ZCB and the CCC: how the models measure up

How does CAT's Zero Carbon Britain scenario compare to other models for getting to net zero? **Philip James** compares the key changes, choices and technologies from Zero Carbon Britain with the Committee on Climate Change's 'Further Ambition' scenario.

Issue	CAT's Zero Carbon Britain	CCC's Further Ambition
Target date for a net zero greenhouse gas UK	• 2030, or as soon as possible thereafter	• 2050
Electricity generation	• 790 TWh/year • 100% renewable energy, biogas/synthetic methane power stations provide backup (which meets 2% of demand)	• 645 TWh/year • Renewables (59%), nuclear (11%), bioenergy with Carbon Capture and Storage (BECCS) (6%), natural gas with CCS (23%), backup provided by hydrogen/ammonia produced from methane reforming with CCS (1%)
Electricity use	• 578 TWh/year	• 594 TWh/year
Bioenergy	• 230 TWh/year, all from UK energy crops or waste. Some used in buildings and industry but most used for synthetic methane and synthetic liquid fuel production.	• 200 TWh/year (of which 17% is imported). Over 85% is used with BECCS, either in power generation or biofuel production, generating negative emissions.
Hydrogen	• 100 TWh/year, produced by electrolysis. Used mainly for synthetic methane and liquid fuels, small amount used in transport (10 TWh).	• 270 TWh/year, produced by methane reforming with CCS and a limited role for electrolysis. Used mainly in shipping (70 TWh), industry (120 TWh), HGVs and buses (25 TWh) and heating in buildings at times of peak demand (53 TWh).
Buildings	• Around 50% reduction in heating demand. • Buildings mainly heated with heat pumps, some biomass, direct electric, solar thermal and geothermal where feasible.	• Around 25% reduction in heating demand. • Majority of homes heated with heat pumps, some with hybrid systems using hydrogen or biogas for heating at times of peak demand. Hydrogen boilers also considered.
Industry	• High levels of electrification. Some solid biomass, biogas/synthetic methane and synthetic liquid fuel.	• High levels of hydrogen, as well as electrification, solid biomass, biomethane, and CCS for industry with high process emissions.
Transport	• Switching to walking, cycling and public transport reduces car mileage by a third. • Cars, vans and trains nearly all electric. • HGVs and ships run on mixture of electric, synthetic liquid fuel and some hydrogen. • Significant (two-thirds) reduction in aviation. Planes fuelled with synthetic liquid fuel.	• Switching to walking, cycling and public transport reduces car mileage by 10%. • Cars, vans nearly all electric. Trains, HGVs and ships are electric and hydrogen/ammonia. • Growth in aviation is 'constrained' by limiting demand growth to 60% above 2005 levels. • Biofuels meet 10% of energy demand.
Agriculture and land use	• Emissions reduced to 20 $MtCO_2e$. • Over 90% reduction in beef and lamb. • Food waste halved. • Around half of agricultural land freed up for other uses. • Woodland area increases to 24% of UK land. Around 1 million hectares of peatland restored.	• Emissions reduced to 26 $MtCO_2e$. • A 20% reduction in the consumption of beef, lamb and dairy by 2050. • 20% reduction in food waste. • A fifth of agricultural land freed up for other use. • Woodland area increases to 17% of UK land. Around 1 million hectares of peatland restored.
Net emissions balance	• The equivalent of 47 $MtCO_2e$/year of residual emissions remain from industrial processes, waste, agriculture/land use and aviation impacts. These are fully offset by an equivalent amount of negative emissions from natural climate solutions including increased forests, timber products, peatland restoration and biochar.	• Around 90 $MtCO_2e$/year of residual emissions remain from fossil fuel use - particularly in aviation, industrial processes, waste and agriculture/land use. 55 $MtCO_2e$/year of negative emission are generated, mainly from BECCS. This leaves 35 $MtCO_2e$/year of remaining emissions. The CCC identifies further 'speculative measures' to bridge the gap to net zero. These include further dietary change and greater reductions in aviation.

Key: TWh = terawatt-hours / $MtCO_2e$ = million tonnes of carbon dioxide equivalent / CCS = Carbon Capture and Storage