

Role and Value of Demand Side Response in Reducing the Cost of Transition to a Low Carbon Energy Future

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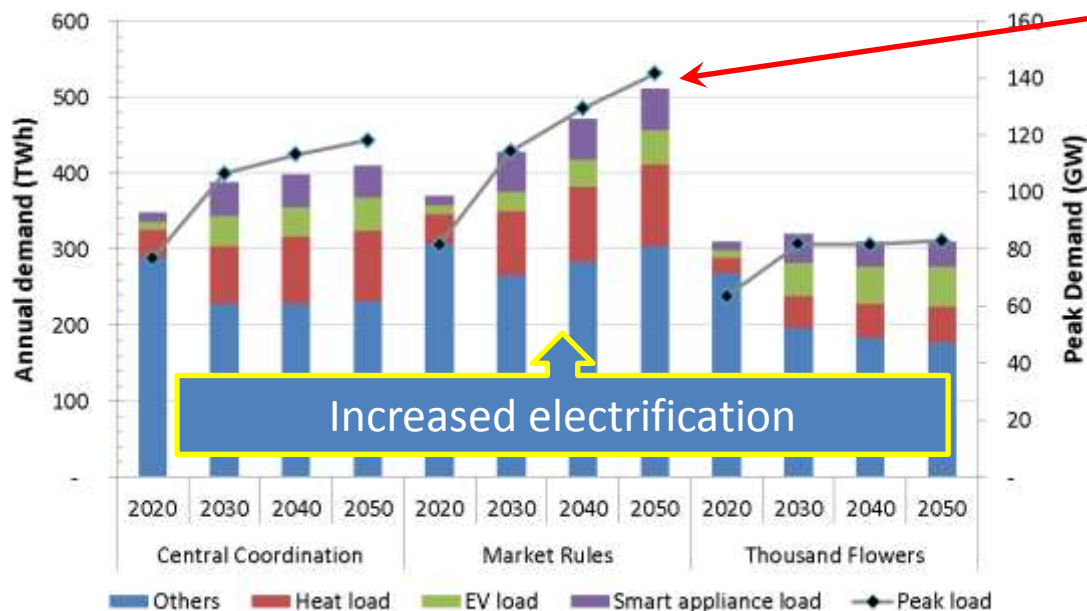
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Overview

- Key challenges
 - Impact of electrification on peak demand
 - Increased capacity of inflexible low carbon technology
- Opportunities for DSR and the control challenges
- Approach to evaluate the benefits of DSR
 - Whole system analysis
- Quantified benefits of DSR
 - Savings in investment and operational costs
 - Reduction of emissions
- Summary
- Research impact

Key challenges/1

- Meeting carbon target involves electrification of transport and heating



Increased peak demand



Additional system capacity

Load factor

Current load: 60%-65%

EV load: 30% - 35%

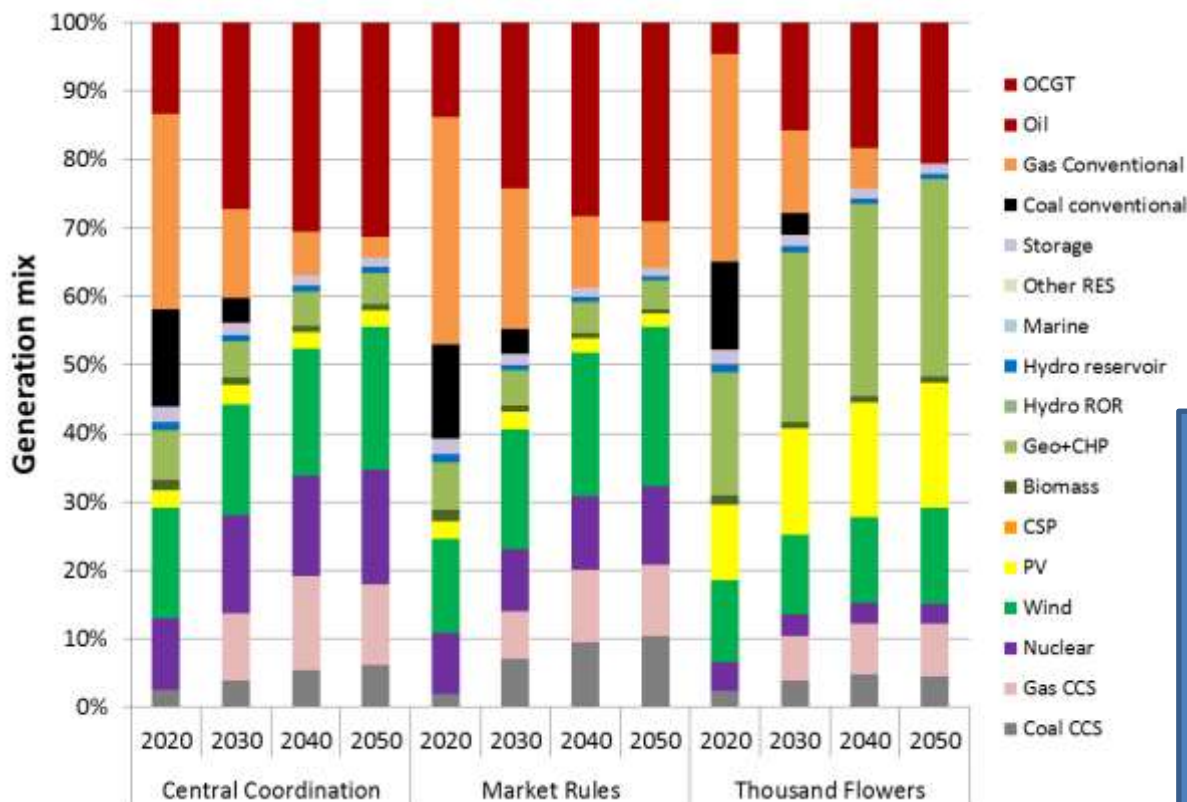
Heat load: 15%-20%

Improving investment efficiency ?



Key challenges/2

- Increased inflexible low carbon technologies



Balancing issues due to increased frequency response and reserve requirements

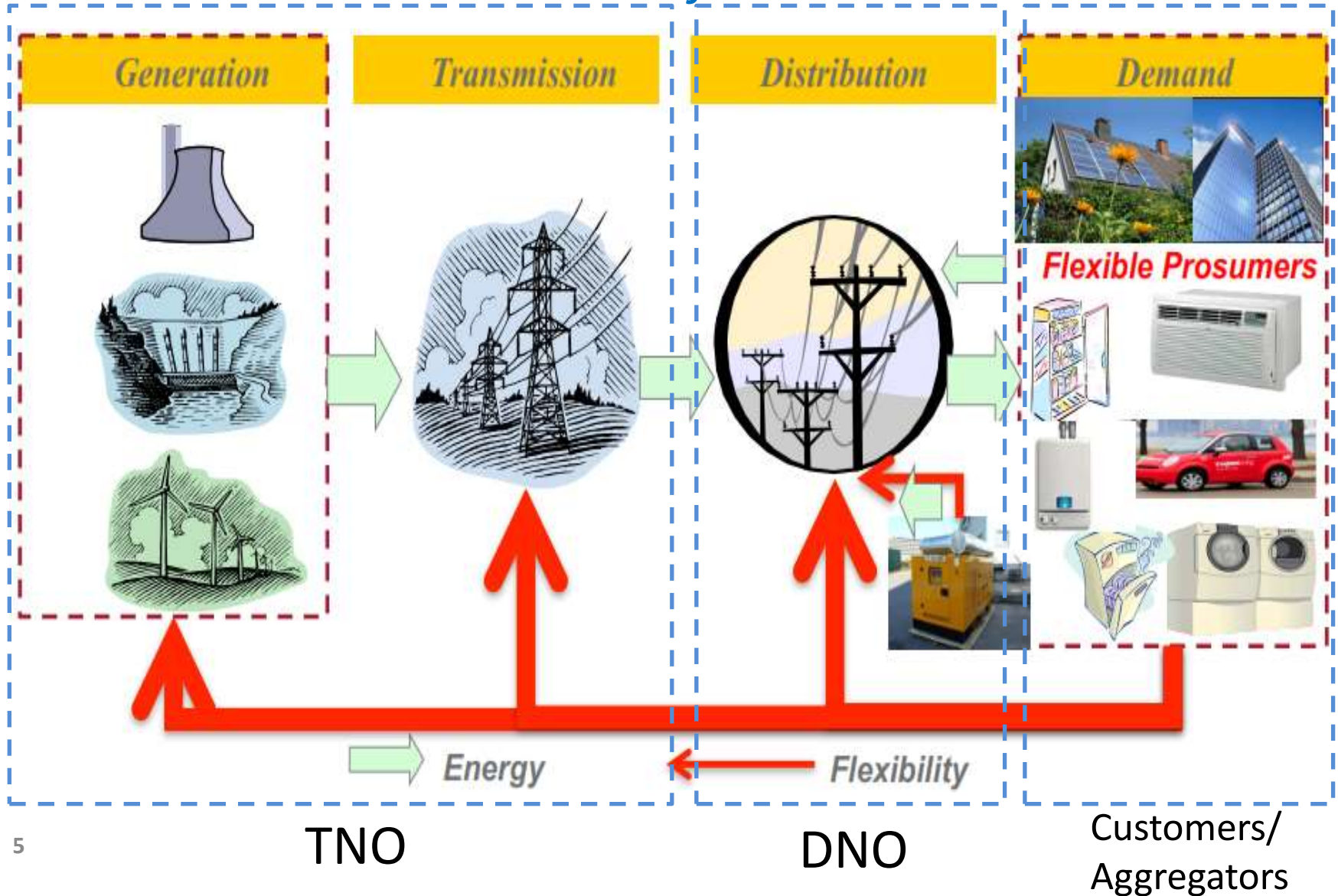
- (1) Curtailment of LCT's output
- (2) Higher emissions
- (3) Retaining conventional capacity (lead to low utilisation)

Improving operational efficiency?



Opportunities for DSR and the control challenge

Who controls flexible demand?



Approach

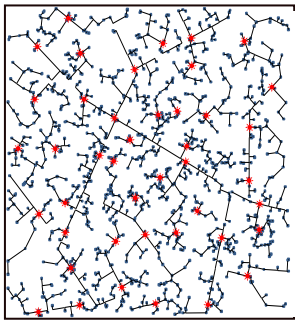


Gen and Tx data

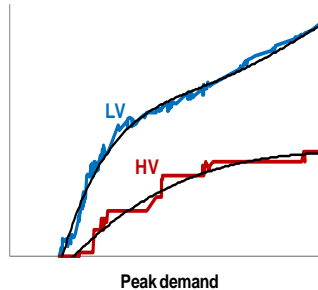


Industrial and Commercial
Transport
Heat
Residential

Load data



Network reinforcement cost



Peak demand

Fractal model

Distribution network cost function



WeSIM
Minimisation of investment and operating costs

Subject to:
Operating constraints;
Energy constraints;
Reliability / Security constraints;
Emissions constraints;
Policy constraints

Investment decisions:

- Generation
- Transmission
- Distribution
- Storage
 - Bulk
 - Distributed

Operational decisions:

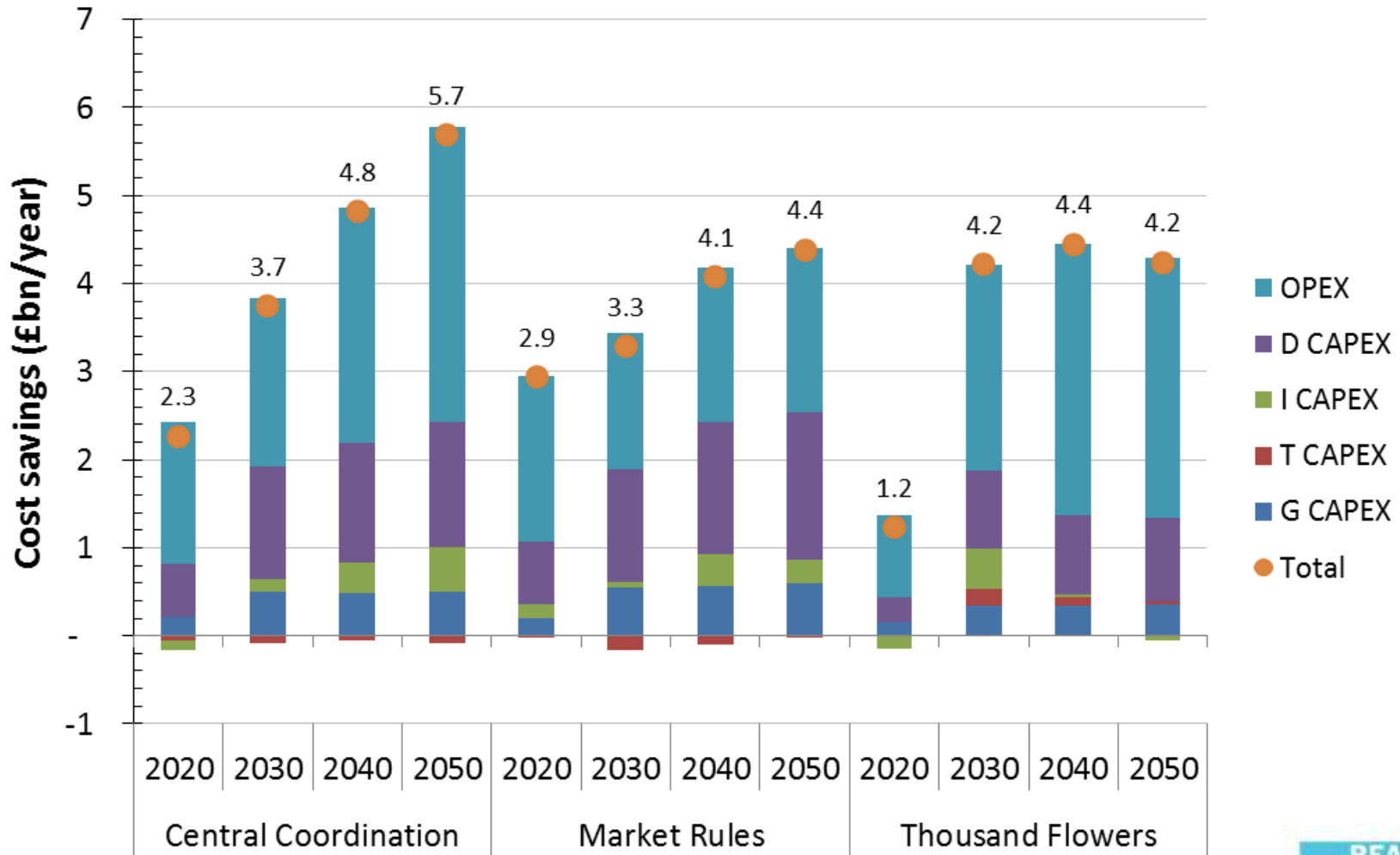
- Gen, storage, DSR scheduling
- Flows

Costs

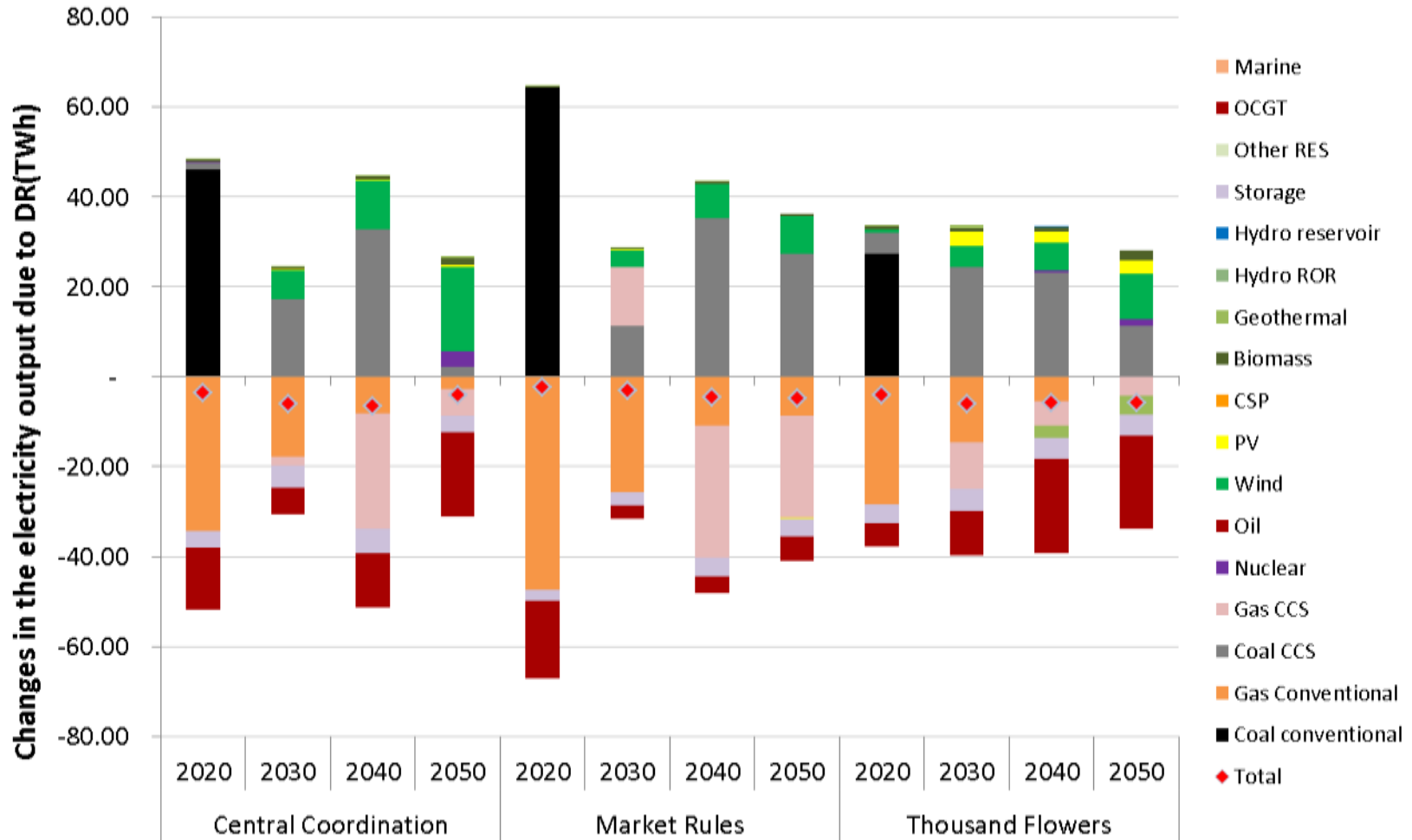
Electricity prices

Potential Value of DSR

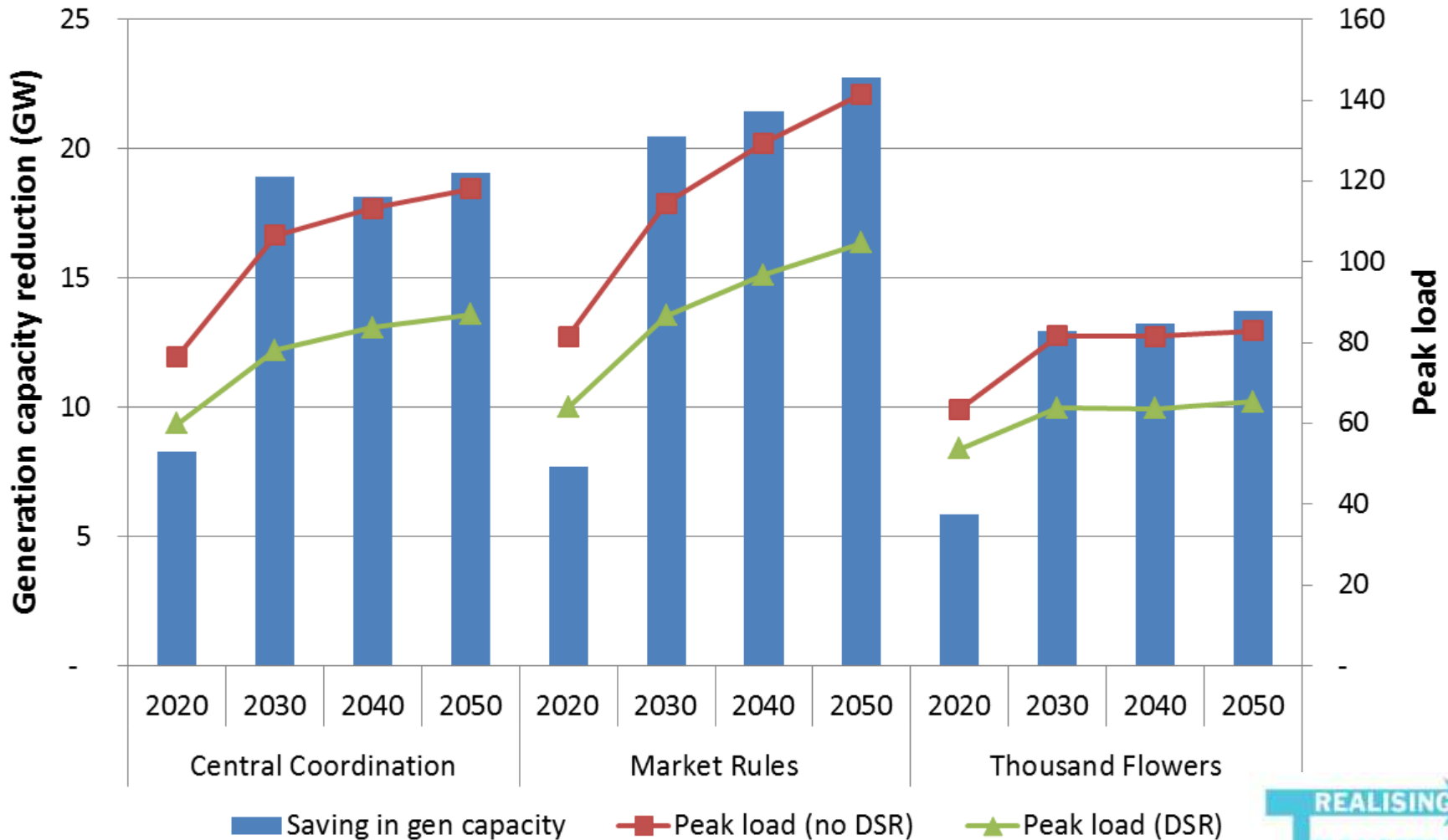
Whole-System Approach



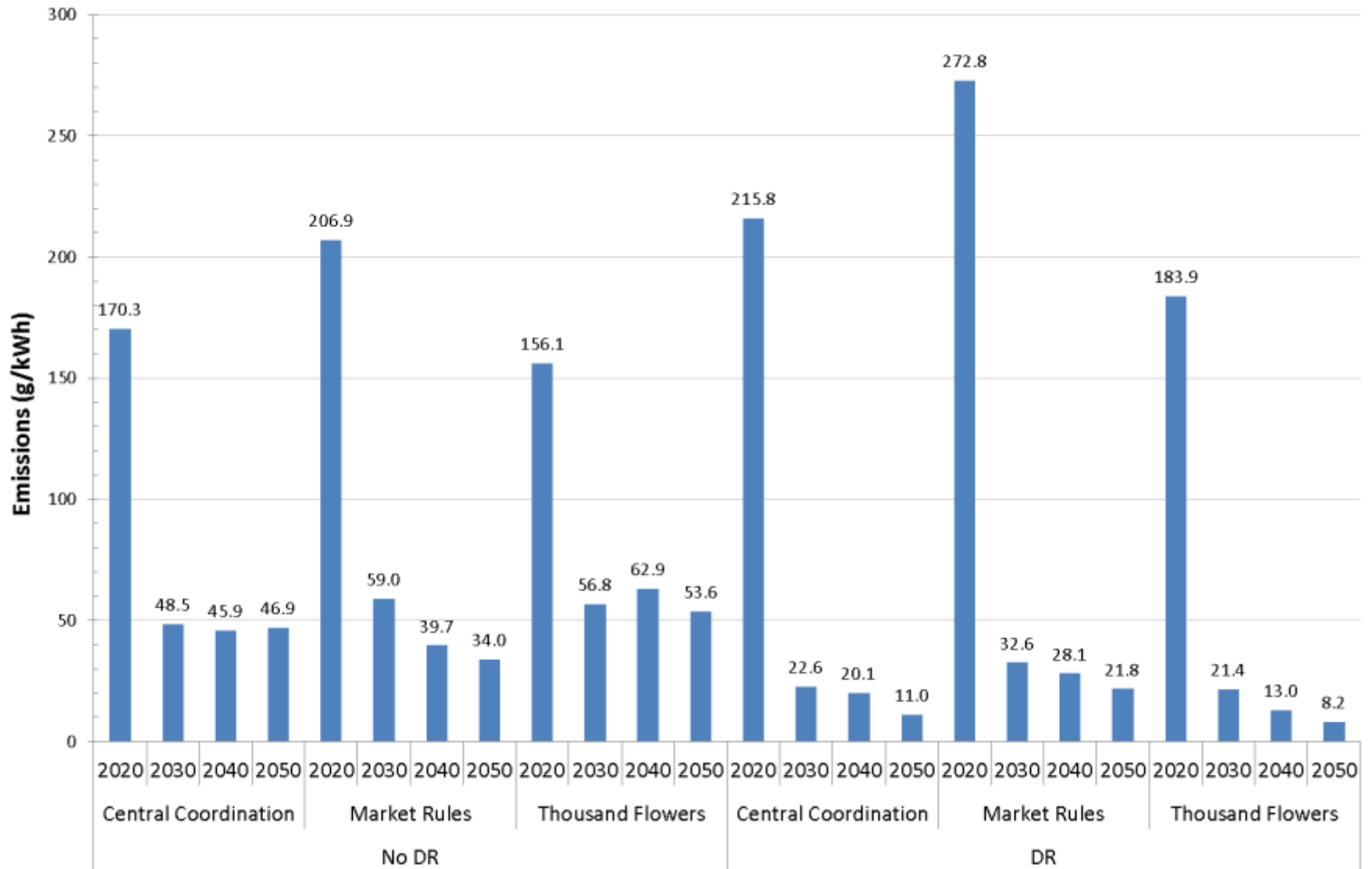
DSR enables higher utilisation of LCT's output and reduces OPEX



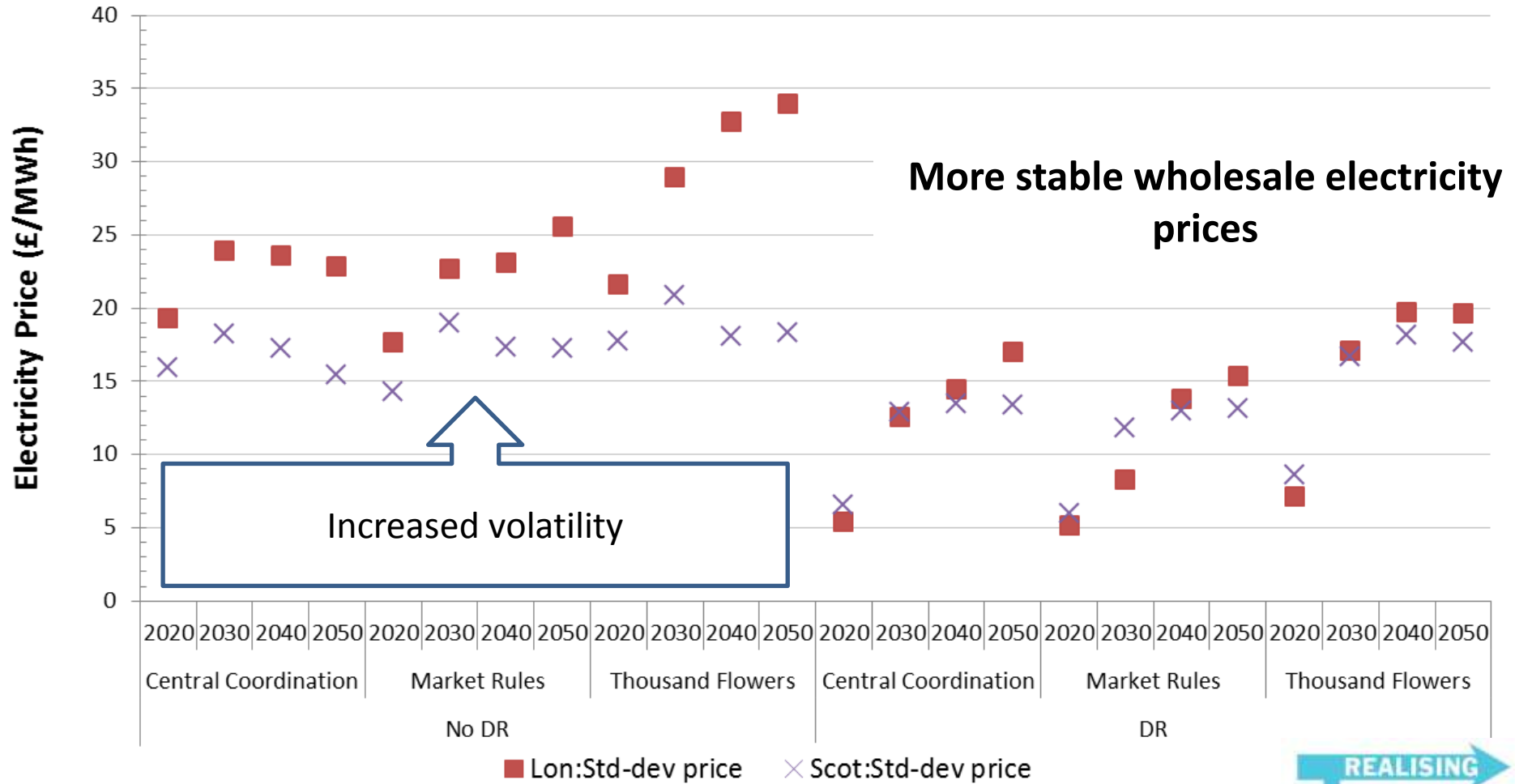
DSR reduces generation capacity requirement and peak demand (distribution)



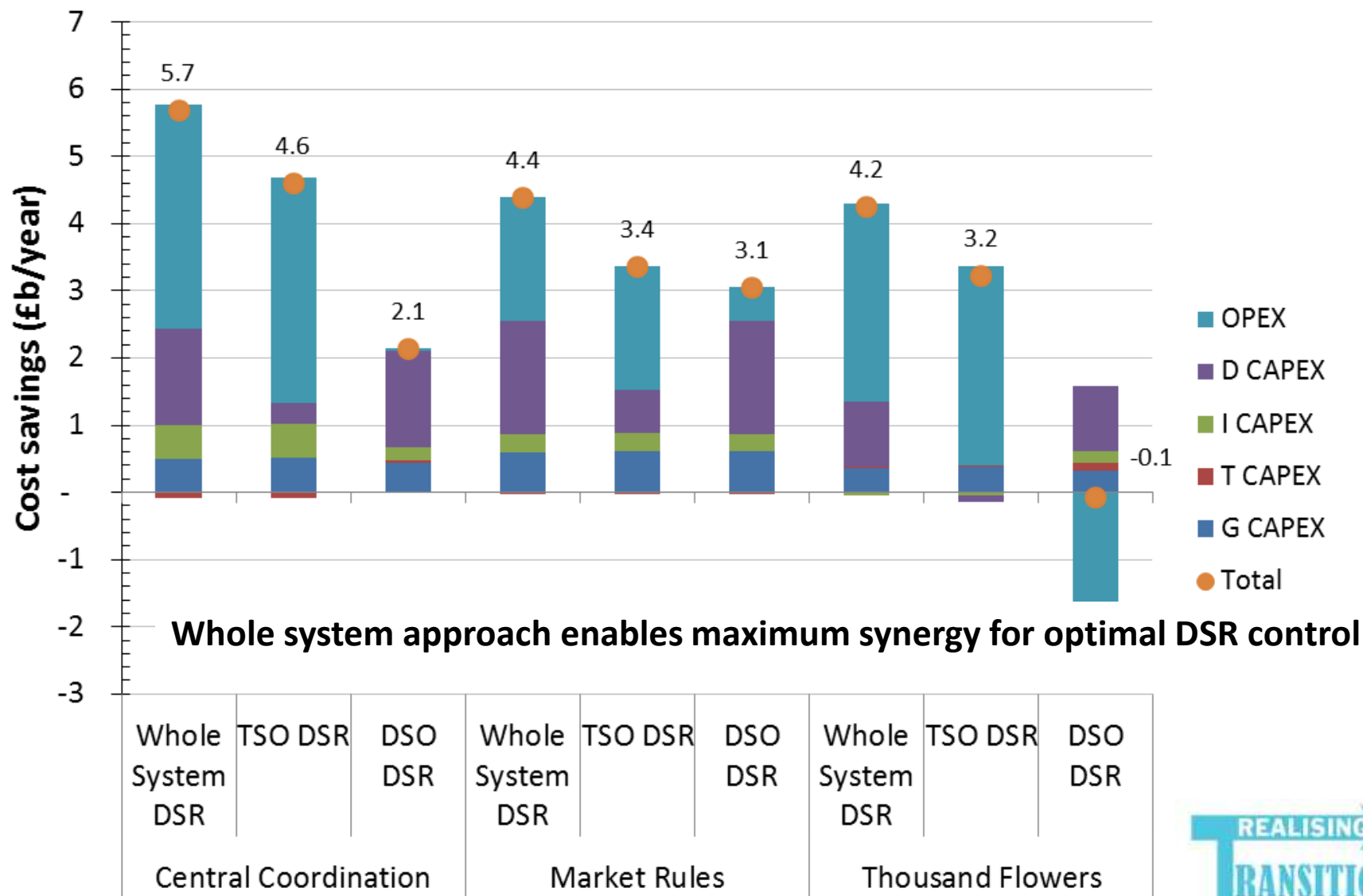
DSR reduces carbon emissions



DSR reduces price volatility



Whole system vs. TSO/DSO centric DSR



Conclusions

- Benefits of DSR
 - Higher utilisation of LCT's output and reduction of OPEX
 - Reduction of generation, interconnection capacity requirement and peak demand (distribution)
 - Reduction of market volatility
 - Lower emissions
- Whole system based DSR can save up to £5bn/year
- Coordination between TSO and DSO is needed to improve the synergy of DSR control
 - Savings can be up to £4 bn/year

Impact of research

Papers

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THANK YOU !

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