

07 May 2019

## Net Zero

The UK's contribution to stopping global warming



### Summary recommendations

- The UK should legislate as soon as possible to reach net-zero greenhouse gas emissions by 2050. The target can be
  legislated as a 100% reduction in greenhouse gases (GHGs) from 1990 using the existing Climate Change Act procedures.
- The target should cover all sectors of the economy, including international aviation and shipping.
- The aim should be to meet the target through UK domestic effort, without relying on international carbon units (or 'credits').
- Now is the right time to set a net zero target. It is technically possible, based on current consumer behaviours and known technologies, with prudent assumptions over cost reduction.
- An earlier date should not be set at this stage. Some sectors could reach net zero earlier, but for most sectors 2050
  appears to be the earliest credible date, to give time to develop speculative options as alternatives for any shortfalls.
  Avoiding the need for early capital scrappage or punitive policies.
- The target is an appropriate contribution to the Paris Agreement. The UK can benefit from the international influence
  of setting a bolder target, using it as an opportunity for further positive international collaboration.
- Wales should set a target for a 95% reduction in emissions by 2050 relative to 1990. Wales has less opportunity for CO<sub>2</sub> storage and relatively high agricultural emissions that are hard to reduce. On current understanding it could not credibly reach net-zero GHGs by 2050.
- Scotland should aim for net-zero greenhouse gas emissions by 2045. Scotland has proportionately greater potential
  for emissions removal than the UK overall and can credibly adopt a more ambitious target. Interim targets should be set
  for Scottish emissions reductions (relative to 1990) of 70% by 2030 and 90% by 2040.



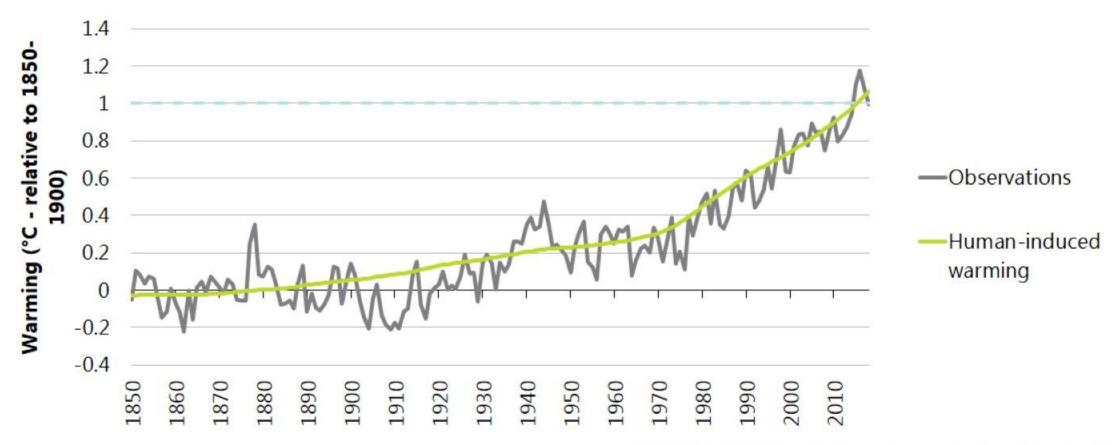
### Summary recommendations

#### Net zero target is only credible if policy to reduce emissions ramps up significantly

- The target can only be delivered with a strengthening of policy to deliver emissions reductions across all levels and departments of government. This will require strong leadership at the heart of Government. Delivery must progress with far greater urgency.
- Policies must be designed with businesses and consumers in mind. They must be stable, long-term and investable. The
  public must be engaged, and other key barriers such as low availability of necessary skills must be addressed.
- Report emphasises previous CCC recommendations for: Heating buildings; CCS; Electric vehicles; Agriculture; Waste;
   Low Carbon Power.
- With new recommendations for stronger approaches to: Industry; land use; HGVs; aviation and shipping; and GHG removals.
- Overall costs are manageable, but must be fairly distributed. Rapid cost reductions during mass deployment for key technologies mean that net zero can be met an annual resource cost of up to 1-2% of GDP to 2050, the same cost as the previous expectation for an 80% reduction from 1990.
- HM Treasury should undertake a review of how the transition will be funded and where the costs will fall. It should
  develop a strategy to ensure this is, and is perceived to be, fair. A broader strategy will also be needed to ensure a 'just
  transition' across society, with vulnerable workers and consumers protected.



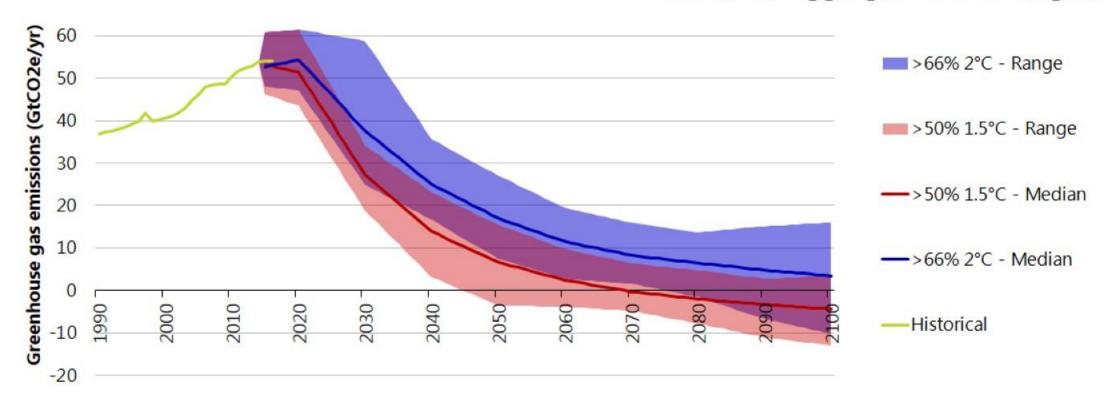
### Observed and human-induced warming



**Source**: HadCRUT4, NOAA, NASA and Cowtan & Way datasets; IPCC (2018) Chapter 1 - Framing and Context.

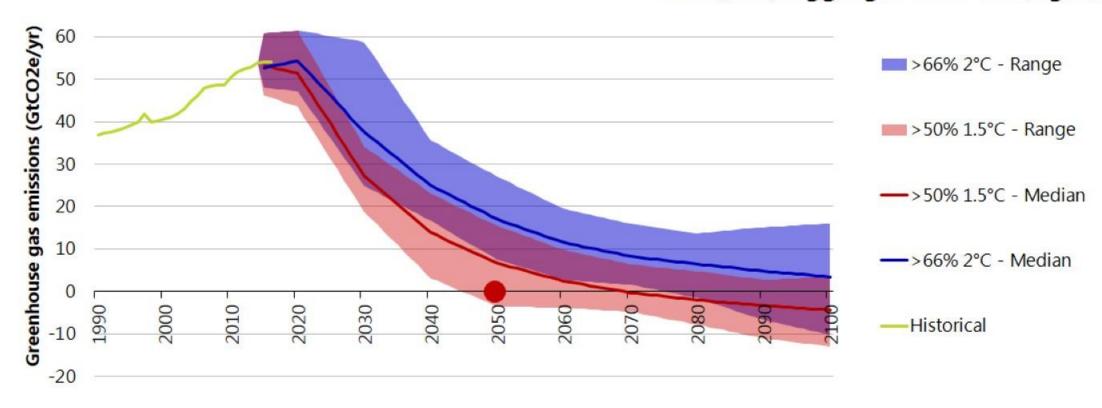


## Global emissions pathways consistent with Paris CO2 (left) Aggregated GHGs (right)



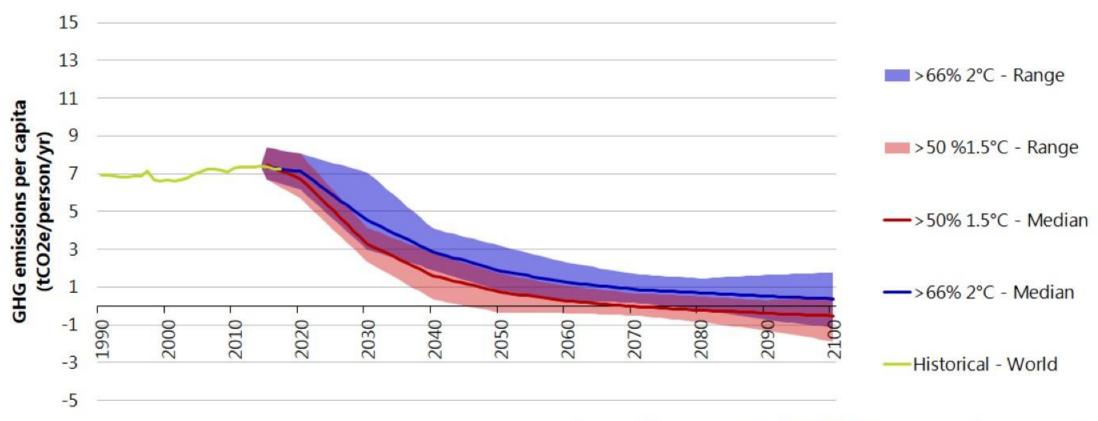


## Global emissions pathways consistent with Paris CO2 (left) Aggregated GHGs (right)



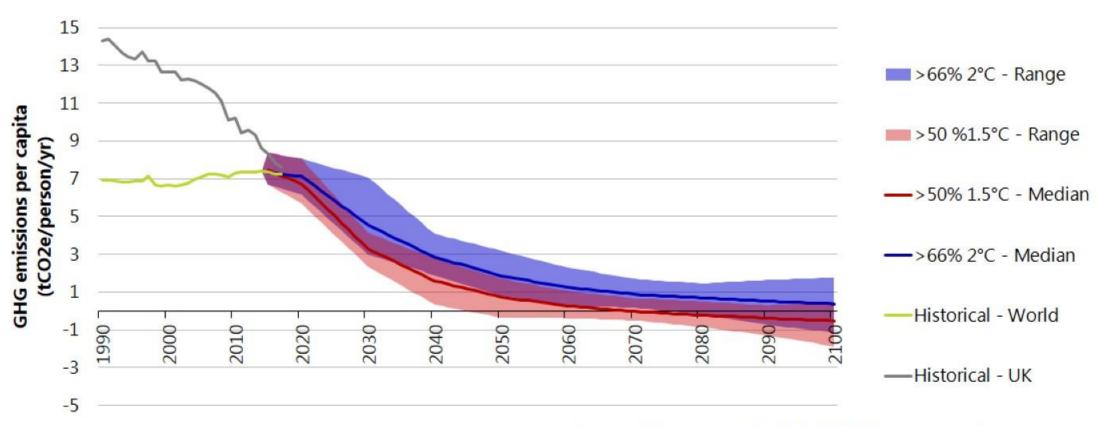


### Evolution of global per capita emissions over time





#### Evolution of global per capita emissions over time





## Science and international context Supporting increased global ambition

	Net-zero: CO₂ or GHGs	Date to achieve target by	Formality	International offsetting?	International aviation & shipping?
Proposed UK target	GHGs	2050	To be legislated in Climate Change Act		
Net-zero targets un	der considerat	ion			
European Union	GHGs	2050	Proposed by European Commission		
France	GHGs	2050	Bill - not yet legislated		
New Zealand	To decide	2050	Bill - currently being drafted		



## Science and international context Supporting increased global ambition

	Net-zero: CO₂ or GHGs	Date to achieve target by	Formality	International offsetting?	International aviation & shipping?
Net-zero targets tha	at have been a	dopted			
California	Unclear	2045	Executive Order		
Sweden	GHGs	2045	Legislation		
Denmark	Unclear	2050	Legislation		
Norway	GHGs	2030	Binding Agreement		



### Reaching net-zero emissions in the UK How UK net-zero scenarios can be delivered

	2020s	2030s	2040s
Electricity	Largely decarbonise electricity: renewables, flexibility, coal phase-out	Expand electricity system, dec generation (e.g. using hydrogen	100 M
Hydrogen	Start large-scale hydrogen production with CCS	Widespread deployment in industry, us heavier vehicles (e.g. HGVs, trains) and po	
Buildings	Efficiency, heat networks, heat pumps (new-build, off-gas, hybrids)	Widespread electrification, gas grids potentially s	
Road Transport	Ramp up EV market, decisions on HGVs	Turn over fleets to zero-emission ve	ehicles, cars & vans before HGVs
Industry	Initial CCS clusters, energy & resource efficiency	Further CCS, wide hydrogen, some	
Land Use		Afforestation, peatland restoration	
Agriculture	Healthier diets, re	educed food waste, tree growing and efficiency	y on farms



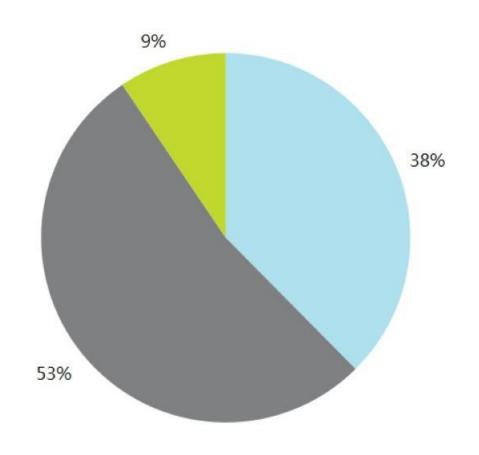
### Reaching net-zero emissions in the UK How UK net-zero scenarios can be delivered

2030s 2020s 2040s Aviation Operational measures, new plane efficiency, constrained demand growth, limited sustainable biofuels Shipping Operational measures, new ship fuel efficiency, use of ammonia Limit emissions from combustion of non-bio Reduce waste, landfill ban for Waste wastes (e.g. some use of CCS) biodegradable waste F-Gases Move almost completely away from F-gases Deployment of BECCS in various forms, demonstrate direct Removals Develop options & policy framework air capture of CO<sub>2</sub>, other removals depending on progress Industrial CCS clusters, decisions on gas Hydrogen supply for industry & potentially buildings, roll-out of infrastructure for Infragrid & HGV infrastructure, expand vehicle hydrogen/electric HGVs, more CCS infrastructure, electricity network expansion structure charging & electricity grids Health benefits due to improved air quality, healthier diets and more walking & cycling Co-benefits Clean growth and industrial opportunities



## Reaching net-zero emissions in the UK Scenarios to reduce UK emissions to net-zero

### Role of societal and behavioural changes



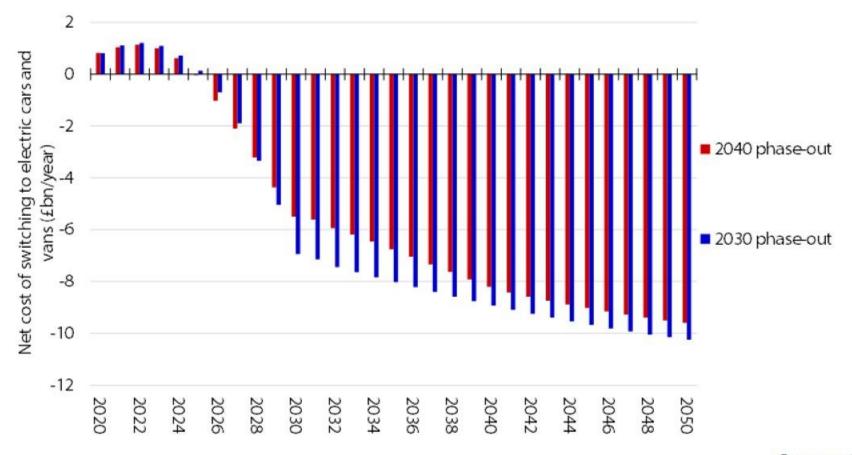
- Low-carbon technologies or fuels not societal / behavioural changes
- Measures with a combination of lowcarbon technologies and societal / behavioural changes
- Largely societal or behavioural changes

Source: CCC analysis



# Reaching net-zero emissions in the UK Costs and benefits of meeting a UK net-zero target

### A 2030 switchover to electric vehicles would save more money than a 2040 switchover



Source: CCC analysis



# Reaching net-zero emissions in the UK Costs and benefits of meeting a UK net-zero target

#### The impact of innovation on the costs of achieving carbon targets

 Overall, innovation and falling technology costs mean that we now estimate that the UK's 80% emissions target could be met at a lower cost than we estimated in 2008 – under 1% of GDP in 2050, rather than 1-2% of GDP.

GHG emissions reduction target (relative to 1990)	Year and report	Cost range estimated for 2050	
60% reduction in CO₂ (~55% reduction in GHG)	2003 - Energy White Paper	0.5-2.0% of GDP	
80% reduction in GHG	2008 - Building a low-carbon economy – the UK's contribution to tackling climate change	1-2% of GDP	
100% reduction in GHG	2019 - this report	1-2% of GDP	



### Summary recommendation

#### Science and International context

- Global 2050 emissions aligned to the Paris Agreement: ~1 tCO2e for 1.5C; ~2 tCO2e for well below 2C
- The UK can and should go further than the world's average
- Other climate leaders are aiming for net-zero GHG emissions by 2050 or before

#### Reaching net-zero emissions in the UK

- Credible scenarios can reduce UK GHG emissions to net-zero by 2050
- The foundations for the change are in place, but a major ramp-up and acceleration in policy effort is required
- Expected cost of a net-zero target is the same as the cost accepted by Parliament when the existing 80% target was set





#### UK should target net-zero GHG emissions by 2050

Backed by significant policy strengthening
HM Treasury should review where the costs of the transition fall



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