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**Programme Area:** Energy Storage and Distribution

**Project:** Storage & Flexibility Modelling

**Title:** Balancing Supply & Demand in the Energy System

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**Abstract:**

Presentation for All Energy 2017.

**Context:**

This project will develop energy system modelling capability to increase understanding of the role of energy storage and system flexibility in the future energy system. The modelling capability will provide a whole systems view of the different services that could be provided and at which points in the energy system they are most appropriate. Management consultancy Baringa Partners are delivering this new project to develop the capability to improve understanding with regards the future role of energy storage and the provision of cross-vector system flexibility within the context of the overall UK energy system.



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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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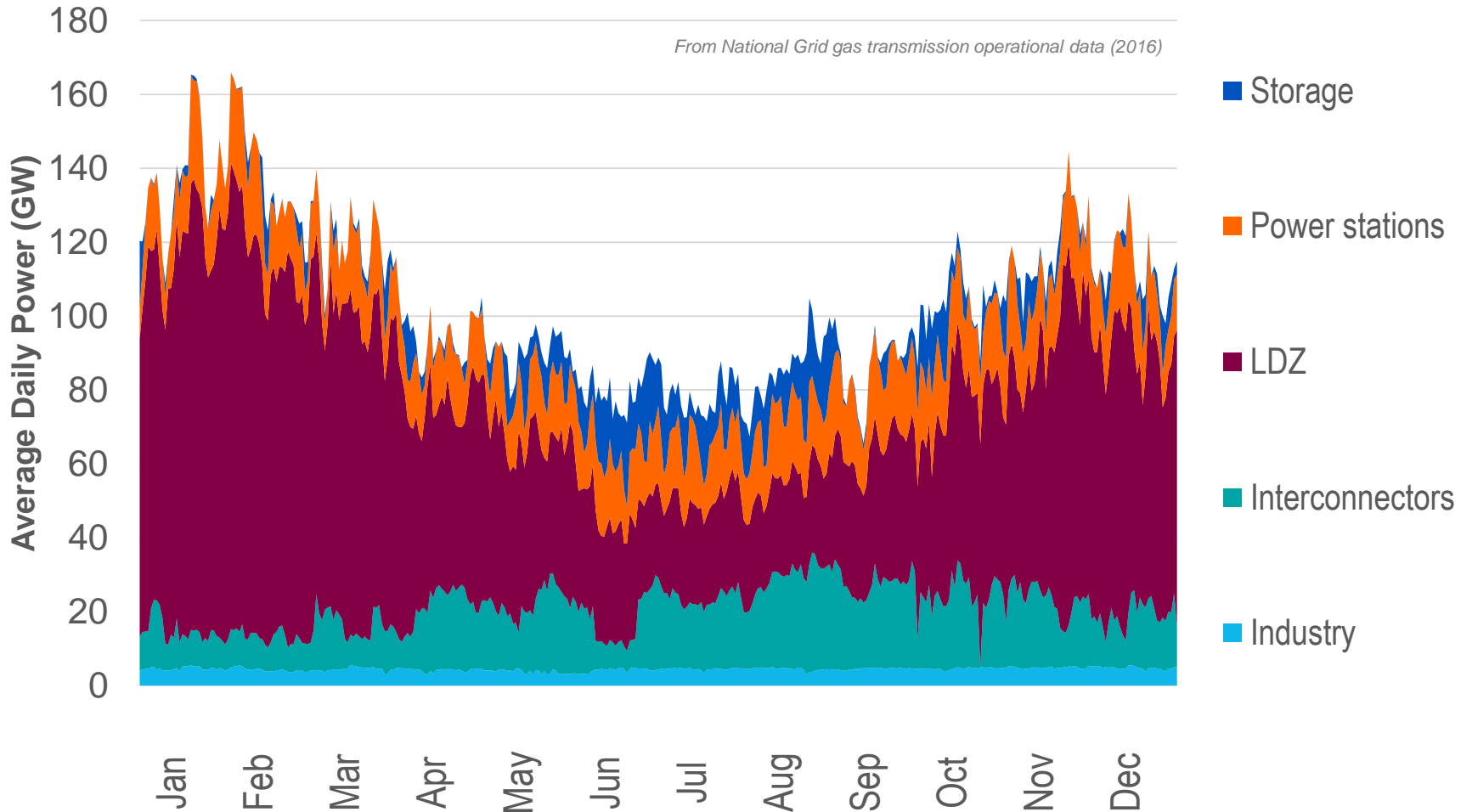


Balancing Energy  
>  
Balancing Electricity

Whole Energy Systems  
>  
Transmission and Distribution

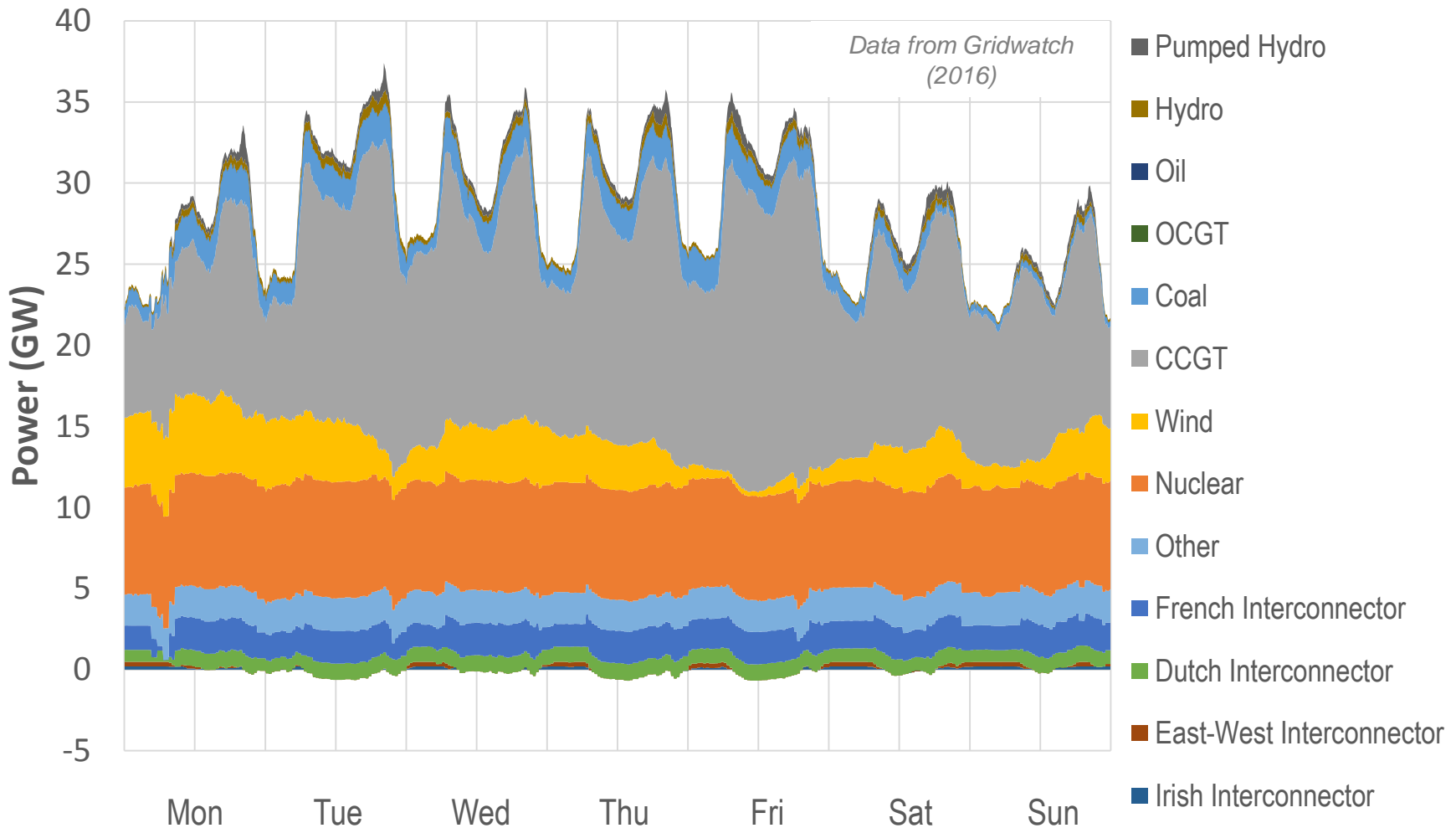


# Why do we need to balance?



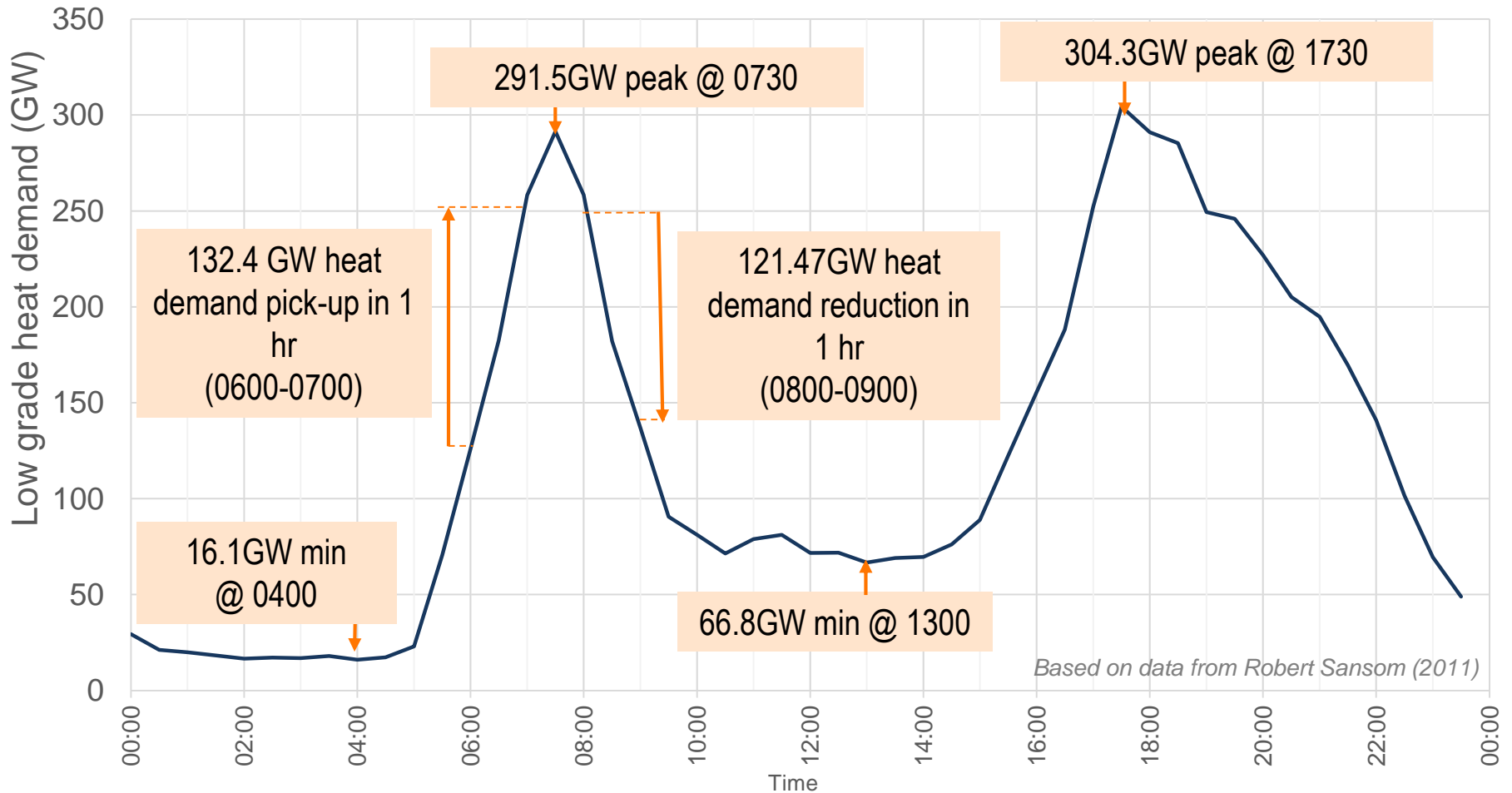


# Why do we need to balance?





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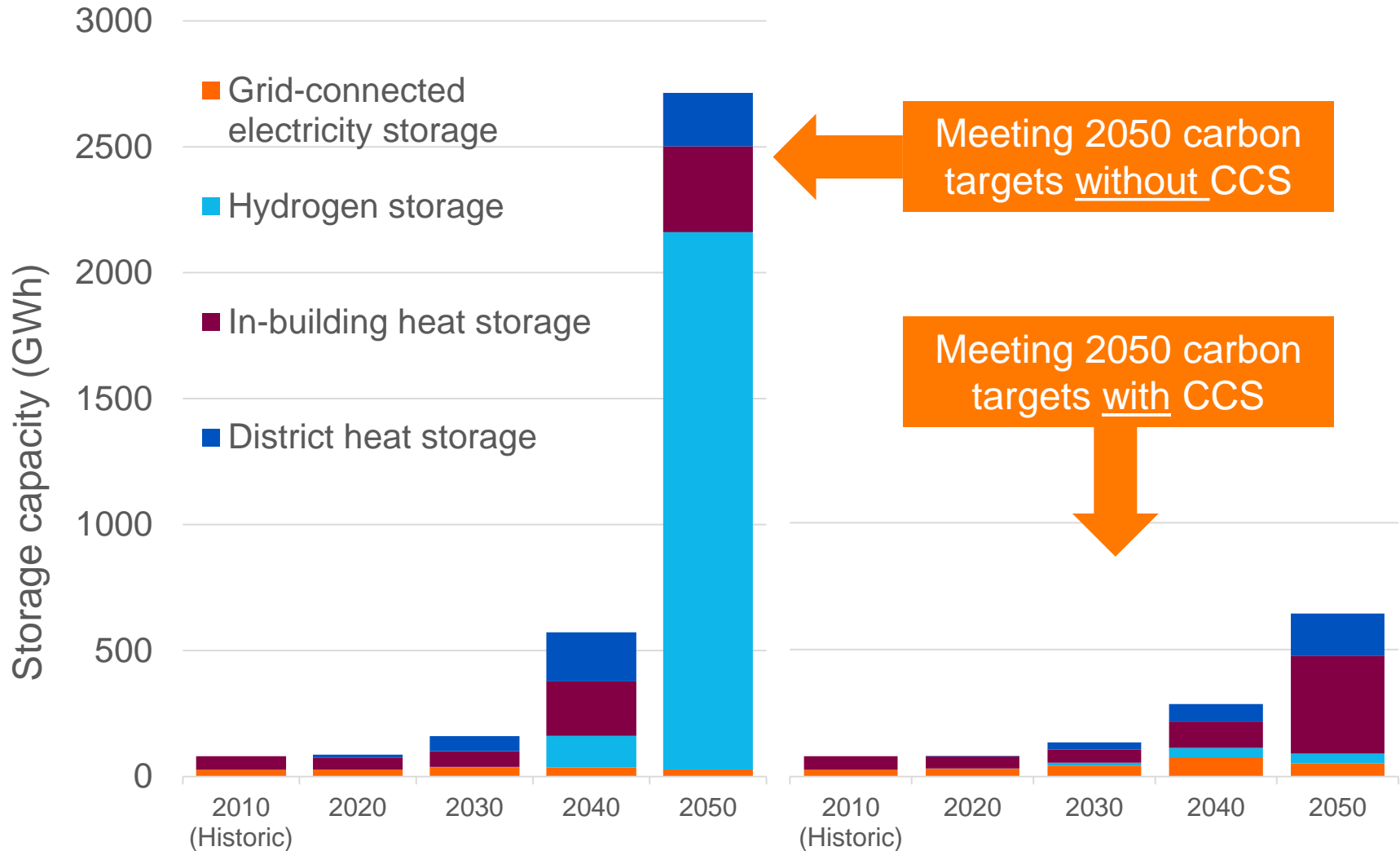
# The tools at our disposal



- 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

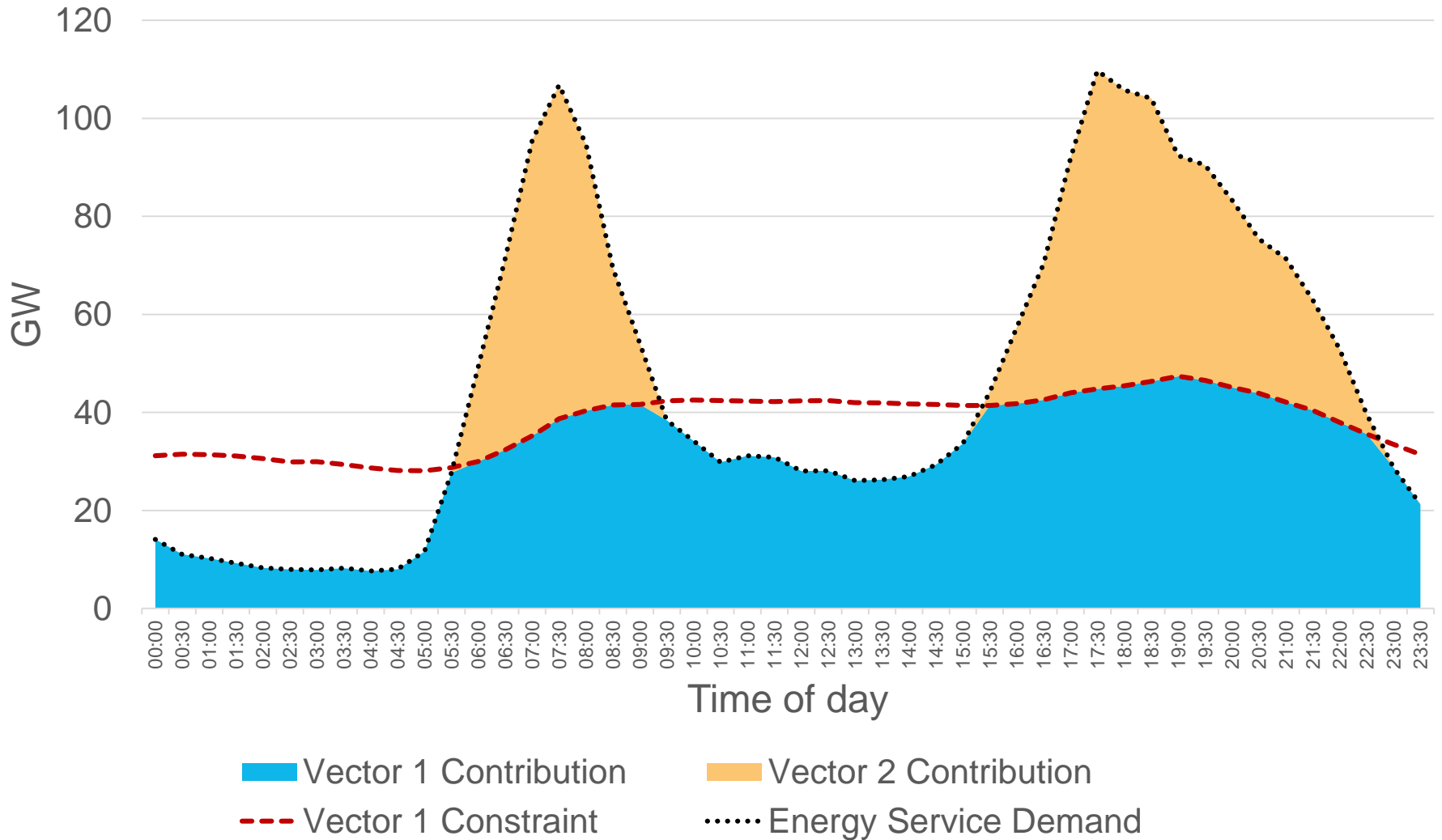


Hierarchical





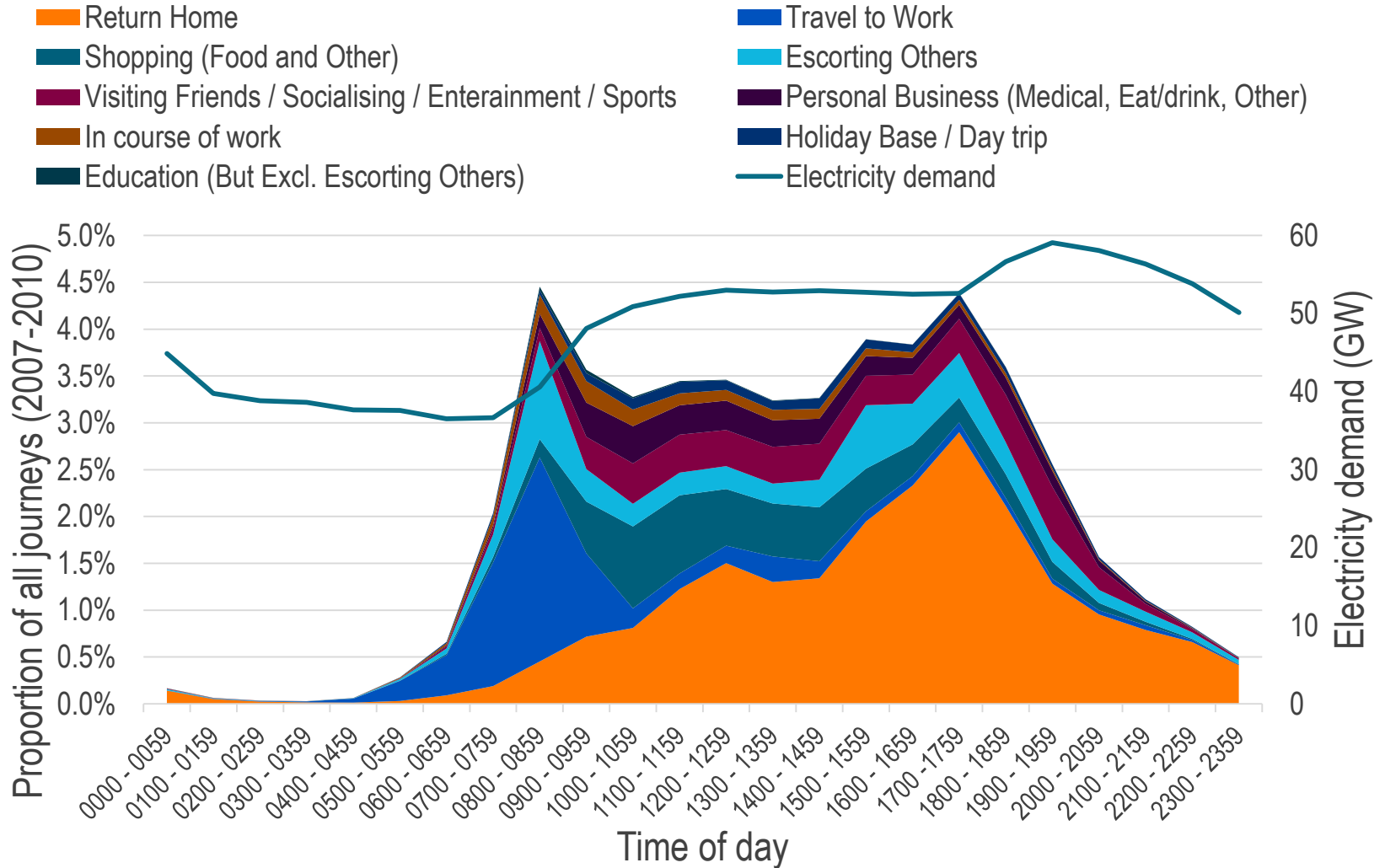
# Vector Flexibility





# Demand Flexibility

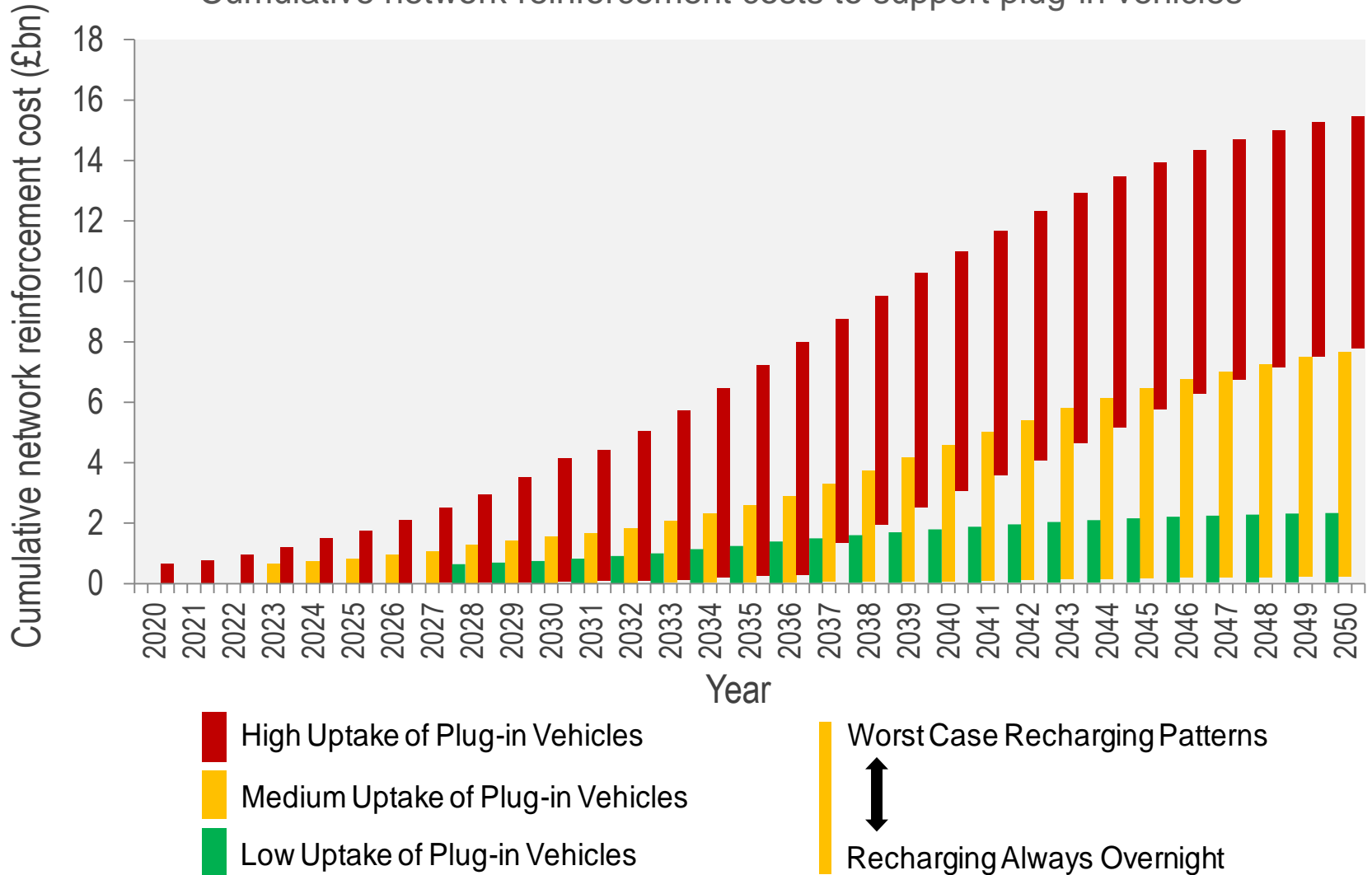
Journey arrival times (2007-2010) and Electricity demand profile (7th December 2010)





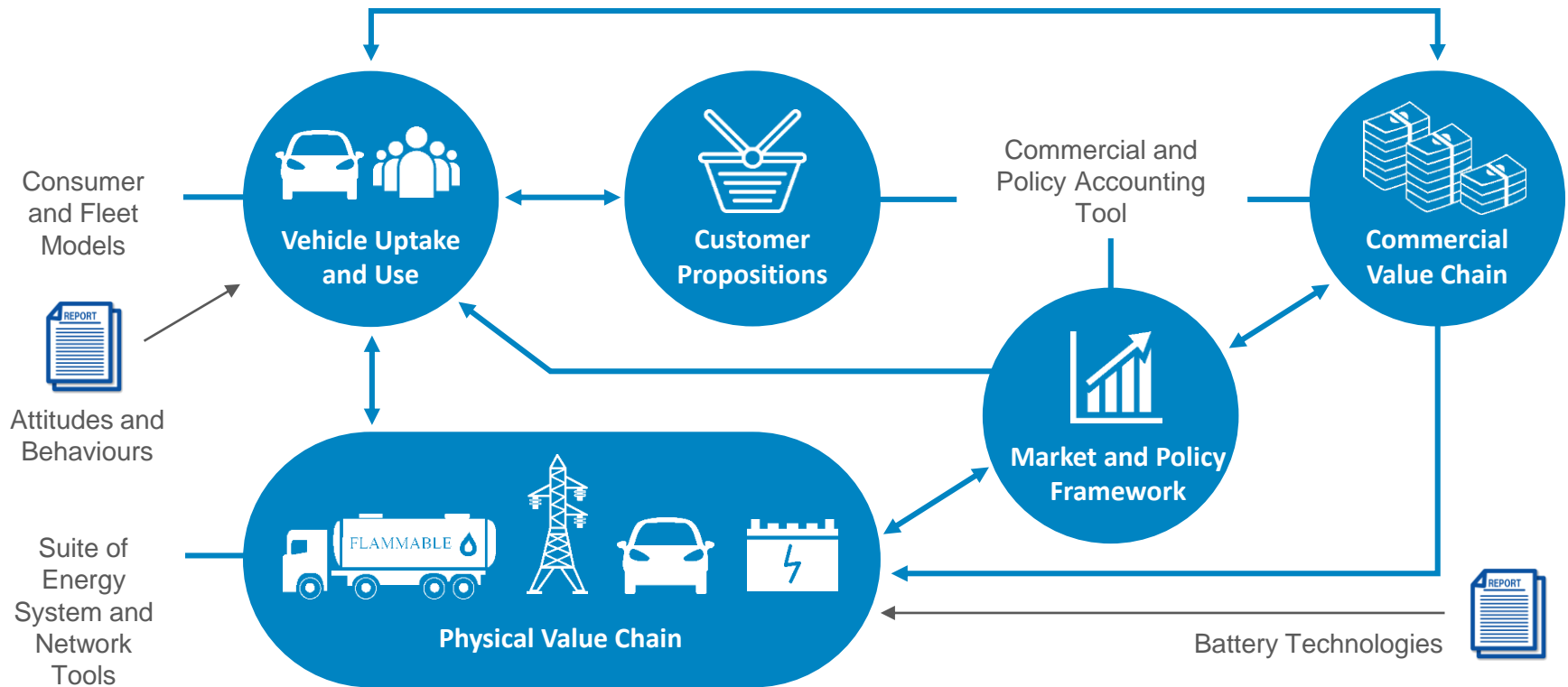
# Demand Flexibility

Cumulative network reinforcement costs to support plug-in vehicles





# Consumers, Vehicles, Energy Integration



Mass Market

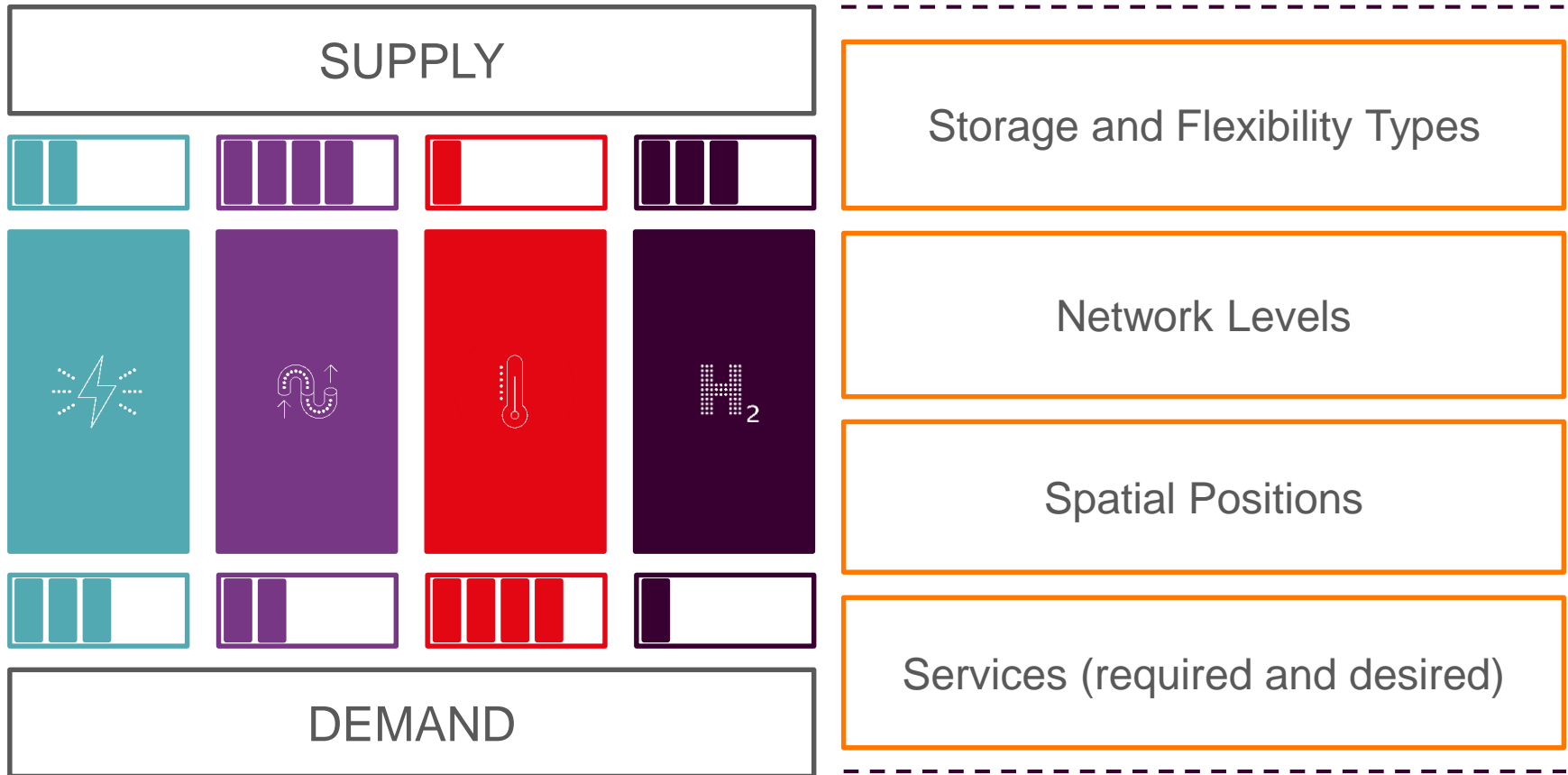
Charging Trials

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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