We already have the technology to power the UK with 100% renewable energy, to feed ourselves sustainably and to leave a safe and habitable climate for our children and future generations.

ZERO CARBON BRITAIN

Rethinking the Future

Report in short: a summary of key findings

***Zero Carbon Britain: Rethinking the Future* models a technically robust scenario in which the UK has risen to the challenges of the 21st century.**

Current UK climate change targets do not offer a good enough chance of avoiding what is now considered extremely dangerous climate change.

In contrast, the Zero Carbon Britain (ZCB) scenario demonstrates that we could rapidly reduce UK greenhouse gas (GHG) emissions to net zero by 2030, using only currently available technology.

We can do this whilst maintaining a modern standard of living, as well as:

- Creating 1.5 million new jobs in the UK.
- Increasing our resilience to climate impacts we are already experiencing.
- Helping address other environmental issues such as loss of biodiversity.
- Fostering a society in which we are happier and healthier.

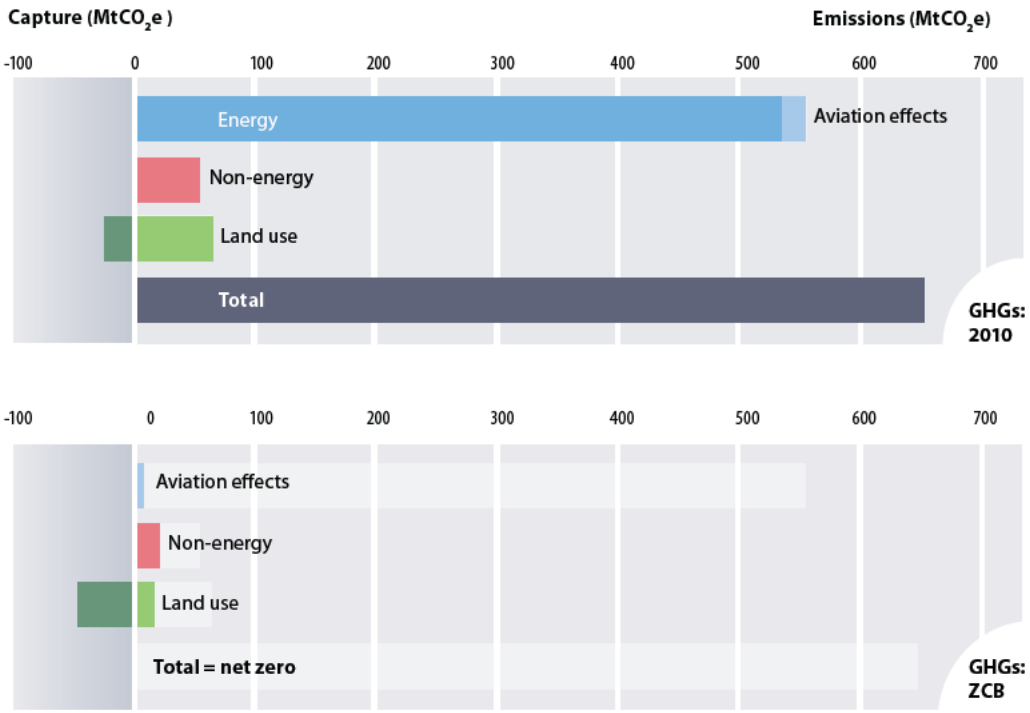
The aim of the Zero Carbon Britain project is to demonstrate that integrated and technically feasible solutions to the climate problem do exist, to inspire action towards a positive zero carbon future.

***Zero Carbon Britain: Rethinking the Future* (the full report) can be download for free at www.zerocarbonbritain.org, or bought online from the Centre for Alternative Technology Eco Store.**

How would a zero carbon Britain work?

Reducing our energy demand by 60%, using our renewable energy resources instead of fossil fuels and making changes to our agricultural system and diets would reduce the UK's annual GHG emissions by 94%.

We could balance out the remaining 6% of emissions from non-energy processes (such as cement production or methane from livestock) by removing greenhouse gases from the atmosphere through carbon capture from forests and restored peatlands. This would take us to zero emissions overall.

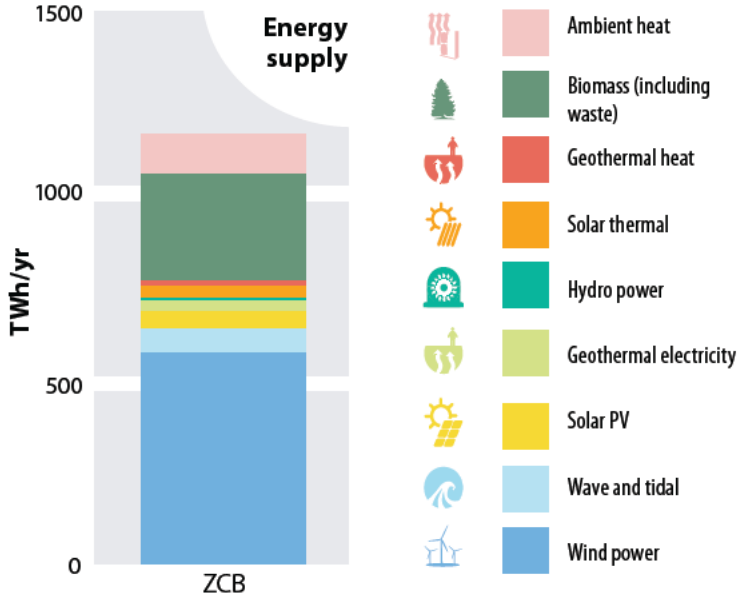


UK Greenhouse gas emissions in 2010 (top) compared to our Zero Carbon Britain scenario (bottom), including carbon captured, international aviation and shipping, and the enhanced effect of emissions from aviation.

Powering up renewable energy

It is possible to meet 100% of the UK's energy demand with renewable and carbon neutral energy sources; without fossil fuels and without nuclear. In the ZCB energy scenario:

- Many different renewable energy sources suited to the UK – solar, geothermal, hydro, tidal and others – are used to produce electricity and heat.
- Wind energy – both onshore and offshore – plays a central role, providing around half of the energy supply.
- Most of the energy in this ZCB scenario (about 60%) is produced in the form of electricity.
- Carbon neutral synthetic fuels play an important role where it is not possible to use electricity – for example in some areas of industry and transport – and as back up for our energy system.



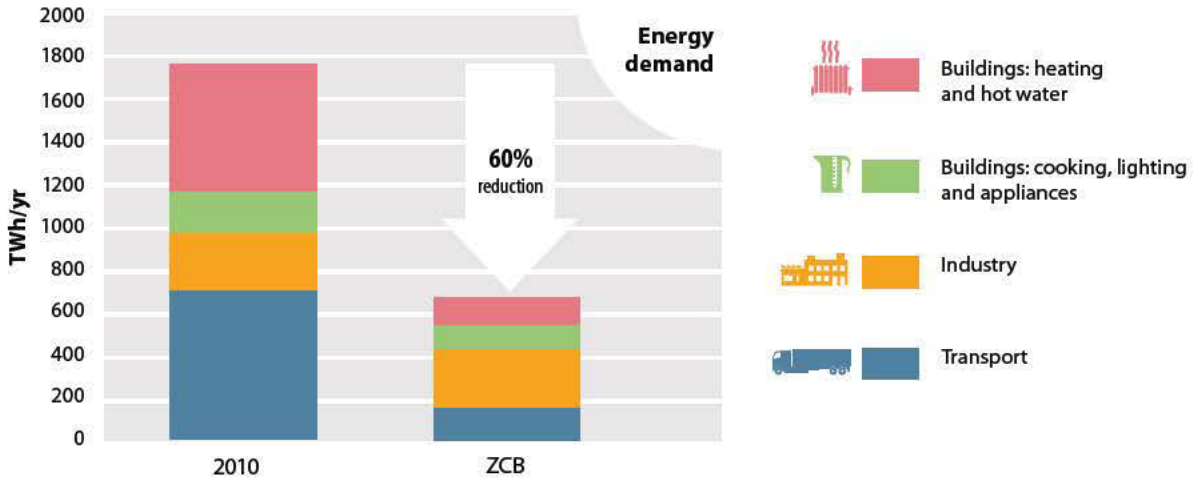
Energy mix in our scenario – the amount of energy supplied by each renewable source.

Powering down our energy demand

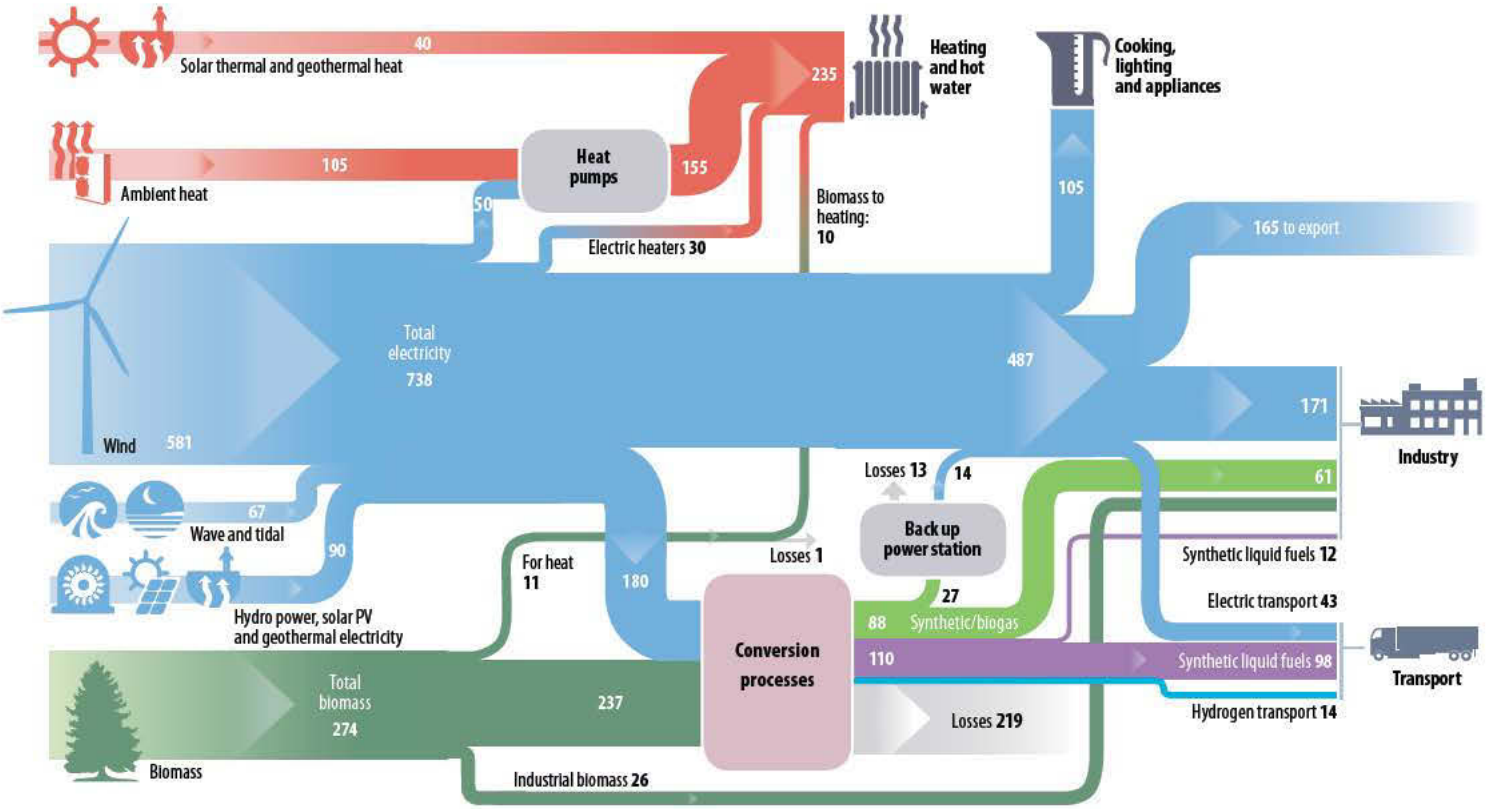
ZCB's research shows that we could reduce our energy demand by around 60%, with particularly large savings in heating buildings and transport.

- **Buildings:** having high 'Passivhaus' standards for new buildings, retrofitting all existing buildings, and improving internal temperature control would reduce energy demand for heating by around 50%.
- **Transport:** reducing how much we travel, and how we travel – with more walking, cycling, use of public transport, switching to efficient electric vehicles and two thirds less flying – would reduce energy demand for transport by 78%.


James D. Schwartz



Total annual energy demand by sector in the UK in 2010 and in our scenario in terawatt-hours per year (TWh/yr).



Energy flows in our scenario – from supply to demand (figures are in TWh/yr).


Bob Jagendorf

Balancing supply and demand

The important question for a 100% renewable energy system is not if we can produce enough energy, but whether we can produce enough energy **at all times** – even when the wind isn't blowing, the sun isn't shining and our energy demand is high.

Hourly modelling of the renewables mix in the ZCB scenario shows that we would produce a surplus of energy 82% of the time. We ensure there is enough energy the rest of the time by:

- Shifting energy demand using 'smart' appliances and using batteries, pumped storage, heat storage and hydrogen for short-term energy storage over hours or days.
- Using carbon neutral synthetic gas (which can be dispatched quickly when we need it) for long-term energy storage over weeks or months.

This research suggests that 'baseload' power that usually provides a continuous supply of electricity, and can only respond slowly (nuclear, for example) doesn't work well with a highly variable energy system, and leads to further overproduction when renewables already exceed demand.

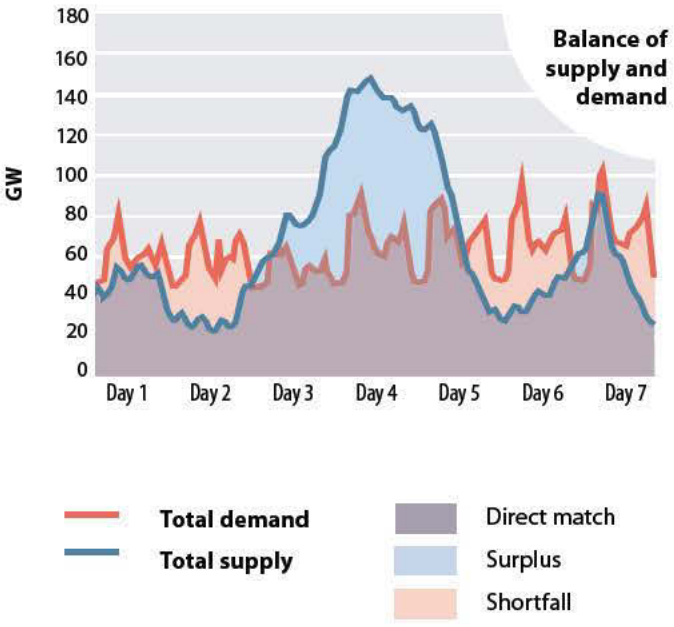
Carbon neutral synthetic fuels

Synthetic fuels have the same chemical make up as fossil fuel oil and gas, but can be created by combining hydrogen (produced using renewable electricity during times of surplus) with carbon from sustainable UK grown biomass, making them carbon neutral.

New research: ZCB hourly energy model

The ZCB energy model is one of the most detailed studies into balancing demand and supply in a renewable energy system done to date.

It uses hourly weather data (sunlight, wind speeds, temperatures etc.) over a ten year period between 2002 and 2012 – a total of almost 88,000 hours – to test renewable energy mixes under real life conditions.



Example of seven days (13th-19th December 2010) from the hourly energy model, showing electricity demand and supply (in gigawatts (GW)); highlighting times of surplus and times of shortfall, before measures to manage variability are implemented.

A healthy low carbon diet

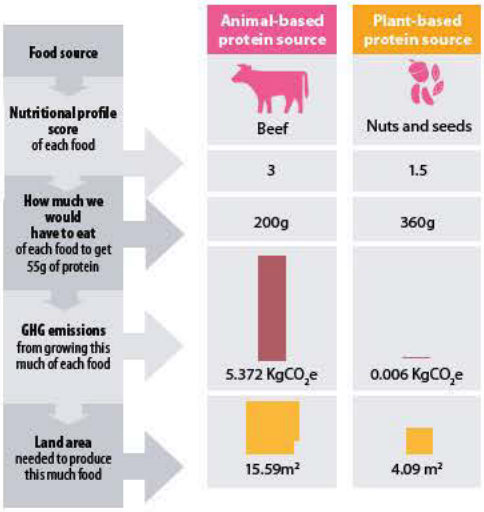
ZCB's research shows that through dietary change, food waste reduction and improved agricultural practices we could provide a healthy, sustainable diet for the whole UK population. These changes would mean that:

- GHG emissions from agriculture would be reduced by 75%.
- 85% of our food would be produced in the UK, reducing our impact overseas.
- Our health would be improved by eating a better and more balanced diet.
- 75% of the land currently used for grazing livestock could be repurposed.

The dietary change modelled contains significantly less protein from meat and dairy (which have high GHG emissions and use a lot of land) and more from plant sources like beans, nuts, cereals and vegetables.

New research: ZCB food and diets model

The ZCB food and diets model combines data describing the nutritional qualities of the foods we eat, their land requirements, and the GHGs emitted in producing them. This model can then be used to monitor the impacts of dietary change.

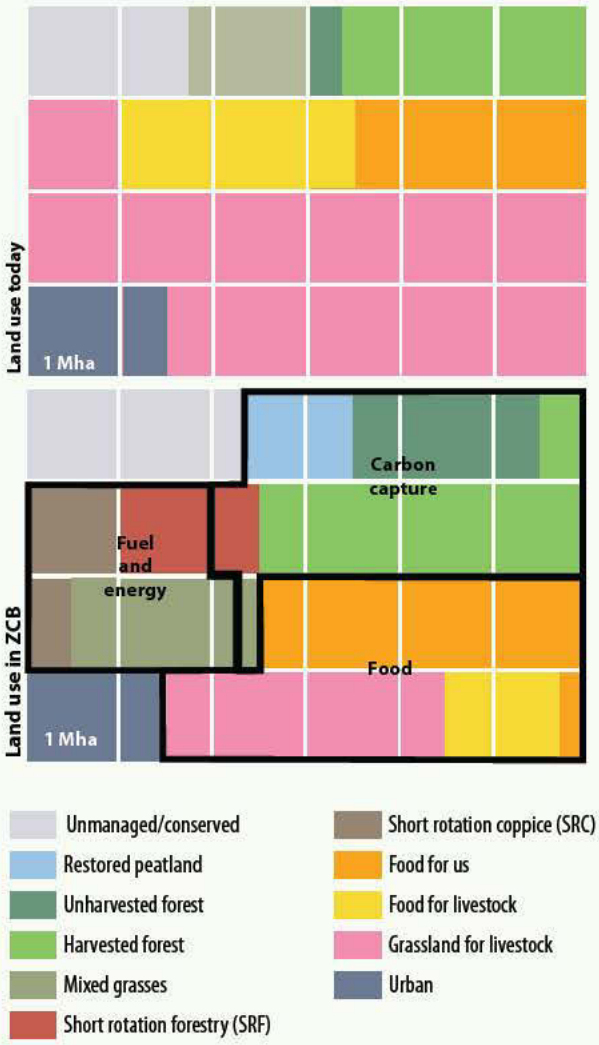


Example of two high protein foods from the ZCB food and diets model: their nutritional scores (negative values are best), their GHG emissions (in kilograms carbon dioxide equivalent ($KgCO_2e$)), and the land required to produce them.

Diversifying our land use

Making changes to our food systems would mean that we have enough land in the UK, not only for producing food, but for:

- Sustainably growing all the biomass required to support our energy system.
- Doubling forest area to 24% of the land area of the UK, and restoring 50% of UK peatlands to capture carbon.
- Providing more room for biodiversity in wild, conserved or protected areas.



Approximate land use today and in ZCB in million hectares (Mha). Areas dedicated to providing food, biomass for fuel and energy, and carbon capture are shown in our scenario.

Joanna Wright

New skills for a new future

Innovative postgraduate programmes

MSc Sustainability and Adaptation in the Built Environment

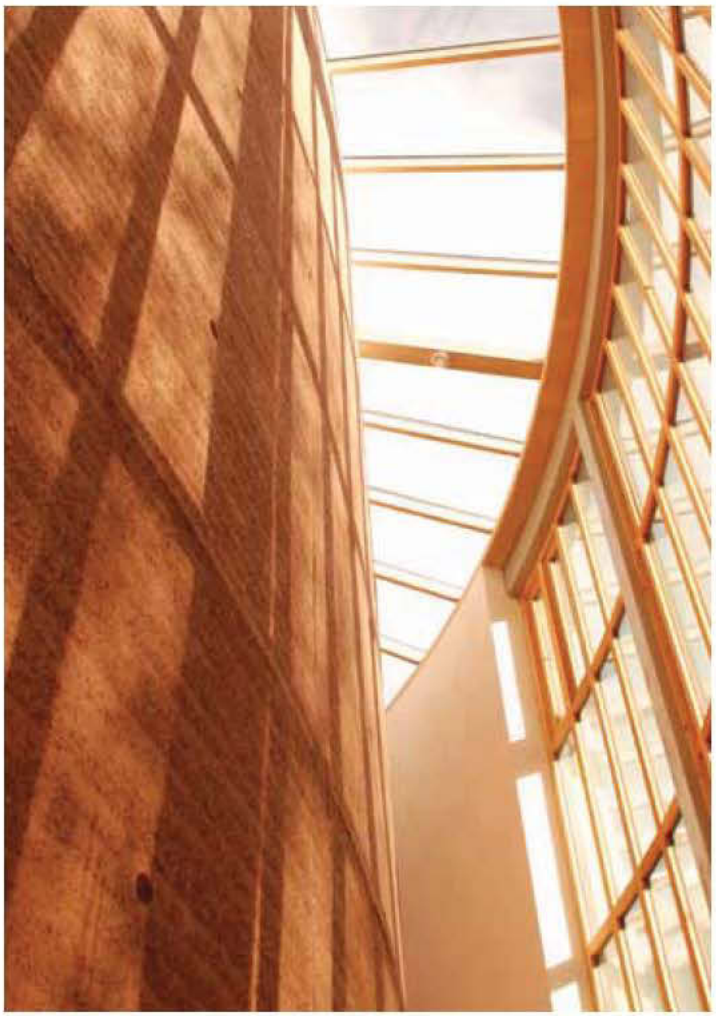
MSc Sustainability and Adaptation: Transformation Planning

MSc Renewable Energy and the Built Environment

Professional Diploma in Architecture: Advanced Environmental and Energy Studies

Graduate school of the Environment

http://gse.cat.org.uk



Centre for Alternative Technology

Zero Carbon Britain (ZCB) is an initiative from the Centre for Alternative Technology (CAT). Established over 40 years ago, CAT is a leading research and educational charity which demonstrates practical solutions for sustainability.

CAT offers a wide range of practical and academic courses up to postgraduate level and a unique range of educational services for school groups, universities and educators. CAT also offers a free information service, backed by consultancy advice, and has published a wide range of books on sustainable living.

CAT's award winning educational facility – the Wales Institute for Sustainable Education (WISE) – and visitor centre are based in Machynlleth, mid-Wales.

www.zerocarbonbritain.org
www.cat.org.uk
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