FES: Bridging the gap to Net Zero

Bio resources in a net zero world

26 November 2019

The Conduit, London

nationalgridESO

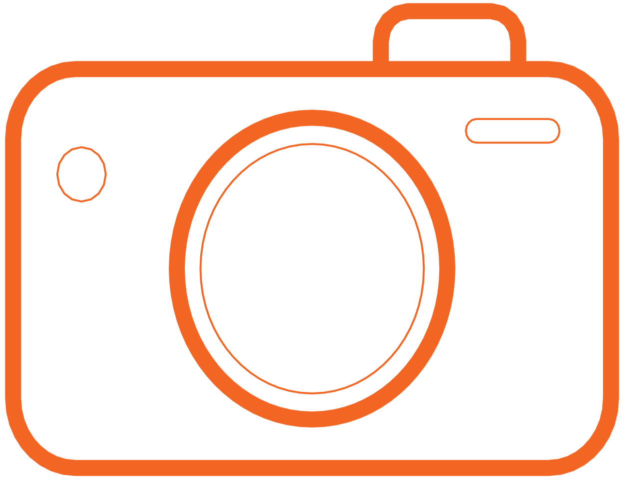
Welcome

Mark Herring

Senior Strategy Manager

nationalgridESO

Housekeeping



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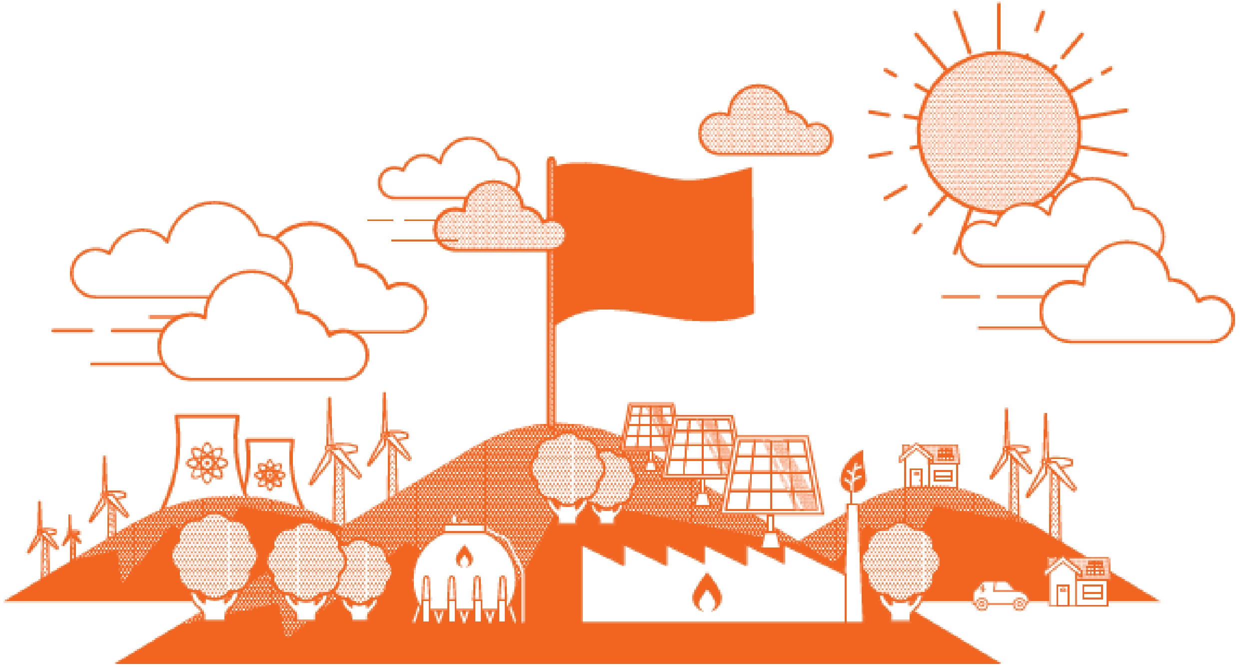
National Grid ESO – who are we?

Our mission:

We enable the transformation to a sustainable energy system and ensure the delivery of reliable affordable energy for all consumers



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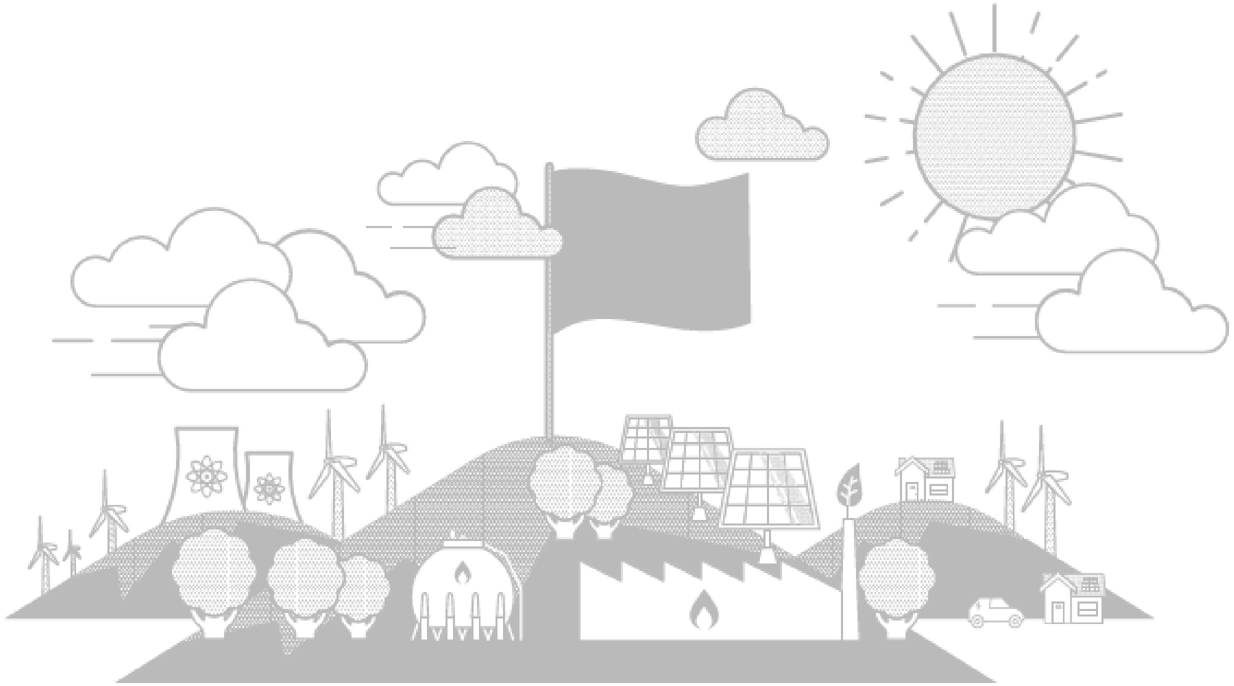

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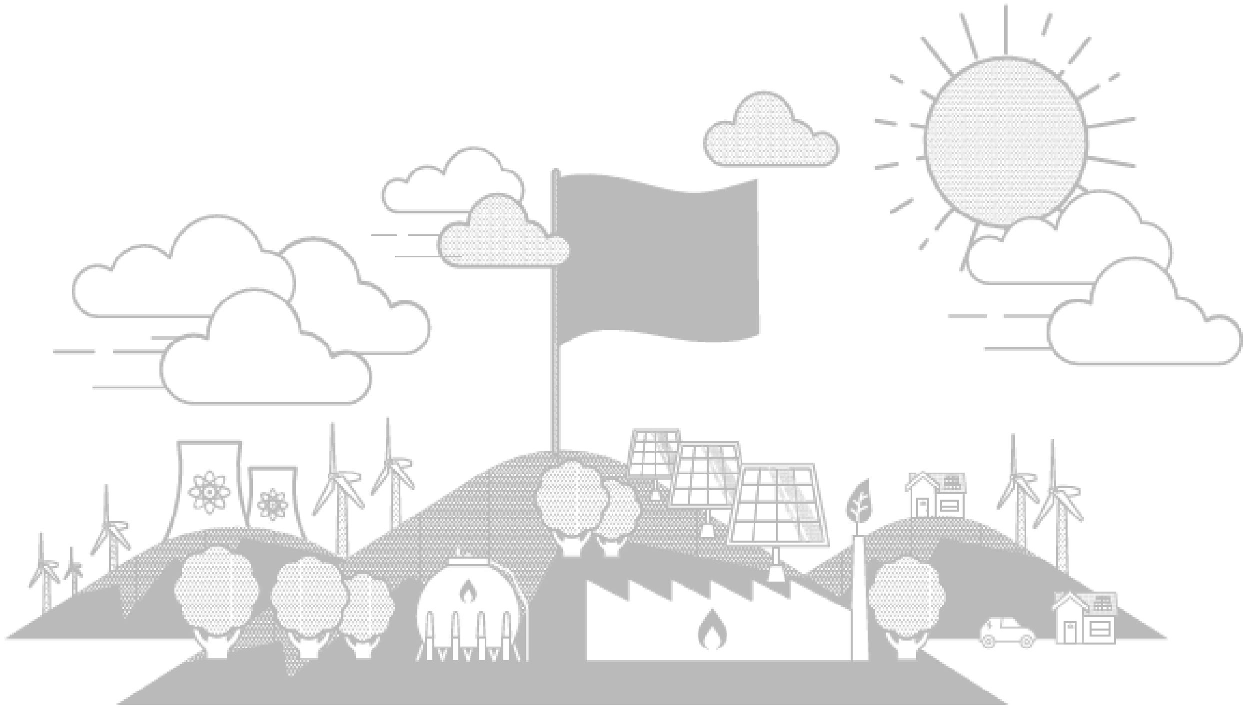

National Grid ESO – who are we?

- Thinking beyond the electricity and energy sectors to meet the challenge of net zero
- Trusted partner to industry and government

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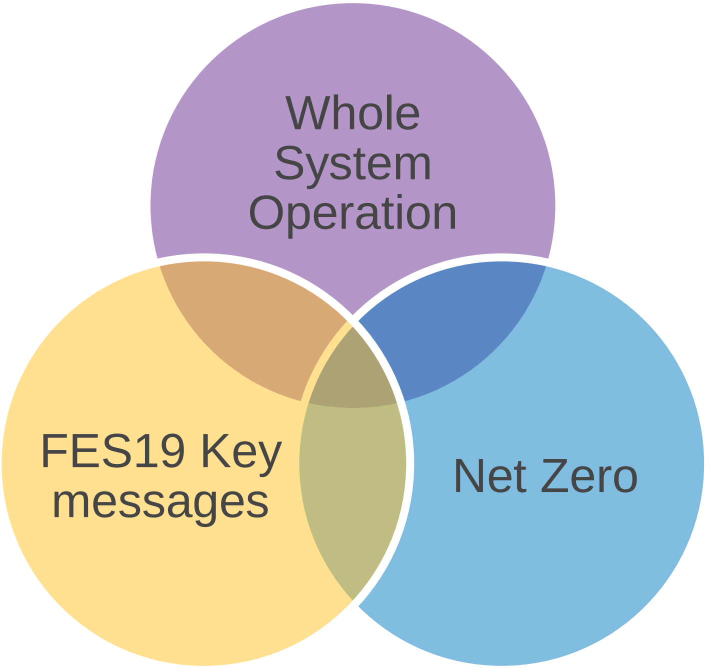
FES: Bridging the gap to net zero

- Our Future Energy Scenarios (FES):
  - explore what *could* happen in the next 30 years
  - are used by thousands of readers across industry and govt
- The new net zero target in GB requires wholesale change across society
- So we now want to consider - **what *should* happen if we are to meet net zero?**
- Collectively moving the conversation across industry and government forward



What will the *FES: Bridging* programme look like?

Our Future Energy Scenarios look at emissions across all areas of society, with detailed modelling of energy use in the power, heat and transport sectors.

FES: Bridging the gap to net zero looks at uncertainties from FES 2019 in more depth, each focussing on 1-2 of the FES 19 key messages. This year we will be looking at:

- Bioresources in a net zero world (key messages 1 and 4) – ***Today!***
- How electric vehicles can facilitate renewable growth (key message 2) - *December*
- Managing peak heat demand (key message 3) – *January*

Conclusions published in a summary report in Spring 2020

Where appropriate, findings will support FES 2020 analysis, to be published next July.

Co-led with **independent chair and guest editor (Laura Sandys)**, and working with partners to broaden the range of perspectives.

Introducing today's workshop

Laura Sandys

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Today

9.50am	**Setting the scene** Current work considering bio resources in a net zero world: *Committee on Climate Change, Renewable Energy Association, Navigant*
10.20am	**Bioresources across the value chain** Feedstock, processing and end use of bio resources - Certainty and divergence - Challenges, trade offs and opportunities
11.20 am	*Refreshment break*
11.40 am	**Bridging the gap to net zero:** For areas of uncertainty and consensus - what are the **next steps** required?
12.40 pm (approx.)	**Summary and close, followed by lunch.**

By the end of the morning….

Questions we'd like to move forward on by the end of the day:

i. What are the benefits and drawbacks of using bio resources?

ii. Where are the areas of consensus and divergence in the areas of bioresource use and supply – and what factors are behind these?

iii. For areas of divergence – what could be done to bring greater certainty?

iv. For areas of consensus - are there no regrets policy actions or other activities that could be undertaken now? **What are the next steps – and who should take them?**

Setting the scene

Committee on Climate Change

Navigant

Renewable Energy Association

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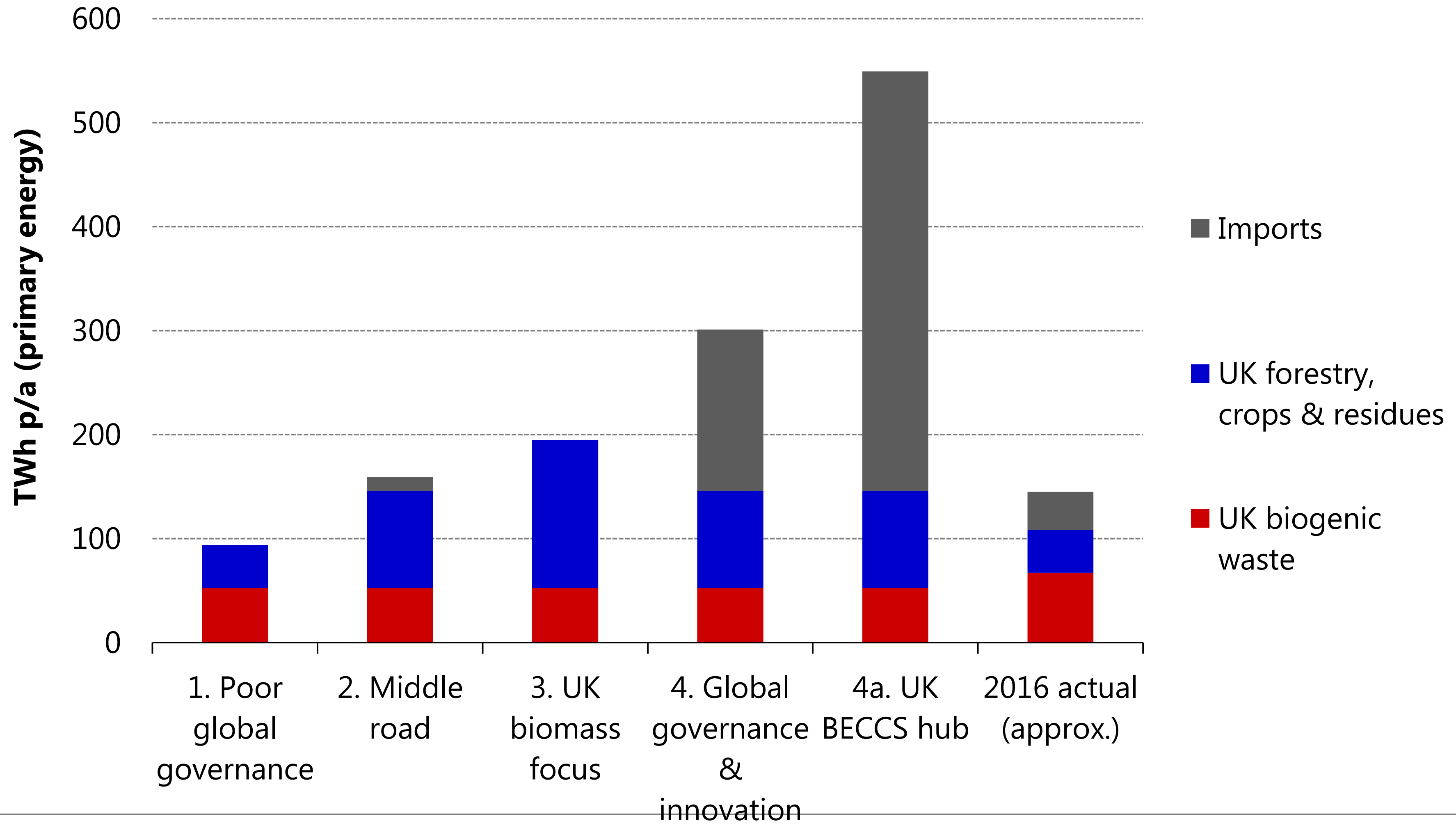
Committee on Climate Change

Tuesday, 26th November 2019

Biomass in the CCC Net Zero report

Richard Millar, NG Bio resources workshop

In 2018, the CCC undertook an exercise to scope possible UK biomass supply futures



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Committee on Climate Change

Biomass availability in 2050

Total biomass
142 TWh

CCC 2019 'Further Ambition' scenario

Total bio *inputs*: 196 TWh

Wet and dry waste
54 TWh

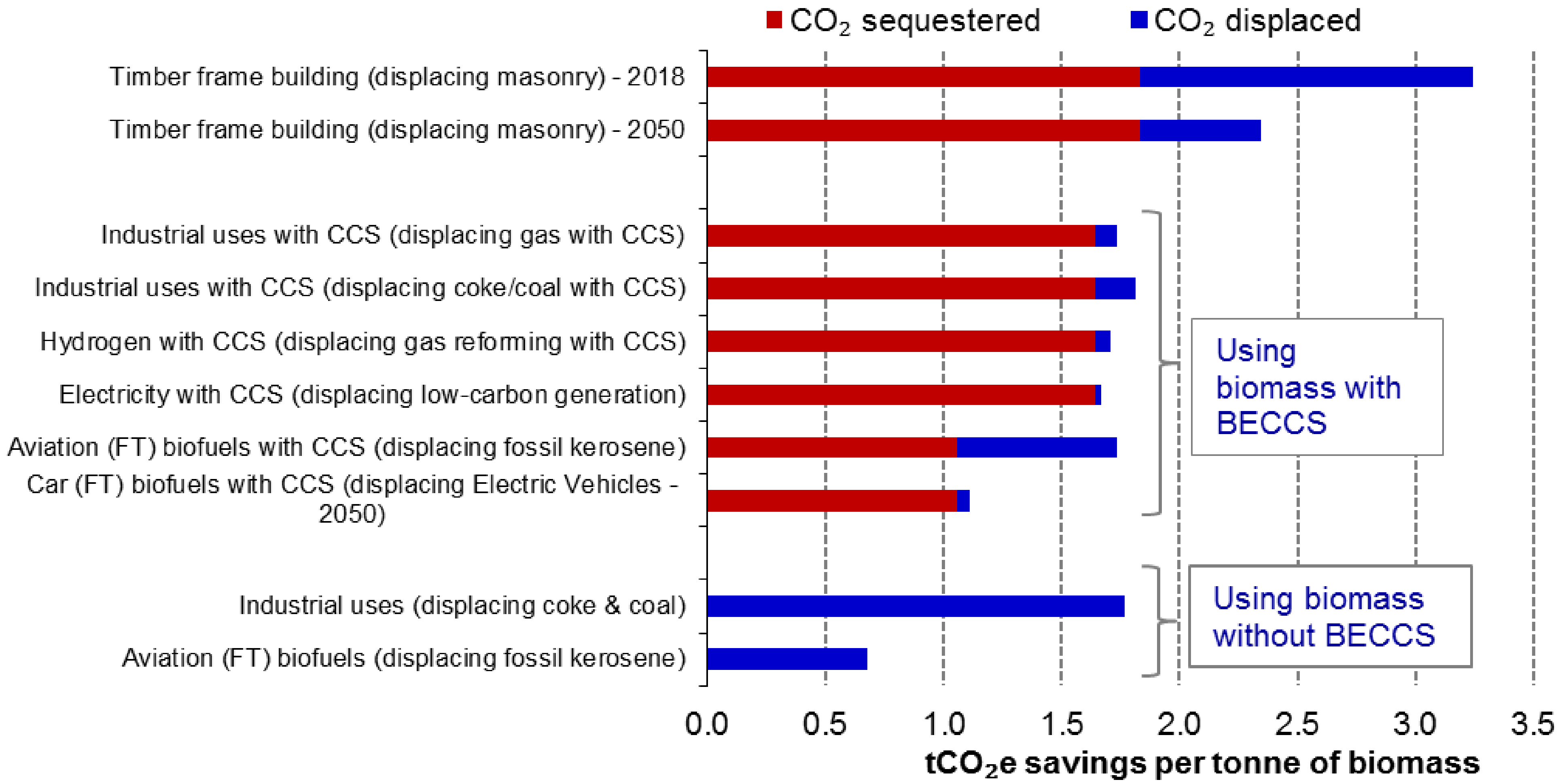
Of which imports = c. 34 TWh (Mainly wood pellets)

'Further ambition' scenario biomass availability is based on scenarios developed in our 2018 Biomass report.

Key elements:

- **UK uses a 'fair share' of imported resource**
- **~700,000 ha of 2nd gen bioenergy crops in UK**
- **Forested land cover in UK increases from 13% to 17%**

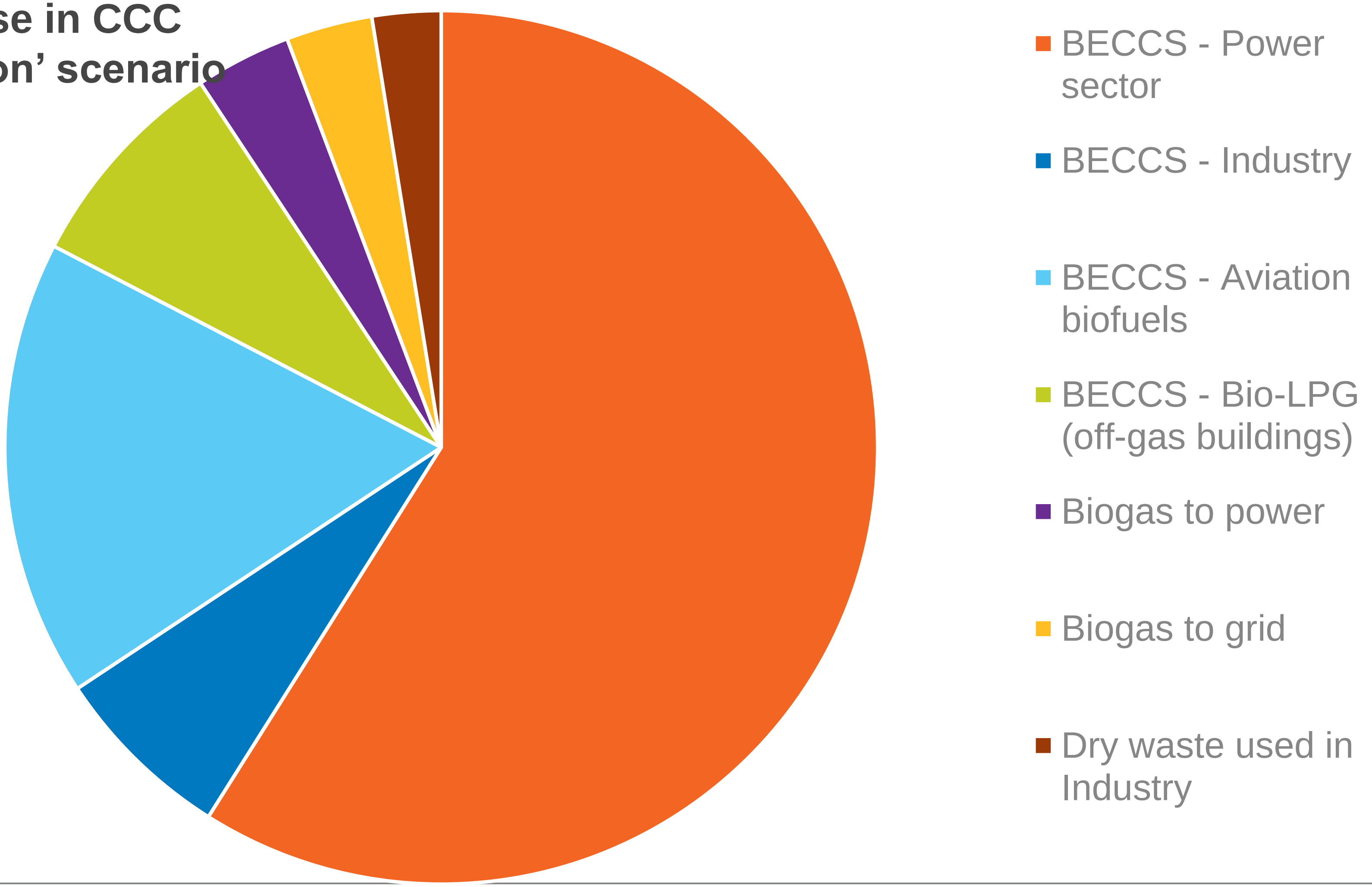
In deciding between end-uses we used a framework focused on maximising the carbon benefits from biomass



Committee on Climate Change

This means use with BECCS where possible in the long-term

Biomass end-use in CCC 'Further Ambition' scenario (2050)



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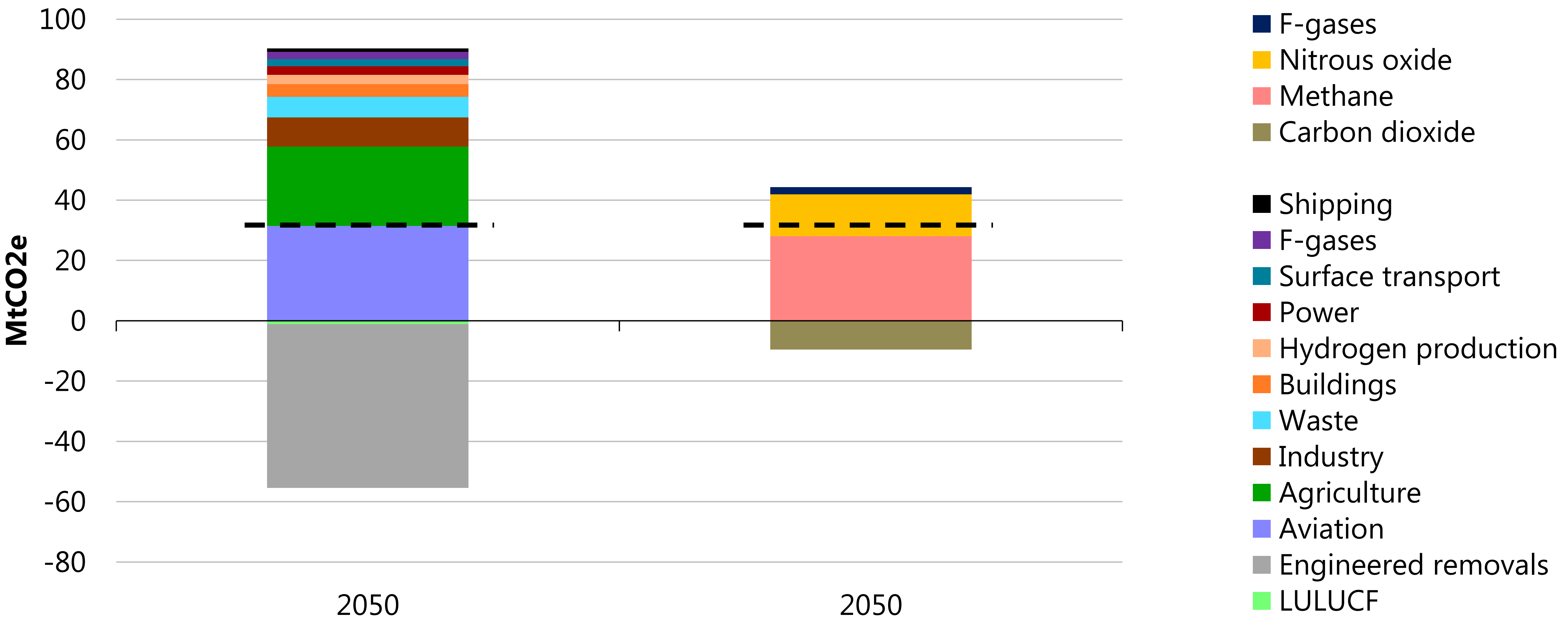
Further ambition scenario is ~96% reduction scenario (vs 1990 levels), but doesn't quite get to net-zero

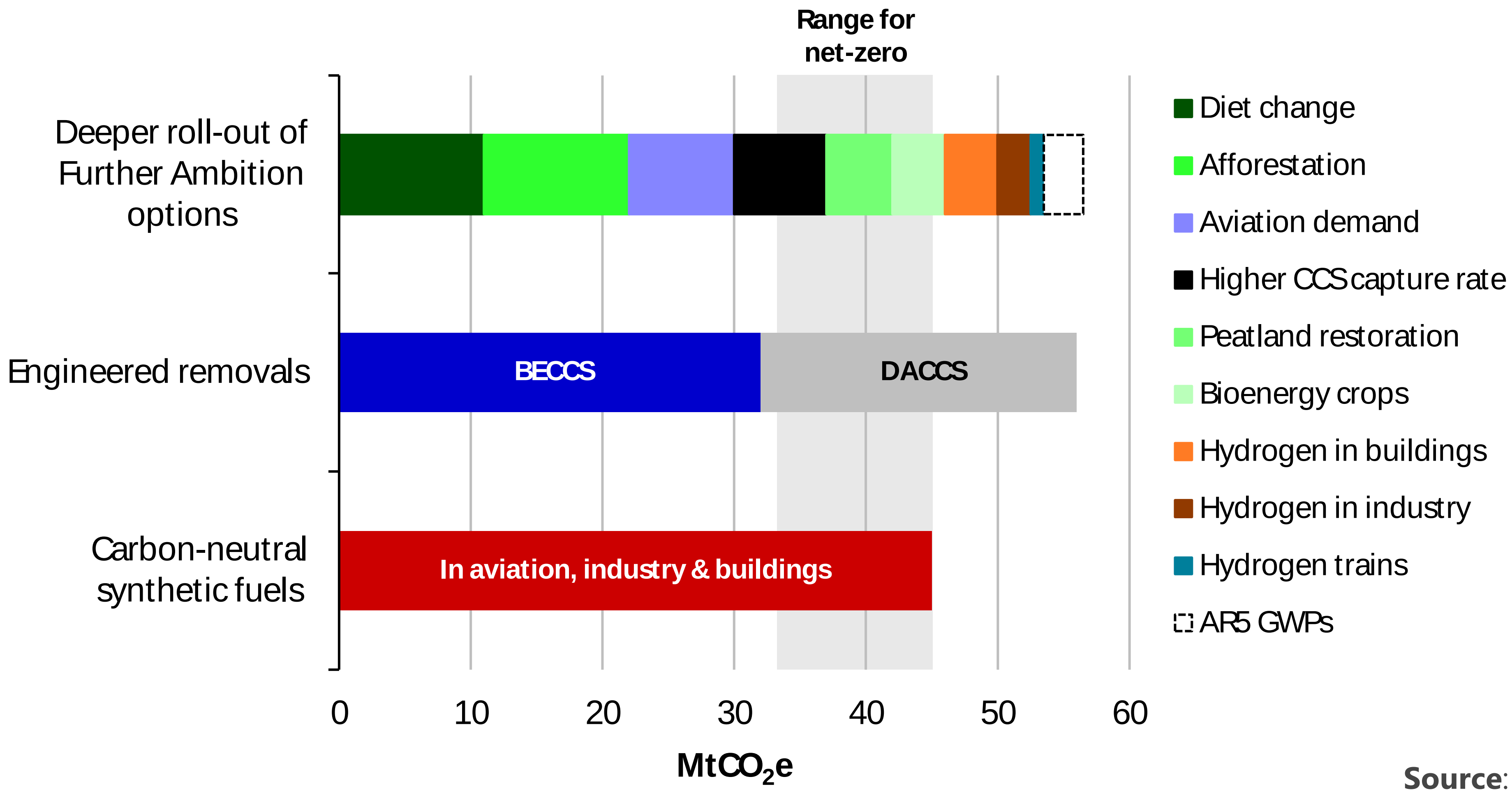
Remaining emissions by sector (left) and type of gas (right)



Source: CCC analysis

Additional biomass could help close the gap to net-zero GHG emissions in the UK if more sustainable resource is available

Additional abatement potential from Speculative options in 2050



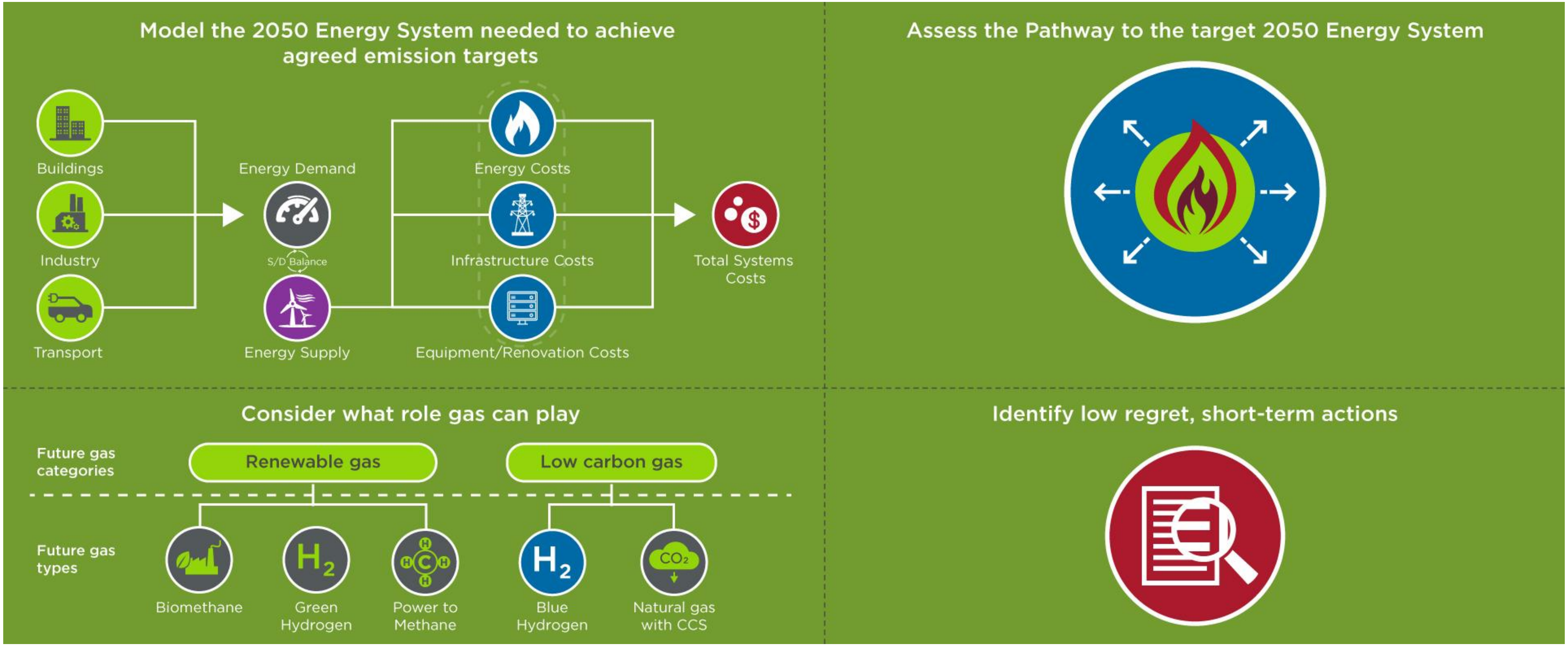
Source: CCC analysis

DECARBONISATION PATHWAYS FOR THE GB GAS NETWORKS

NATIONAL GRID – BIO RESOURCES WORKSHOP

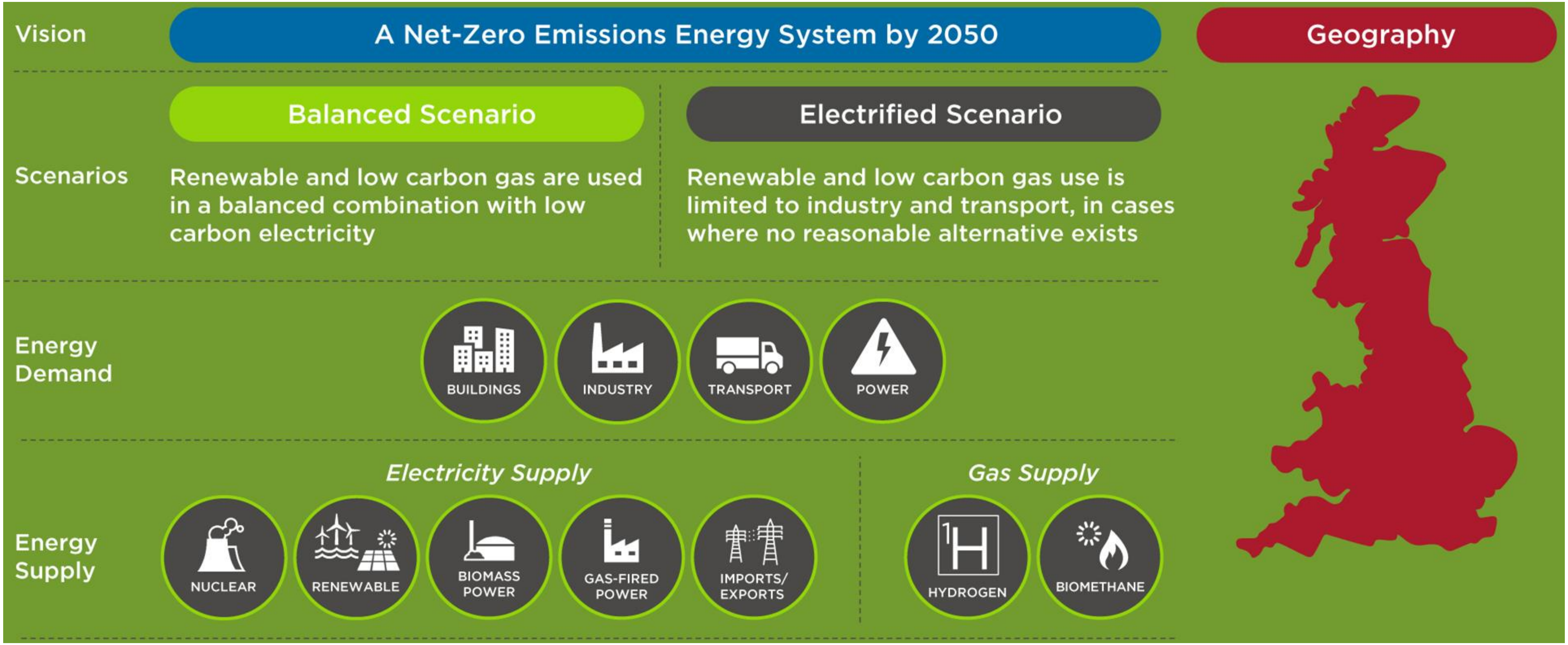
26 NOVEMBER 2019

ENA ASKED NAVIGANT TO ASSESS HOW GB'S ENERGY SYSTEM CAN DECARBONISE AND THE ROLE GAS COULD PLAY IN A PATHWAY TO DECARBONISATION



NAVIGANT

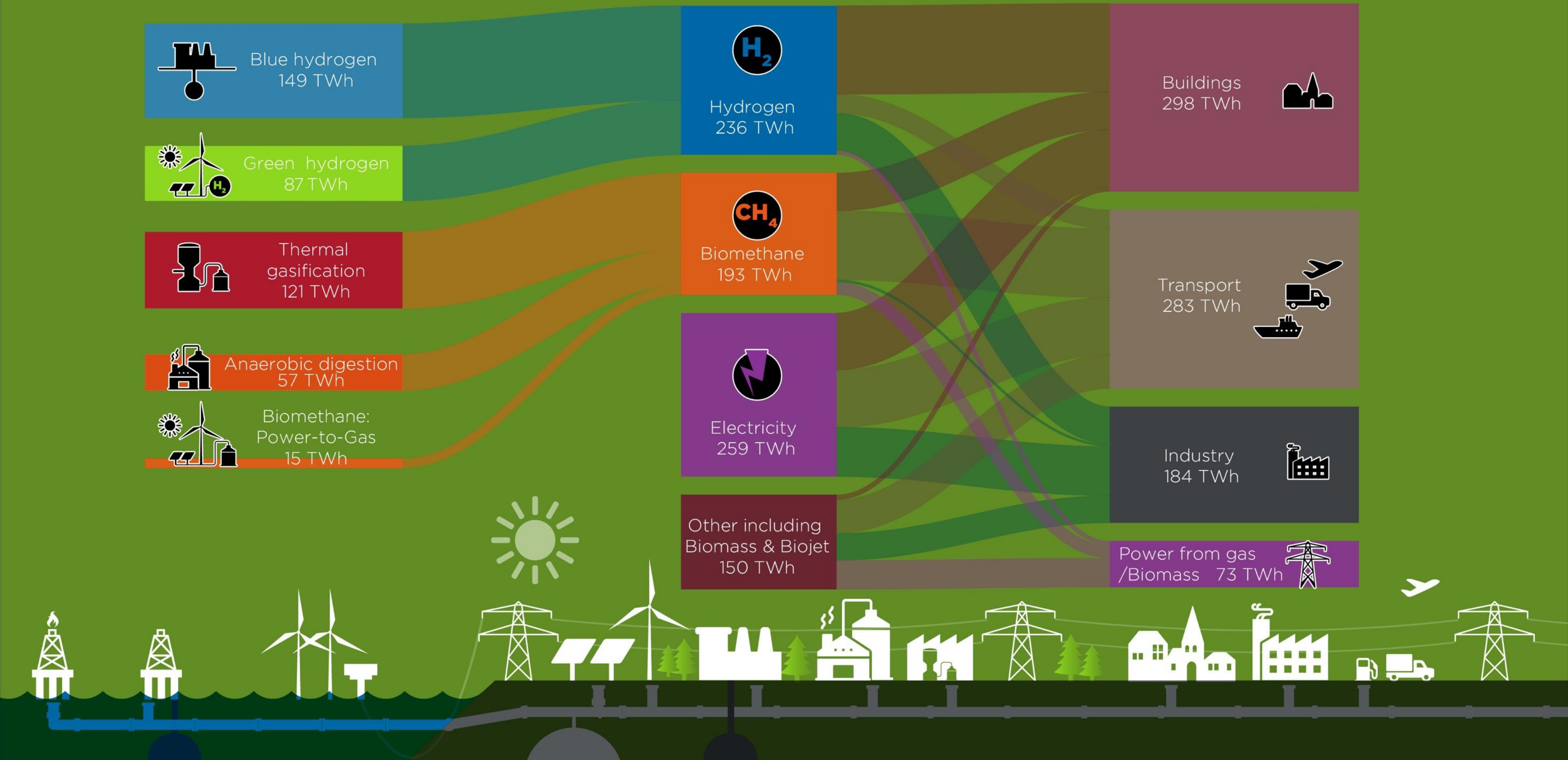
OUR ANALYSIS COVERED FOUR SECTORS:
BUILDINGS, INDUSTRY, TRANSPORT AND POWER GENERATION



NAVIGANT

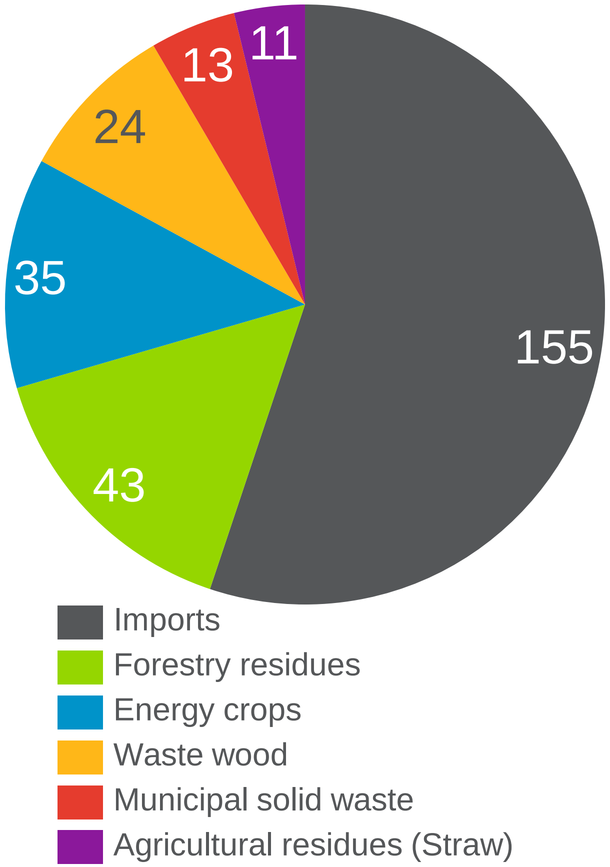
A balanced combination of low carbon gases and electricity

The optimal way to decarbonise Great Britain's energy system and reach net-zero emissions

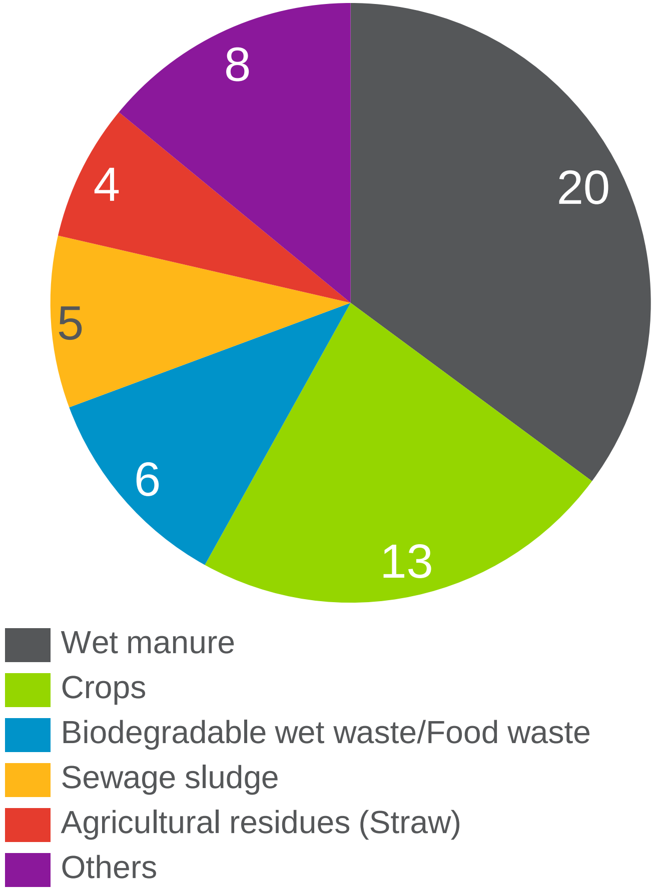


OUR BALANCED SCENARIO ASSUMES 342 TWH BIORESOURCES SUPPLY IN 2050

Solid biomass (incl. biomass fraction in MSW)

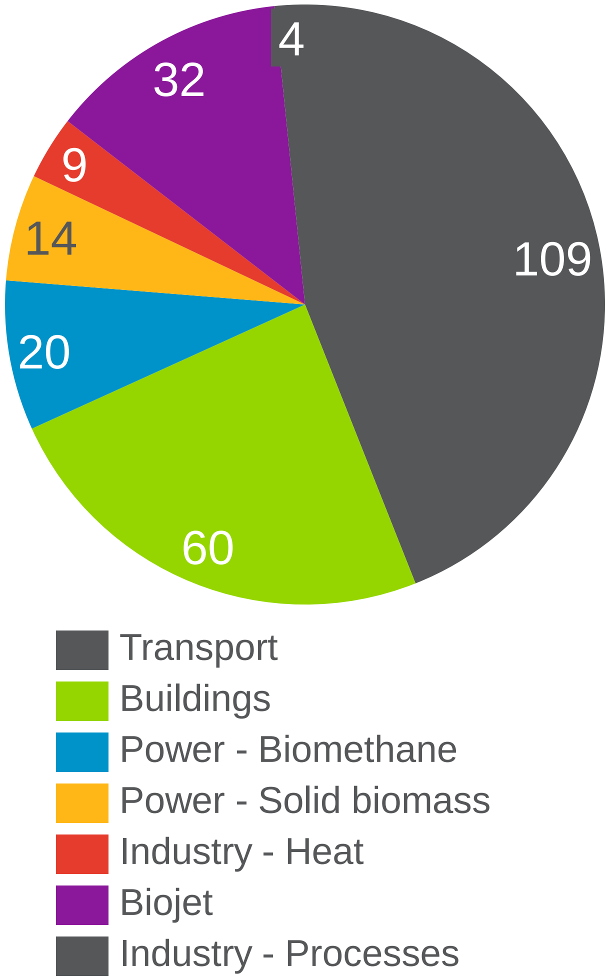


Biomethane feedstocks



- Solid biomass assumptions are aligned with CCC's Global Governance & Innovation Scenario (55% imports)
- Biomethane assumptions are (largely) aligned with ADBA estimates for 2032 (flatlined to 2050), with CCC estimates for Food waste, Sewage sludge and Landfill gas
  - Aggregation of Manure collection to improve economics
  - Strict sustainability requirements for Crops (e.g. improved agronomic practices to maximise yield/energy output)
- Additional 5 TWh of waste oils available

OUR BALANCED SCENARIO ASSUMES 248 TWH BIORESOURCES DEMAND IN 2050



- Largest demand foreseen in Transport in particular Bio-LNG in intra-EU/ International Shipping (89 TWh), followed by Aviation (32 TWh) and Freight (16 TWh) as Bio-CNG/LNG
- Decarbonisation of buildings through electrification and low carbon gas - around 20% of which is Biomethane (supplied via grid and Bio-LNG for off-grid properties)
- Important role for solid biomass and biomethane in providing dispatchable Power generation
- Industry largely decarbonised through deployment of hydrogen and electrification, with a limited role for Solid biomass and Biomethane

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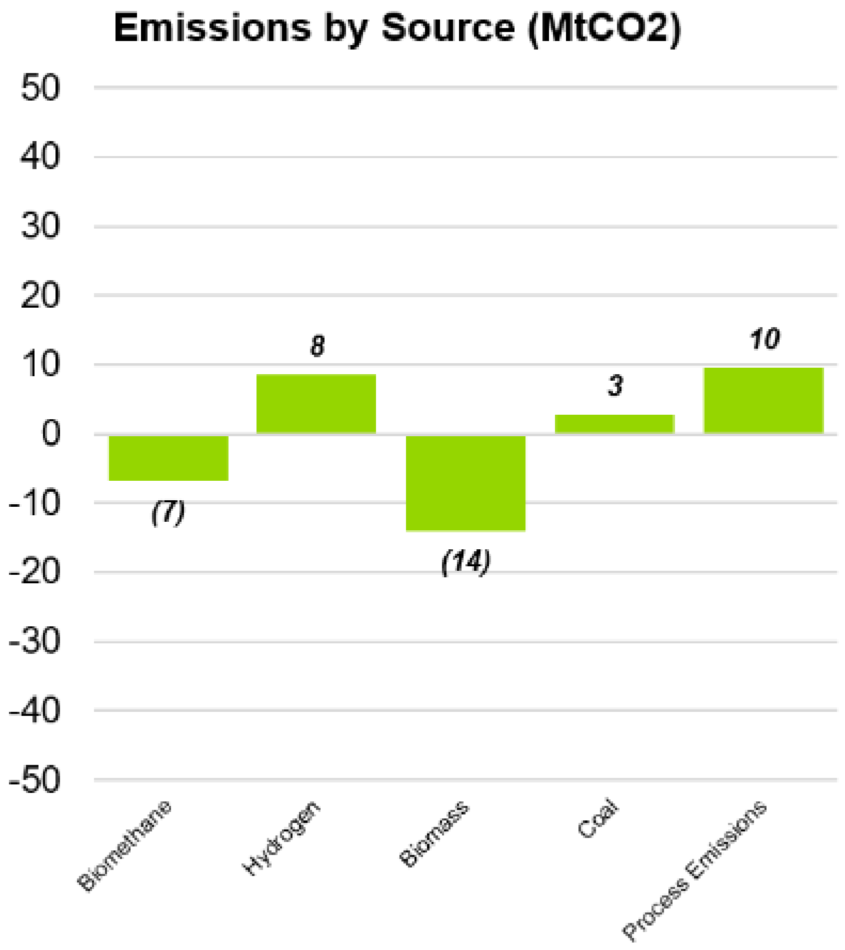
THE NEGATIVE EMISSIONS GENERATED FROM BIOMASS WITH CCS (BECCS) IS VITAL TO MEETING NET ZERO



- Residual emissions remain in 2050 from Blue Hydrogen production and hard to decarbonise industrial processes
- ‘Negative emissions’ from Biomass Power and Bio-SNG production with CCS are therefore critical to achieving net zero
- We assume that 100% of the Biomass Power and 50% of the Bio-SNG production are coupled with CCS (actual deployment higher – but we only account for 50%)
- CCS deployment concentrated in industrial clusters located along North Sea coast and Morecombe Bay

NAVIGANT

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NAVIGANT

REA Bioenergy Strategy

FES: Bridging the Gap to Net Zero

Bio Resources Workshop

26th November 2019

Mark Sommerfeld, Policy Manager REA

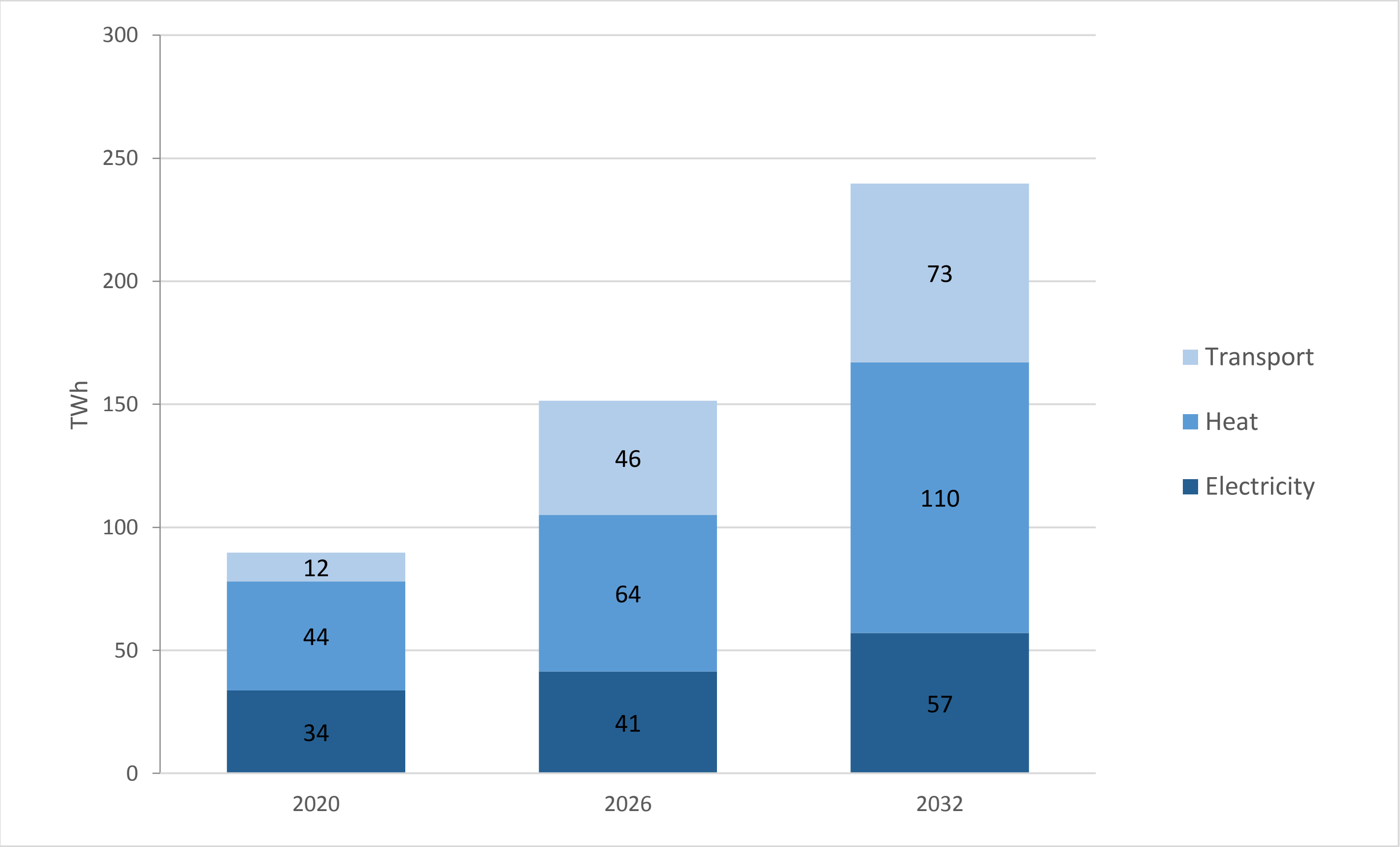
REA Bioenergy Strategy - Objectives

An industry–led strategy for bioenergy in the UK

1. Highlight what Bioenergy already does for the UK
   - Building on current progress to develop GHG savings and other co-benefits
   - Role in achieving decarbonisation targets by 2032 and in net zero scenario
2. Identify the extent to which bioenergy could sustainably expand
3. Set out, in clear terms, the policy recommendations required to deliver our sustainable vision for bioenergy over the medium and longer term

Potential Overall Growth in Bioenergy out to 2032

Bioenergy grows to provide around 16% of UK final energy demand



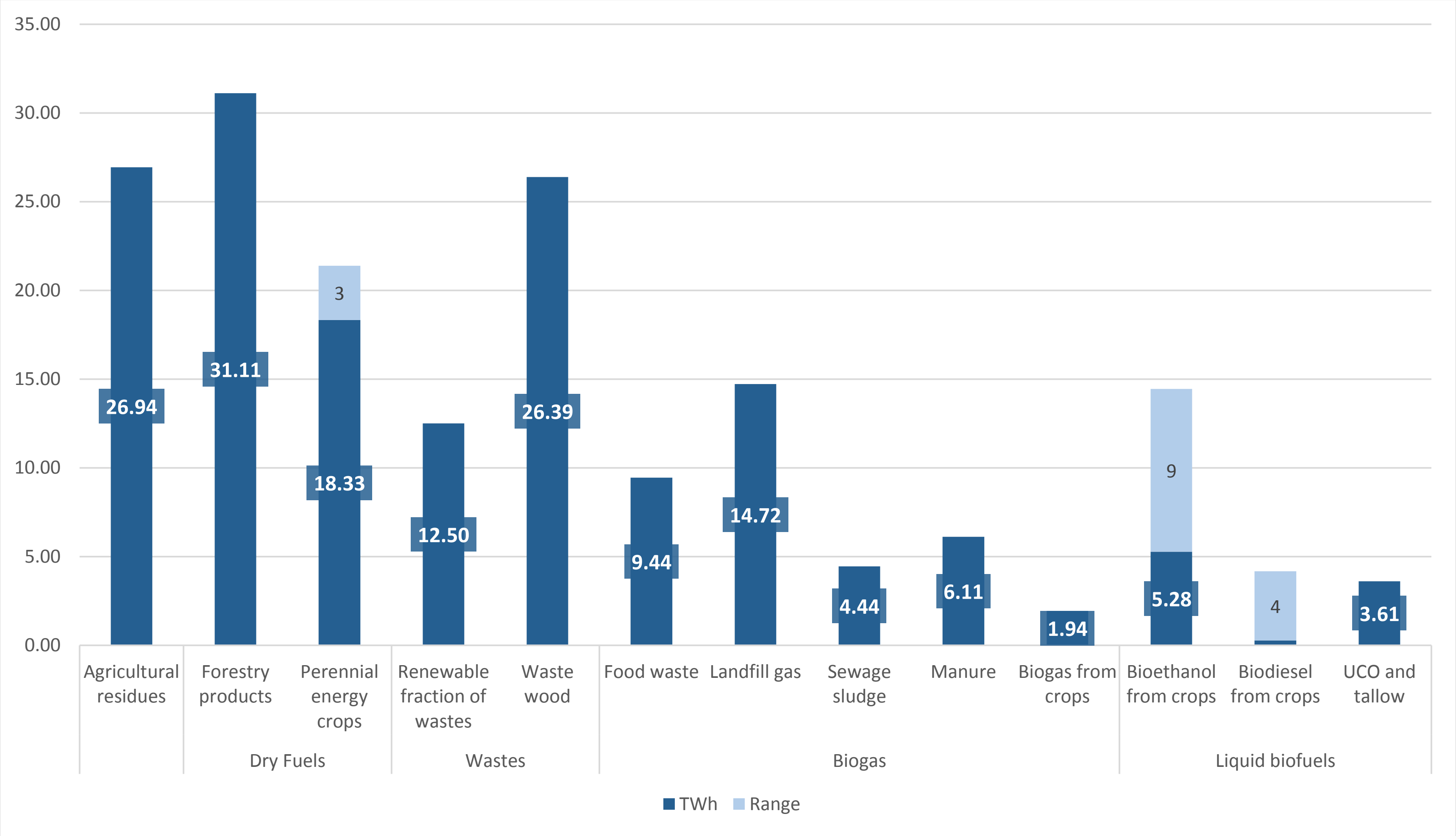
	2032	
Transport	**PJ**	**TWH**
Bioethanol	27	7.5
Biodiesel	79	21.9
Biomethane	87	24.2
Aviation and marine	68	18.9
Transport Total	***261***	***72.5***
Heat	**PJ**	**TWH**
Unmanaged domestic wood heating	20	5.6
Wood chips and pellets	152	42.3
Biomethane	107	29.6
Heat networks	83	23.0
Biopropane	30	8.2
Thermal gasification	5	1.4
Heat Total	***396***	***110.0***
Electricity	**PJ**	**TWH**
Existing biogeneration	107	29.7
Low cost fuels including MSW	19	5.3
Large scale biomass with CCU	79	22.1
Electricity Total	***205***	***57.1***
Grand Total	**863**	**240**

How is this Growth Fuelled?

Full use of UK domestic feedstock potential plus sustainable expansion of imports for large-scale applications

	Heat	Transport	Power
Forestry and wood fuels	***		
Waste fuels			***
Wet wastes	***	***	*
Agricultural wastes	***	***	
Energy crops	***	***	
Imported fuels		***	***

Accessible UK Bioenergy Feedstock Resource, 2030



Based on BEIS UK supply model, recently updated by Ricardo AEA

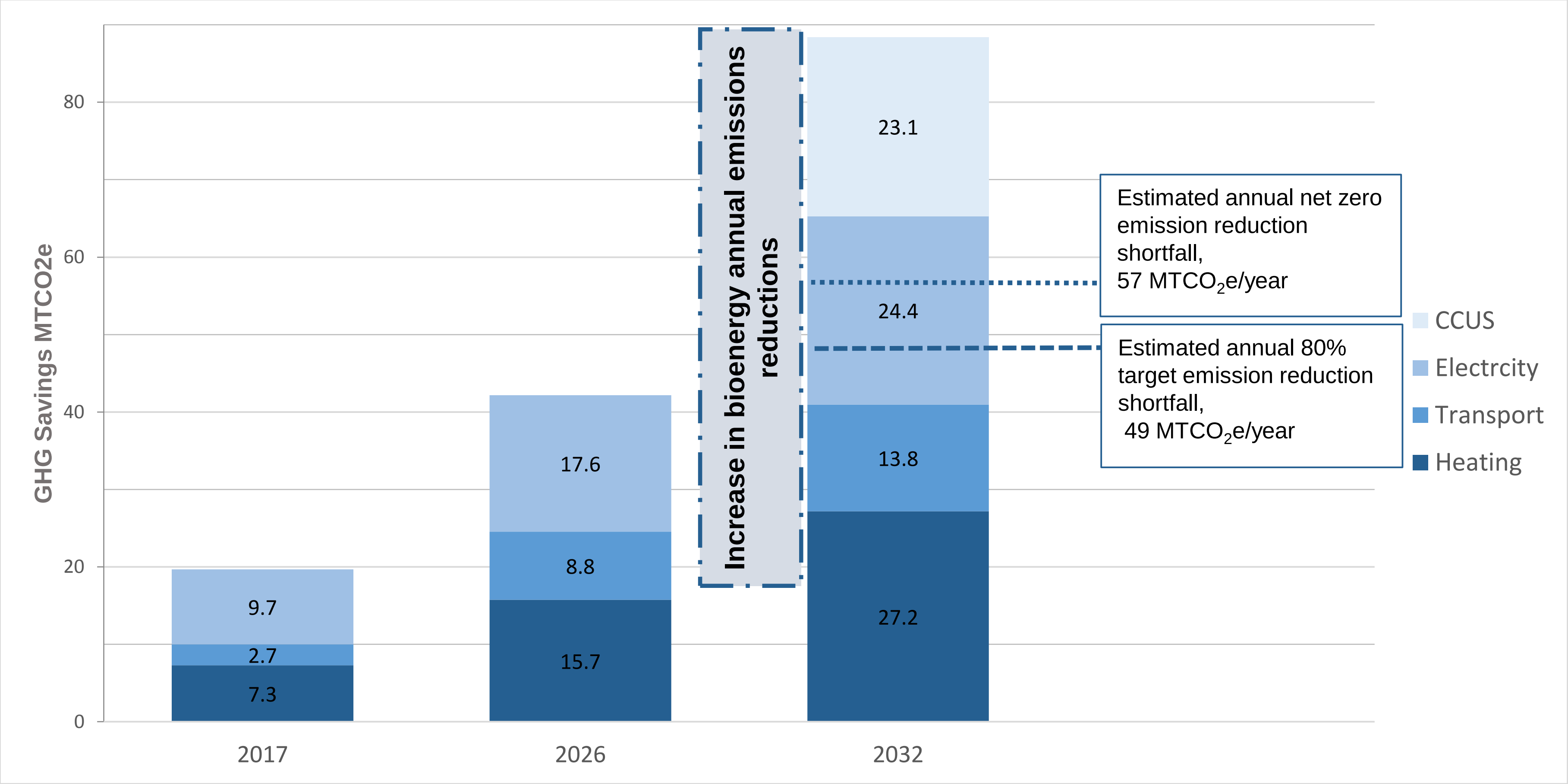
Estimates for both UK and Internationally available resources, taking account of:

- Sustainability Criteria
- Competing Non-energy uses and
- Barriers to availability

Total resource 580 – 670 PJ (161 – 186 TWh)

GHG Benefits Over 80 $MTCO_2e$ per year by 2032

Enough to address the current predicted shortfall in emissions reductions required to meet the 5th Carbon Budget and put the UK on track to meet its net-zero carbon ambitions by 2050.



Fossil fuel replacement amounts to about **65 $MTCO_2e$** in 2032.

A further **23 $MTCO_2e$** from CCUS

Conclusion

Meeting Net-Zero GHG not possible without Bioenergy

- The strategy finds that bioenergy can be sustainably increased by a factor of 2.5 in the UK by 2032.
- Bioenergy is required to meet the UK's legally binding carbon budgets and realise 'net-zero' by 2050.
- Bioenergy provides energy security, mitigating future strain on the electricity system and addressing the gap left by shelved nuclear power projects.
- Growth depends on maintaining existing markets to provide pathway to strategically important bioenergy technologies. You don't get BECCS without Biomass Power. You don't get advanced thermal heat without biomass supply chains and AD Biomethane gas market.
- Bioenergy delivers the most immediate and affordable route to carbon reductions in heat and transport sectors
- Sustainability must be considered throughout growth process – REA Establishing Sustainability Taskforce

Thank you!

www.bioenergy-strategy.com

Mark Sommerfeld
Policy Manager, Bioenergy
Renewable Energy Association
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Bio resources across the value chain

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Feedstock (biomass, dry waste, wet waste)

- **Where are the areas that we feel fairly certain about?**
- **Where are the areas of divergence or uncertainty? What are the unknowns?**
- **What are the challenges, trade offs and opportunities?**

Constraints / opportunities for domestic supply of:

- Biomass
- Dry waste
- Wet waste

Factors influencing imports or development of global markets?

Interdependence with aspects such as crop failure?

Interaction with competing uses for land, agricultural policies?

Biodiversity impacts?

Potential range in 2050 (TWh):
Total feedstock: 100 – 342 or more
Imports: 15 – 35 – 111 – 155 or more

Processing

- Where are the areas that we feel fairly certain about?
- Where are the areas of divergence or uncertainty? What are the unknowns?
- What are the challenges, trade offs and opportunities?

Efficiencies of conversion of feedstock into electricity, gas, heat or fuel? (Now and in the future)

Constraints / opportunities for domestic processing?

Current / future technology limitations? Are there any technologies that may not be or become viable?

Policy support for processing into different products?

Interaction with other areas?

End uses

- **Where are the areas that we feel fairly certain about?**
- **Where are the areas of divergence or uncertainty? What are the unknowns?**
- **What are the challenges, trade offs and opportunities?**

Assumptions on consumer behaviour / preferences?

Highest decarbonisation potential of different bio uses – and what affects this?

Need for carbon negative technologies?

What drivers will influence competition for end use – where are there (not) alternatives, or most profit?

Are there tipping points for viability?

Options in 2050:
Aviation, shipping
Low to high biomethane
Any biofuels in road transport?
Any direct biomass heat
Any / how much BECCS?

Refreshment break

Bridging the gap to net zero

Opportunities, challenges and **next steps**

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Decisions and consensus

What are the areas of (some) consensus?

Are there any **no regrets** actions in the areas where there is more consensus? **Who** should take these forward?

What are the kinds of decisions participants might be making in the next 12 months - and what would unlock these?

Feedstock	Processing	End Use

Areas of uncertainty

Where are the divergences occurring and why?

Are there any areas of uncertainty where there is clear scope for research or further action? What could be done to reduce uncertainty and refine our understanding of bio in a net zero world?

Feedstock

Processing

End Use

Coming back to our questions….

Questions we'd like to move forward on by the end of the day:

i. What are the benefits and drawbacks of using bio resources for energy?

ii. Where are the areas of consensus and divergence in the areas of bioresource use and supply – and what factors are behind these?

iii. For areas of divergence – what could be done to bring greater certainty?

iv. For areas of consensus - are there no regrets policy actions or other activities that could be undertaken now? **What are the next steps and who should take them?**

Next steps

Recommendations

Testing report with attendees after Christmas

Final report Spring 2020

….. And lunch!

Thank you

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Supply and end use of bio resource in 2050: FES19 Net Zero

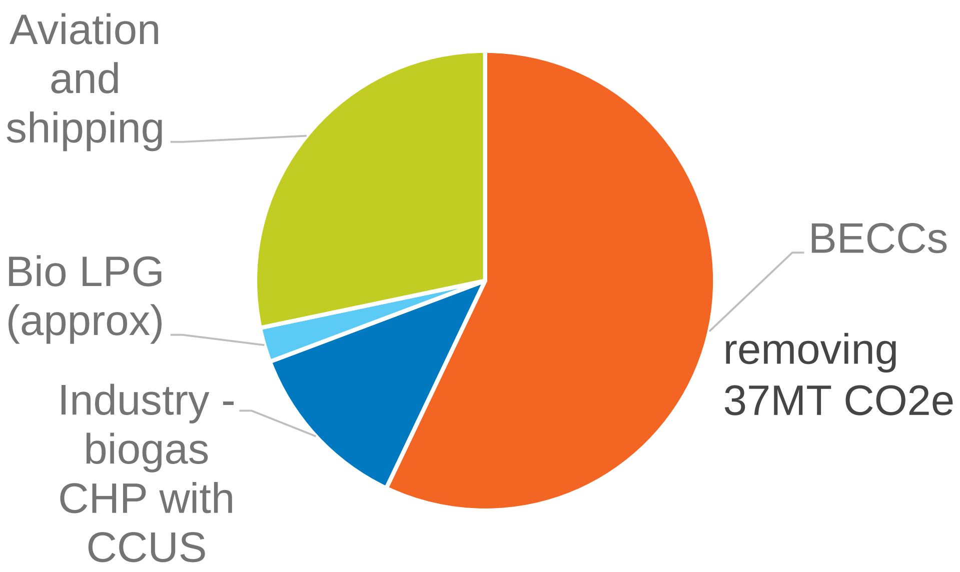
Biomass:
117 TWh

Wet and dry waste: 83 TWh

Total bio *inputs*:
200 TWh

Of which imports c. 35 TWh (Mainly wood pellets)

End Use:



Assumptions:

Reduction in food waste compared to today, but increase in recycling

Some imports available

Supportive policy environment

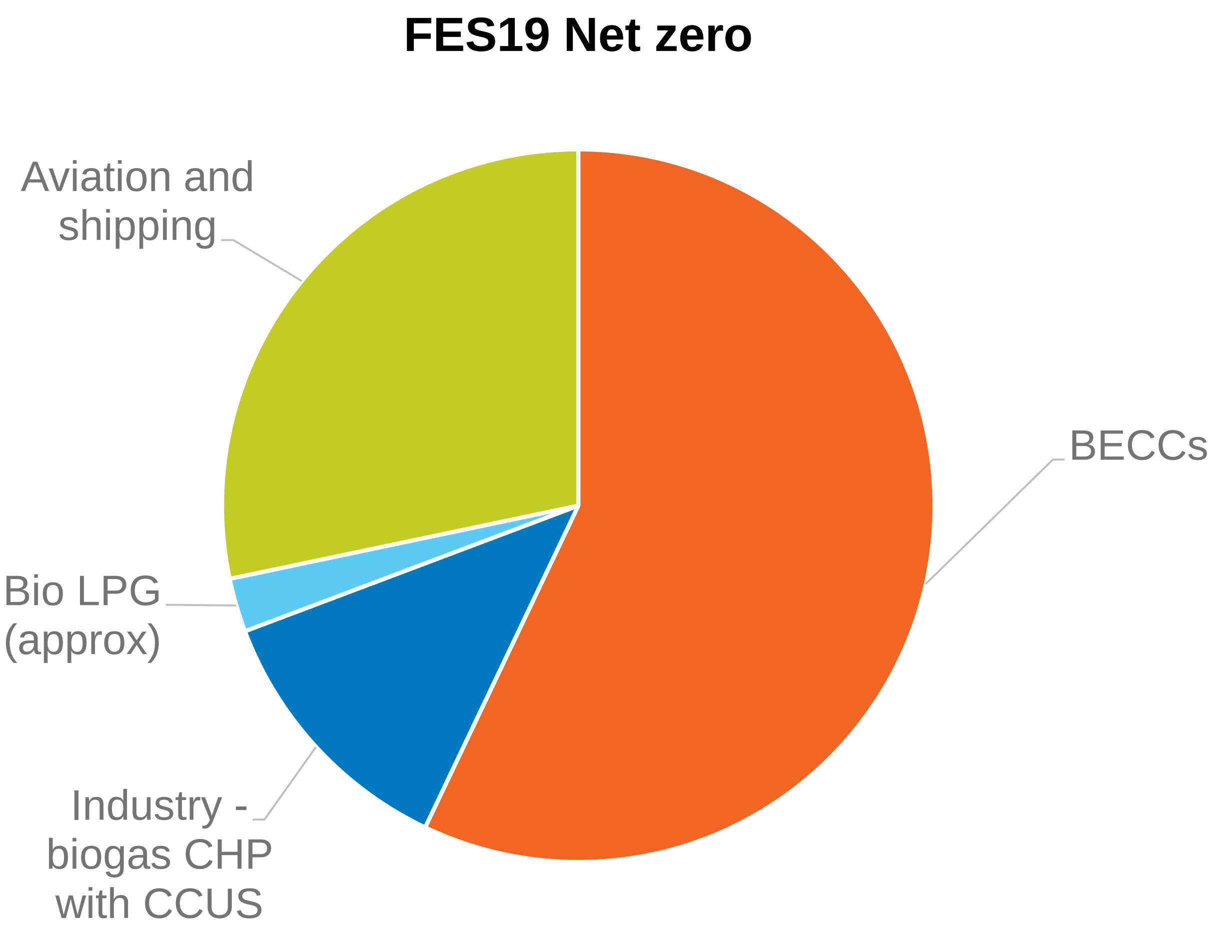
Hard to decarbonise processes in agriculture, industry etc. and lack of other negative emissions technologies (e.g. DACCs) means that electricity has to be negative carbon via BECCs

Other options (electricity and H2) pursued to decarbonise road transport and domestic heating – bioLPG in a small number of off gas grid buildings.

Growth in aviation demand compared to today.

Similar efficiencies in bio resource technologies as today.

Assumptions in FES 19…. and FES 2020



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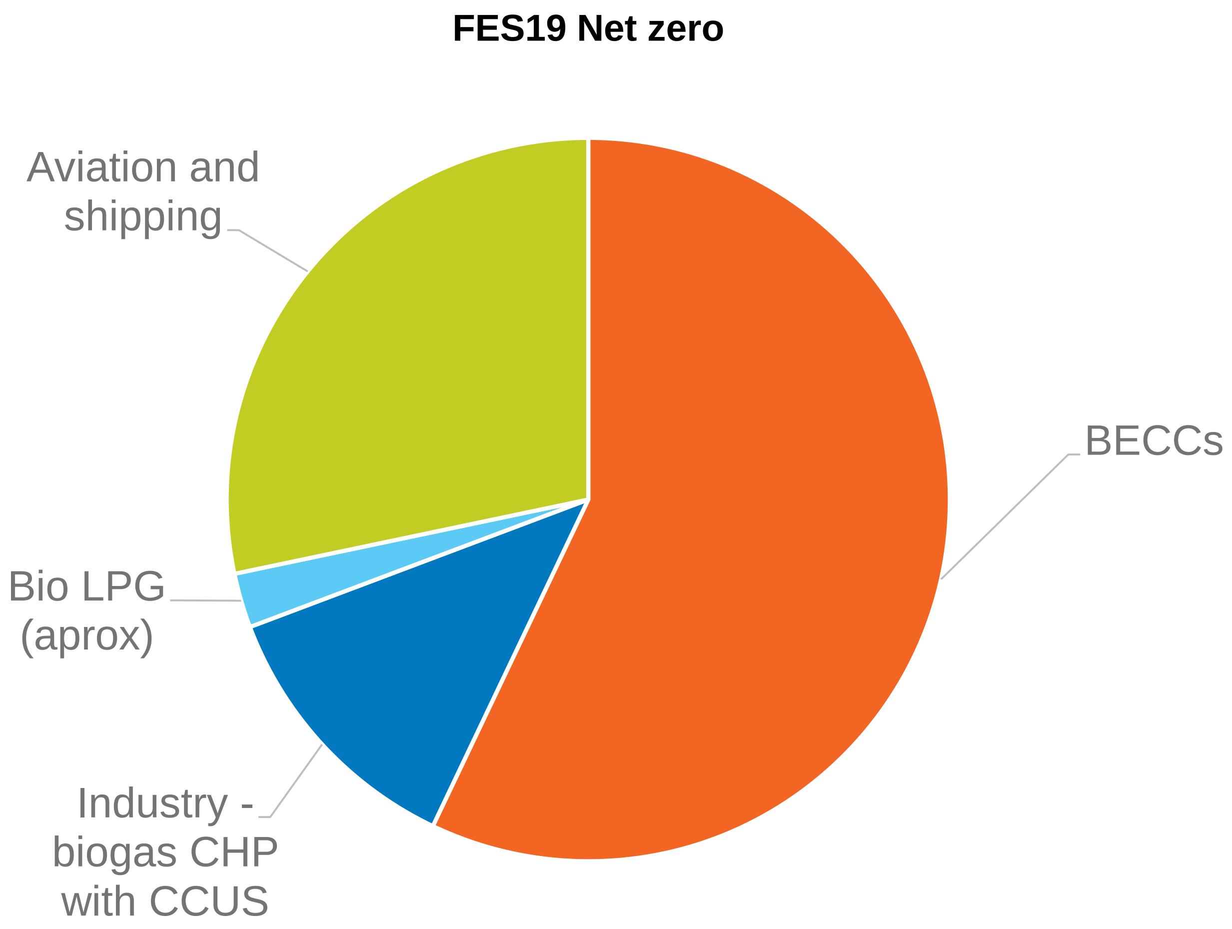
End use

	Biomass	Wet waste	Dry waste	Elec	Biogas	biofuels
Biomethane into the gas grid,, or						
biogas CHPs or generation						
biomass electricity generation (with CCUS),,						
biomass heating						
aviation						
road fuels						

End use of bio resources in [2030] / [2050]



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Net zero society – carbon accounting

Table 6.1
Carbon emissions – tracking the journey to **Net Zero**

(Mt CO_2 equivalent)	2017	Net Zero 2050
Heat for buildings	85	0
Electricity before BECCS	73	0.35
BECCS in power sector	0	-37
Industry	105	10
Road transport	117	0
Hydrogen production	0	3
Other (non energy related)	123	59
Total	**503**	**35**
Relative to 1990 Emissions (% reduction)	39%	96%

By 2050, residual emissions in industry, hydrogen production and other sectors are partially offset by negative emissions from BECCS.

Assumptions:

Heat and road transport are completely decarbonised.

Hard to decarbonise processes in agriculture, aviation, industry etc. and lack of other negative emissions technologies (e.g. DACCs) means that electricity has to be *negative* carbon via BECCs.

Challenges and opportunities

Transition and end state – what are the differences?

Role of markets and policy

Consumer acceptance, behavioural assumptions / lifestyle changes

Technology developments

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Bio resource value chain

Biomass

Energy crops, agricultural and forest residues (domestic and imported)

Processing	End Use
Combustion (with/out) CCUS	Electricity
Fermentation or transesterification to create bioethanol or biodiesel	Transport
Combustion in biomass boilers	Heat (residential or industrial)