Group of Experts on Cleaner Electricity Systems

15th session

Geneva, 5-6 November 2019, Palais des Nations, Salle XI

Towards a solid strategy for the Group of Experts: The role of coal/fossil fuels in sustainable energy and meeting climate goals

Background data on coal use, overall CO_2 emissions from fossil fuels and using CCS to deliver net-zero GHG emissions

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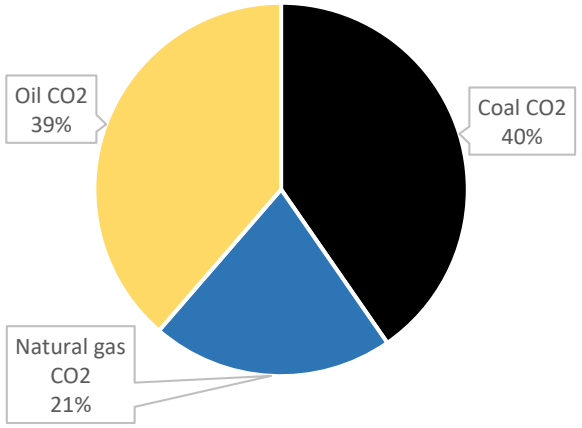
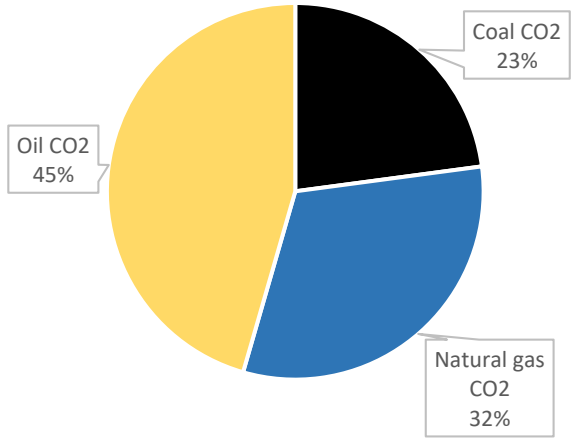
UNECE countries emit around a third of global fossil CO_2 emissions, coal is a relatively small part of UNECE fossil CO_2, around 25%

Estimates based on BP Statistical Review of World Energy 2019

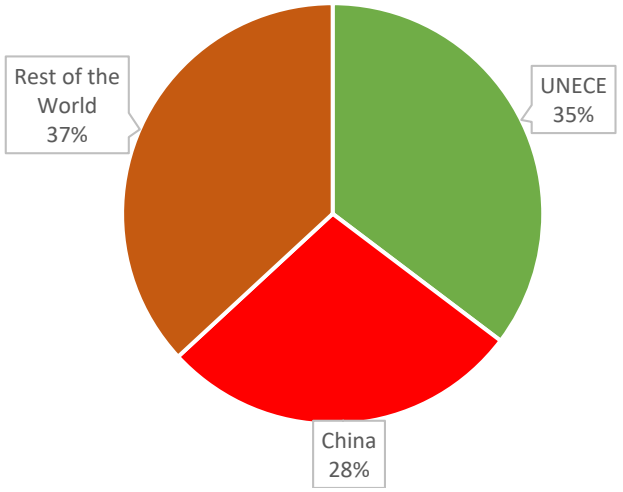
Approximate estimated global CO_2 emissions by fuel



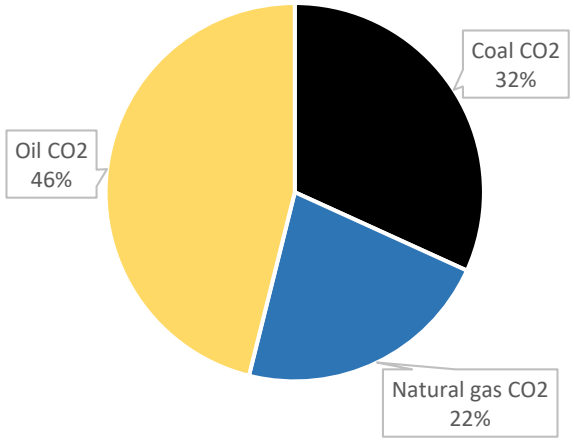
Approximate estimated UNECE CO_2 emissions by fuel



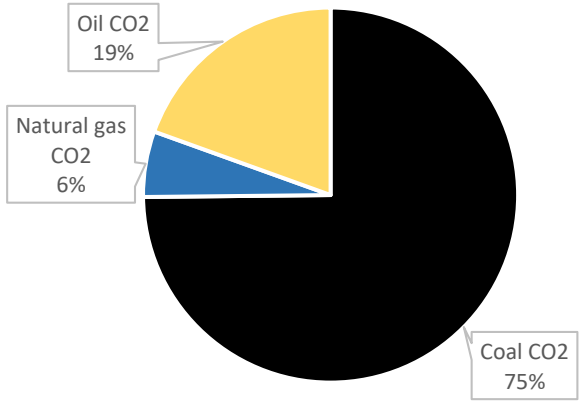
Fossil fuel CO_2 emissions



Approximate estimated Rest of the World CO_2 emissions by fuel



Approximate estimated China CO_2 emissions by fuel



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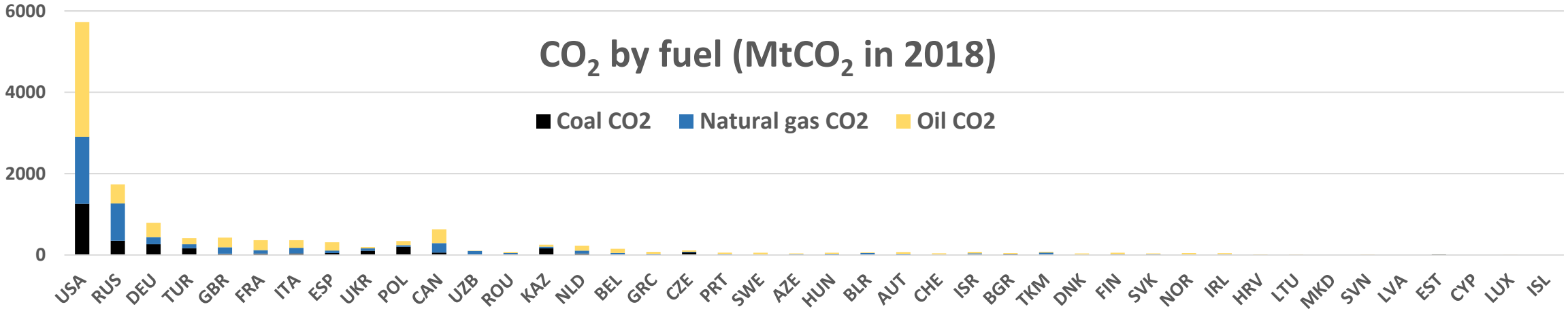

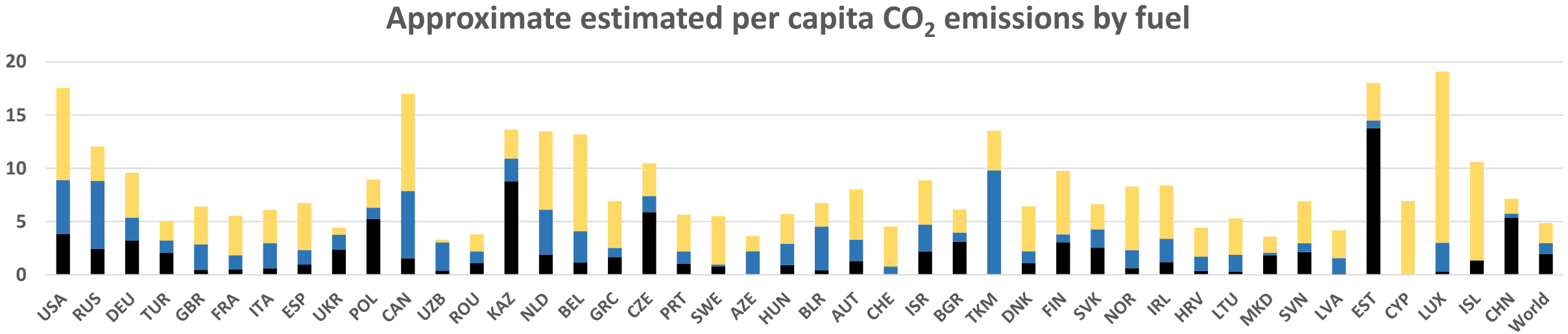

UNECE countries average ~60% of electricity sector fossil emissions from coal, below the world average

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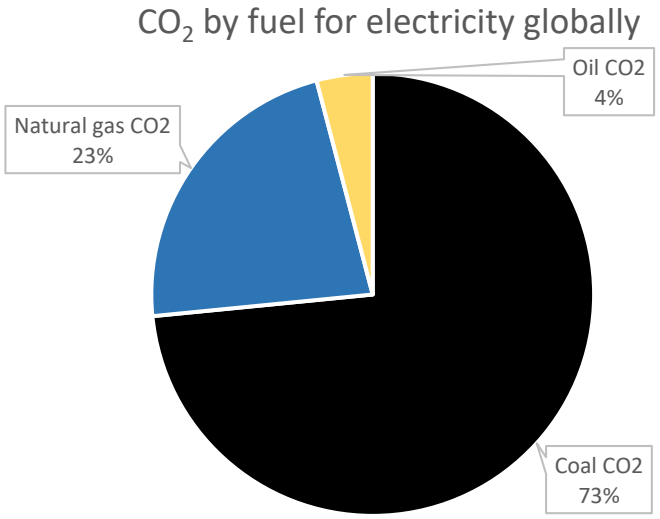

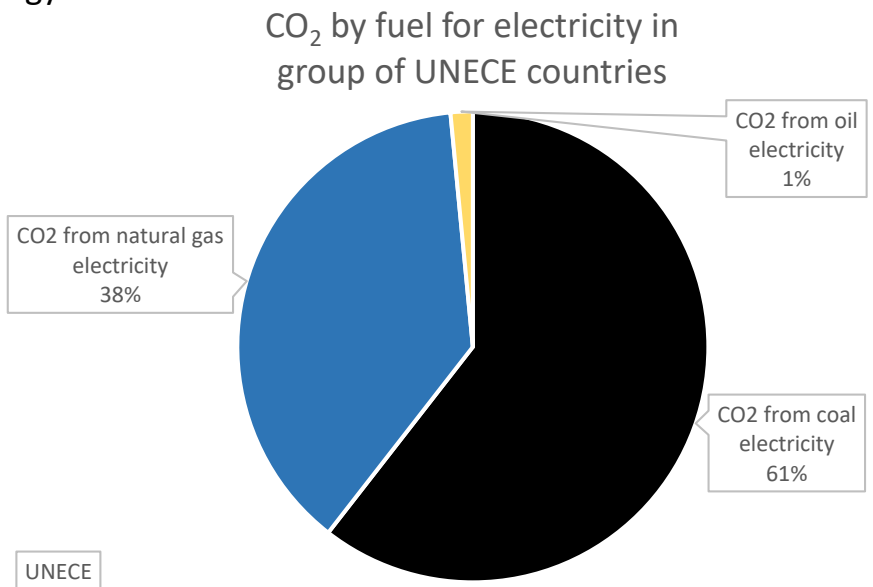

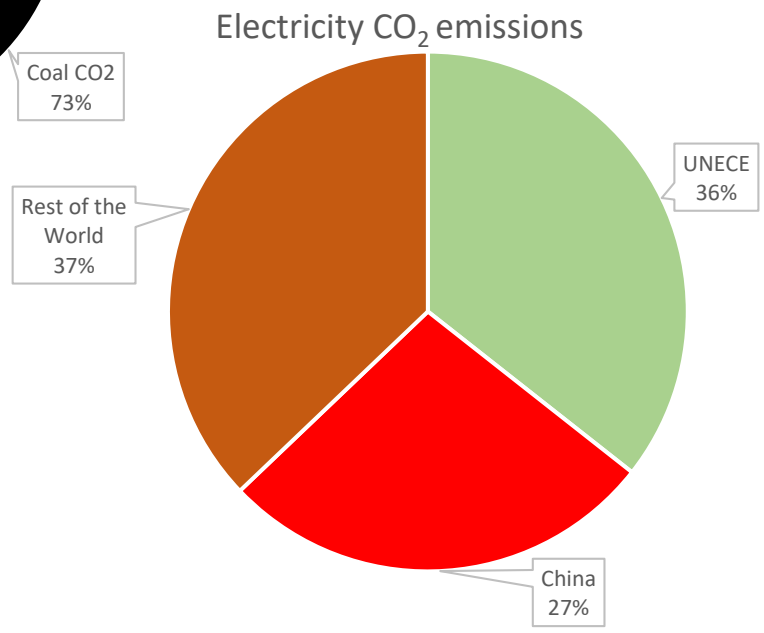

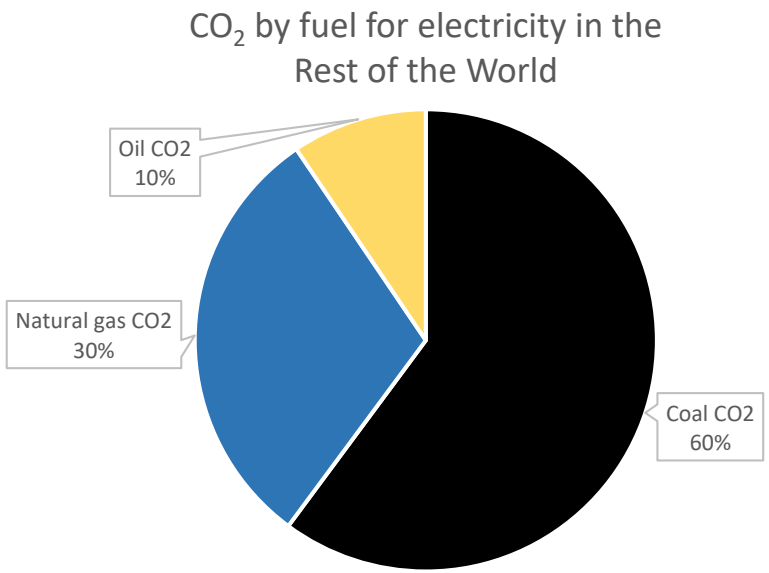

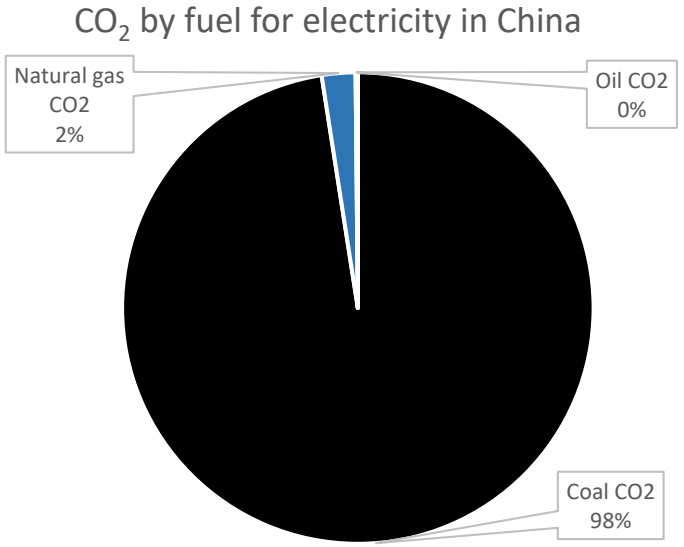

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Bulk of UNECE coal CO_2 emissions are concentrated in a small number of countries, but locally some countries are very dependent on coal

Estimates based on BP Statistical Review of World Energy 2019

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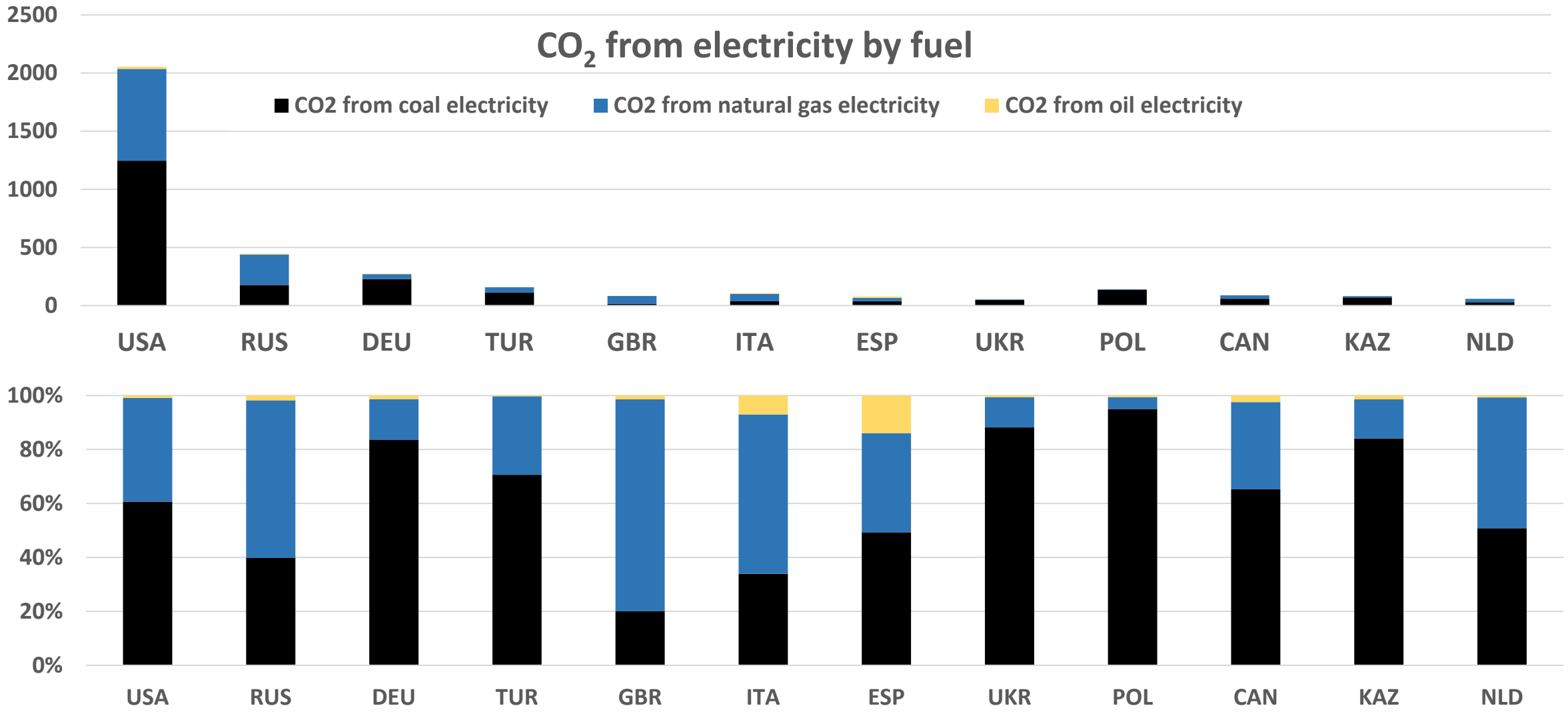
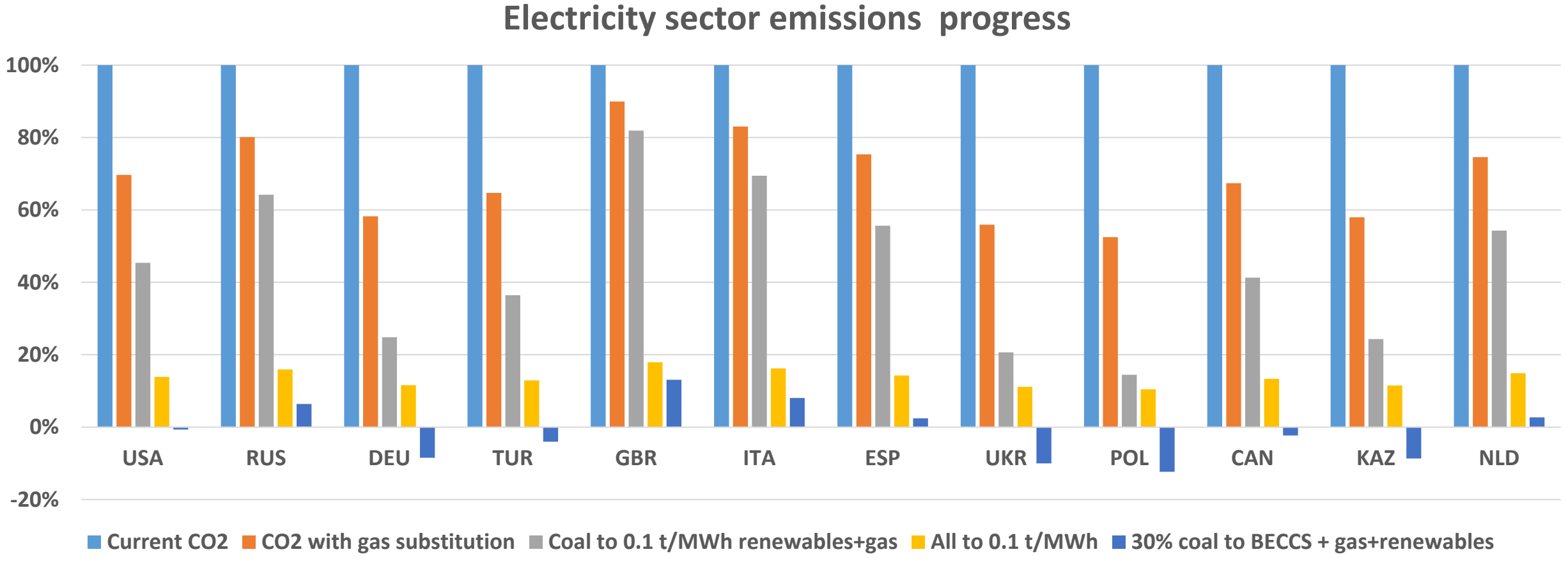


Cutting electricity sector emissions in UNECE countries via different scenarios for replacing existing coal generation - just getting rid of coal will not solve climate change!

- Switching from coal to gas has a limited effect
- Also cutting coal generation by 90% (or replacing with gas) and using renewables for the rest to average 0.1tCO_2/MWh
- Need to cut <u>all</u> fossil generation to get low levels of emission – but this would not be sufficient for net-zero
- Converting ~30% of coal generation to BECCS get to net-zero CO_2 emissions or below

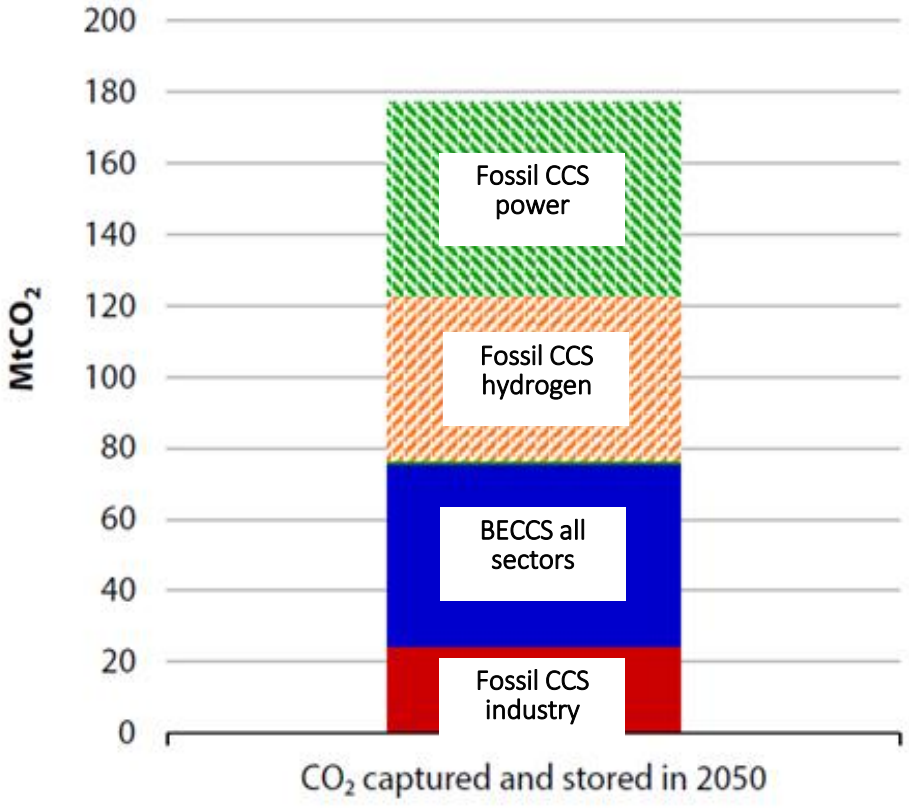


CCS in Net-Negative Electricity Systems for Net-Zero GHG Emission Societies

https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/

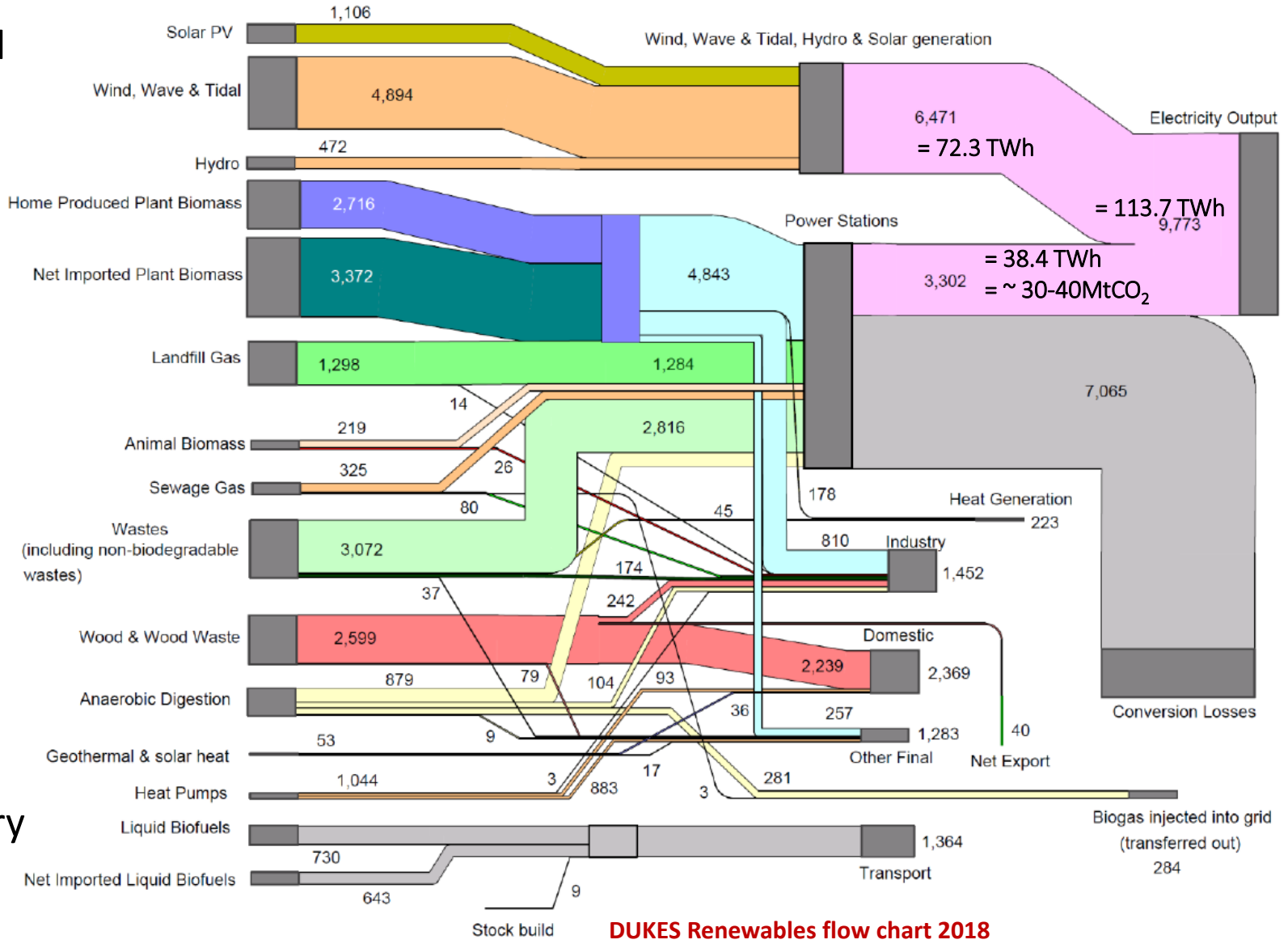
- UK Committee on Climate Change has scenarios for achieving net-zero GHG emissions nationally in 2050
- "CCS in not an option, it's a necessity"
- Negative emissions are a key requirement to get to net-zero and BECCS is limited only by biomass availability
- Most BECCS expected via combustion for electricity, may be in old or new power plants
- Also significant CCS on power from natural gas , with a limited amount of this via hydrogen

Emission source	**$MtCO_2$ in 2017/2018**	**2050 CCC Further Ambition Scenario for CO_2 captured and stored vs 2018**
Natural gas for power	50.2	~50 $MtCO_2$; ~100% of current
Hydrogen, for natural gas substitution and 'new' applications		~45$MtCO_2$; equivalent to~45% of current total direct natural gas use, or >100% of current industry and commercial natural gas use
Direct Air Capture		Yet to be determined
Biomass and wastes into power only (but CO_2 not reported)	30-40	~50 $MtCO_2$; ~ 150% of current, but current is a mix of large and dispersed sources with domestic and imported biomass
Industry, fossil and process above	~35	~25 $MtCO_2$; ~70% of current, some extra reductions could be via H_2



UK renewables – large role for biomass in coal plants - but CO_2 emissions from biomass are largely invisible

- If CO_2 from <u>any</u> source is captured and stored and prevented from going into the atmosphere then the result is the same
- Biomass flue gases have high concentrations of CO_2 so the electricity output penalty for capturing them is low
- Drax in the UK has converted 3 x 660MW coal units to 100% biomass firing, with derate
- Drax is now examining possibility for CCS
- But full conversion is not necessary to get the benefits of BECCS; co-firing gives flexibility



DUKES Renewables flow chart 2018

https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2019

The role of all fuels – fossil, biomass and hydrogen - in delivering net-negative electricity to support net-zero societies

- Just getting rid of coal power generation won't solve climate change
- In the short term just cutting coal can give marginal changes in electricity CO_2 emissions but delays essential developments on CCS
- Emissions from low-efficiency peaking plants likely to be locked in – hard to address with CCS
- When CCS is needed on both coal and natural gas then there will be much closer competition between these two fossil fuels
- But there is also a major requirement for BECCS to deliver net-zero societies - electricity will have to be net-negative to compensate for more challenging sectors
- Co-firing in coal plants and 100% conversion to biomass has been widely demonstrated
- Amounts of biomass could be limiting for BECCS – but there may be more than is obvious
- Big waste if coal plants are closed and then new solid fuel power plants have to be built again for BECCS - CCS also provides scope for additional coal use alongside BECCS