



[www.eti.co.uk](http://www.eti.co.uk)

## Evolution of our Energy System

Alex Buckman – Energy Technologies Institute

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

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# What is the ETI?

- The ETI is a public-private partnership between global energy and engineering companies and the UK Government.
- Targeted development, demonstration and de-risking of new technologies for affordable and secure energy

## ETI members



**CATERPILLAR®**



 **Rolls-Royce**



  
Department for  
Business, Energy  
& Industrial Strategy

**EPSRC**  
Pioneering research  
and skills

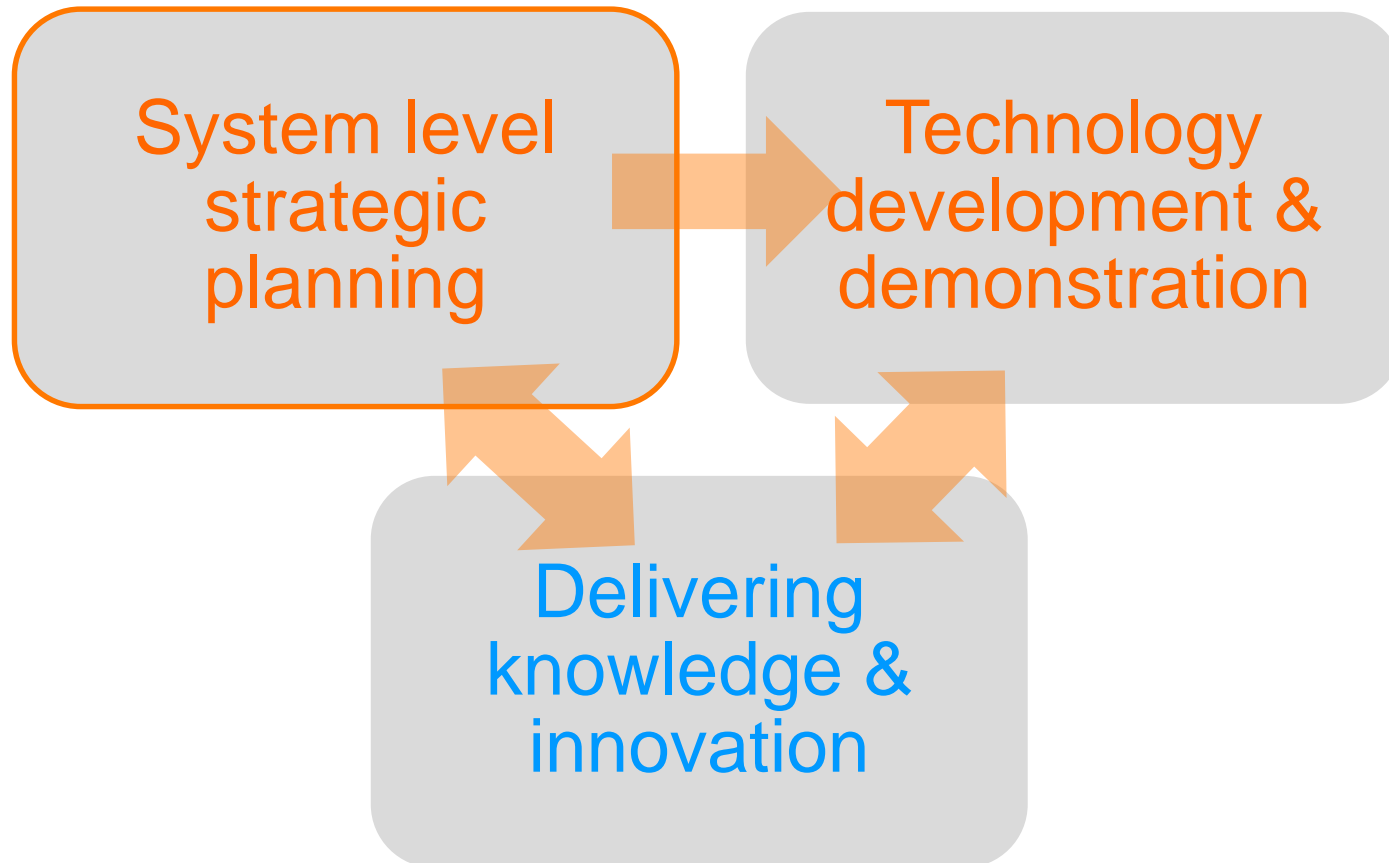
**Innovate UK**

## ETI programme associate

**HITACHI**  
Inspire the Next



## What is the ETI?






9'441 tonnes



# Our energy system evolves around our choices

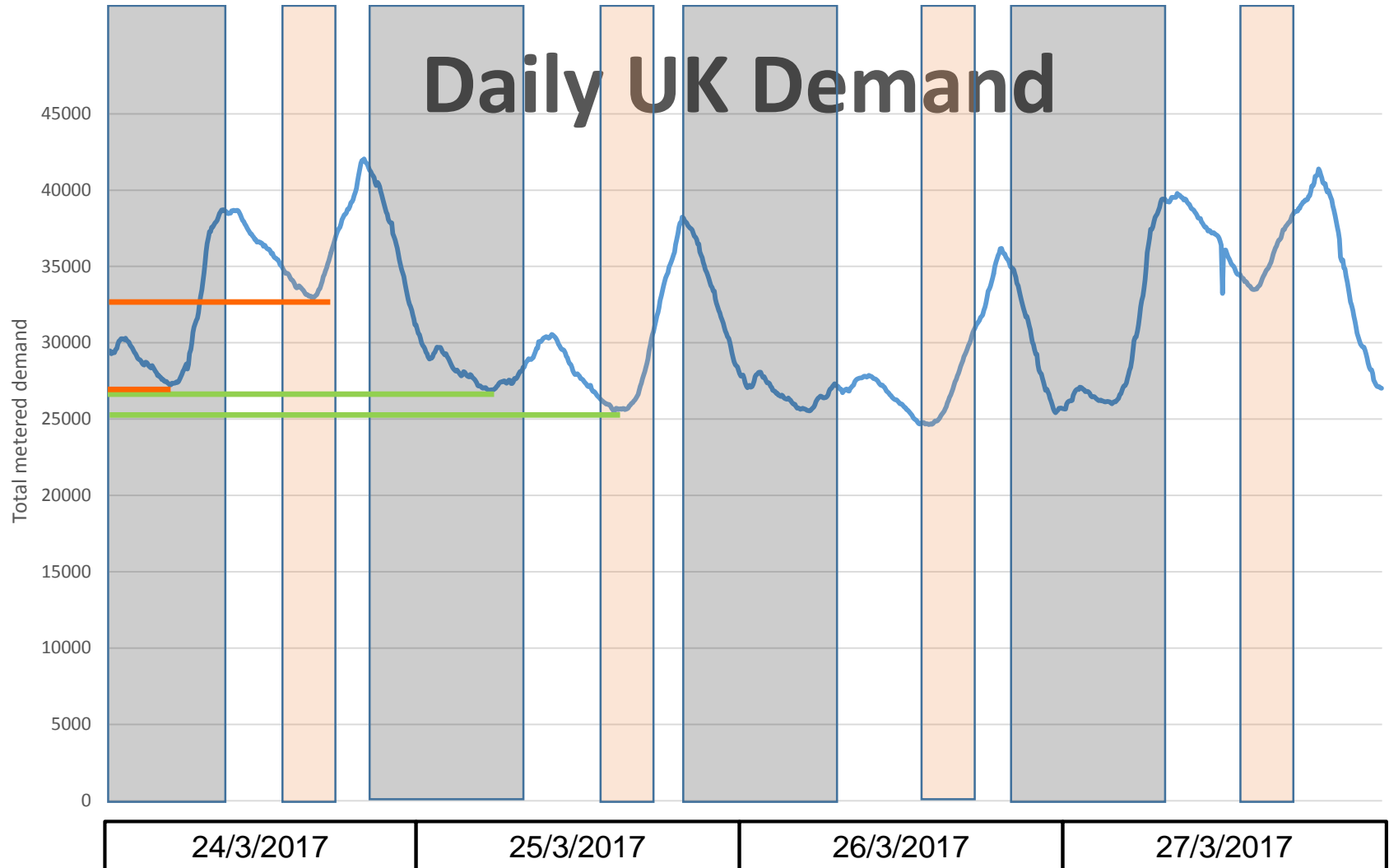


# Why do people put solar on their roofs? Because other people put solar on their roofs

By **Chris Mooney** October 23, 2014 

Washington Post, 2014







# Change happens fast







Change happens fast

## Uber's First Self-Driving Fleet Arrives in Pittsburgh This Month

The autonomous cars, launching this summer, are custom Volvo XC90s, supervised by humans in the driver's seat.



**Wannis Kabbaj:**

Director of global strategy for healthcare logistics at UPS

***“Traffic will be functionally exuberant. It will be liquid like our blood”***

***Ted Talk: What a driverless world could look like***

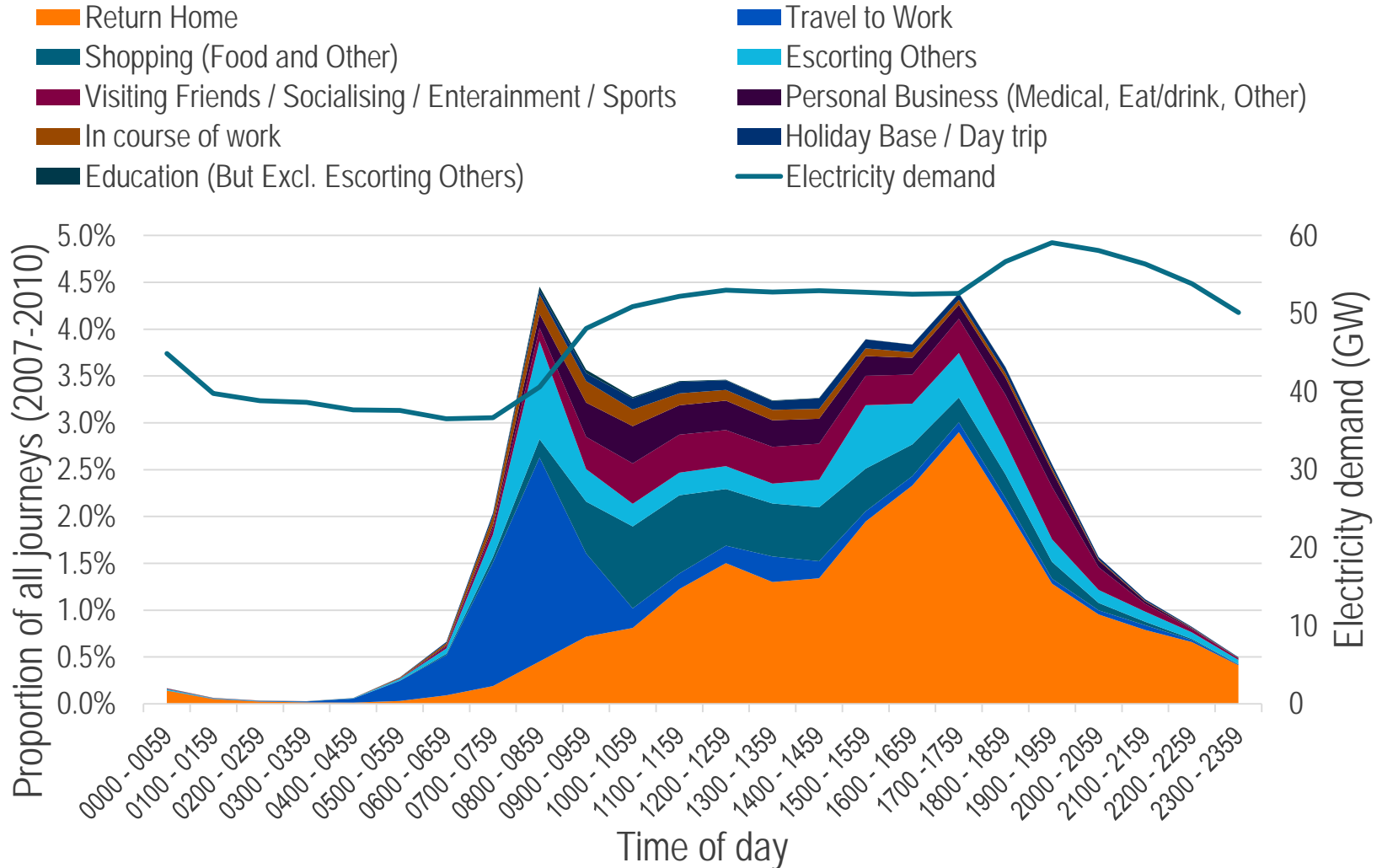


Image courtesy of GoToVan - [Flickr](#) - Creative Commons licence



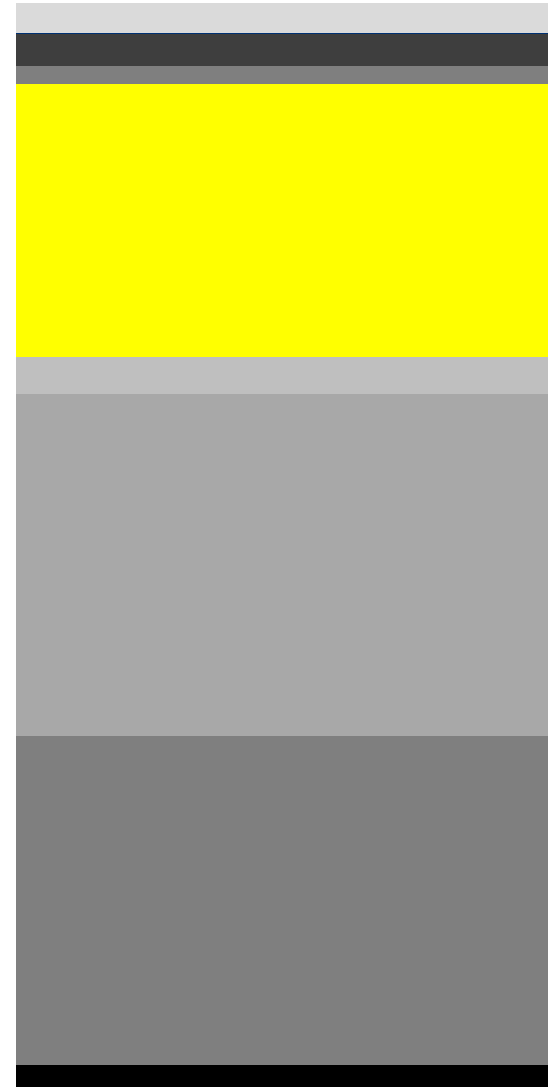
# Change happens fast

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



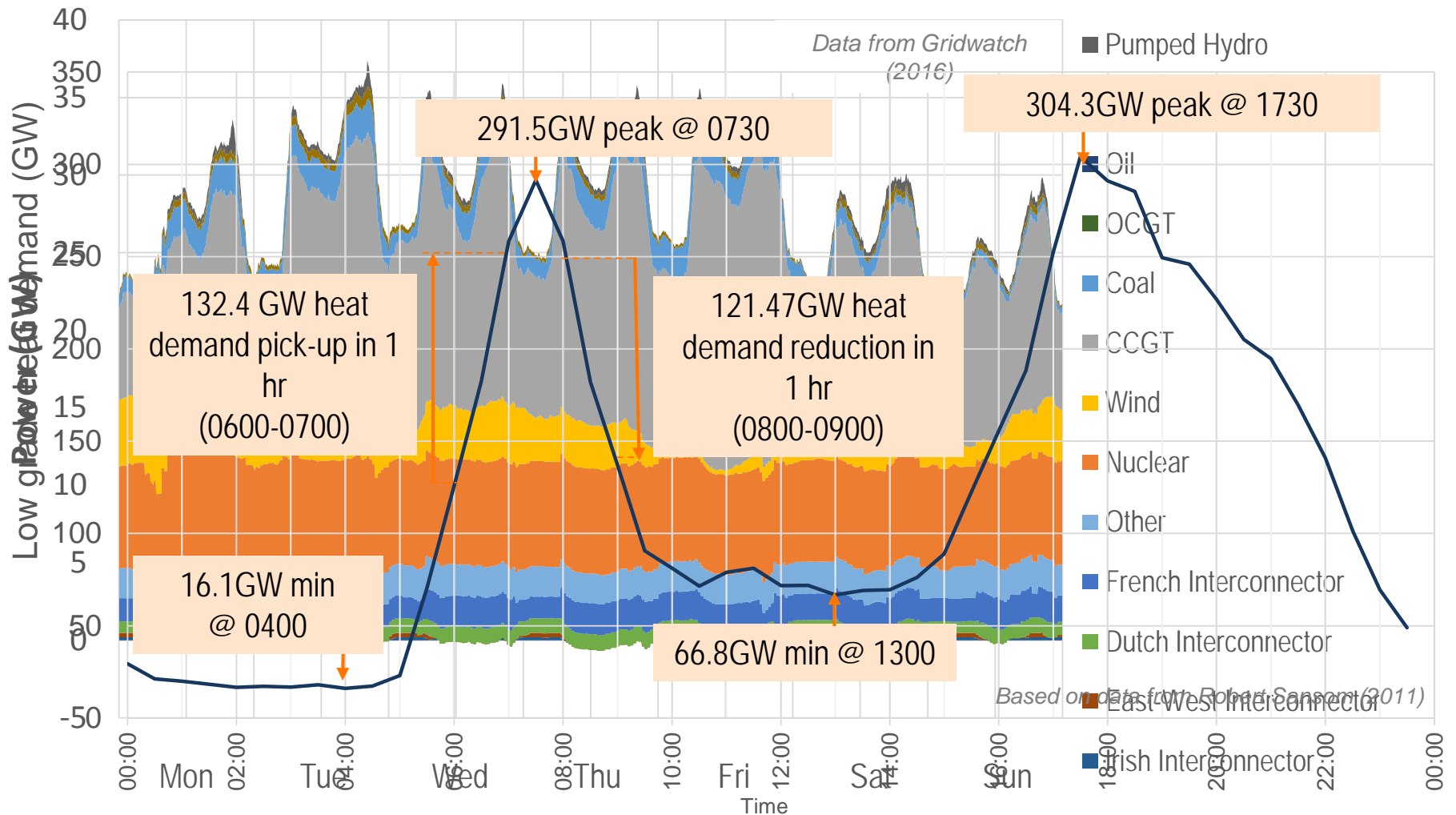


# Change happens fast





# Why do we need to balance?





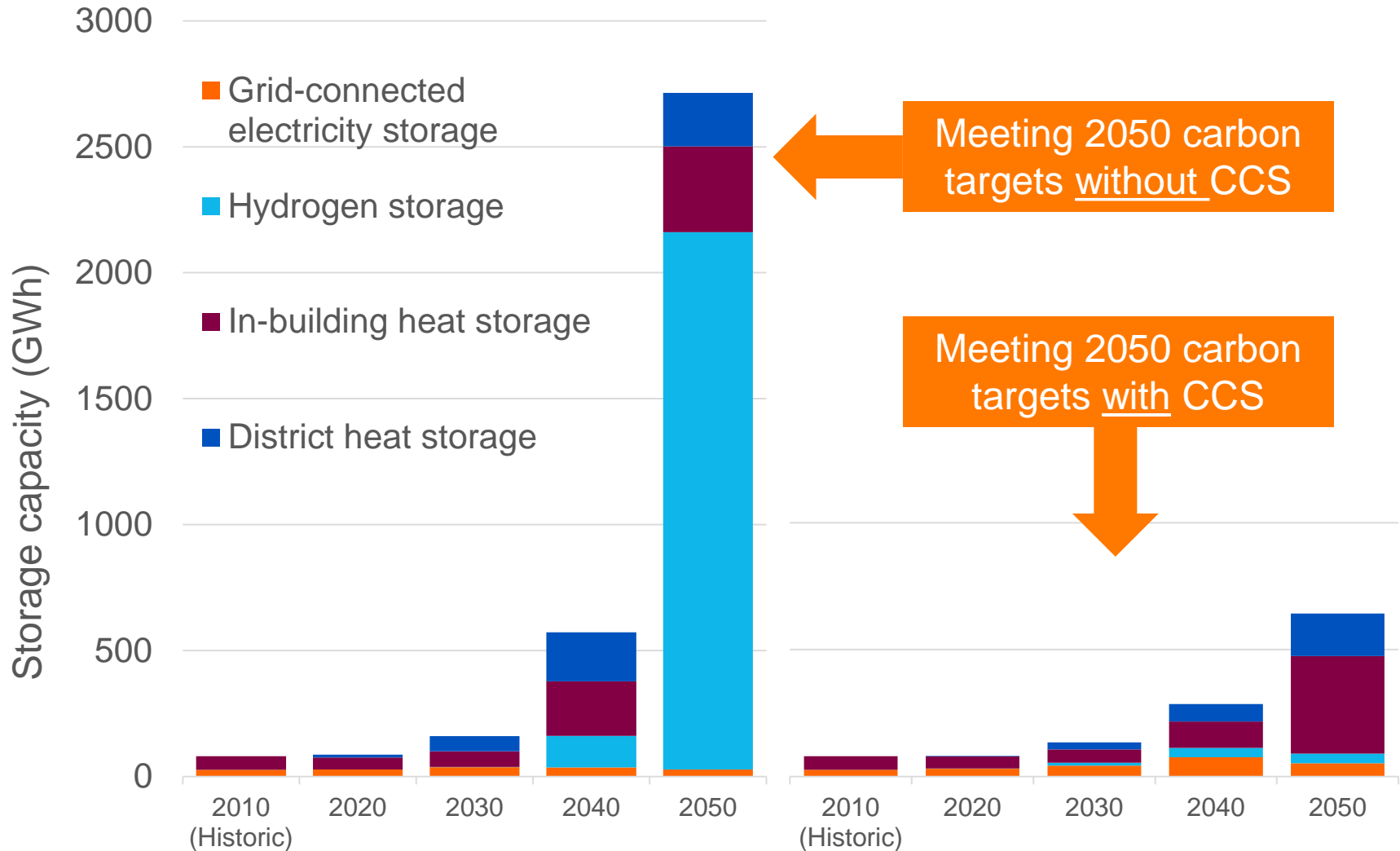
# The tools at our disposal



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

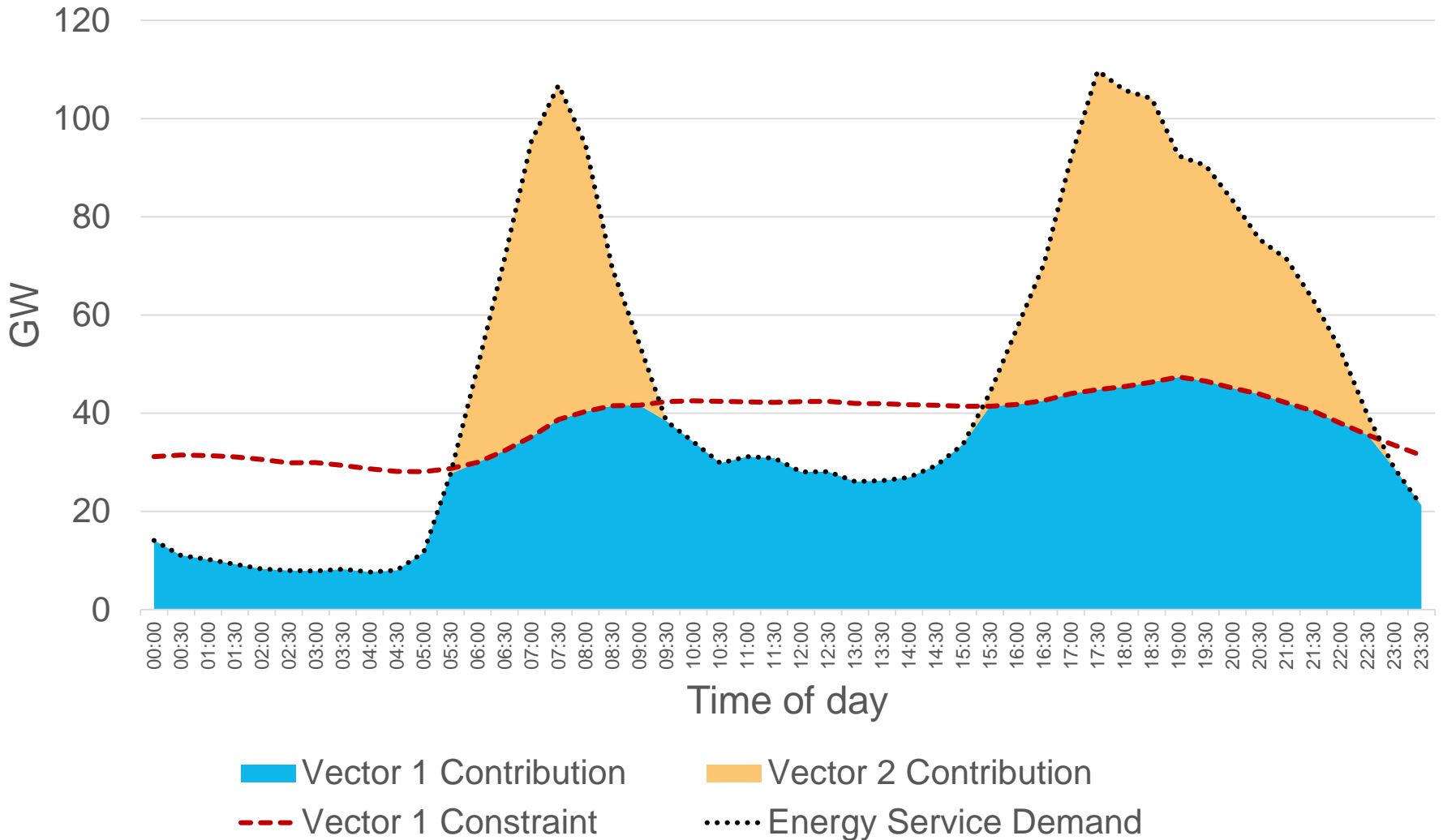


# How much storage is needed?





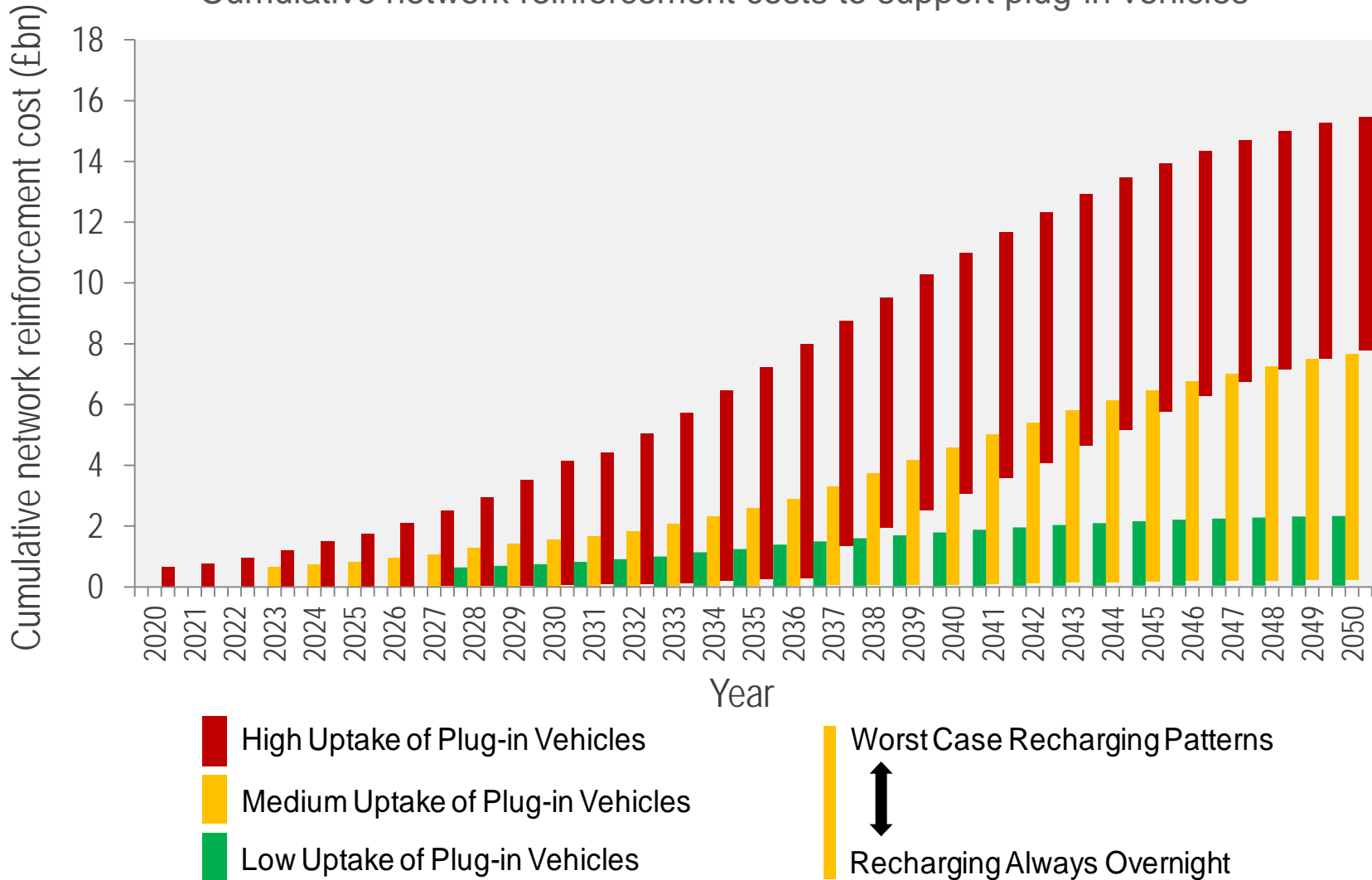
# Vector Flexibility





# Demand Flexibility

## Cumulative network reinforcement costs to support plug-in vehicles







# Concluding Statements

- Create new energy systems, adapt existing ones and integrate them together
- Users define the energy system's evolution, not the other way around
- We need to understand the implications of different scenarios so that we are prepared to evolve



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