The Future of Energy

Revolution or Evolution?

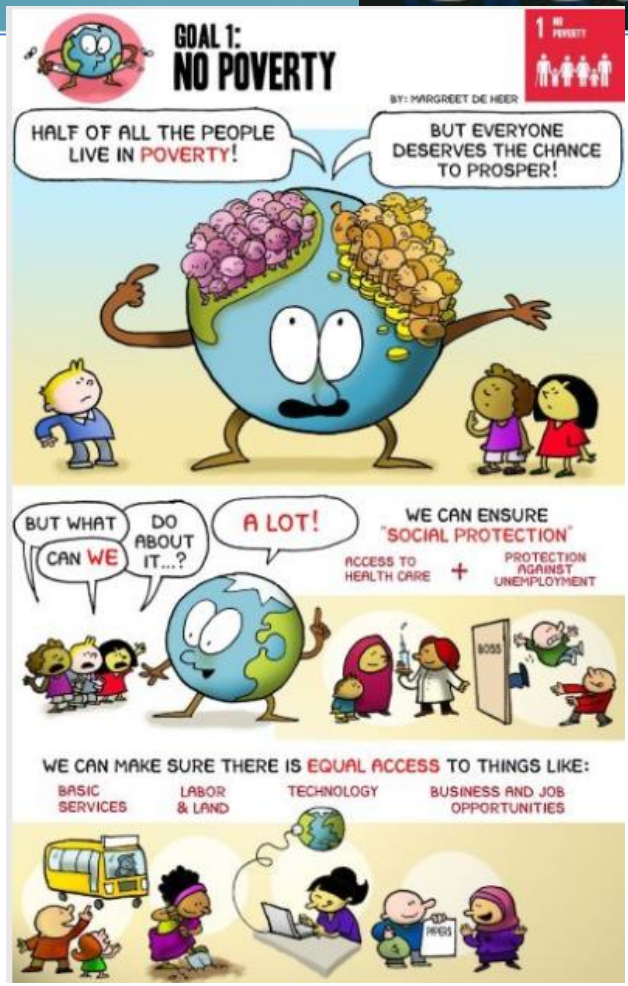
"I don't want you to be hopeful, I want you to panic"

"We want to help the world reach net zero and improve people's lives and can do this by being a safe, focused, responsible, well-governed and transparent organization"

What does Sustainability mean?

- "Meeting the needs of the present without compromising the ability of future generations to meet their own needs"
- United Nations 17 Sustainable Development Goals (SDGs)
- Global framework for international cooperation (signed by 193 countries)

www.un.org/sustainabledevelopment/sustainable-development-goals/

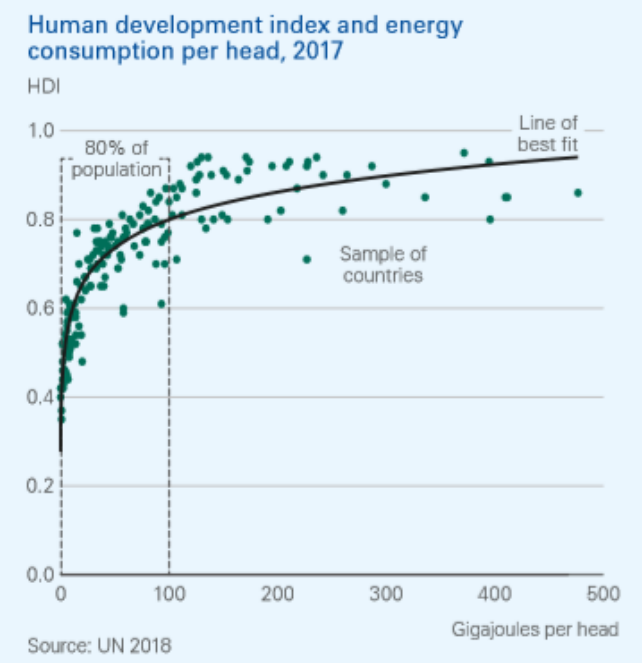


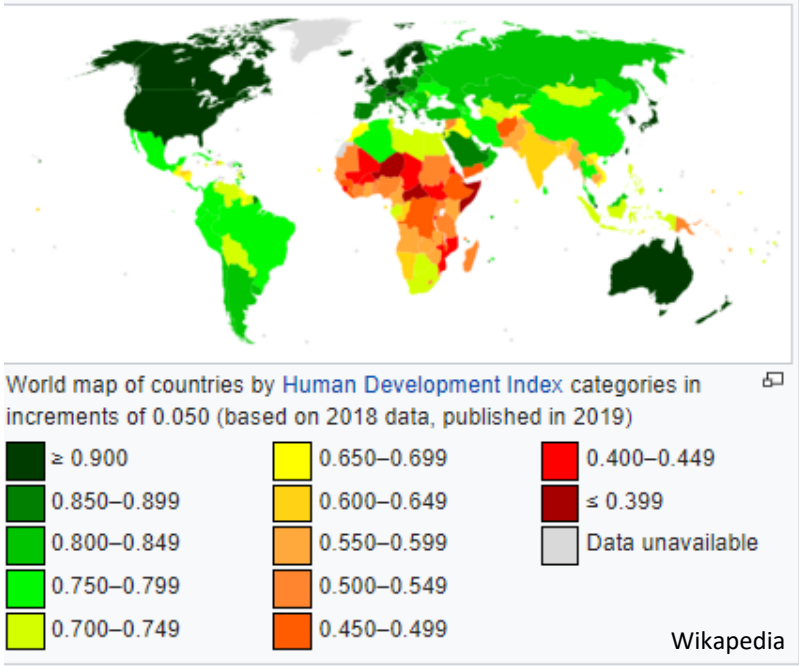
END EXTREME POVERTY.
FIGHT INEQUALITY AND INJUSTICE.
TACKLE CLIMATE CHANGE.

Energy Poverty

- "Energy is central to nearly every major challenge and opportunity the world faces today." United Nations
- Energy poverty is a lack of access to modern energy services In 2018, 620 million people in Africa did not have access to electricity and 730 million relied on unclean fuel (e.g. wood, animal waste) for cooking*

www.un.org/sustainabledevelopment/sustainable-development-goals/

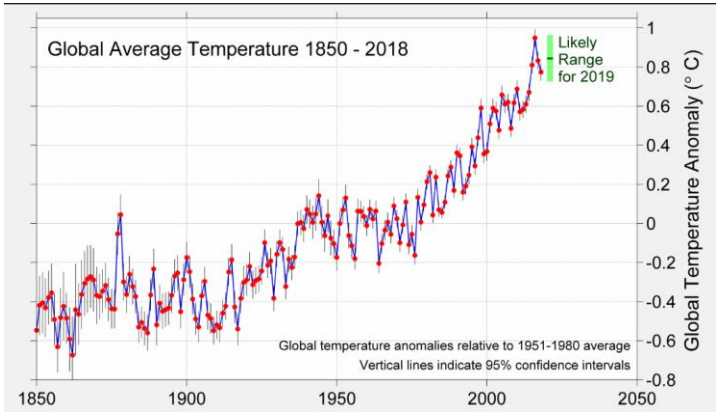




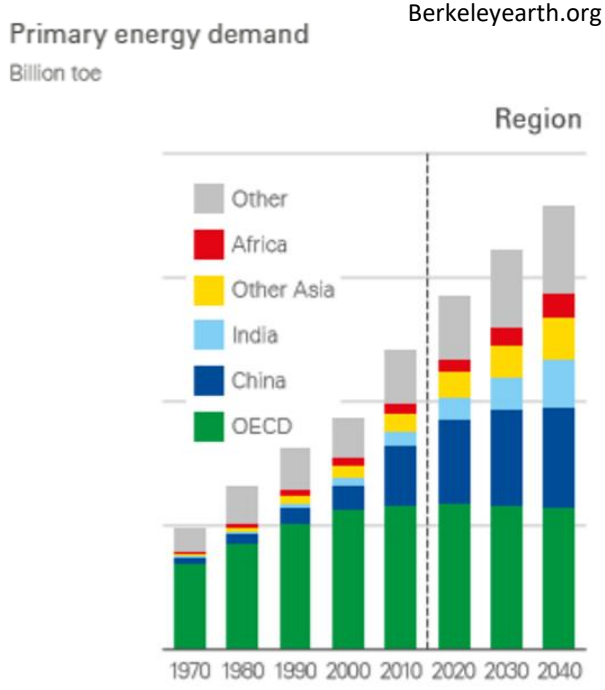
*Source: IEA

Climate Change vs. Energy Demand

- UN SD Goals aim to limit climate change. 189 countries have now signed up to the Paris agreement, taking action to limit global temperature rises to below 2°C
- Global Energy demand continues to increase as poorer countries develop and population increases
- UN Sustainable Development Goals strive to increase the quality of living for many people in poverty around the world



Berkeleyearth.org

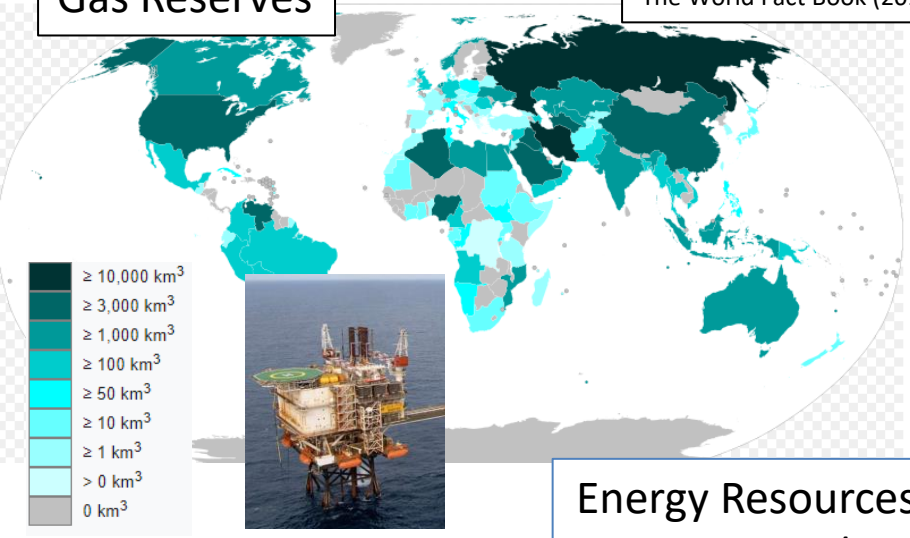


BP Energy Outlook 2019

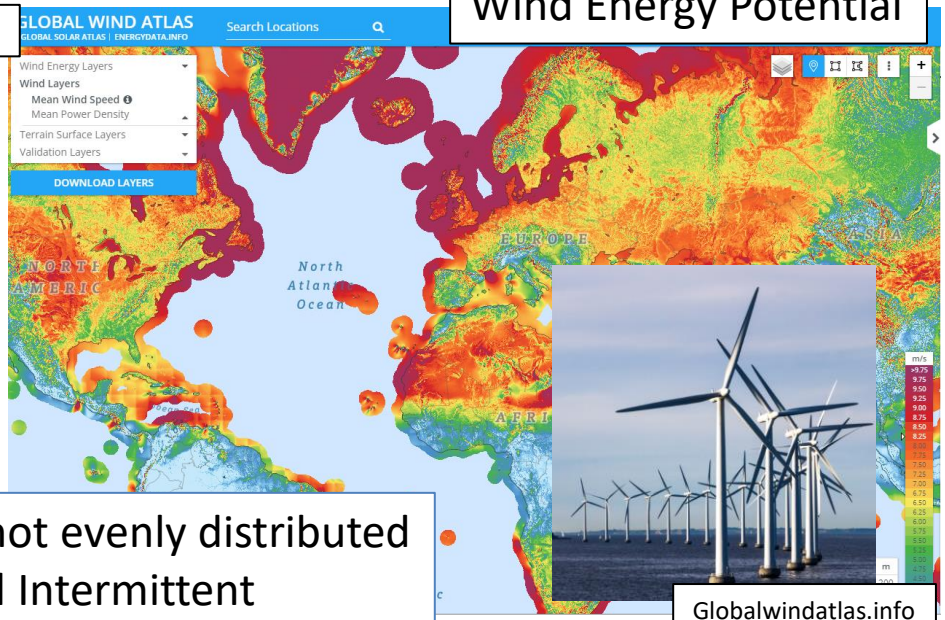
Energy Sources

Gas Reserves

The World Fact Book (2014)



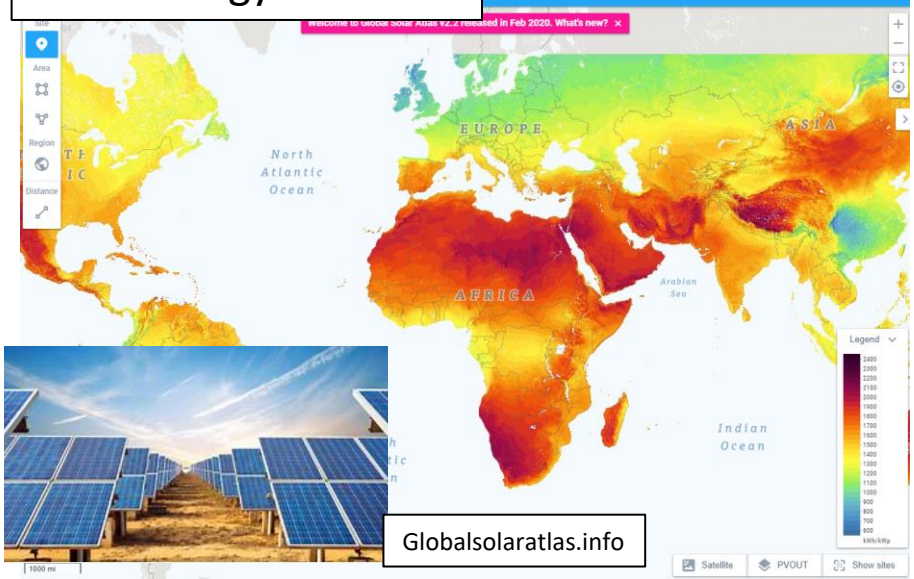
Wind Energy Potential



Globalwindatlas.info

Energy Resources not evenly distributed
Solar/Wind Intermittent

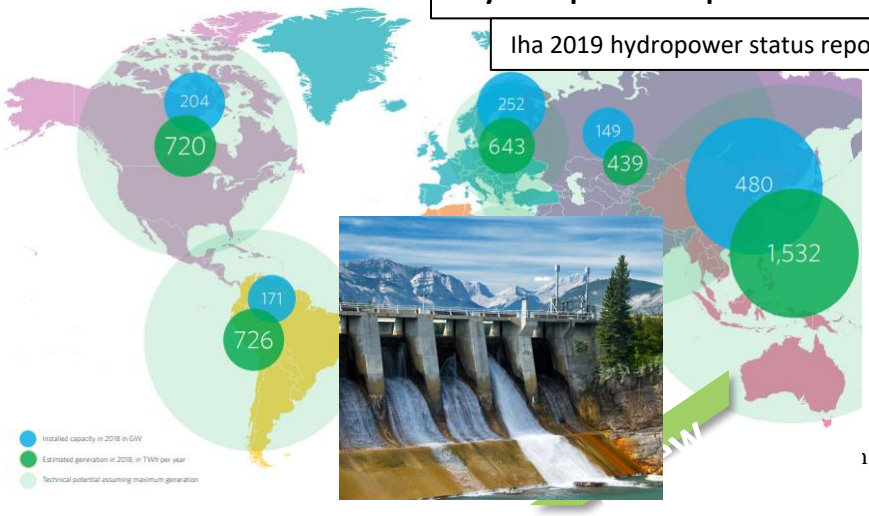
Solar Energy Potential



Globalsolaratlas.info

Hydropower potential

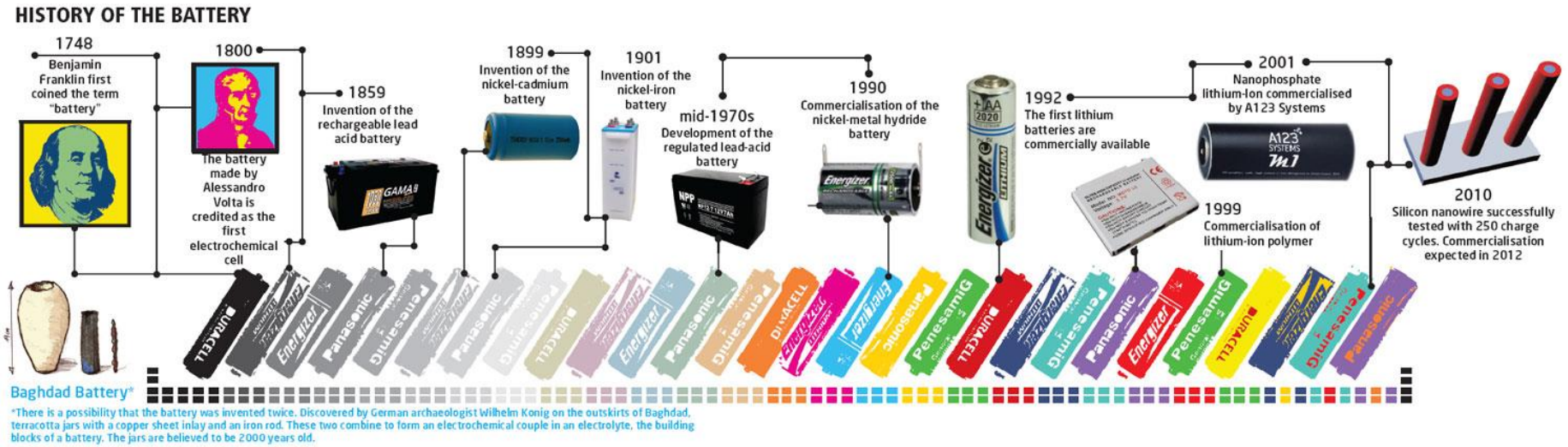
Iha 2019 hydropower status report



Battery Storage

- UK Electricity requirement: ~100,000MW/day
- Require at least 25% storage capacity for reliable solar/wind power generation
- In 2019 biggest UK battery storage site 50MW (half size of a football pitch)
- Pumped hydropower also good storage

Tesla 129MW Battery storage, S. Australia



Sources: Telegraph, reneweconomy.com.au, upsbatterycentre.com

Go to **www.menti.com** and use the code **90 57 71**

Mentimeter

What items in your daily lives are made from hydrocarbons?

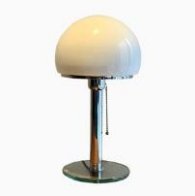
0

Morning

Afternoon

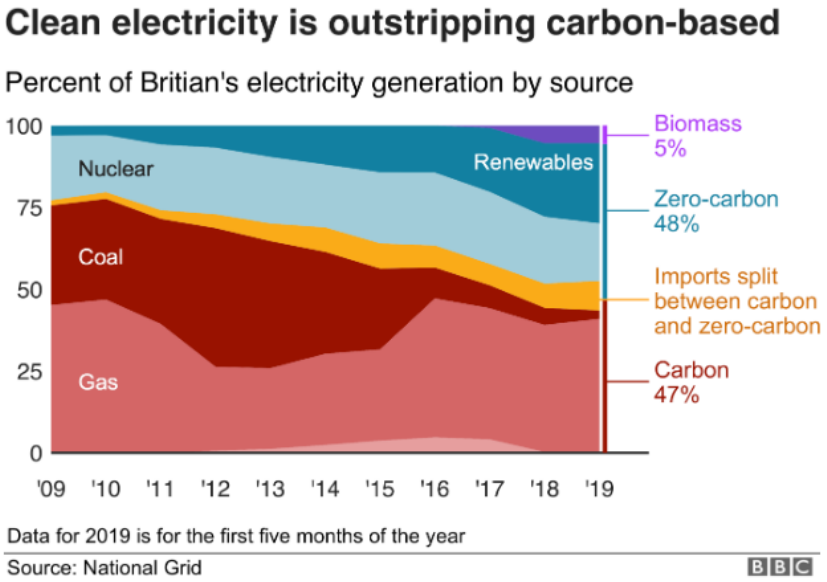
Headlights & roads

Evening

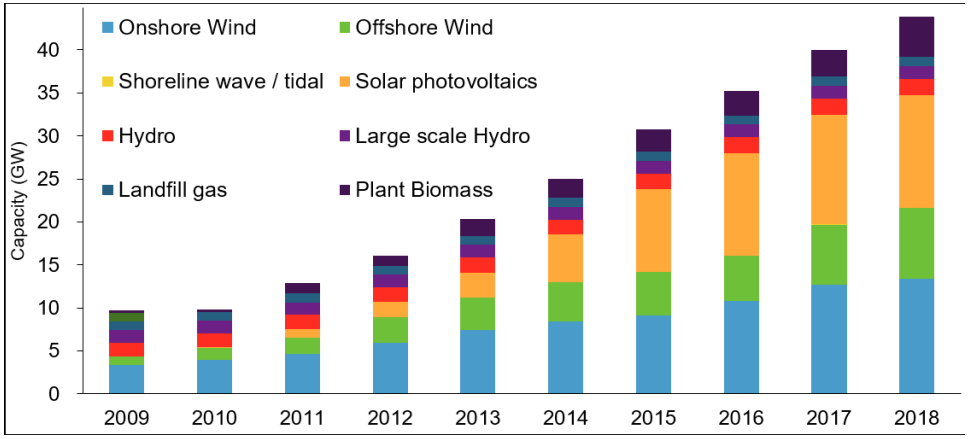


Energy in the UK

- The UK has committed to reduce CO_2 emissions to zero by 2050, known as the “Net Zero” ambition.
- The UK already reduced its CO_2 emissions by 40% from 1990 to 2018
- The UK has started producing more electricity from “clean energy” than fossil fuels
- Rapid cost reduction has driven economic development of wind & solar power in UK.
- As part of Net Zero UK will need to be generating 75 GW offshore wind power by 2050 vs. just 8 GW today.
  - 7,500 turbines, 2% of seabed



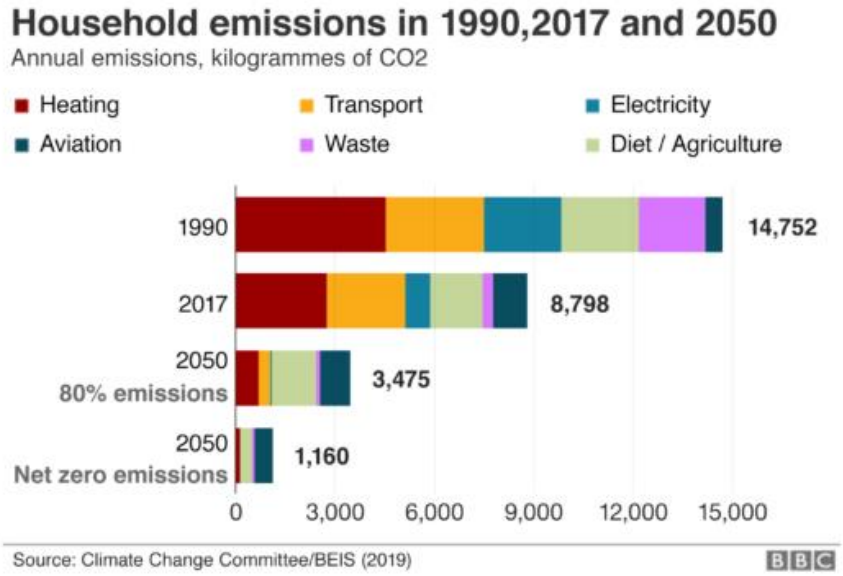
GOV.UK Energy Trends



Source: UK Committee on Climate Change (May2019)

Net Zero UK -Why will it take to 2050?

- It requires many new government policies and individual change of habits. We need be become "Net Zero" ready
  - In 2019 only 7% car sales electric cars
  - Currently 80% of homes are heated by gas
  - 20,000 hectares/yr tree planting required (1/5 of UK agricultural land usage change)



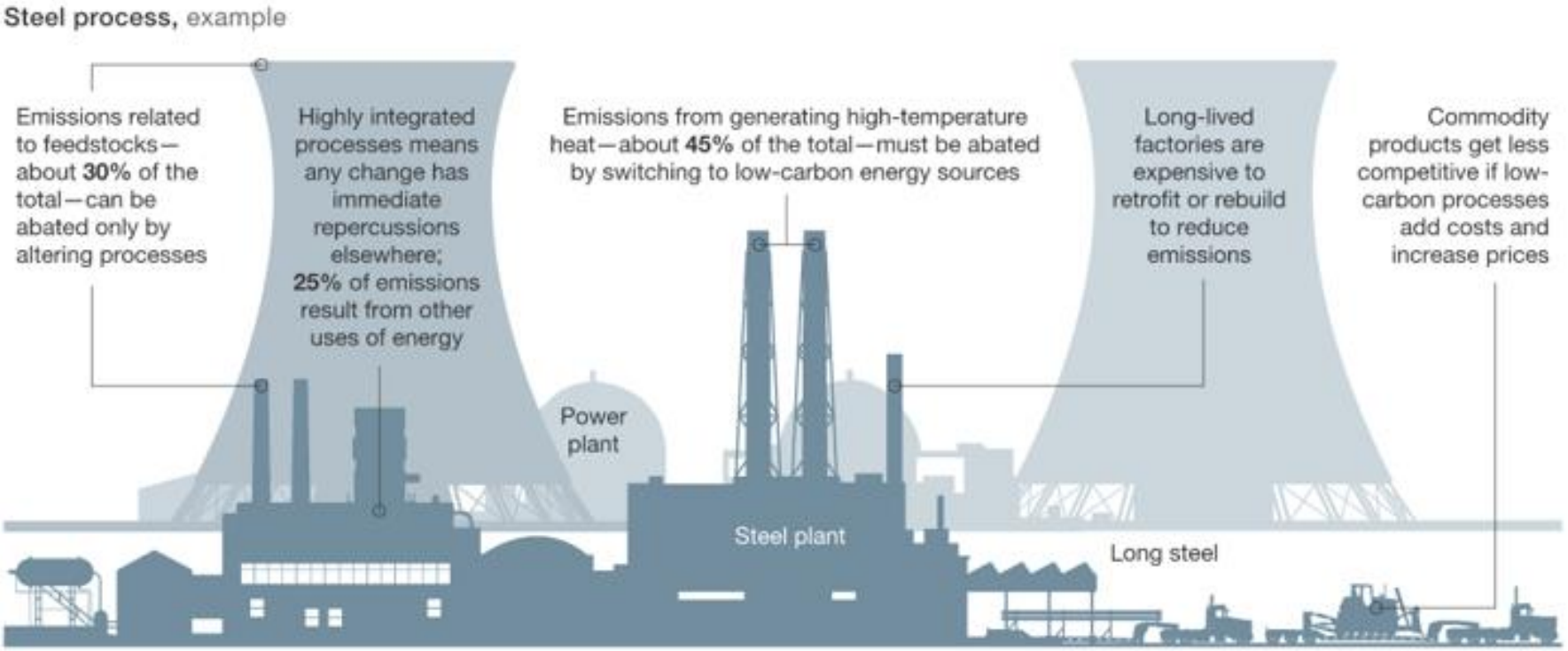
- The energy transition is expected to cost 1-2% of GDP per year (~£30bln/yr)
  - NHS 7% GDP per year, Education 4% GDP, Defence 2% GDP per year
- The UK "Climate Change Committee" agree some fossil fuels will likely still be needed even in 2050

Source: UK Committee on Climate Change (May2019)

Hard to Decarbonize Industries

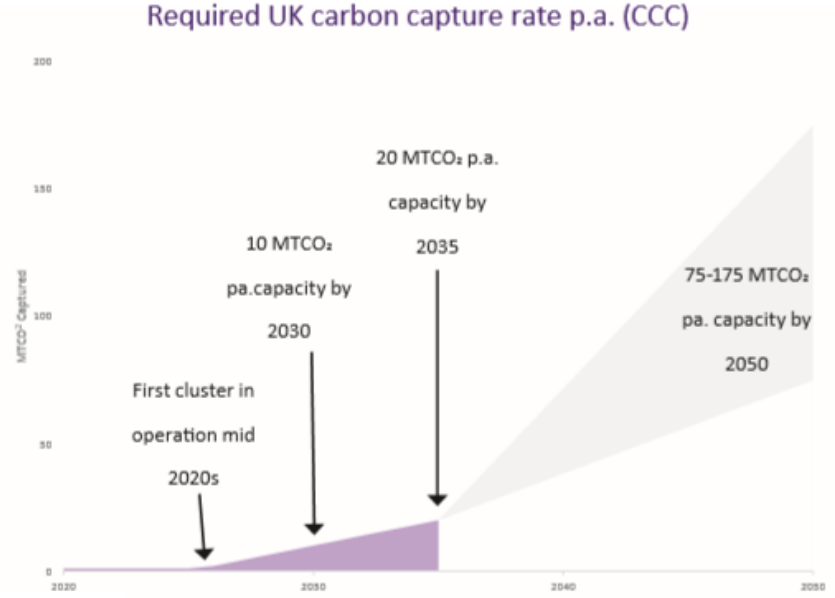
- Almost 45 percent of industry's CO2 emissions result from the manufacturing of key materials such as cement, steel, ammonia (cleaning products, fertilizer), and ethylene (plastics). These industries emply a lot of people

- "Carbon capture" has therefore been identified as an essential part of Net Zero



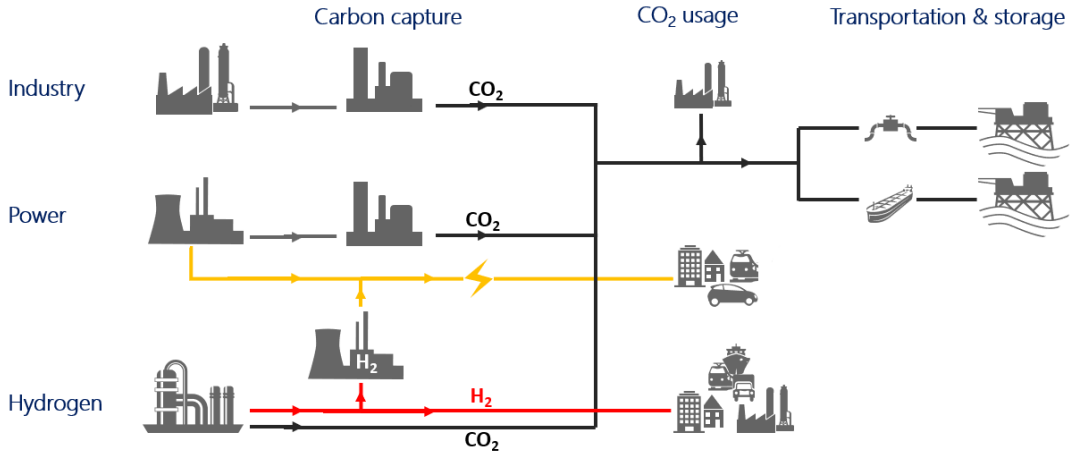
Carbon Capture and Storage (CCS)

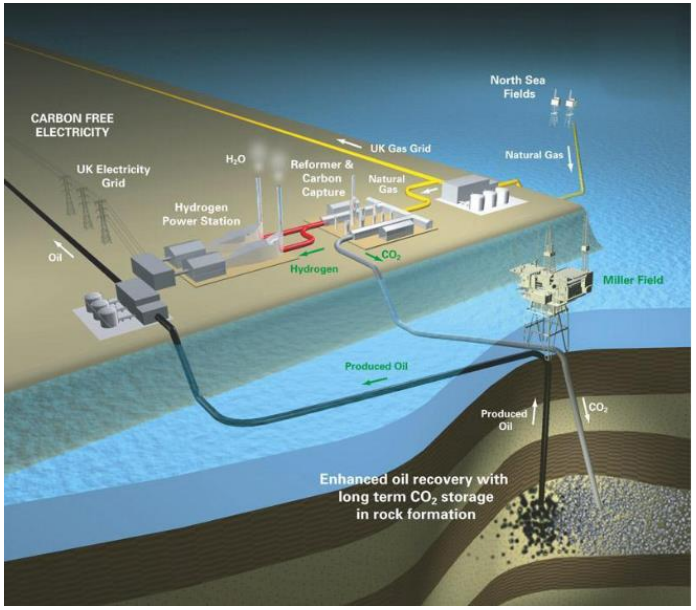
- CCS is the process of capturing waste carbon dioxide and transporting it to a storage site, where it cannot enter the atmosphere, normally underground
- This allows you to reach net zero even with some continued fossil fuel use where required
- UK has lots of storage potential in depleted North sea oil and gas reservoirs
- CCS needs to be developed very quickly



Carbon Capture, Usage & Storage (CCUS)

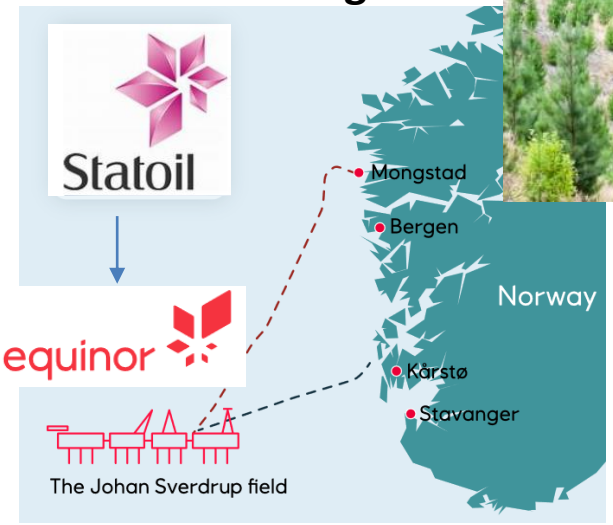
Key roles across industry, power and hydrogen





How will the Oil & Gas Industry adapt to Net Zero 2050?

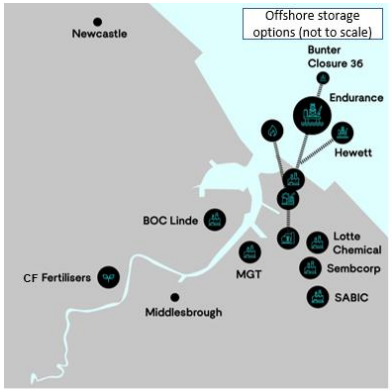
Emission Reductions & Offsetting



Electric/Hydrogen Vehicle Charging

Oil & Gas → Energy

Carbon Capture & Storage



OGCI CLIMATE INVESTMENTS
OIL AND GAS CLIMATE INITIATIVE

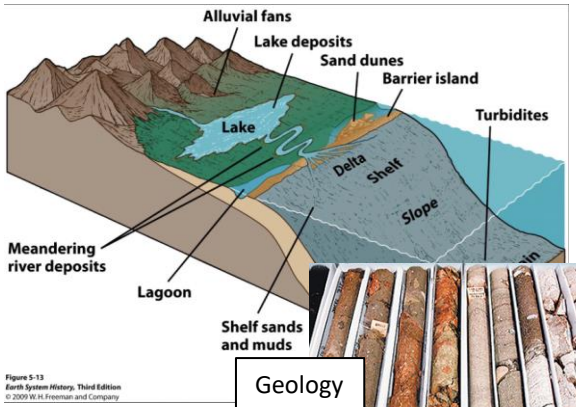
bp · eni · equinor · Shell · TOTAL · TEES VALLEY COMBINED AUTHORITY · TEES VALLEY MAYOR · BOC A Member of The Linde Group · sembcorp · CF · LOTTE CHEMICAL · nepic · Department for Business, Energy & Industrial Strategy

Renewables & Battery Storage

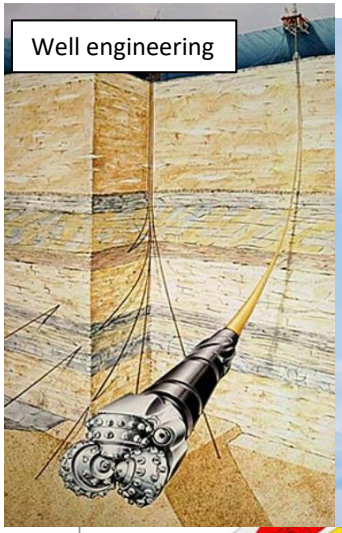
DONG energy → Ørsted

Energy Industry: Traditional Jobs (only 3-4% offshore)

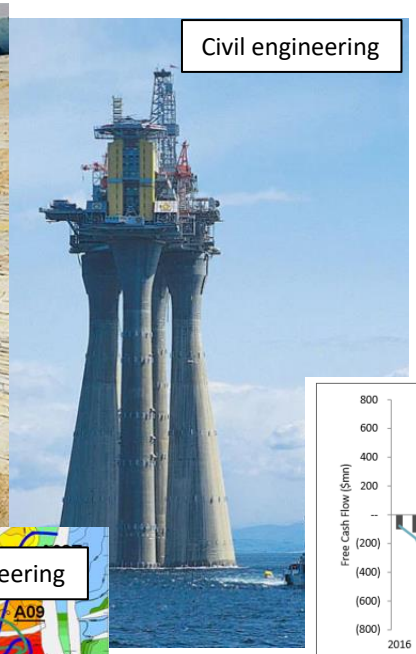
Skill requirements: Maths, physics, chemistry, geography, economics, statistics, computer science



Geology

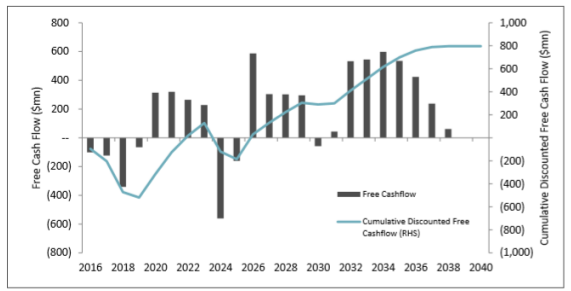


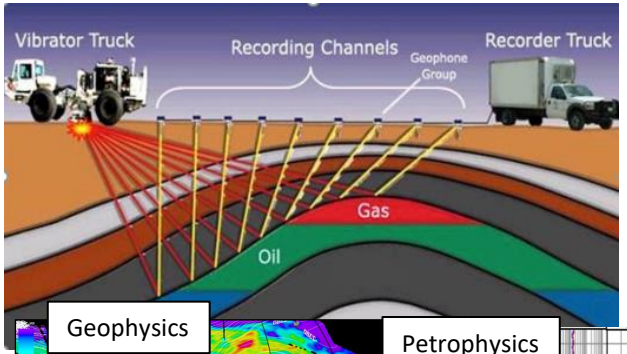
Well engineering



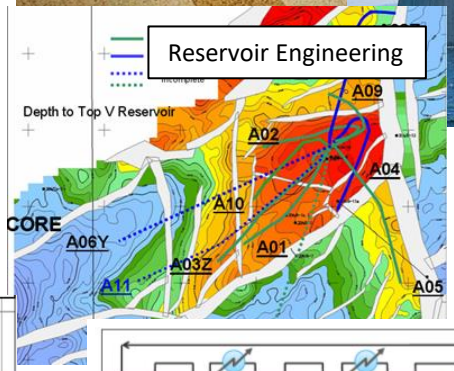
Civil engineering

Health & Safety
Environmental Impact
Accounting
Economics
Commercial
Law

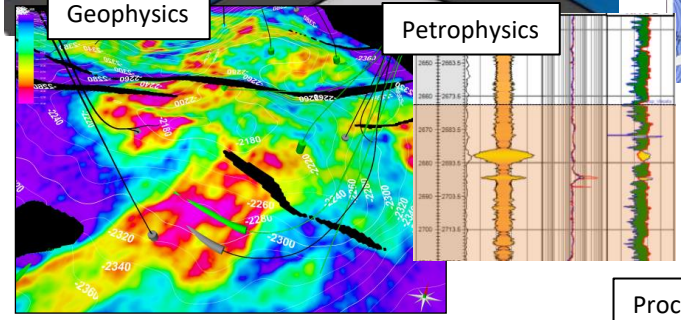




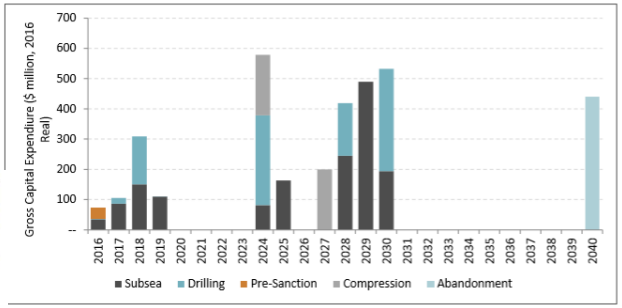
Geophysics

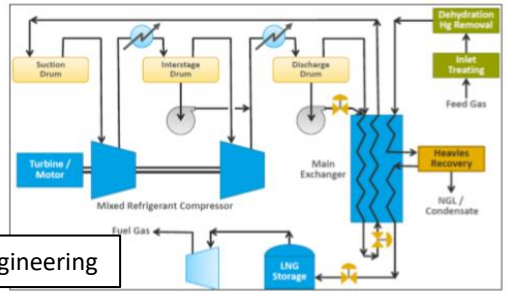


Reservoir Engineering



Petrophysics





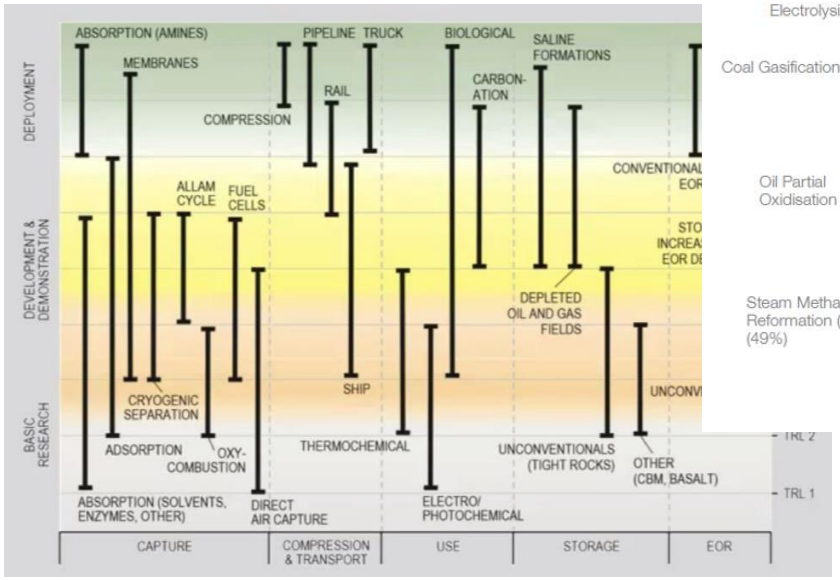
Process Engineering

Energy Industry: Developing Technical Areas

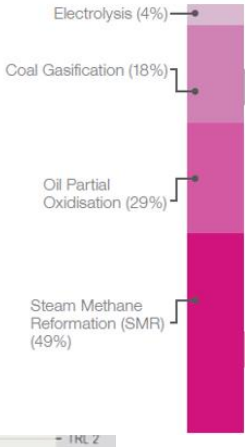
Augmented Reality

Carbon Capture & Storage & Hydrogen Technology

CCS



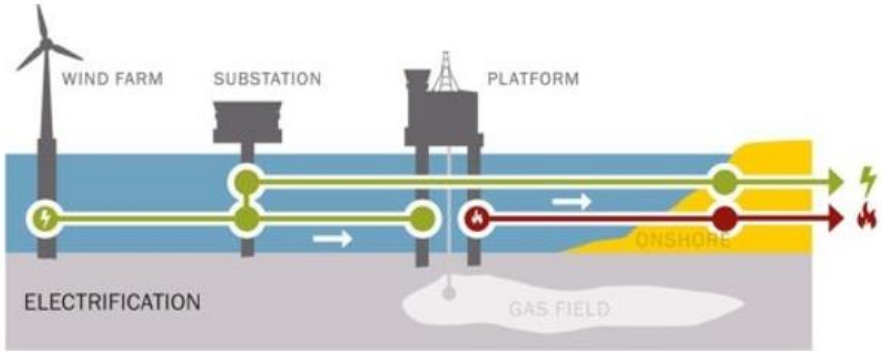
Hydrogen Production



Wind Technology

Big Data, Coding, Artificial Intelligence

Electrification



The Energy Industry as an Employer

- The Energy Industry is evolving to become an even more exciting & innovative place to work
- The Energy Industry needs energetic, forward looking problem-solvers to reach Net Zero 2050 and help achieve the UN Sustainable Development Goals