Energy Transition Careers

Alison Isherwood

My Career Path

AJ Isherwood Consulting Ltd.

1997

MEng Chemical Engineering Nottingham University

1997-2016

Reservoir Engineer -> Technical Manager -> Chief Engineer

2017->

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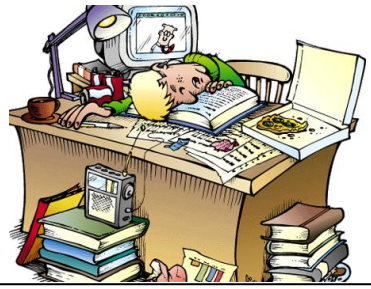
Independent Consulting

2020



Sustainable Business PostGrad Certificate

Focus on Green jobs, Just Transition, Start ups

London SPE Net Zero Programme

GHG Accounting Qualification

ISO 14064

2021-2024

GHG emissions
Geothermal
Hydropower
CCS
Hydrogen & Helium
Oil & Gas

sustain:able
SUSTAINABILITY MADE SIMPLE

STOREGGA

Helium One

zerogeo energy

bluemethane

CAUSEWAY ENERGIES

My Career Path

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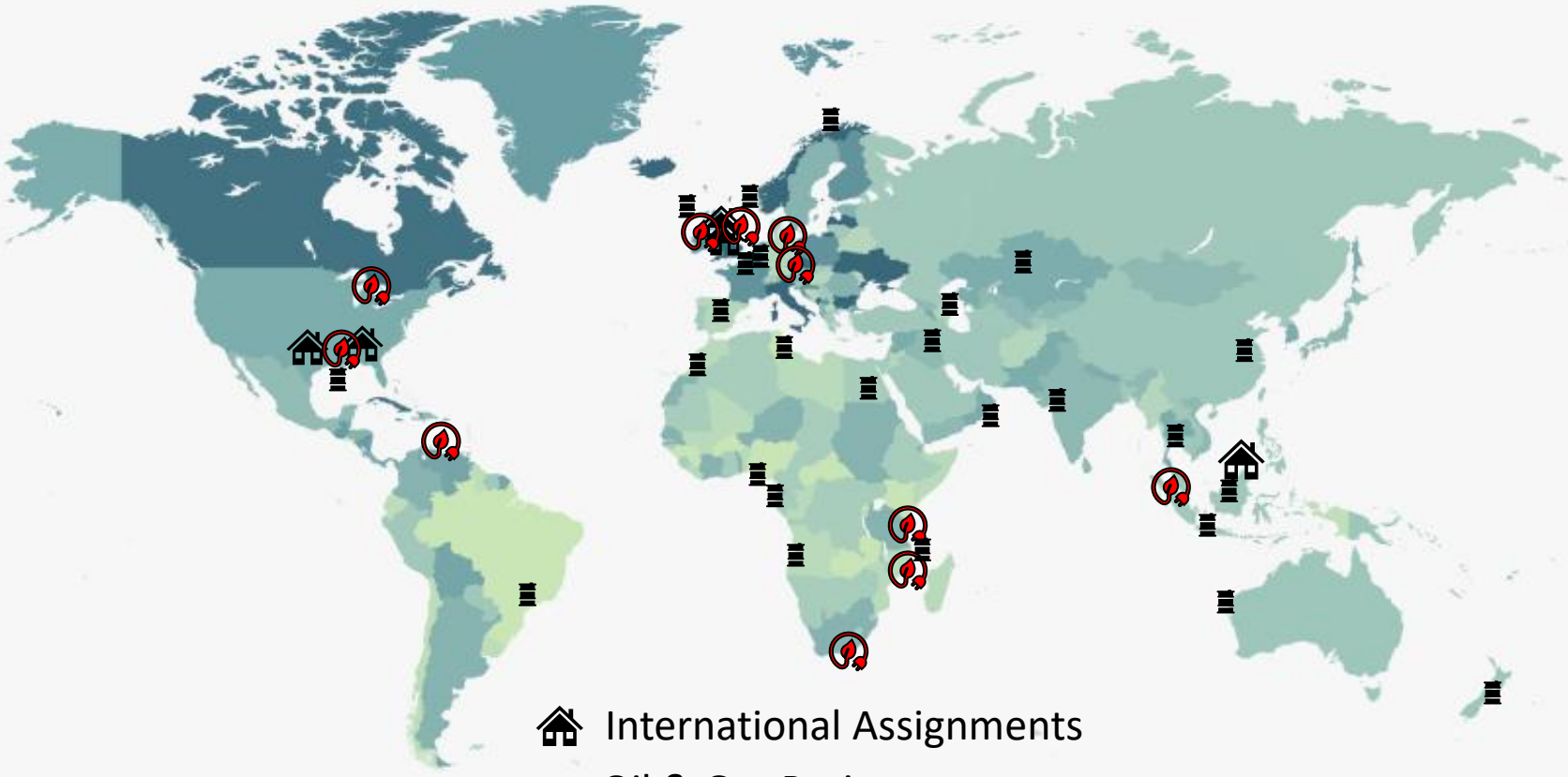
- Energy Transition jobs are global too



Energy Transition Careers

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- Areas of interest:
  - Geothermal
  - Carbon Capture & Storage
  - Hydrogen
  - Energy Storage, electrification & renewables
  - GHG Accounting & decarbonising Oil and Gas
  - Sustainability

- Crossover & challenges
  - Insights from someone with “a foot in both worlds”

Energy Transition
Pathways

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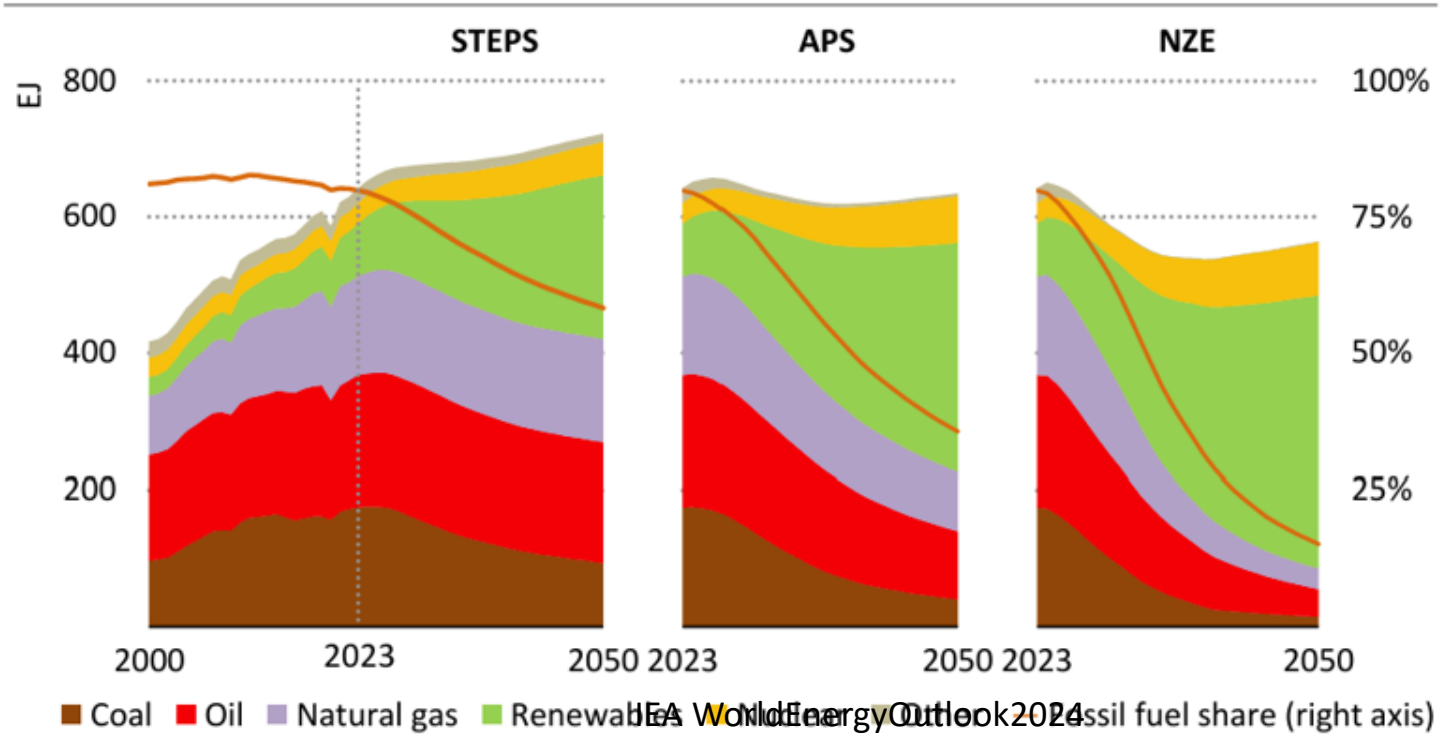
- To get to Net Zero will take a huge transformation of our energy system.
- Range of predictions of where we need to get to and how we get there
- Net Zero 2050 is always represented as the "stretch target"

Figure 3.1 ▷ Global total energy supply by source and fossil fuel share by scenario, 2000-2050



STEPS: Stated policies scenario
APS: Announced pledges scenario
NZE: Net Zero Emissions by 2050

Energy Transition
Pathways

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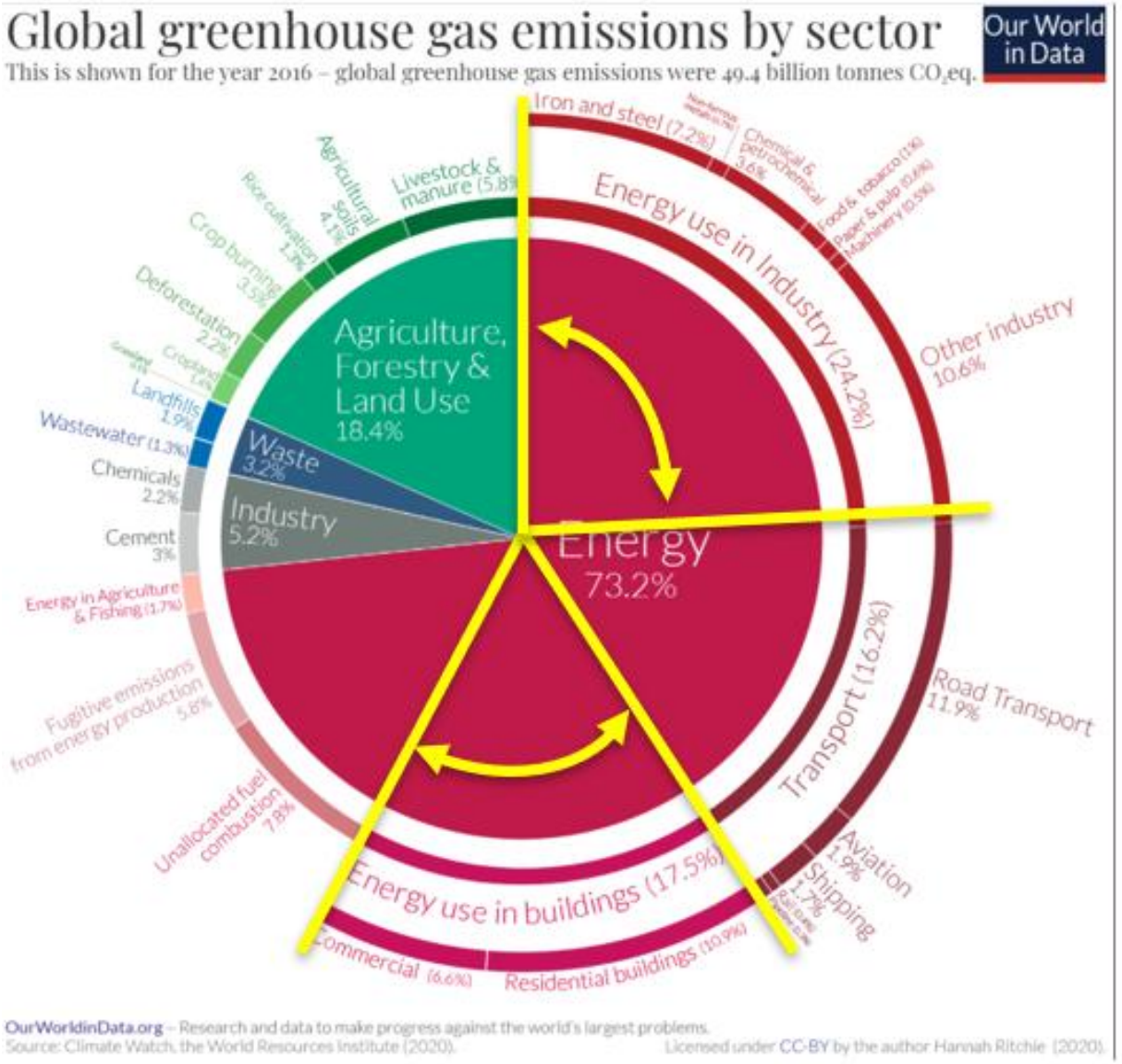

- Heating & cooling account for >40% of global GHG emissions
- 74% UK households heated by gas boilers only (2021 census)
- Opportunity for geothermal, direct heat supply

Energy Transition
Start-ups

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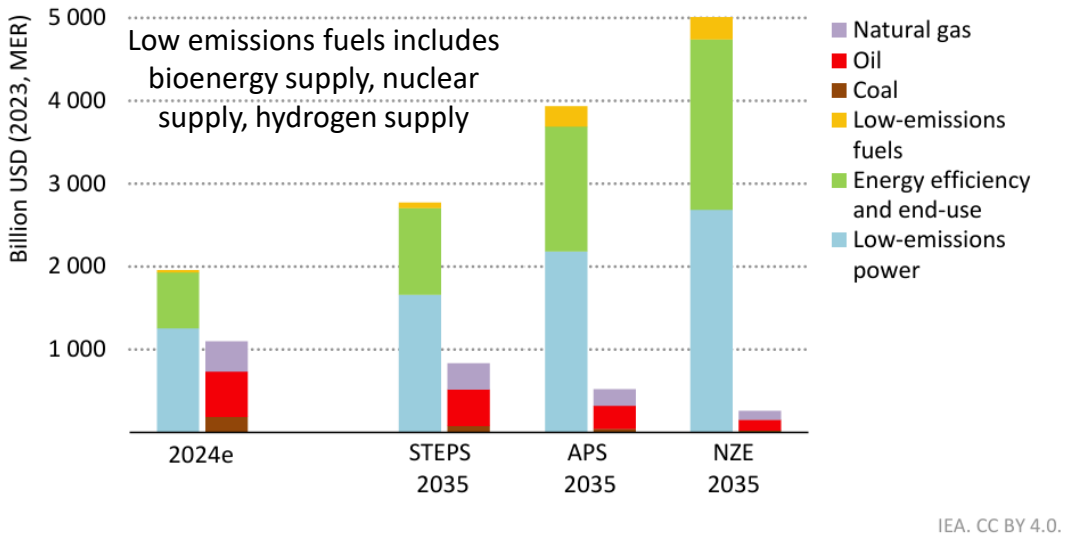
Blackrock CEO Larry Fink: The next 1,000 billion-dollar start-ups will be in climate tech

"Engineers and scientists are working around the clock on how to decarbonize cement, steel, and plastics; shipping, trucking, and aviation; agriculture, energy, and construction. I believe the decarbonizing of the global economy is going to create the greatest investment opportunity of our lifetime."

Larry Fink 2022 letter

Figure 5.31 ▷ Annual energy sector investment by sector and scenario, 2024 and 2035



For every USD 1 invested in fossil fuels today, around USD 2 is invested in clean energy. By 2035, this rises to USD 3 in the STEPS in 2035, USD 7 in the APS, and USD 20 in the NZE Scenario.

- Entrepreneurship is exciting but carries risk and uncertainty
- Funding is everything
- Blackrock world's largest investment management firm. Larry Fink 2023/2024 letters shifted away from sustainability focus due to "ESG backlash"

Energy Transition
Employment

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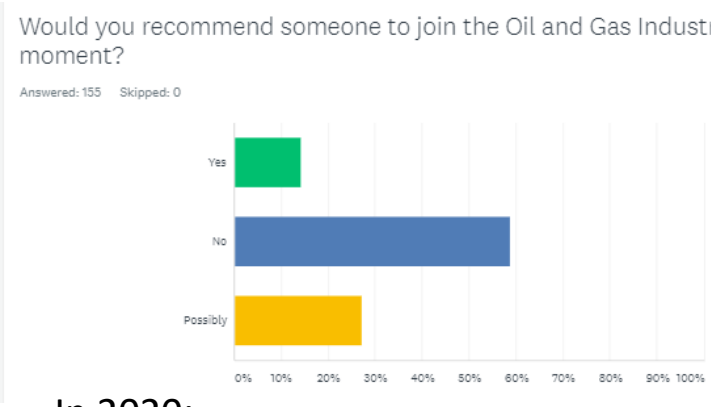
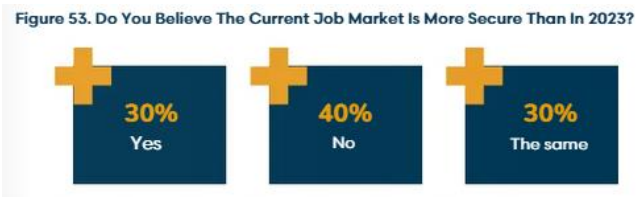
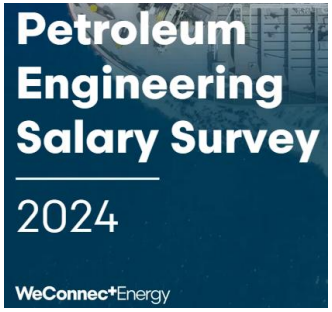
Sustainable Business Course Just Transition Survey 2020

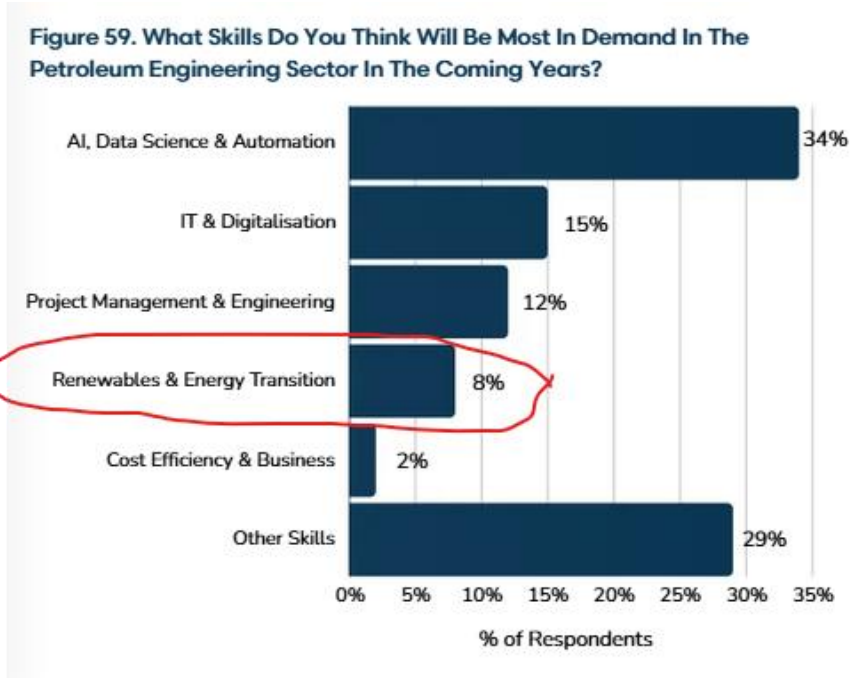






In 2020:

- >50% of people not recommending joining oil and gas, 77% of people considering leaving
- 33% of people completed formal education to develop new skills, 29% thinking about it; 90% of those paid for it themselves. We are trying to transition ourselves.
- Since then, O&G has picked up, less focus on upskilling for energy transition?



Energy Transition
Employment

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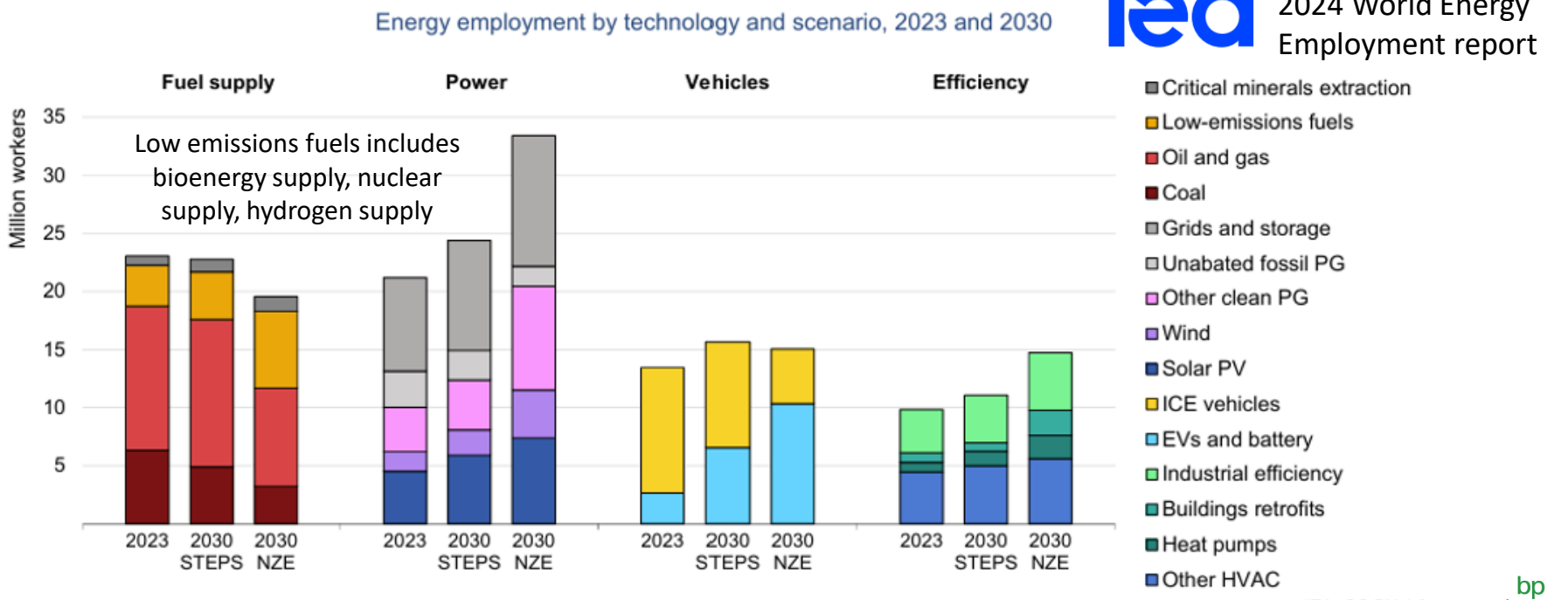
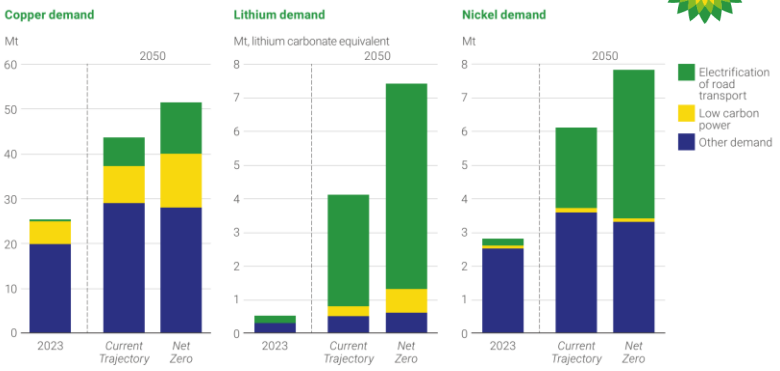


2024 World Energy Employment report

- Most “green job growth” is downstream, fuel supply (& extraction) sees job reduction, despite huge increase in demand for critical minerals
- The construction and manufacture of clean energy infrastructure and technologies accounted for 60% of all new clean energy jobs added 2019-2023



bp

Energy Transition

Is green job growth real?

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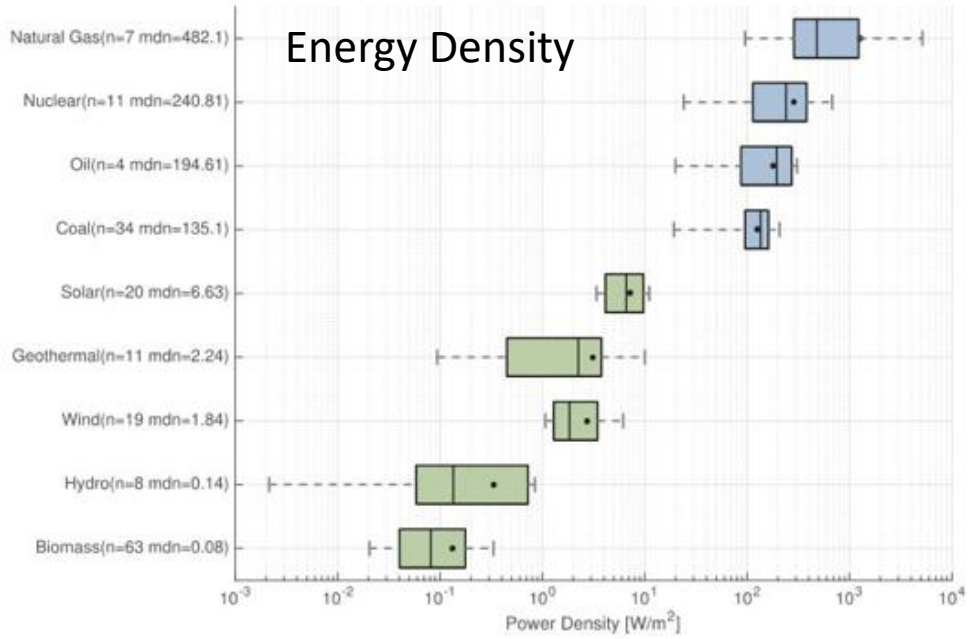
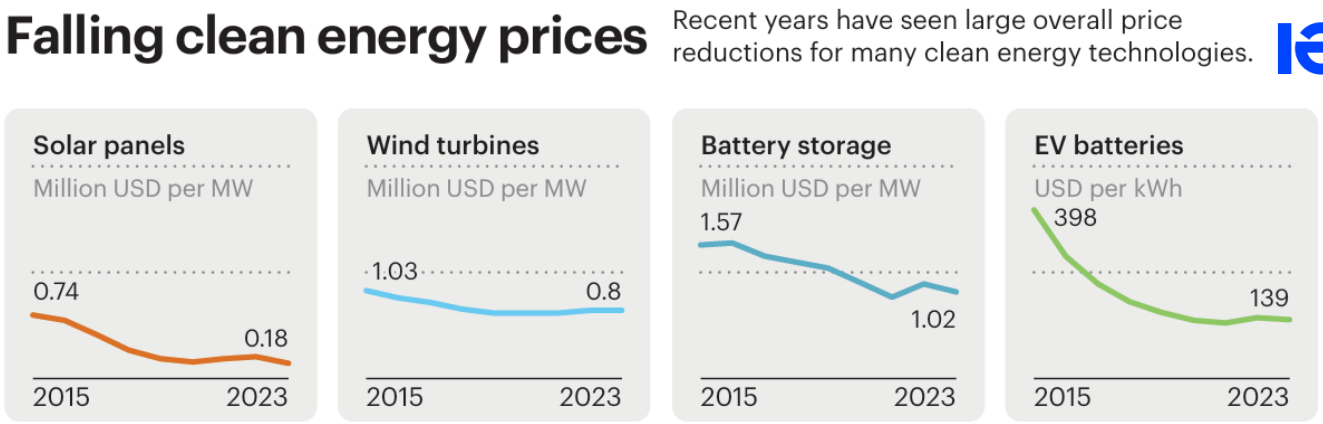


- The lower energy intensity of low carbon sources makes economics more challenging
- My green job research in 2020 suggested energy generation job intensity correlates closely to cost of energy, cannot have lower cost and higher job intensity

Van Zalk & Behrens 2010



Energy Transition
Carbon Capture & Storage

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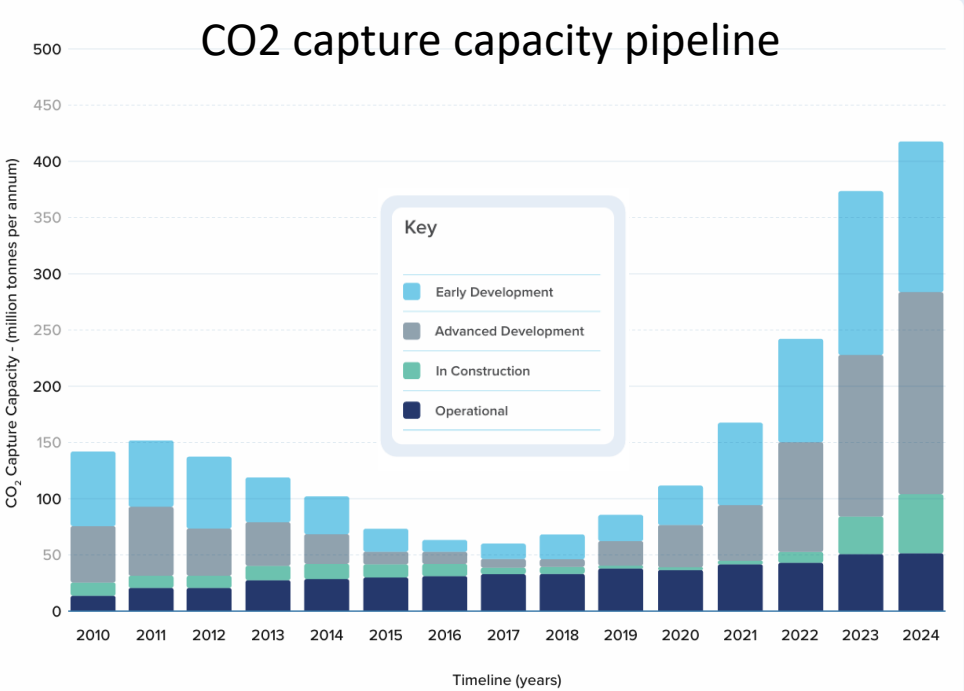
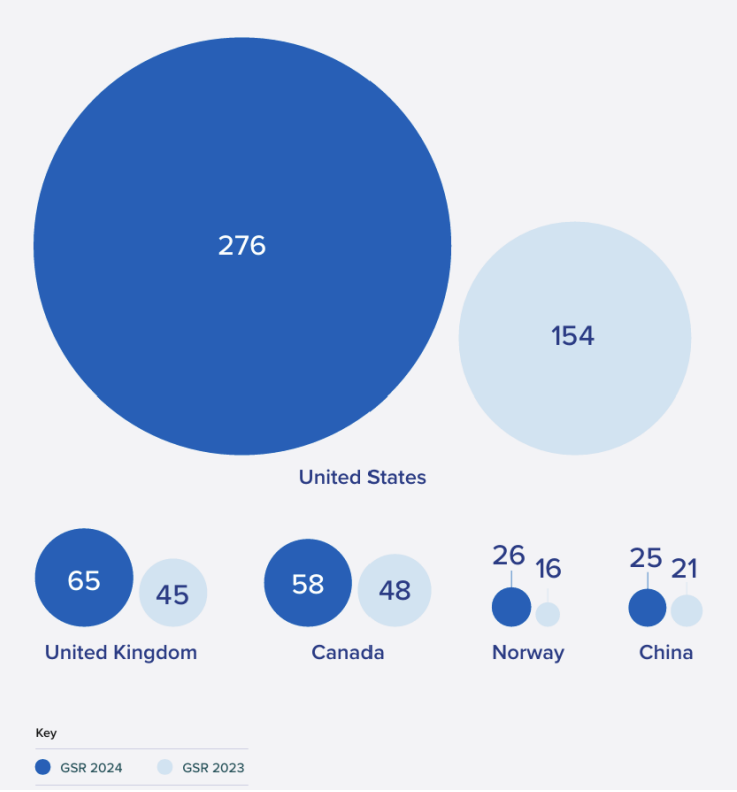


GLOBAL CCS INSTITUTE

6Nov2024 report

Top 5 countries with CCS Projects 2024 vs 2023



- Clear transferable technical knowledge and skill sets
- Slow progress but USA accelerating with IRA (including EOR CCS)
- Plenty of subsurface focus in the development stage

Energy Transition
Carbon Capture & Storage

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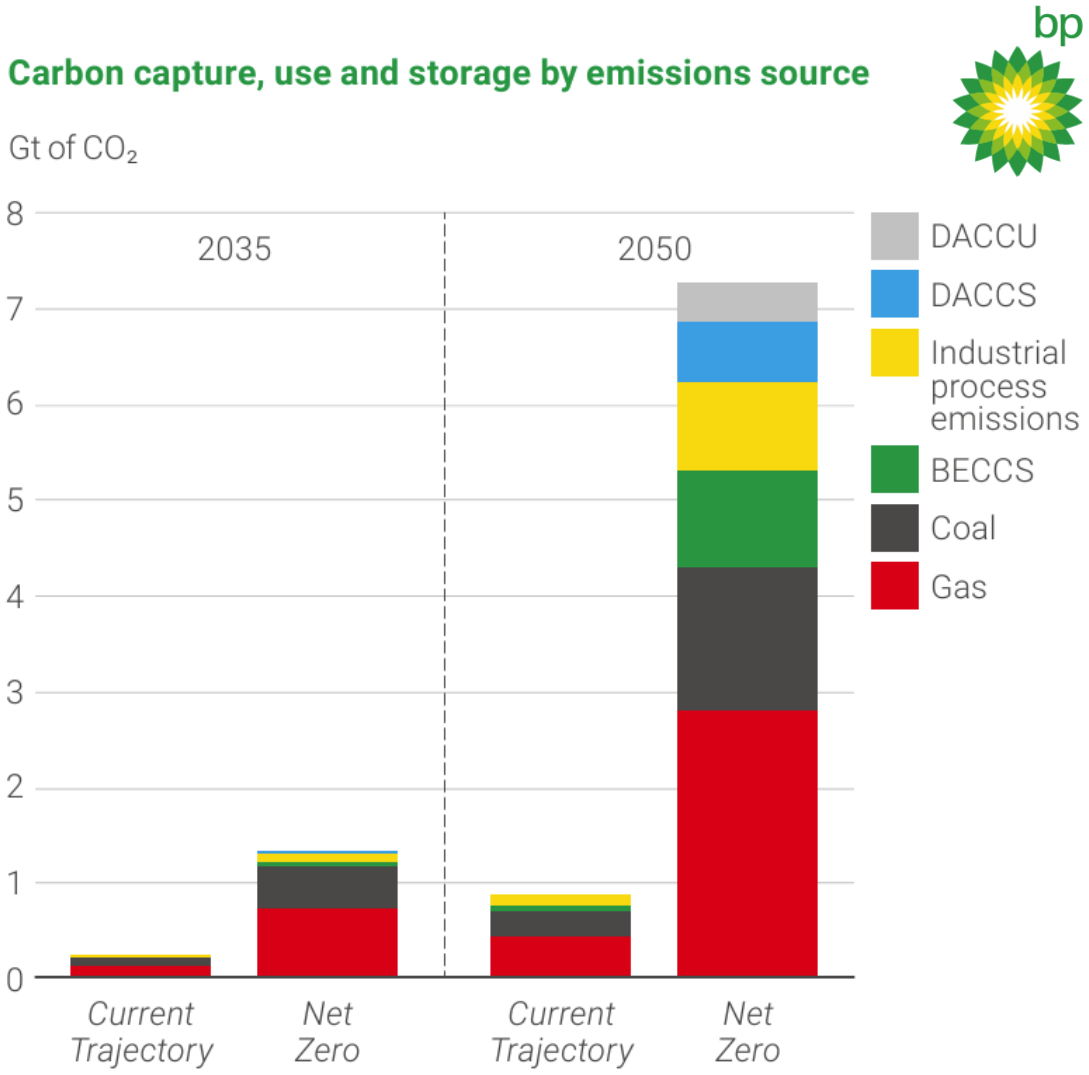
- Still a huge range of uncertainty in how CCS might grow,
  - Will all development projects make it to construction & operation phase?

BECCS: Bioenergy with carbon capture & storage

DACCS: Direct Air Capture & Storage

DACCS: Direct Air Capture & Use



bp 2024 Energy Outlook

Energy Transition

Geothermal

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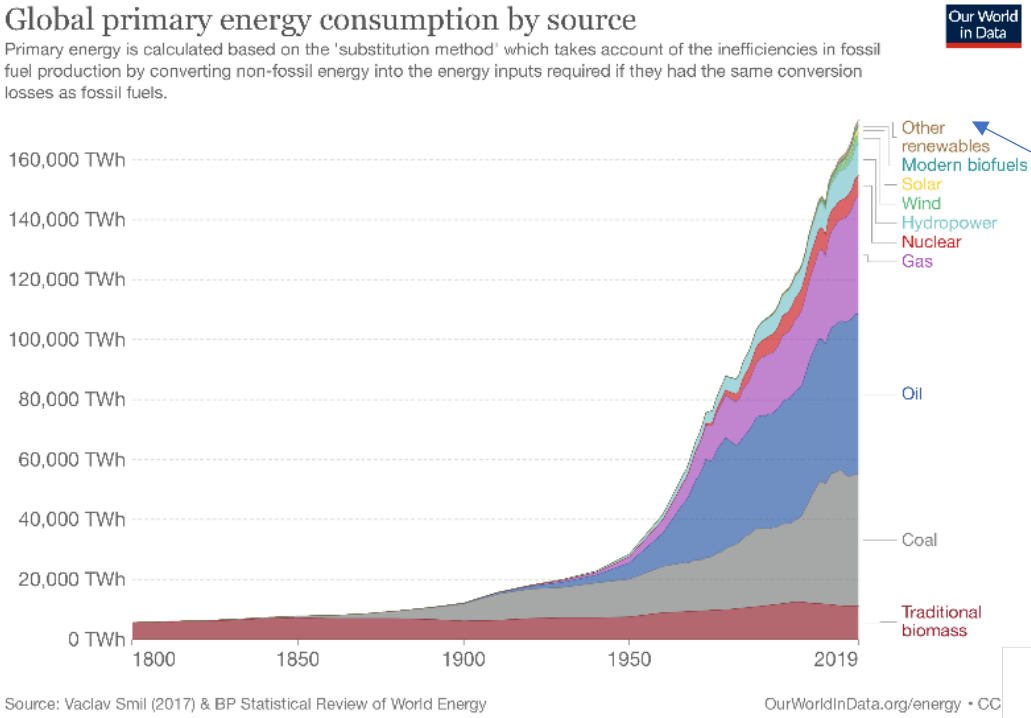
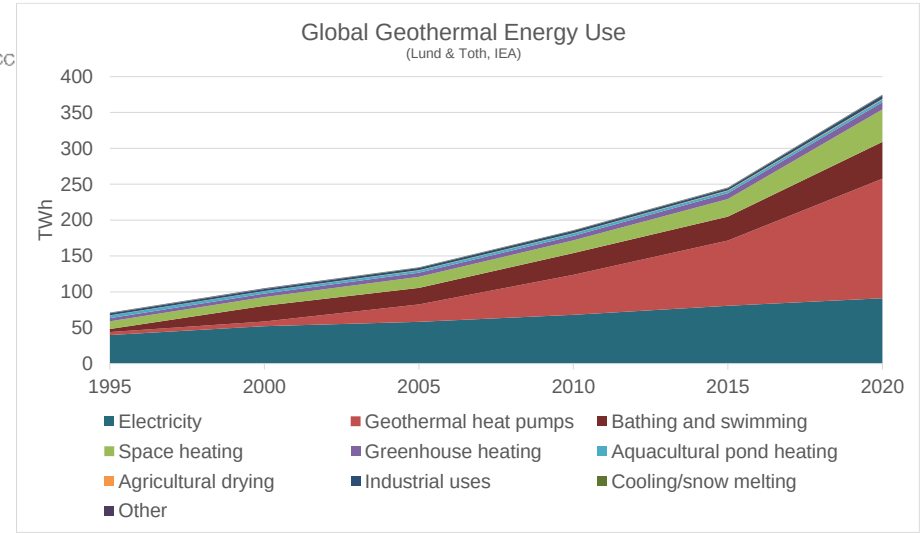


Geothermal <0.5% world energy consumption (under "other") **–most people know nothing about it**

~75% is direct heat use vs. 25% electricity generation

Need 150C temperature to efficiently generate electricity from geothermal



Energy Transition
Geothermal

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Academia	University of Glasgow, Newcastle University, Stanford EARTH, Berkeley Lab, China University of Petroleum, TNO, SMU, TEXAS
Technology (drilling, ORC, heat pumps)	STRADA, HEPHAE Energy Technology, TURBODEN, QUISE, EXERGY, ElectraTherm by Bitzer Group, HYPER SCIENCES
Service Companies	HALLIBURTON, Baker Hughes, Wood Mackenzie, CGG, Schlumberger
O&G Operators	ONGC, REPSOL, bp, Chevron
Start-ups	OGL Geothermal, CeraPhi energy, terrapin, GreenFire Energy, RG Reykjavik Geothermal, CAUSEWAYGT, SAGE Geosystems, Eavor, FERVO Energy
Traditional Geothermal	GEL Geothermal Engineering Ltd, eden geothermal, BHE Renewables, CALPINE, enel Green Power, ORMAT

SPE International Geothermal Technical Section

project innerspace

Based on author's own experience only!

Energy Transition
Hydrogen

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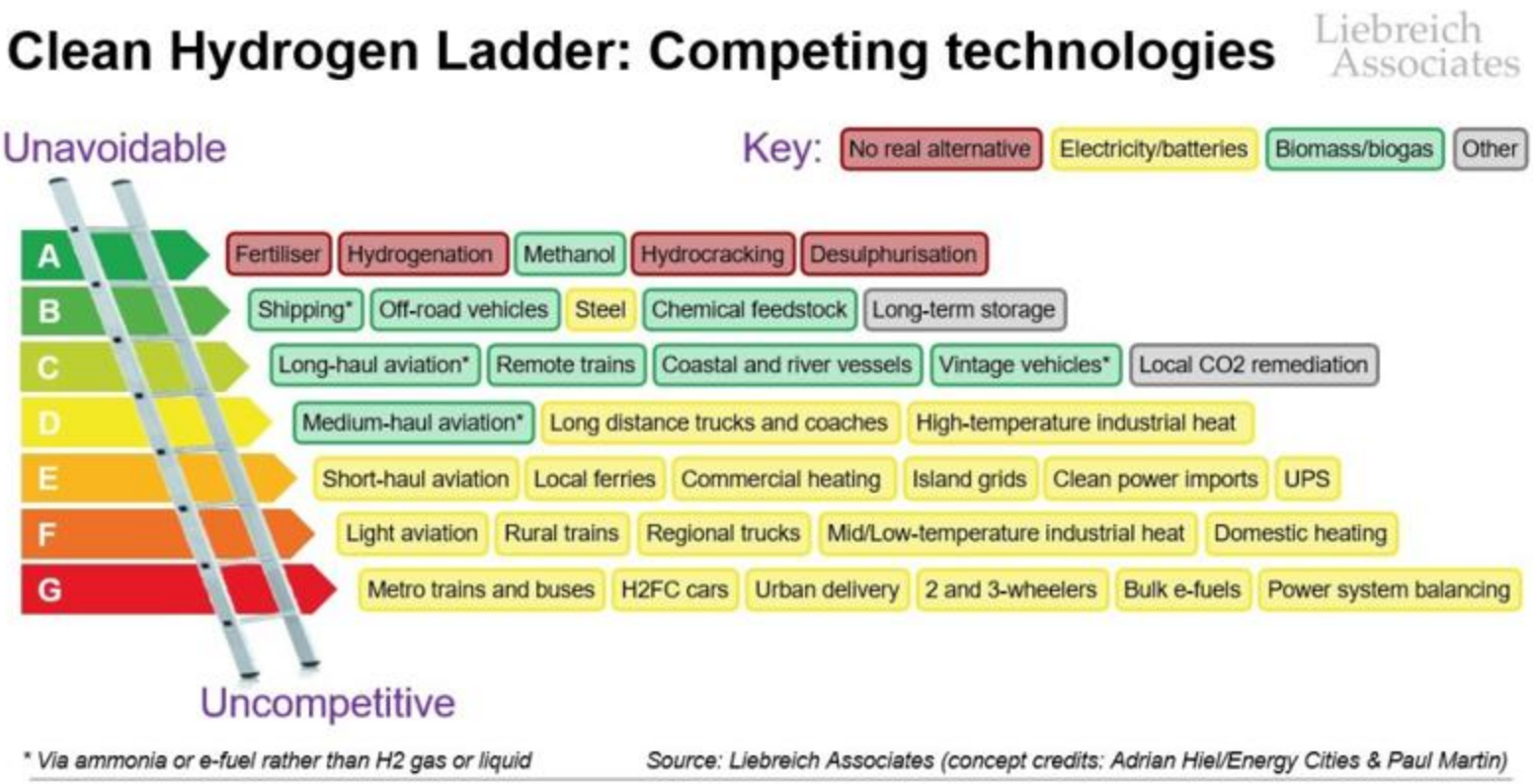

- Hydrogen is a potentially versatile “energy carrier” but cost and inefficiencies mean it is not the right answer for everything
- Hydrogen storage may be one of the few long –term storage options but you need a transport network

Energy Transition
Salaries

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2024 World Energy Employment report

Despite wage growth in renewable sectors, earning potential remains highest in oil and gas, presenting a barrier to inter-industry transitions

Median energy salary ranges by sector and country, 2023

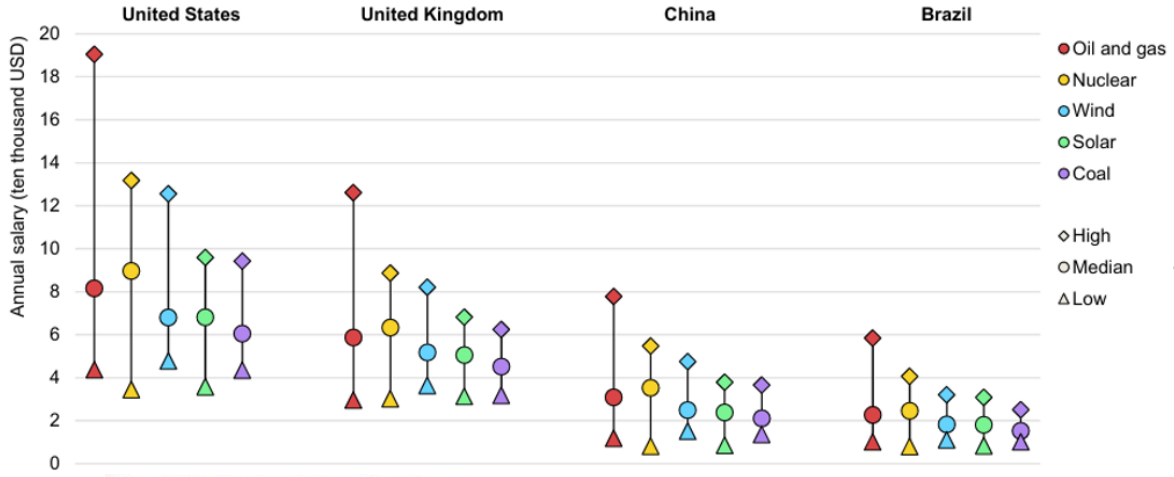
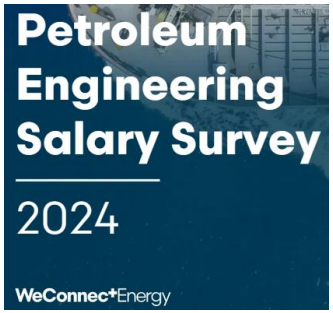


Figure 33. Median Salary Vs Years Of Experience



THE ENGINEER

2024 Salary Survey

Transferable Skills

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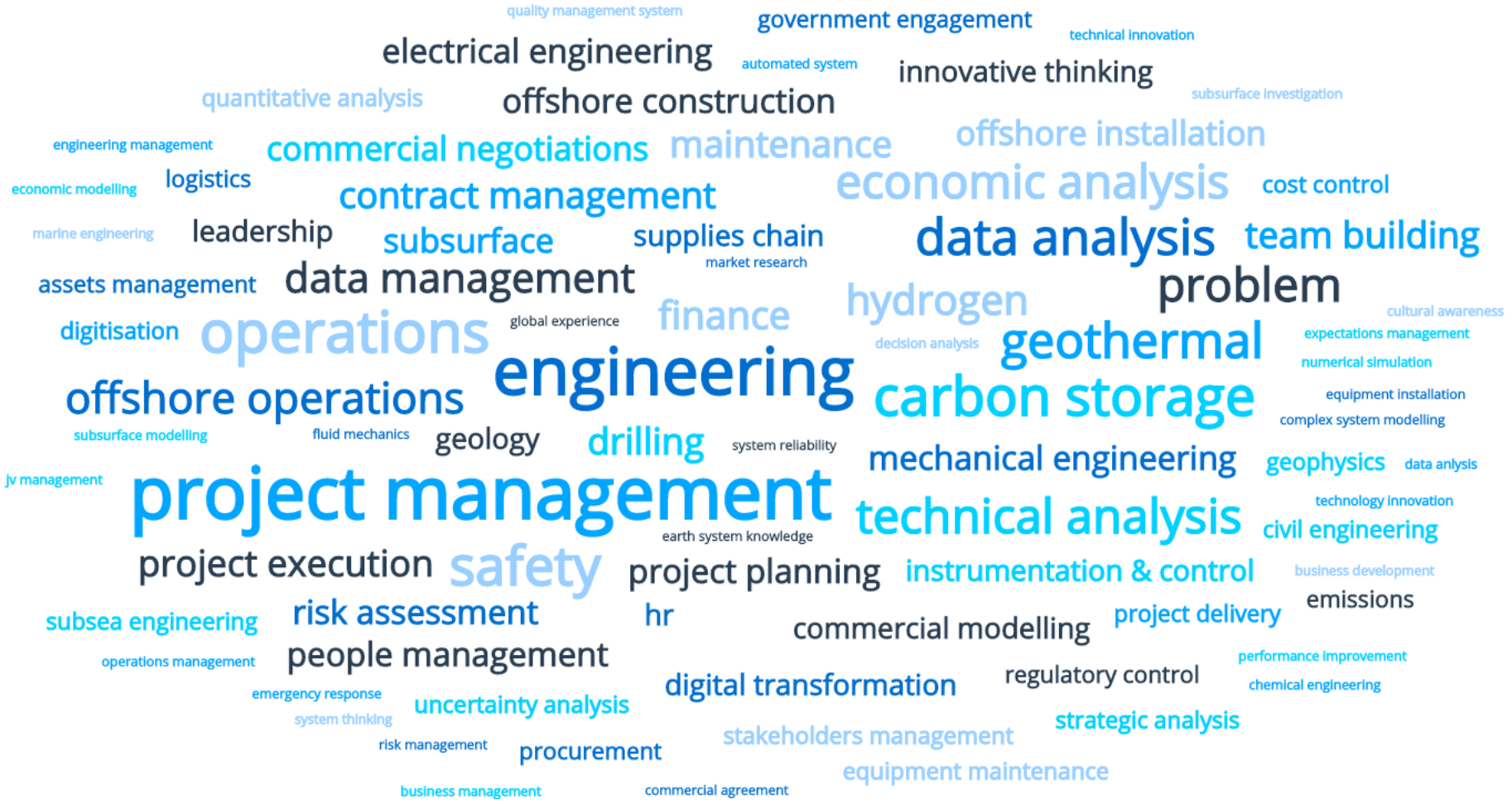

Sustainable Business Course Just Transition Survey 2020

Transferable Skills

AJ Isherwood Consulting Ltd.

UK offshore Energy Workforce Transferability Review
Robert Gordon's University, May 2021

TRANSFERABLE METASKILLS

"Problem Solving"

"Computational skills"

"Sense checking & audit (with numbers!)"

"Resilience, curiosity and comfort with change"

"Be open to every opportunity, get involved outside your core role, continue to learn"

"Network"

"Embrace your inner entrepreneur"

"Customer focus, System thinking"

"Thinking outside the box as to where your skill sets might apply"

Geothermal/CCS/Hydrogen

What's the same as O&G, what's different?

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Same	Different
Applying core technical skill sets to problem solving (including geology, engineering & economics) Material & energy balance	Boundary/operating conditions, fluid behaviour & importance of temperature, lower efficiencies/energy density, reusing infrastructure
Exploration & Appraisal, reservoir characterization, modelling uncertainty & development optimisation	Lack of experience, calibration, analogues & industry standards. Significantly more focus on academic research & debate. Ongoing lack of data due to lower budgets
Development decision gate process, project/risk management & regulatory requirements	Longer timelines, rapid scaling ambitions. different technical & commercial risks (e.g., containment for CCS), regulatory requirements still being developed
Significant investment requirements	Lower rates of return or reliance on carbon pricing/government funding, more complex business models/partnerships, less public awareness, demand risk & lack of infrastructure

Energy Transition Careers

My insights

AJ Isherwood Consulting Ltd.

- Experienced oil and gas people across multiple disciplines needed to support the energy transition
  - My biggest contribution? Robust technical audit
  - O&G experience may not be valued or compensated as you well as you would like
  - Energy transition remains frustratingly “pre-development” in many areas with high uncertainty

- Watch out for green job and technology hype (“Hopium” & “Greenwishing”)
  - Embrace your entrepreneurialism but go in with your eyes open
  - New technology should adhere to fundamental physics and thermodynamics
  - How are they funded, path to commercialisation

- You can continue to make a positive contribution in oil and gas or keep a foot in both worlds

- Anyone working in energy can benefit from better understanding of wider energy system transition
  - Plenty of bias, don’t believe everything you read and/or hear –consult diverse sources
  - Check out the London SPE Net Zero Committee resources:
    - SPE Net Zero Gaia virtual programme - SPE London (spe-london.org)