

FUTURE ENERGY AND ENERGY MATERIALS

ENERGY FACTSHEET 2022 – ELECTRICITY AND TRANSPORTATION FOCUS

OVERVIEW

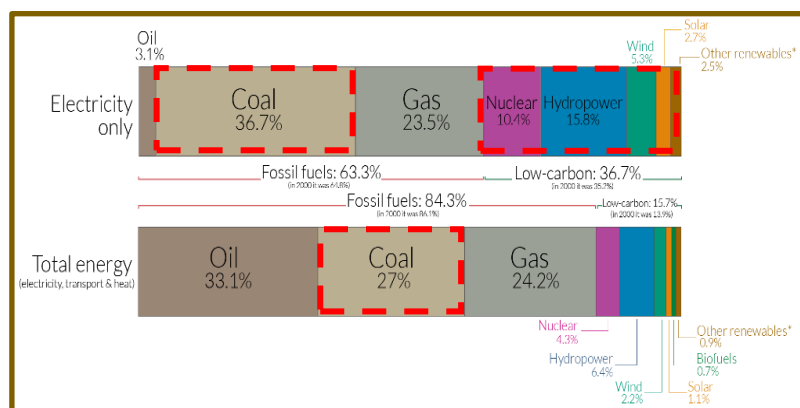
There are three energy **end uses** that make up total global energy production – **electricity, transport and heating**.

Combined, the overall energy sector accounts for 73% of **global greenhouse gas emissions** annually, with a further ~18% from agricultural/land use activity, 5% from industry and 3% from waste (Ritchie & Roser, 2020).

When people refer to the ‘**energy mix**’ this covers a diverse range of **energy sources** from coal, oil, gas, nuclear, hydro, solar, wind, bioenergy to Ammonia/Hydrogen that are used to produce energy.

People commonly use the words ‘**electricity**’ and ‘**energy**’ interchangeably, however they have vastly different meanings and understanding the difference between these terms is essential in focusing global decarbonisation efforts and related investments.

ELECTRICITY



Coal is currently the largest source of electricity generation globally with coal use increasing during COVID-19 (Ritchie & Roser, 2020). Coal is also the primary electricity generation source in Asia Pacific (Ritchie & Roser, 2020). Low-carbon emission energy sources (i.e., nuclear and renewables) together account for 36.7% of total electricity output - the same level of electricity generation as Coal (Ritchie & Roser, 2020). Transport and heating end uses rely much more heavily on fossil fuels.

Figure 1 Total Energy & Electricity Breakdown per Energy Source (Ritchie & Roser, 2020)

As a result of generations of innovation and development, Coal-fired power plants are now highly cost competitive in electricity generation.

Co-firing Coal-fired power plants with De-Carbonised (Blue and/or Green) Ammonia or **DCammonia** takes advantage of existing operating plant infrastructure, limiting the need for new construction investment, significantly reducing the electricity sector’s carbon emissions and potentially creating the lowest cost impact on electricity end consumers.

Hexagon’s **DCammonia** production will use renewable energy input to the greatest extent possible from the outset and is expected to participate in electricity and transport, shipping specifically, decarbonisation.

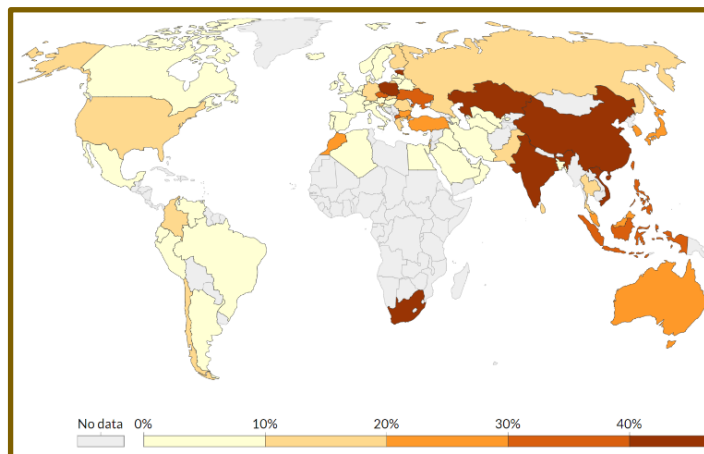


Figure 2 Share of Primary Energy from Coal in 2019 (Ritchie & Roser, 2020)

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TRANSPORTATION

Transportation globally can be broken down into four major modes – road, air, shipping, and rail.

Transportation generates approximately 16% of global greenhouse gas emissions annually - road contributing 12%, air 2%, shipping 2% and rail 0.4% (Ritchie & Roser, 2020).

Each mode has distinctly different vehicle types, and as a result, uses different sources of energy:

- For road, air, and shipping transportation predominantly fossil fuels are used – petroleum products, biofuels, and natural gas;
- The road sector is currently undergoing rapid electrification, with introduction of full hybrid, plug-in hybrid, and battery electric vehicles. In 2021, electric car sales more than doubled, representing close to 9% of the global car market and more than tripling market share from two years earlier (IEA, 2022);
- Low-carbon fuels, including hydrogen, are being considered for air;
- For rail, electricity is the most common energy source.

The shipping sector is currently reliant on fossil fuels used in reciprocating diesel engine technology, a result of their operating simplicity, robustness, and fuel economy. Developments are underway to deliver innovative, new shipping engine technology that use sole and mixed Ammonia/Hydrogen for combustion with no resulting carbon emissions. New technology and the use of De-Carbonised (Blue and/or Green) Ammonia or **DCAmmonia** could transform the shipping sector, significantly reducing carbon emissions from shipping transportation.

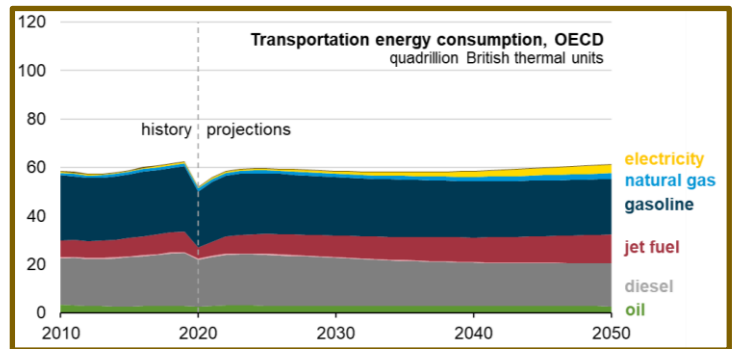


Figure 3 Global Transportation by Energy Source, OECD (US EIA, 2021)



Figure 4 Electric Car Fleet (Geotab Inc, 2022)

DCAMMONIA ADVANTAGES IN ELECTRICITY AND TRANSPORTATION



Ability to co-fire **DCAmmonia** with existing coal fired power plants without significant engineering and design changes and capital investments.



DCAmmonia already proven as a drop in fuel with diesel for maritime shipping



No CO₂ emissions directly attributed to using **DCAmmonia**



Low production, storage, and transport costs of **DCAmmonia** compared to other carbon-neutral fuels particularly liquid hydrogen.

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