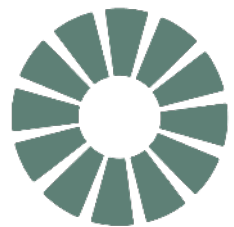




# ZERO CARBON



Centre for Alternative Technology  
Canolfan y Dechnoleg Amgen

**Paul Allen, CAT, UK**

21 September, 2020

# BRITAIN

**RIISING TO THE CLIMATE EMERGENCY**

INFORSE-Europe Webinar Seminar    Transition to 100% Renewable Energy and a Zero Carbon Society

Part of Proceedings of INFORSE-Europe Seminar on 21/9 2020  
Transition to 100% Renewable Energy and a Zero Carbon Society (Examples from UK, France, Denmark):  
<http://www.inforse.org/europe/seminar.htm#INFORSEEuropeSeminar100RE21092020>

# Where we are now –

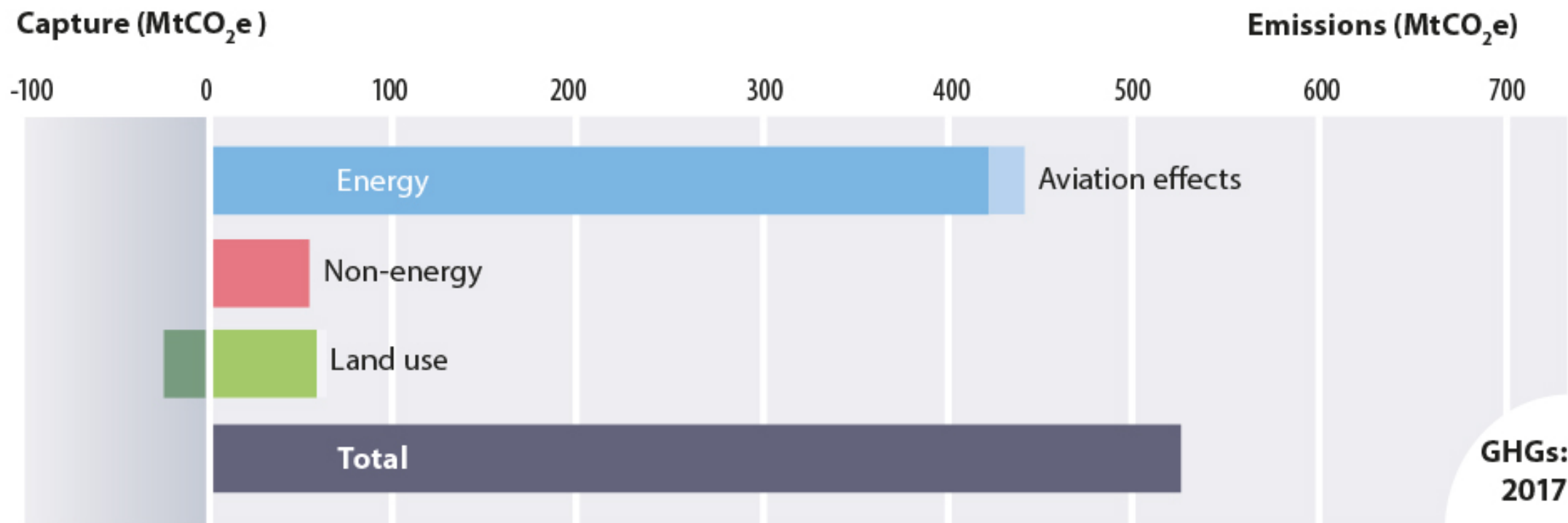


Figure 3.1: UK Greenhouse gas emissions in 2017, including international aviation and shipping, and the enhanced effect of emissions from aviation (BEIS, 2019).

# Power-down & Power-up

Through integrating a smart approach to energy use we can Power-down demand & Power-up 100% clean energy supply for **buildings, transport, energy & land-use** - the UK's greenhouse gas emissions can be rapidly reduced to net zero.



# Power down – how we use energy:

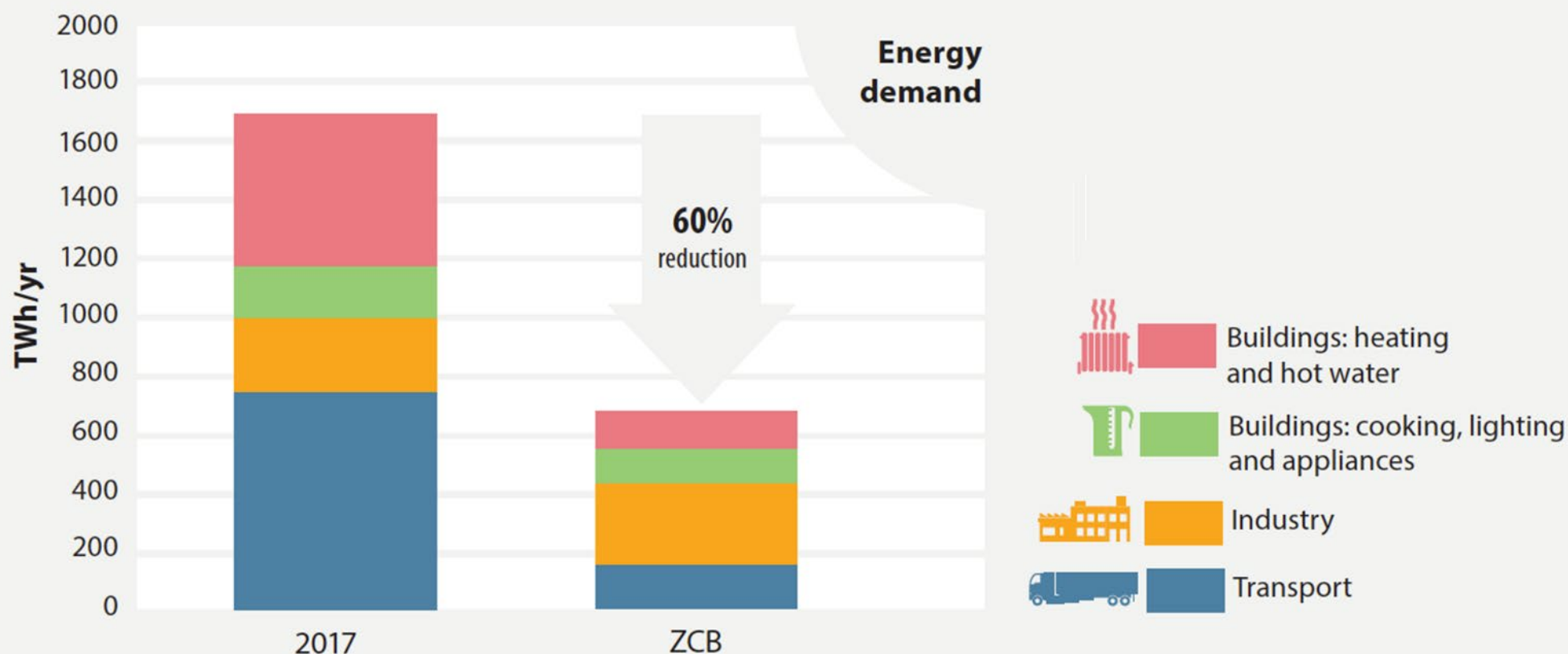


Figure 3.4: Total annual energy demand by sector in the UK in 2017 (BEIS, 2018) and in our scenario.

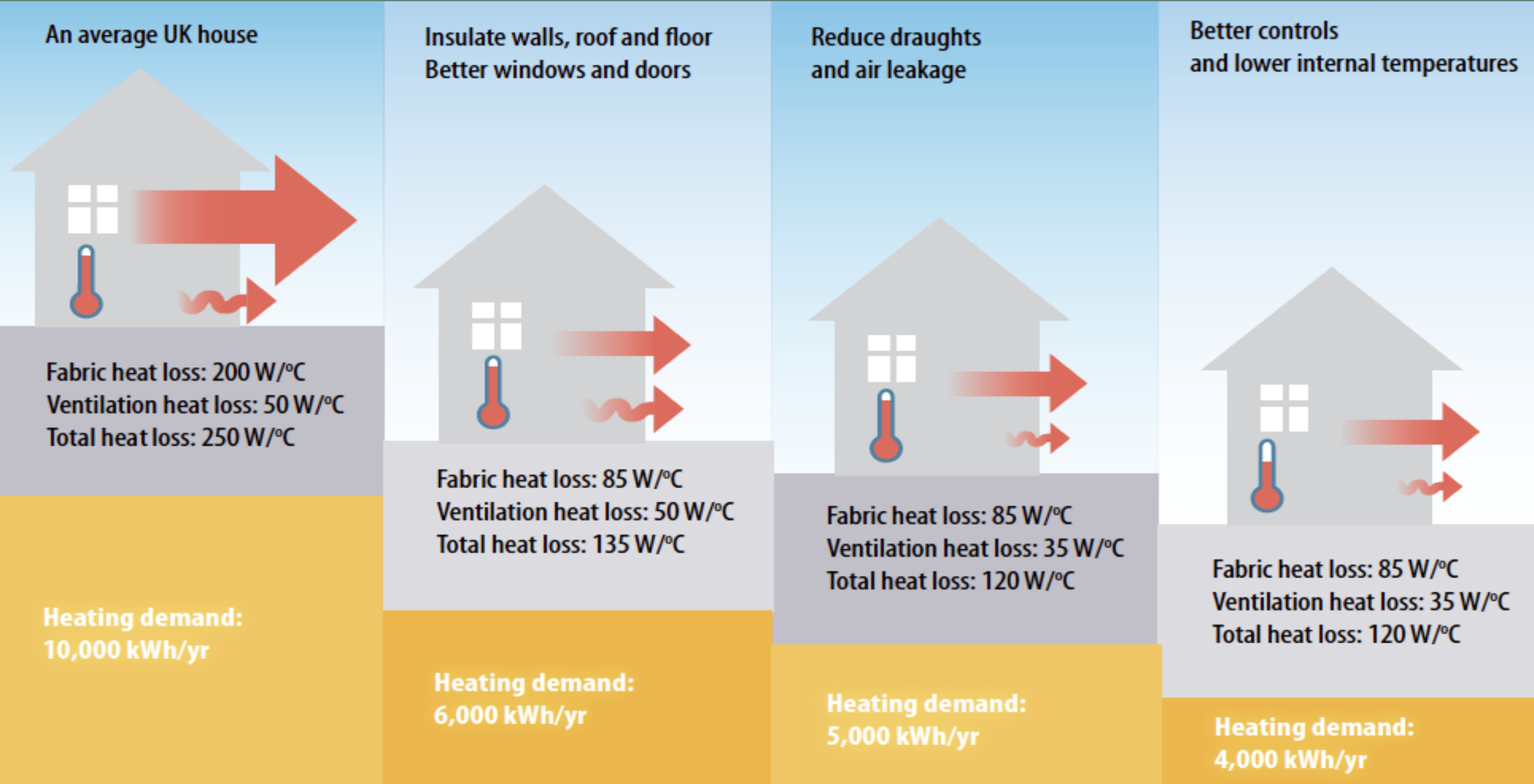
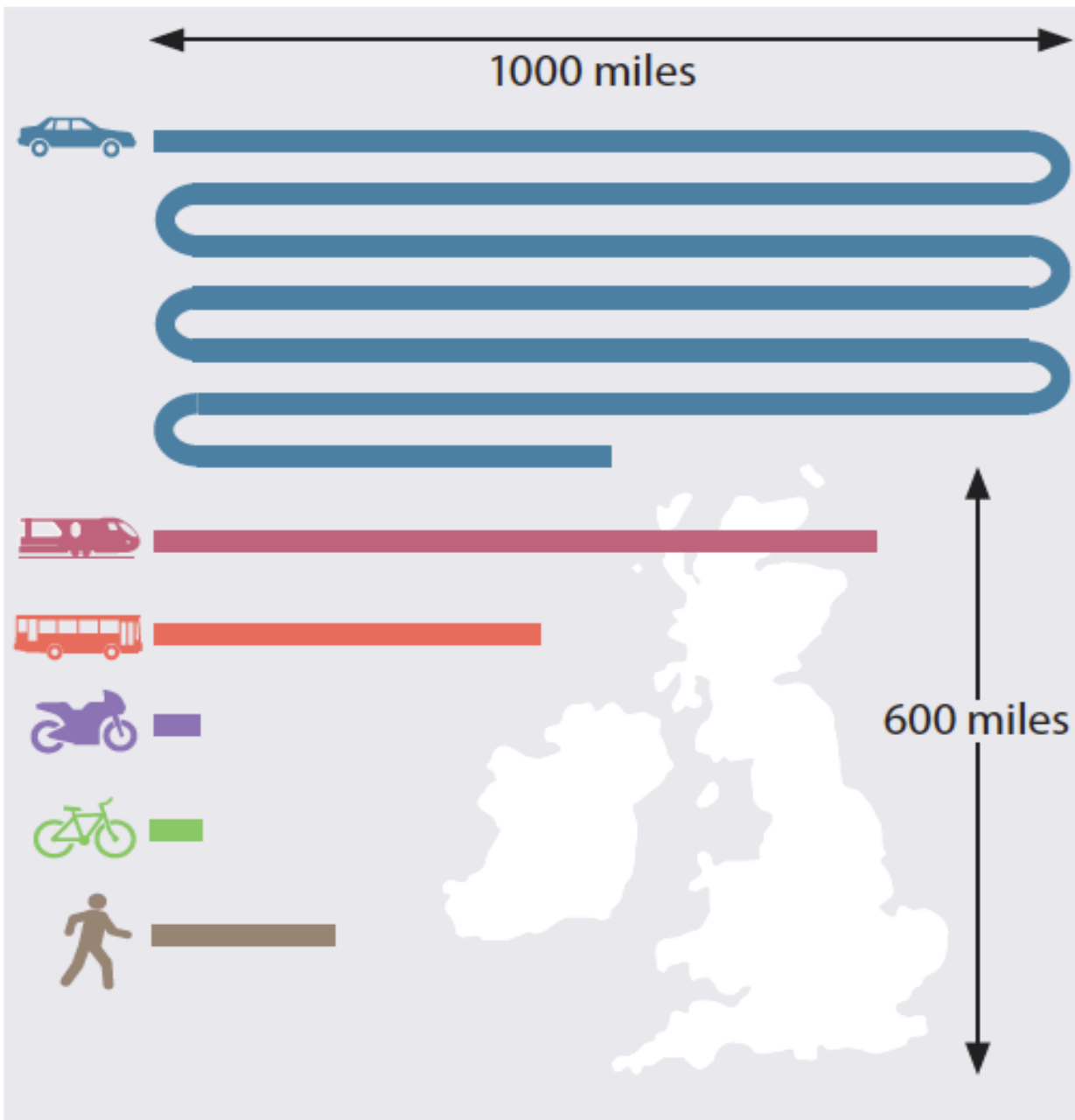


Figure 3.7: measures that reduce building's heat loss and heating demand. [#ZeroCarbonBritain](#)



2017



ZCB

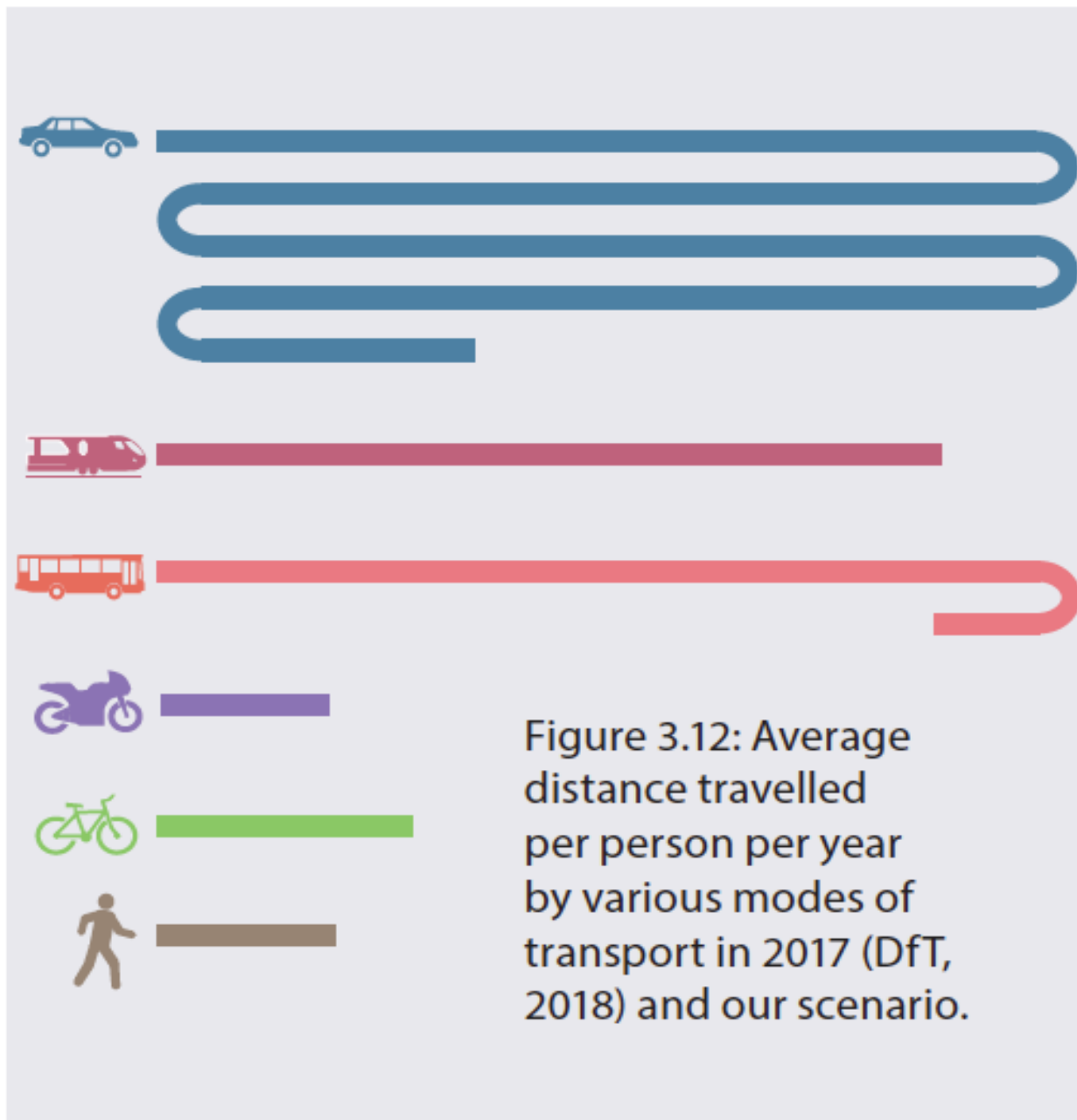


Figure 3.12: Average distance travelled per person per year by various modes of transport in 2017 (DfT, 2018) and our scenario.

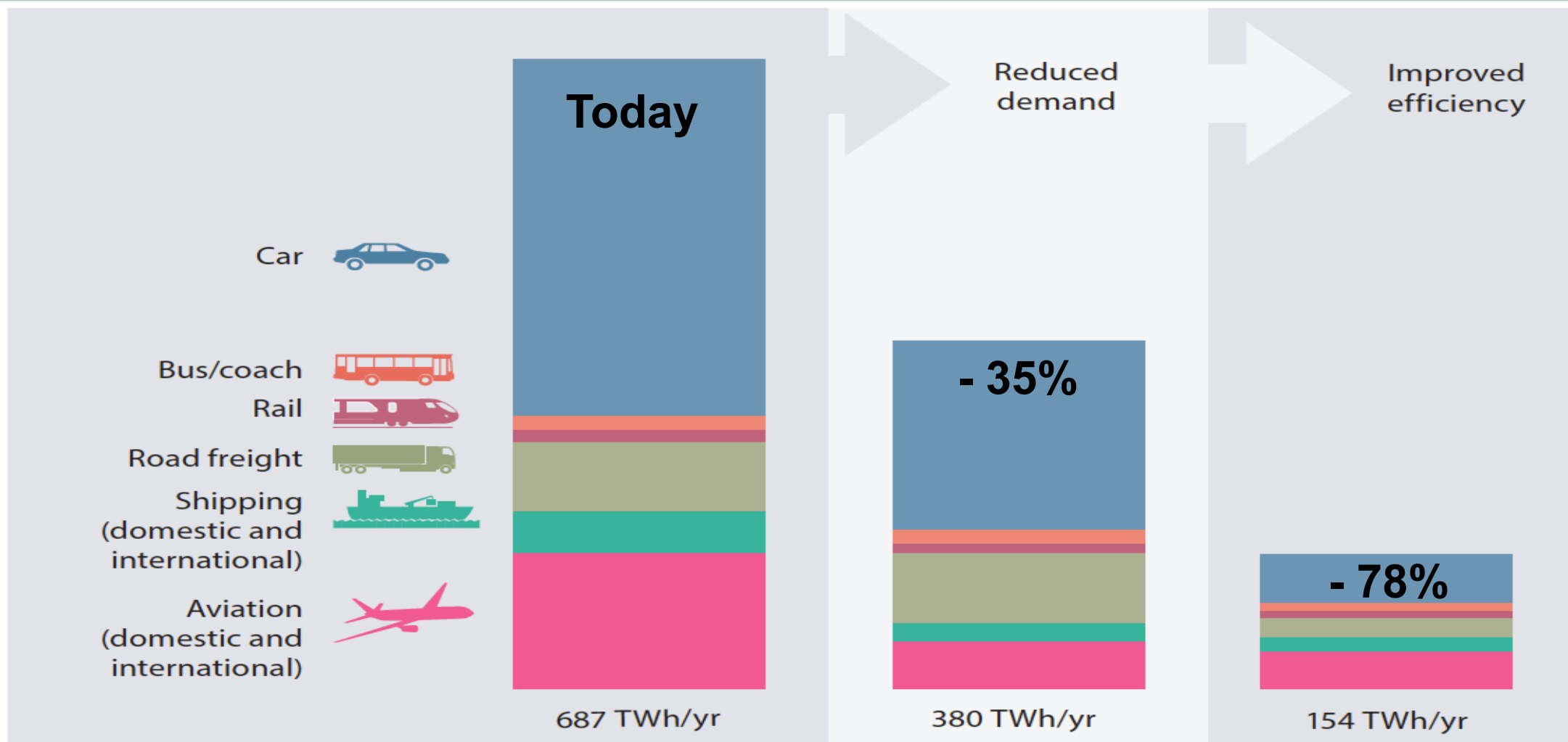


Figure 3.13: Reduction in energy demand for transport in our scenario, shown in two stages: firstly with only the impact of reduced distances travelled and higher occupancy levels; secondly, adding the impact of higher vehicle efficiencies (initial figures from BEIS, 2018; DfT, 2018). [#ZeroCarbonBritain](#)

**Power Up**

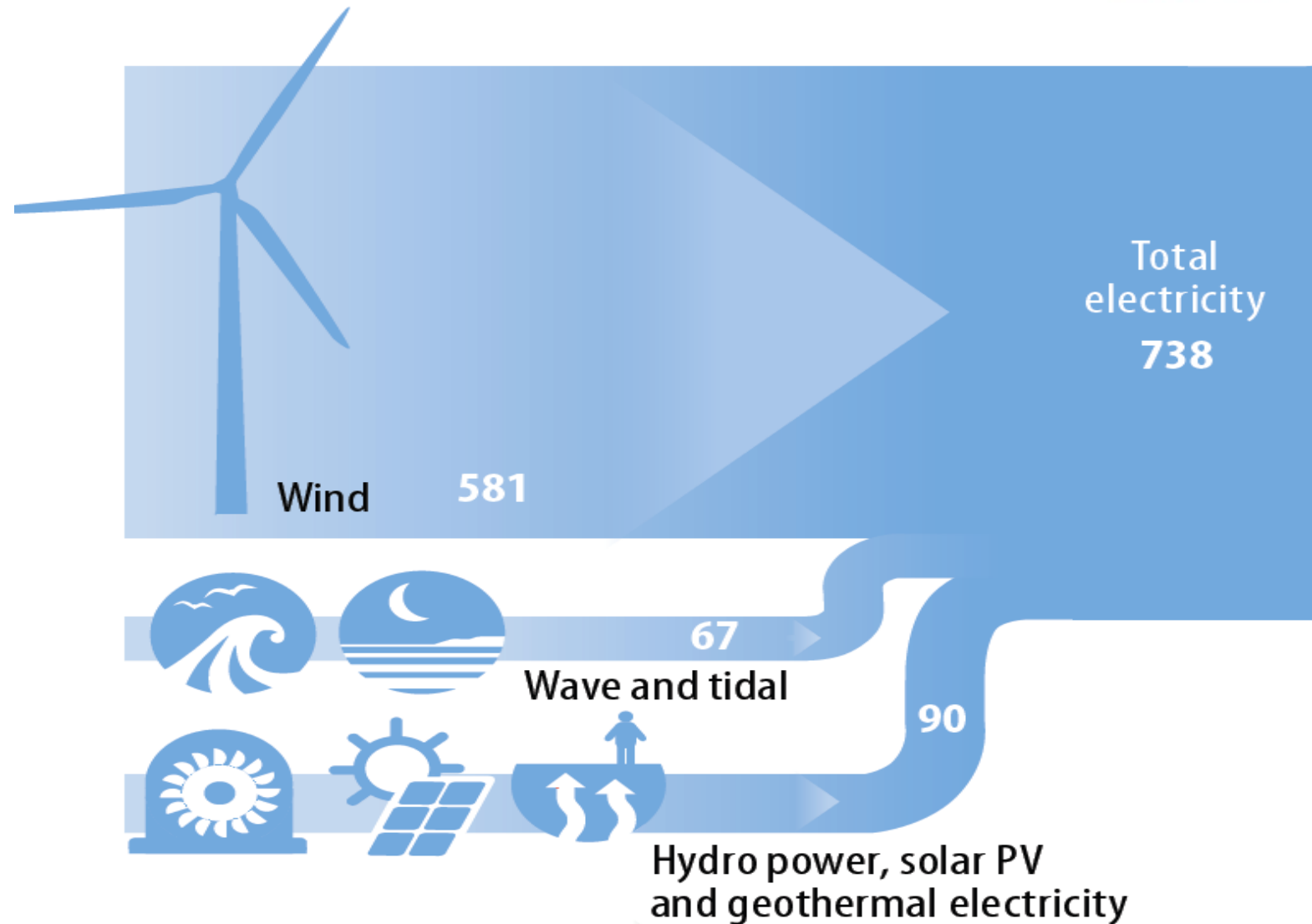






# Powering up Britain with 100% renewables:

Can we  
“keep the lights  
on”?

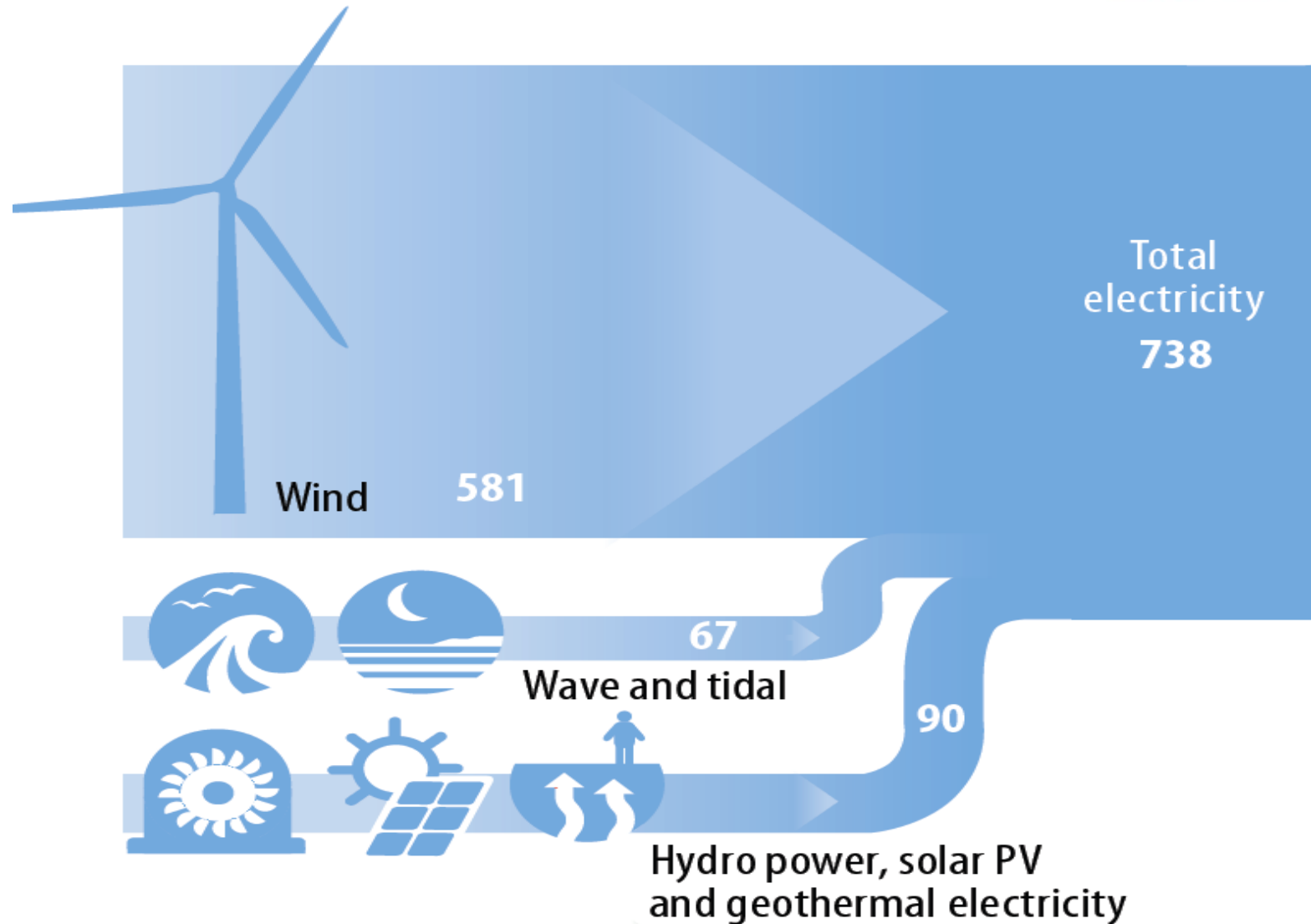


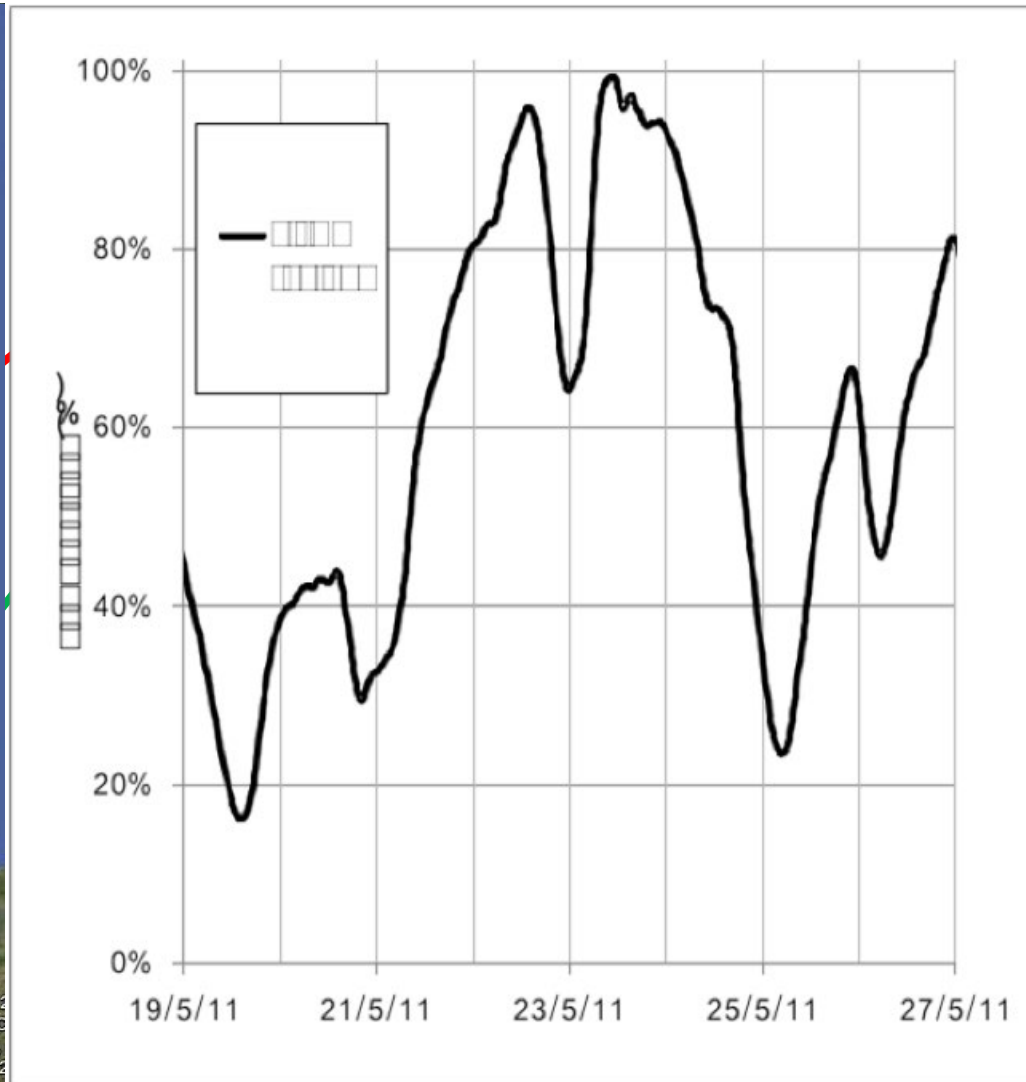
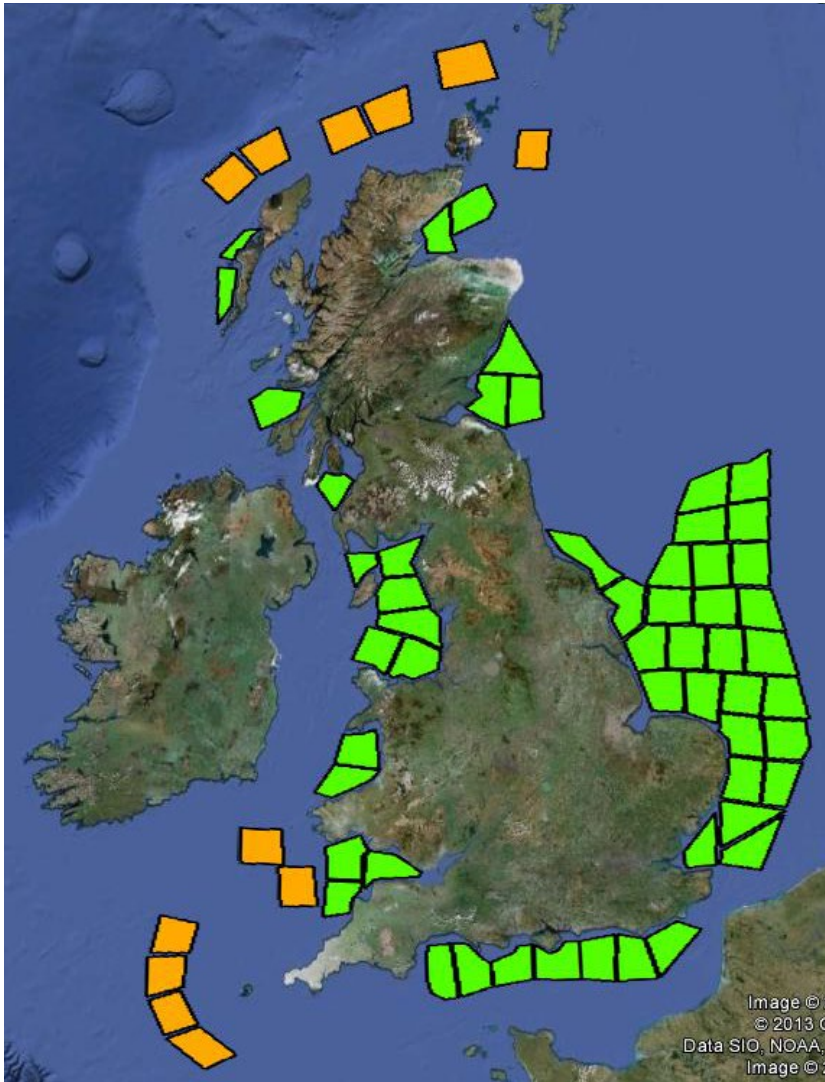


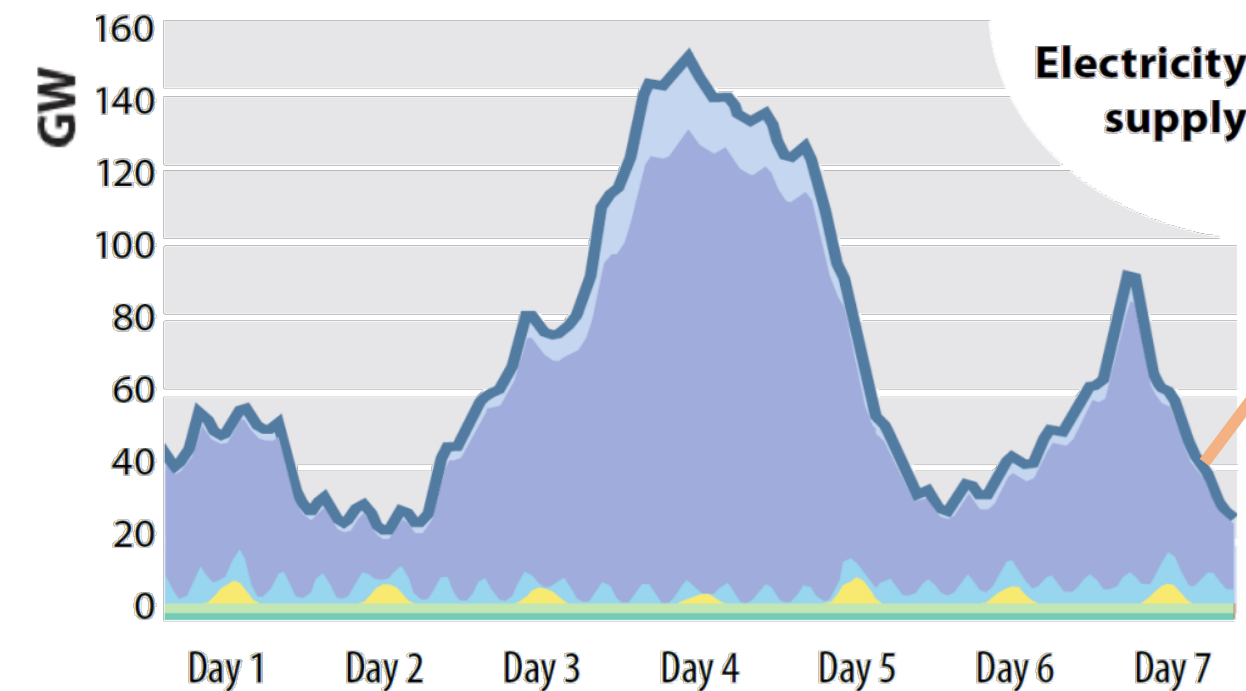
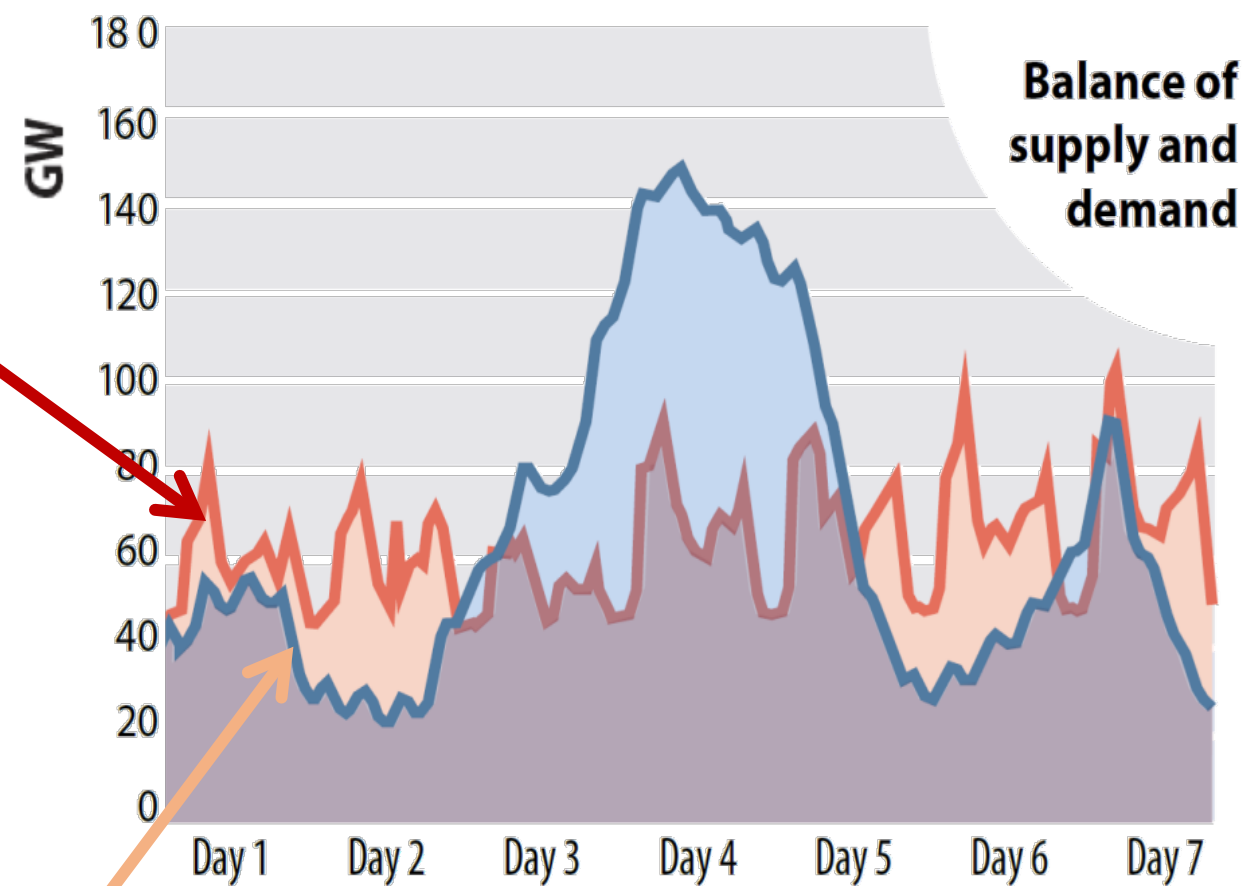
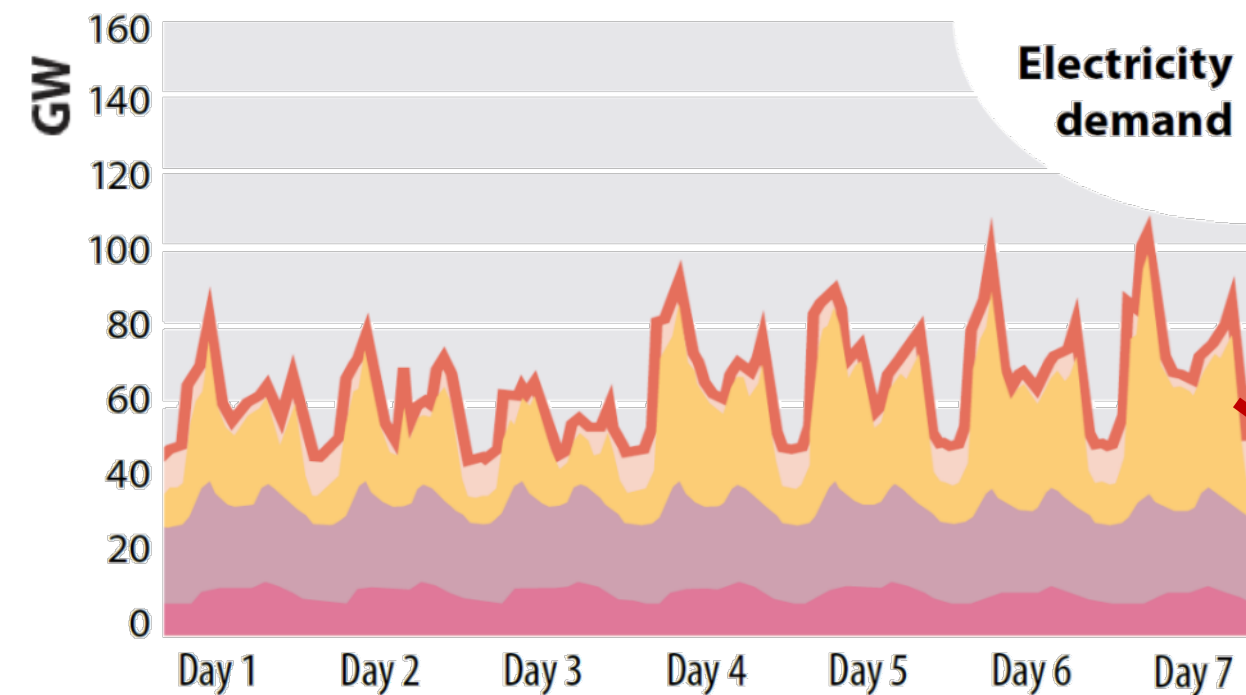
## Yes we can!

The ZCB Energy  
Model is based  
on ten years of  
real-world hourly  
data from  
2002 – 2011

87,648 hours







- Direct match
- Surplus
- Shortfall

# Synthetic gas storage meets demand **100%** of time

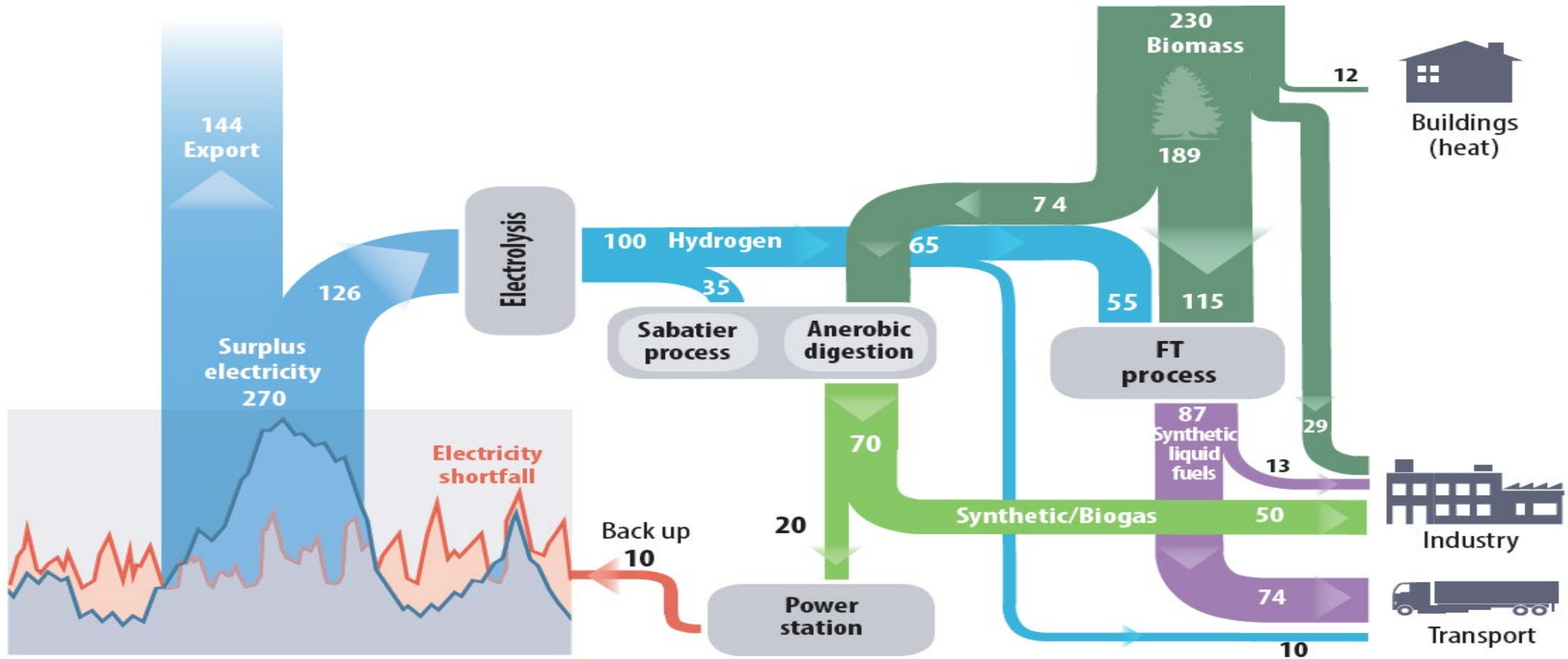
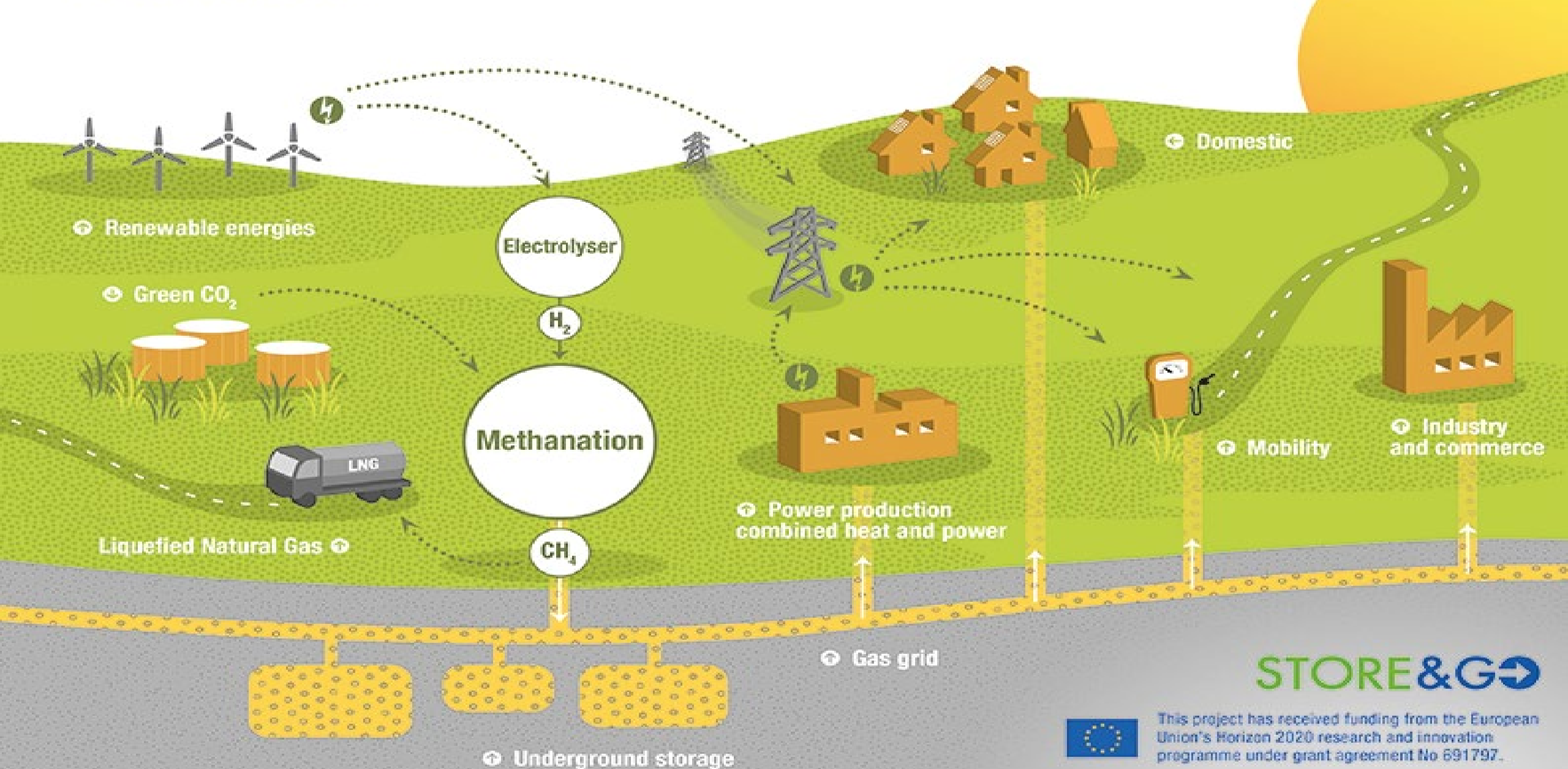


Figure 3.20: From surplus electricity and biomass to synthetic fuels for industry, transport and energy system back up. - Losses are not shown in this figure. [#ZeroCarbonBritain](#)



# STORE&GO



STORE&GO



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691797.

# **Management of supply & demand in a 100% renewable energy system is possible with existing technology**

74% of the time, supply exceeds demand.

26% of the time, supply does not fully meet demand.

Short-term storage & load shifting reduces this to 11%.

Carbon-neutral synthetic gas power stations cover this.

**But this requires re-thinking land-use...**



# Land use today

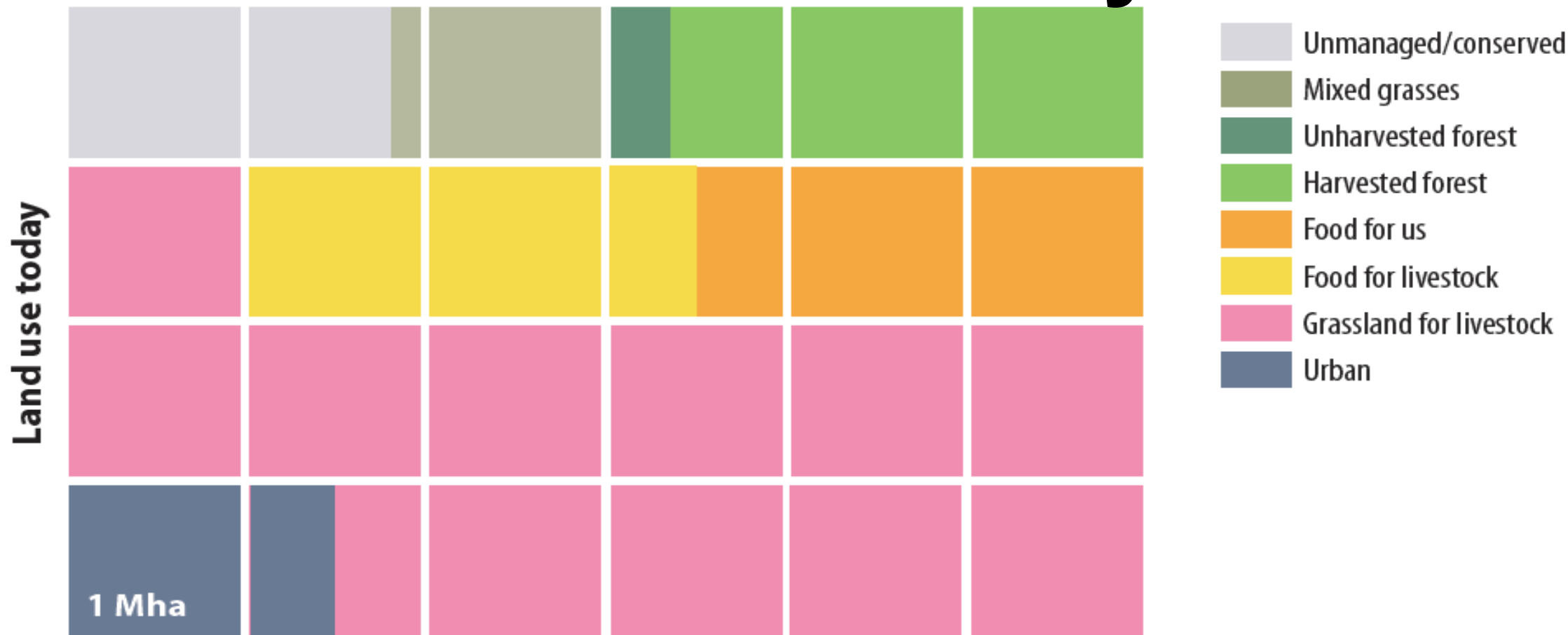
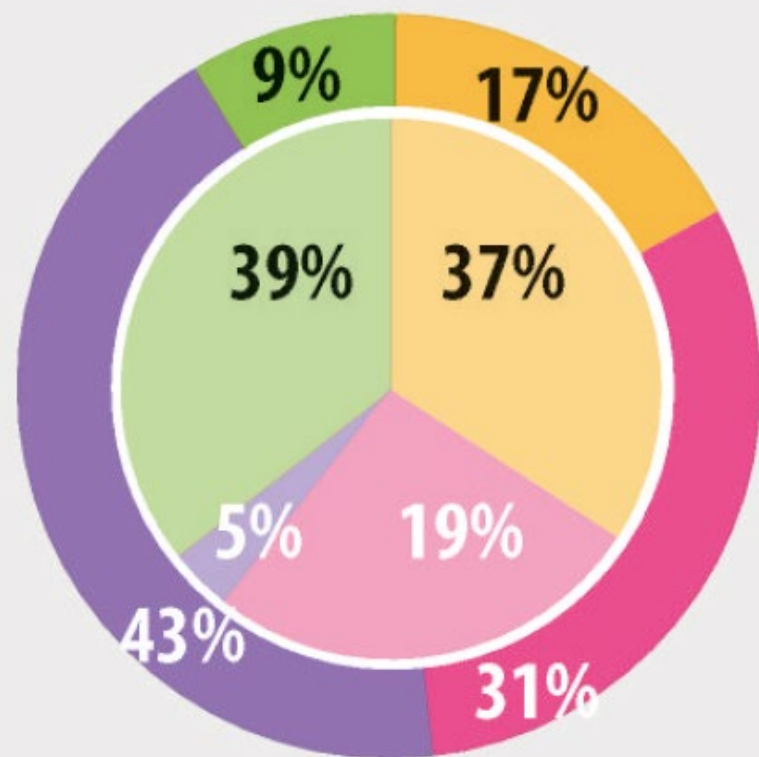


Figure 3.3: Approximate land use today (not including water courses and coastal areas). Based on data from Morton et al. (2008), Forestry Commission (2007), DEFRA (2012), NERC (2008), Bain et al. (2011) and Read et al. (2009).



## Average diet today



## Average diet ZCB

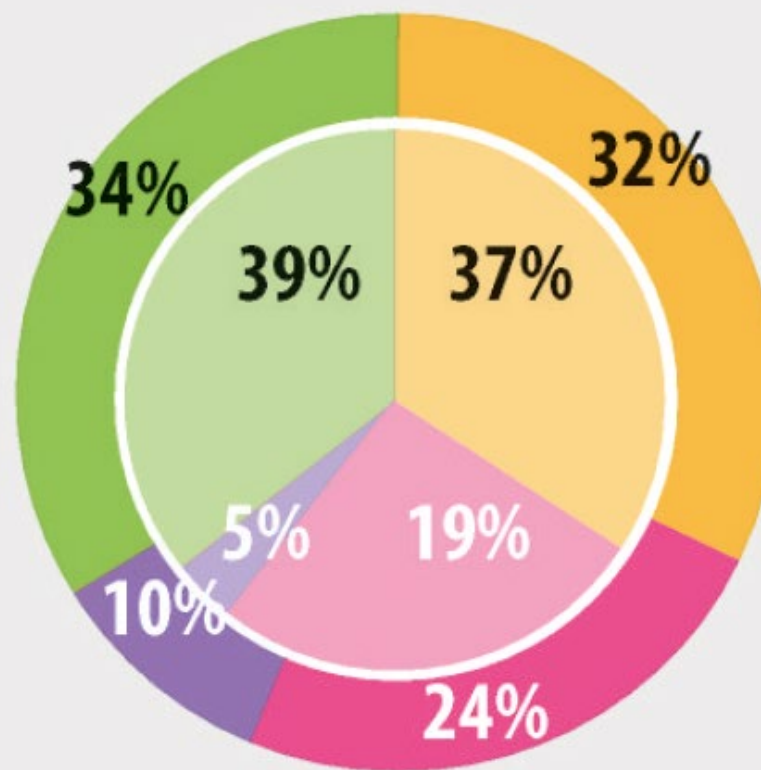


Fig 3.29: Government recommendations for a healthy balanced diet. Both today's average diet and the average diet in our scenario are shown (outside circle) relative to the Eatwell guide recommendations (central circle).



**Switching to a healthier ZCB  
diet can free up lots of land!**



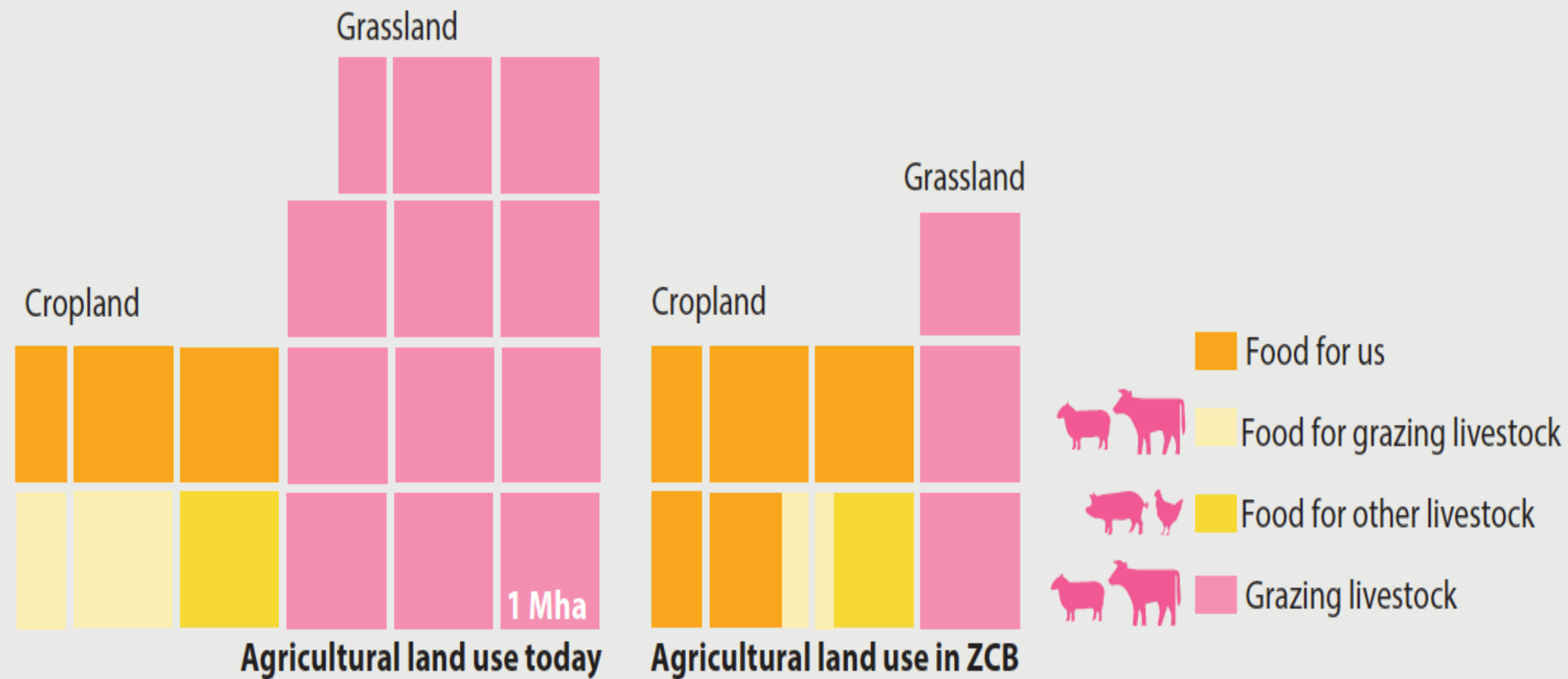
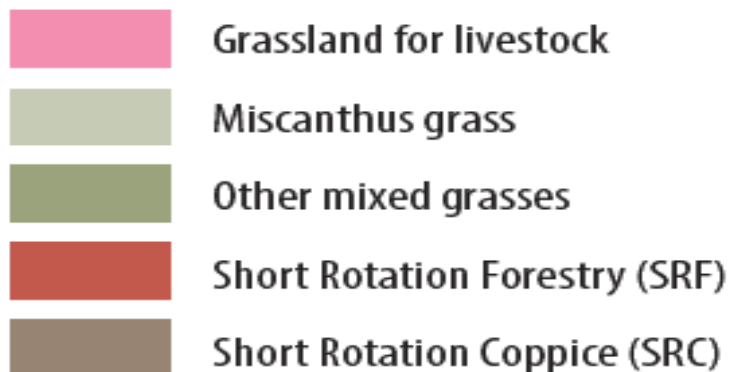
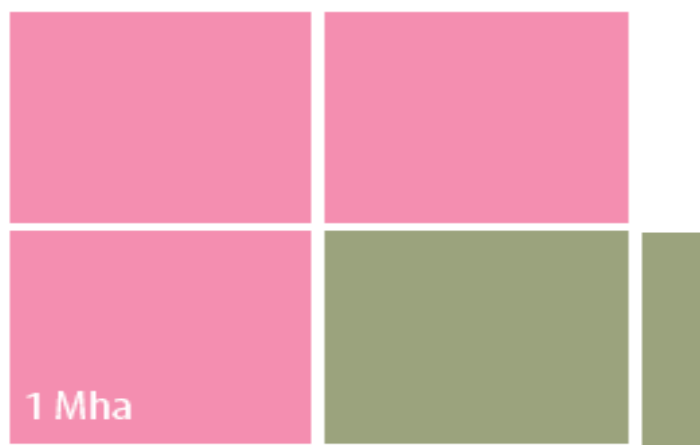


Figure 3.28: The area of cropland and grassland used for agriculture today (DEFRA, 2012) and in our scenario.



# Growing energy and making synthetic fuel

## Land use today



## Land use in ZCB

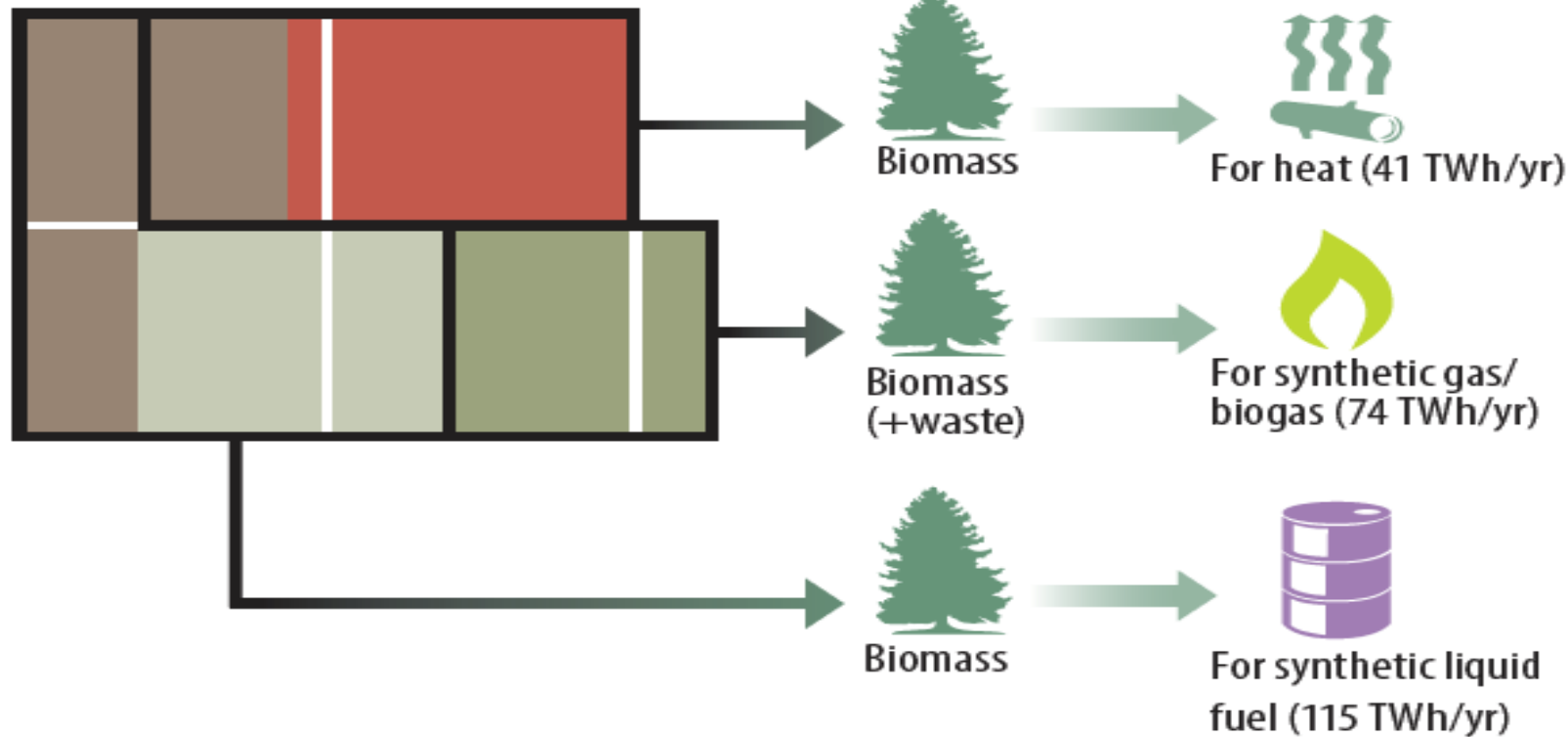


Figure 3.30: Area of land used today (DEFRA, 2012) that is used for energy crops in our scenario, the types of crop grown, and the amount and use of the biomass produced.



# Capturing carbon - ecologically

- Double forest area.
- Increase use of wood products.
- Restore 50% of peatlands.

Balance GHG emissions of

~ 47 MtCO<sub>2</sub>e/year

Grassland for livestock  
Food for livestock  
Mixed grasses (hemp in ZCB)

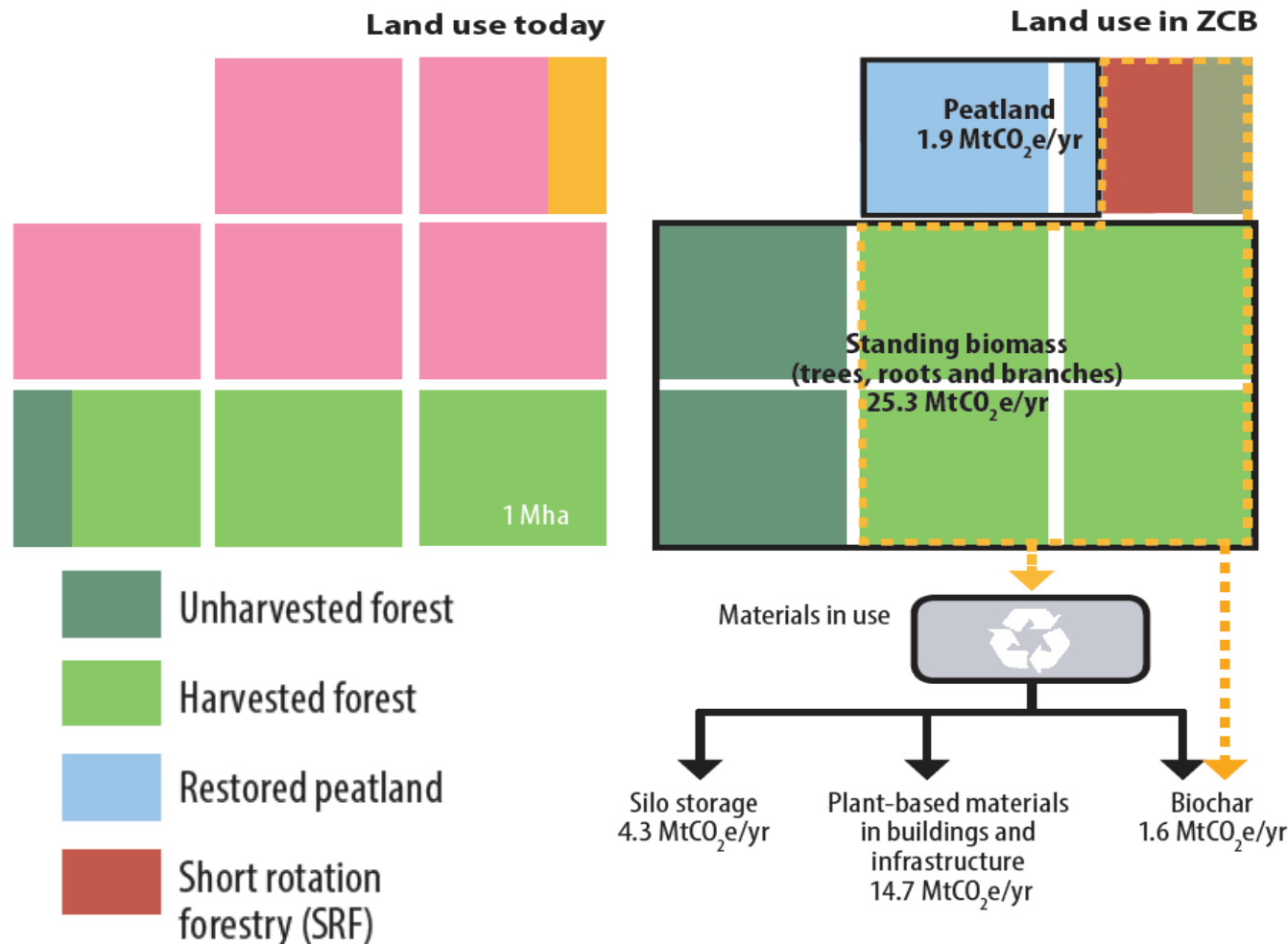


Figure 3.34: Area of land used for capturing carbon in our scenario, the methods, and how much carbon is captured as a result.



# So we can go from this...

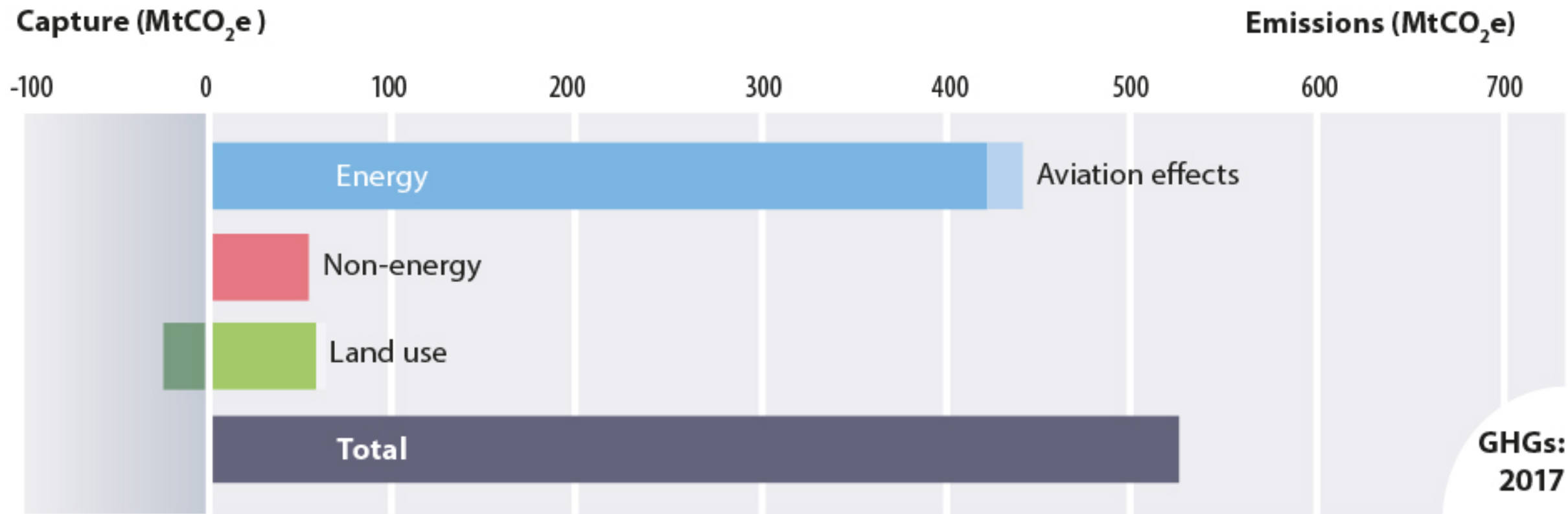


Figure 3.1: UK Greenhouse gas emissions in 2017, including international aviation and shipping, and the enhanced effect of emissions from aviation (BEIS, 2019).



# ... to this - Net zero is achievable!

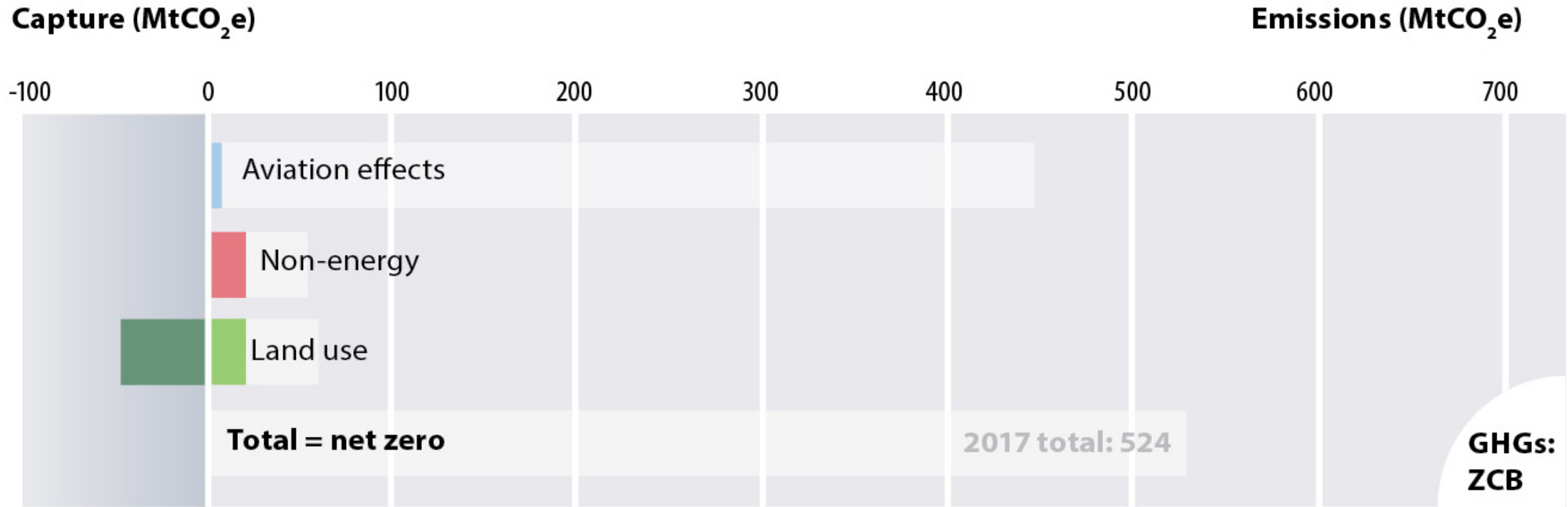


Figure 3.35: Carbon captured and greenhouse gas emissions for the UK in our scenario relative to 2017, including international aviation and shipping and the enhanced effect of emissions from aviation. Total emissions sum to net zero. [#ZeroCarbonBritain](#)



## Multi-solving – maximising the benefits beyond carbon





# **The trick is to identify synergies between changes to reach net zero & those which also:**

*Create jobs & build a sense of purpose*

*Improve our diets, health & wellbeing*

*Increase active mobility / reduce unnecessary travel*

*Enhance space for biodiversity*

*Restore UK soils*

*Reduce fuel poverty*

*Re-boot our economy*

*Increase resilience to climate & other emergencies!*

**Let's open new conversations...**





Declare a Climate Emergency

Go Zero Carbon by 2030

Local Councils

Zero Carbon Britain

Climate Change

Resources

Solutions

Policy

DECLARE A CLIMATE EMERGENCY

Local councils can play a key role in leading the climate emergency response. Write to your Councillor & sign a petition.

UK GOVERNMENT & PARLIAMENT

Click to sign the Petition: Declare a Climate Emergency, end fossil fuel use and build community resilience

RENEWABLE ENERGY

Switch to renewables and take your money out of fossil fuels

Local Council News





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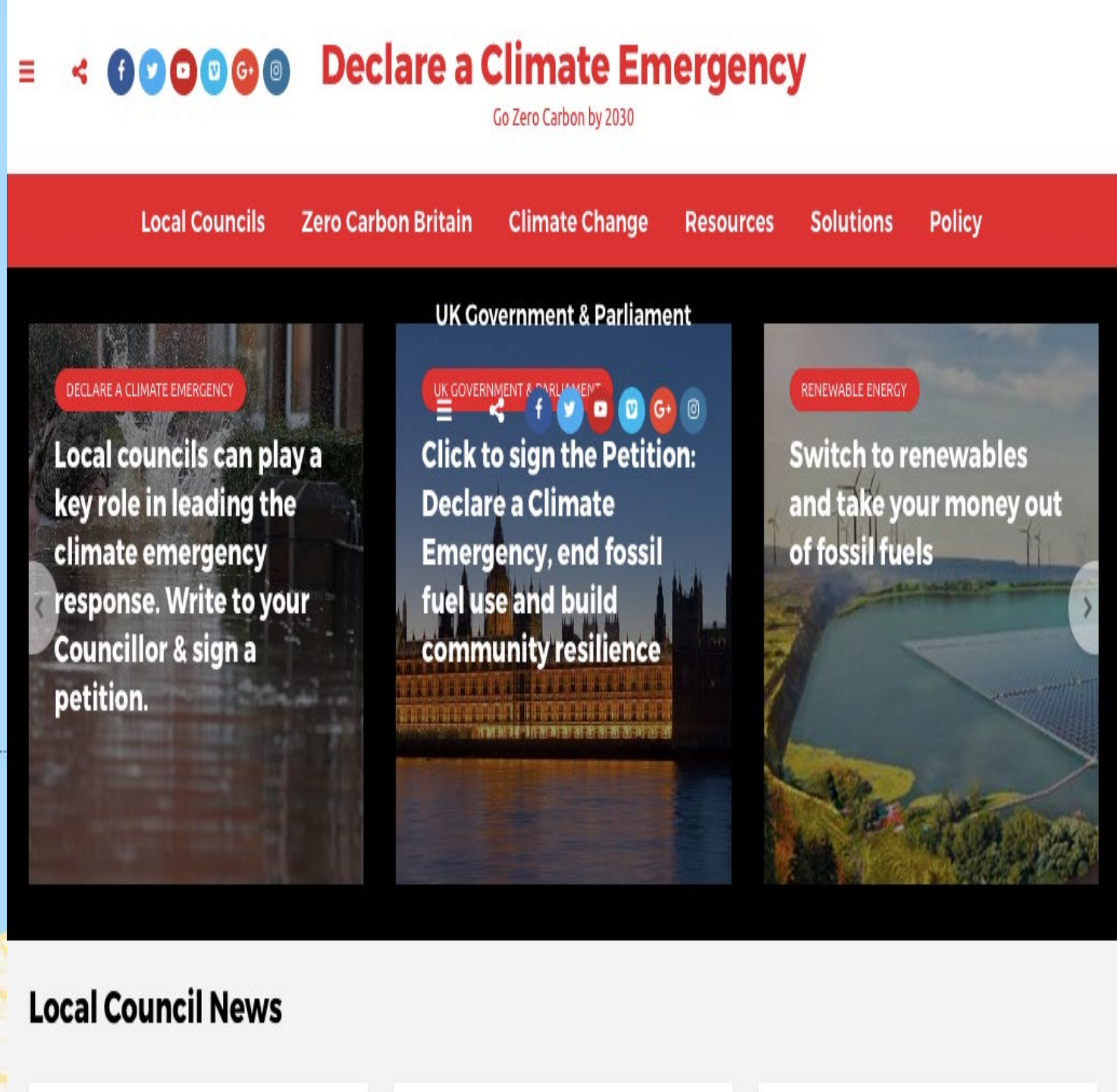
Click to sign the Petition:  
Declare a Climate Emergency, end fossil fuel use and build community resilience

RENEWABLE ENERGY

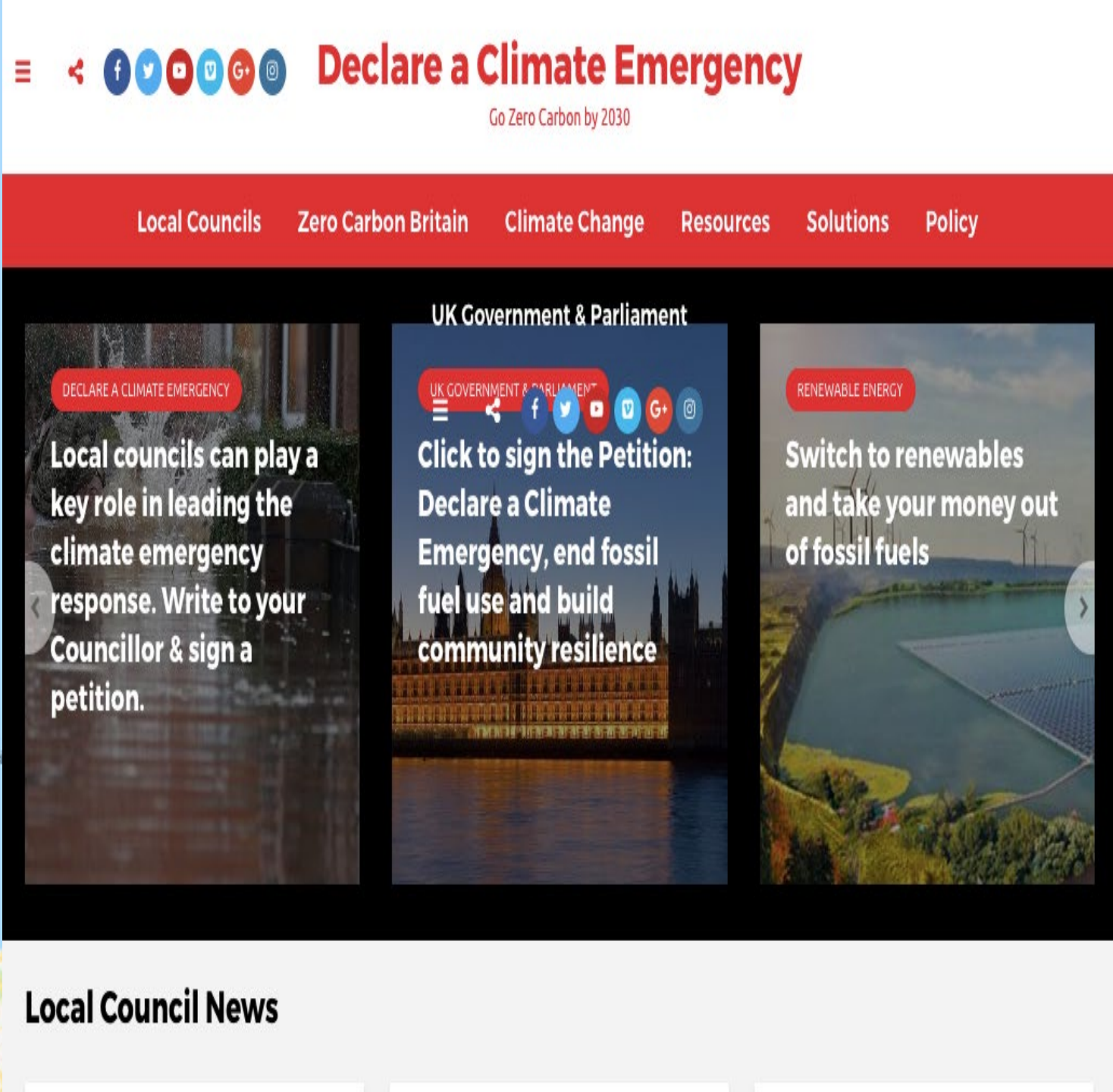
Switch to renewables and take your money out of fossil fuels

## Local Council News















# Zero Carbon Britain Hub and Innovation Lab

CAT's new Zero Carbon Britain Hub and Innovation Lab helps turn climate emergency declarations into action, sharing zero carbon solutions to help build resilience where you live.

We provide local authorities, businesses, institutions and community groups with the confidence, skills and understanding to help achieve net zero greenhouse gas emissions by 2040.

With technical solutions readily available, the momentum coming from towns and cities to get to net zero is the political and cultural challenge of our generation.

The Zero Carbon Britain Innovation Lab tackles the specific barriers to transforming the complex economic, social and political dynamics here in the UK, and beyond. Working with others, we test and prototype solutions, and create routes for a sustainable future for all.



Centre for Alternative Technology  
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- **Zero Carbon Britain reports**
- **Hub and Innovation Lab**
- **Postgraduate degrees**
- **Short courses**
- **Free information service**

**[www.cat.org.uk](http://www.cat.org.uk)**

**Sustainability and Ecology**

**Sustainability and Adaptation**

**Sustainability and Behaviour Change**

**Sustainability and Adaptation Planning**

**Sustainability and Adaptation in the Built Environment**

**Sustainability and Energy Provision and Demand Management**

**Sustainable Food and Natural Resources**

**Green Building**

**MArch Sustainable Architecture**

