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The Role of Upstream Exploration and Production in the Energy Trilemma

Adam Borushek, RISC

Introduction to Upstream Oil and Gas for the Net Zero World

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Presenter

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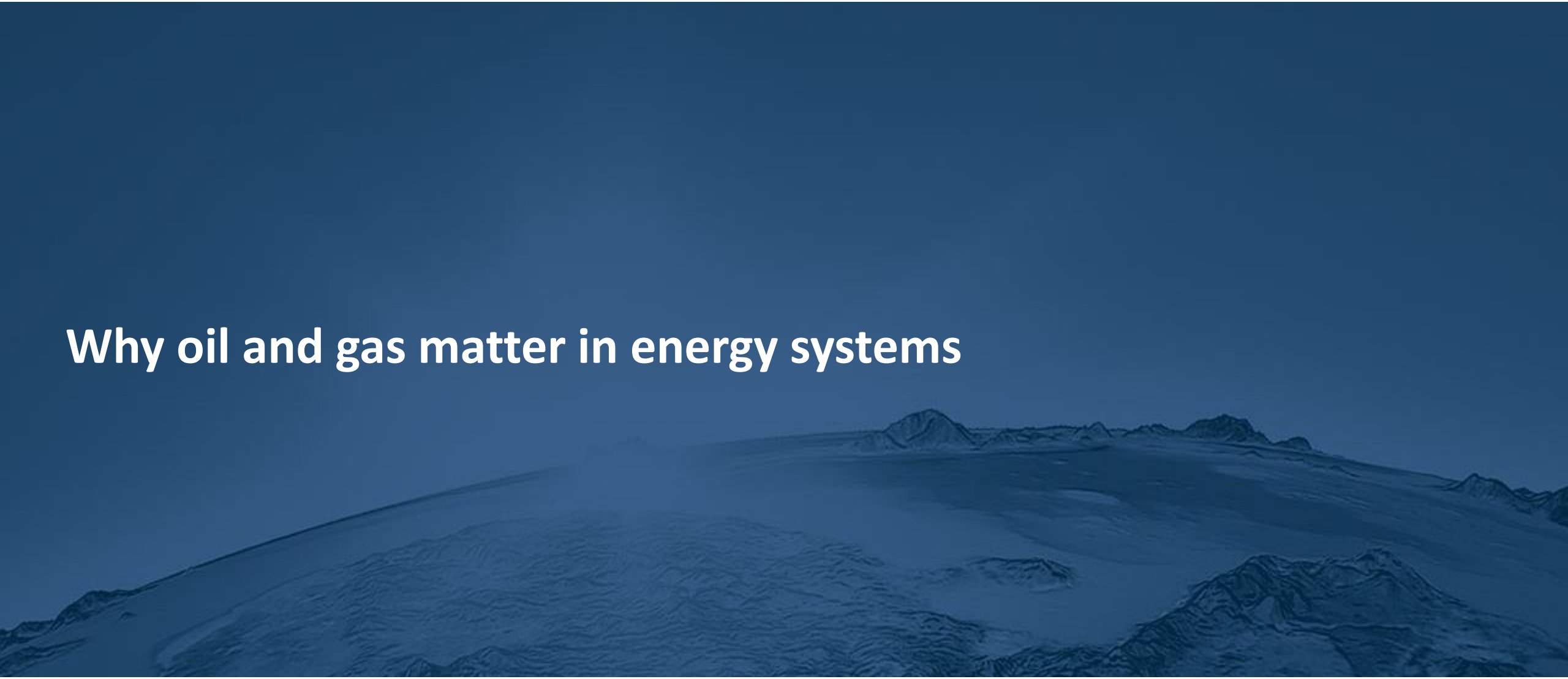
- Reservoir Engineer with 25 years of global experience in the upstream hydrocarbon industry. Expertise in asset valuation, due diligence assessment for M&A and project finance requirements, and reserves assessment.
- Project manager of multidisciplinary teams with reports quoted on AIM, TSX, OSX, ASX, NYMEX.
- Experienced in a range of reservoirs including fractured carbonate reservoirs, tight gas, coal bed methane, and gas storage in depleted fields.
- Member of SPE, SPEE, GESGB.
- Chair of SPE London section 2024-25.
- Chair of Continuing Education for SPE London section, 2016-2024.
- SPE Regional Service Award, North Sea Region, 2019.
- Qualified Reserves Auditor (PRMS, COGEH) and Competent Person (AIM).

Agenda

- Why oil and gas matter in today’s energy systems
- The energy trilemma
- The role of upstream oil and gas in the UK
- The energy trilemma in the UK



Why oil and gas matter in energy systems

Context: why is energy important?

- Energy is the lifeblood of modern society. It powers our homes, industries, and transportation systems.
- Currently oil and gas account for the majority of the UK's energy use.
- Why can't we just stop using all oil and gas immediately?
- We are here today to learn about upstream oil and gas, in the context of Net Zero.

Oil and gas is a global industry

- Oil and gas are important to every country's economy and industry, used for a wide range of products and services. Including:
  - Transportation:
    - Fuel for cars and trucks
    - Diesel fuel for trucks and machinery
    - Jet fuel for airplanes
    - Marine fuel for ships
  - Heating and Electricity:
    - Gas for heating homes and businesses
    - Gas for generating electricity
  - Manufacturing:
    - Petrochemicals for plastics, synthetic fibers
    - Lubricants for machinery
    - Asphalt for roads and roofing
    - Fertilizers
    - Pharmaceuticals
    - Steel and cement production
- Global oil production is circa 100 million barrels per day[1] and consumption of natural gas is circa 400 billion cubic feet per day[2].

1: U.S. Energy Information Administration; 2: International Energy Agency

Oil and gas is a global industry

- There is global interdependence with many links.
  - For example, oil may be produced in Norway by a US-listed company. It may be sold via pipeline to the UK, with the oil exported and consumed in the Netherlands.

- Key industry players include:

Government

Finance
- HM Treasury

Energy
- Department for Energy Security and Net Zero

Regulators
- North Sea Transition Authority
- Health and Safety Executive

Production Companies

Integrated Majors
- Shell, BP, TotalEnergies

Independents
- Serica, Harbour

National Oil Companies
- Saudi Aramco, Equinor, CNOOC

Service Companies + more

Engineering and Construction
- Bechtel, Petrofac, Aker

Drilling
- Noble, Diamond

Oilfield Services
- Halliburton, SLB, Baker

Finance
- Banks, private equity, traders

Examples of global upstream industry companies

Majors

bp
TotalEnergies
Chevron
ConocoPhillips
ExxonMobil
eni
OXY

Independents

HESS
Apache
SERICAENERGY
TULLOW OIL plc
Harbour Energy
Anadarko

NOCs

equinor
aramco
CNPC
PETRONAS
BR PETROBRAS
GAZPROM
ADNOC
ONGC

Financial Institutions

citi
standard chartered
Blackstone
Goldman Sachs
BlackRock
BERKSHIRE HATHAWAY INC.
THE CARLYLE GROUP
GLOBAL ALTERNATIVE ASSET MANAGEMENT

Service Companies

CGG
SAIPEM
slb
HALLIBURTON
MCDERMOTT
Baker Hughes
Technip
Petrofac
ALMANSOORI

Consultancies

GENESIS
accenture
ERCE
Independent Energy Experts
Rystad Energy
XODUS
RISC
IHS Markit
Gaffney Cline

Instability in oil price

- The oil industry is interconnected, resulting in global oil prices
  - Local variations: Brent, WTI.

- Factors driving oil price instability include:
  - Geopolitical factors
  - Supply and demand dynamics
  - Economic cycles
  - OPEC decisions
  - Climate change policies
  - Technological advancements.

Which countries produce the most oil?

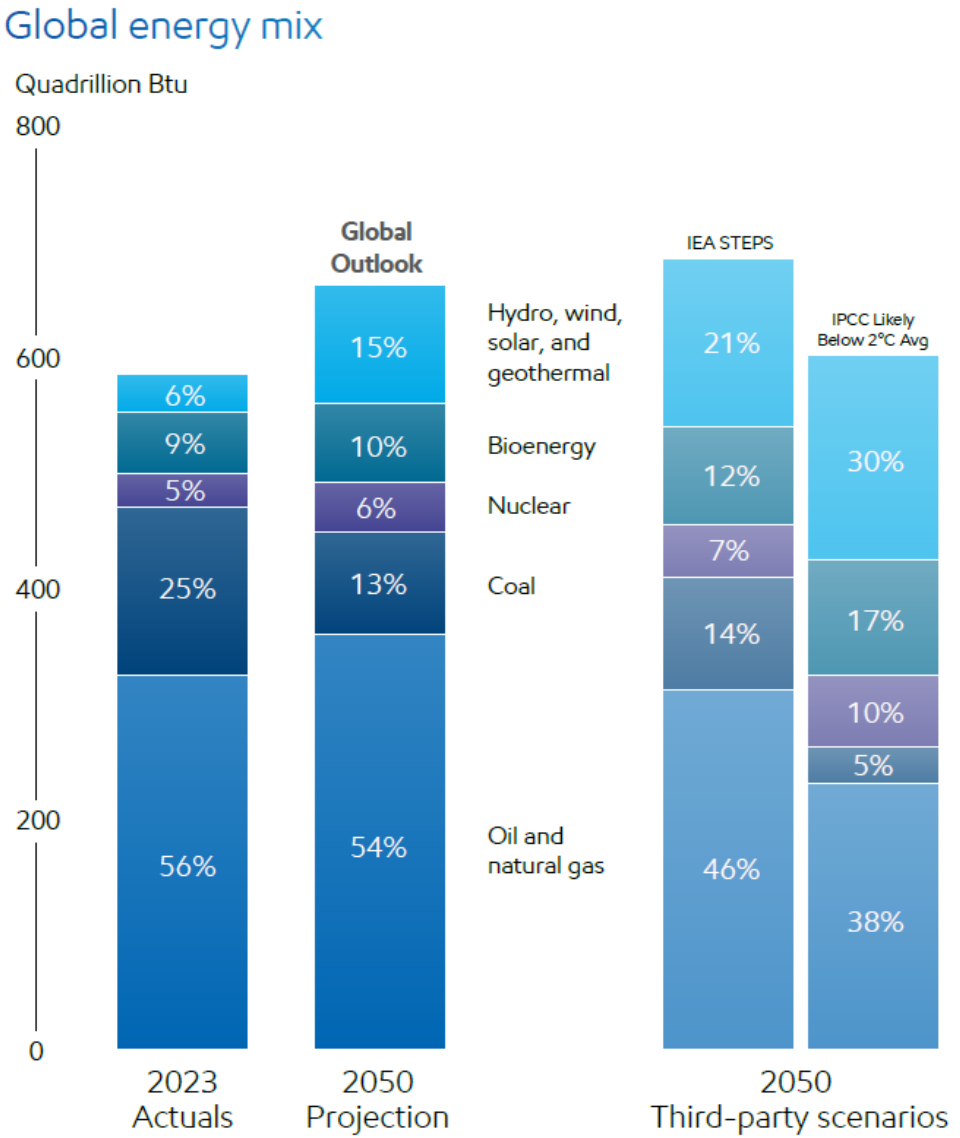
- The USA has significant oil production due to shale wells, since 2005.
- Many of these are in OPEC or OPEC+.

- The UK's peak production was 3 million bopd in 1999. We now produce 0.6 million bopd.

Country	Million barrels per day	Share of world total
United States	21.9	22%
Saudi Arabia	11.1	11%
Russia	10.8	11%
Canada	5.8	6%
China	5.3	5%
Iraq	4.4	4%
Brazil	4.3	4%
United Arab Emirates	4.2	4%
Iran	4.0	4%
Kuwait	2.9	3%
Total top 10	74.6	73%
World total	**101.8**	

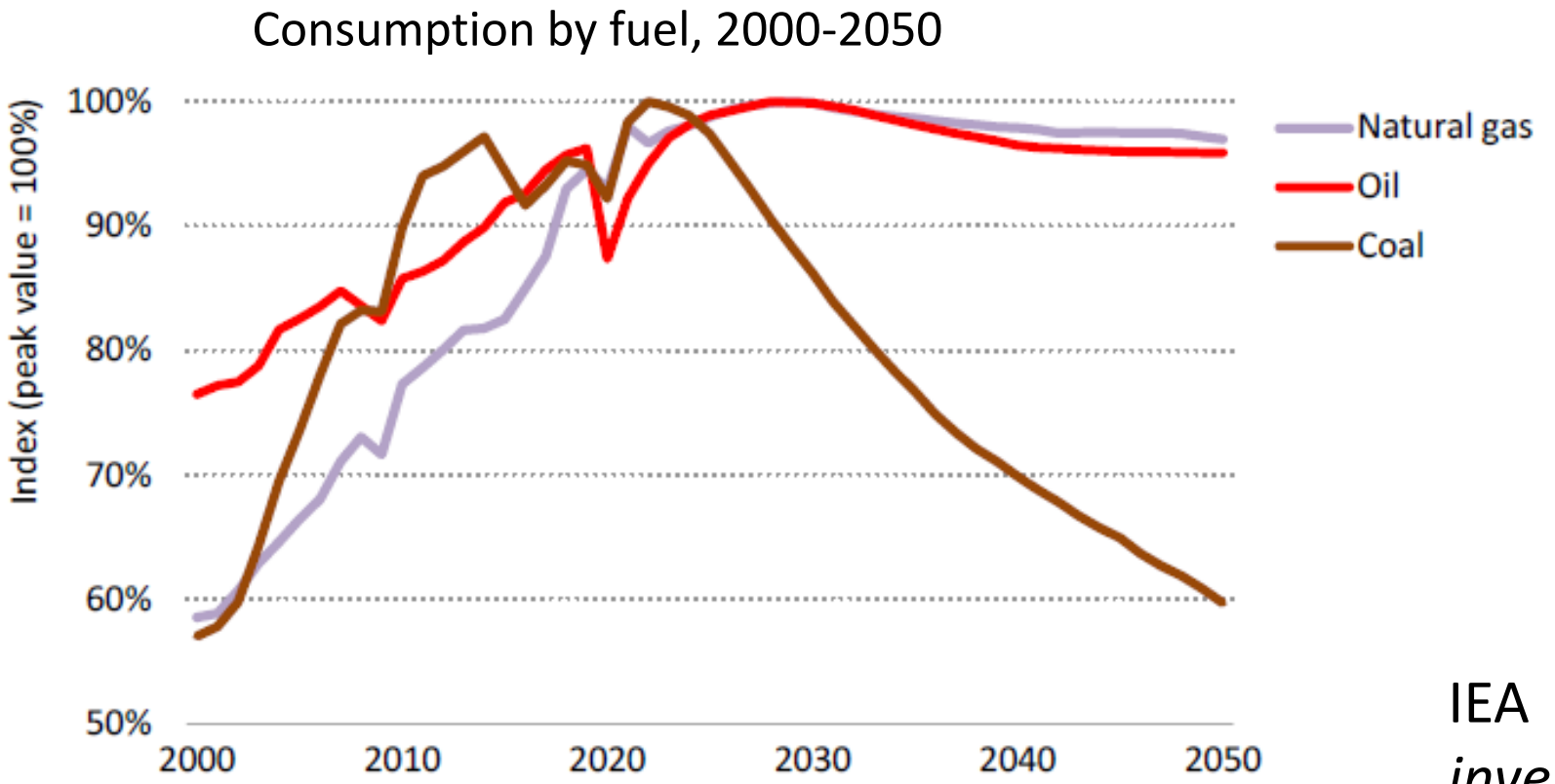
How much energy will the world need in future?

- As developing nations increasingly meet modern energy standards to enable economic growth, global energy use will increase by 25%.
- By contrast, energy use in developed nations will decline by 10% as efficiency improves.
- The net impact will increase global energy needs by 15% between now and 2050.
- Renewables will play an important role. So will the continued use of oil and natural gas.



1: ExxonMobil Global Outlook, 2024

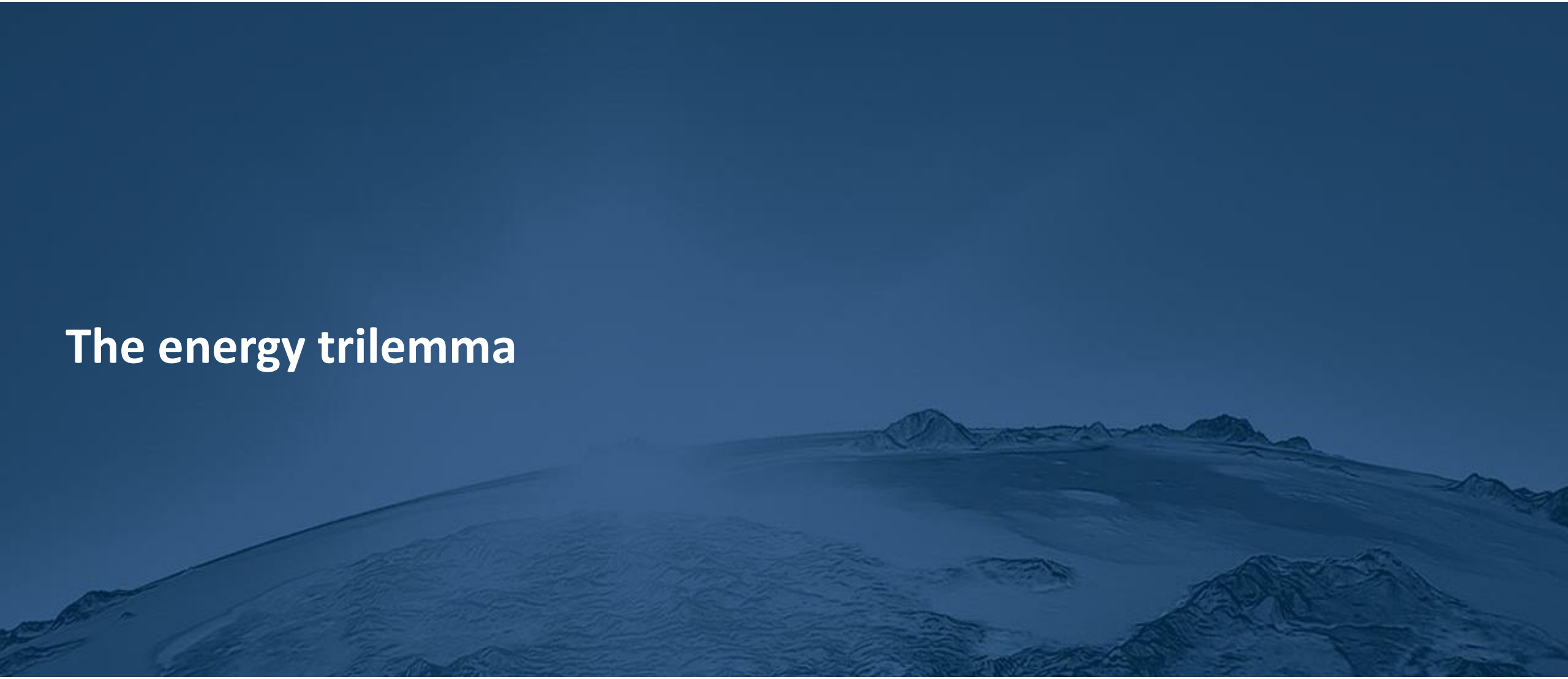
How much energy will the world need in future?



IEA stated *"Continued investment in fossil fuels is essential in all of our scenarios."*

ExxonMobil Global Outlook, 2024
https://iea.blob.core.windows.net/assets/26ca51d0-4a42-4649-a7c0-552d75ddf9b2/WorldEnergyOutlook2023.pdf

The energy trilemma



Risks to our energy supply

- How should a nation handle these problems?
  - Drop in energy supply following sanctions after Russia's invasion of Ukraine
  - Globally rising CO_2 and the climate crisis
  - Changing energy demands during COVID
  - Cost of living crisis raising the cost of petrol, heating, electricity
  - Increasing reliance on energy imports
  - Risks to economic growth
  - Instability in the Middle East.

- Can you see how many of these are interconnected?

The energy trilemma

- The UK government defines[1] a framework of three objectives that energy policymakers need to balance.

- The trilemma comprises:
  1. **Sustainability**: decarbonising energy
  2. **Security**: ensuring the security and reliability of energy supplies
  3. **Affordability**: minimising the cost of energy to consumers.

- There are no easy solutions. Balancing these objectives will involve trade-offs.

1: https://commonslibrary.parliament.uk/research-briefings/cdp-2023-0074/

The energy trilemma

- Each nation's circumstances will influence their energy choices:

  - **Geography**: Norway has hydropower, Iceland has geothermal energy
  - **Natural resources**: oil, gas, solar, wind
  - **Capital**: Strong economies can invest in diverse energy sources
  - **Leadership**: Some countries aim to take responsibility to lead industry
  - **Political factors**: Public support for the energy transition
  - **Development**: Countries in energy poverty focus on low-cost, reliable energy.

The energy trilemma

- A government's policy framework can speed up action by the private sector.

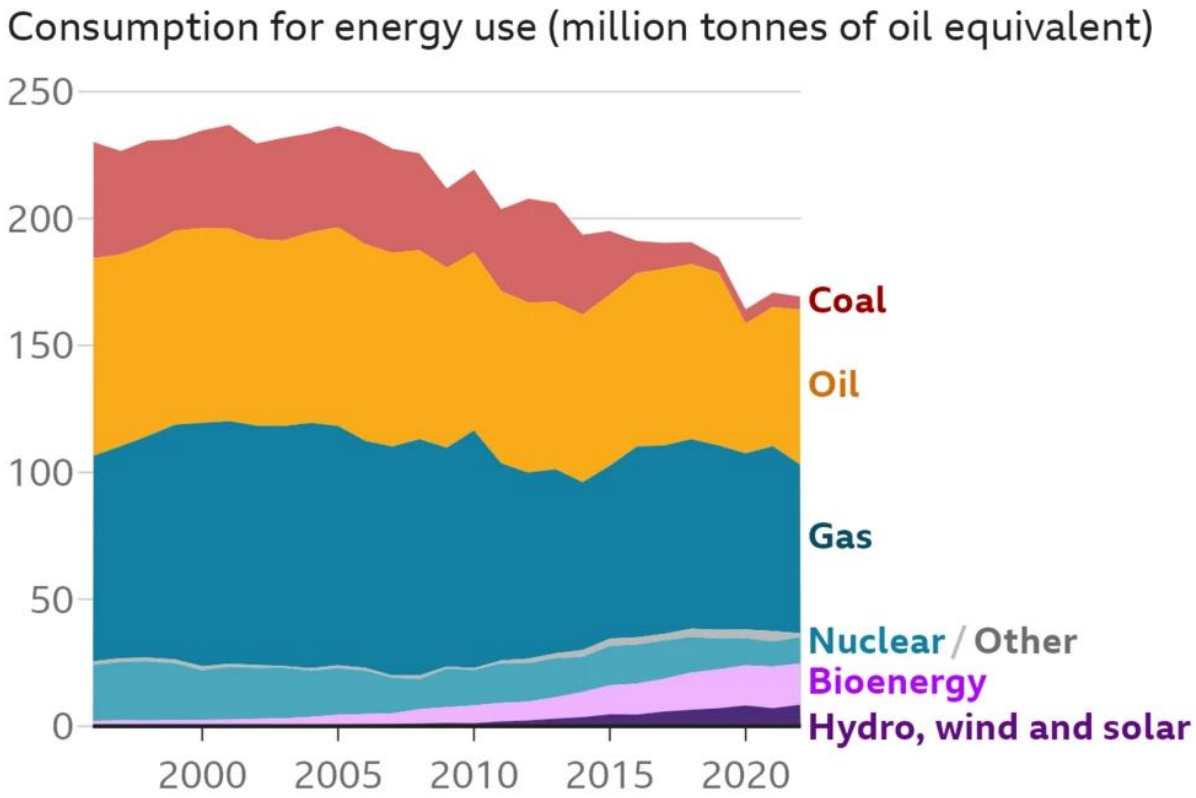
- Examples include:
  - **U.S. Inflation Reduction Act**, which focuses on an outcome of carbon intensity and does not pick winners and losers
  - **Canada's Clean Fuel Regulations**, which allows for co-processing of biofuels to achieve a lower carbon
  - European Union **coal phase-out commitments**: 25 member states will be coal-free by 2030.

- National Oil Companies are also working towards this:
  - Eg ADNOC aims for Net Zero by 2045, Saudi Aramco by 2050.

The role of upstream oil and gas in the UK

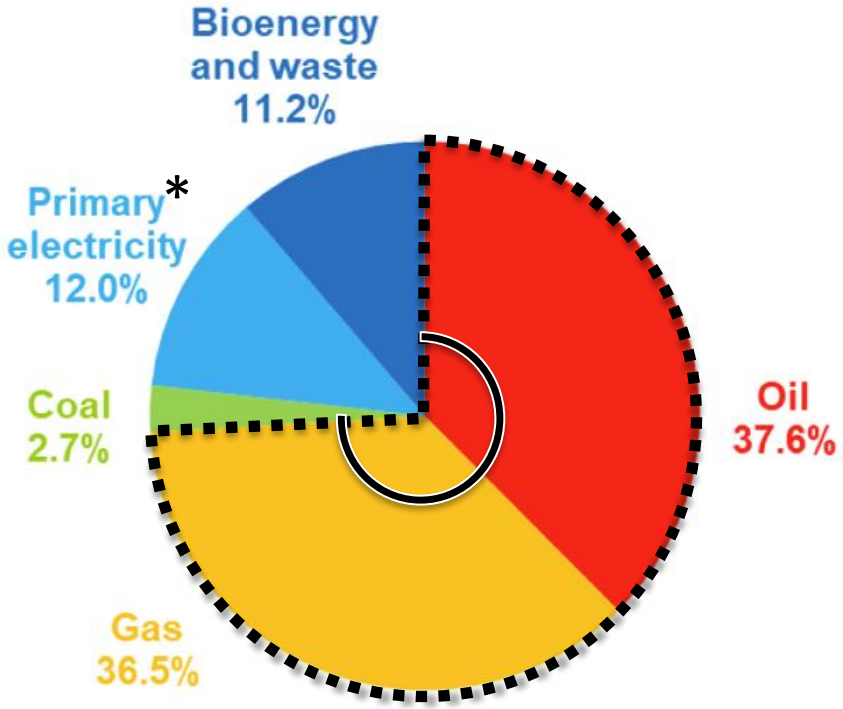
The UK's historical energy mix

- The North Sea has been significant for the UK
  - Historical reliance on fossil fuels.
  - The industry employs over 200,000 people, plus many more indirectly.
  - The oil and gas industry contributed circa $13.2 billion of Gross Value Added in 2023.

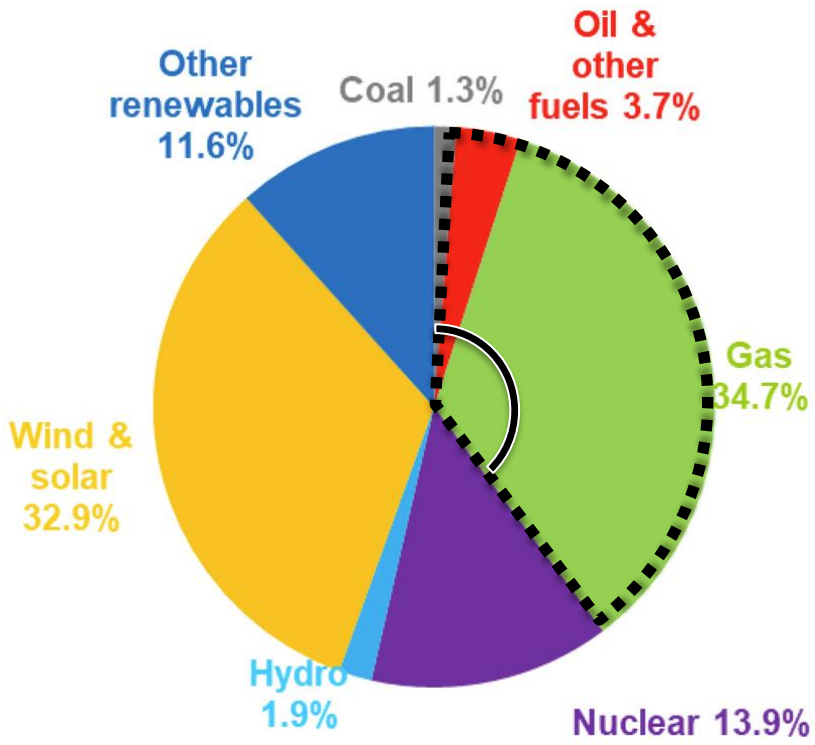


https://www.bdo.co.uk/getmedia/3a60e82b-3710-4d14-b35a-b98ec3c3f277/NR-Report-Oil-Gas-Report-2024-BDO.pdf
https://assets.publishing.service.gov.uk/media/66a76bf2ce1fd0da7b592e5d/UK_Energy_in_Brief_2024.pdf
https://www.bbc.co.uk/news/business-63976805

The UK's energy mix now



- Oil+Gas account for 74% of total UK <u>energy</u> use



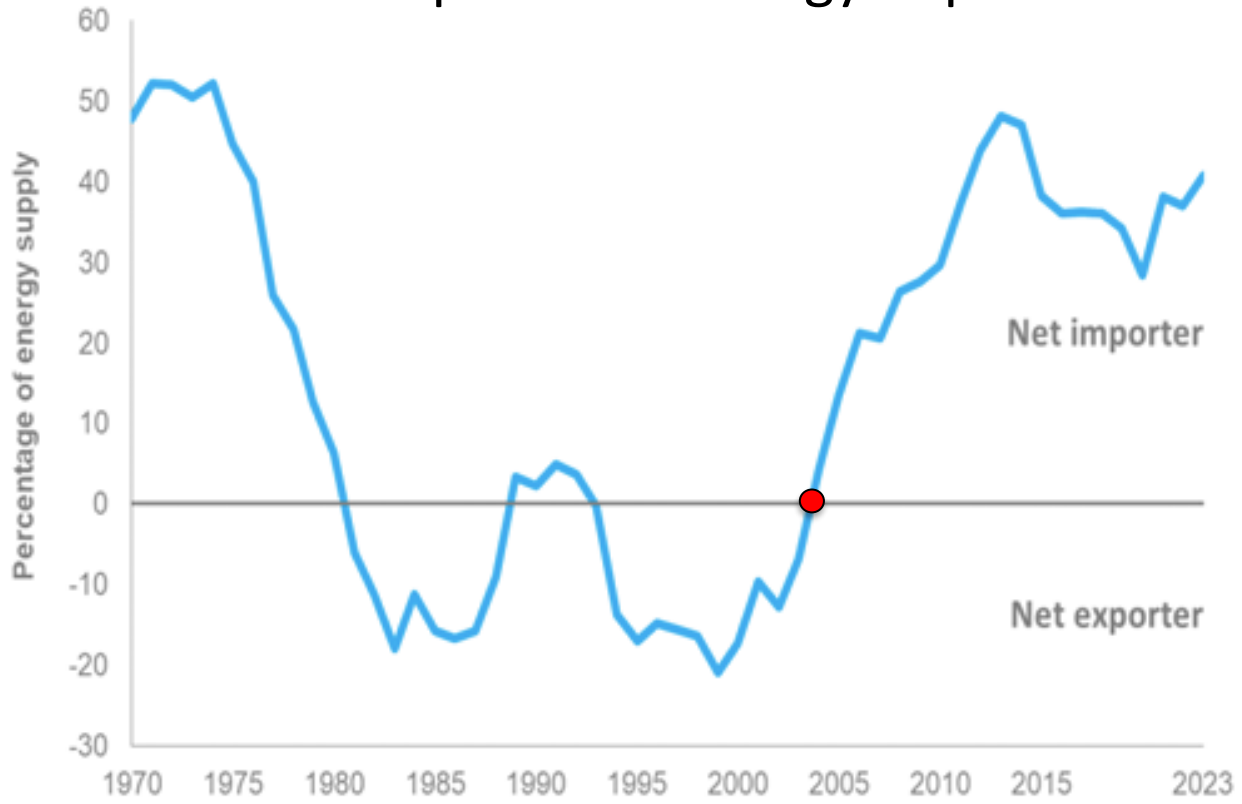
- Oil+Gas account for 38% of UK <u>electricity generation</u>

* Primary electricity includes nuclear, wind, solar, hydro and net imports.
https://assets.publishing.service.gov.uk/media/66a76bf2ce1fd0da7b592e5d/UK_Energy_in_Brief_2024.pdf

Challenges facing the UK's oil and gas sector

- Declining North Sea production:
  - In 2023 the UK net imported £21 billion of petroleum
  - We import gas via pipeline from Norway, plus LNG from US and Qatar
  - The carbon intensity of UK North Sea gas is ¼ of the imported LNG.
- Increasing climate change goals.
- Less finance and investment available.

The UK depends on energy imports



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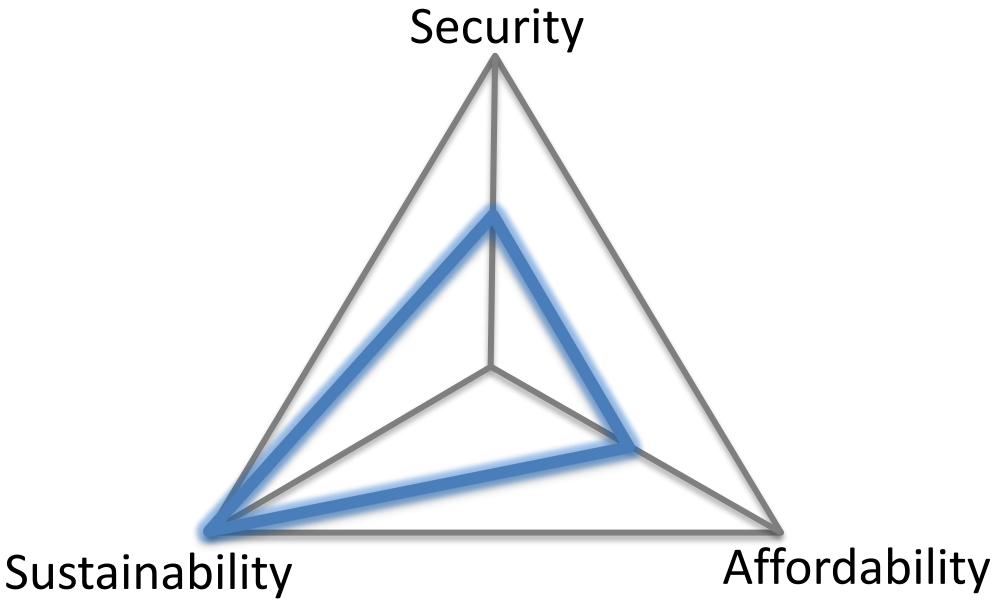
The energy trilemma in the UK

Energy trilemma in the UK

- Let's now combine these issues:
  - The global energy system
  - Changing energy sources in the UK
  - The energy trilemma

Energy trilemma in the UK

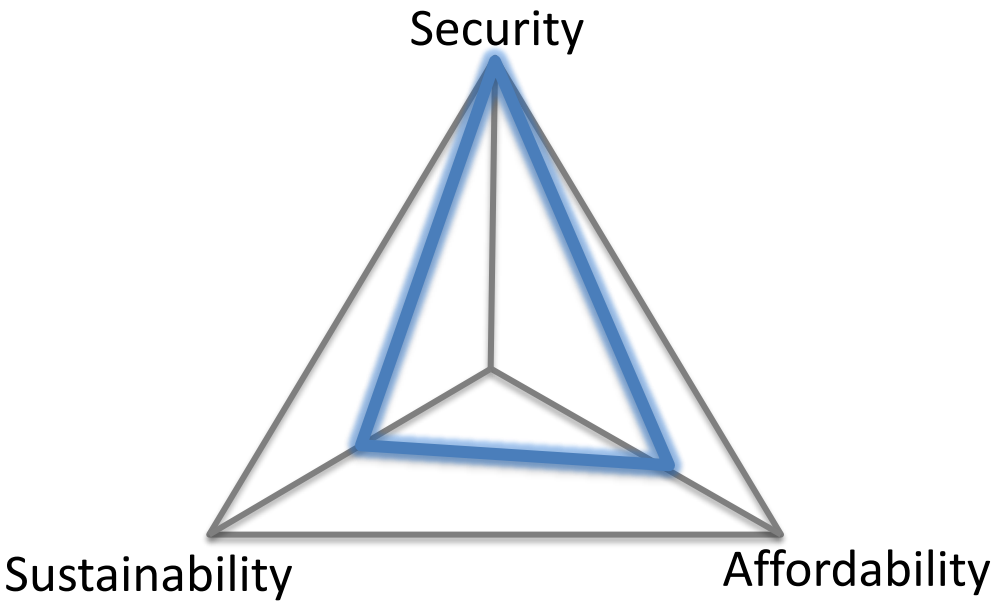
- The UK's focus within the energy trilemma has shifted significantly.
- 2020: the emphasis was strongly weighted on sustainability.
- Regulators assumed energy would remain affordable and the global market would supply as required.



Energy trilemma in the UK

- 2022: Russia invaded Ukraine, followed by sanctions on Russian exports of gas to Europe.

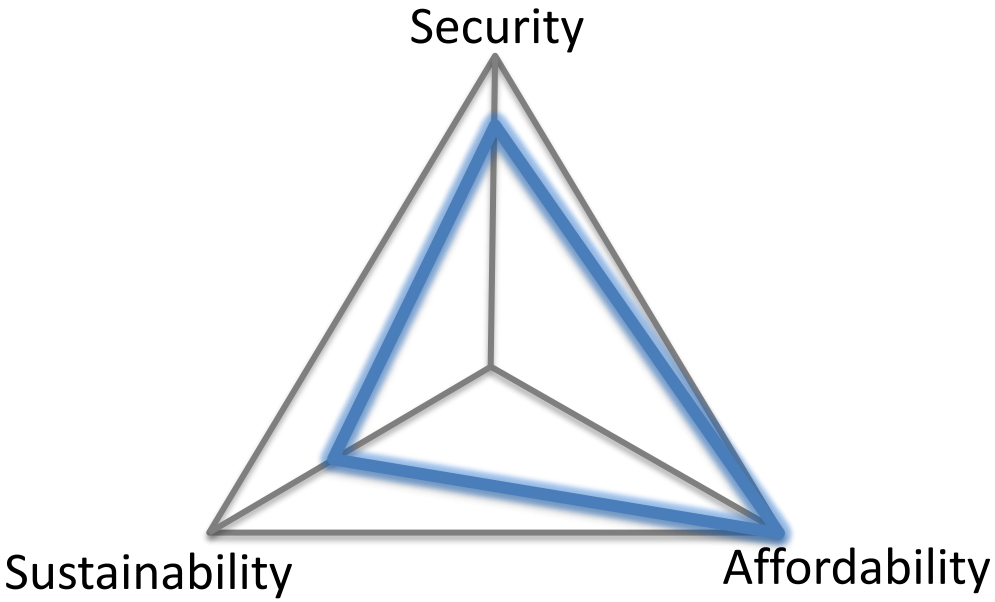
- Russia supplied 30% of EU's gas at that time, so supply was required from other sources. This challenged the UK's energy security.



Energy trilemma in the UK

- In 2022/23 the cost of living increased significantly, including energy prices.
  - Goods and energy prices were the main contributors to the rise in inflation[1].

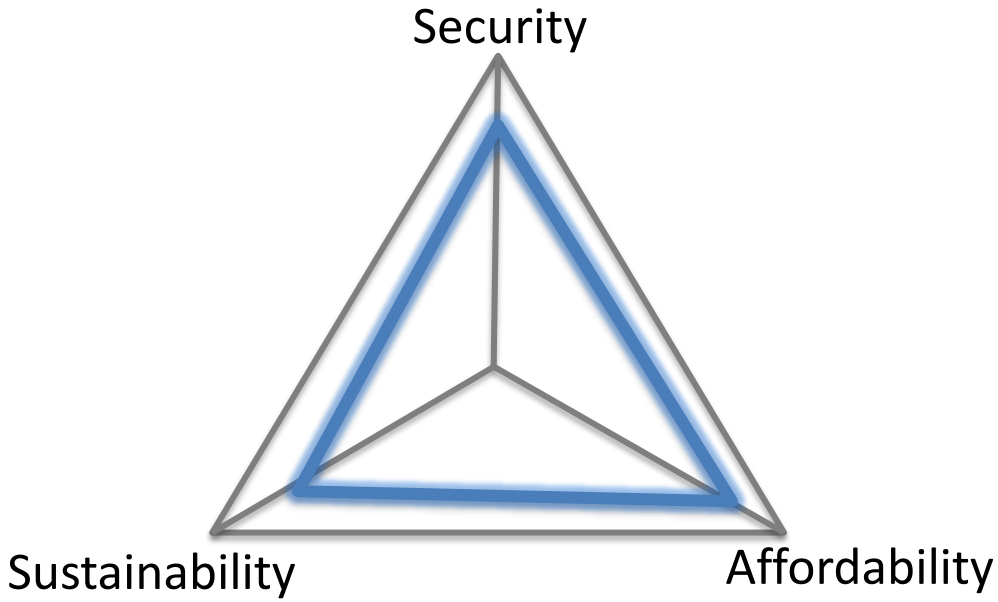
- The UK government responded with:
  - Energy Price Guarantee limiting energy costs to households.
  - Financial support for energy bills.



1: https://commonslibrary.parliament.uk/research-briefings/cbp-9428

Energy trilemma in the UK

- Are we in a more balanced position in late 2024?



Energy trilemma: Environmental Sustainability in the UK

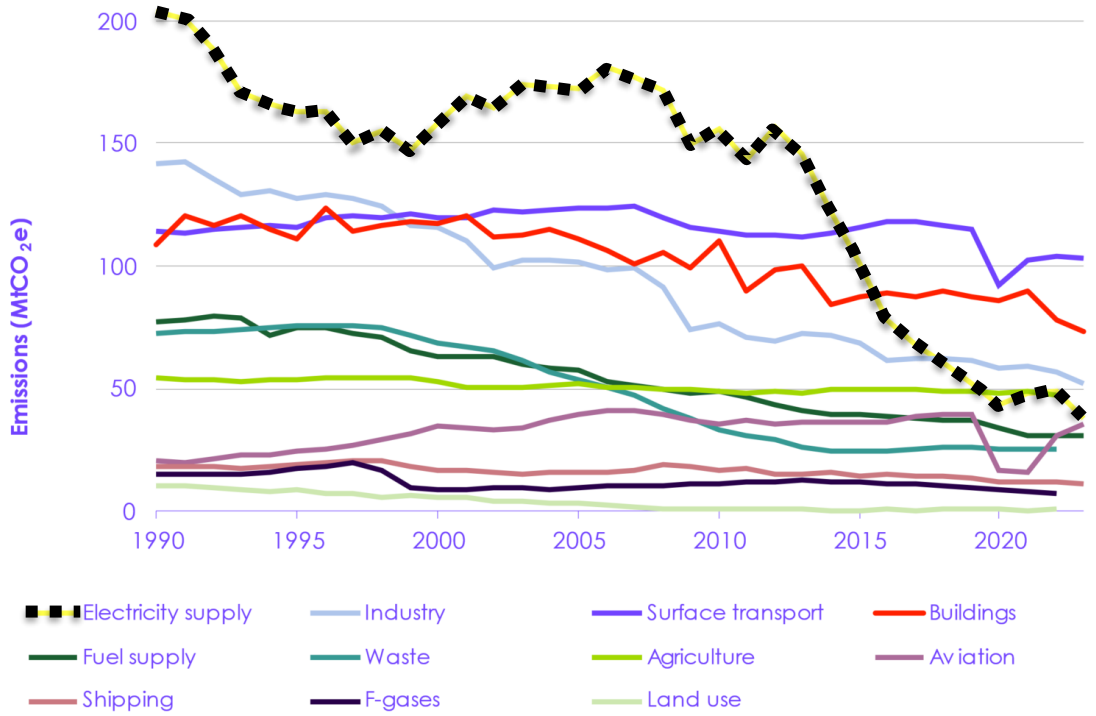
- The UK is committed to reaching net zero by 2050:
  - Reducing greenhouse gas emissions
  - Decarbonising our energy systems.

- Plus ongoing investment in:
  - Renewable energy like solar, wind
  - Carbon capture and storage
  - Hydrogen as a fuel
  - Research and development for new technologies.

Energy trilemma: Environmental Sustainability in the UK

- The UK has made excellent progress.
- UK greenhouse gas emissions in 2023 were 49.5% lower than in 1990
  - Increased electricity imports and less production in the UK.
- UK shut its last coal power plant in September 2024.

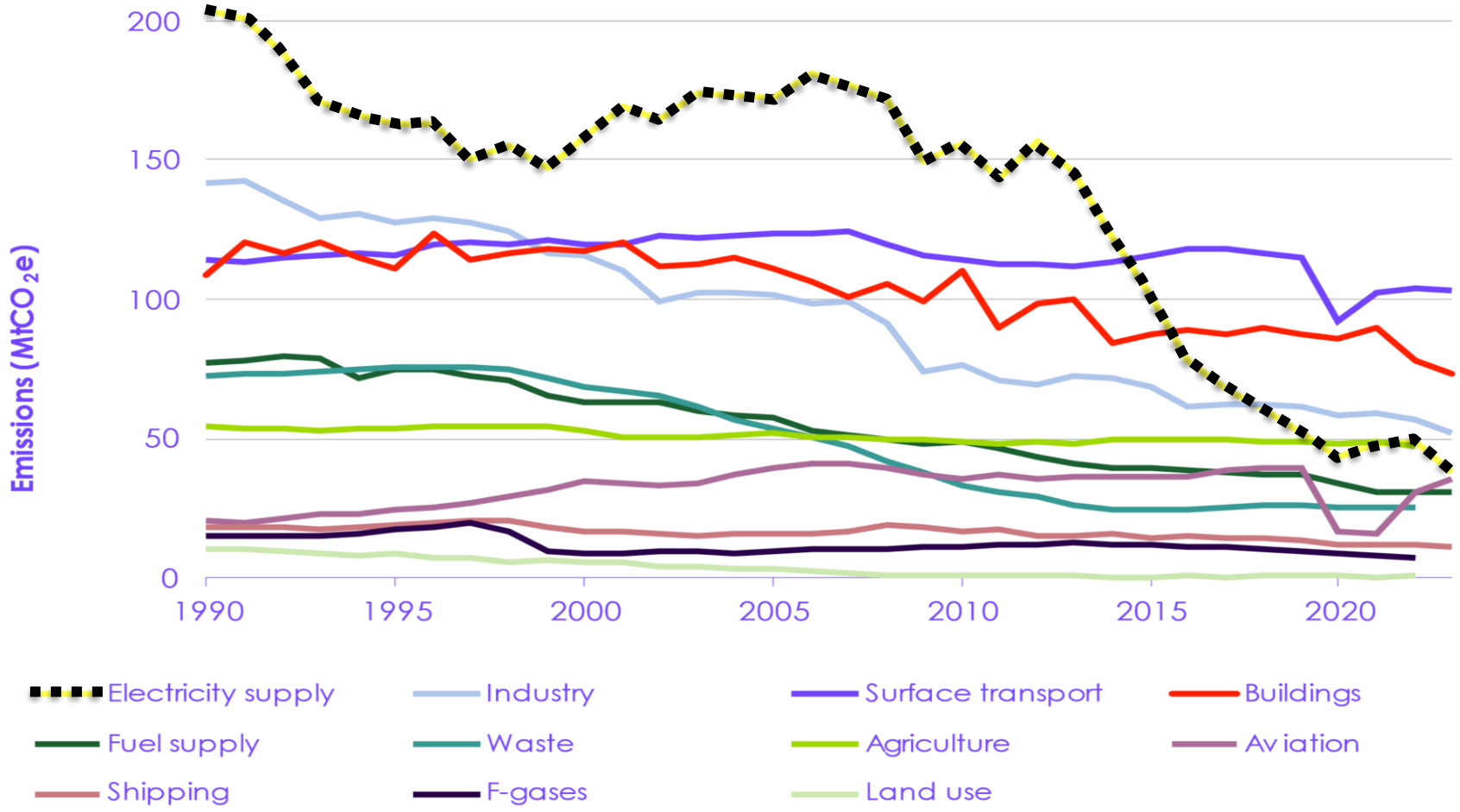
UK emissions by sector since 1990



https://www.theccc.org.uk/publication/progress-in-reducing-emissions-2024-report-to-parliament/

Energy trilemma: Environmental Sustainability in the UK

UK emissions by sector since 1990



https://www.theccc.org.uk/publication/progress-in-reducing-emissions-2024-report-to-parliament/

Energy trilemma: Environmental Sustainability in the UK

- We need to address concerns about the rapid pace of change:
  - Job losses in oil and gas, and manufacturing
  - Will the UK be less competitive than countries with less strict standards?
  - Are we losing industries without their replacements being ready?
  - Are renewables a good long-term investment, at high interest rates?
  - Are we becoming too reliant on Norway, China, Qatar?
  - Will our lifestyle change: flying to holidays? Our cars? Our food?

- A ‘just transition’ approach ensures that the affected people are considered by those making decisions
  - Lessons from another transition – the end of the UK coal industry in the 1980s.

Energy trilemma: security of supply in the UK

- The UK needs a diverse energy mix to secure a supply to homes and industries.
  - Imports: electricity from Europe; gas from Norway and outside our region
  - Solar, wind, plus gas with carbon capture and storage
  - Even with clean electricity, we need similar backup gas-powered generation in 2030, compared with today.

- Physical security is also essential:
  - Gas pipelines sabotaged
  - Cyber-security threats from nations, criminal organisations, and hackers
  - Supply chain security, ensuring access to spares/repairs of critical infrastructure.

Energy trilemma: affordability in the UK

- “How does this all affect me?”

- It directly impacts what you pay to cook you dinner, heat your home, and wash your clothes.

- Energy prices fell since summer 2023, but still above pre-'energy crisis' levels.

- There is little prospect of large cuts to bills in the near future.

https://commonslibrary.parliament.uk/research-briefings/cbp-9714/

Energy trilemma: affordability in the UK

- As we import gas and LNG, changes in global energy prices affect UK consumers
  - Reducing our reliance on volatile gas markets could lower energy costs.

- However, removing oil and gas from the UK's energy system will be expensive:
  - Levies to support renewable energy will be £10-15 billion each year to 2030
  - This can be increases to electricity bills, gas bills, or taxation.

https://www.theguardian.com/business/2024/nov/05/what-will-the-uks-clean-energy-by-2030-plan-mean-for-the-industry-and-public

UK government policies and initiatives

- Examples of policies in place:
  - A clean electricity system by 2030
  - A Net Zero target of 2050
  - North Sea Transition Deal
  - A National Energy System Operator - upgrading the electricity and gas networks
  - Great British Energy - a publicly owned clean power company
  - The UK Emissions Trading Scheme - a price on carbon emissions.

- And under consideration:
  - Phasing out new fossil-fuel cars and vans by 2030
  - Phasing out new gas-fired boilers for new homes.

What's next for the UK and elsewhere?

- Consider the world's energy future:
  - All energy types will remain in the mix
  - Renewables will grow the fastest
  - Coal will decline the most
  - Under any credible scenario, oil and natural gas remain essential
  - Will companies increase investment in renewables?
  - Can we supply a 'just energy transition' to the UK? Also to less developed nations?

- From the IEA: "**No country is an energy island, and no country is insulated from the risks of climate change.**"

1: ExxonMobil Global Outlook, 2024
2. IAE World Energy Outlook, 2023

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