

2050 UK Emission Reduction Pathway

Reduction of CO₂ at 80% by 2050!



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Carbon Dioxide Emission

Carbon Dioxide, CO₂

It is colorless, odorless, non-poisonous gas.

Formed by the combustion of carbon and as living lives breath out.¹

Emission

The carbon dioxide, CO₂ being release into the atmosphere over a specified area and time.¹

¹ Glossary of Statistical terms



Climate Change & Global Warming



1,420,181,678
Tons emitted into the atmosphere



14.882
World average temperature (°C)



246,440,324,536
Tons of melted ice



24.395
Rise in sea levels (cm)²

² The World Counts; <https://www.theworldcounts.com/challenges/climate-change/global-warming/global-co2-emissions>

The consumption of energy has **major impacts**:

- Climate Change
- Global Warming
- Pollution

For instant, some adverse climatic events around the world.



Antarctica Loss



Antarctica is now losing
252 billion tonnes
of ice each year.³



³ <https://www.theworldcounts.com/challenges/climate-change>

Projections



Halting the loss and degradation of natural systems and promoting their restoration have the potential to contribute over 1/3 of the total climate change mitigation by 2030.⁴

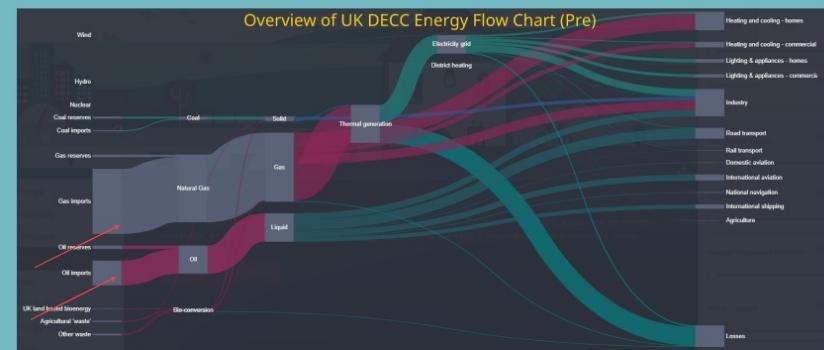


⁴ 2020 IUCN, International Union for Conservation of Nature; Forest & Climate Change

MSc RE 2050 UK Emissions Reduction Pathway

In our pathway, we have decided to maximize the following criteria:

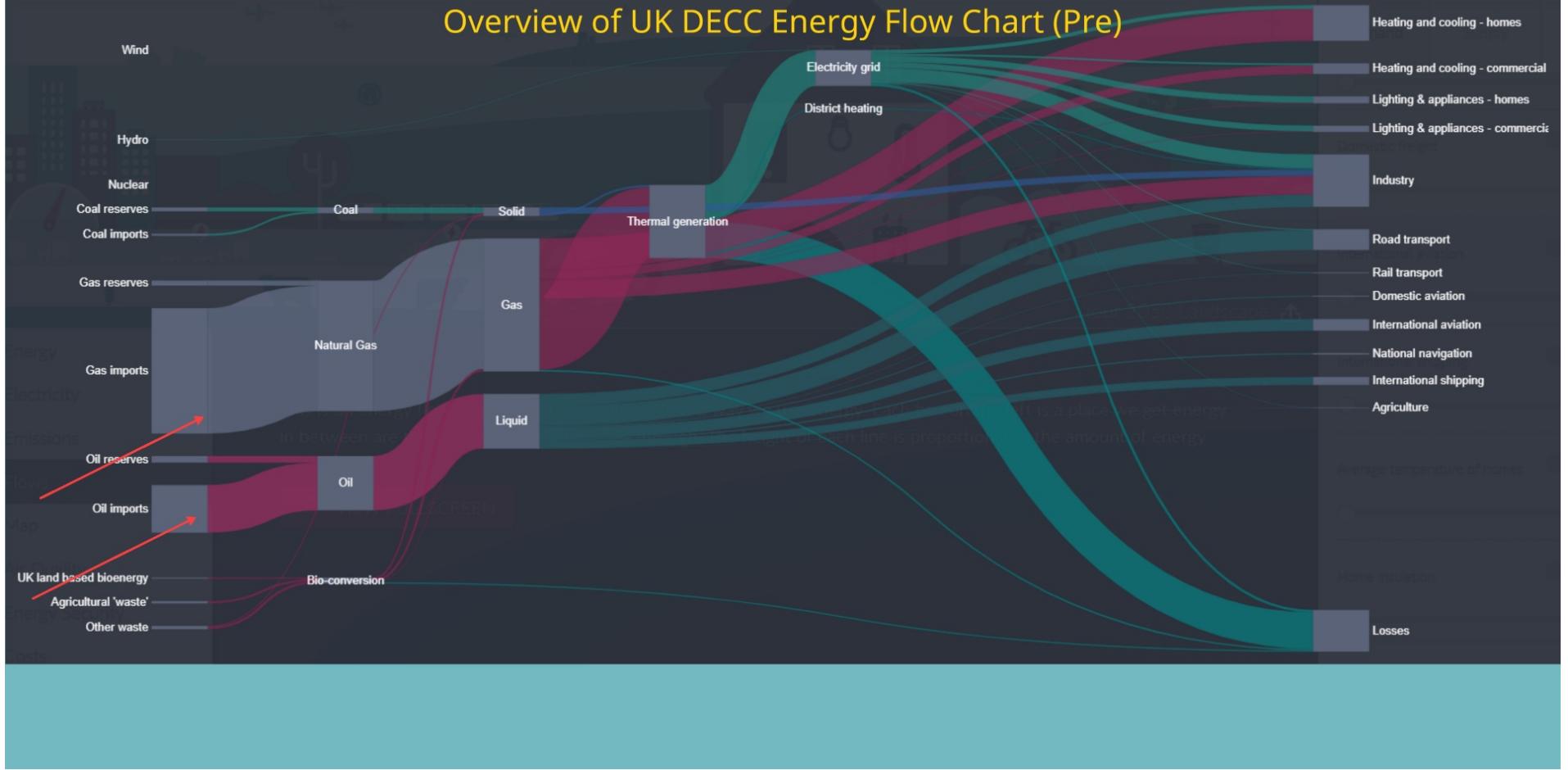
- Demand
 - Domestic Transport Behavior
 - Shift to zero emission
 - Average temperature of homes
 - Home heating electrification
 - Energy intensity of industry
- Supply
 - Bio-energy Imports
 - Geo-sequestration



Fuel Combustion



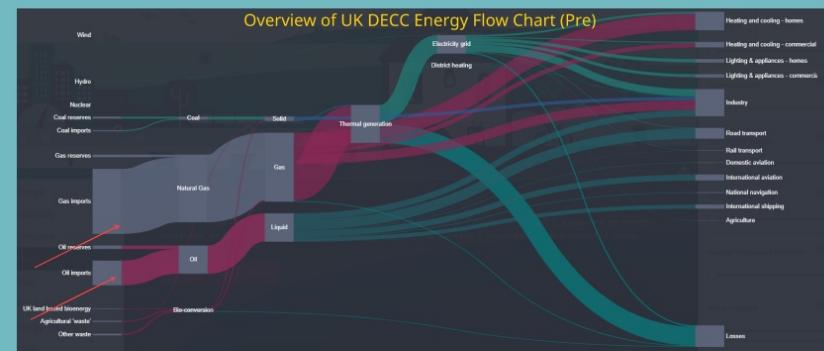
Overview of UK DECC Energy Flow Chart (Pre)



MSc RE 2050 UK Emissions Reduction Pathway

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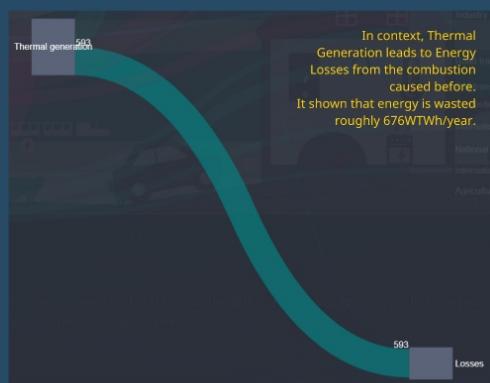
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Fuel Combustion



Gas - Takeaways



Justification

Average temperature at home:

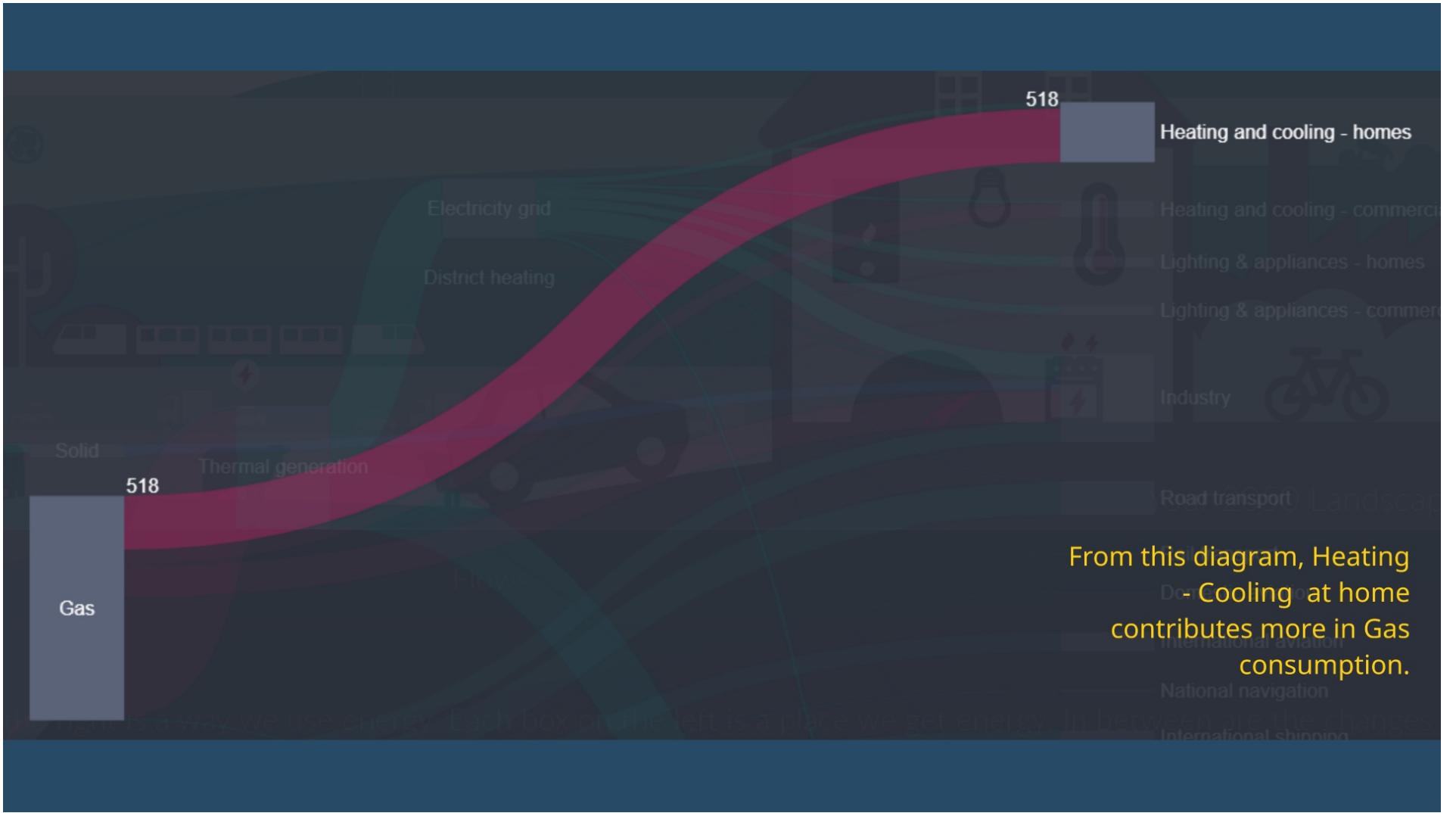
- Demands for heating and cooling can be adjusted by several actions and understanding awareness.

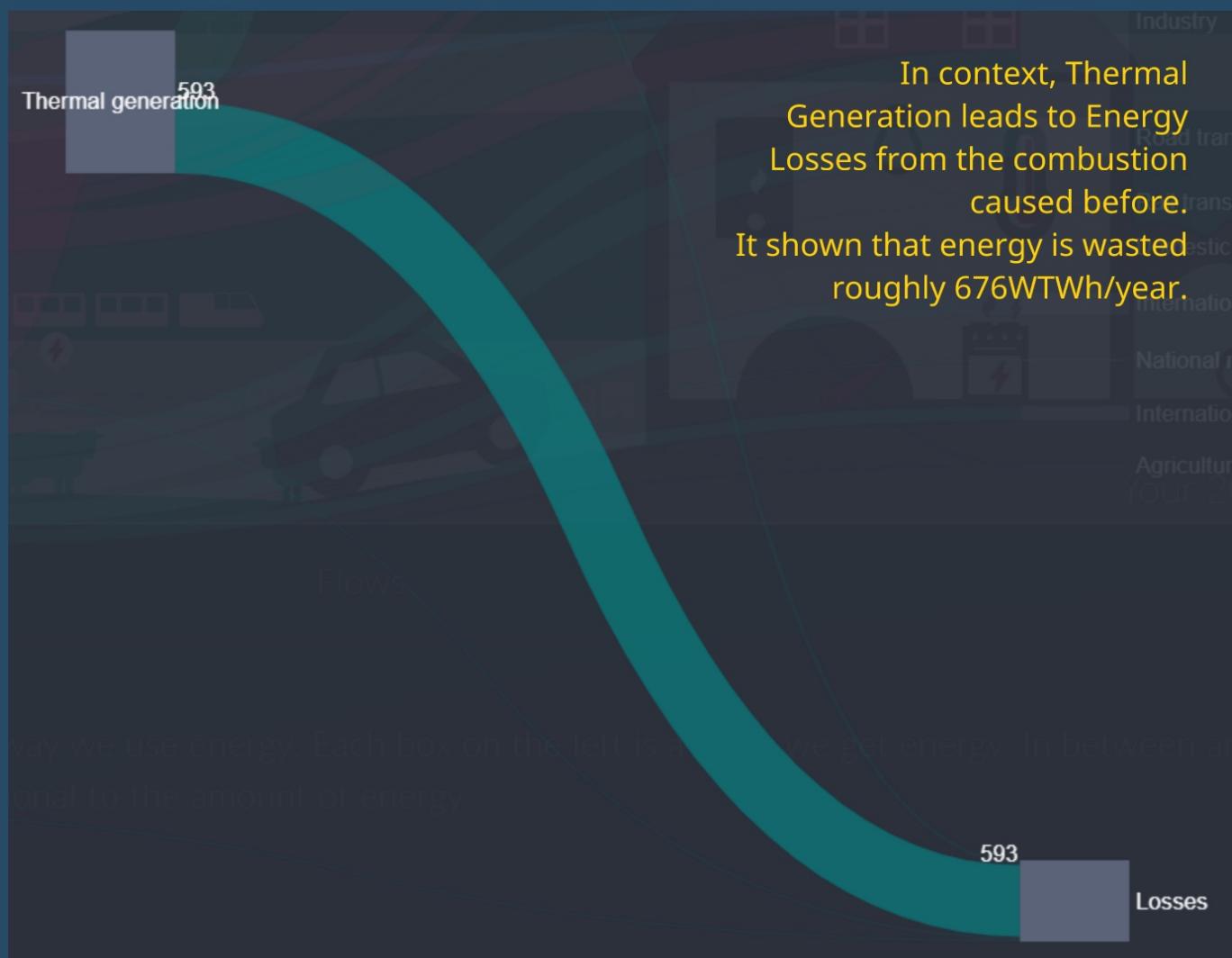
Home Heating Appliance:

- In 2007, only 10% of homes used the heater appliance as the rest used the conventional way.

Home Insulation:

- Requires investment which may be unaffordable for some.
- Leads to higher cost per capita.





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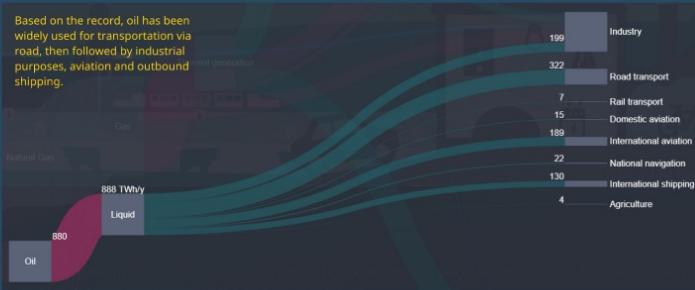
Home Heating Appliance:

- In 2007, only 10% homes used the heater appliance as the rest used the conventional way.

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Oil - Takeaways



Justification

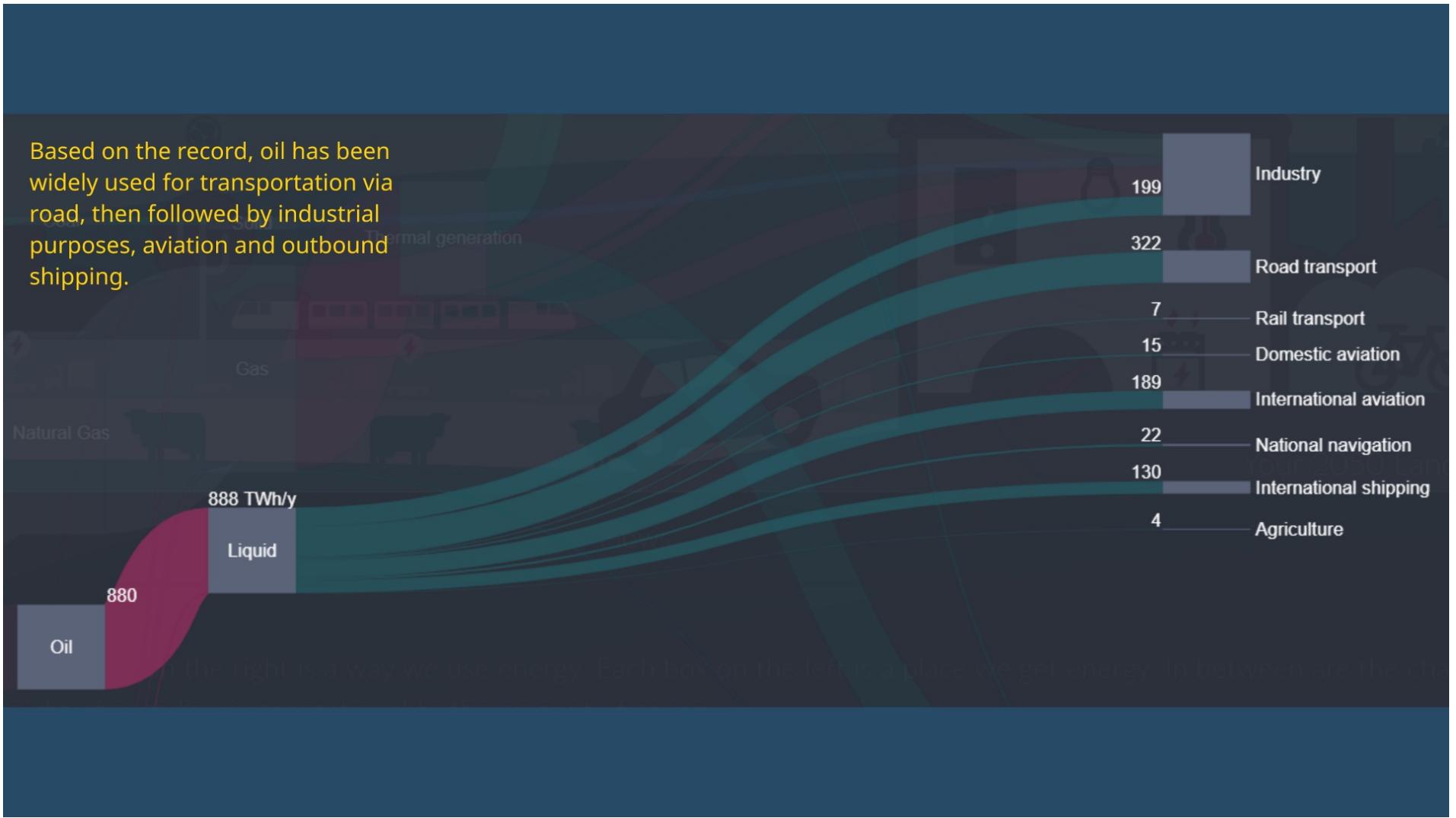
The reduction in the demand of fuel for transportation is estimated to face drastic changes with the technological evolutions in the future.

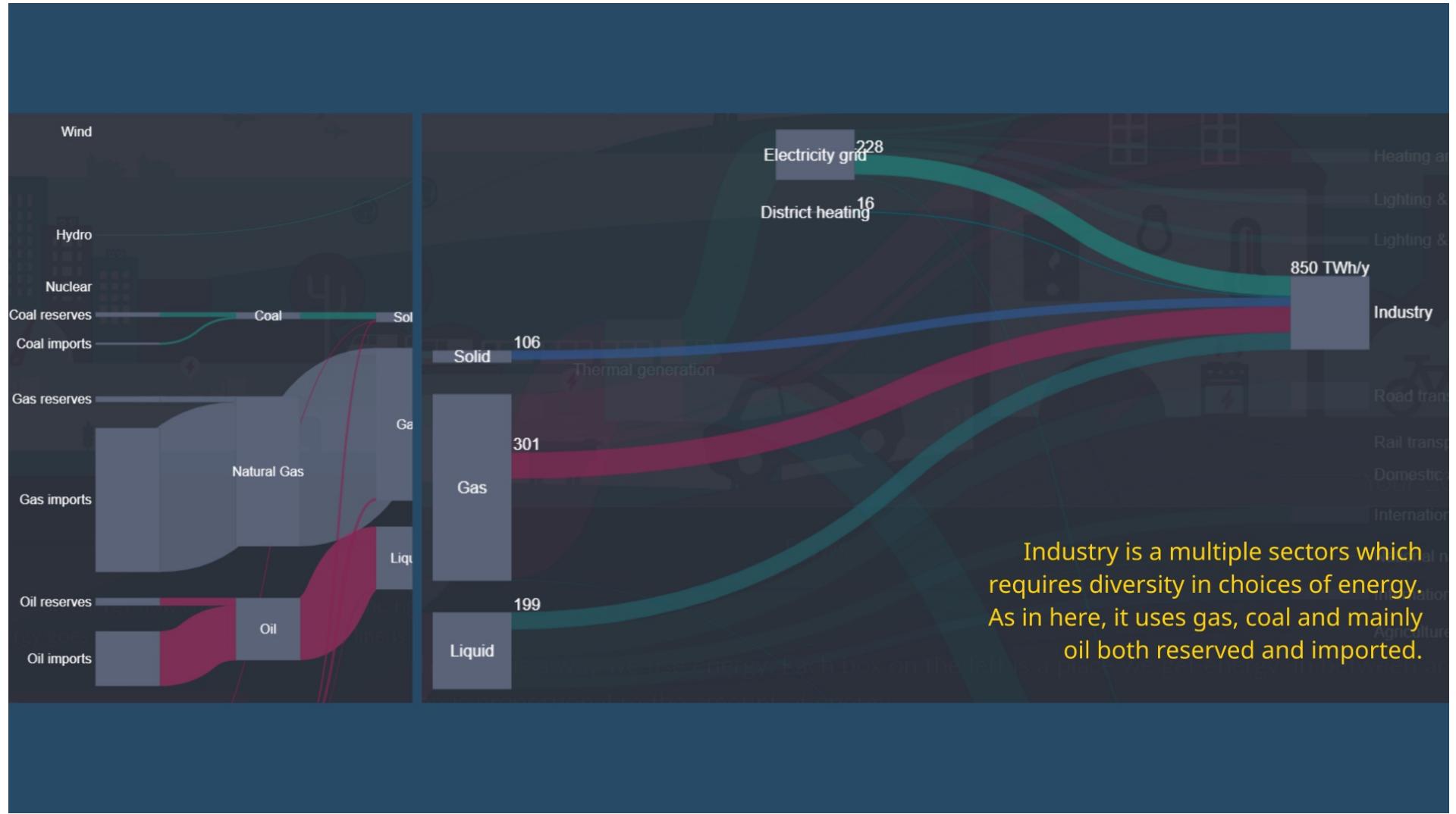
- Domestic Transport Behavior
 - Car Pool
 - Public transport

- ZERO Emission Transport
 - Electric vehicle
 - Renewable Energy public transport

Industrial and large public or private sectors organization contributes more in greenhouse emissions because gas and oil are the main mobilizer to its operation.

- Renewable Electricity
 - Bio Energy
 - Geo-sequestration





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The Alternatives

**Advanced
Technologies**

7 to 8 inches

Sea levels have
gone up since 1900



01

Offshore Wind Turbine

- UK has a geographical advantage which allows an offshore wind turbine to be installed widely.

02

Solar Panel

- With abundant source from the sun, solar panel can be the most clean energy with zero carbon dioxide emission.
- Also, it is adaptable, compatible and user-friendly.

03

Bio-energy

- Flexible energy source, easily step up and down to meet the load demand.
- Great back up for weather-dependent renewable technologies.

04

Geo-sequestration

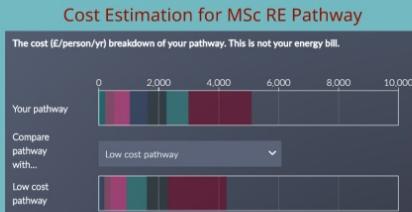
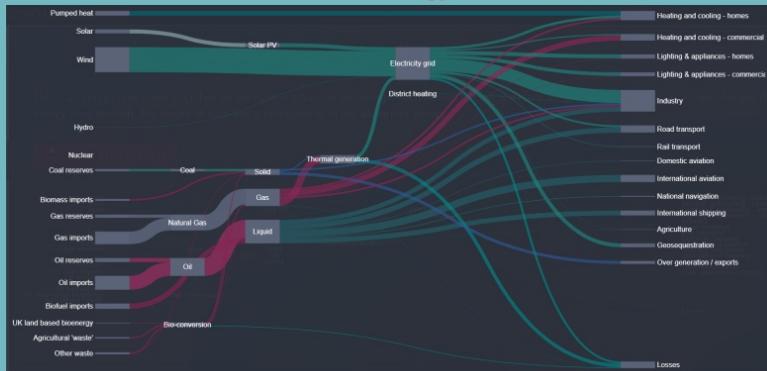
- Decompose-technology with plenty of benefits.

DIVERSITY:
By reducing the gas and oil consumptions, researches has been expanding over the years. Following are the choices MSc RE has strongly agreed with.



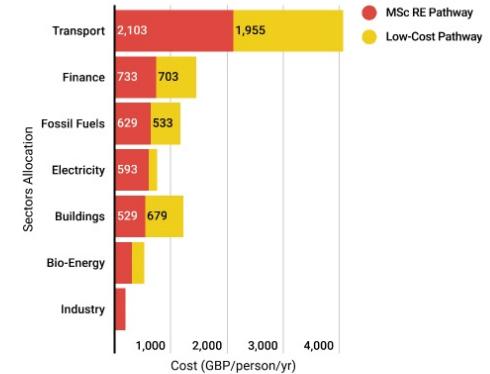
The Outcomes in 2050

Overview DECC 2050 Energy Flow Chart (Post)

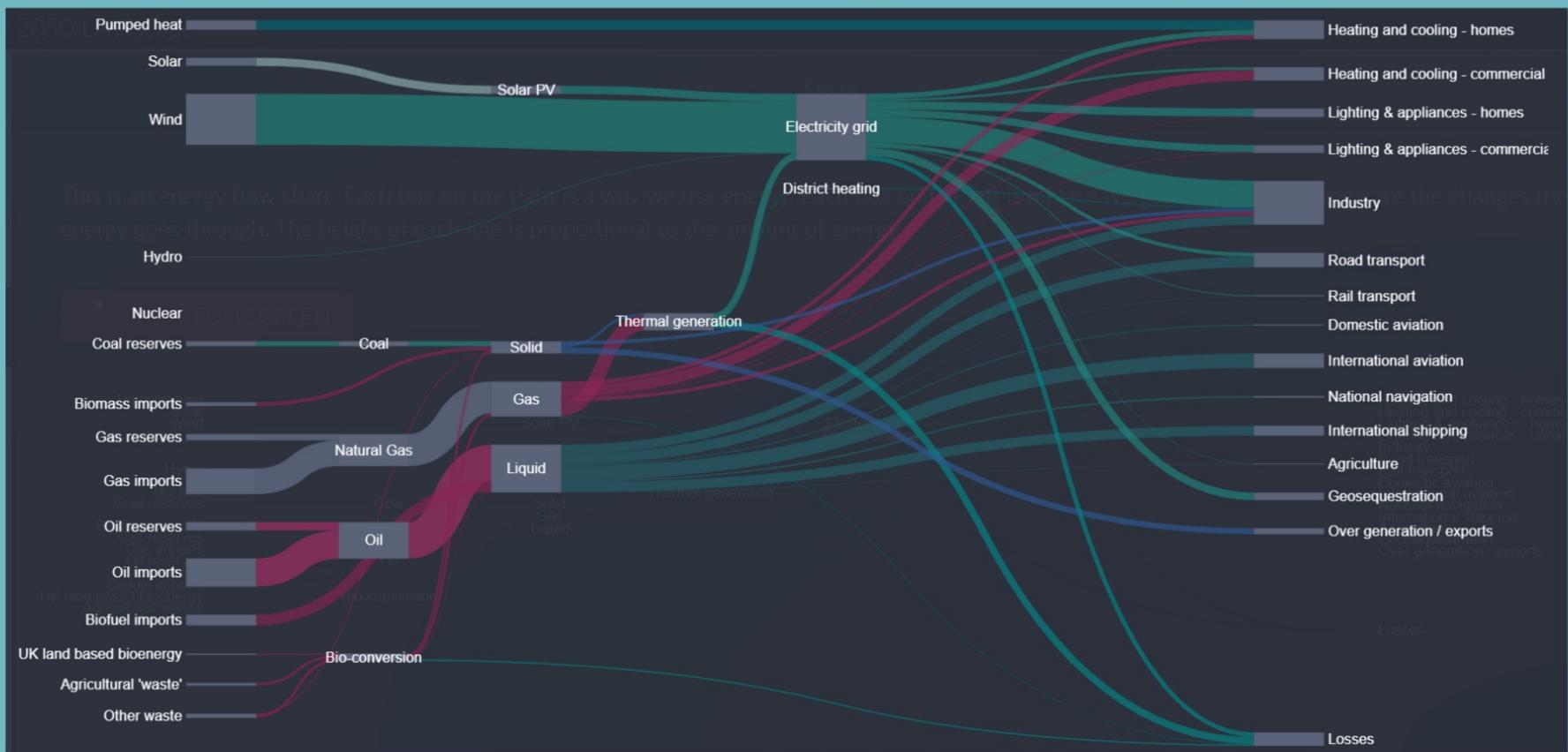


In details observation from the overview:

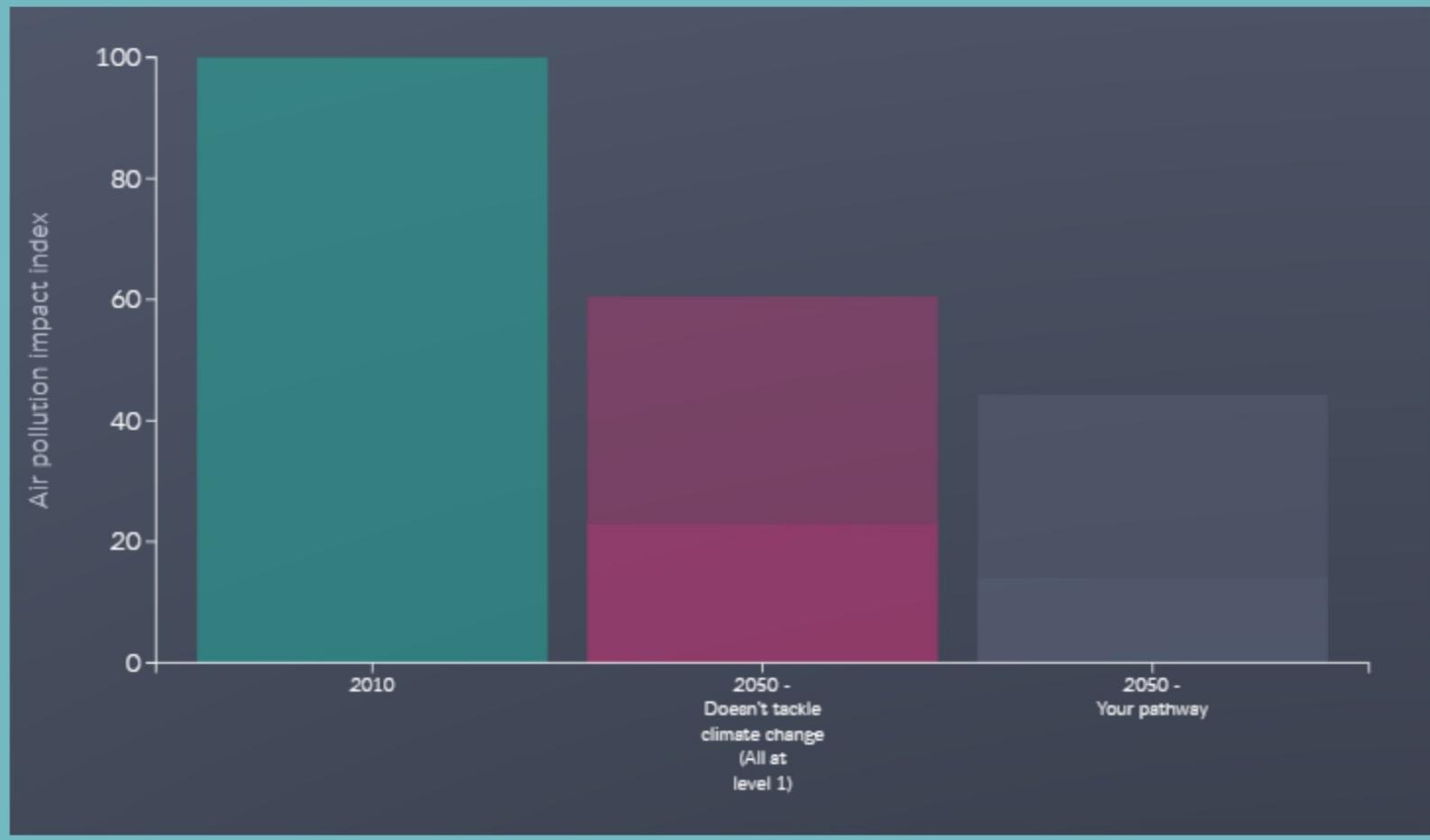
- **Losses** in total of 175TWh/yr has been decreased as following:
 - Gas : 5TWh/yr
 - Bio-conversion : 18TWh/yr
 - Thermal Generation : 93TWh/yr
 - Electricity Grid : 60TWh/yr
- The **air pollution** has decreased half from 2010.
- While the **cost** breakdown can be illustrated as below:



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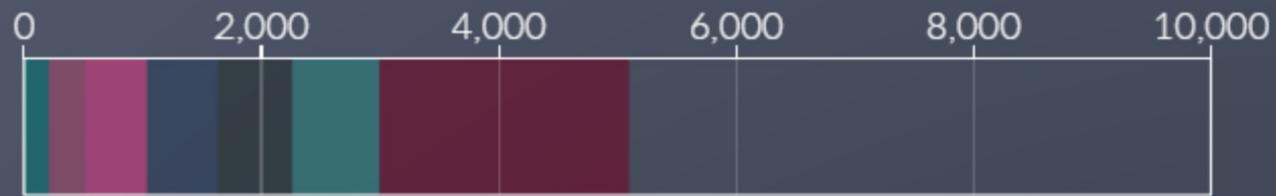
Air Quality for MSc RE Pathway



Cost Estimation for MSc RE Pathway

The cost (£/person/yr) breakdown of your pathway. This is not your energy bill.

Your pathway



Compare
pathway
with...

Low cost pathway

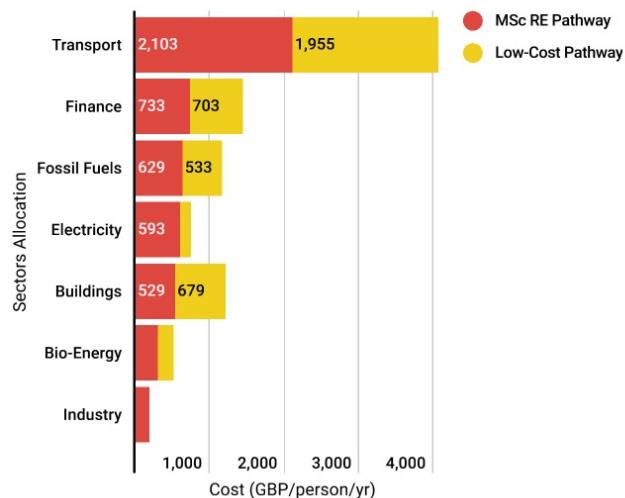


Low cost
pathway



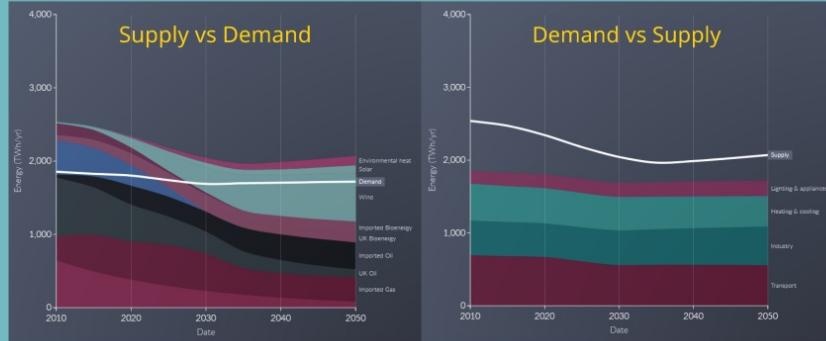
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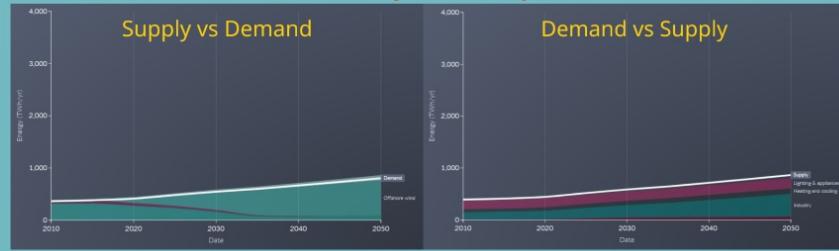


Demand & Supply of Energy & Electricity in 2050

Comparison between the demand and supply of energy over the year.



Comparison between the demand and supply of electricity over the year.



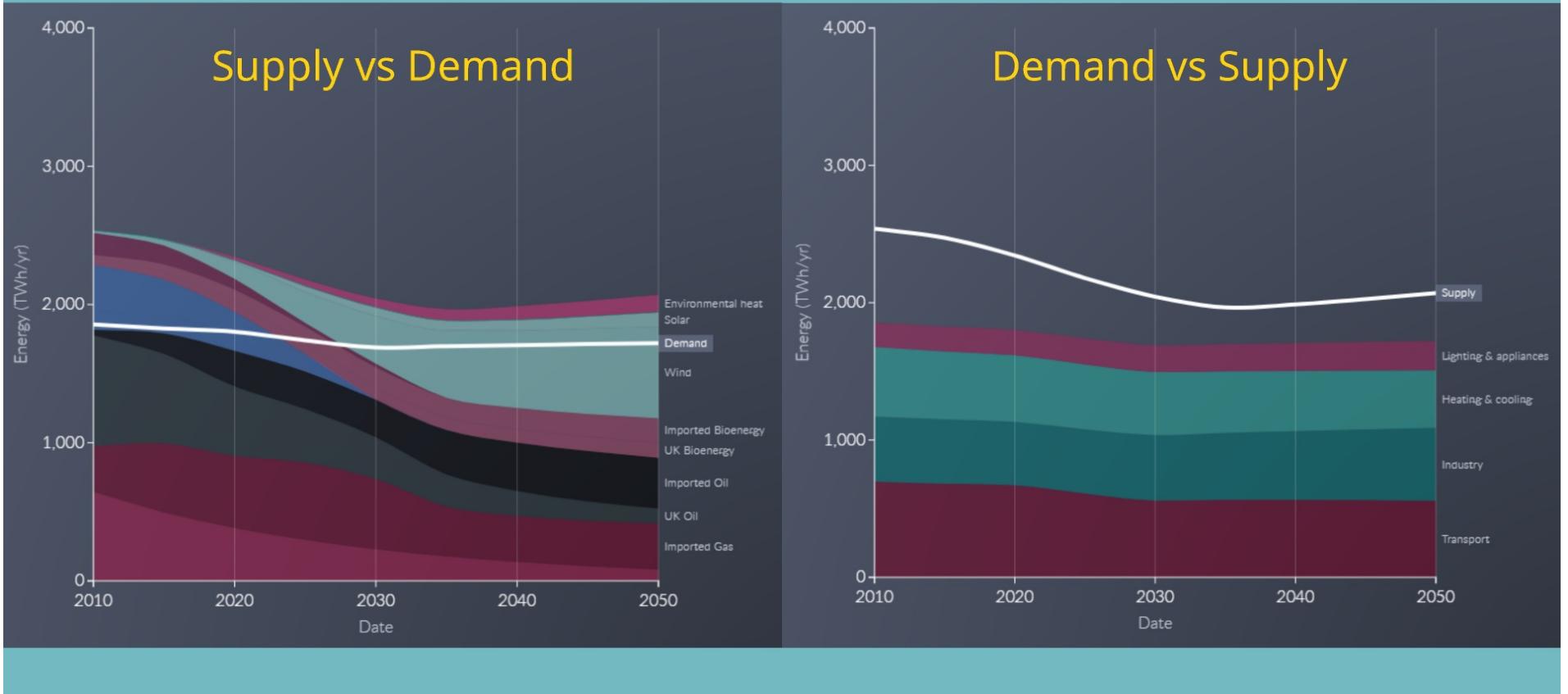
Demand for energy and electricity and the supply for both factors by 2050:

- Generation is 2720 TWh/yr.
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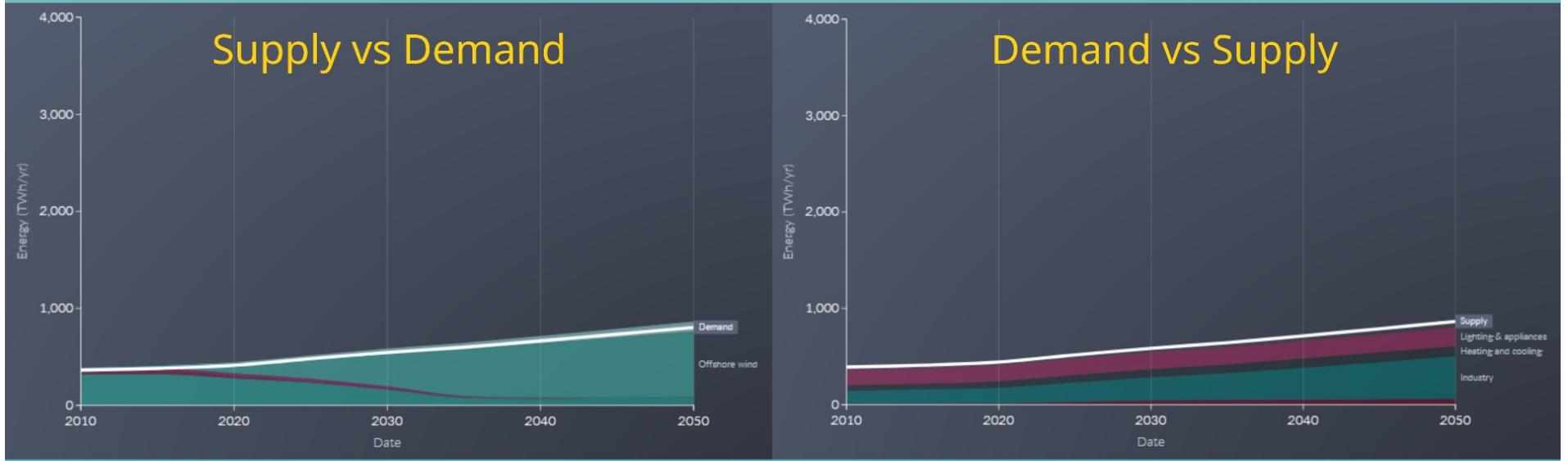
Projection:

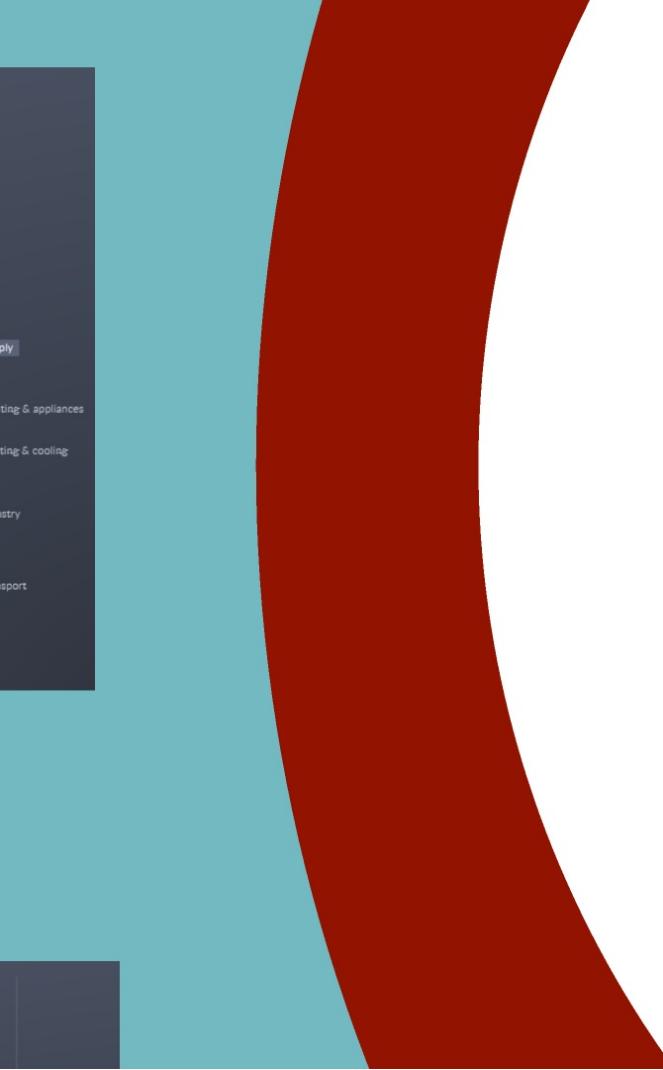
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Supply is secured!

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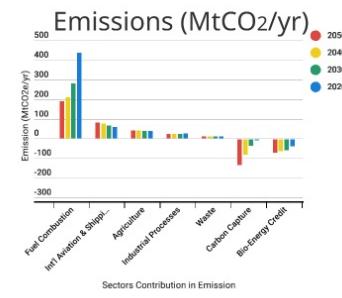
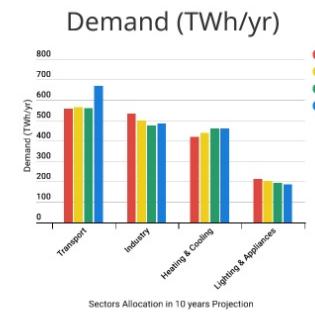
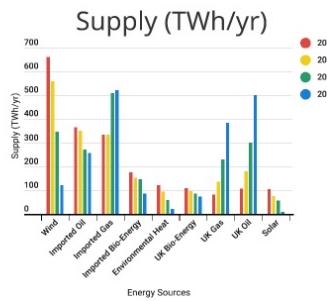


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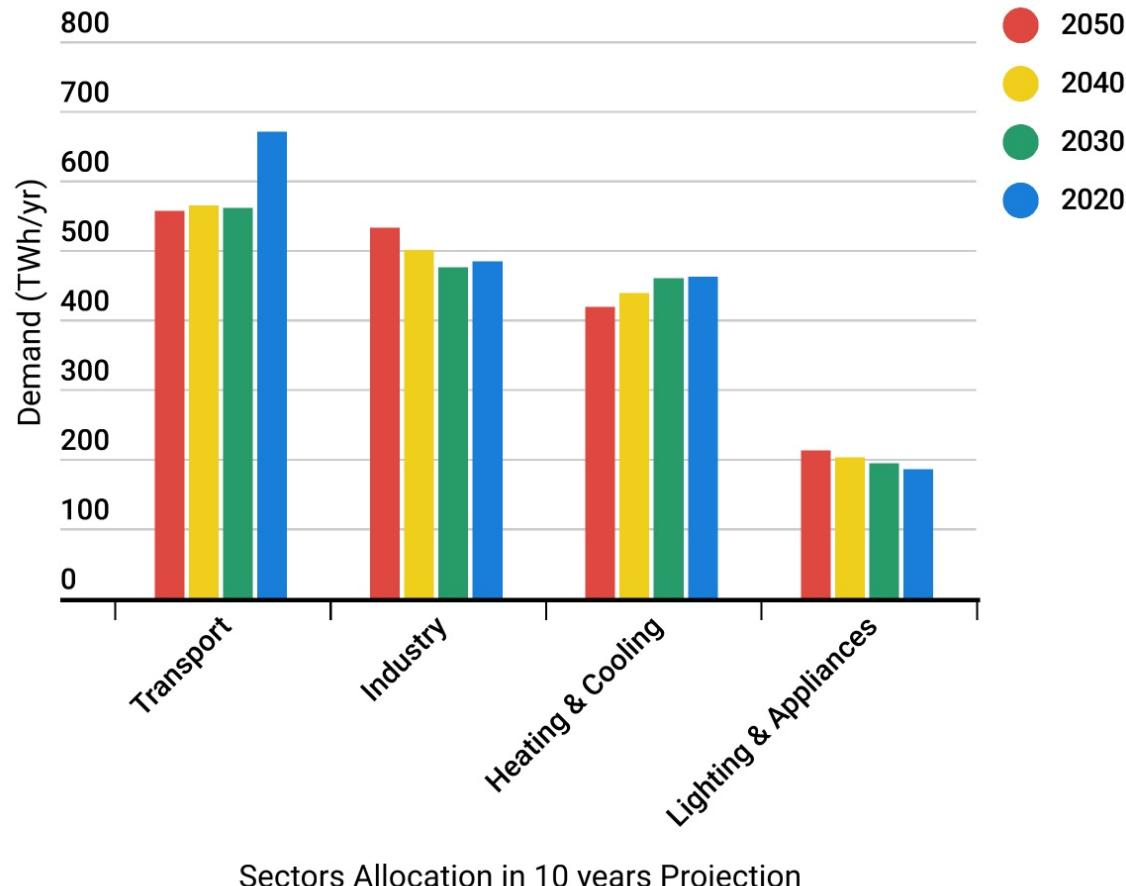
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Overview of Demand, Supply & Emission over the Decades

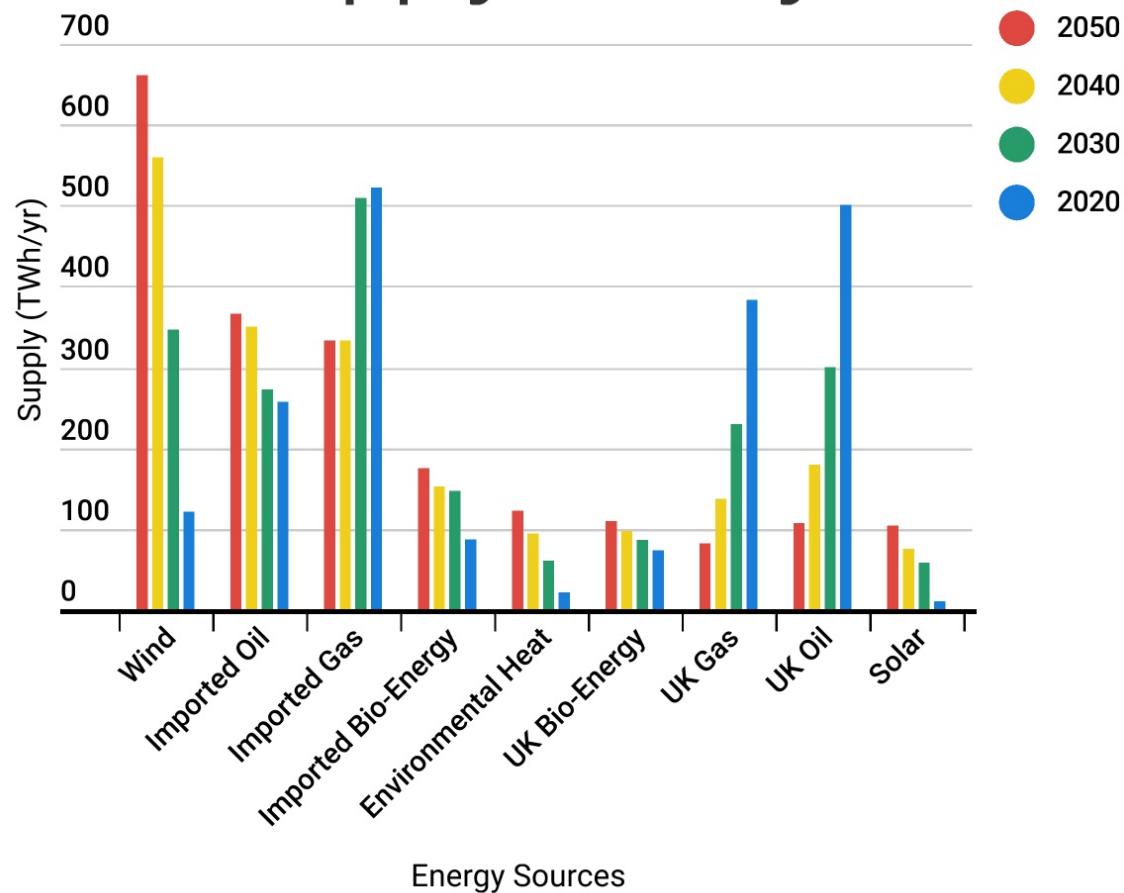




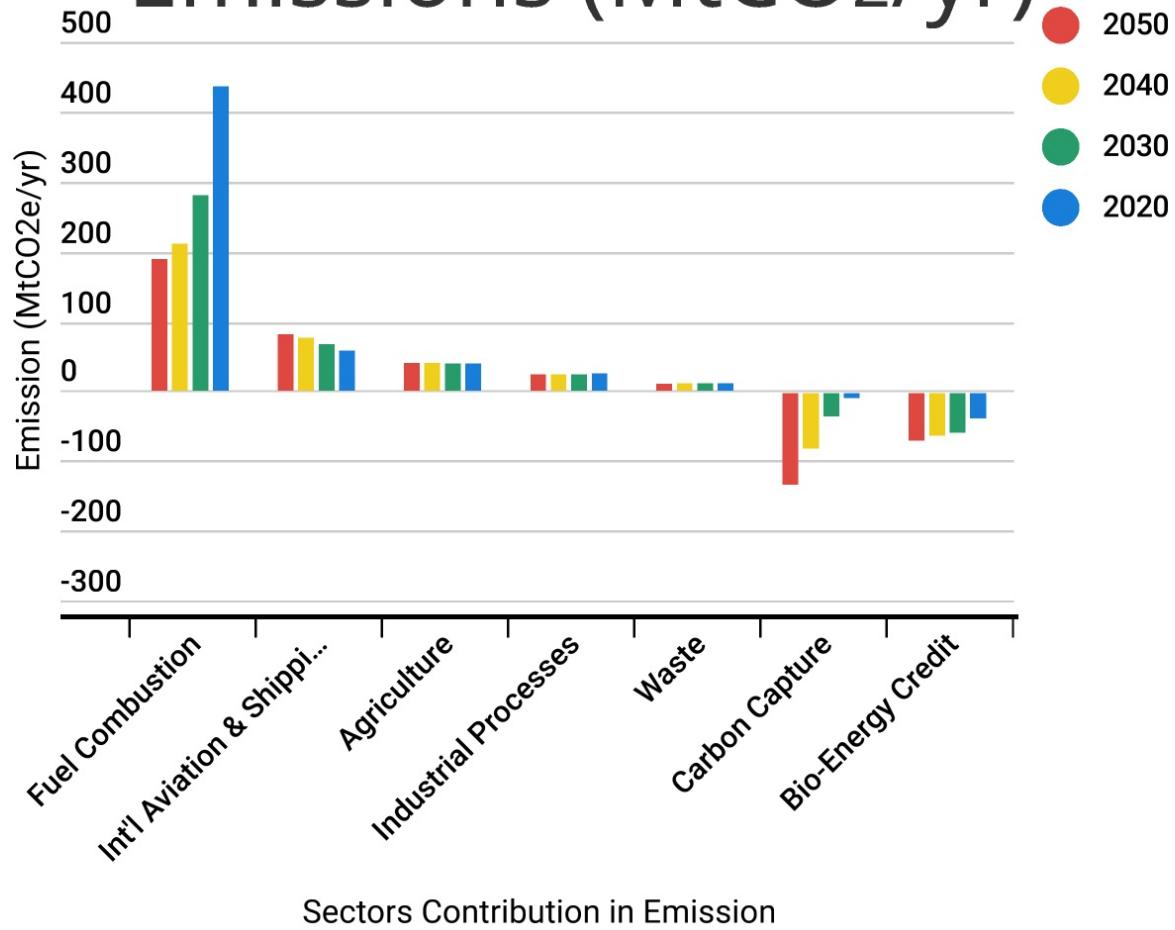
Demand (TWh/yr)



Supply (TWh/yr)



Emissions (MtCO₂/yr)



MSc RE vs Low-Cost

Main Differences

80% Target!

Cost

Choices of
Pathways





John Leland said..
Put biodegradable stickers in places that will
eventually be underwater with just 2°C of
global warming.



The Low-Cost's pathway has not reached the 80% goal of the target of reducing the greenhouse gas emission.

Due to several differences in choosing the suitable actions to be taken, it has only reached 77% of reduction target.

**80% CO₂
Reduction**



Cost for each UK citizen

- Despite the underachieved aims, on the pros side is the cost is lower by £1000 per capita in a year.
- Comparing result from DECC's calculation, it has illustrated than the cost for our pathways sums up to £5000 annually per capita.



The ideas of minimize the damage CO₂ emission strike from all sides of criteria, behavior and actions.

- Expedite on the renewable energies development.
- Cater the study the supply chain, in what can be done to help on this missions.

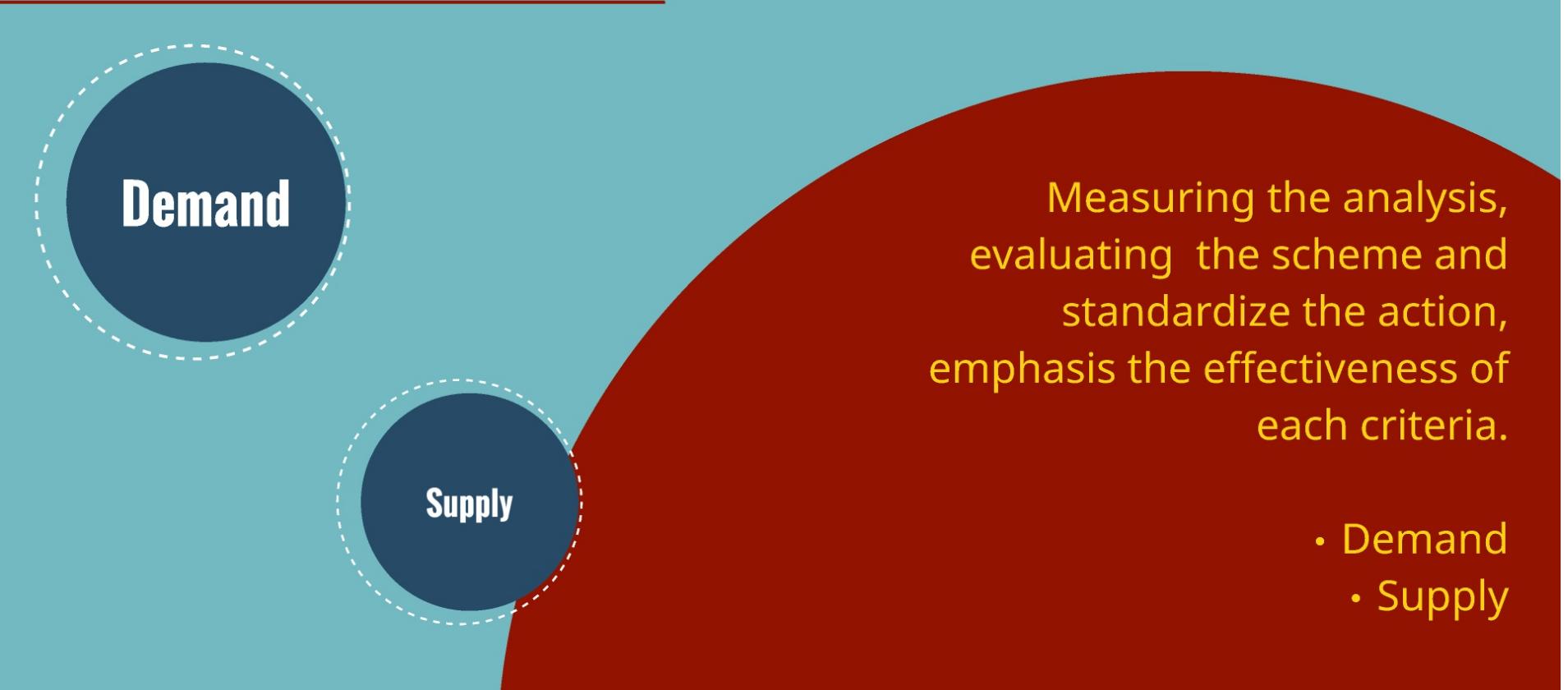
Oppositely from the Low-Cost's, whereas it only strike on the demand which is quite arduous especially amongst human being.

What to do?



Design Criteria

According to Jon Leland, people don't think about the damages of climate change because people assumed it scary. But people need to be scared, or they will have to pay for the causes.



Demand

Supply

Measuring the analysis, evaluating the scheme and standardize the action, emphasis the effectiveness of each criteria.

- Demand
- Supply

Demand

Significance

Economic growth paralleling with energy demand?

- Complex economy is endurable with larger energy flows.
- Optimize response for climate change, energy demand as the main contributor.
- Innovation, energy efficiency and conservative policy is the keys.

Low-Cost Pathway



(to be)

Average temperature of a home:

The ideal is 18 to 21 degrees Celsius.

Yet, it has to be decrease to 16 degrees Celsius.

(..drop about 1.5 degrees Celsius compared in 2007.)

Commercial Demand:

...Hot water demand: ▼ until 10%.

...Cooling demand: ▼ until 60%.

...Space heating demand: ▼ until 25%.

Home Lighting & Appliances:

Energy demand for electricity and appliances: ▼ until 60%.

Supply



Projection layout proposed from manufacturing companies into tackling the supply chain correlation with the carbon emission reduction:

- Modify and integrate the technology.
- Introduce the ideology of CO₂ reduction at both ends (Supplier & Consumer).⁵

Highlight



⁵ Demand-side approaches for limiting global warming to 1.5°C.

MSc RE Pathway

- Developing renewable, beneficial for cost impact mitigation.
- Expanding the biomass by planting almost 10% of the land's capacity for energy harvesting.
- Initiate the eco-saving policy, "Volume of Waste & Recycling" with the goal of 20% decrement of wastes and boost up the recycling habits.

**Low-Cost
Pathway**

Nuclear Power Stations

- Target to deliver 13.3GW, roughly 280TWh/year.
- Limited supply of Uranium, estimation only secured within 80 years ahead.
- Nuclear fuel decomposition takes years until it is properly vanished.
- Also, every power stations must be decommissioned after 40-60 years of operation.
- Uranium is highly aimed as a weapon threat.⁶



⁶ Renewable Resources Coalition

References

- [1] Glossary of Statistical Terms. <https://stats.oecd.org/glossary/detail.asp?ID=284>
- [2] The World Counts; <https://www.theworldcounts.com/challenges/climate-change/global-warming/global-co2-emissions>
- [3] <https://www.theworldcounts.com/challenges/climate-change>
- [4] 2020 IUCN, International Union for Conservation of Nature; Forest & Climate Change; <https://www.iucn.org/resources/issues-briefs/forests-and-climate-change>
- [5] Mundaca, L., Ürge-Vorsatz, D. & Wilson, C. Demand-side approaches for limiting global warming to 1.5 °C. Energy Efficiency 12, 343–362 (2019). <https://doi.org/10.1007/s12053-018-9722-9>
- [6] Renewable Resources Coalition; <https://www.renewableresourcescoalition.org/nuclear-energy-pros-cons/>
- [7] https://set.kuleuven.be/ei/images/EI_factsheet1_eng_def.pdf
- [8] <https://share.america.gov/diversifying-energy-sources-boosts-security/>
- [9] National Academies of Sciences, Engineering, and Medicine. 2019. Negative Emissions Technologies and Reliable Sequestration: A Research Agenda. Washington, DC: The National Academies Press. doi: <https://doi.org/10.17226/25259>.

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