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# Balancing Supply and Demand in the Energy System

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All Energy – 11<sup>th</sup> May 2017

**ETI10** | TEN YEARS  
OF INNOVATION  
2007 – 2017

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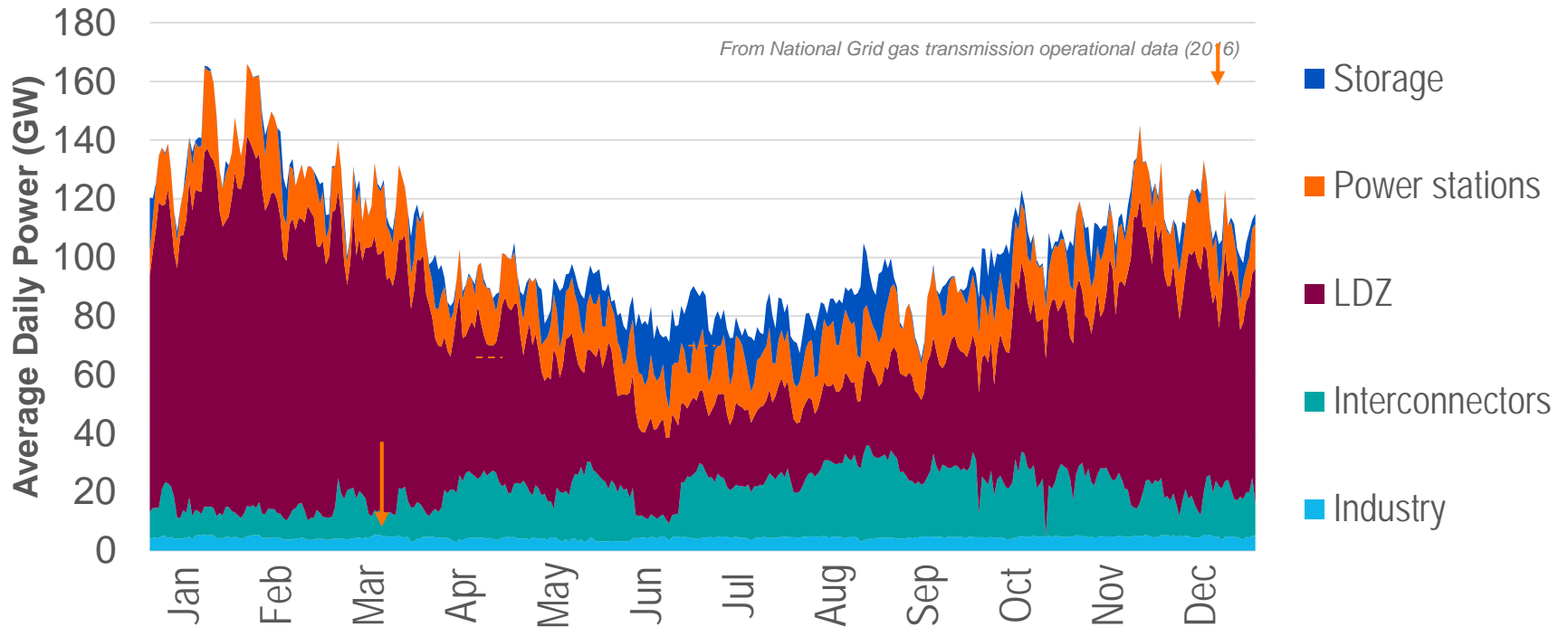
# Why do we need to balance?

Supply meets demand

Technical constraints maintained

Over different time periods

Over the whole UK geography





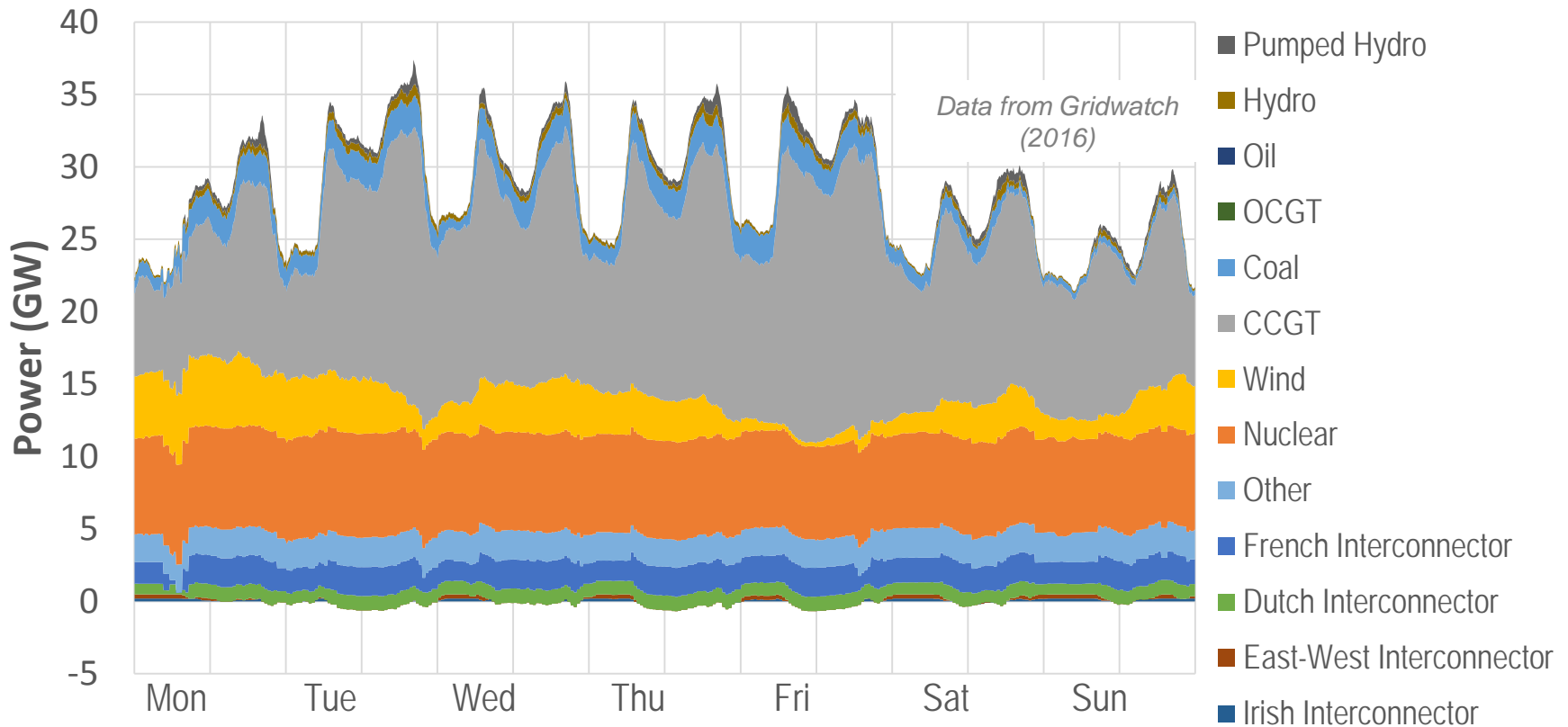
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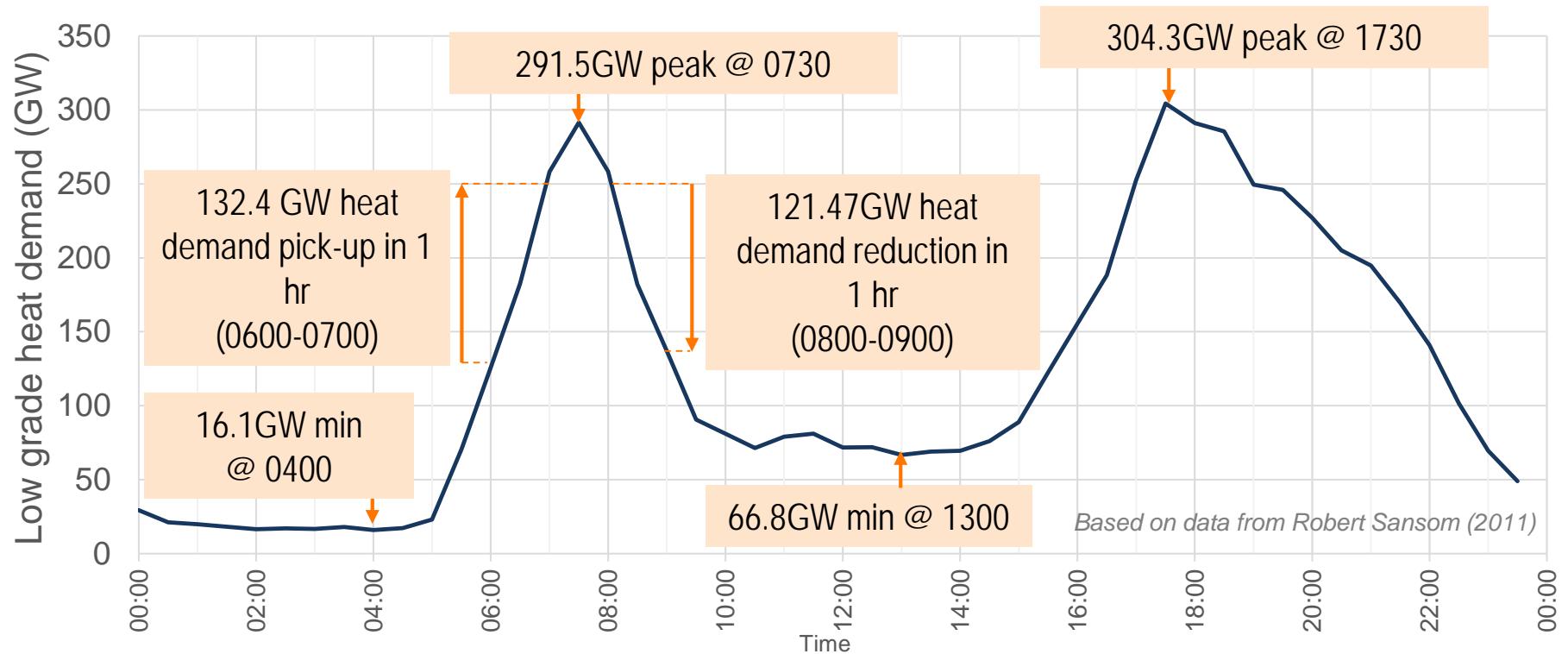
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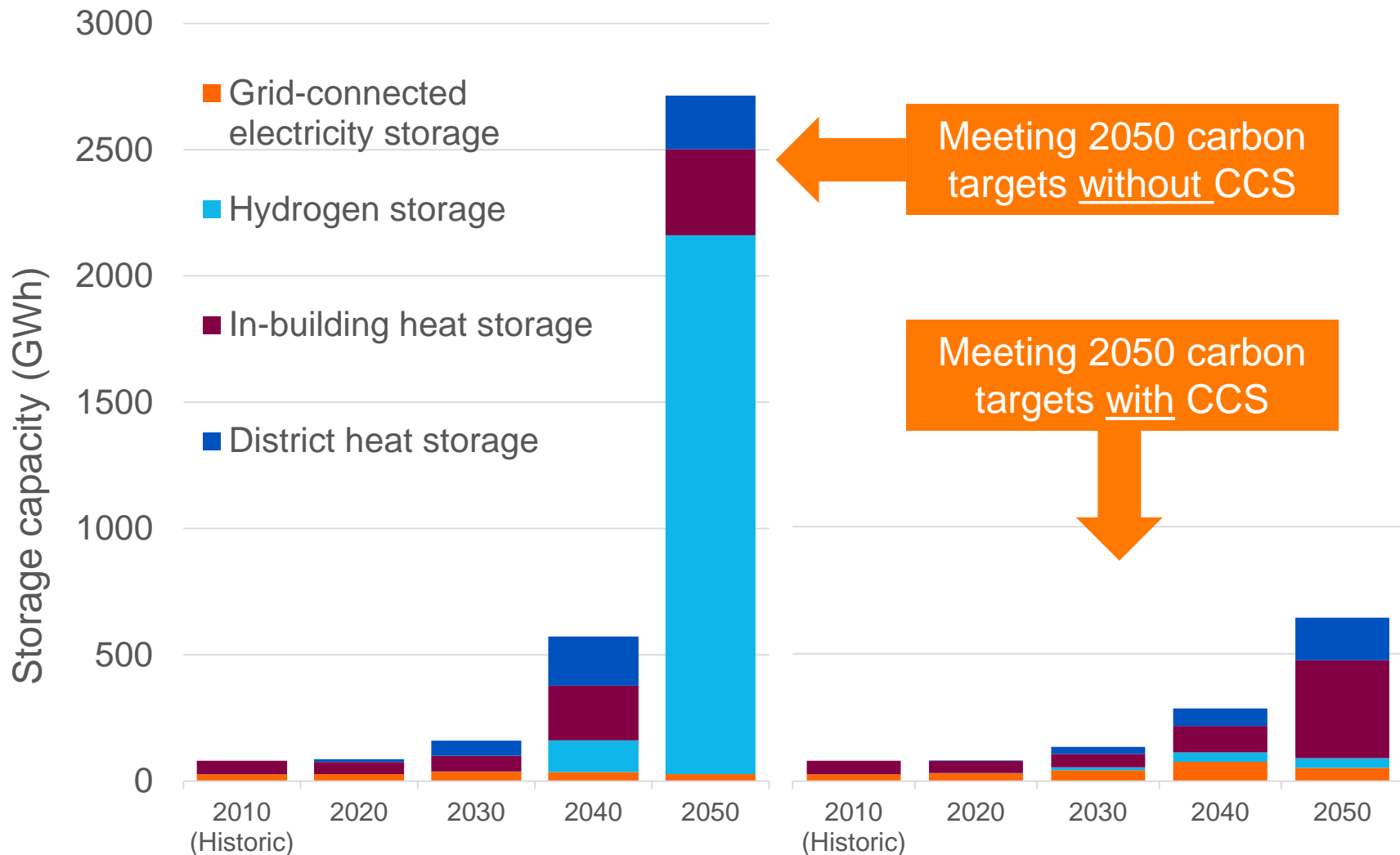
# Balancing Methods



- Between 2011 and 2016 8.5GW of intermittent generation was connected to the grid
- Roughly 2GW of this is under 20MW



# How much storage is needed?





# Energy Storage in Networks

Real time balance and  
expensive

Inherent storage and low cost dedicated storage

ELECTRICITY

GAS

HEAT  
NETWORKS

HYDROGEN

Spatial

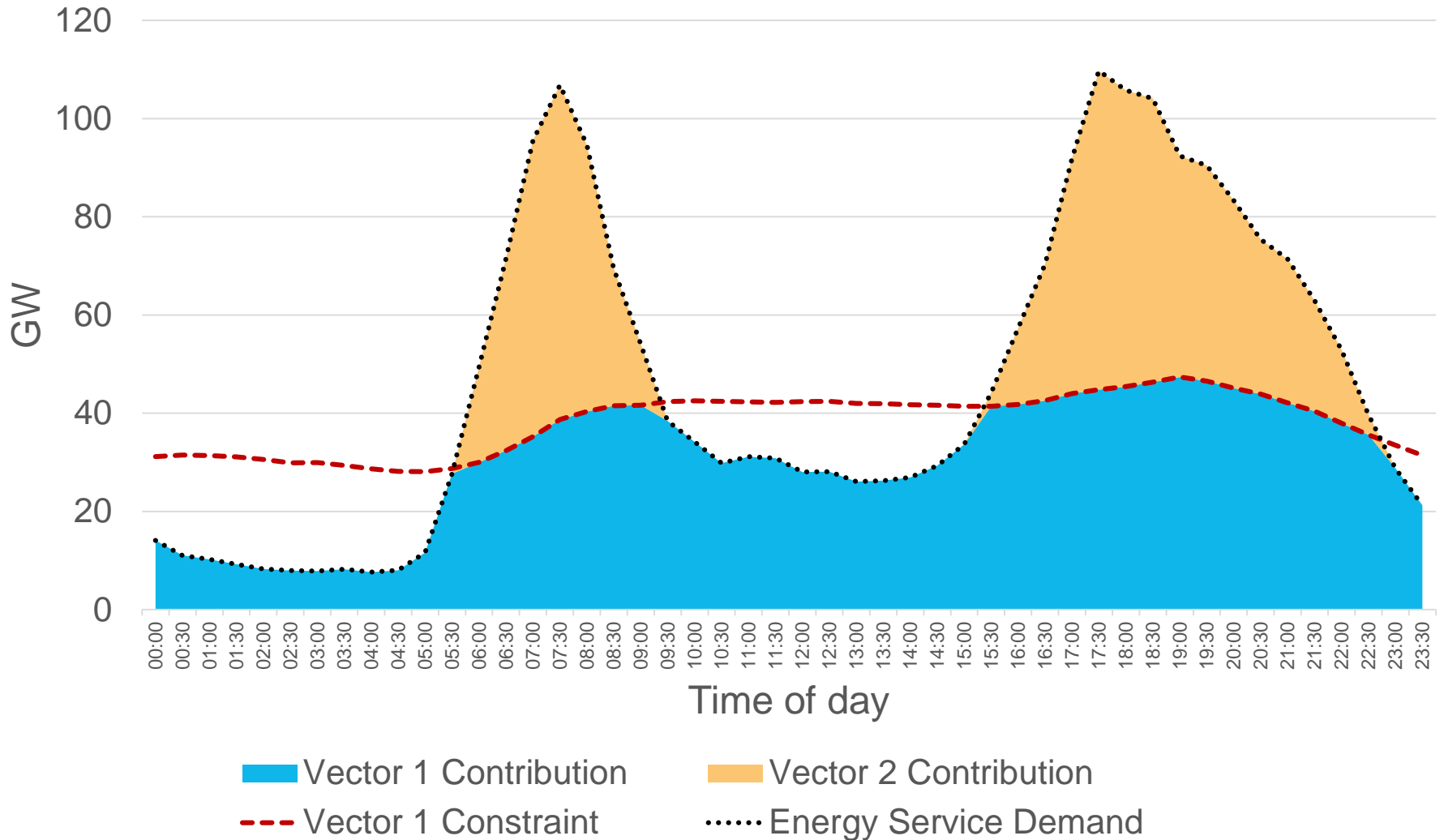


Hierarchical





# Vector Flexibility

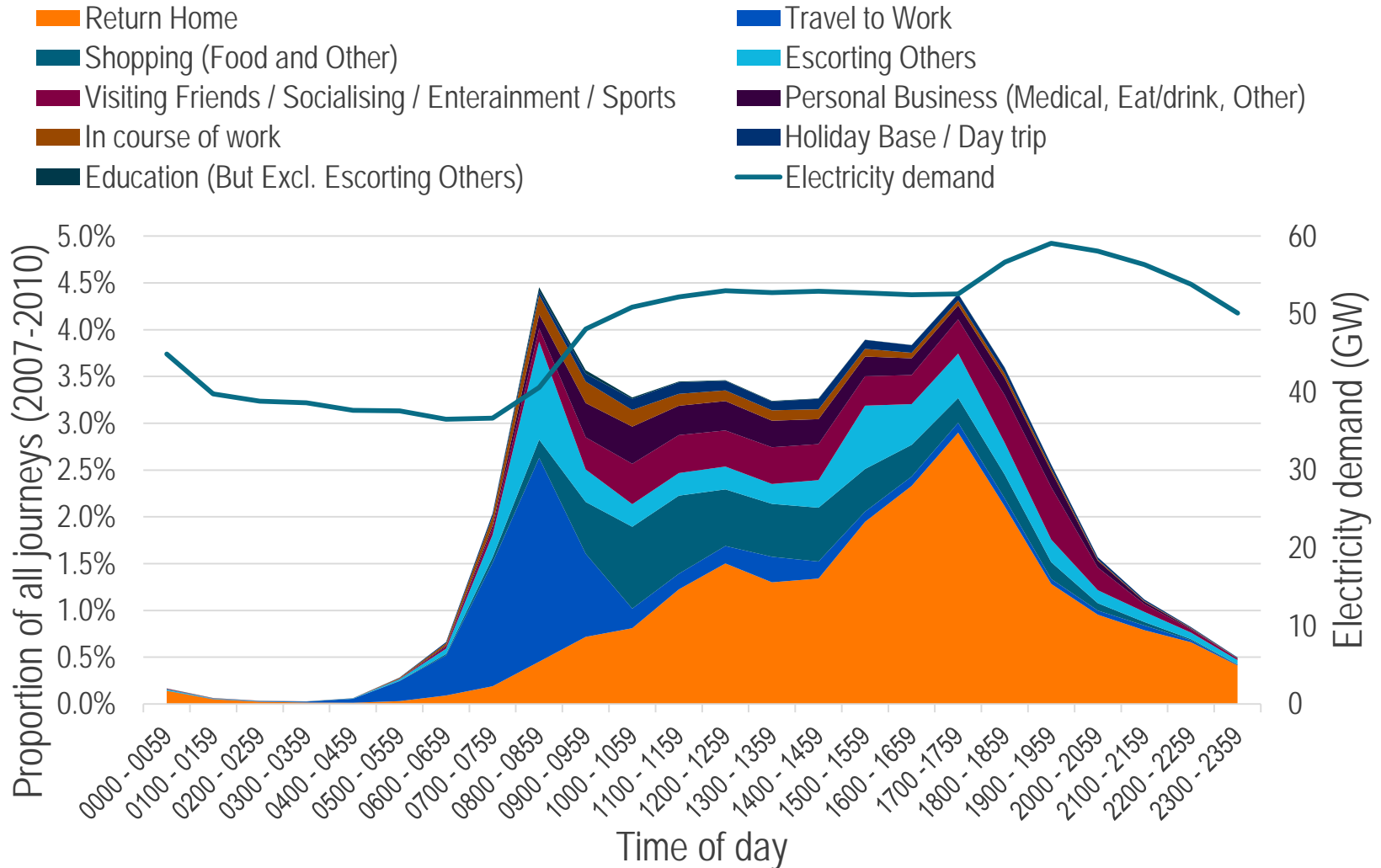






# Demand Flexibility

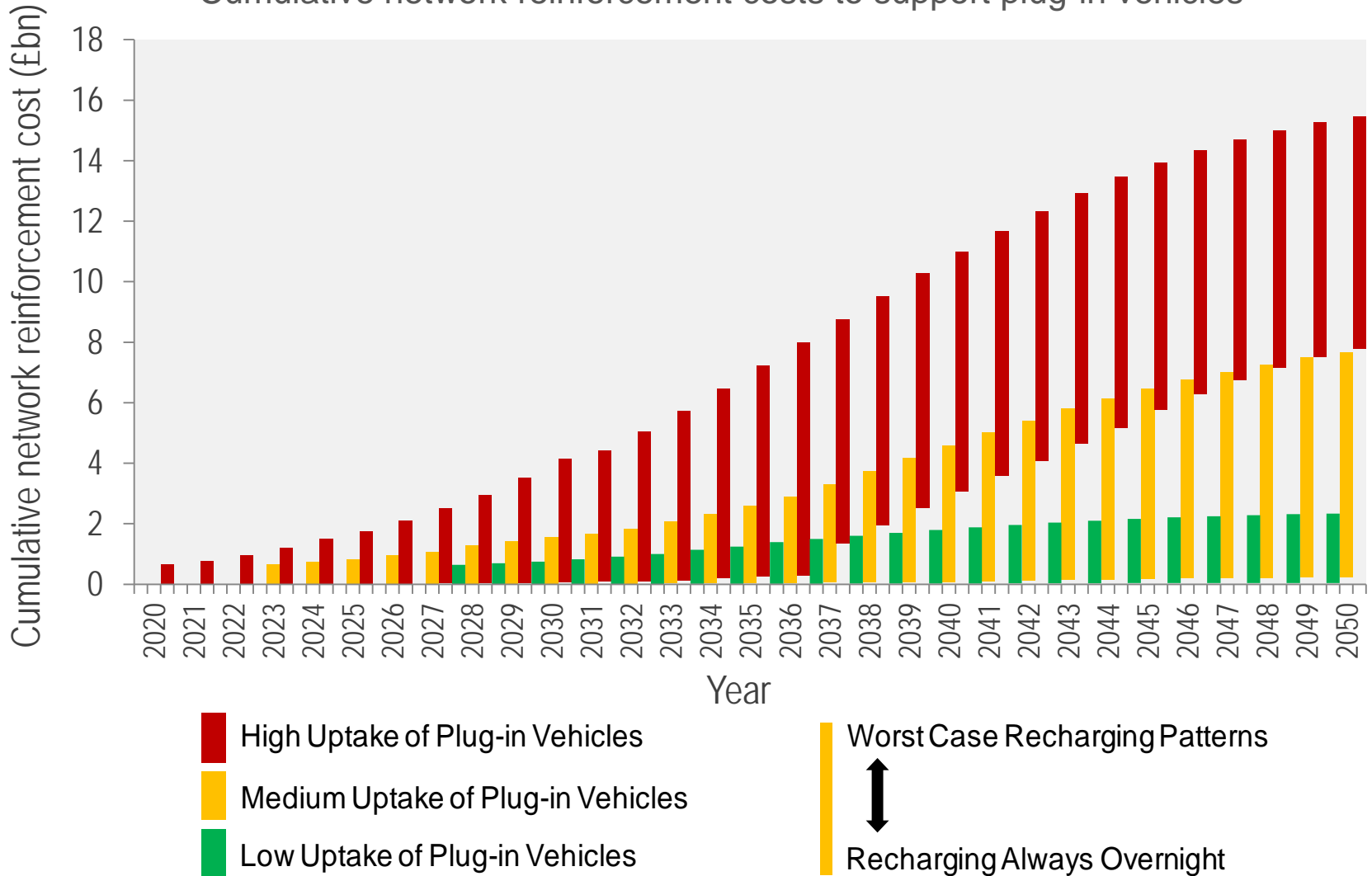
Journey arrival times (2007-2010) and Electricity demand profile (7th December 2010)





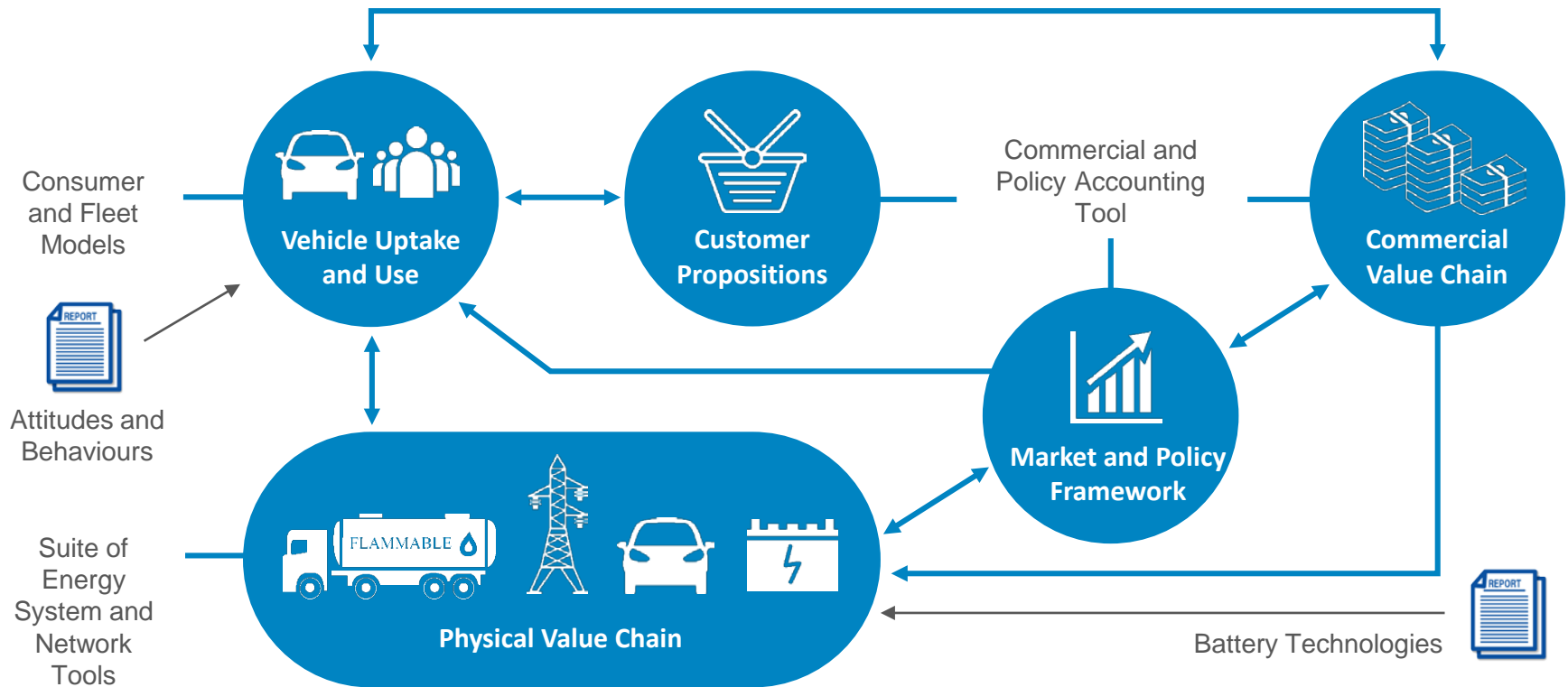
# Demand Flexibility

Cumulative network reinforcement costs to support plug-in vehicles





# Consumers, Vehicles, Energy Integration



Mass Market

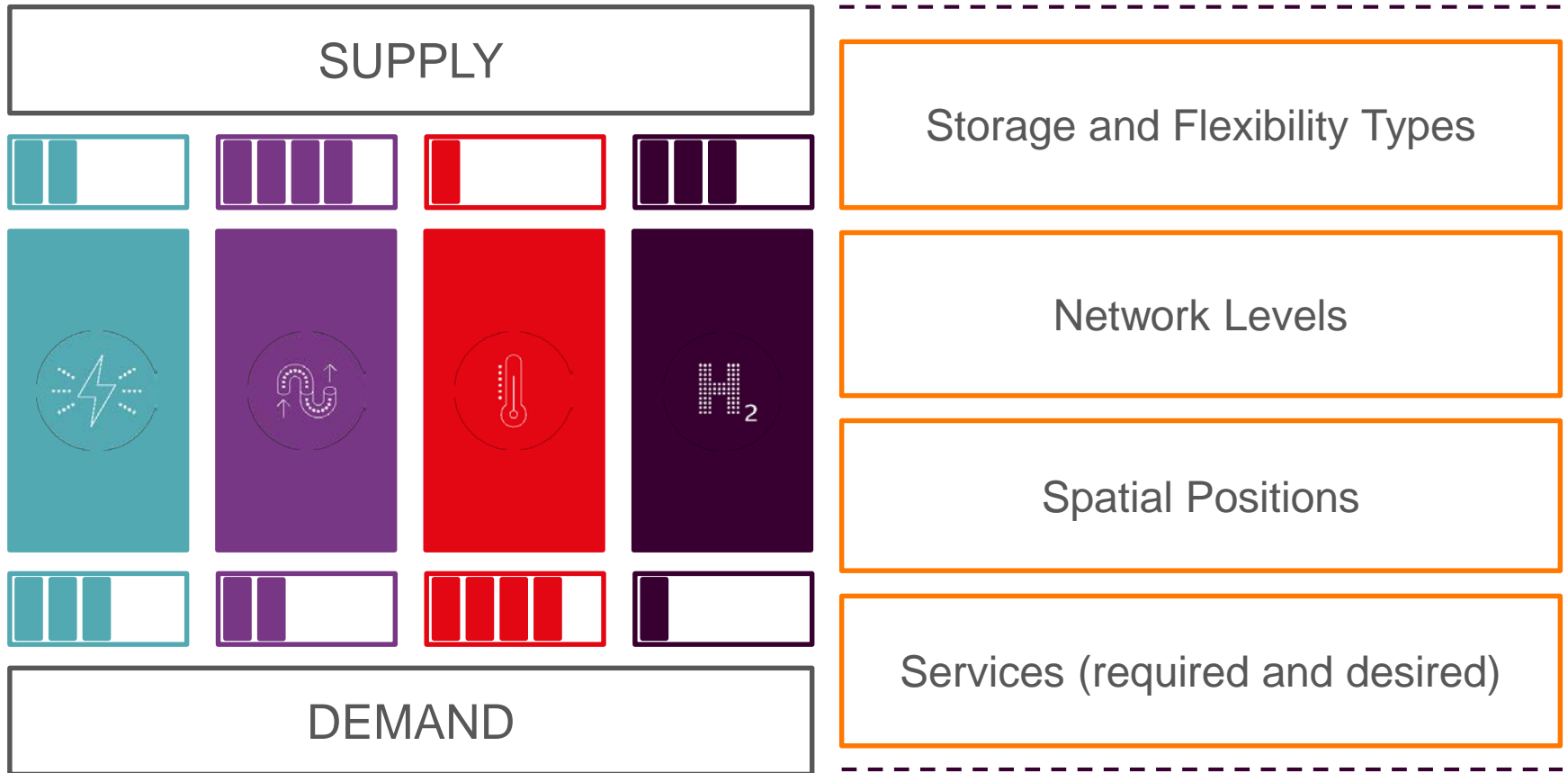
Charging Trials

Feeding into a whole energy systems model



# The ETI Storage and Flexibility Model

For different future energy systems...





# Summary

- Energy balancing is critical and extends beyond the electricity system
- Numerous opportunities to achieve balancing include:
  - Energy storage
  - Demand side flexibility
  - Vector integration
- Key decisions that lead to new energy systems will affect how much and what type of flexibility is needed.
- There is a huge amount of potential that we do not currently understand about balancing within a whole energy system.
- It is possible to assess the requirements for future flexibility – tools and evidence are being developed to help with this.



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