

Britain's Energy Needs & Supplies

Past, Present &
Future



What do we need energy for?

- Domestic heat & light
- Transport (individual & public)
- Social infrastructure (schools, hospitals, public utilities)
- Industry & Construction
- Agriculture & farming

Prehistoric energy utilisation

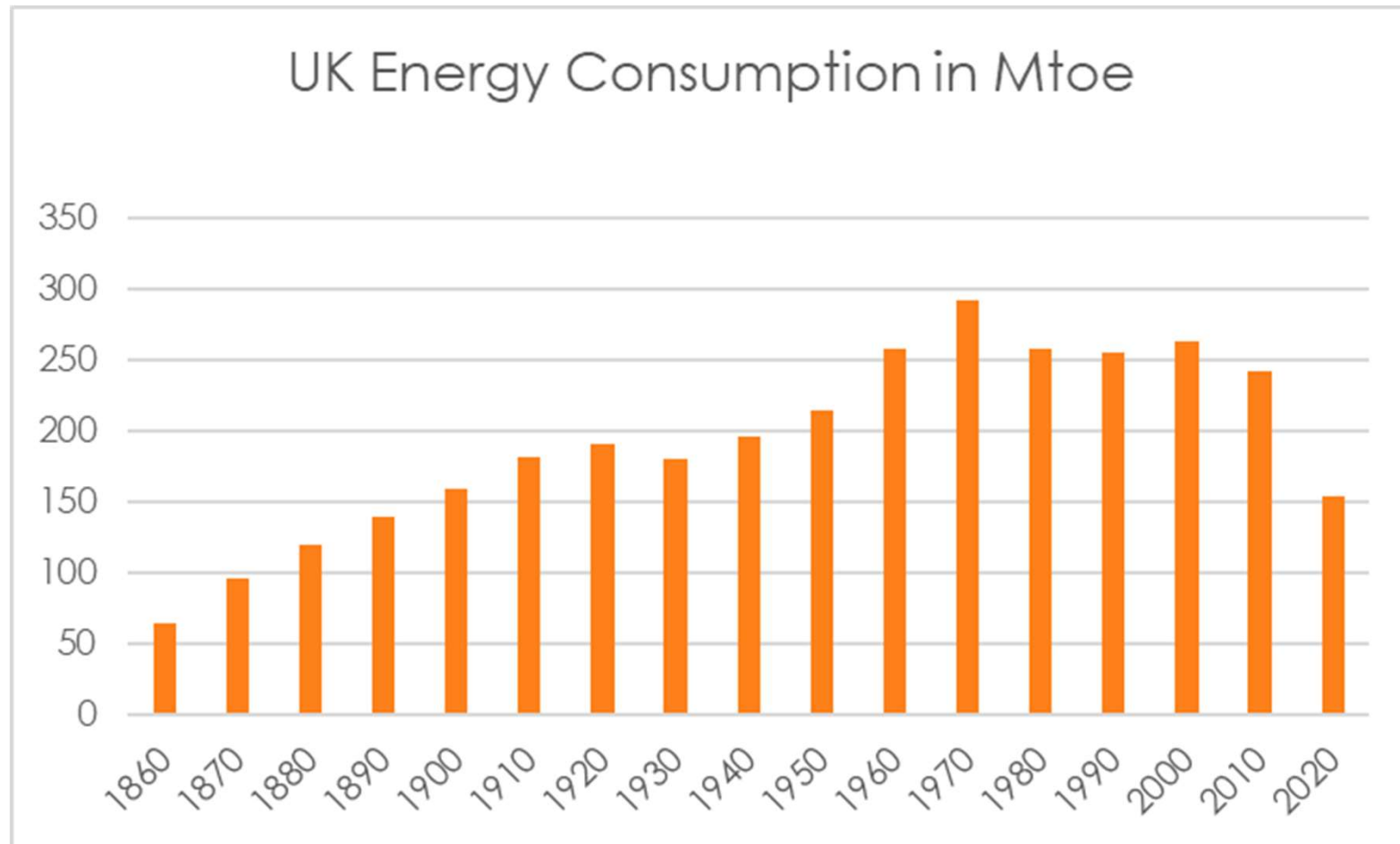
- Success of early humans based on their ability to utilise an external energy resource i.e. fire that provided:
 - Warmth
 - Protection
 - Improved nutrition
 - Manipulation of materials (pottery & metals)
- Provided by:
 - burning wood
 - domestic animal muscle power

Meeting our energy demands

- Pre-industry
 - Wood (domestic fires, kilns/ovens, metallurgical furnaces)
 - Wind (mills, pumps, sailing ships)
 - Water (mills)
 - Horses & other animals
- Industrial (18th century - present)
 - Coal
 - Oil
 - Gas
 - Hydro
 - Nuclear

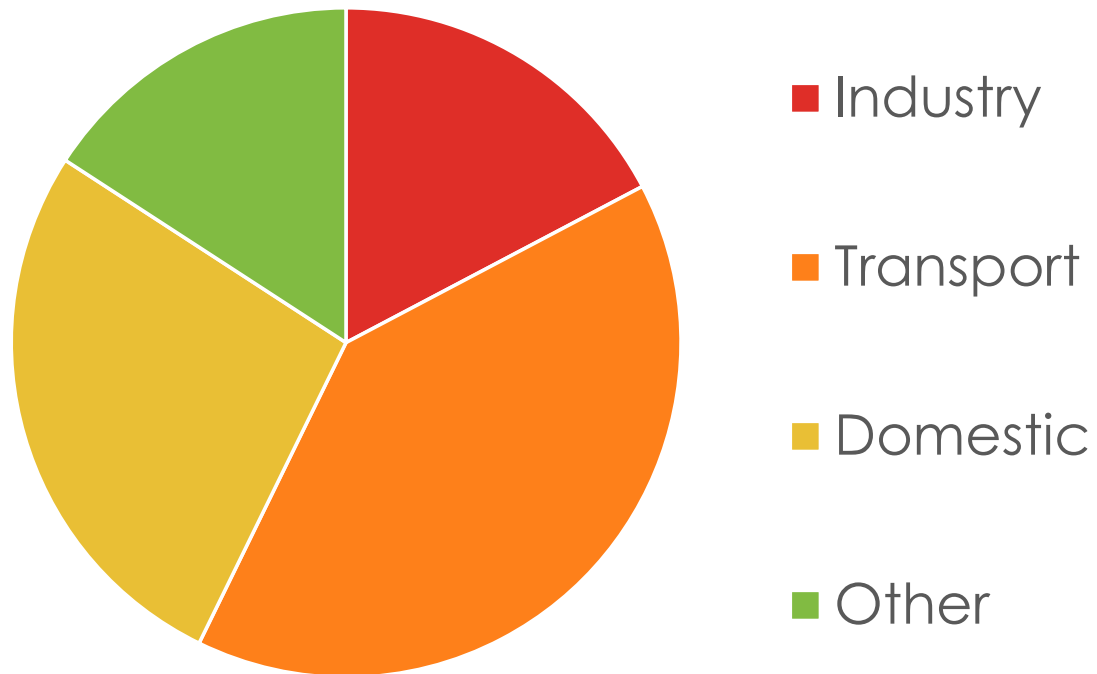
Historical UK Energy Consumption in Mtoe

1 Mtoe = 11,630 GWhr

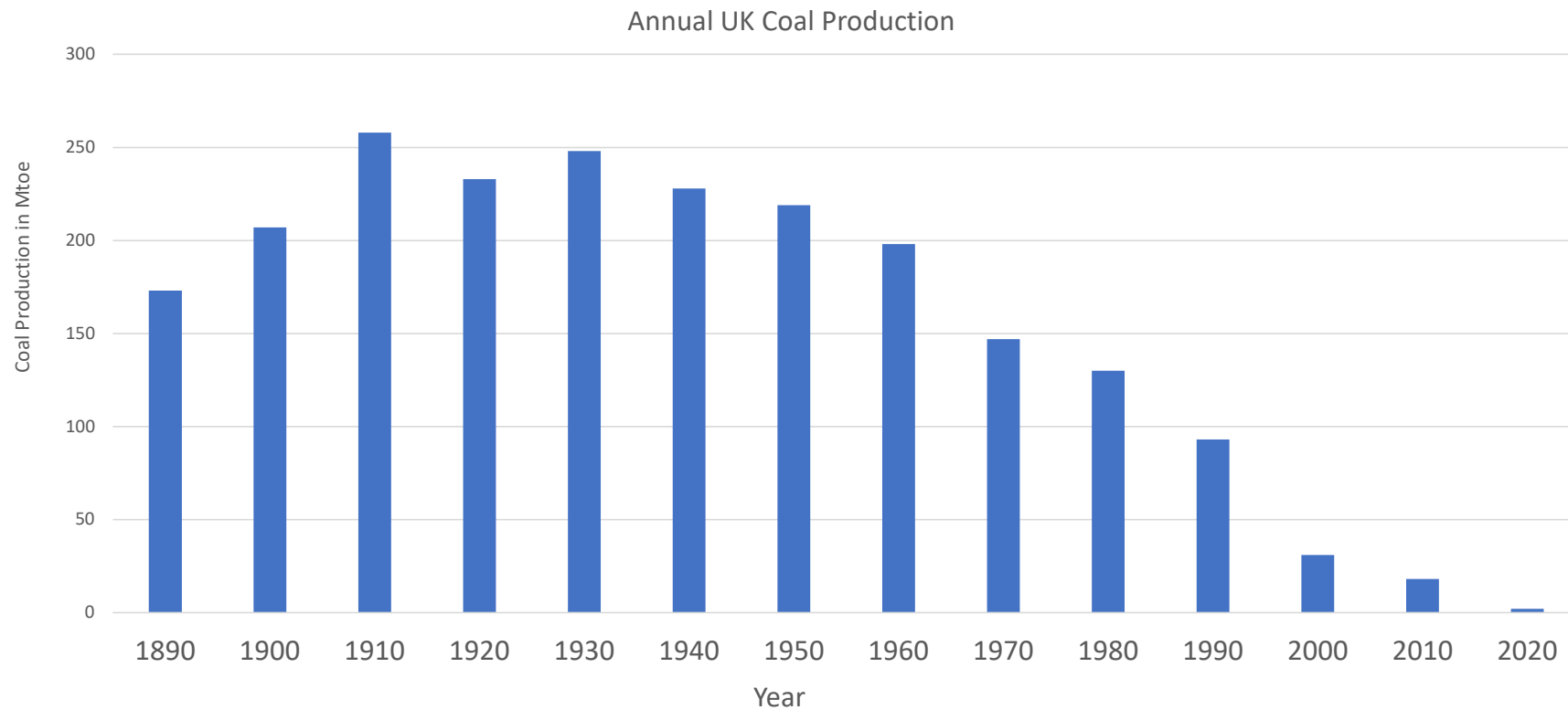


What is it used for?

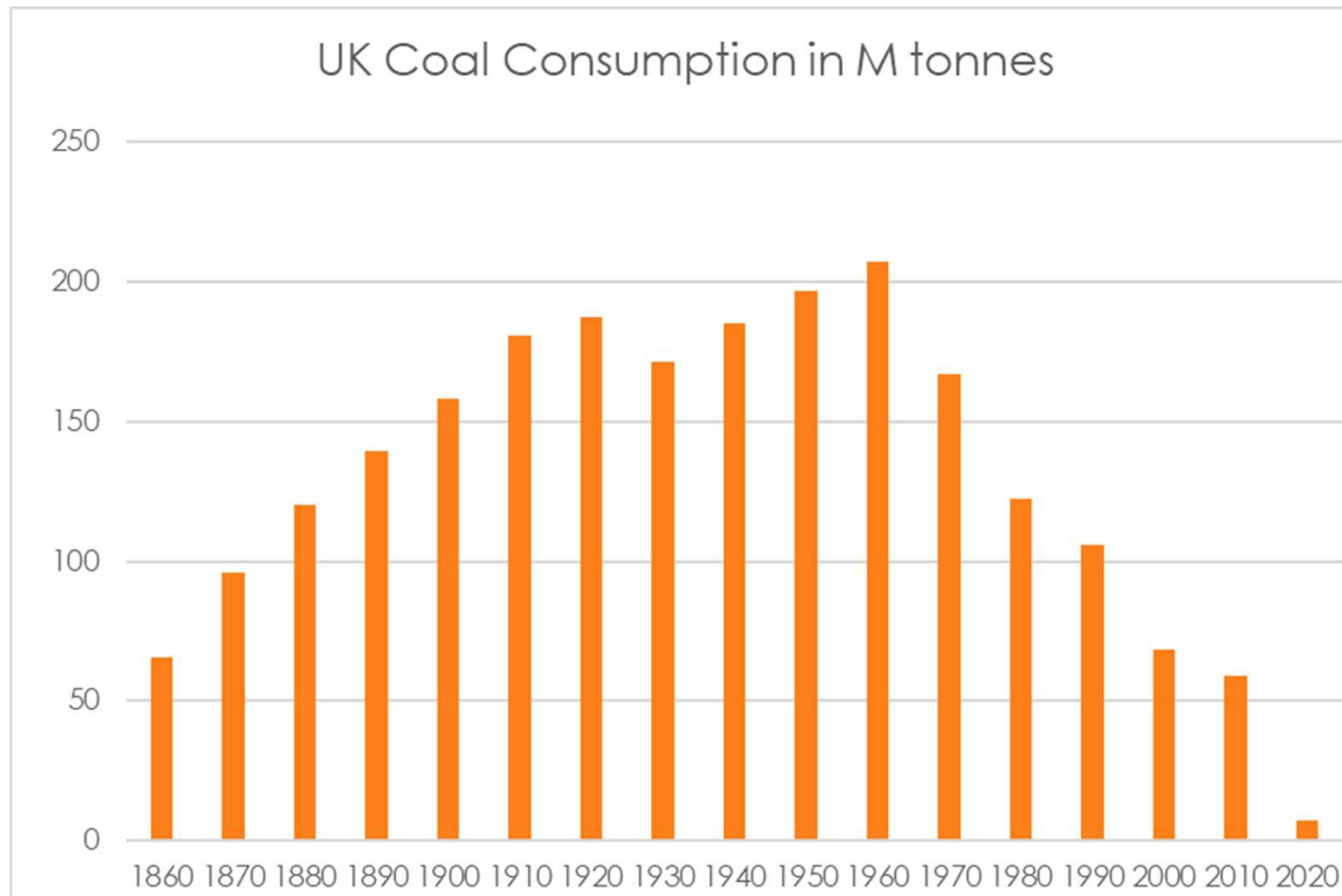
UK Energy Consumption 2022



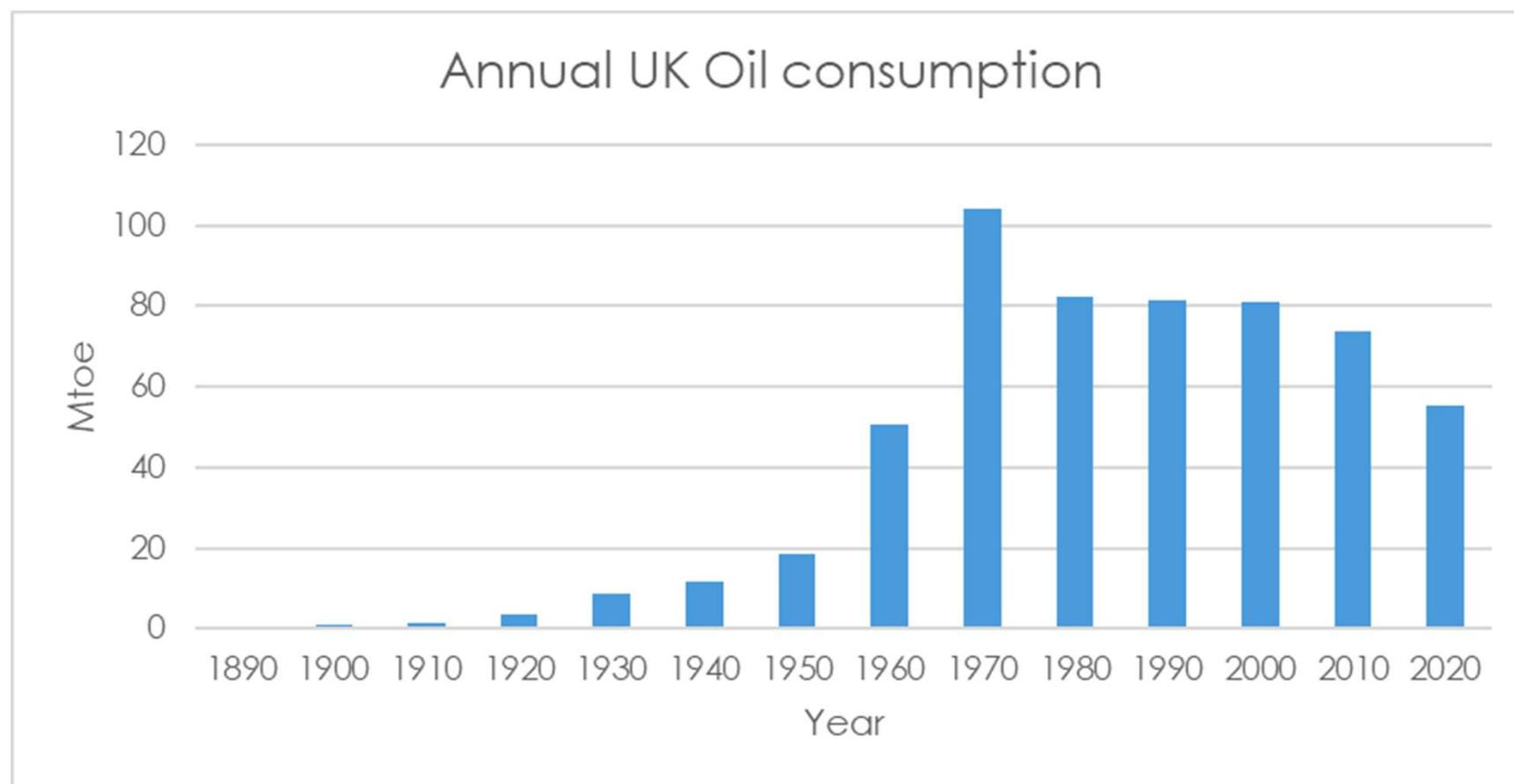
UK Coal production in Mtoe



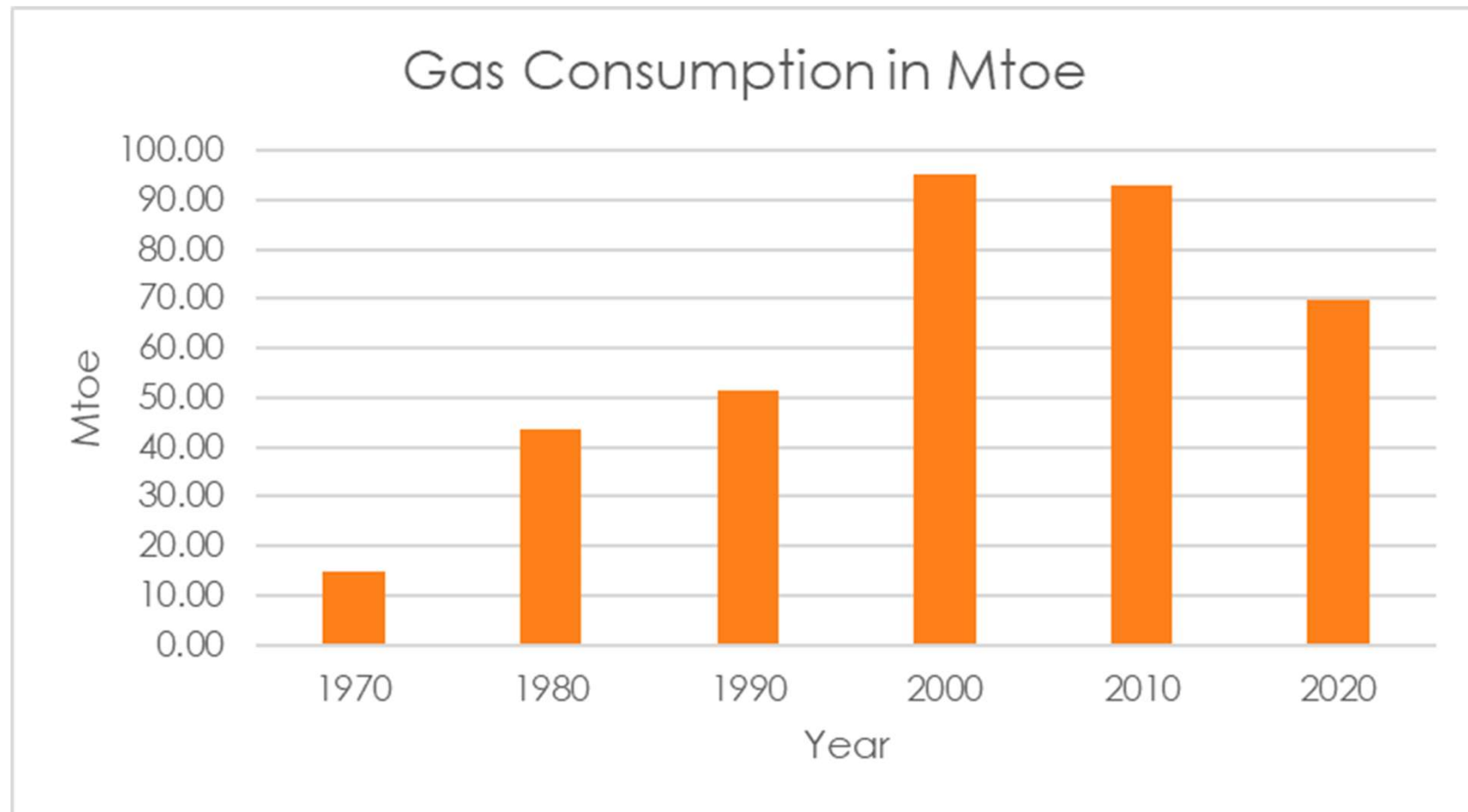
Coal Consumption



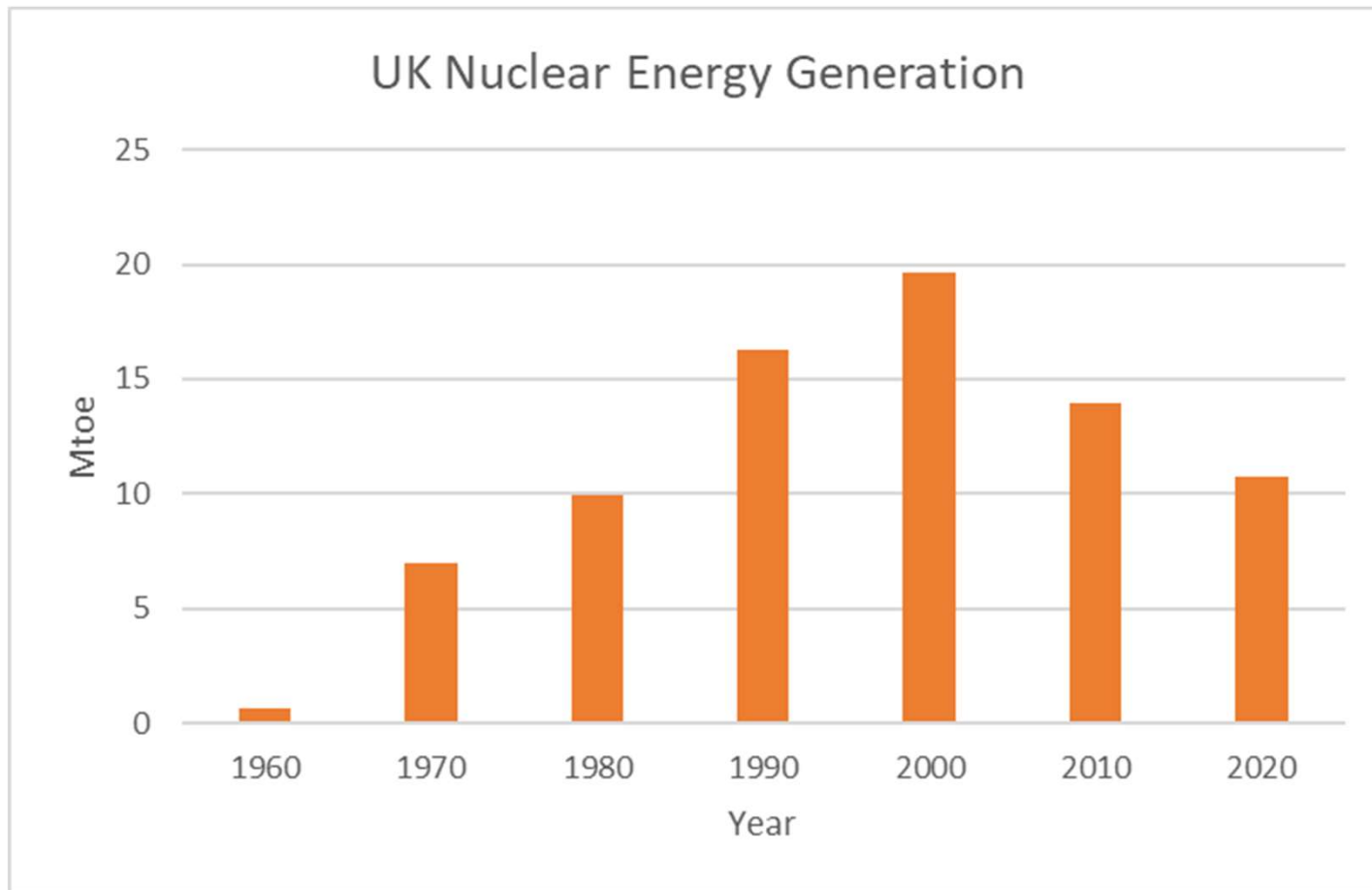
UK Oil Consumption in Mtoe



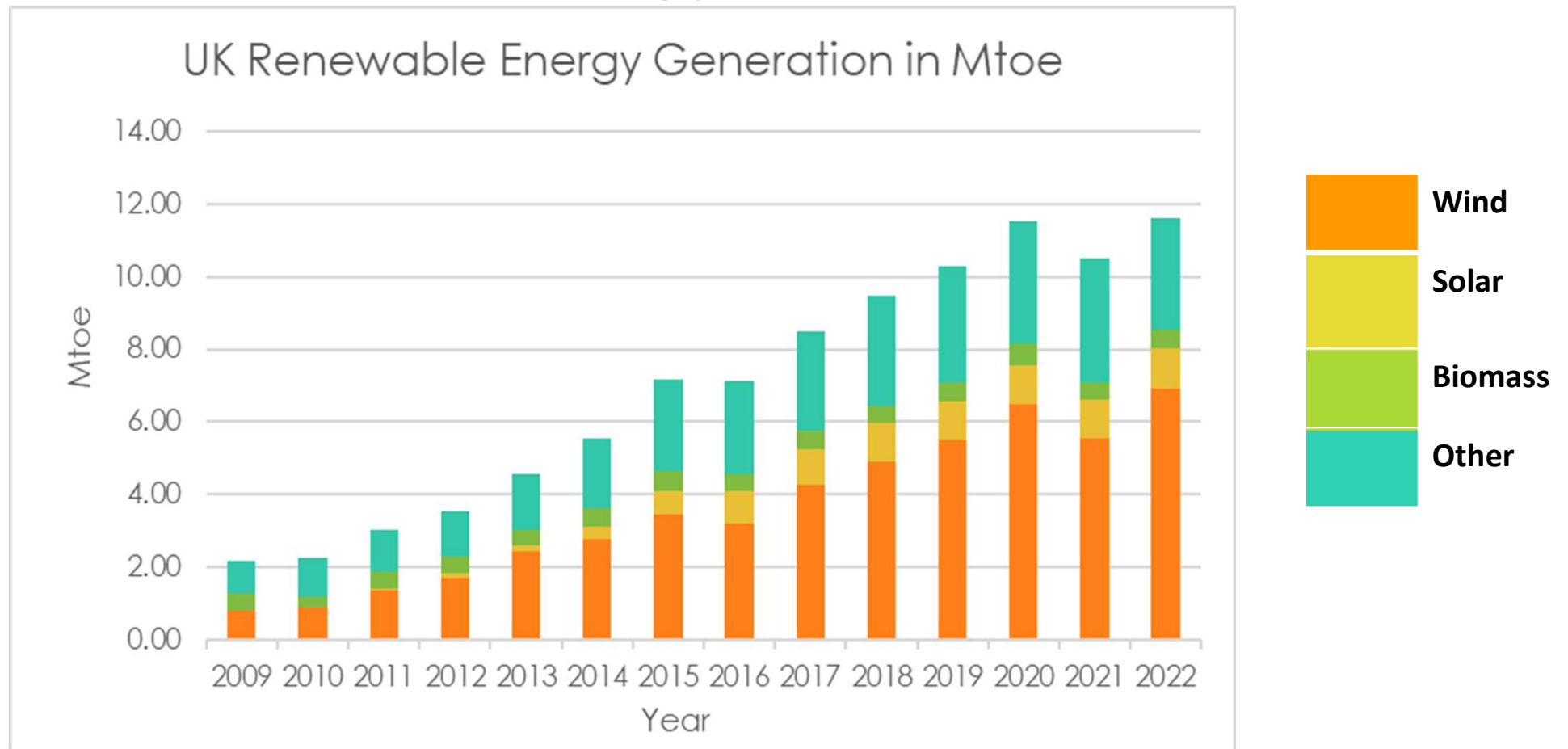
UK Gas Consumption in Mtoe



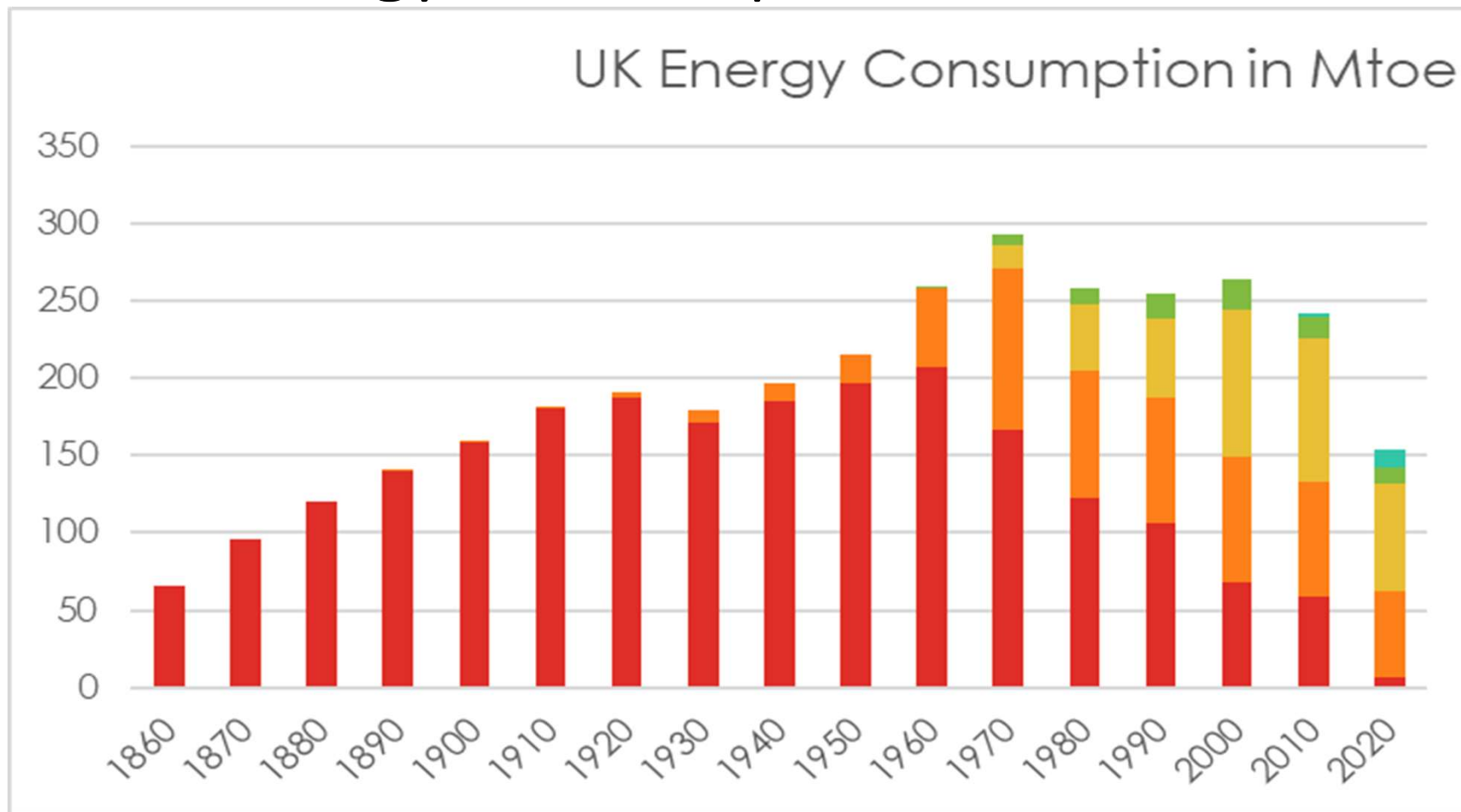
UK Nuclear Energy Generation



UK Renewable Energy Generation



Total UK Energy Consumption in Mtoe



Future UK Energy Supply Trends

- Coal production & utilisation in UK will cease in the next ten years
- Oil production, imports and utilisation will decline significantly in the next 15 years
- Renewable energy resource utilisation will increase significantly in the next 10-15 years
- Overall energy utilisation will decline

Where will our power come from?

- Hydrocarbons (oil and natural gas) *utilising CC*
- Nuclear
- Hydrogen
- Wind
- Solar
- Hydro (indigenous & imported)
- Biomass

Hydrocarbons



Fossil Fuel Utilisation

- Simply burning is no longer an acceptable long term option
 - Environmental damage caused by extraction practices and CO2 emissions to atmosphere
 - Finite resource
- Carbon Capture technology is possible and increasingly practical but expensive & reduces available energy from fuel
- Currently no practical substitute for fluid fuels in some applications e.g. aviation fuel *but watch this space see hydrogen*

Nuclear



Nuclear

- Magnox stations
 - 11 stations operated 1956 – 2015
 - 46 – 590MWe
- AGR stations
 - 7 stations (4 currently operating) 1983 – 2028
 - 1040 – 1250 MWe
- PWR stations
 - 1 station operating 1995 – 2035(55?)
 - 1188 MWe
- Hinkley C
 - 3200 MWe

New/Future Stations

- Large Scale Updated PWR designs
 - Hinkley C & Sizewell C
 - Generation capacity 3.2 GW
 - Cost £30 - £46 billion
- Small Modular Reactors
 - Known technology *+ive*
 - Cheaper to build *+ive*
 - Construction/Fabrication/Operation infrastructure does not exist for commercial implementation *-ive*
 - Inefficient use of fuel *-ive*
 - Control of Fissile material and waste *-ive*

Hydrogen

- Portable and energy dense (120,000 kJ/kg) {cf Octane 44,455 kJ/kg}
- No polluting exhaust
- Storage is difficult - either:
 - Cryogenic at -252°C
 - High pressure (leaks a lot)
 - Adsorbent system (complex)
- Blue Hydrogen – from natural gas requires CC or CO₂ emissions
- Green Hydrogen – needs electricity & currently is inefficient
- Will require new production & supply infrastructure

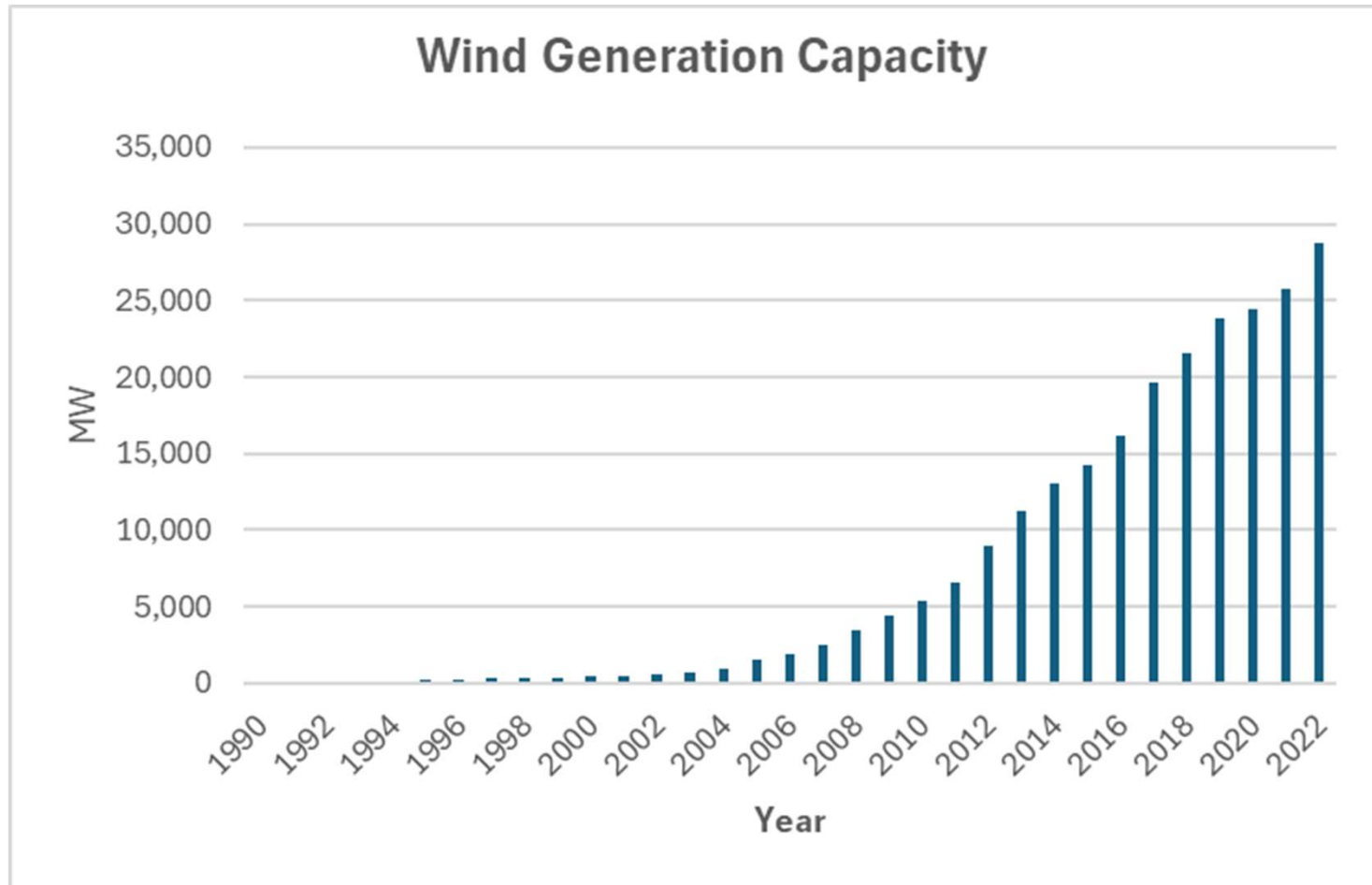
Hydrogen (summary)

- Clean
- High energy density
- Expensive to generate and store
- Best used as aviation and road transportation fuel

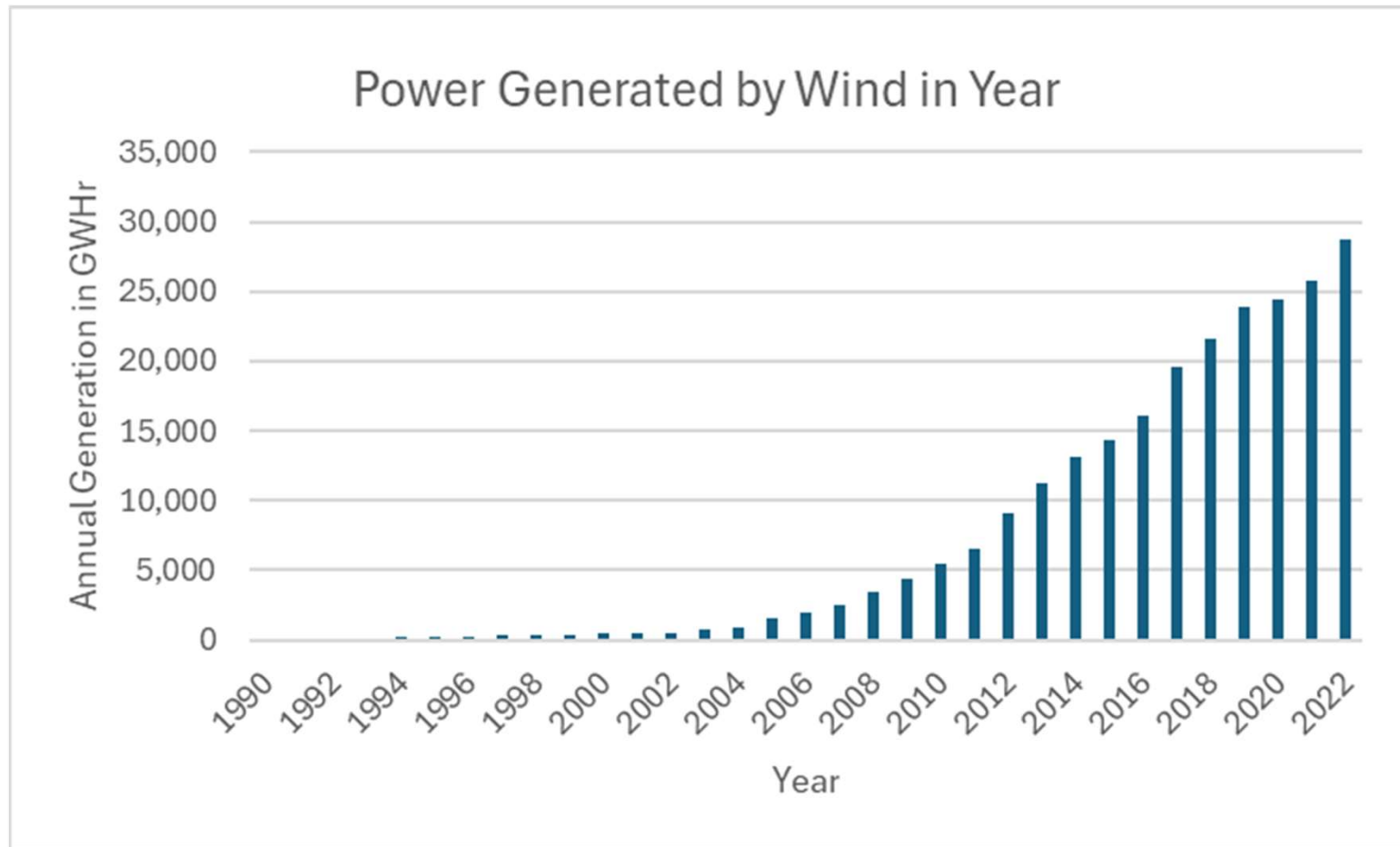
Wind Generation



Wind Generation

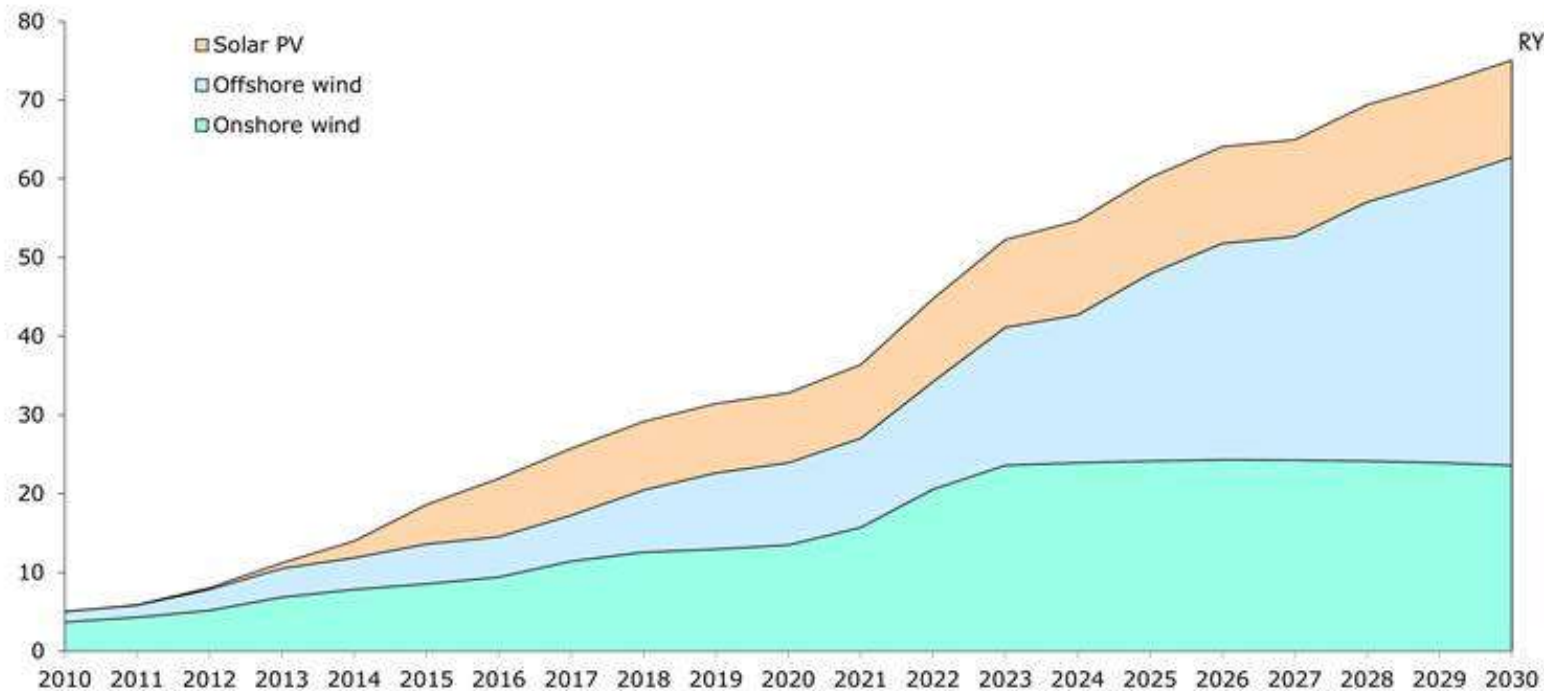


Wind Energy Consumption



Projected Wind & Solar Generation Capacity

Renewable energy capacity outlook in the UK
Gigawatts



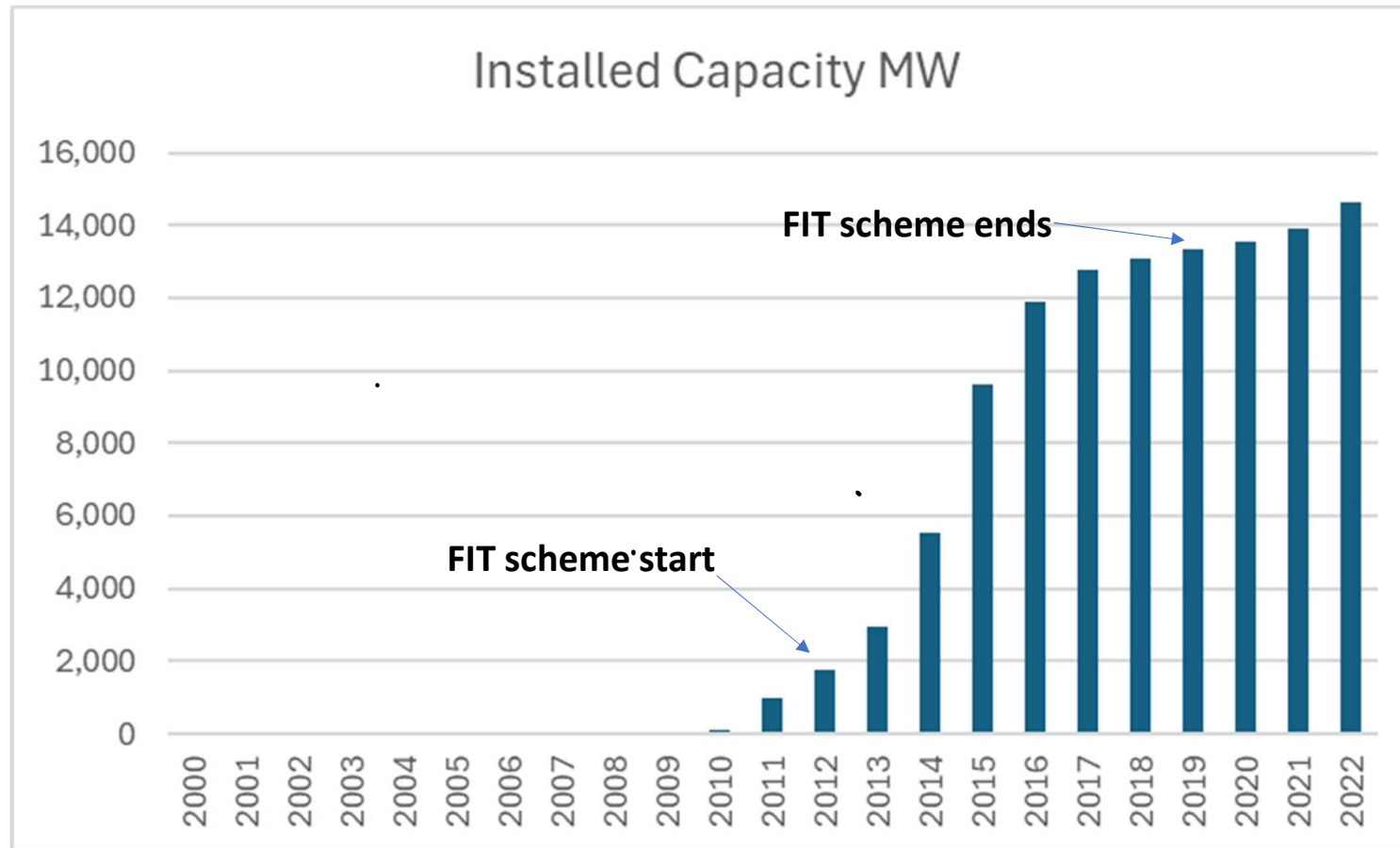
RYSTAD ENERGY

Source: Rystad Energy RenewableCube

Solar (PV) Power Generation



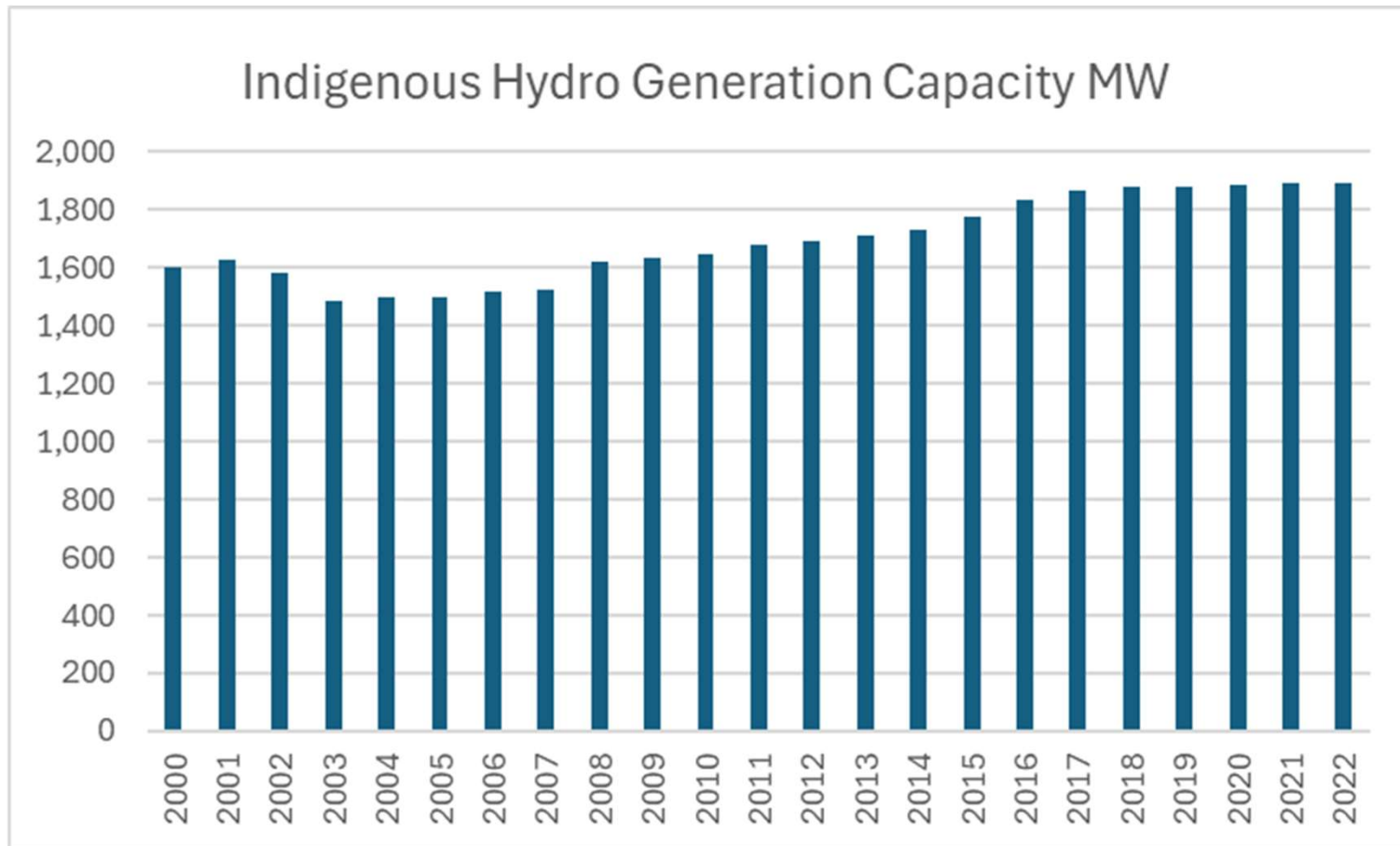
UK Solar (PV) Power Generation Capacity



Hydro



Hydro



Biomass

- **Woodchip (imported and indigenous)**
- **Landfill gas**
- **Waste incineration**
- **Anaerobic Digestion**
- **Biofuels**

Consumption Changes 2010 to 2020

- **Coal -86%**
- **Oil - 34%**
- **Gas - 26%**
- **Wind +632%**
- **Solar +3487%**
- **Biomass +124%**
- **Waste Incineration +203%**
- **Overall -24.9%**

Consumption Changes 2020 to 2022

- **Coal -13.3%**
- **Oil +12.5%**
- **Gas - 3.1%**
- **Wind +6.5%**
- **Solar +5.9%**
- **Biomass -35%**
- **Waste Incineration +5%**
- **Overall +2.4%**

Information Sources Used

- Digest of UK Energy Statistics (DUKES) produced by DESNZ
- Our World in Data - Global Change Data Laboratory (Oxford University)