Energy Transition Careers

Alison Isherwood

The views and opinions expressed in this presentation are solely those of the author and do not reflect the opinions of the author's employer or other affiliates

My Career Path

1997

MEng Chemical Engineering Nottingham University

1997-2016

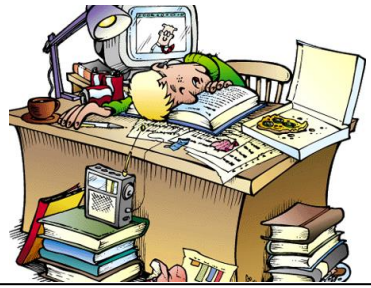
Reservoir Engineer -> Technical Manager -> Chief Engineer

2017->

AJ Isherwood Consulting Ltd.

Independent Consulting

2020



Sustainable Business PostGrad Certificate

Focus on Green jobs, Just Transition, Start ups

London SPE Net Zero Programme

ISO 14064

GHG Accounting Qualification

2021-2022

GHG emissions
Geothermal
Hydropower
Oil & Gas

sustain:able
SUSTAINABILITY MADE SIMPLE

bluemethane

CAUSEWAYGT
The Power Beneath Us

2023

STOREGGA

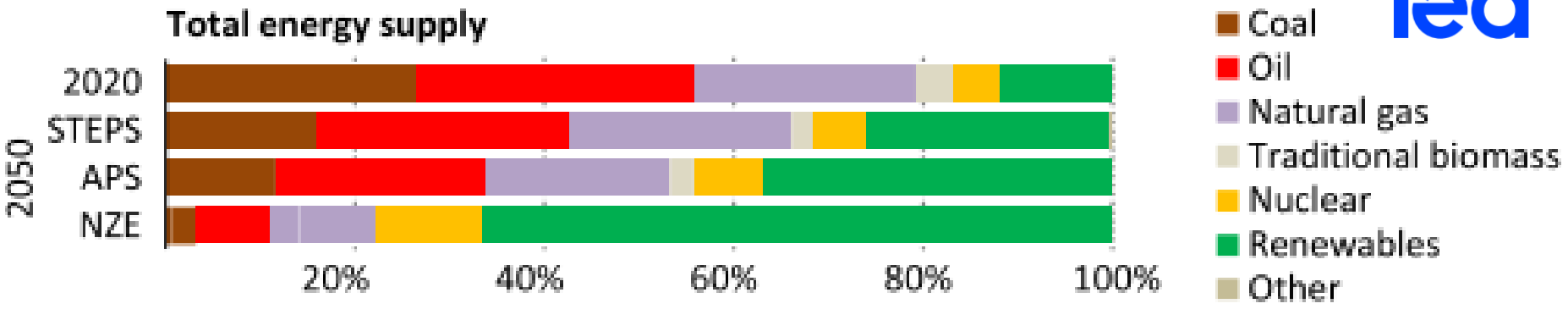
Carbon Capture
Hydrogen
Reservoir Engineer

Energy Transition Careers

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

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

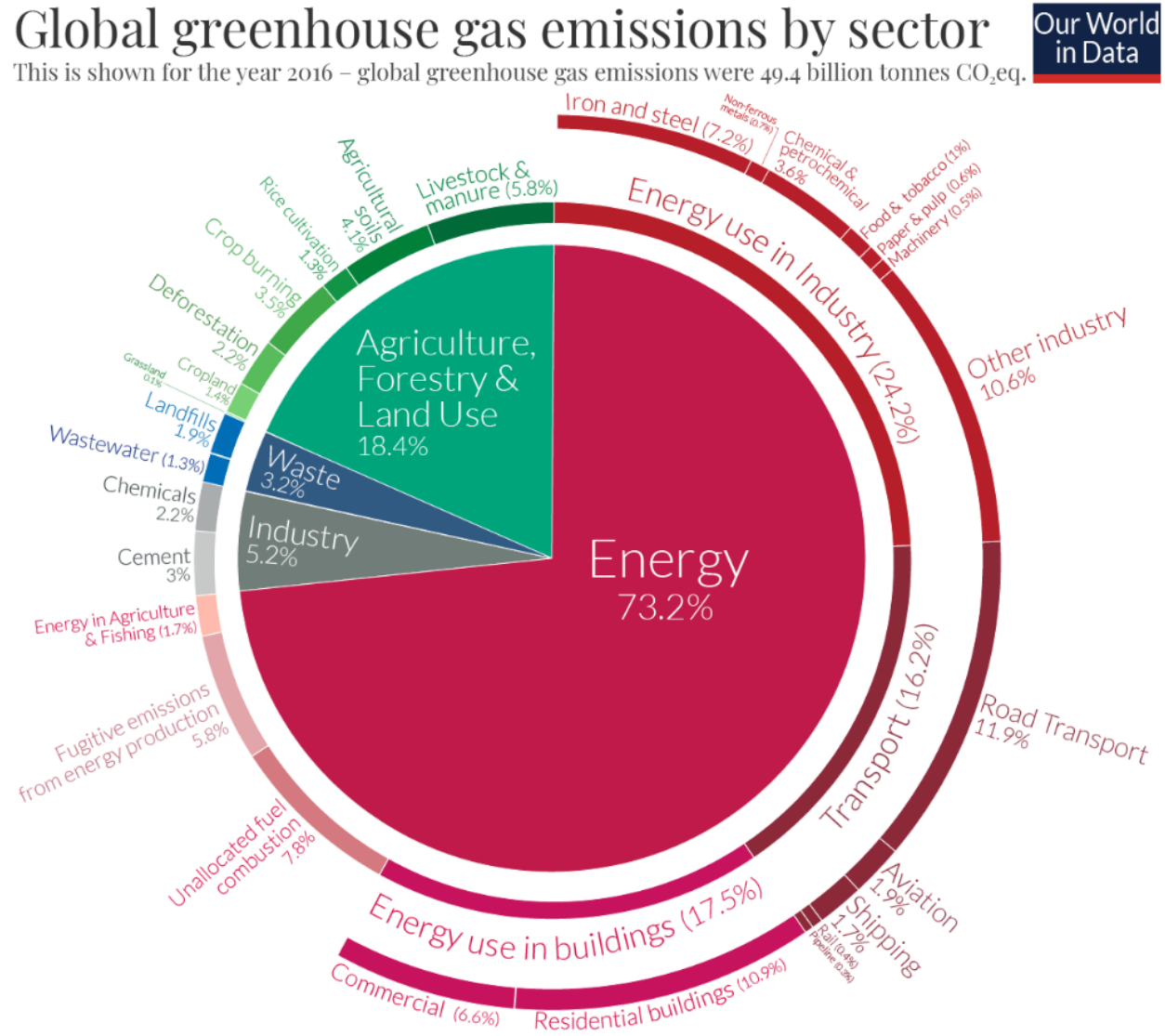
Energy Transition
Pathways



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

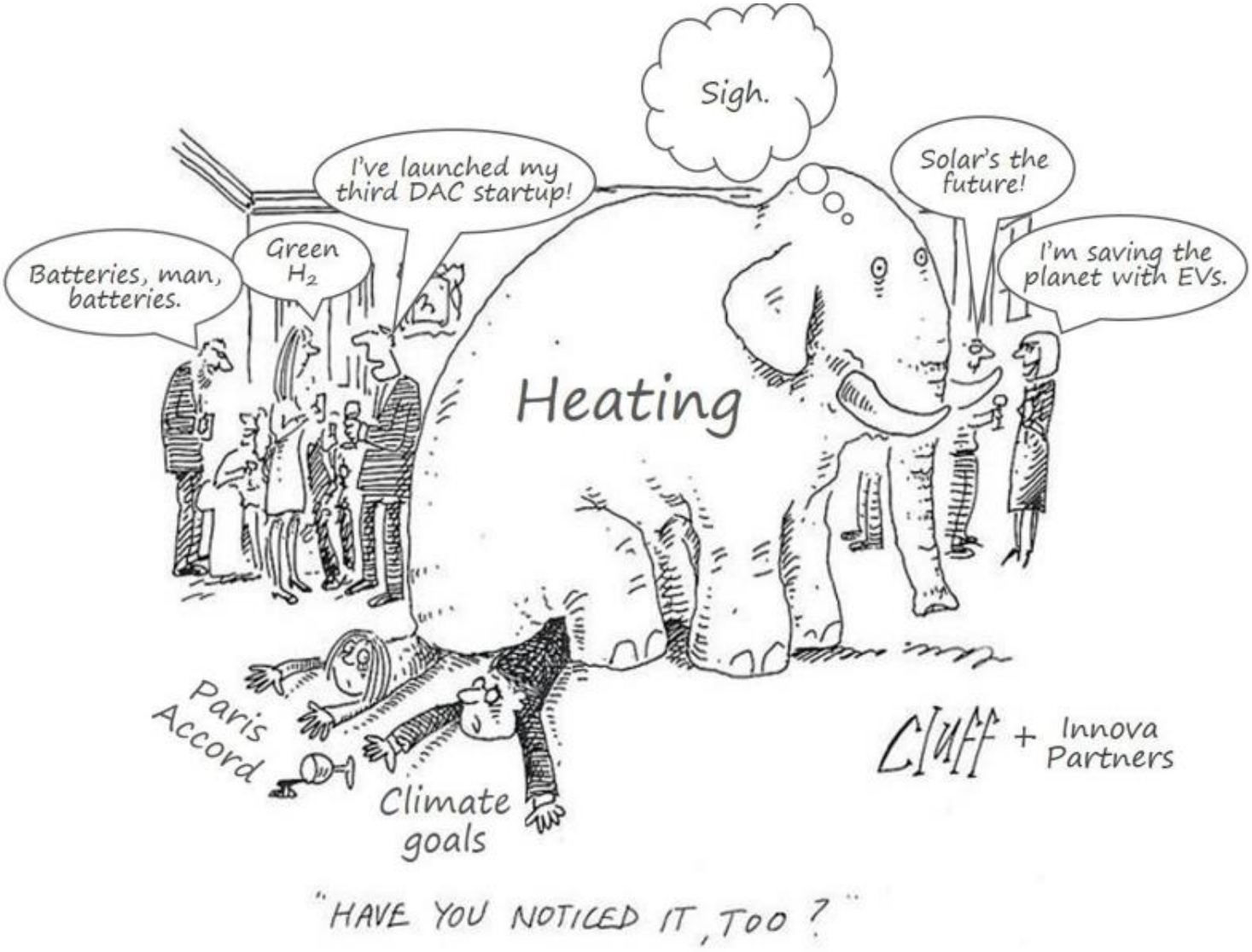
- To get to Net Zero will take a huge transformation of our energy system.
- Range of predictions of where we need to get to and how we get there
- Net Zero 2050 almost always represented as the “stretch target” on a global basis and there is frustratingly limited progress to date (mostly greening of electricity in Europe/UK)

Energy Transition
Pathways



- Heating & cooling (domestic & industry) accounts for >40% of global GHG emissions
- >80% UK households heated by gas boilers

Energy Transition
Pathways

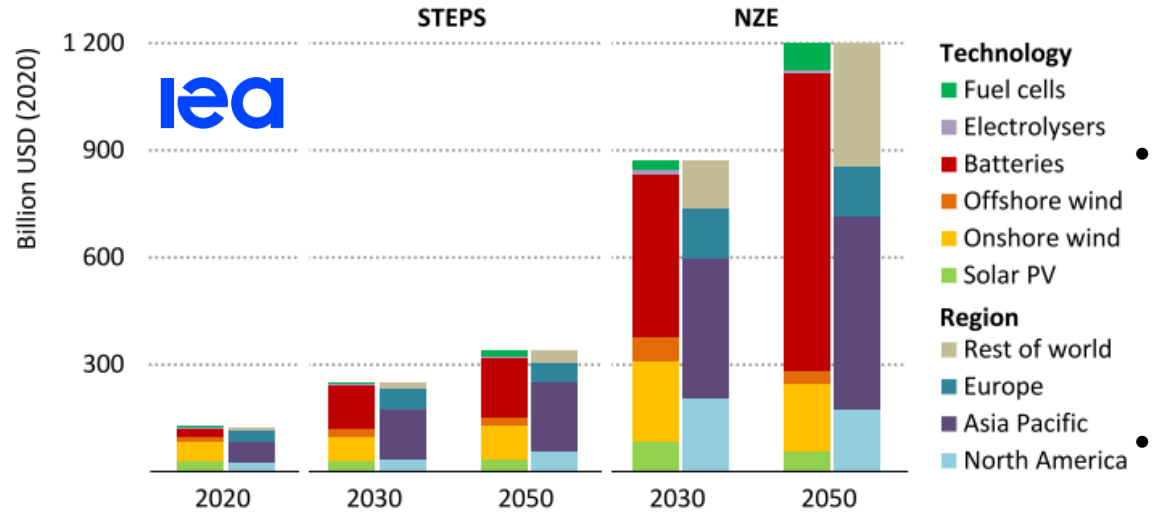


Energy Transition
Technology & Start-ups

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."

Figure 1.3 ▷ Estimated market size for selected clean energy technologies by technology and region, 2020-2050



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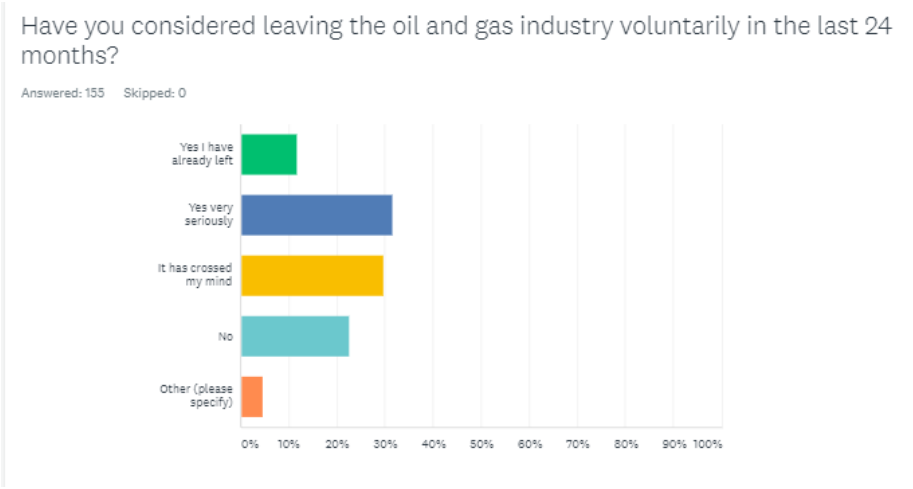
There is explosive growth in clean energy technologies over the next decade in the NZE, leading to a clean energy market worth a cumulative USD 27 trillion by 2050

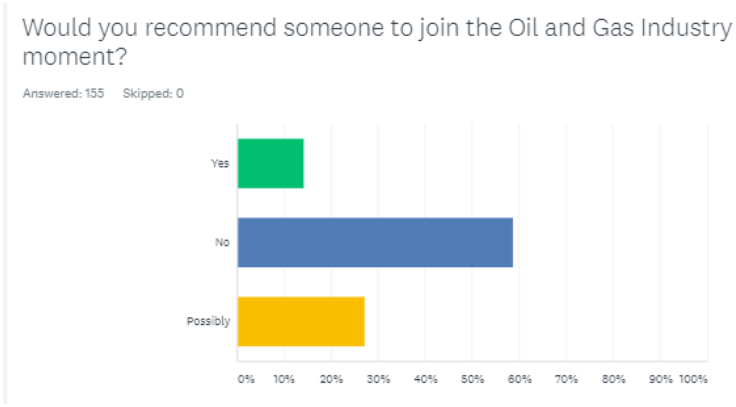
- The prospect of working for a start-up can be exciting, and their role in the energy transition is important, but carries risk and uncertainty
- Is the idea technically sound and can it make money? Has it been tested? Does it have a path to market?
- Do they have funding? How will you get paid?
- Go in with your eyes open

Energy Transition
Employment

O&G Employee Survey 2020

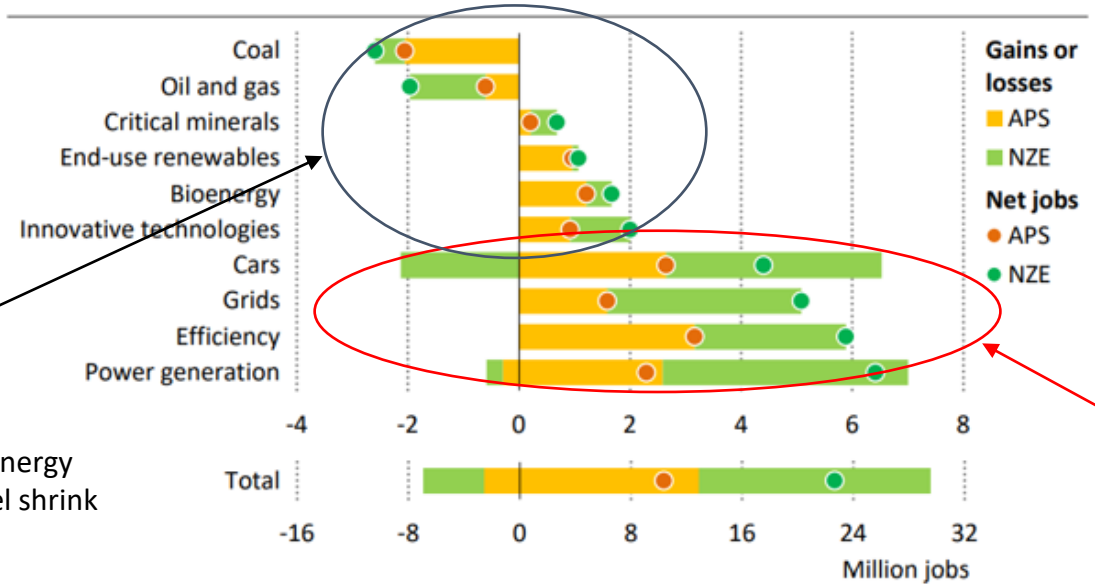
- 2020 overprint -covid, low oil price, UK 2050 Net Zero emission law in 2019
- May be different response if repeated now





Energy Transition
Employment

Figure 1.15 ▷ Employment growth in clean energy and related areas to 2030



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- Suggests alternative energy job growth = fossil fuel shrink

Majority green job growth predicted "downstream"

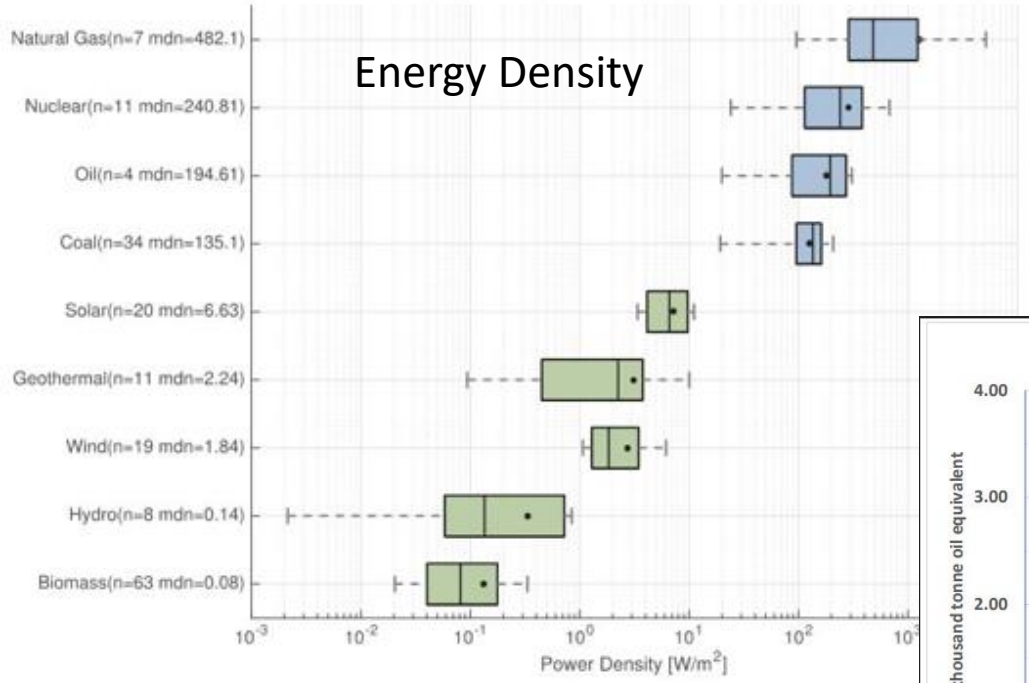
Clean energy job gains outpace losses in fossil fuels jobs in the APS and job growth in clean energy and related segments doubles in the NZE

OEUK WORKFORCE INSIGHT 2022

"The skills, knowledge, and expertise of people whose roles are supported by the oil and gas sector are crucial to the development of the UK's future, lower-carbon energy system. However, the **transformation of the system will take place over decades**. It is therefore more efficient to **retain these skills** through ongoing and new investment in the **UK's oil and gas resources** while projects in the new energy sector develop momentum."

Energy Transition

Is green job growth real?



Van Zalk & Behrens 2010

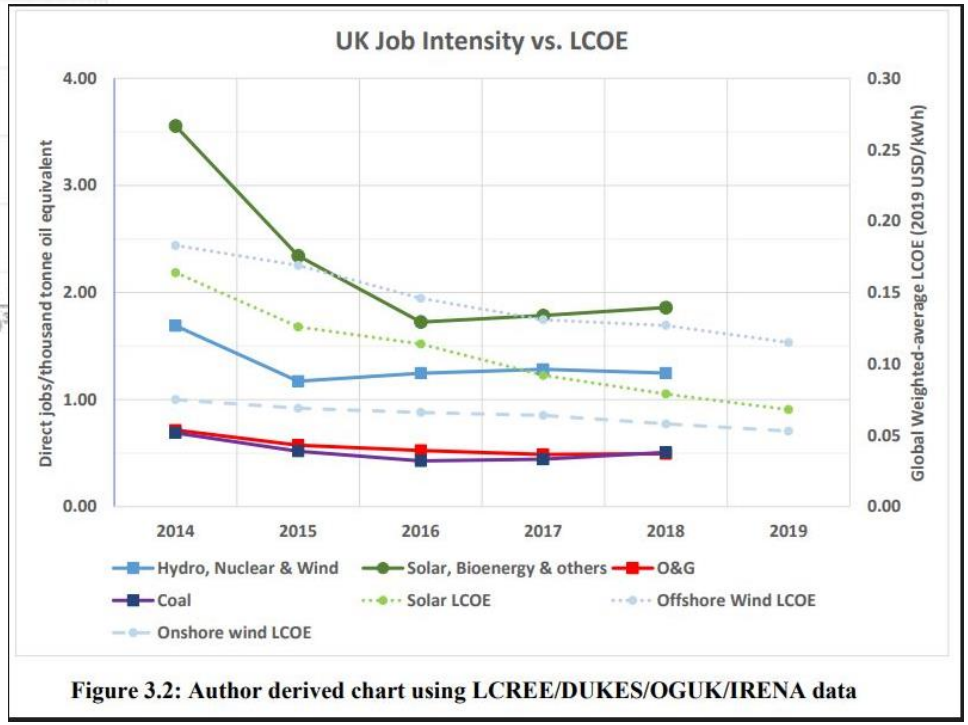


Figure 3.2: Author derived chart using LCREE/DUKES/OGUK/IRENA data

Sustainable Business Course Individual Project on Green Jobs 2020

Energy Transition

Is green job growth real?

Transferable Skills

Sustainable Business Course Just Transition Survey 2020

Transferable Skills

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"

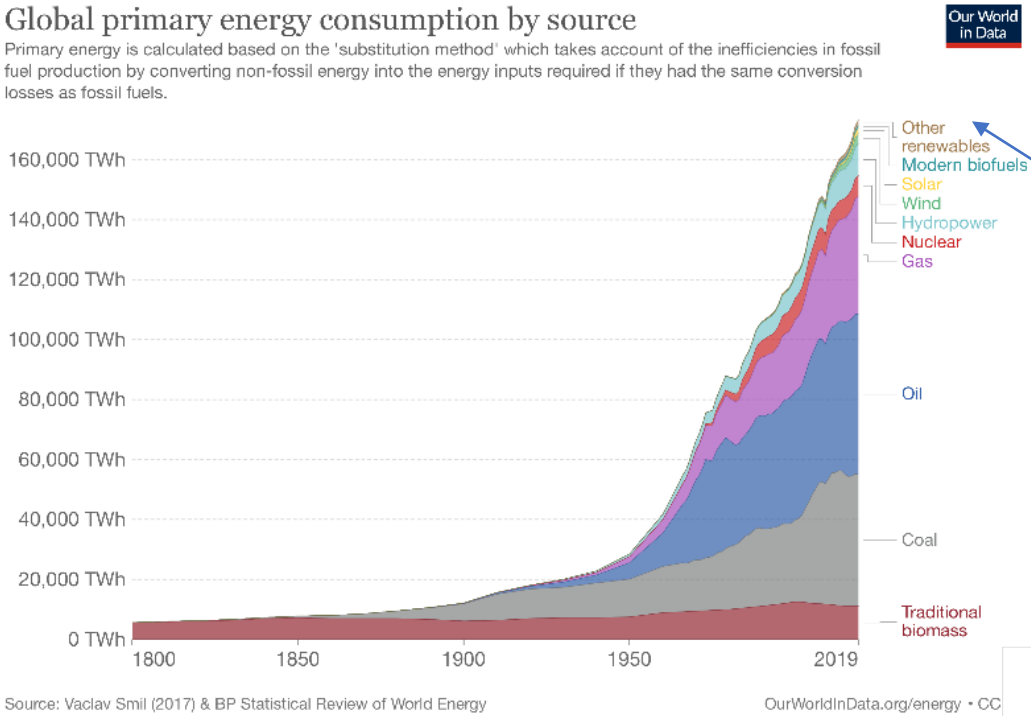
"Thinking outside the box as to where your skill sets might apply"

Geothermal/CCS/Hydrogen

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

Same	Different
Applying core technical skill sets to problem solving (including geology, engineering & economics) Material & energy balance	Fluid behaviour & importance of temperature, boundary/operating conditions, 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

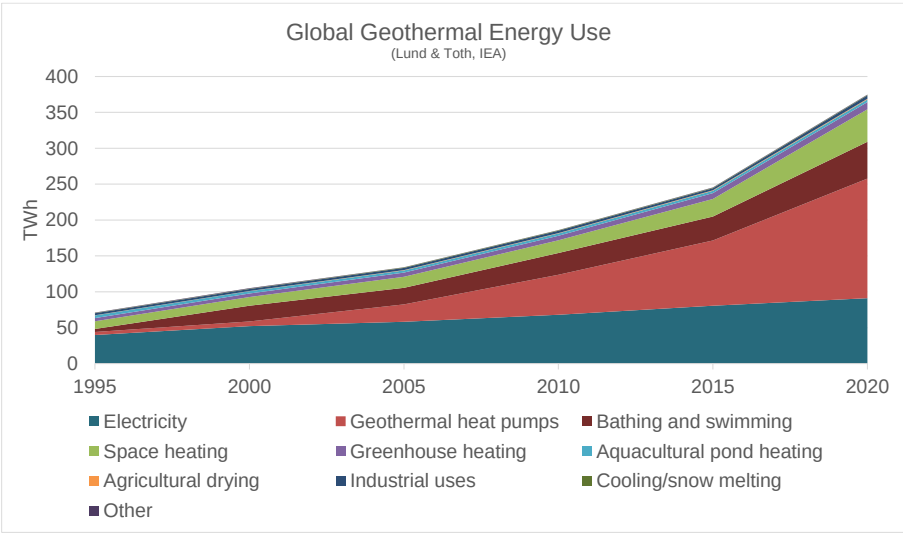
Geothermal



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

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

Need 150C temperature to efficiently generate electricity from geothermal



The Geothermal Ecosystem

Academia	University of Glasgow, Newcastle University, Stanford EARTH, BERKELEY LAB, 中国石油大学(北京) 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 Heat Value Experts, GreenFire Energy, RG Reykjavik Geothermal, CAUSEWAYGT The Power Beneath Us, SAGE GEOSYSTEMS, Eavor, FERVO ENERGY
Traditional Geothermal	GEL Geothermal Engineering Ltd, eden geothermal, BHE RENEWABLES, CALPINE, enel Green Power, ORMAT

SPE International London Section

SPE Gaia SUSTAINABILITY PROGRAM

SPE International Geothermal Technical Section

project innerspace

Based on author's own experience only!

Carbon Capture & Storage

- Clear transferable technical knowledge and skills
- Frustratingly slow progress in implementation (most existing is still enhanced oil recovery)
- >90% global storage capacity in saline aquifers, not depleted O&G, only handful of active saline aquifer projects outside EOR
- “Pressure space” could become competitive as we scale up

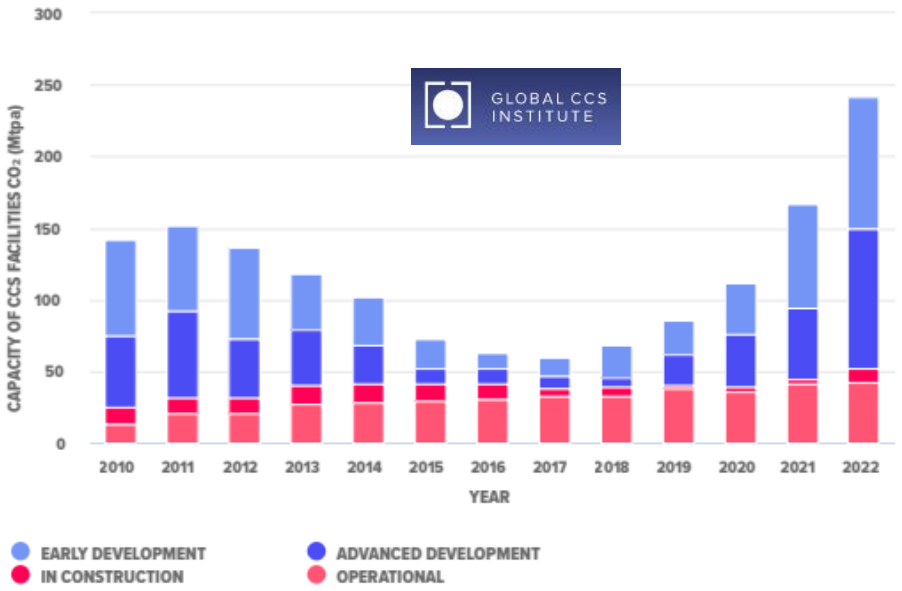
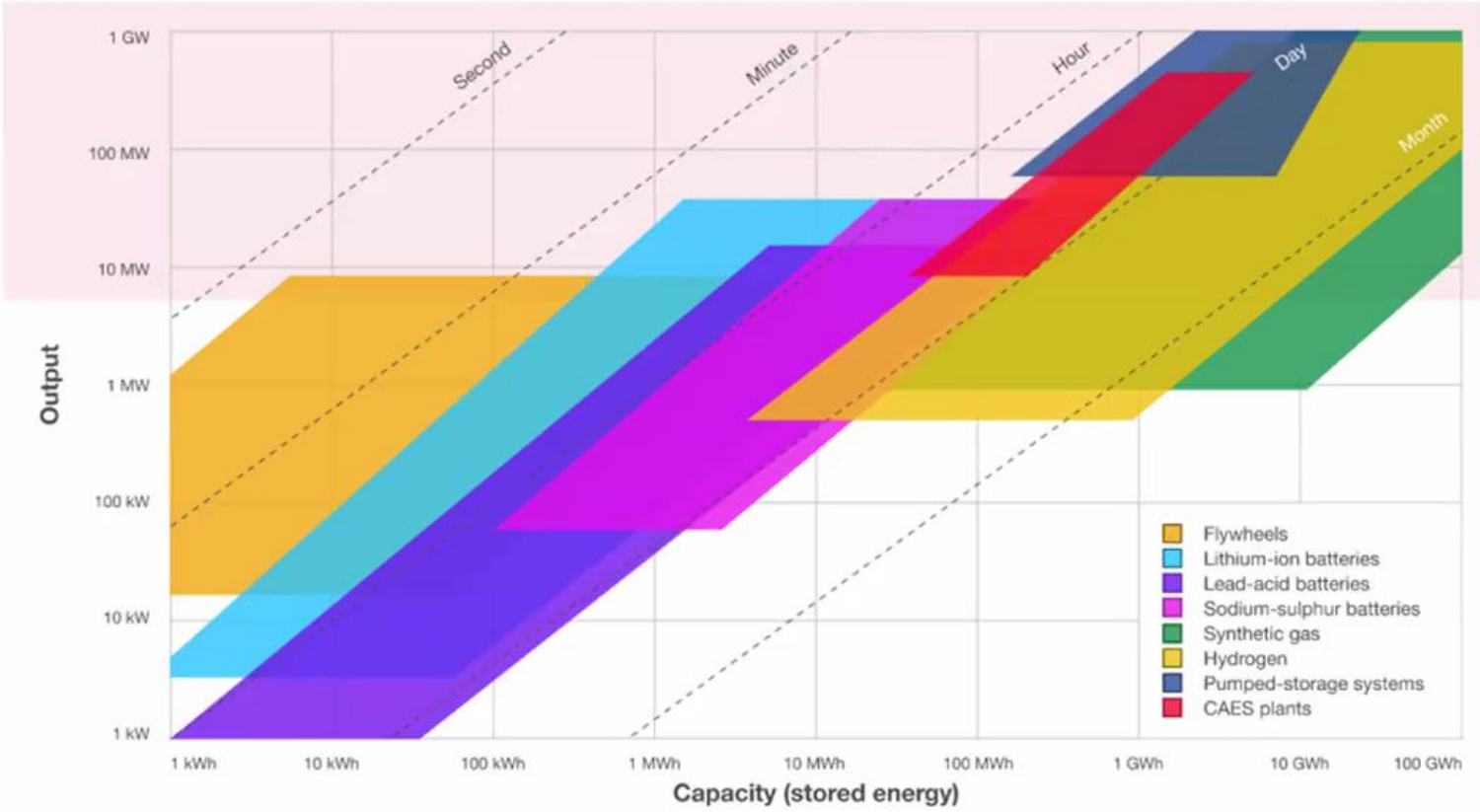


FIGURE 3: PIPELINE OF COMMERCIAL FACILITIES SINCE 2010 BY CAPTURE CAPACITY (MTPA)

IEA. Licence: CC BY 4.0

Energy storage

Energy storage technology mix

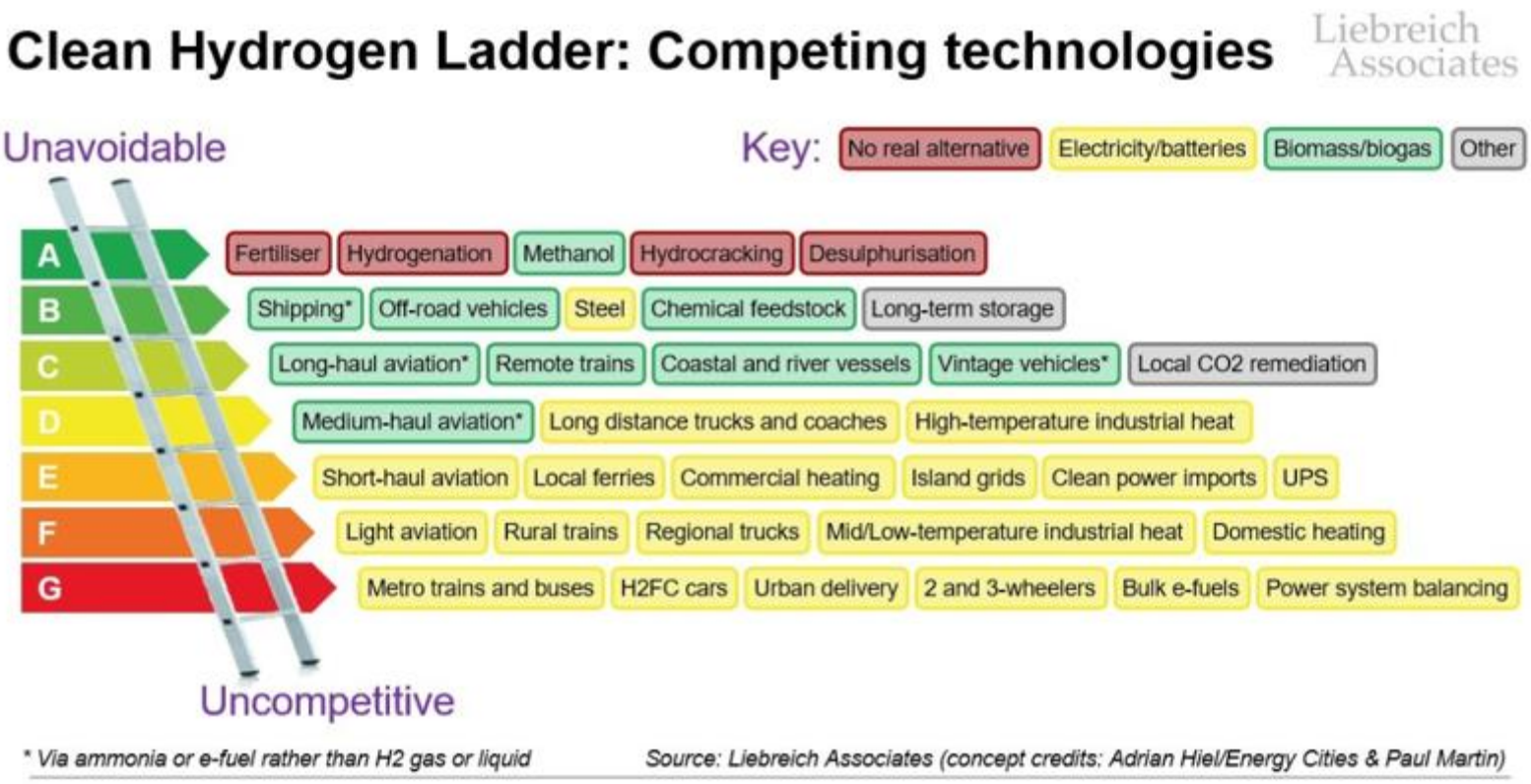


Capacity and output ranges as well as typical storage durations in which different storage technologies are considered appropriate due to their characteristics.

Source: "Technologie-Roadmap Stationare Energiespeicher 2030", Fraunhofer Institute for Systems and Innovation Research, Karlsruhe, 2015

- Need both short duration (minutes->hours) and long duration (up to seasonal) storage
- Different technologies for different durations

Hydrogen



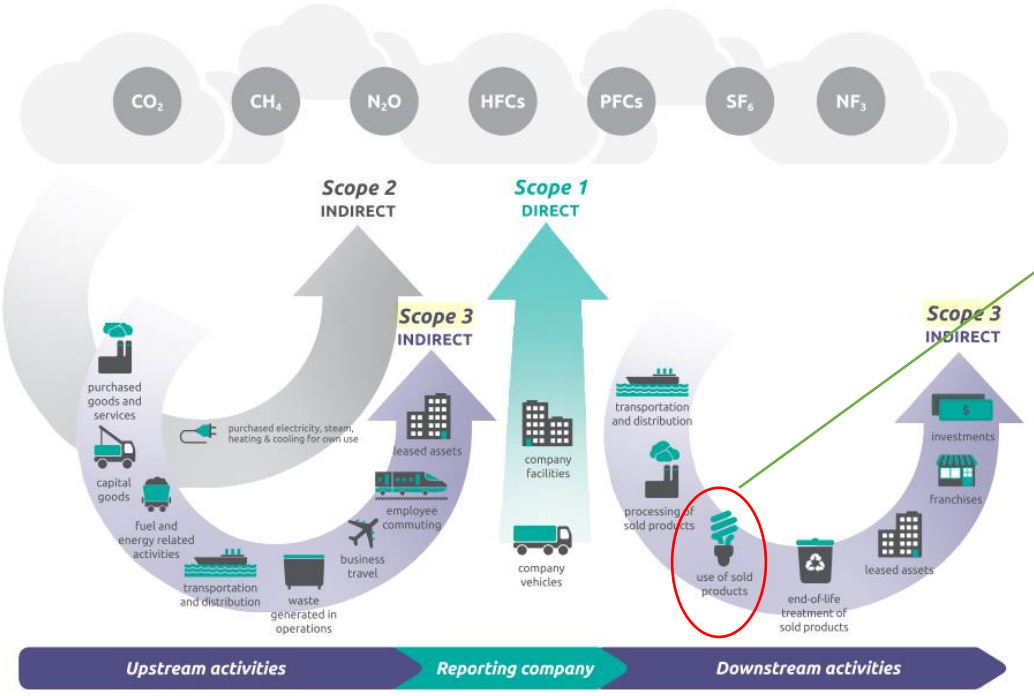
- Hydrogen is a potentially versatile “energy carrier” but cost and inefficiencies mean it is not the right answer for everything

Decarbonising O&G

Measuring & reducing GHG emissions

- Reducing flaring, venting & fugitive emissions
  - Focus on methane first
- Focus on operational emission reduction before offsetting. Efficiency is key.
- Know your emissions before reporting them –start with small steps
- **"We cannot reduce what we cannot measure" IPCC 2019;**
- **Managing risk and reputation**

Figure [I] Overview of GHG Protocol scopes and emissions across the value chain



Source: Figure 1.1 of *Scope 3 Standard*.

Scope 3 **use of product** category is usually >85% of an O&G company's total associated emissions

The Majors (e.g., bp, Shell, Equinor) are now tracking their **product carbon intensity**

However smaller O&G companies are generally focused on reducing **operational carbon intensity** (Scope 1&2 only)

Decarbonising O&G

Scrutiny of pledges & reputation risk

RESEARCH ARTICLE

The clean energy claims of BP, Chevron, ExxonMobil and Shell: A mismatch between discourse, actions and investments

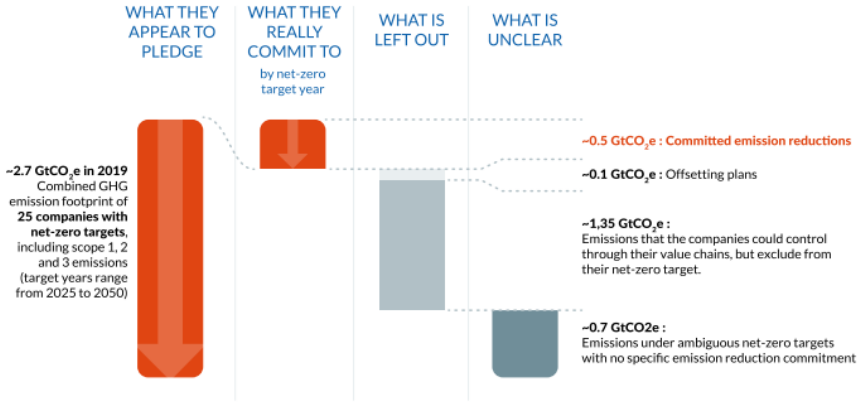
Mei Li[1], **Gregory Trencher**[2]*, **Jusen Asuka**[3]

1 Graduate School of Environmental Studies, Tohoku University, Sendai, Miyagi Prefecture, Japan, **2** Graduate School of Global Environmental Studies, Kyoto University, Kyoto, Japan, **3** Center for Northeast Asian Studies, Tohoku University, Sendai, Miyagi Prefecture, Japan

Big oil coined 'carbon footprints' to blame us for their greed. Keep them on the hook

Rebecca Solnit

Figure S1: Integrity of corporate net-zero pledges



The 2018 Climate Accountability Scorecard

Insufficient Progress from Major Fossil Fuel Companies

TABLE 2. Consistently Accurate Public Statements on Climate Science and the Consequent Need for Swift and Deep Reductions in Emissions from the Burning of Fossil Fuels

Arch Coal	BP	Chevron	Conoco-Phillips	CONSOL Energy	ExxonMobil	Peabody Energy	Royal Dutch Shell
-2	1	-2	-2	-1	-2	-1	2
Egregious	Good	Egregious	Egregious	Poor	Egregious	Poor	Advanced

Only BP and Shell scored positively on this metric. BP replaced an inaccurate statement with an accurate one on its website, following engagement with UCS ahead of the release of this report.

Energy Transition Careers

My insights

- 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 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 needs to adhere to fundamental physics and thermodynamics, and have a realistic path to market to gain funding

- 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)
  - Helping to reduce the carbon intensity of oil and gas may be more impactful than other options