



# **Zero Carbon Frome**

## **How we can get to Zero!**

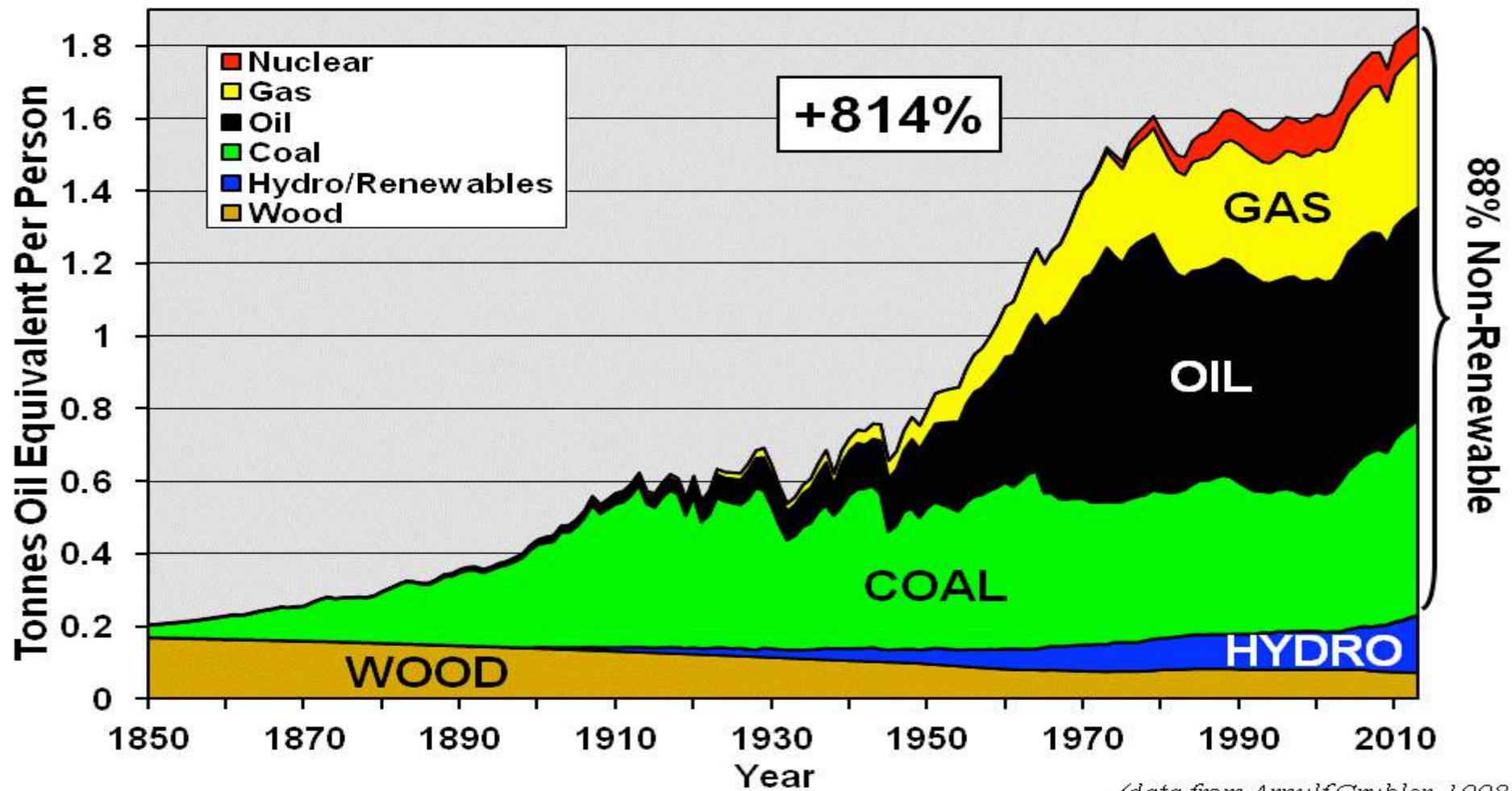


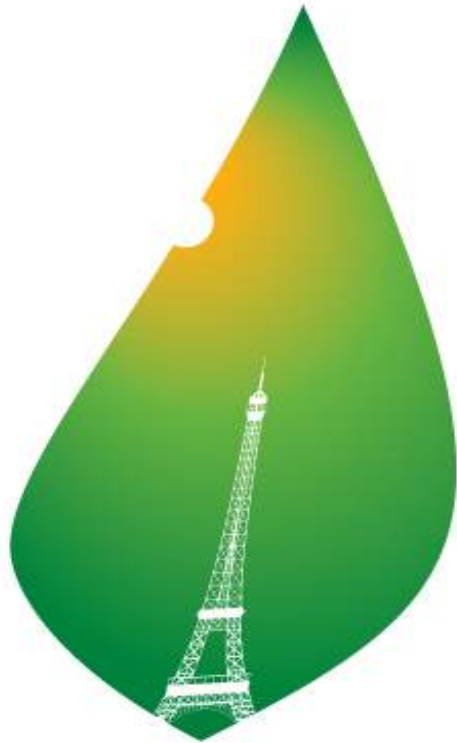
Centre for Alternative Technology  
Canolfan y Dechnoleg Amgen

# Where we are now? - Normality



## World Per Capita Annual Primary Energy Consumption by Fuel 1850-2013

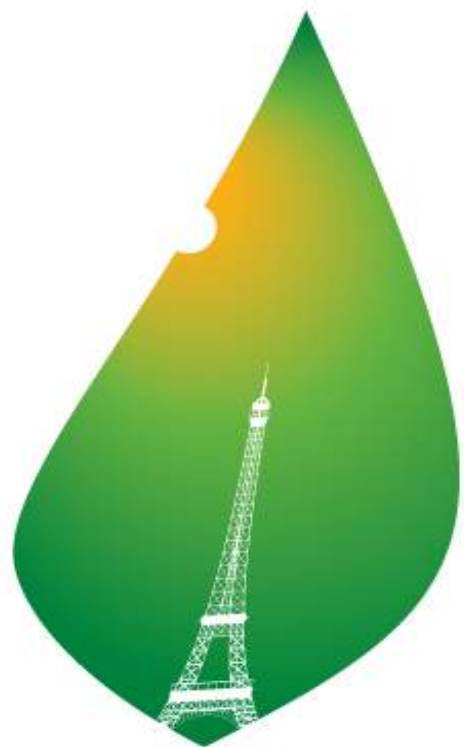




**PARIS2015**  
UN CLIMATE CHANGE CONFERENCE  
**COP21·CMP11**



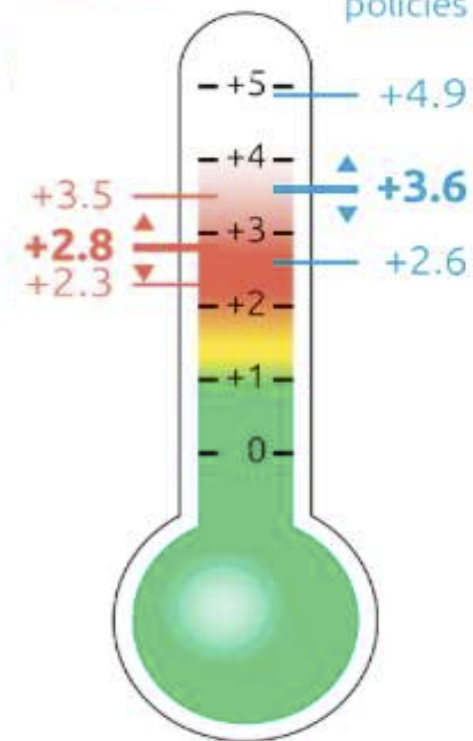
*"well below 2C above pre-industrial levels and to pursue efforts to limit temperature increase to 1.5C".*



**PARIS2015**  
UN CLIMATE CHANGE CONFERENCE  
**COP21·CMP11**

# CLIMATE ACTION TRACKER

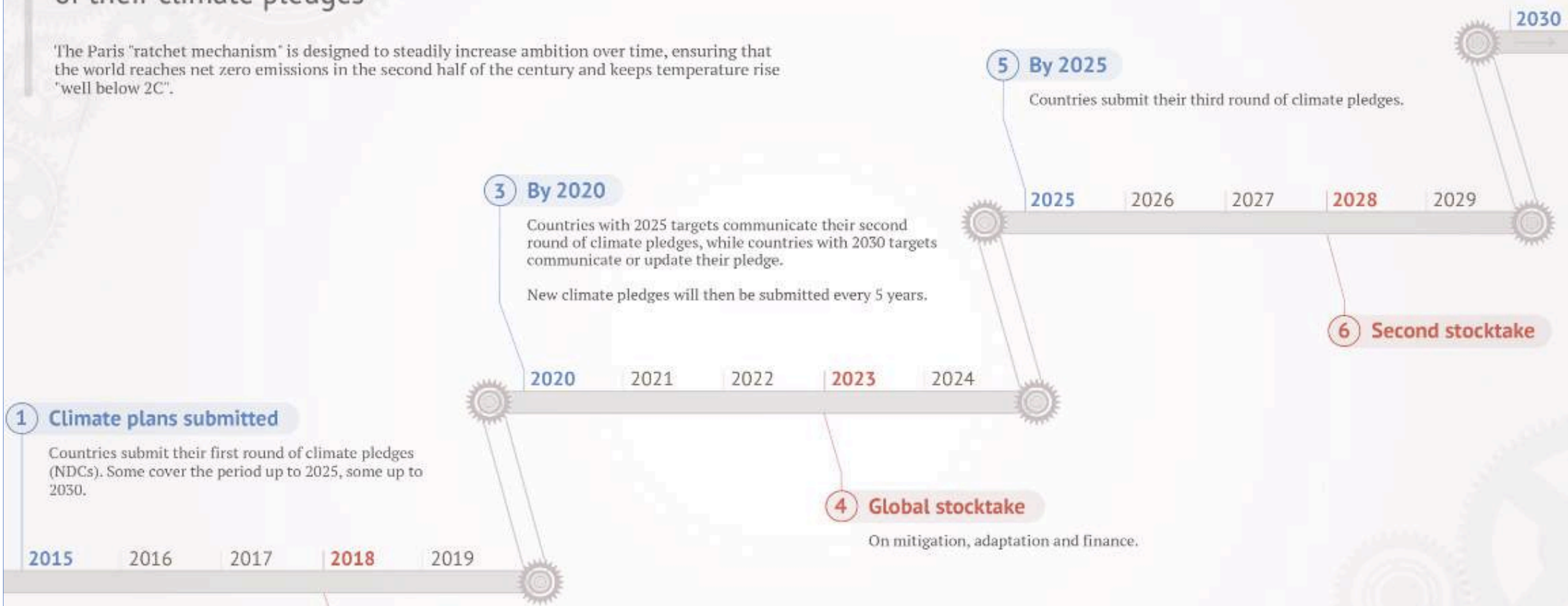
Pledges °C Current policies



Thermometer shows the global-mean temperature increase above pre-industrial by 2100, with an uncertainty range originating from carbon-cycle and climate modelling

# Timeline: How countries plan to raise the ambition of their climate pledges

The Paris "ratchet mechanism" is designed to steadily increase ambition over time, ensuring that the world reaches net zero emissions in the second half of the century and keeps temperature rise "well below 2C".





United Nations  
Climate Change

[Home](#) [Presidencies' Corner](#) [Talanoa Dialogue](#) [Inputs](#) [More](#)

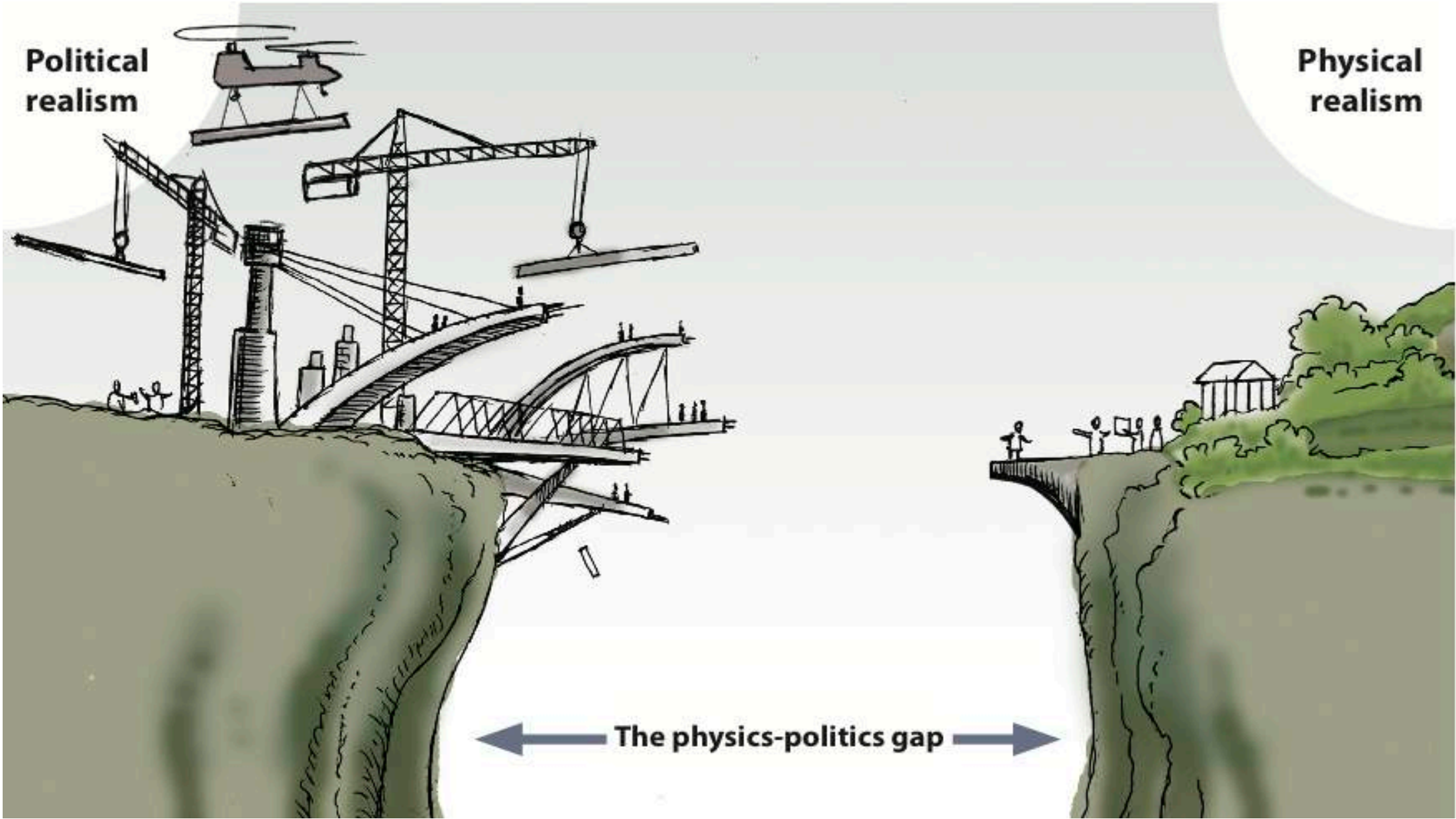
# Welcome to the Talanoa Dialogue Portal

#Talanoa4Am



**Political  
realism**

**Physical  
realism**

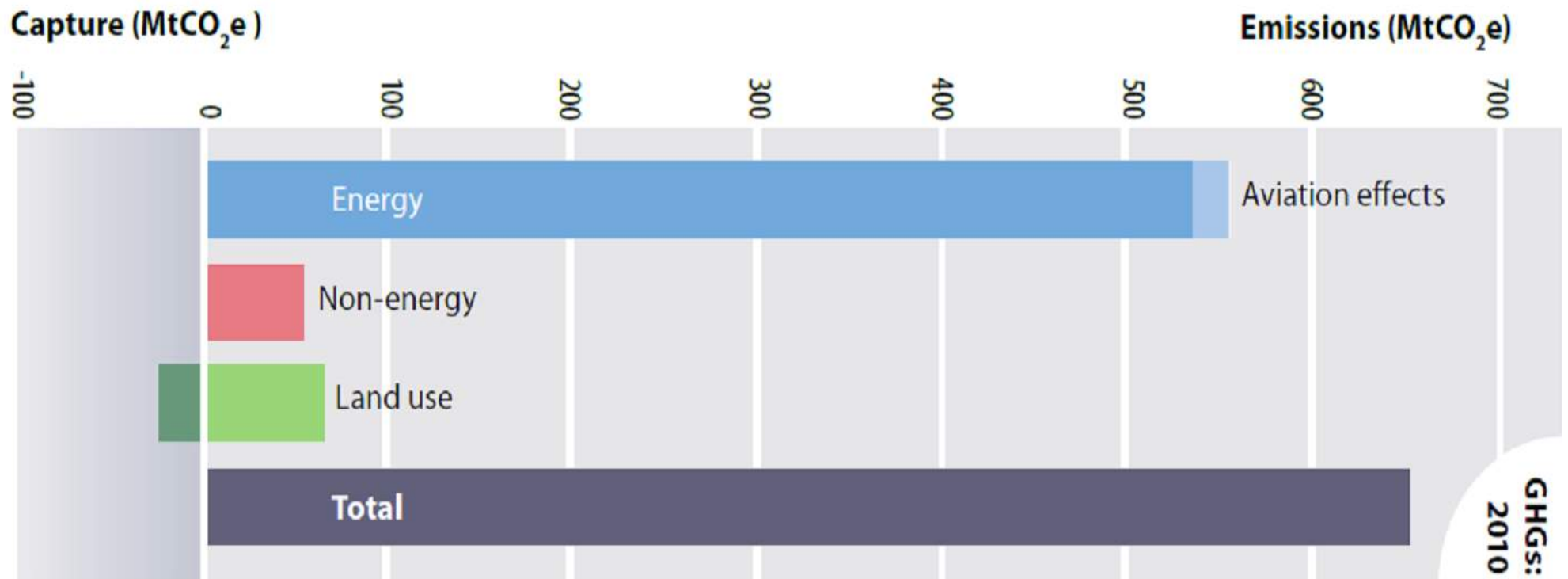




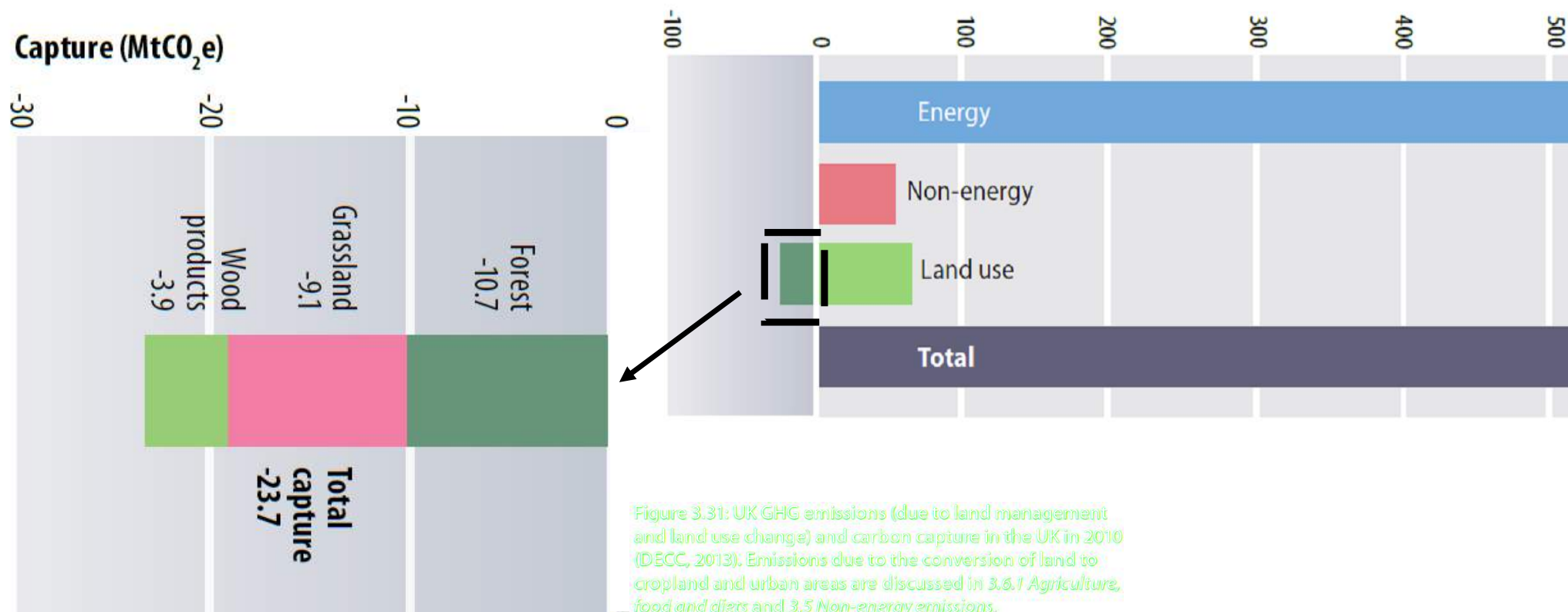
IF WE CAN'T IMAGINE  
A POSITIVE FUTURE  
WON'T CREATE IT



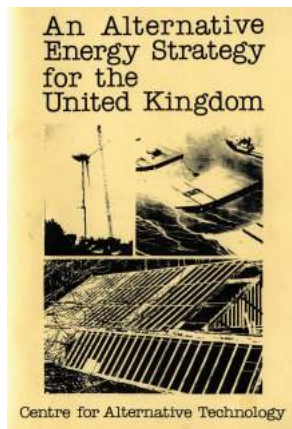
# Where we are now



# UK Carbon capture today



# Where do we need to be – delivering the Paris Agreement



1977



2010



**Rethinking  
the Future**

**zerocarbonbritain**  
an alternative energy strategy

In collaboration with:

**publicinterestresearchcentre**

2007



2014

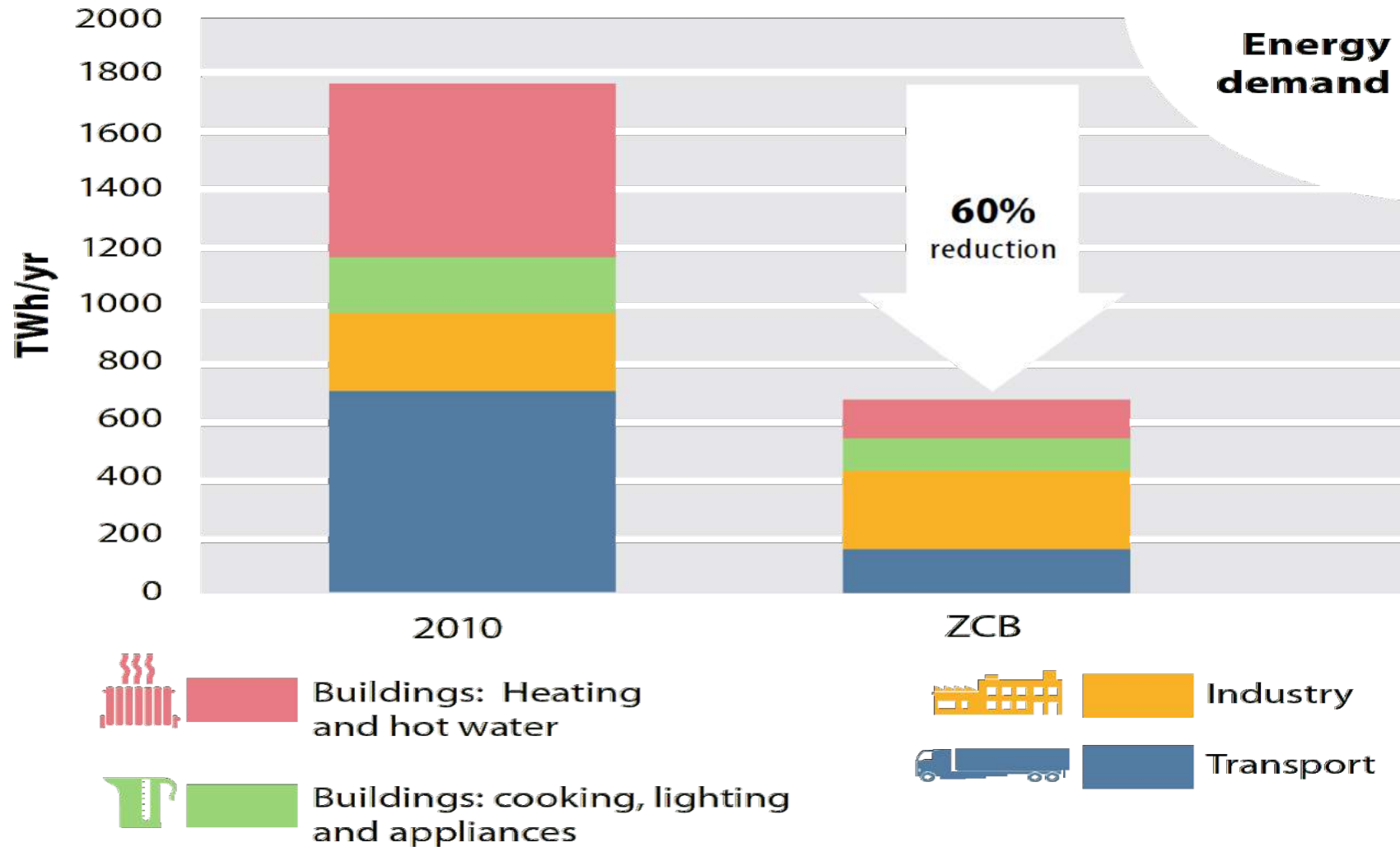
# Power-down & Power-up

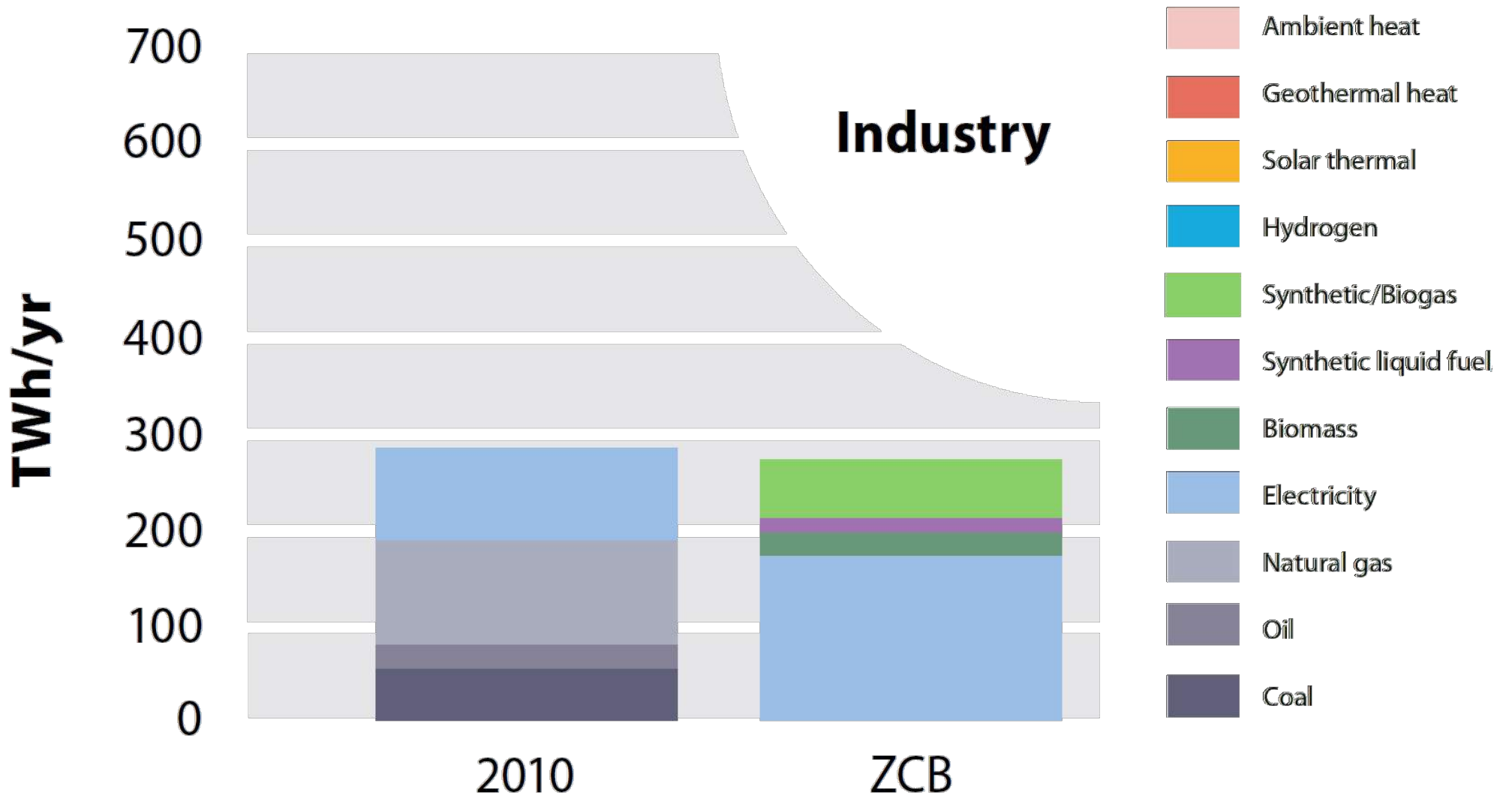
Through integrating a smart approach to food, diet, buildings, transport, energy & land-use, the UK's greenhouse gas emissions can be reduced to net zero

- without relying on future technology
- without major impacts on quality of life
- whilst also considering 'adaptation'

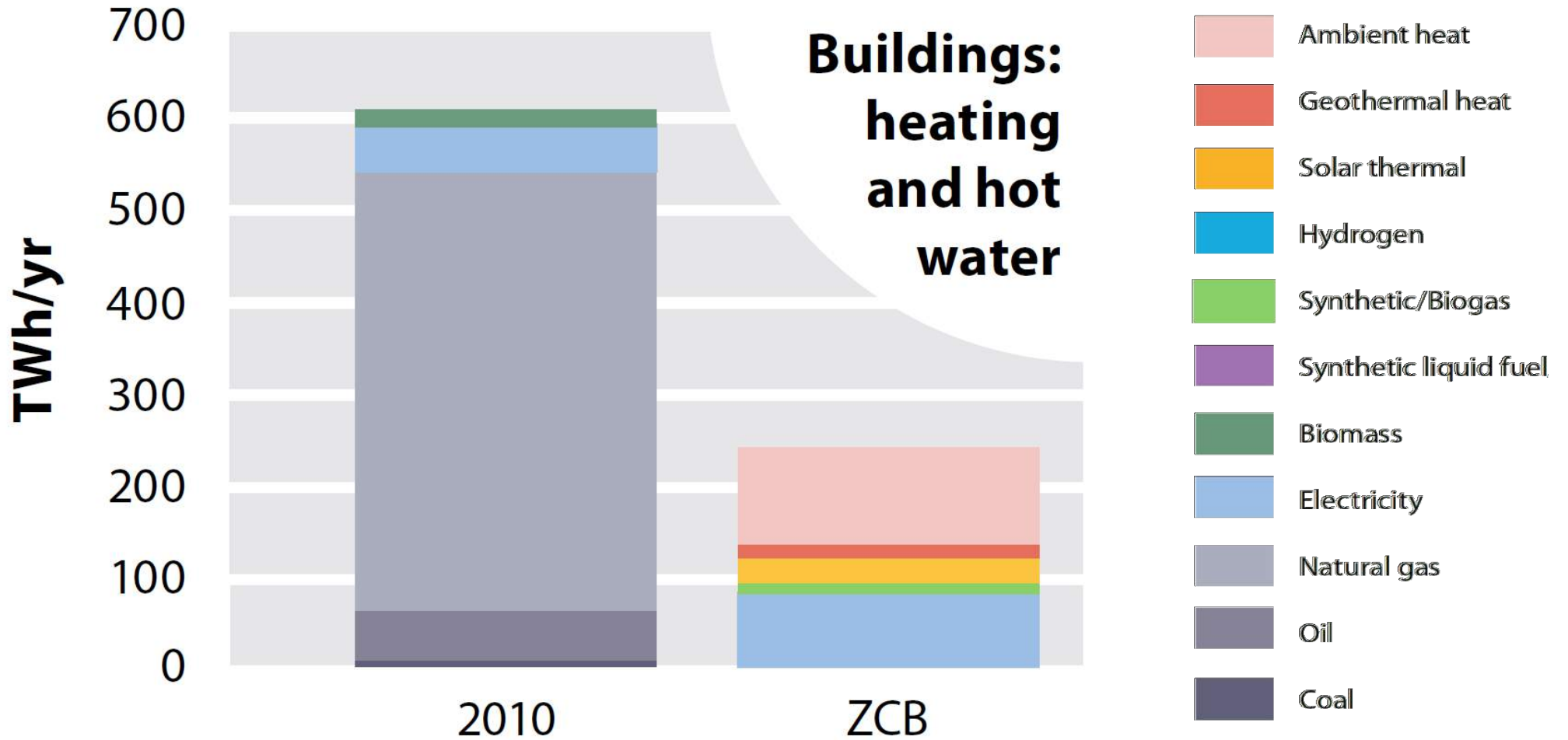


# Power down from extreme energy normality:



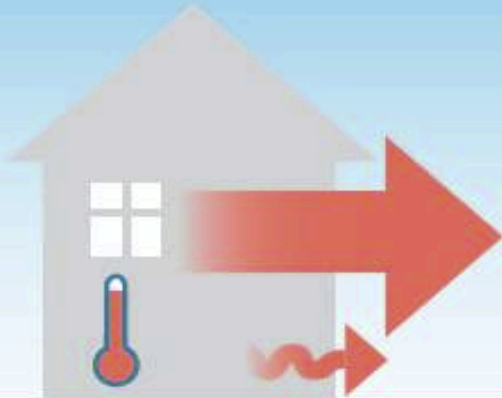


# Buildings: heating and hot water





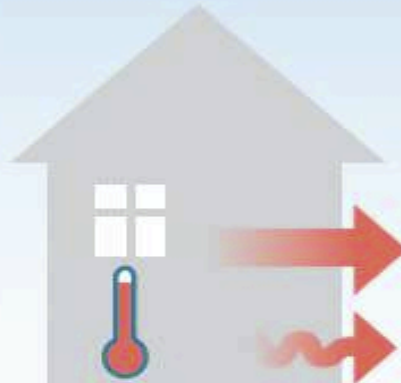
An average UK house



Fabric heat loss: 200 W/°C  
Ventilation heat loss: 50 W/°C  
Total heat loss: 250 W/°C

Heating demand:  
10,000 kWh/yr

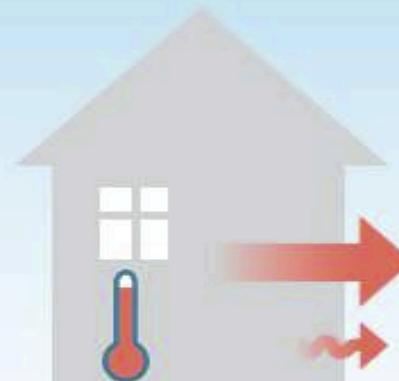
Insulate walls, roof and floor  
Better windows and doors



Fabric heat loss: 85 W/°C  
Ventilation heat loss: 50 W/°C  
Total heat loss: 135 W/°C

Heating demand:  
6,000 kWh/yr

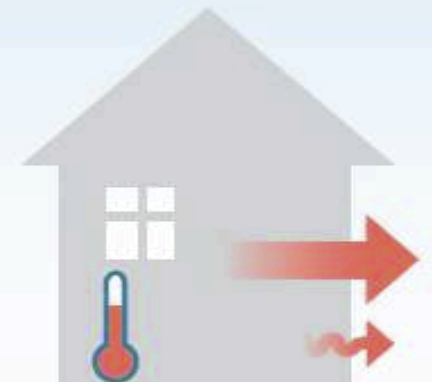
Reduce draughts  
and air leakage



Fabric heat loss: 85 W/°C  
Ventilation heat loss: 35 W/°C  
Total heat loss: 120 W/°C

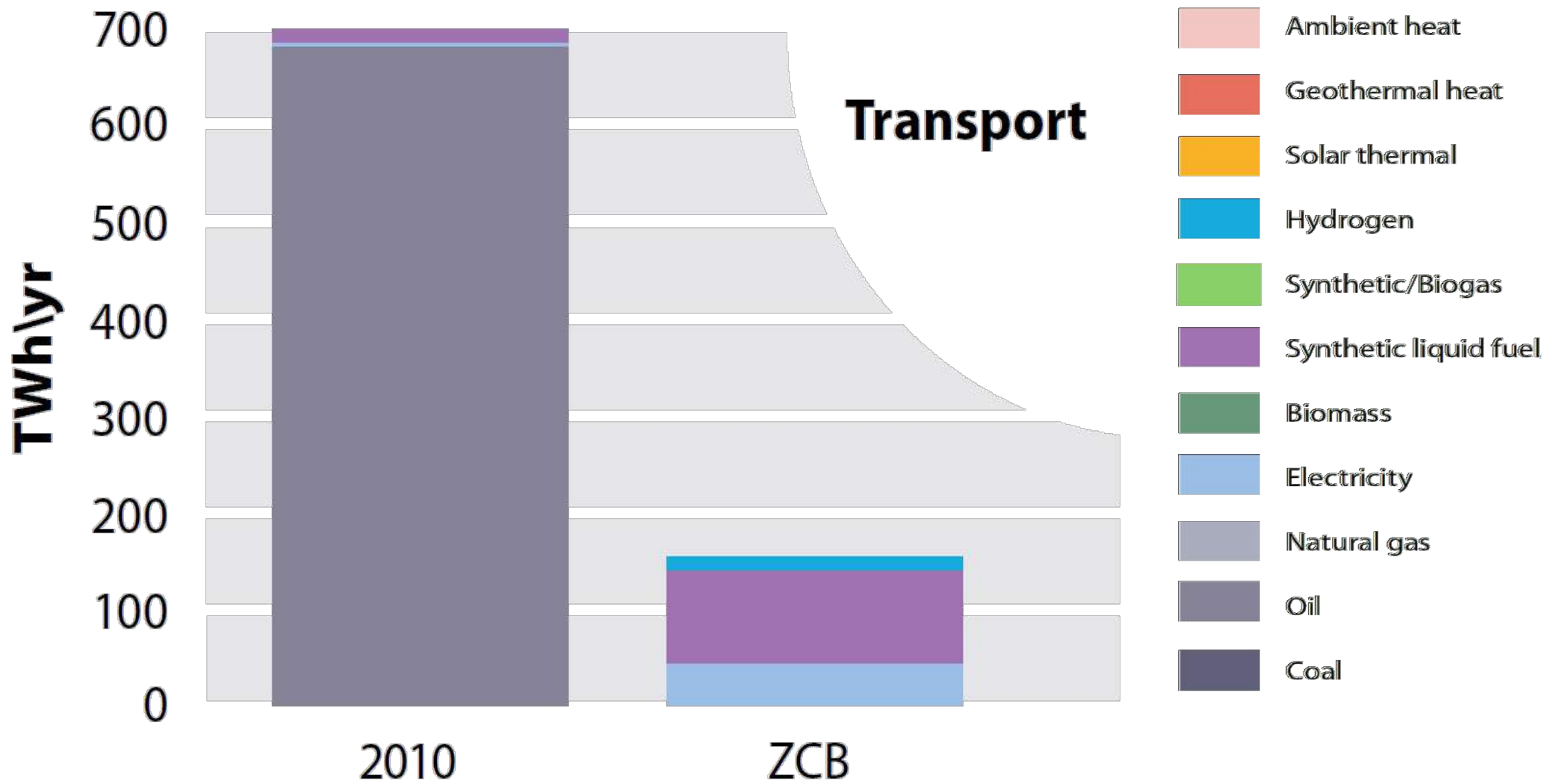
Heating demand:  
5,000 kWh/yr

Better controls  
and lower internal temperatures

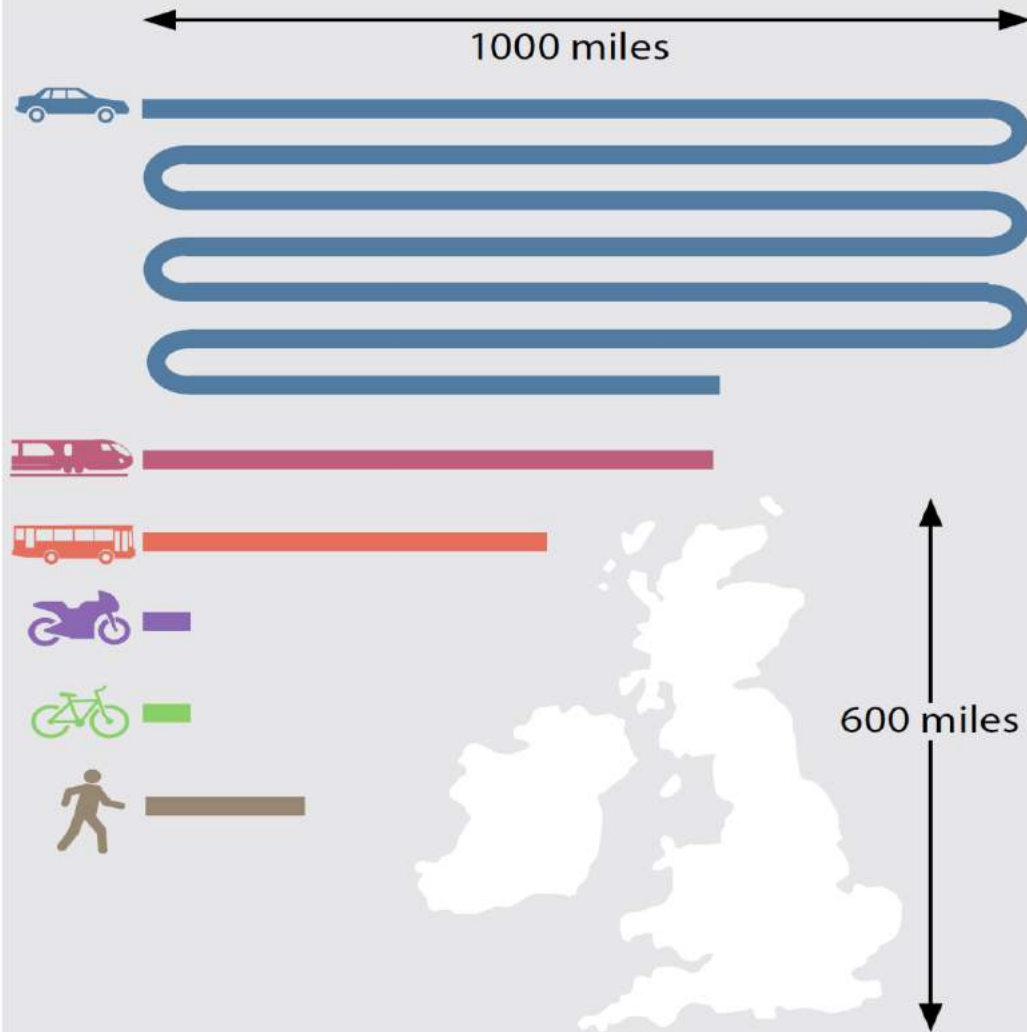


Fabric heat loss: 85 W/°C  
Ventilation heat loss: 35 W/°C  
Total heat loss: 120 W/°C

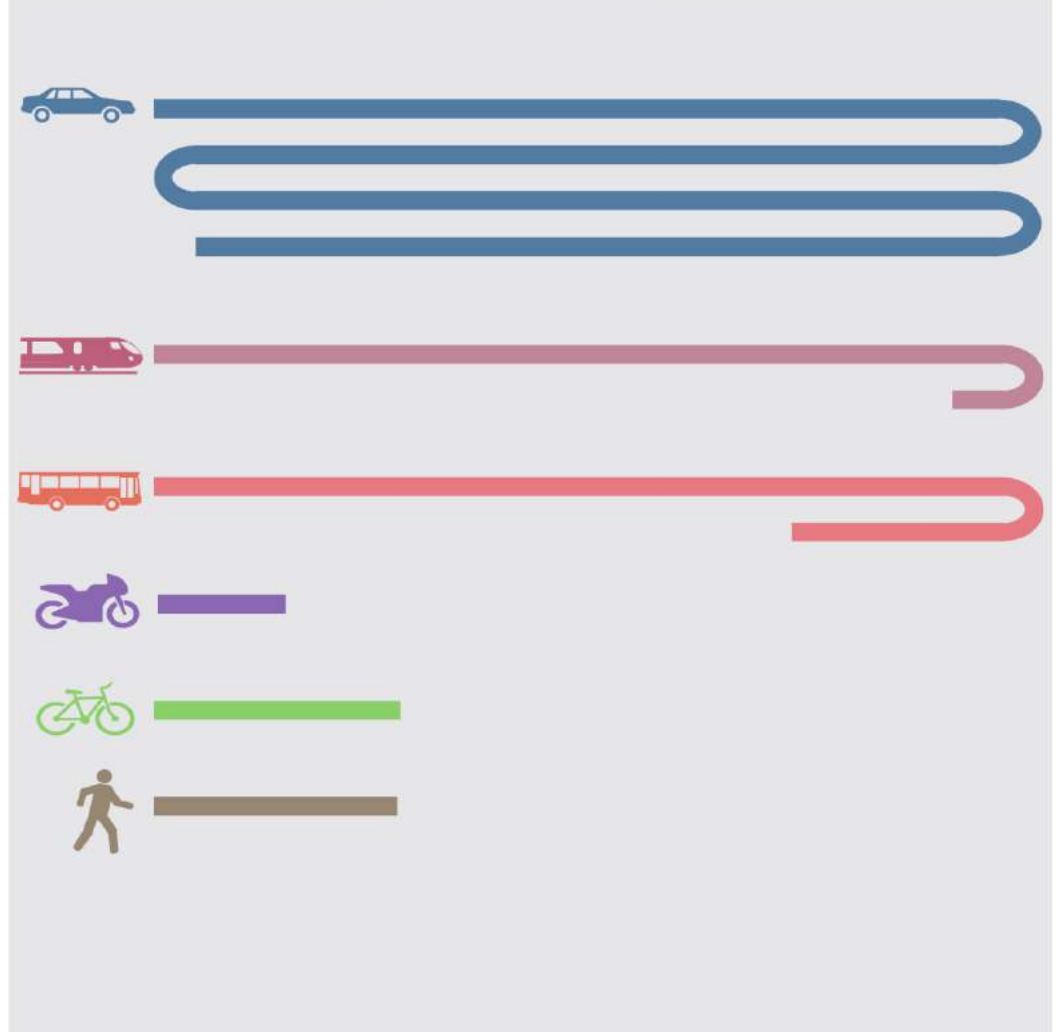
Heating demand:  
4,000 kWh/yr

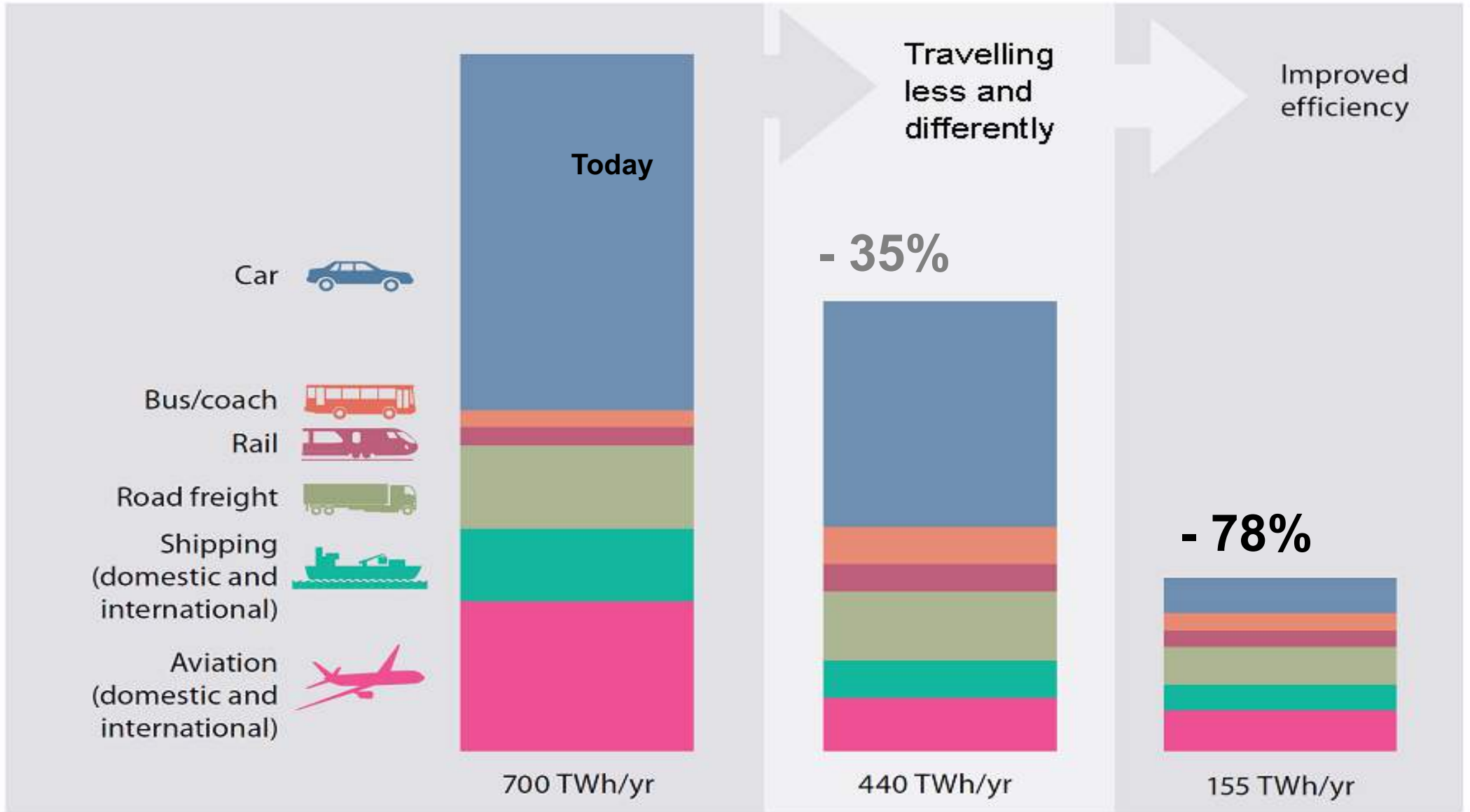


2010




ZCB







Today


Car 

Bus/coach 

Rail 

Road freight 

Shipping (domestic and international) 

Aviation (domestic and international) 

700 TWh/yr

Travelling less and differently

- 35%

440 TWh/yr

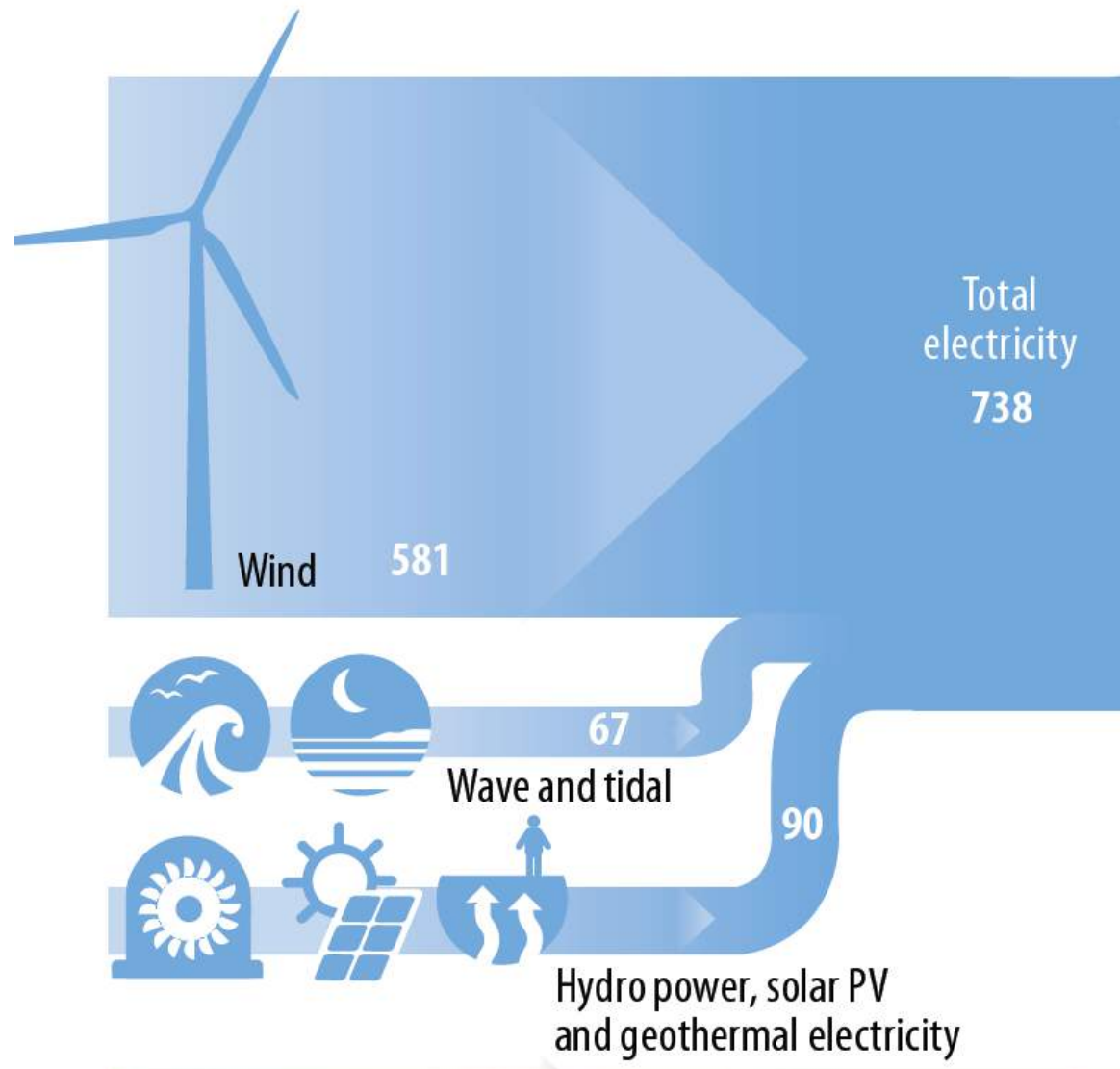
Improved efficiency

- 78%

155 TWh/yr

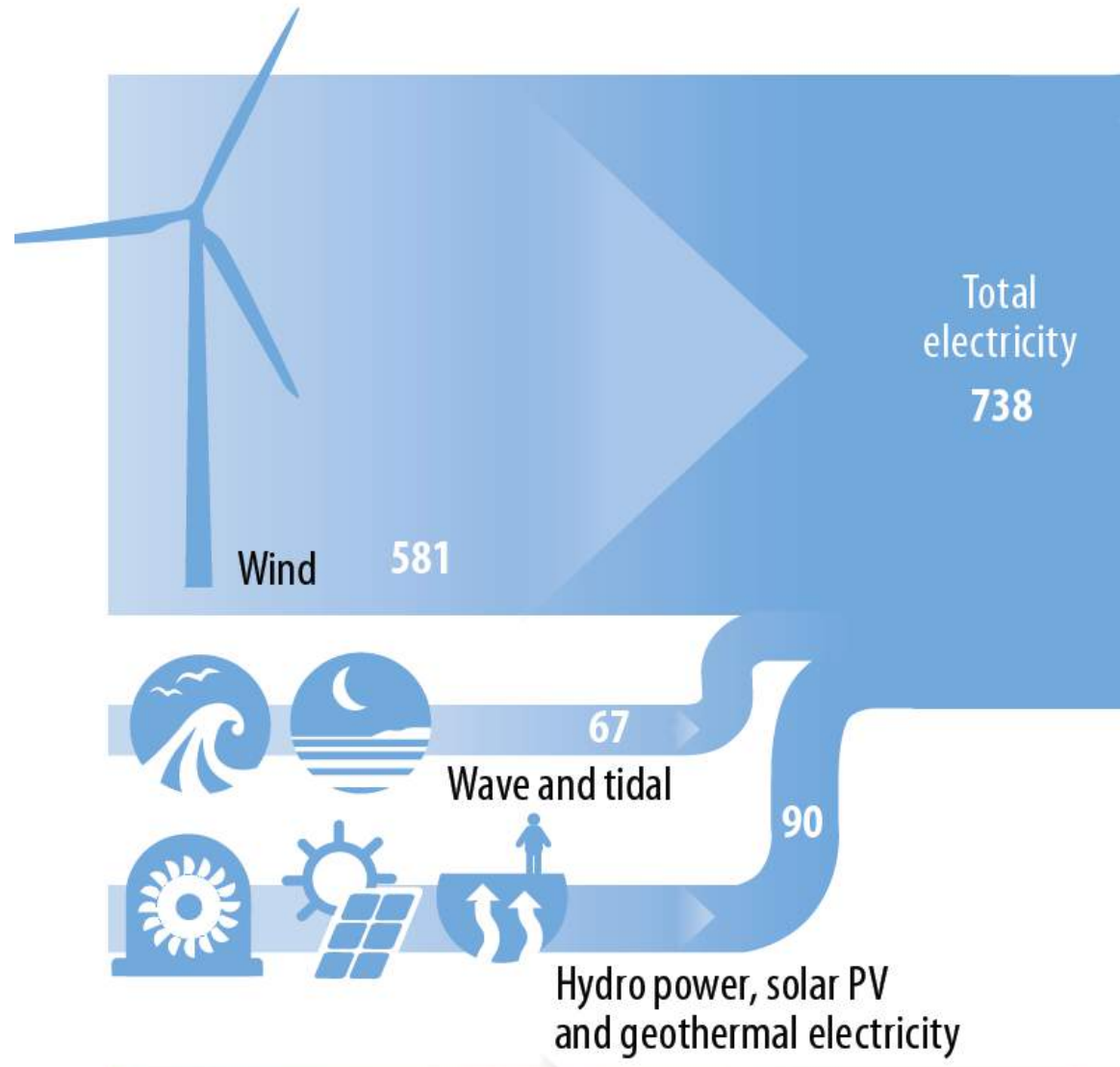
# Powering up Britain with 100% renewables:

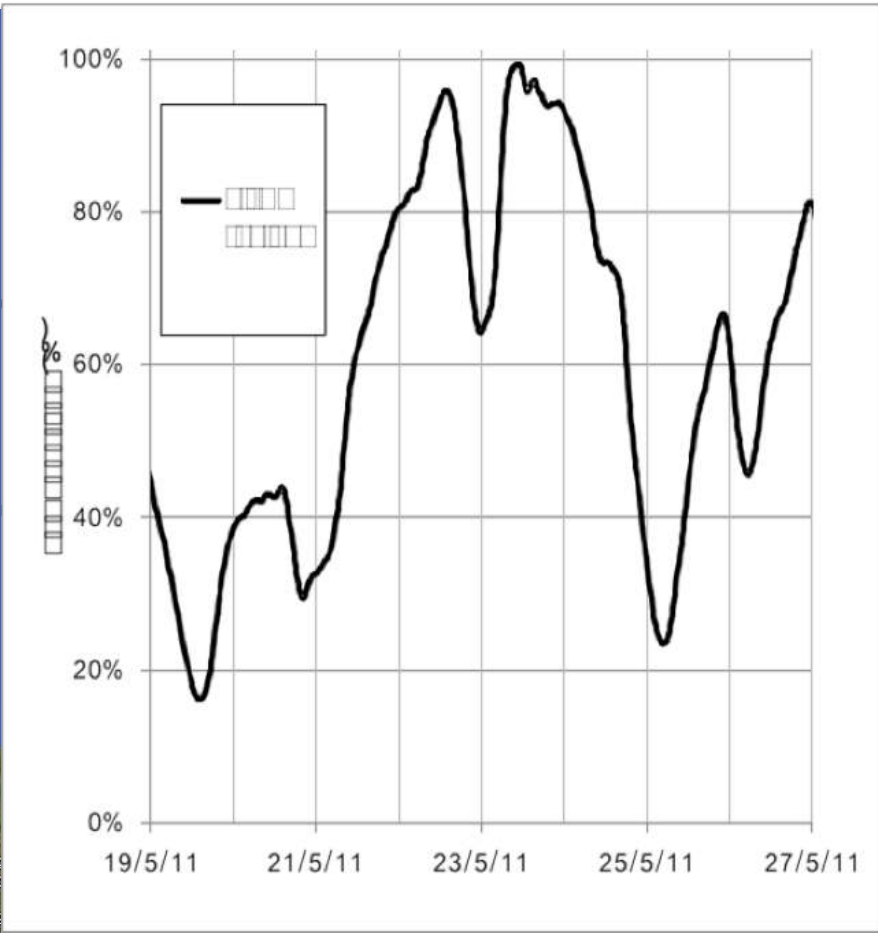
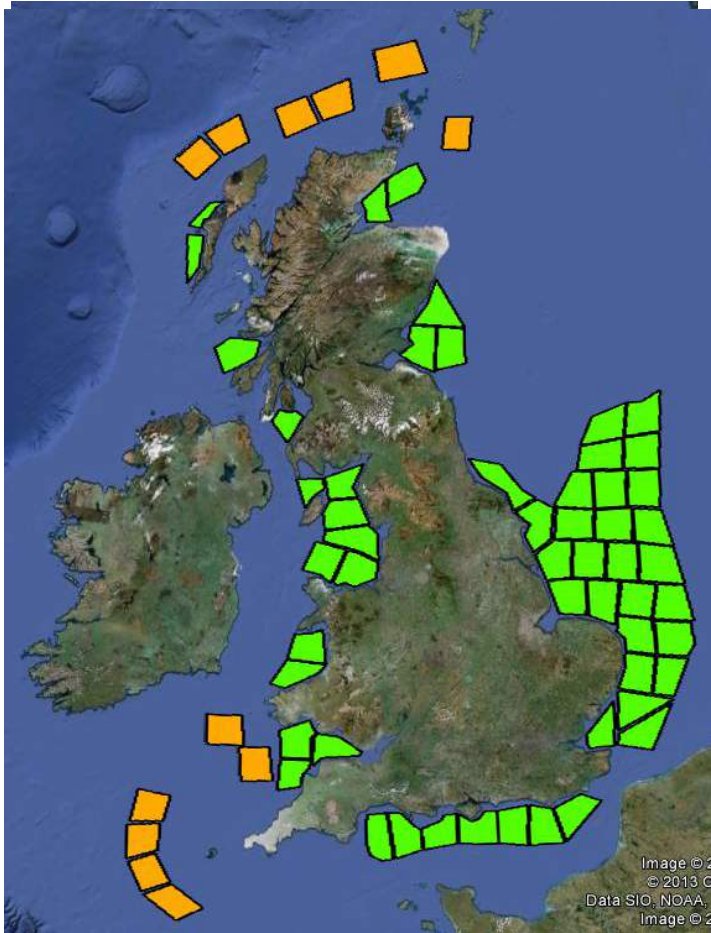
## Can we “keep the lights on”?

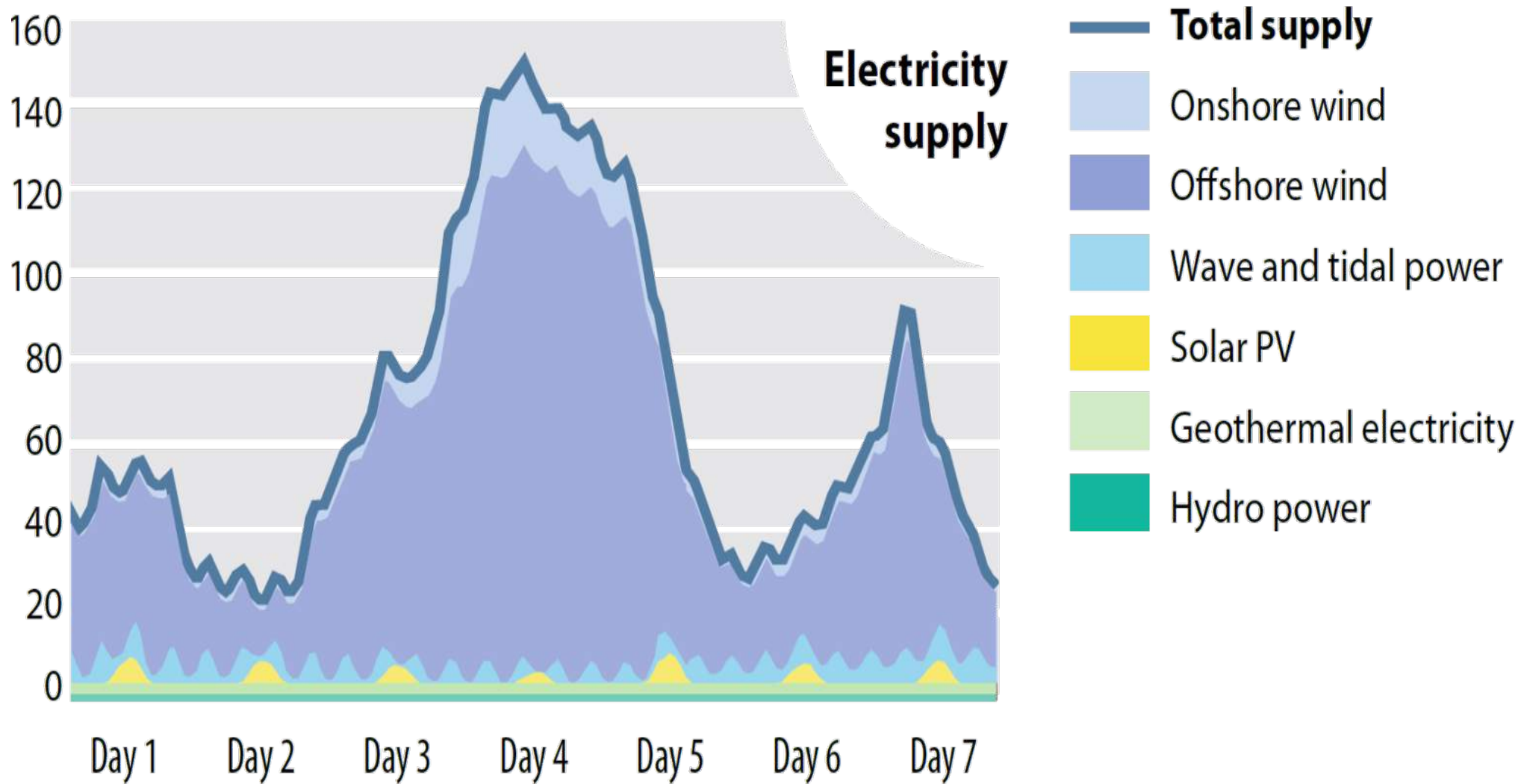


**Yes we can!**

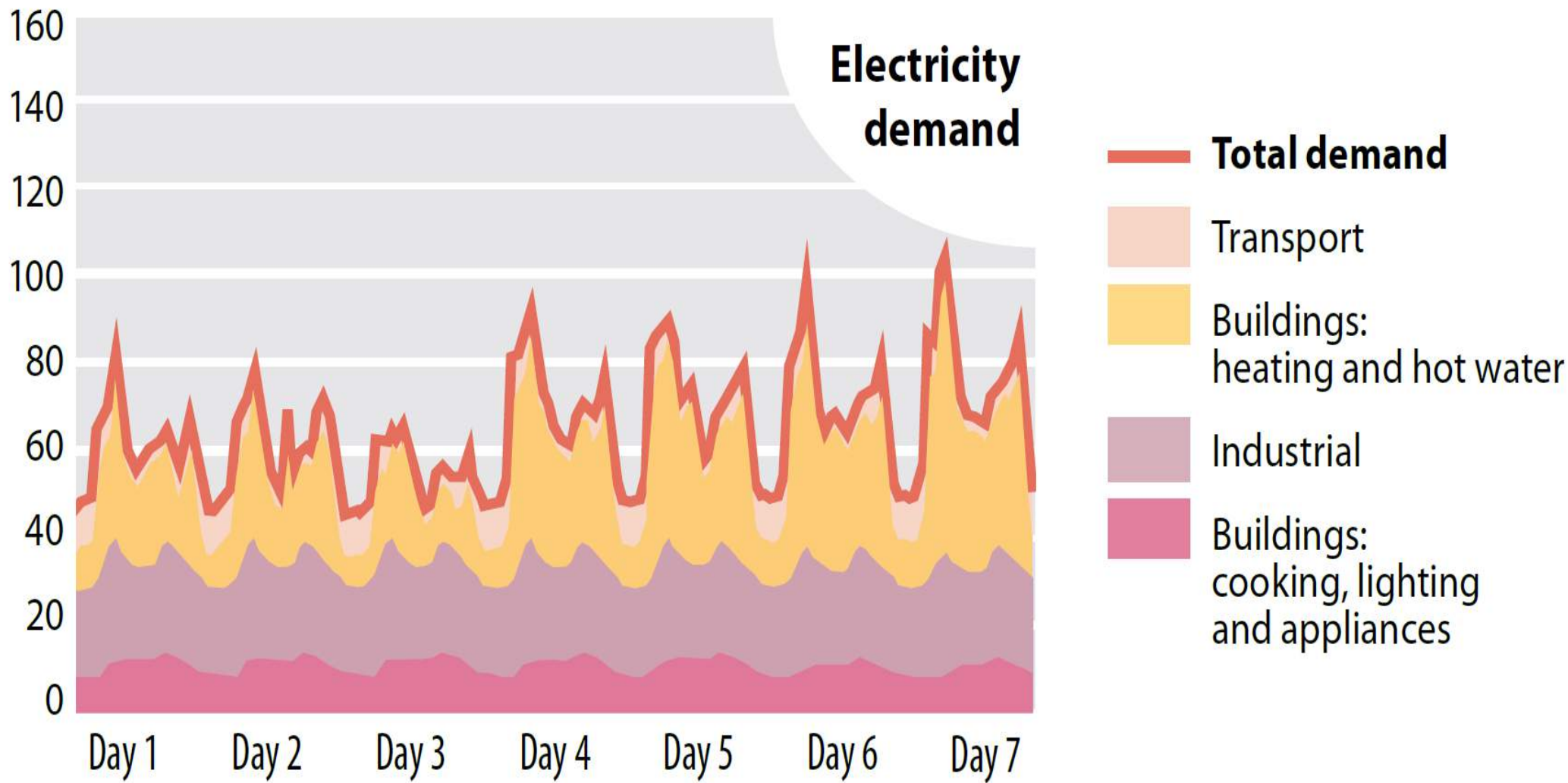
**The ZCB Energy Model:  
is based on ten years of  
real-world hourly data  
from  
2002 - 2011  
87,648 hours**

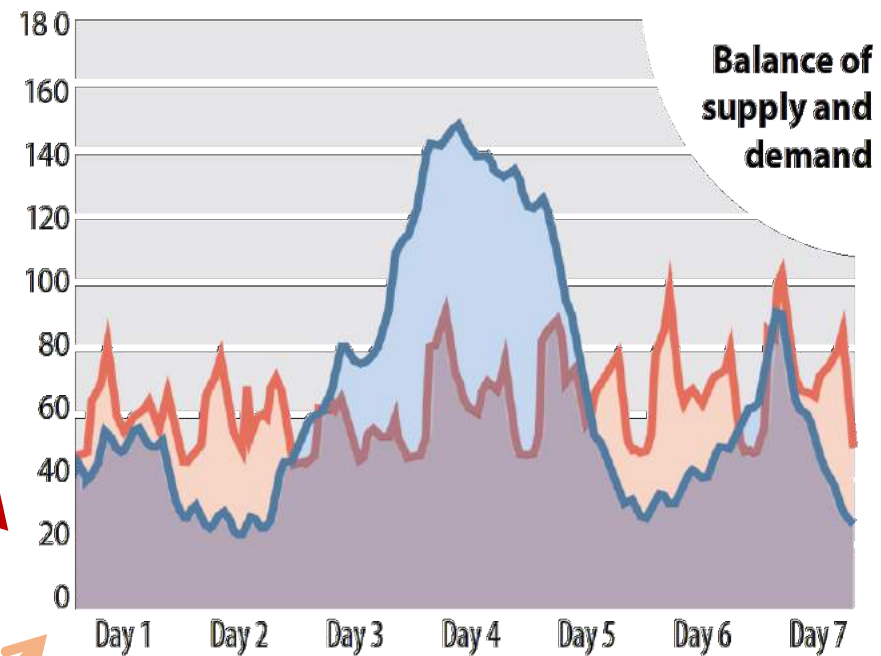
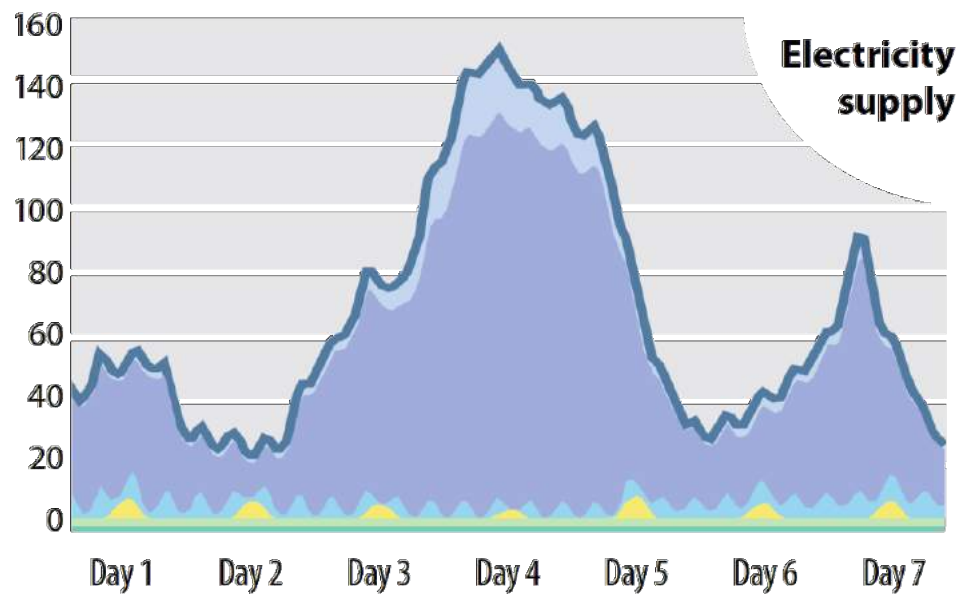
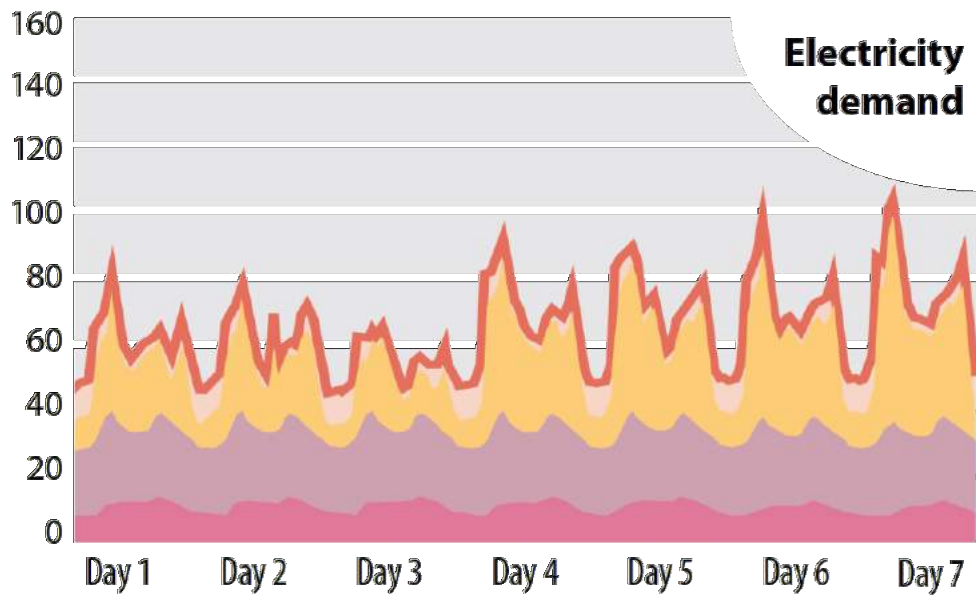




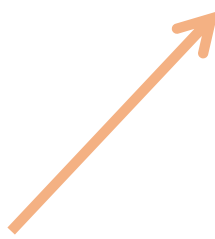








- Direct match
- Surplus
- Shortfall



Synthetic gas storage = Demand met **100%** of time

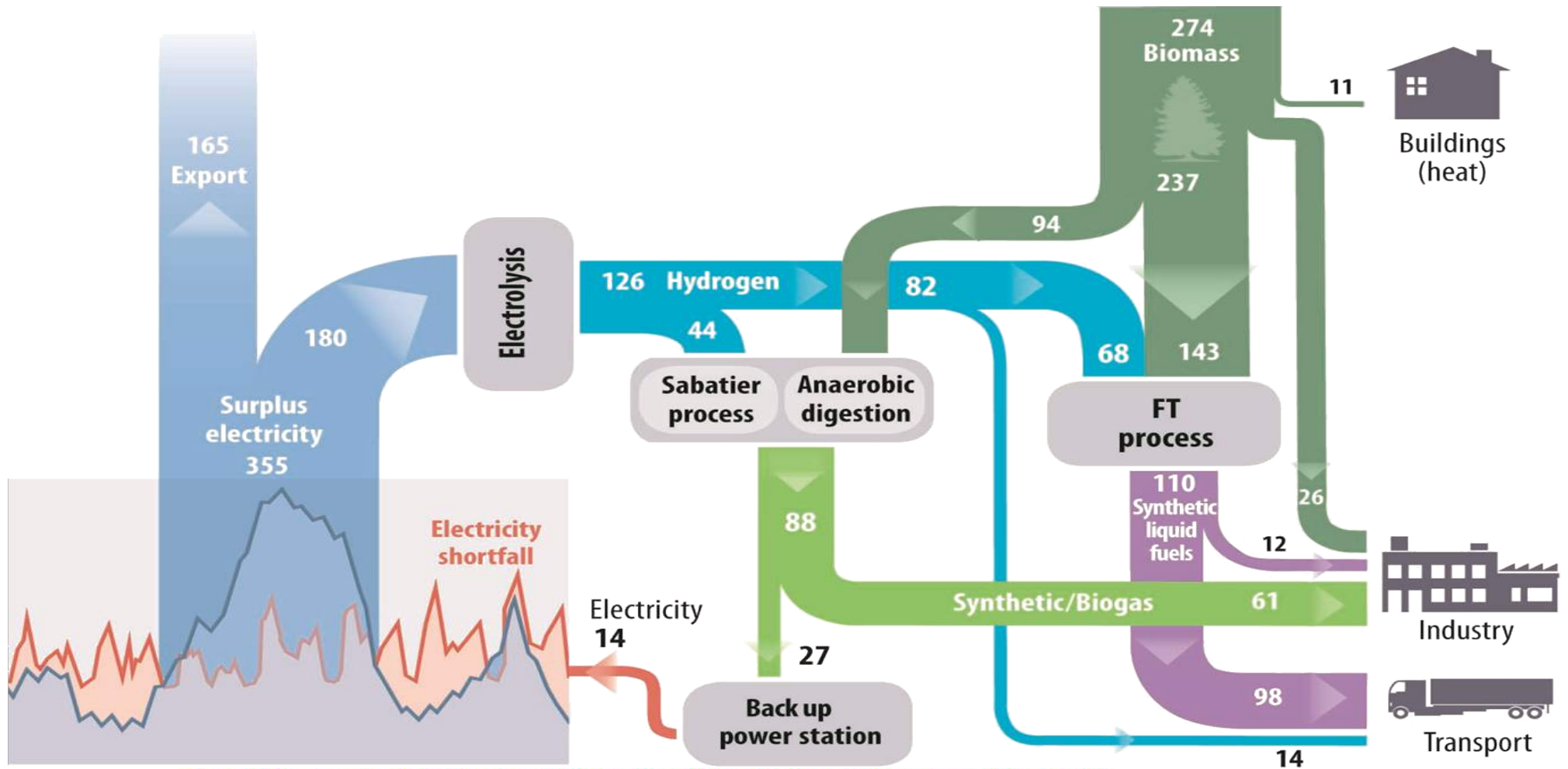
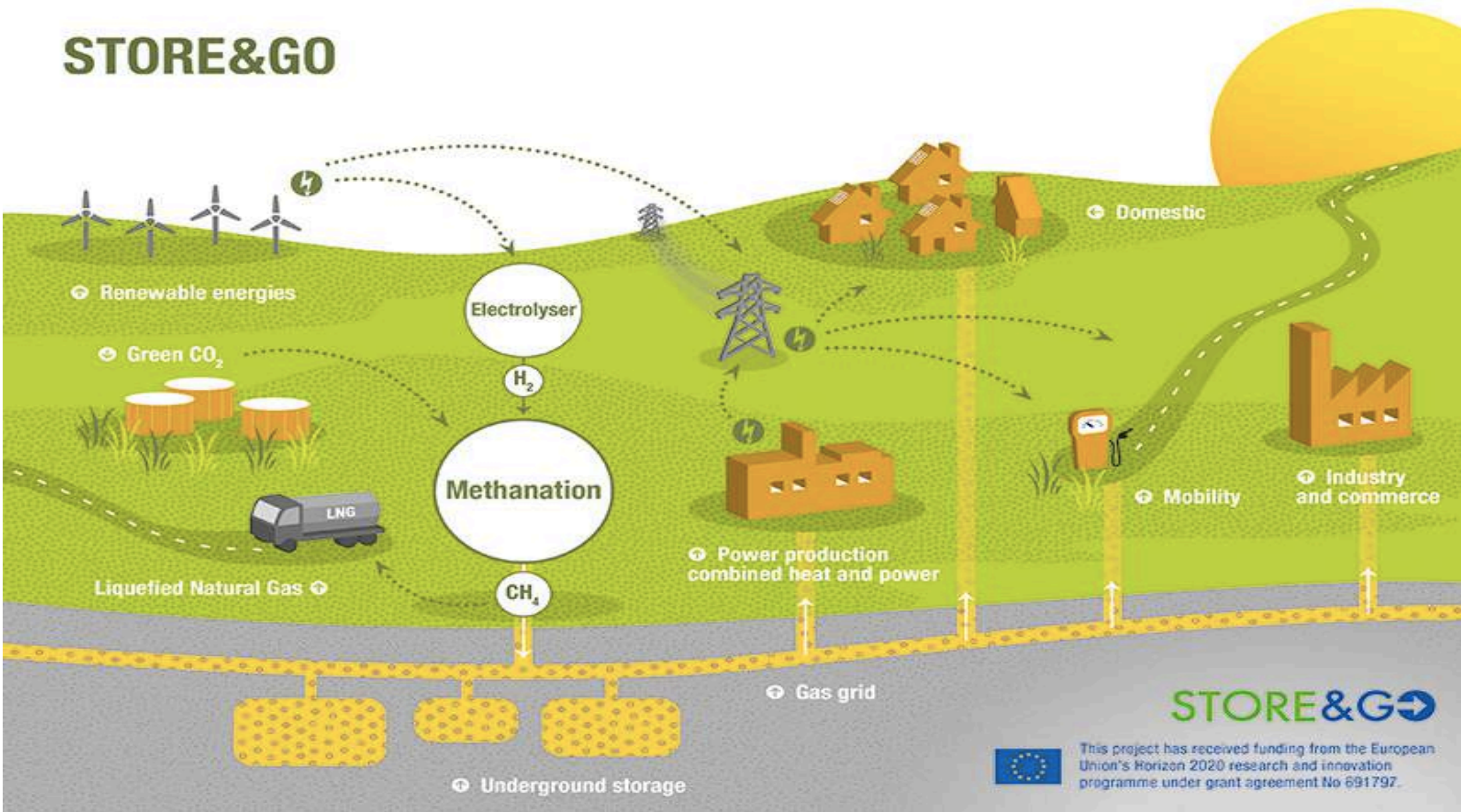
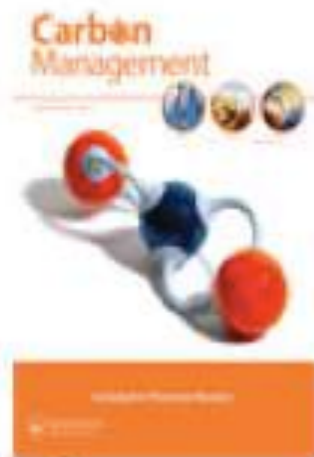


Figure 3.20: From surplus electricity and biomass to synthetic fuels for industry, transport and energy system back up. Losses are not shown in this figure.

# STORE&GO



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



## Carbon Management

Publication details, including instructions for authors and subscription information:  
<http://www.tandfonline.com/loi/tcmt20>

### Toward understanding the challenges and opportunities in managing hourly variability in a 100% renewable energy system for the UK

Alice Hooker-Stroud<sup>a</sup>, Philip James<sup>a</sup>, Tobi Kellner<sup>a</sup> & Paul Allen<sup>a</sup>

<sup>a</sup> Centre for Alternative Technology, Llywngwern Quarry, Machynlleth, Powys, SY20 9AZ  
Published online: 22 Apr 2015.

### Toward understanding the challenges and opportunities in managing hourly variability in a 100% renewable energy system for the UK

Carbon Management (2014)



Alice Hooker-Stroud<sup>a</sup>, Philip James, Tobi Kellner & Paul Allen

One hundred percent renewable energy systems have the potential to mitigate climate change, but large fluctuations in energy supply and demand make ensuring reliability a key challenge. A hypothetical future energy system developed for the UK features reduced total energy demand, increased electrification and 100% renewable and carbon-neutral energy sources. Hourly modelling of this system over a 10-year period shows that even in an integrated energy system there will be significant electricity surpluses and shortfalls. Flexible demand and conventional electricity and heat stores reduced the extremes but could not provide the capacity required. Carbon-neutral synthetic gaseous fuel could provide a flexible and quickly dispatchable back up system, with large storage and generation capacities comparable with those in the UK today.

## The ZCB Scenario demonstrates

- 82% of the time, the supply of renewable electricity exceeds demand (inc. electricity for heating and transport).
- 18% of the time, electricity supply does not fully meet demand.
- Short-term storage & load shifting can reduce this from 18% to 15%.
- Biogas and carbon neutral synthetic gas are burned in gas power stations to cover this.
- **Management of supply and demand with a 100% renewable energy system is possible with existing technology**
- **But it requires land to capture the carbon....**

# Rethinking diets & land-use

64% of adults overweight/obese  
(Bates et al, 2011).

**Too much food.**

**An unhealthy balance.**

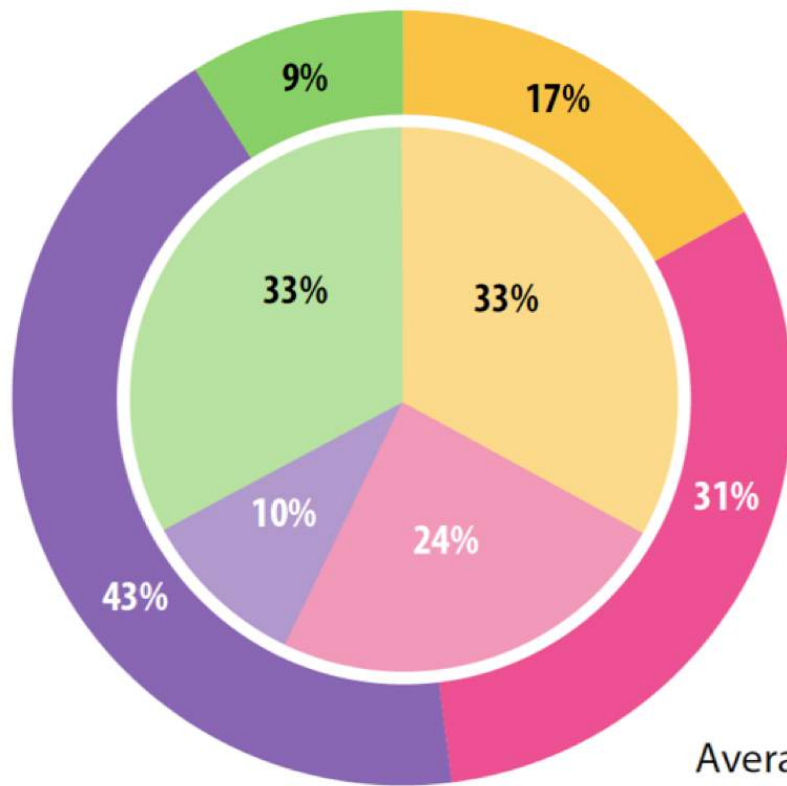
- Too much HFSS & high protein foods.
- Too little fruit, vegetables & cereals.

**Waste (30% in Europe (FAO, 2011)).**

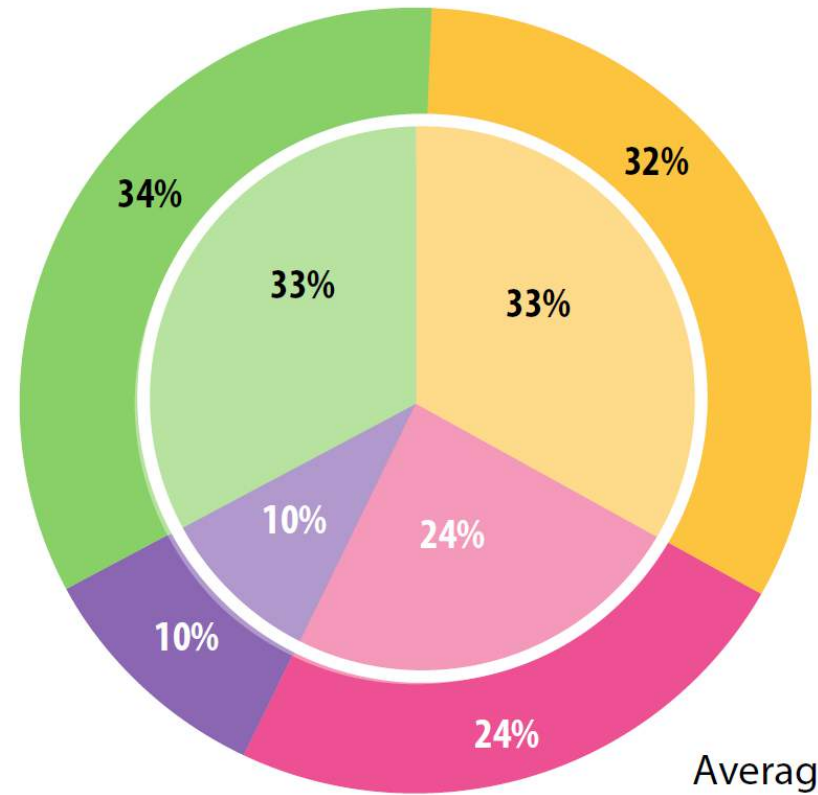


## **People, Plate and Planet**

The impact of dietary choices on health,  
greenhouse gas emissions and land use.



Average diet today

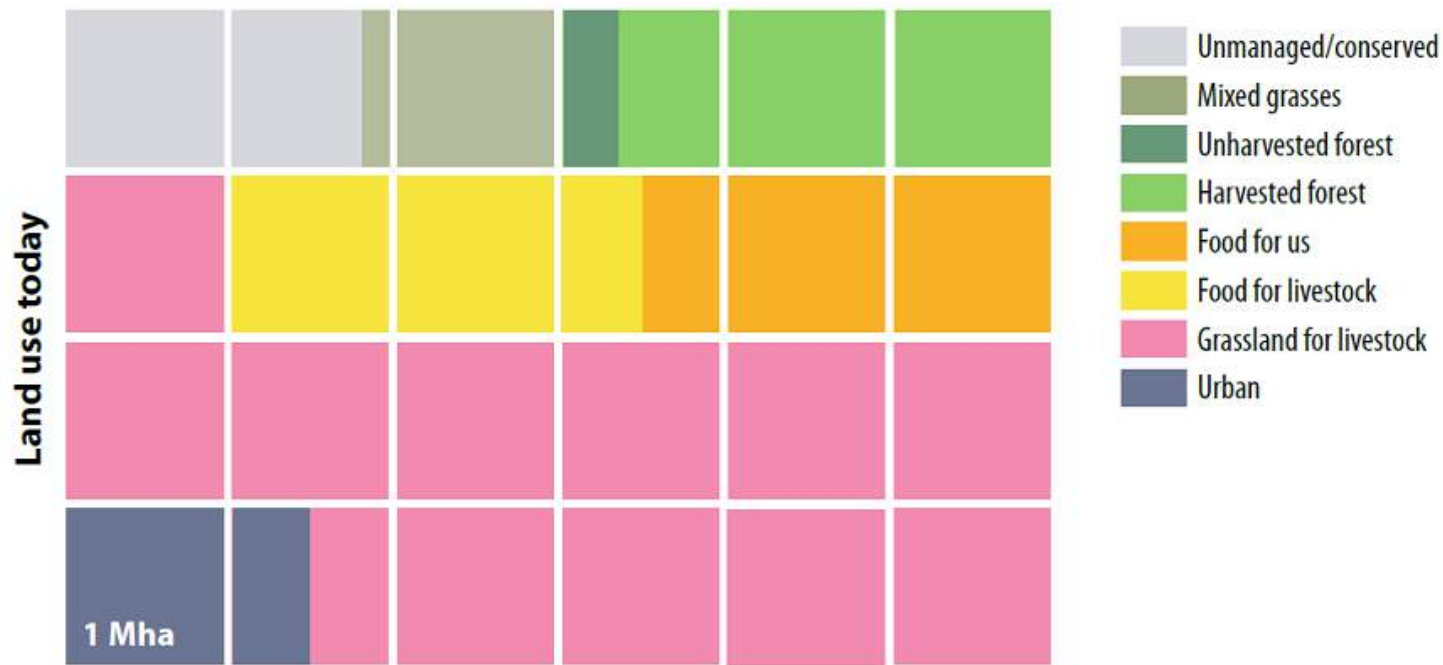


Average diet ZCB

Figure 3.29: The Eatwell Plate. Government recommendations for a healthy balanced diet (FSA, 2007). Today's average diet and the average diet in our scenario are shown (outside circle) relative to the Eatwell Plate recommendations (central circle).

- Starchy foods
- High protein foods
- HFSS foods
- Fruit and vegetables





## Land use today

- 65-70% = food production/agriculture (despite 42% imports).
- 85% of agricultural land is used for livestock.
- Only about 12% = forest (European average = 37%).

# Growing energy and making synthetic fuel

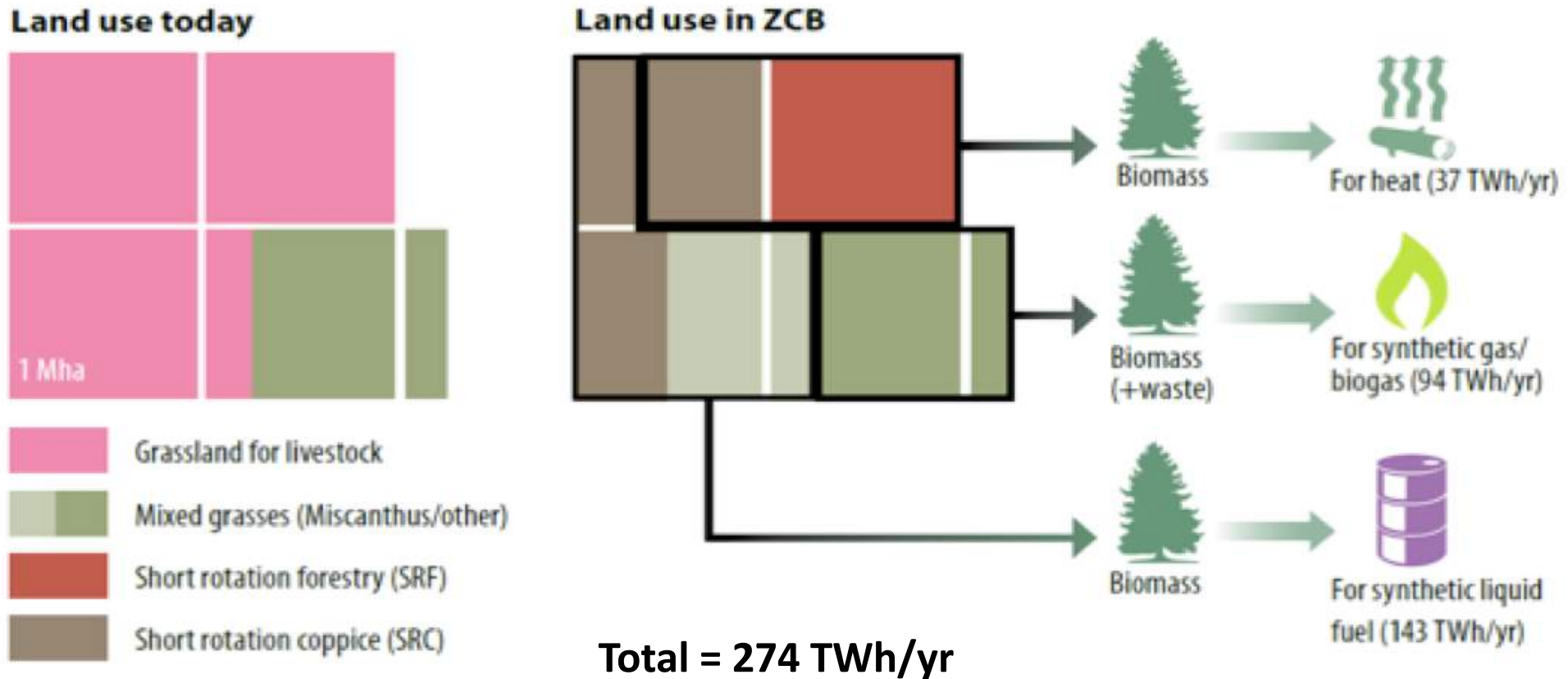
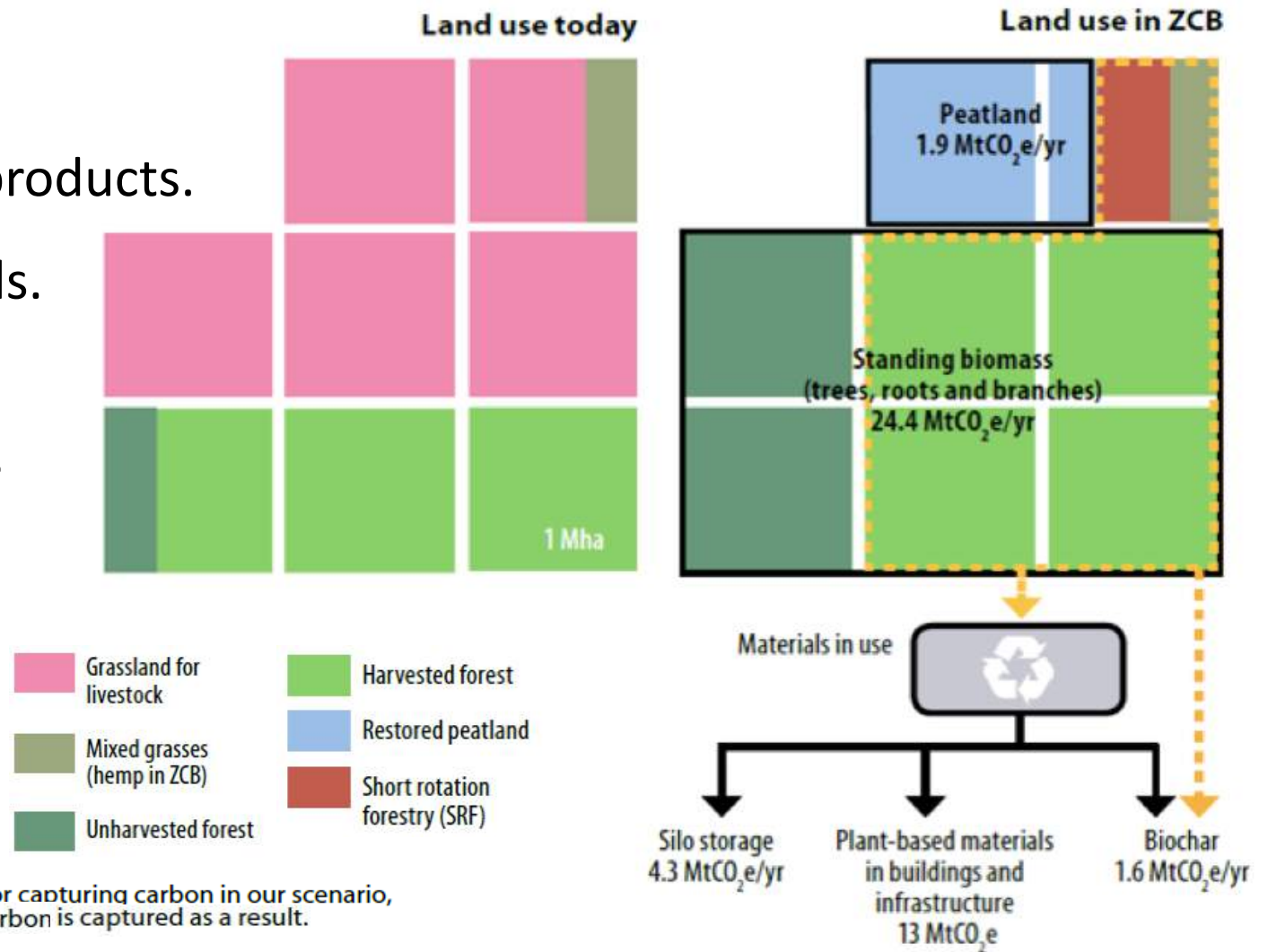


Figure 3.30: Area of land used today (DEFRA, 2012) that is used for energy crops in our scenario, the types of crop grown, and the amount and use of the biomass produced.

# Capturing carbon - ecologically

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

Balance GHG emissions of  
~ 45MtCO<sub>2</sub>e/year



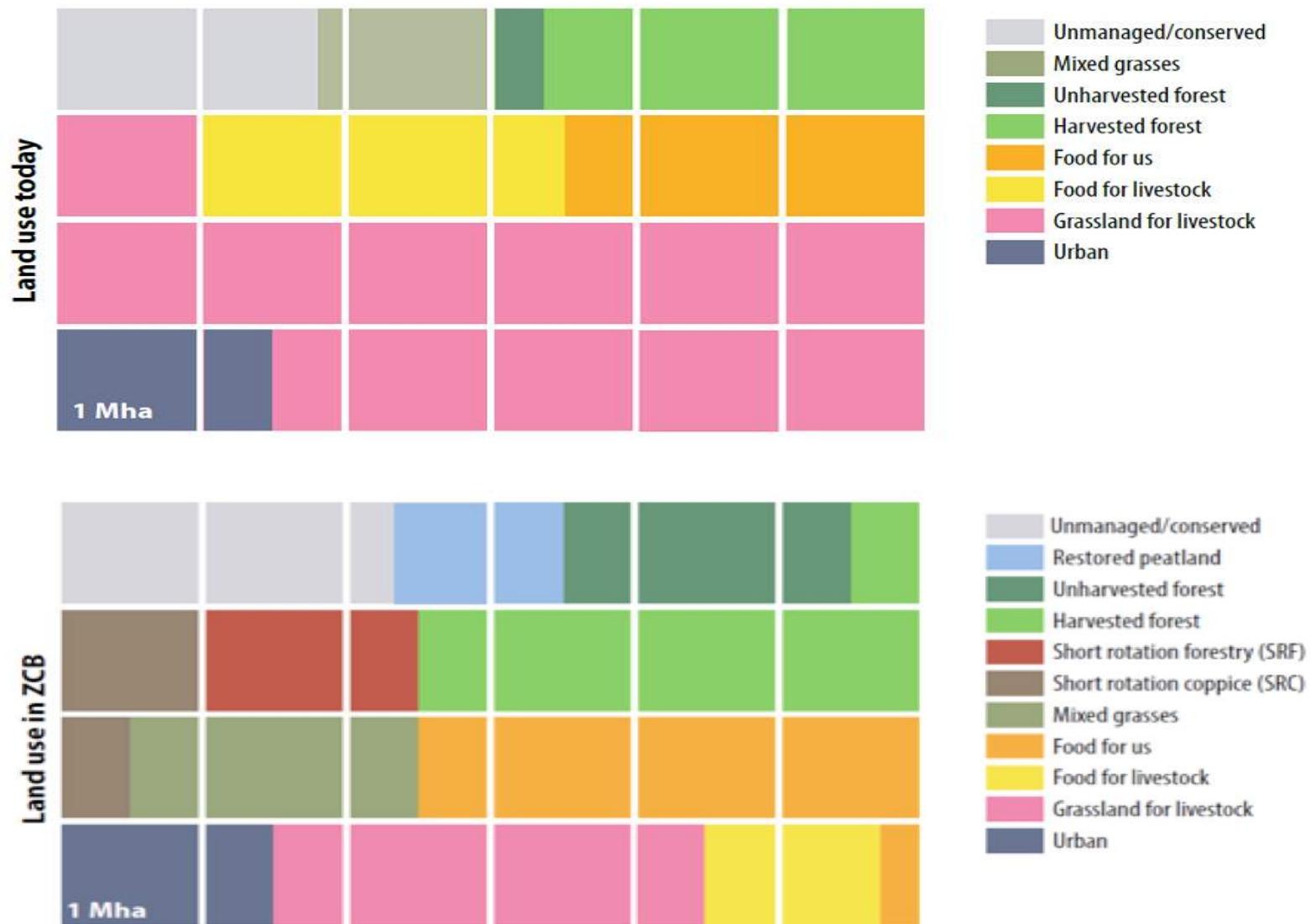


Figure 3.37: Approximate land use in our scenario (not including water courses and coastal areas). 'Mixed grasses' includes hemp, Miscanthus and other energy grass crops.

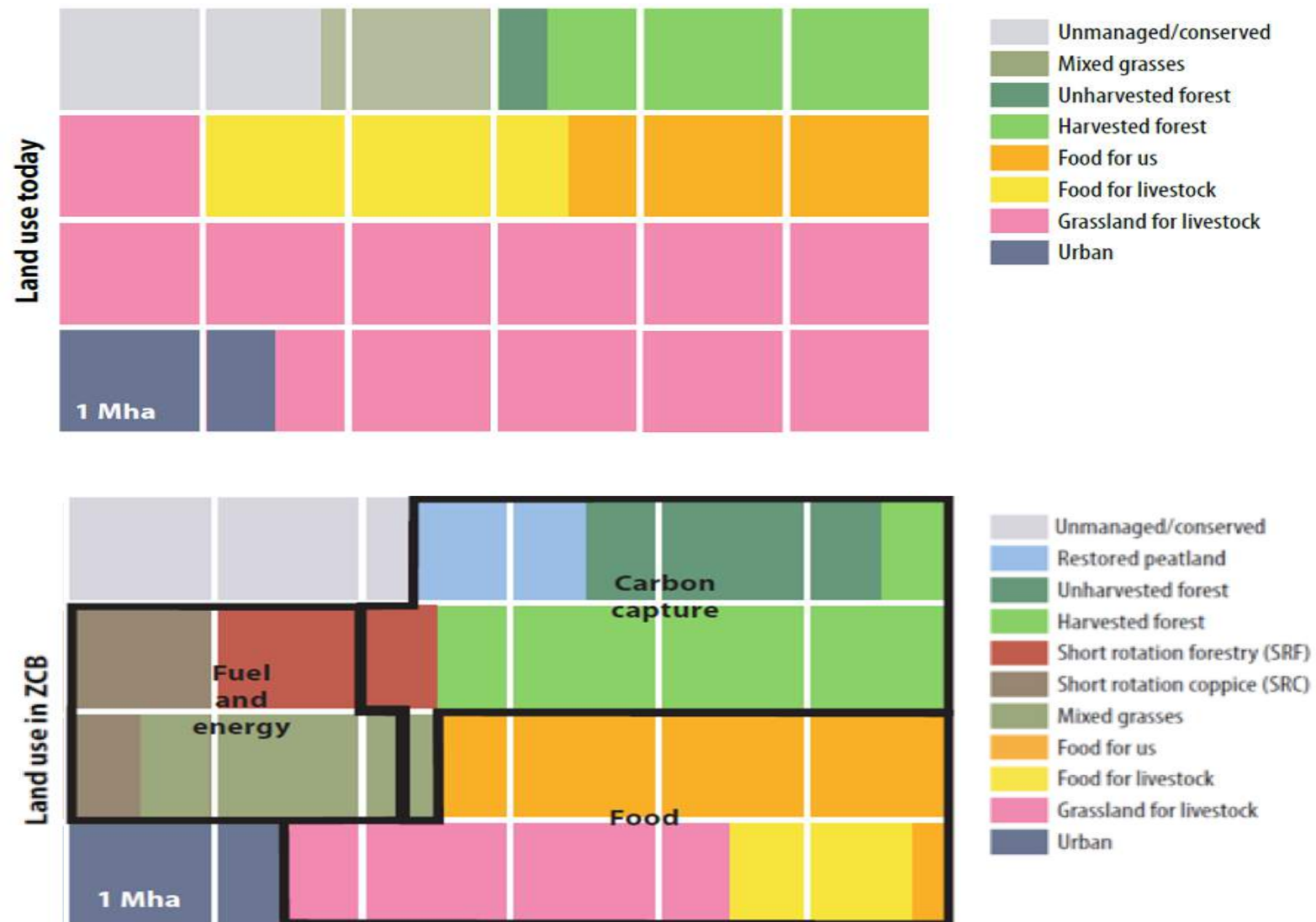
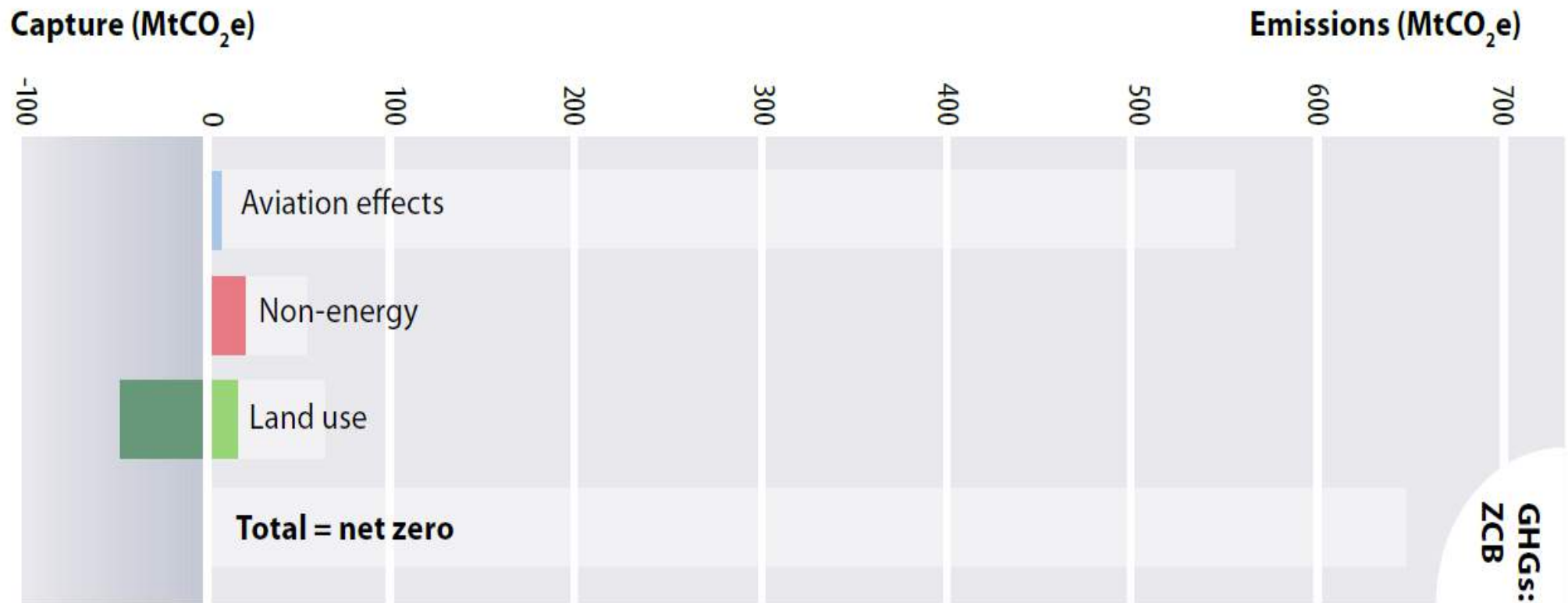


Figure 3.37: Approximate land use in our scenario (not including water courses and coastal areas). 'Mixed grasses' includes hemp, Miscanthus and other energy grass crops.

# Net zero emissions is achievable



# WHO'S GETTING READY FOR ZERO?



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**ZERO  
CARBON  
BRITAIN**

**TRACK**



# WHO'S GETTING READY FOR ZERO?

## COUNTRY SCENARIOS

|   |  |  |  |
|---|--|--|--|
|    | Beyond Zero Emissions                      | <a href="#"><i>Zero Carbon Australia</i></a>   | ZERO GHG <sub>e</sub> NG DDPP 100% RE% |
|    | Royal Government of Bhutan                 | <a href="#"><i>A national strategy and action plan for low carbon development</i></a>  | ZERO GHG <sub>e</sub> G DDPP 100% RE%  |
|    | Mitigation Action Plans & Scenarios (MAPS) | <a href="#"><i>MAPS Chile – Mitigation options for a low carbon development</i></a>  | LOW GHG <sub>e</sub> G NG DDPP         |
|    | Costa Rica Climate Change                  | <a href="#"><i>Carbon Neutral by 2021</i></a>  | ZERO GHG <sub>e</sub> G DDPP           |
|    | Danish Climate Commission & Energy Agency  | <a href="#"><i>The Road to a Danish Energy System Without Fossil Fuels &amp; 2020, 2035, 2050 Scenarios for energy decarbonisation</i></a> | LOW GHG <sub>e</sub> G DDPP 100% RE%   |
|    | Vedvarende Energi & INFORSE                | <a href="#"><i>Fast Transition to Renewable Energy by 2030</i></a>   | LOW GHG <sub>e</sub> NG DDPP 100% RE%  |
|    | Federal Democratic Republic of Ethiopia    | <a href="#"><i>The path to sustainable development – Ethiopia's Climate-Resilient Green Economy Strategy</i></a>                           | ZERO GHG <sub>e</sub> G DDPP 100% RE%  |
|    | German Federal Environment Agency          | <a href="#"><i>Germany in 2050 – a greenhouse gas-neutral country</i></a>  | LOW GHG <sub>e</sub> G DDPP 100% RE%   |
|  | Greenpeace Japan                           | <a href="#"><i>The Advanced Energy [R]evolution: A sustainable energy outlook for Japan</i></a>  | LOW GHG <sub>e</sub> NG DDPP           |
|  | World Future Council                       | <a href="#"><i>100% Renewable Energy: Boosting Development in Morocco</i></a>  | LOW CO <sub>2</sub> NG DDPP 100% RE%   |
|  | University of Canterbury                   | <a href="#"><i>A 100% renewable electricity generation system for New Zealand</i></a>  | LOW NG DDPP 100% RE%                   |
|  | Norwegian Env. Agency                      | <a href="#"><i>Knowledge base or low-carbon transition in Norway</i></a>   | ZERO GHG <sub>e</sub> G DDPP           |
|  | Gov. Offices of Sweden                     | <a href="#"><i>Sweden – an emissions-neutral country by 2050</i></a> (in Swedish)  | ZERO GHG <sub>e</sub> G DDPP           |

for Alternative Technology  
and Technology Amgen

ZERO  
CARBON  
BRITAIN





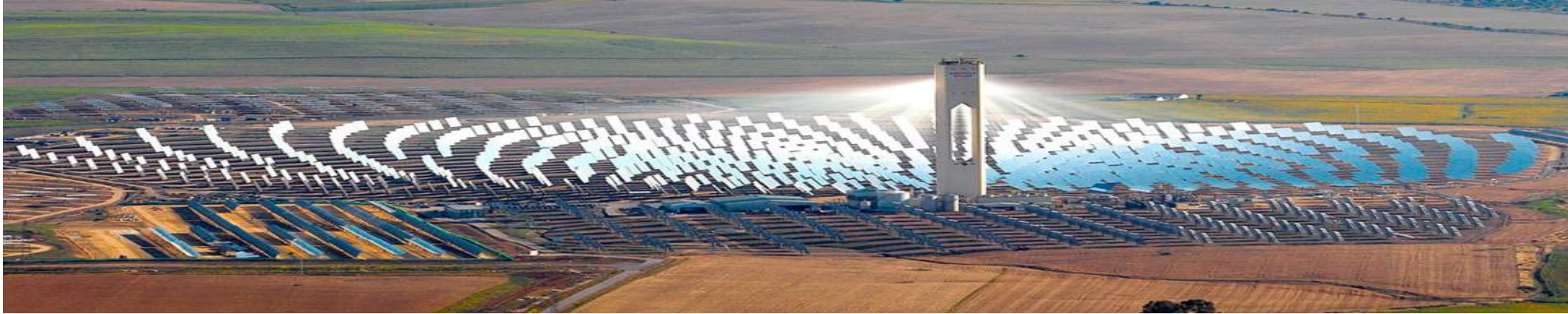
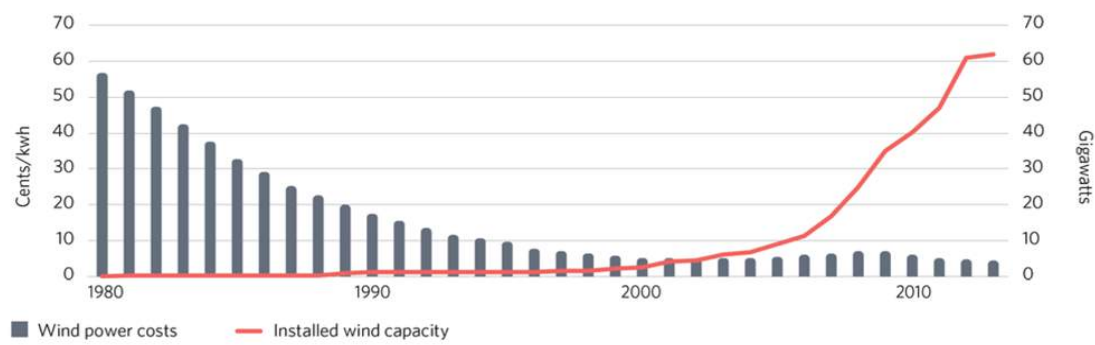




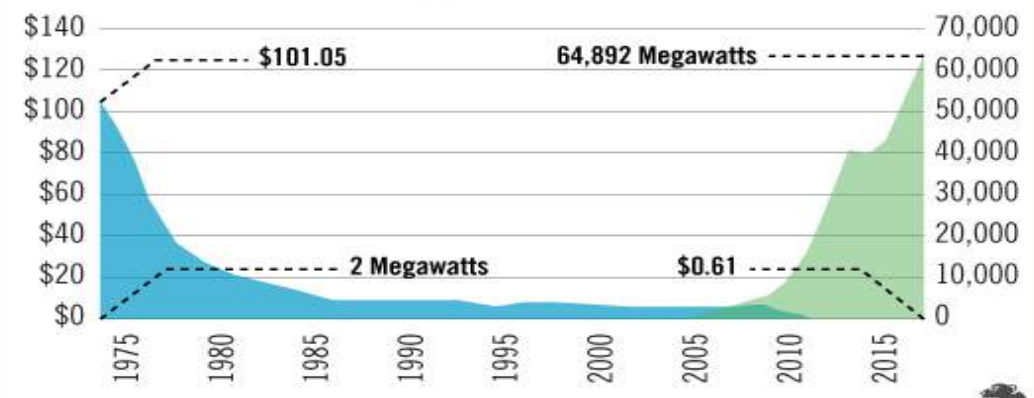


Figure 1  
 Wind Capacity Increased as Prices Fell  
 Land-based wind installations (in gigawatts) and cost (in cents per kilowatt-hour)



Source: U.S. Department of Energy  
 © 2015 The Pew Charitable Trusts

Price of a Solar Panel per Watt vs. Global Installations



Source: Earth Policy Institute/Bloomberg

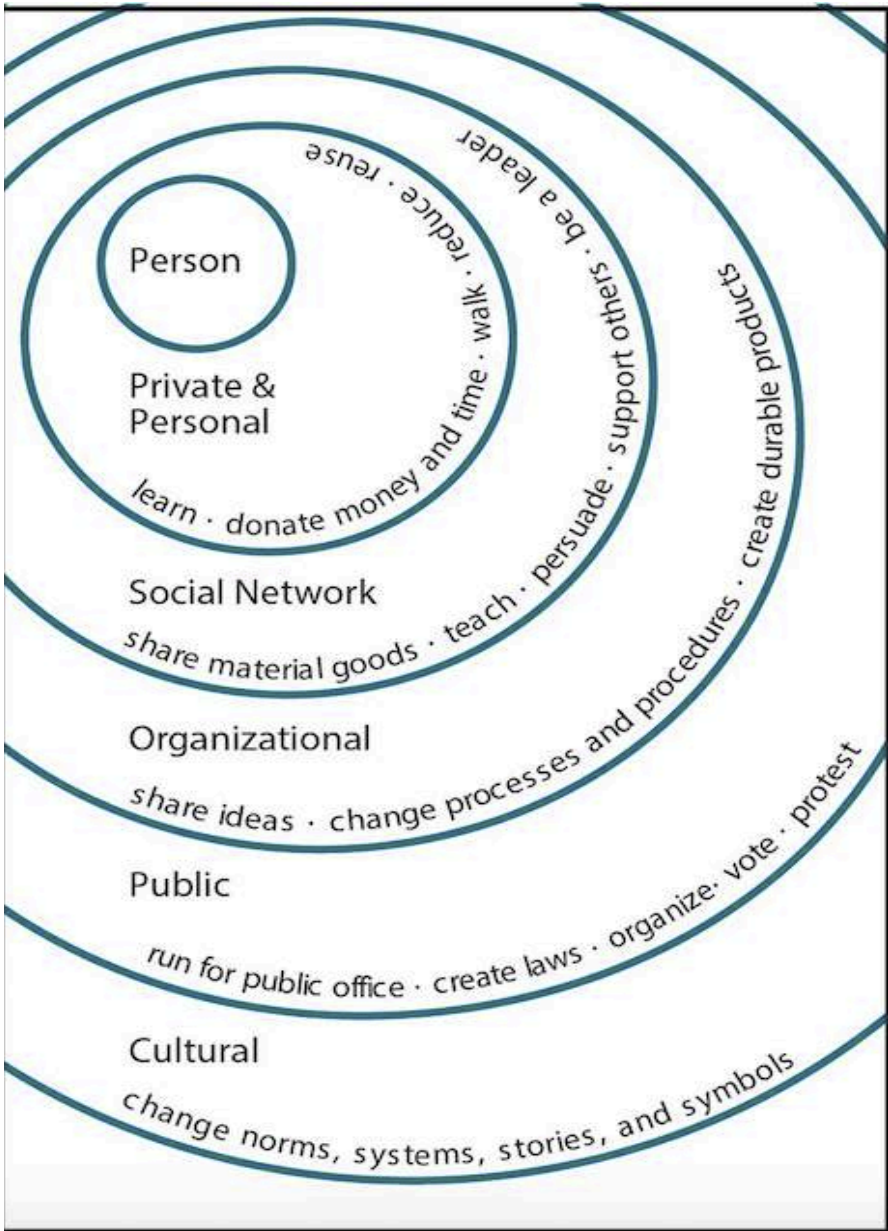


Showing how all the technologies opens new conversations



*'The trend is our friend'*

**-but how do we get there in time?**



Rather than an unresolved technical challenge, it is increasingly accepted that we actually face a mix of **economic, cultural & psychological** barriers.

Yet changing how millions of people think & live is a **very special** kind of problem... as the forces which shape our lives exist on **many different levels**

Tackling such a complex challenge requires a new kind of approach

Tools which join-up research & practice across disciplines, borders, sectors & scales.

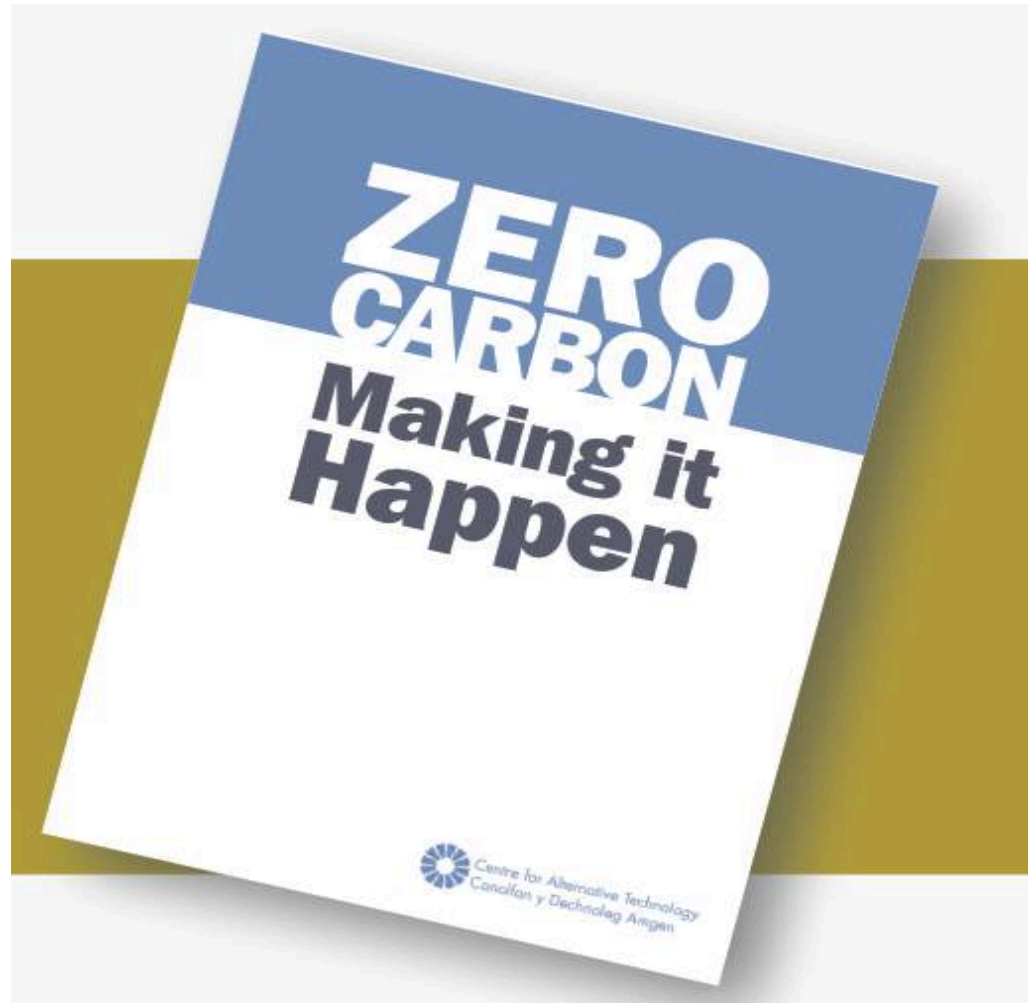


[zerocarbonbritain.org](http://zerocarbonbritain.org) #ZCB

**ZERO  
CARBON  
BRITAIN**

- Science\*
- Technology\*
- Culture
- Economics
- Psychology
- Philosophy
- Sociology
- History
- Democracy
- Law
- Spirit

Identifying barriers & how we overcome them





# Tools to un-lock our 'carbon lock-in'



The historical, technical, cultural & institutional co-evolution of fossil fuels with how we deliver energy, housing, transport & agricultural systems has created persistent forces that are **hugely resistant to change!**



# Energy



# An energy company that's putting people first

Robin Hood Energy is the first, not for profit, energy company, owned by a local authority. We were set up to tackle fuel poverty and to help give people a cheaper, more helpful alternative to the Big Six. Launched by Nottingham City Council, we're proud to be leading the way in trying to reduce fuel poverty for those who need help the most.

And this makes a big difference to the way we do business. We're a not-for-profit company, so we can keep our prices low and competitive. We don't have private shareholders watching our every move, or big bonuses for our company directors. Instead, we have one simple aim – to bring you cheaper gas and electricity.

For years, energy costs have been rising. Many of us have felt mistrustful of the big energy providers and frustrated with the lack of service. Worse, energy poverty has increased, with more and more households struggling to afford to keep their homes warm and dry. That's where we come in.

It's time to say goodbye Big Six, hello smaller bills.

How much could you save?



**“You can argue that perhaps energy is the defining commodity of the last 200 years... Having it local, municipal, socially owned, as it has been in the past, could be very liberating.”**

**~ Chris Blake, TGV Hydro**



photo: Andy Aitchison, Ashden

Read Chris's story and many more examples of innovative projects paving the way to zero carbon in a new report

**Zero Carbon Britain: Making it Happen**  
[zerocarbonbritain.org](http://zerocarbonbritain.org) #ZCB



# Energy



# Transport



Credit: York Bike Belles

# Buildings



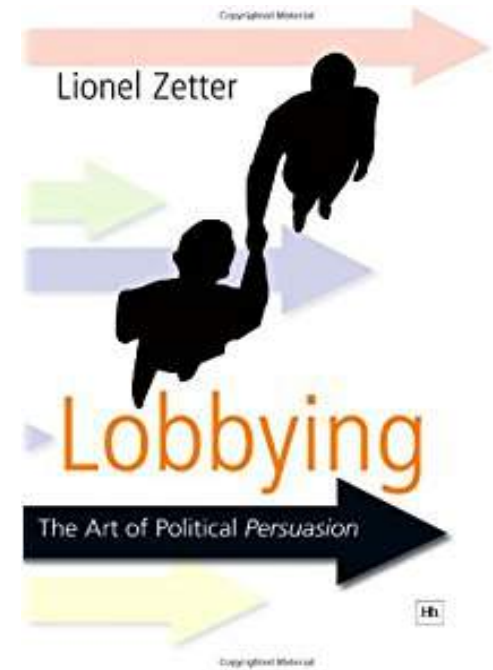
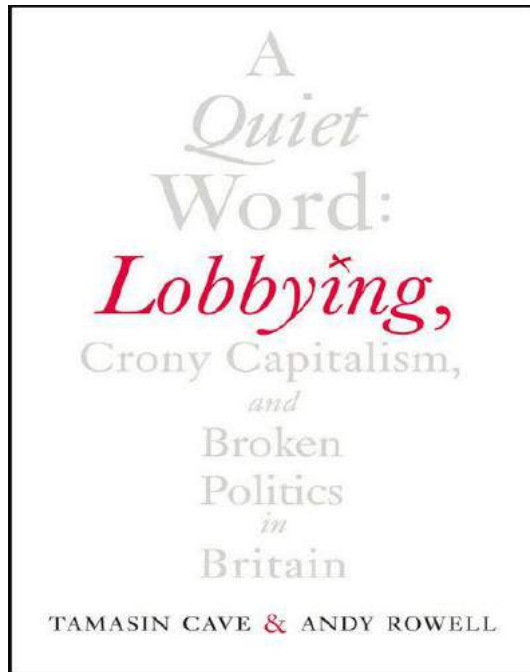
# Food





**How do we overcome the wider systemic barriers?**

# Politics and Governance





**Plan B** is a Charitable Incorporated Organisation (CIO) registered with UK Charity Commissioners (registered no. 1167953).

### **Mission statement**

**Plan B** has been established to support strategic [legal action](#) against climate change. By ensuring those responsible for greenhouse gas emissions bear the costs of loss and damage, we will increase the incentives for investment in clean technologies, harnessing market forces towards a better future for us all.

[www.planb.earth](http://www.planb.earth) offers more detailed analysis in relation to Four Key Scenarios:

- (i) Countries' legal obligations to each other,
- (ii) Challenging your government's actions on climate change, i.e the potential for NGOs and citizens to bring legal actions requiring their national or regional governments to take appropriate action on climate change.
- (iii) Liability of carbon majors, i.e. The principles of private law which may support actions in tort against fossil fuel companies for climate change loss and damage; and The potential liability of companies under constitutional and human rights principles
- (iv) Investor and financier liability, i.e. the potential to bring action against those supporting and profiting from the fossil fuel industry.

# Politics and Governance



Credit: Sustainable Development Alliance

# Communications



Media Consolidation:

## THE ILLUSION OF CHOICE

Media has never been more consolidated. 6 media giants now control a staggering **90%** of what we read, watch, or listen to.



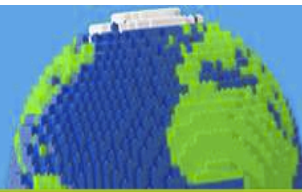
# Communications

# WE DID IT!

## LEGO BLOCKS SHELL



Credit: Greenpeace



# PLANET CREW

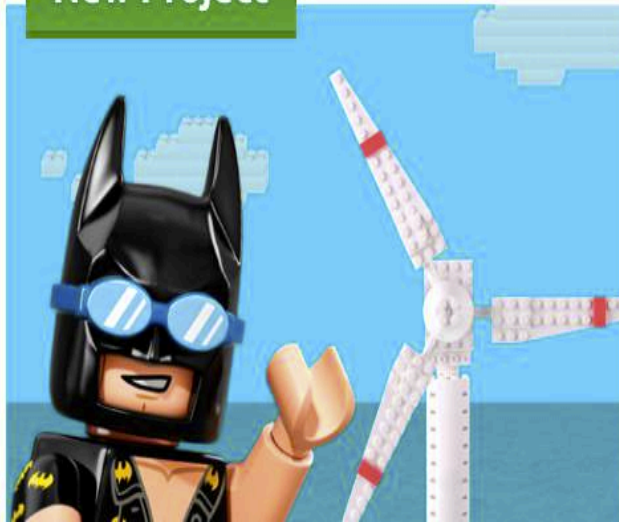
WINDPOWER POWER OF PLAY

## Help protect the planet with the power of play!

Do you want to protect the planet and its living creatures with the power of play? So do we! We are on a mission to protect the planet for future generations and we can't do it alone. We need you!

Join the LEGO® Planet Crew and help leave a positive planet impact.

### New Project



## Burbo Bank Wind Farm

Are you a wind power Superhero? Join us around the world in the unveiling of our Guinness World Records™ attempt.

[Q Explore](#)

# Economics and Finance

**WP/15/105**

**\$5.3 trillion  
in 2015.**

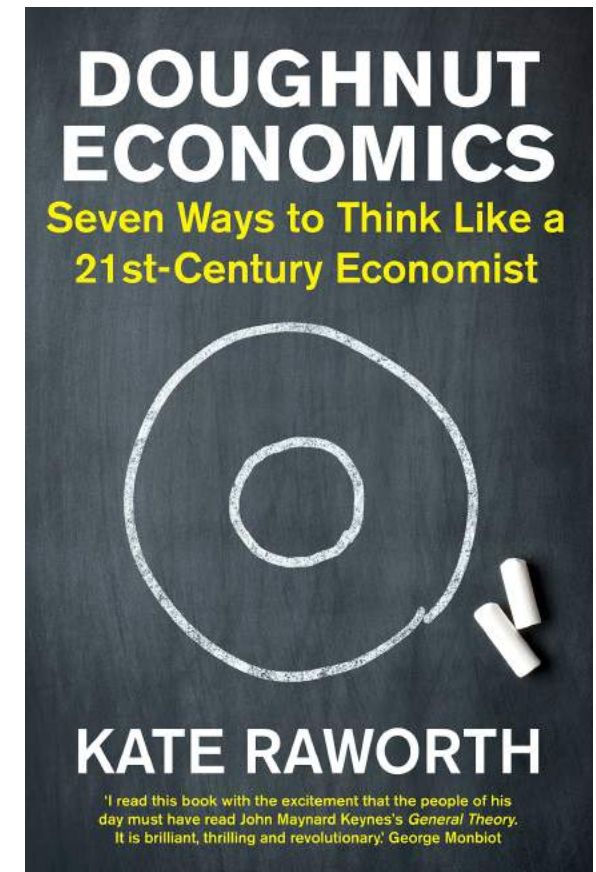
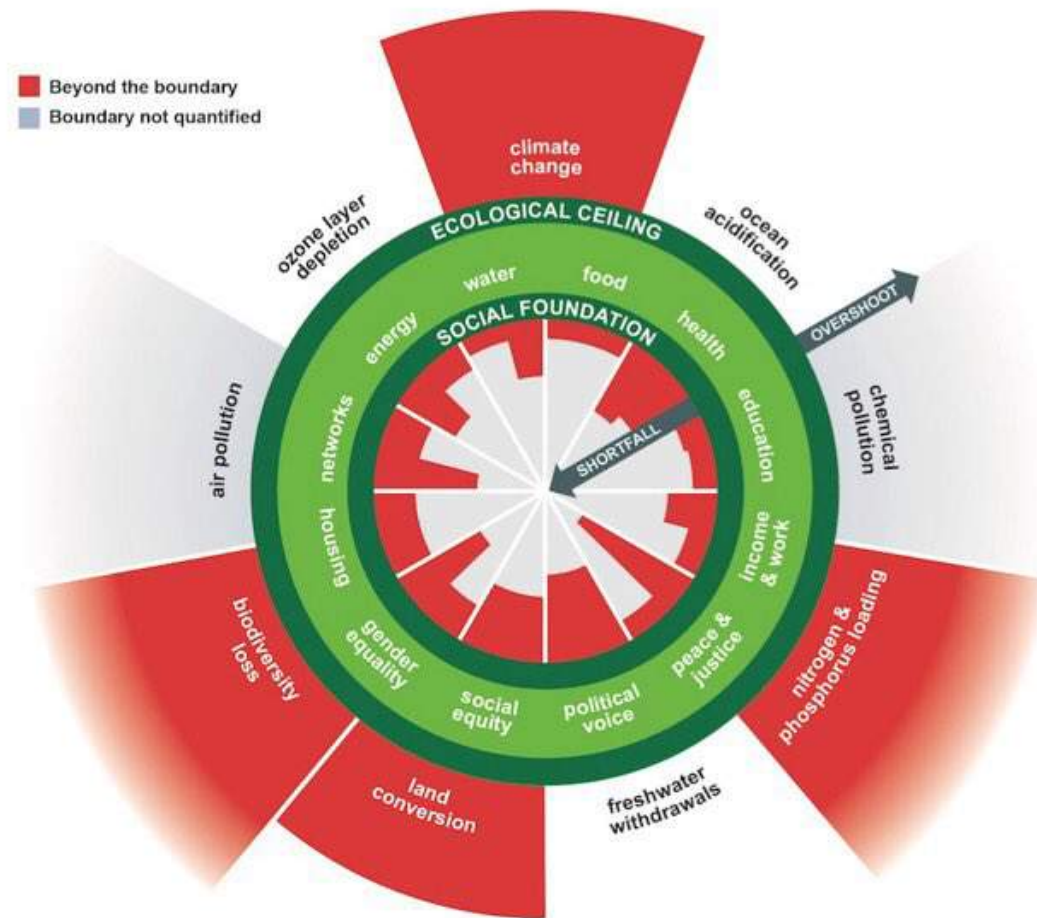
## **IMF Working Paper**

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**How Large Are Global Energy Subsidies?**



# Economics and Finance





**Mindprint**  
learning

# FOOTPRINT



# Psychology & Behaviour

Carbon literacy is the **underpinning knowledge** required to create this vital shift in how we live, work and study. The project is built on the principle that when we are carbon literate will have an instinctive understanding of the carbon impacts of our activities, and be able to make informed choices about the most energy and resource efficient and lowest carbon options available to us.

## Carbon Literacy Project



*"Carbon Literacy is about understanding what I actually need to do, where I can get help to do it, actually doing it and seeing that I've done it."*

# Psychology & Behaviour

A photograph of a man in a red t-shirt with a brain graphic, standing in a living room and gesturing towards a large window. He is addressing a group of people, some of whom are seated in the foreground. The room features a blue ottoman, a potted plant, and framed artwork on the walls. The scene is brightly lit by natural light from the window.

# Psychology & Behaviour

Credit: Green Open Homes

# Changing Values



Credit Muslim Climate Action



**SHARED VALUES FOR THE CITY REGION**

**“What Manchester does today, the world does tomorrow”  
– Disraeli**

Photography courtesy of CityCo

**74%** place greater importance on compassionate values than selfish values



**77%** of people believe that their fellow citizens hold selfish values to be more important, and compassionate values less important, than is actually the case

**This misconception is holding us back from strengthening and celebrating the values that bring us together, rather than those that set us apart.**

A group of diverse people are seated in a room with wood-paneled walls, listening attentively. The scene is captured from a side profile, showing the audience members in a line, some looking towards the right. The lighting is warm and focused on the individuals.

**“There are many solutions,  
but one overarching conclusion:  
we must do this together.”**



# ZERO CARBON

# WALES



13 July  
2017 -  
Bangor

14 July  
2017 -  
Cardiff



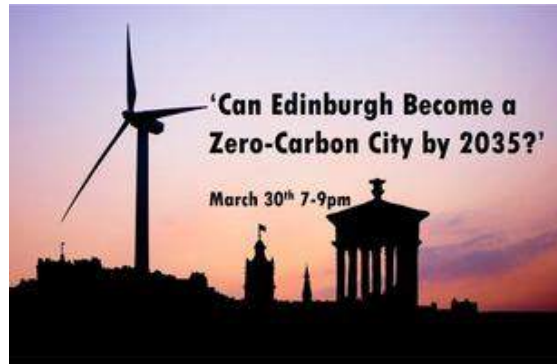
WELCOME TO **CAMBRIDGE**



ZERO CARBON CITY

# ZERO Carbon

(Scotland)



# Zero Carbon Yorkshire



# ZERO CARBON LIVERPOOL 2040

MAKING IT  
HAPPEN

Zero Carbon Liverpool will be  
running two local workshops:



# ZERO CARBON WEDMORE

## Ideas for going forwards ...

1. Detailed action plans for powerdown / power up
2. Making it Happen – explore your local barriers and how can they be overcome?
3. Multi-solving – bridging key silos & building coalition
4. Frome ‘Convergence on Zero’
5. Arts engagement / communication
6. Talanoa Dialogue linking to the global process
7. Zero Carbon Frome ‘*Discovery Trail*’
8. Future visioning workshops
9. Network of zero carbon towns





# Postcard from the Future –

Not a list of '*what it could be like*', or '*should be like*' ...

– but imagine yourselves living a zero carbon culture in 2050.

Actually being in that 'zero carbon world' so many of us are working so very hard to bring to life!

Conversations, your diary, news, blogs, tweets, drawings....

# Re-imagining our Culture ...

- What's for my dinner?
- How did I travel here?
- What's new for me?
- Have you seen my house now?
- What the kids get up to
- What's on at the arts centre?
- The office party
- How it feels to have sorted climate
- Our holiday
- Our allotments
- Time in Nature
- The Frome Bike Belles
- How I spend my leisure time
- The Local Council
- Thinking back on fossil days
- Stopping Shopping

# **ZCB Discovery Trail**

What contribution can different actions or technologies make towards getting us to zero?



Trail

ZERO  
CARBON  
BRITAIN

Llwybr



# Discovery Trail Y Llwybr Darganfod

**ZERO  
CARBON  
BRITAIN**



## Welcome

## Croeso

### What is Zero Carbon Britain?

Zero Carbon Britain is a country much like ours but one that emits no more greenhouse gases than its land can absorb. The things we do today, like living in warm homes, travelling and making things, still happen in Zero Carbon Britain, but in ways that don't produce any greenhouse gases.

Zero Carbon Britain is in the future but not too far away -- we could get there in around 20 years.

#### Why do we need it?

Greenhouse gases are building up in our atmosphere and are causing climate change. We've already warmed the planet by nearly 1°C. If we keep emitting we'll warm it by many degrees. The first effects of climate change, like storms, flooding, drought and heat waves are already being felt. They will only get more extreme.

#### How do we get there?

That's what this discovery trail is all about. Follow the trail and you'll discover the changes and technologies we will need to get to Zero Carbon Britain.

You'll learn how we can:

- Power Down – reduce our energy demand by using energy more efficiently
- Power Up – supply all the energy we need from renewable sources
- Change our food and diets to a healthier, lower-carbon alternative
- Increase the carbon stored in our soils, woodlands and buildings

### Beth yw'r Brydain Ddi-garbon?

Gwlad ddigon tebyg i'n gwlad ni yw'r Brydain Ddi-garbon, ond gwlad nad yw'n allyrru mwy o nwyon tŷ gwydr nag y gall ei dir eu hamsugno. Bydd y pethau rydyn ni'n eu gwneud heddiw, fel byw mewn tai cynnes, teithio a gwneud pethau, yn digwydd yr un fath, ond mewn ffyrdd sydd ddim yn cynhyrchu unrhyw nwyon tŷ gwydr.

Yn y dyfodol y mae'r Brydain Ddi-garbon, ond heb fod yn rhy bell – gallen ni ei chyrraedd o fewn tua 20 mlynedd.

#### Pam mae ei hangen arnon ni?

Mae nwyon tŷ gwydr yn cynyddu yn ein hatmosffer ac yn achosi newid yn yr hinsawdd. Rydyn ni eisoes wedi cynhesu'r blaned bron 1°C. Os daliwn ati, bydd y tymheredd yn codi o'n dipyn yn fwy. Mae effeithiau cynta newid yn yr hinsawdd, fel stormydd, llifogydd, sychdwr a thywydd poeth eisoes gyda ni. Dim ond mynd yn fwy eithafol y byddan nhw.

#### Sut mae ei chyrraedd?

Dyna holl bwmpas y llwybr darganfod yma. Dilynwch y llwybr a byddwch yn darganfod y newidiadau a'r technolegau fydd eu hangen i gyrraedd y Brydain Ddi-garbon.

Byddwch yn dysgu sut gallwn ni:

- Bweru i lawr – lleihau ein galw am ynni drwy'i ddefnyddio'n fwy effeithiol
- Pweru i fyny – cyflenwi'r holl ynni sydd ei angen o ffynonellau adnewyddadwy
- Newid ein bwyd a'n deietau i fwyta pethau sy'n iachach ac yn is eu carbon
- Cynyddu'r carbon a gedwir yn y pridd, ein coetiroedd a'n hadeiladau

### Discovery Trail game: Getting to Zero

Can you find all the changes and technologies we need to reduce emissions to zero?

On your game sheet you'll see circles. These show Britain's current greenhouse gas emissions – 650 million tonnes per year!

Each trail point will tell you about a change or technology and will show you how many circles of greenhouse gas emissions it could prevent - write this number on your gamesheet in the box next to the trail point symbol and cross off that many circles of greenhouse gas. Find all the trail points and get to zero!

### Gêm y Llwybr Darganfod: Cyrraedd Sero

A allwch gael hyd i'r holl newidiadau a thechnolegau sydd eu hangen i leihau allyriadau i sero?

Ar daflen eich gêm, mi welwch chi gylchoedd. Mae'r rhain yn dangos allyriadau nwy tŷ gwydr presennol Prydain – 650 miliwn o dunelli'r flwyddyn!

Bydd pob pwynt ar y llwybr yn sôn wrthoch chi am newid neu dechnoleg gan ddangos i chi sawl cylch allyriadau nwy tŷ gwydr y gallai ei atal – nodwch y rhif hwn ar eich taflen yn y blwch nesa at symbol y pwynt ar y llwybr a dileu cynifer â hynny o gylchoedd nwy tŷ gwydr. Dewch o hyd i'r holl bwntiau ar y llwybr a chyrraedd sero!





**POWER DOWN  
PWERU I LAWYR**

# Energy-efficient new buildings

## Adeiladau newydd sy'n arbed ynni



Highly energy-efficient new buildings use just a tenth of the energy for heating, compared to average buildings today.

Built in 1978, the 'Whole Home' was ahead of its time, using super insulation, quadruple glazing, and heat-recovery ventilation. It has performed very well as a low-energy building. Better windows mean modern buildings can make

more use of sunlight for heating and lighting.

The UK constructs a few hundred thousand new buildings each year. These should all be highly energy efficient so that we minimise heating demand in Zero Carbon Britain.

Mae adeiladau newydd sy'n arbed llawer iawn o ynni yn defnyddio degfed ran yn unig o'r ynni a ddefnyddir at wresogi o'u cymharu ag adeiladau cyffredin heddiw.

Wedi'i adeiladu ym 1978, roedd y 'Cartref Cyfan' o flaen ei amser, gan ddefnyddio uwch-inswleiddio, gwydr pedwarplyg ac awyru adfer gwres. Mae wedi perfformio'n dda iawn fel adeilad ynni isel. Mae gwell

fffenestri'n golygu y gall adeiladau modern ddefnyddio heulwen yn fwy at wresogi a goleuo.

Bydd ychydig gannoedd o filoedd o adeiladau newydd yn cael eu codi yn y DU bob blwyddyn. Dylai fod y rhain i gyd yn gallu arbed llawer iawn o ynni fel y gallwn gadw'r galw am wresogi i'r lleia posibl yn y Brydain Ddi-garbon.



# Putting it all together

## Rhoi'r cwbl at ei gilydd



Hopefully you found the trail a fun introduction to the key changes and technologies we'll need to get to Zero Carbon Britain.

Here at CAT we've worked on a series of reports putting all those pieces of the jigsaw together.

Our latest report is *Zero Carbon Britain: Rethinking the Future*. It presents a vision, based on detailed research, of how Zero Carbon Britain could work. It shows how we can get the energy we need at all times from renewable sources, feed ourselves on a healthy, low-carbon diet, and reduce greenhouse-gas emissions to zero.

### How does our Zero Carbon Britain scenario work?

By 'Powering Down' our energy demand, 'Powering Up' our renewable energy resources, changing our diets and managing our land differently, we can provide a reliable energy system, improve our health, and become net-zero carbon.

The flow diagram below shows where our energy comes from and goes to in Zero Carbon Britain. The following displays summarise each part of Zero Carbon Britain.

Gobeithio bod y Bwrth yn gyflwyniad hwylog i chi i'r pŵer newidiadau a thechnolegau a fydd eu hangen i gyrraedd y Brydain Ddi-garbon.

Yna yn CyDA rydyn ni wedi gweithio ar gyfres o adroddiadau sy'n rhoi holl ddiagramau'r jigsaw at ei gilydd.

Ein hadroddiad diweddaraf yw *Zero Carbon Britain: Rethinking the Future*. Mae'n cyflwyno gwledigaeth, seiliedig ar ymchwil fawr ynglyn â sut gallai'r Brydain Ddi-garbon weithio. Mae'n dangos sut gallwn gael yr ynni sydd ei angen drwy'r adag o ifyrnebau adnewyddadwy, twydo ein hunain ar ddelet iach, carbon iel a lleihau allyriadau nwy ty gwyrdd.

### Sut mae ein senario ar gyfer Prydain Ddi-garbon yn gweithio??

Drwy 'Bweru i Lawr' ein galw ar ynni, 'Pweru i Fyny' ein hadnoddau ynni adnewyddadwy, newid ein dietau a rheoli ein tir yn wahanol, gallwn ddarparu system ynni ddibynadwy, gwella ein bieschyd a dod yn hollt ddi-garbon.

Mae'r diagram llif isod yn dangos o ble mae ein hynni'n dod ac i ble mae'n mynd yn y Brydain Ddi-garbon. Mae'r arddangosfeydd canlynol yn crynhoi pob rhan o'r Brydain Ddi-garbon.

