibility to deal with uncertainty

Option value of DSR









Source: LCL Report D3*

*P. Djapic, M. Kairudeen, M. Aunedi, J. Dragovic, D. Papadaskalopoulos, I. Konstantelos, G. Strbac, "Design and real-time control of smart distribution networks", Report D3 for the "Low Carbon London" LCNF project: Imperial College London, 2014.

Making it happen

Improving regulatory & commercial regimes

1. Strengthening incentives for investment in cost effective smart grid measures –**more positive incentive to adopt**
2. Whole systems approach to network planning – **from silo to whole-system thinking**
3. Emerging new role of DNOs – **from energy delivery to facilitating market integration**
4. Facilitate investment under uncertainty – **from scenario only to option value driven**
5. Enable anticipatory investment framework – **from incremental to strategic**
6. Evolution of the regulatory regime – **Ensure cost assessment appropriately deals with smart grid enablers**

Source: LCL Report D5*

Ioannis Konstantelos, Dimitrios Papadaskalopoulos,Danny Pudjianto, Matt Woolf, Goran Strbac, "Novel commercial arrangements and the smart distribution network, LCL Imperial College London, 2014

ukpowernetworks.co.uk/innovation

Low carbon LONDON
Energising change

UK Power Networks
Delivering your electricity

The findings from **Low Carbon London** represent a step change in understanding the electricity network required for a low carbon future.

If you would like to know more about our reports please email us:
innovation@ukpowernetworks.co.uk

Partners:

CGI
EDF ENERGY
ENERNOC
flexitricity
Unlocking smart grid revenue
Imperial College London
Institute for Sustainability
MAYOR OF LONDON
nationalgrid
SIEMENS
smarter grid solutions
Transport for London