

# Energy Options for Decarbonisation

## Nuclear



Energy density.. 20,000,000\*  
 Safety..... 33\*  
 Life span..... 60y  
 Reliability..... 92%  
 Carbon Footprint..... 6\*  
 Public Support..... 43%

## Hydropower



Energy density.... 0.0003\*  
 Safety ..... 1\*  
 Life span..... 80y  
 Reliability..... 45%  
 Carbon footprint..... 177\*  
 Public Support..... 74%

## Wind



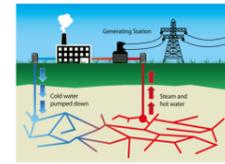
Energy density.... 0.0003\*  
 Safety..... 25\*  
 Life span..... 25y  
 Reliability..... 26%  
 Carbon Footprint..... 16\*  
 Public Support..... 76%

## Solar



Energy density.... 0.0003\*  
 Safety..... 50\*  
 Life span..... 30y  
 Reliability..... 13%  
 Carbon footprint..... 65\*  
 Public support..... 85%

## Geothermal



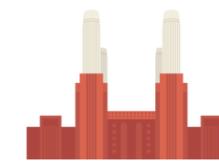
Energy density.... 0.0003\*  
 Safety..... n/a  
 Life span..... 100y  
 Reliability..... 74%  
 Carbon footprint..... 40\*  
 Public Support..... 74%

## Biomass



Energy density..... 1\*  
 Safety..... 0.2\*  
 Life span..... 30y  
 Reliability..... 64%  
 Carbon footprint..... 200+\*  
 Public Support..... 75%

## Coal



Energy density..... 1\*  
 Safety..... 0.04\*  
 Life span..... 50y  
 Reliability..... 80%  
 Carbon Footprint..... 925\*  
 Public Support..... 17%

## Gas

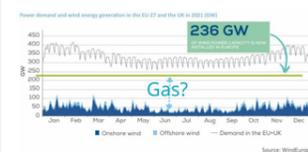


Energy density..... 1\*  
 Safety..... 0.4\*  
 Life span..... 30y  
 Reliability..... 85%  
 Carbon Footprint..... 455\*  
 Public Support..... 26%

**Nuclear Energy** can harness extremely high energy of the nuclear forces to generate energy with very little fuel and very little waste. Initial nuclear plants were designed for making plutonium and uranium but current nuclear plants under construction/planned in the UK are for civilian purposes only. Nuclear energy is safe contrary to public perception. ‘Spent’ fuel is cooled for 2-3 decades in a deep pool of water. Then remotely operated equipment dismantle the fuel elements to be dry stored inside casks.

**Hydropower / hydroelectric power** is one of the oldest and largest sources of renewable energy, which uses the flow of moving water released, generally, from behind a thick concrete dam to generate electricity.

**Wind-generated power** is a variable resource, and the amount of electricity produced at any given point in time by a plant will depend on wind speeds, air density and turbine characteristics. Installed capacity is fixed, but supply and demand are variable characteristics that don’t necessarily match as shown:



**Solar photovoltaics** are silicon semiconductors that absorb sunlight and create an electric current. A 300 Watt PV panel is 10% reliable in the UK, meaning on average, it would generate enough energy to power a 30 Watt lightbulb continuously (if the requisite battery storage were theoretically feasible).

**Geothermal energy** harnesses the natural heat of rocks in the ground. It is potentially feasible in geologically unstable areas with significant tectonic activity in the crust. Geothermal plants exist in California, Italy and Iceland.

**Biomass** is considered ‘renewable’ in the UK, though it primarily derives from burning imported woodchips at Yorkshire’s Drax power plant as well as energy-from-waste schemes. Burning wood releases carbon dioxide which contributes to the greenhouse effect.

**Coal** is a reliable source of ‘baseload’ energy which captures electron energy. As a fossil fuel, it generates carbon dioxide, responsible for the greenhouse effect, as well as particulate matter which can create smog and potentially contribute to respiratory problems in built up regions. The last coal fired power station in the UK closed in 2024.

**Gas** is a generally reliable and flexible energy source which captures electron-energy. As a fossil fuel, it releases carbon dioxide, which stays in the atmosphere 300-1000 years, and methane, which stays in the atmosphere for around 12 years. Methane has more warming potential than carbon dioxide. Gas complements intermittent energy to the grid due to its flexibility.

\* Energy density in kWh/kg derived from “Nature, Energy and Society: A Scientific Study of the Options Facing Civilisation Today” by Professor Wade Allison; Reliability (Capacity factor) and \*lifecycle greenhouse gas emissions (grams of carbon dioxide equivalent per kWh), are from the UNECE Report Life Cycle Assessment of Electricity Generation Options (2022) ; \* Safety is compiled from ourworldindata.org and inverts values to TWh per death; Life Span is the maximum life expectancy of a technology (approximate, depending on design, feasibility, grid system, political factors etc); Public support figures are derived from the YouGov 2024 Polls

About the authors: Marie and Ben Zabell are Imperial College graduates who created these info-cards to summarise the realities of well-known energy sources, due to a concern that, although it is clean and reliable, nuclear fission is not widely recognised in a favourable light, but is vital for decarbonisation.