



Quo vadis petroleum industry? Navigating a sector in the state of flux

Arndt Peterhänsel

*Head of Training
TRACS International*

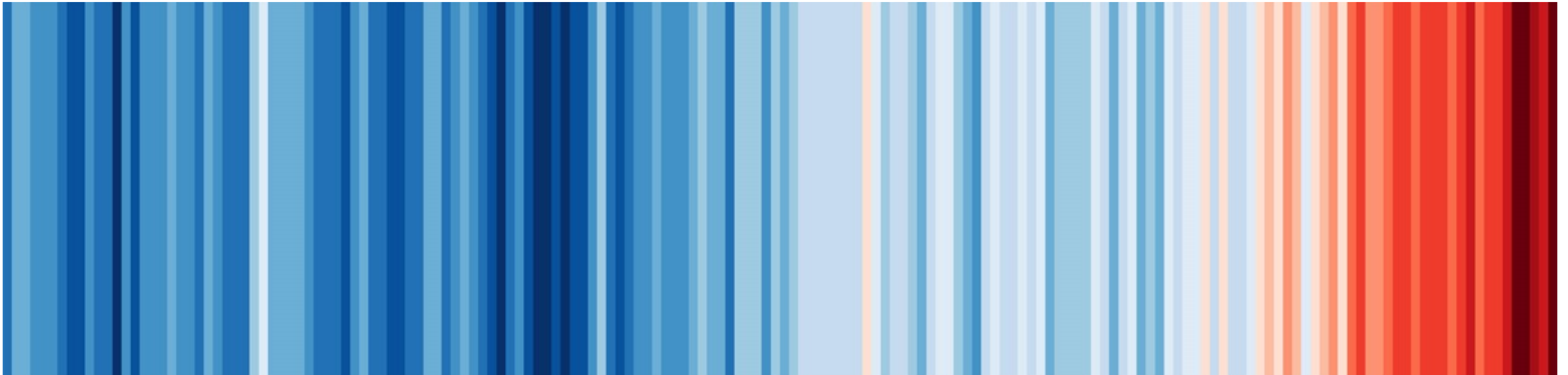
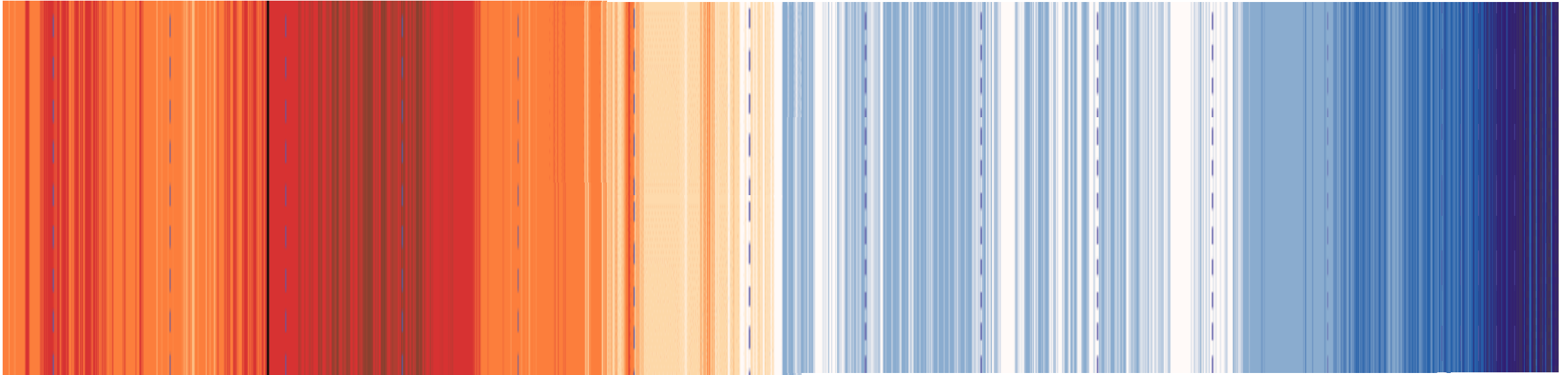
THURSDAY 20 JUNE



**Quo vadis
petroleum
industry?
Navigating a
sector in the
state of flux**



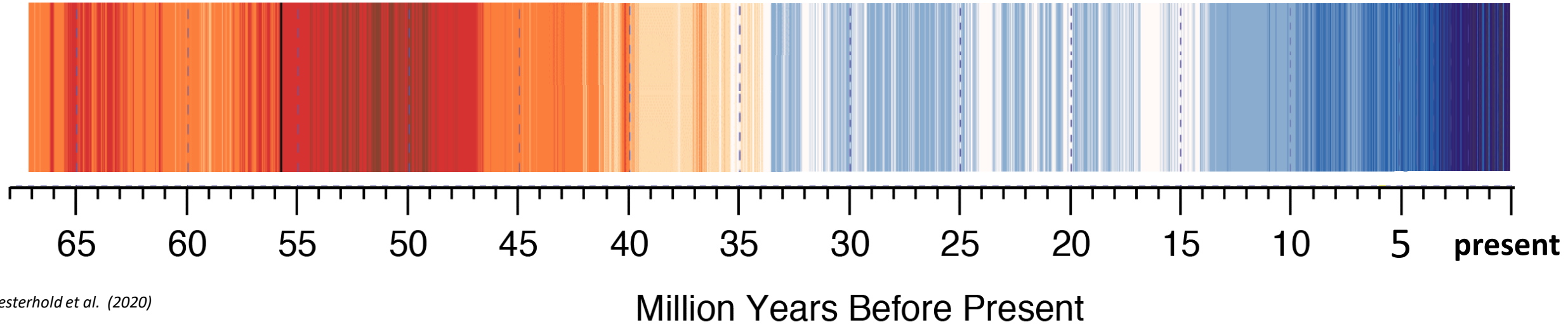
Temperature through time



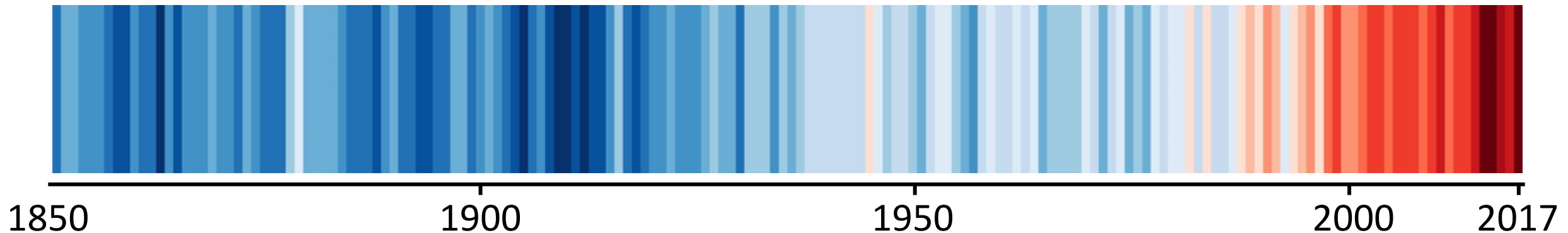
Temperature through time – Earth has seen it all before



$\pm 12^\circ$ (red/blue) from 1961-1990 average



Westerhold et al. (2020)

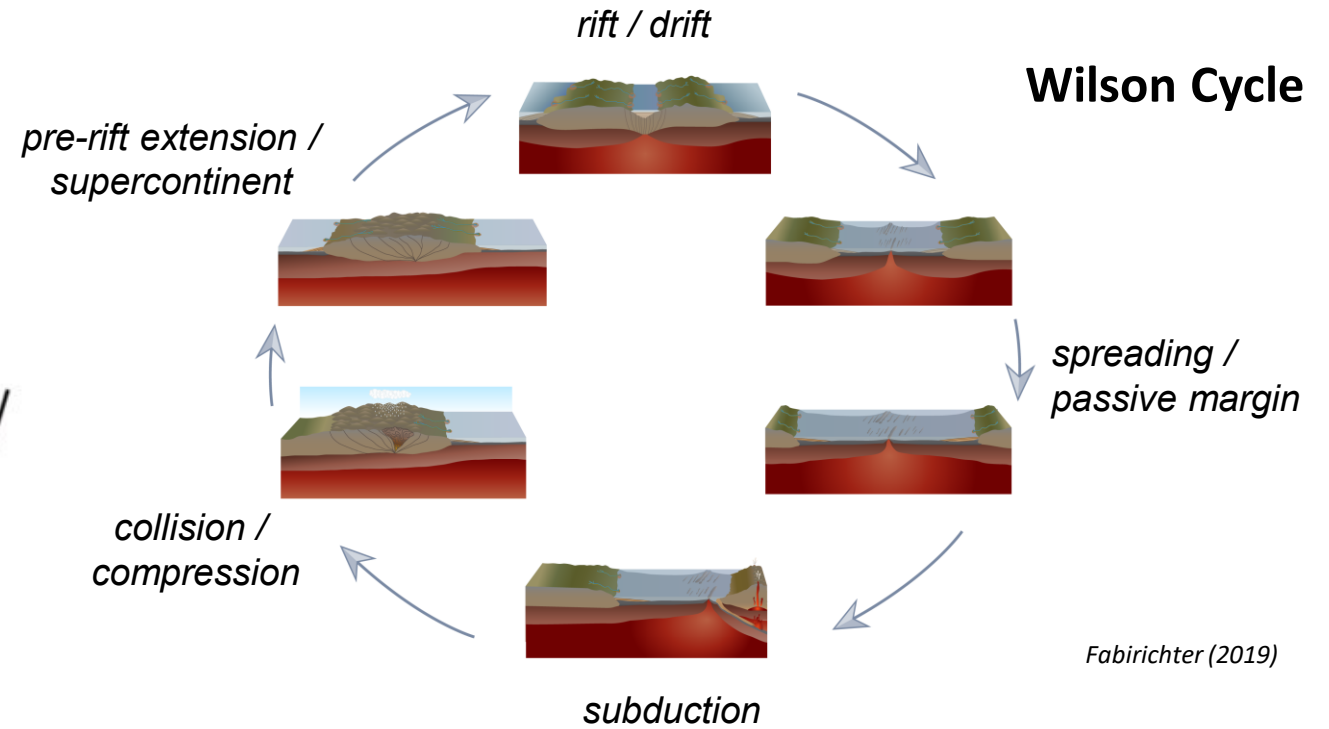


$\pm 1.35^\circ$ (red/blue) from 1971-1990 average

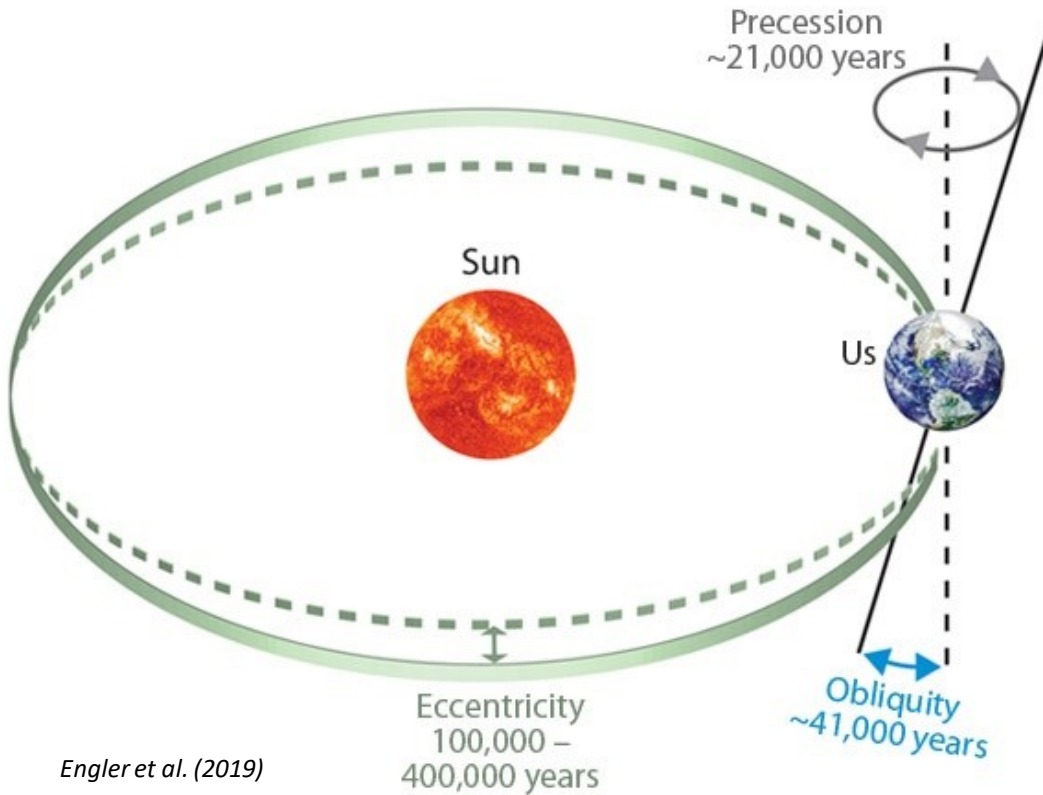
Hawkins (2017)

Climate change – a fact

Wilson Cycle

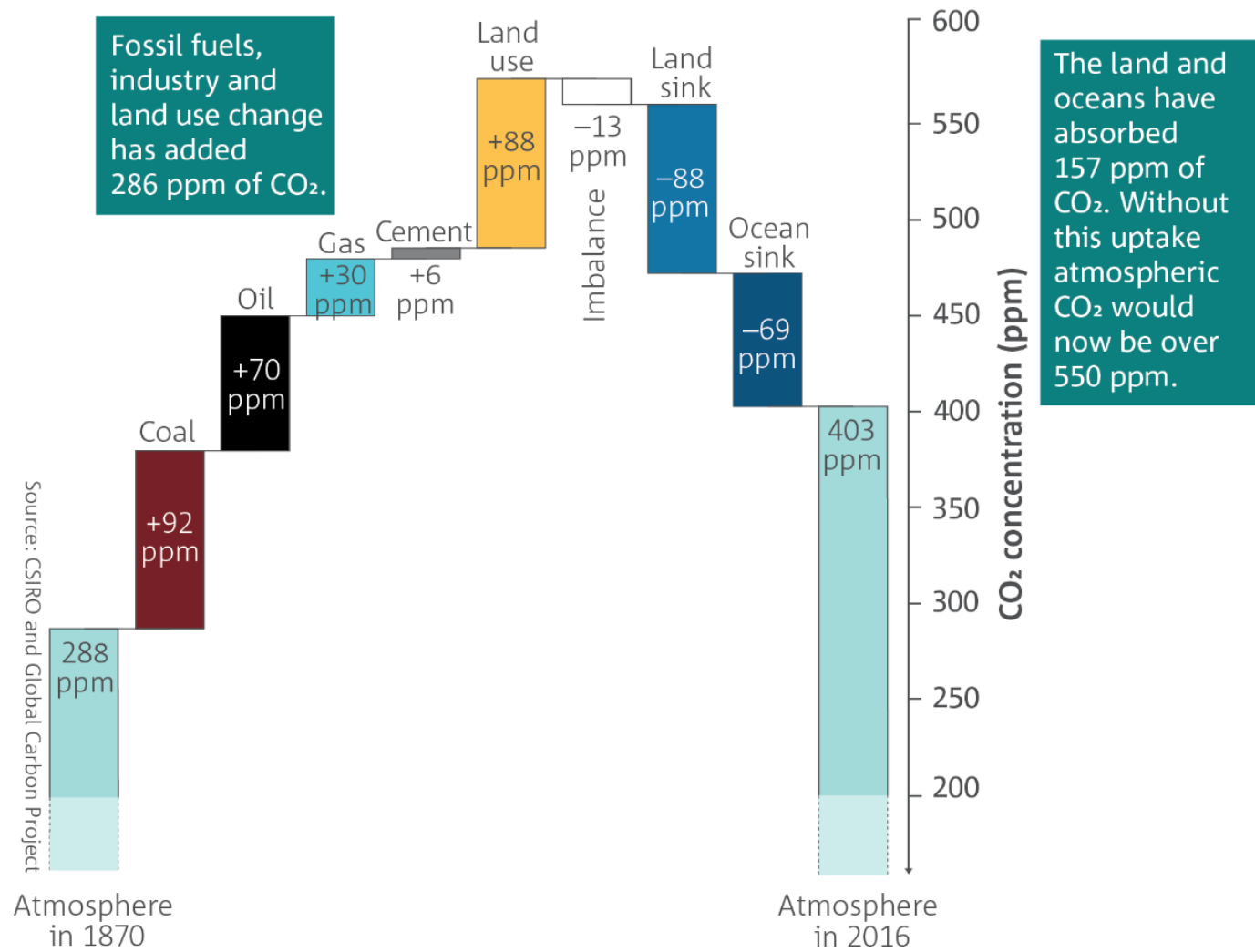


Fabirichter (2019)



Engler et al. (2019)

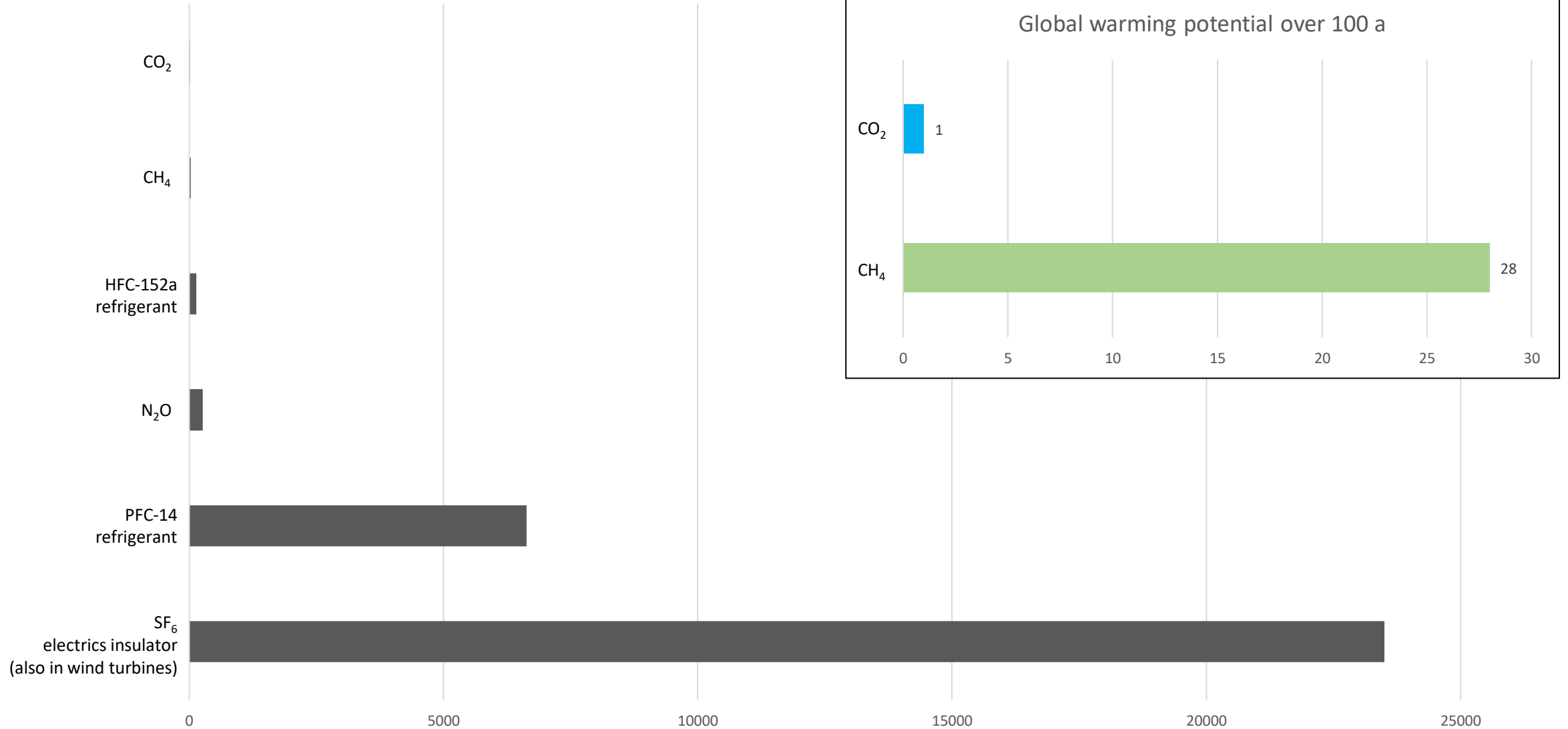
Climate change – CO₂ runaway since the industrial revolution



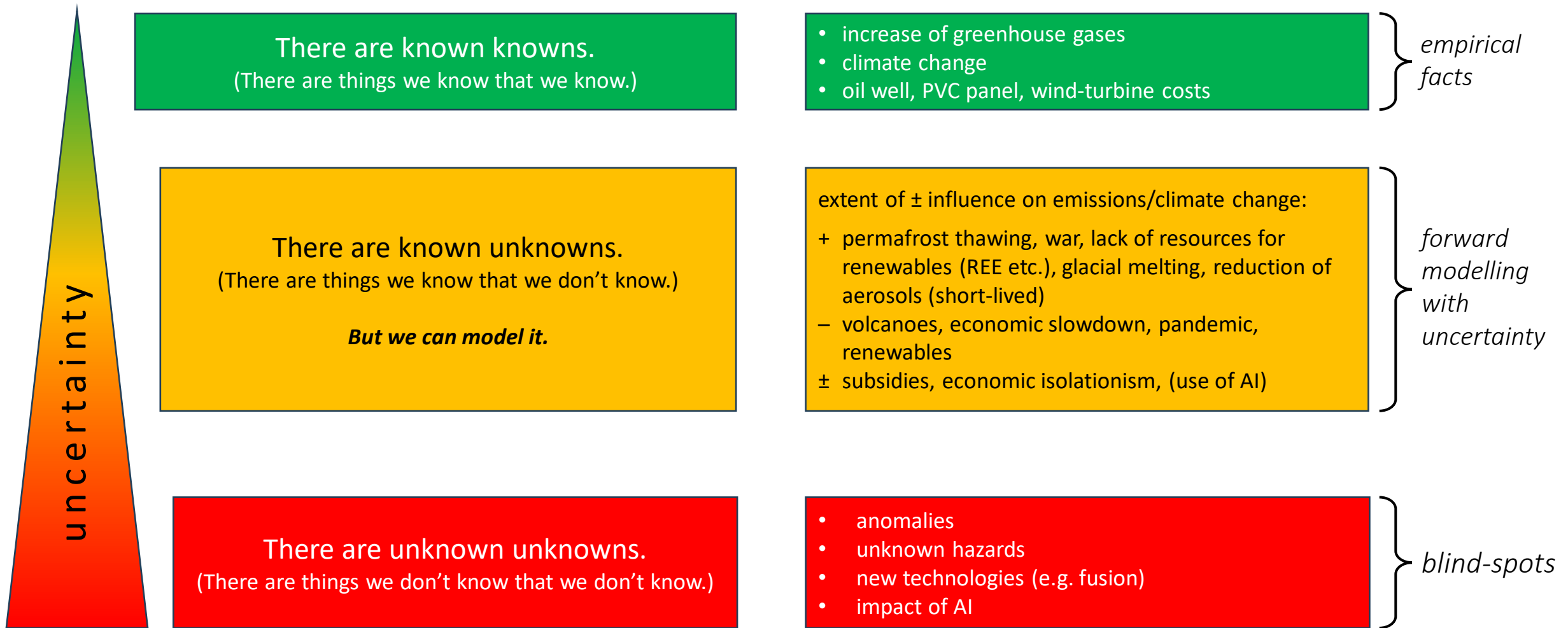
results in acidification of the oceans

Australia Government
Bureau of Meteorology
(2018)

The nastier nasties

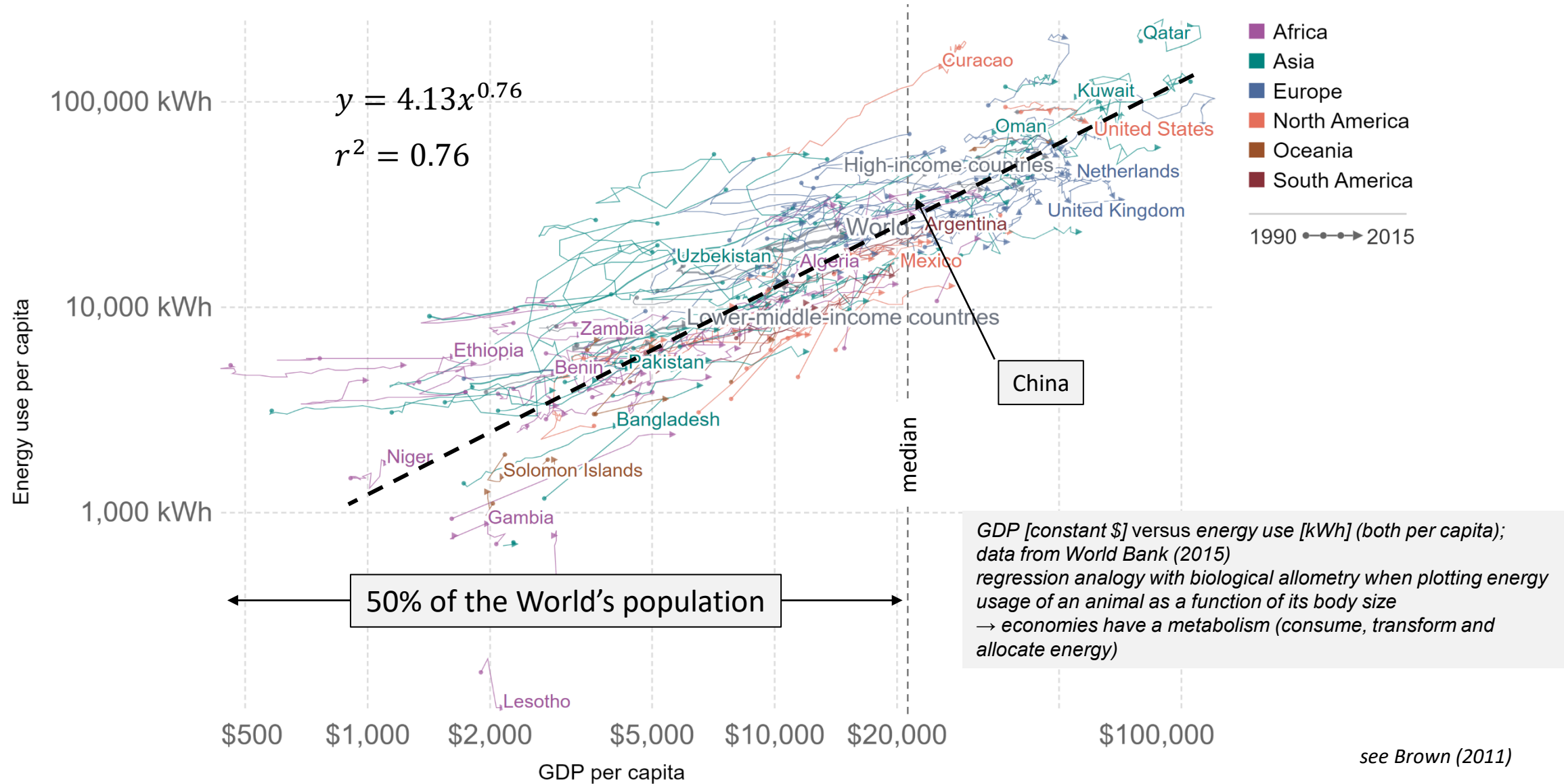


Blindness

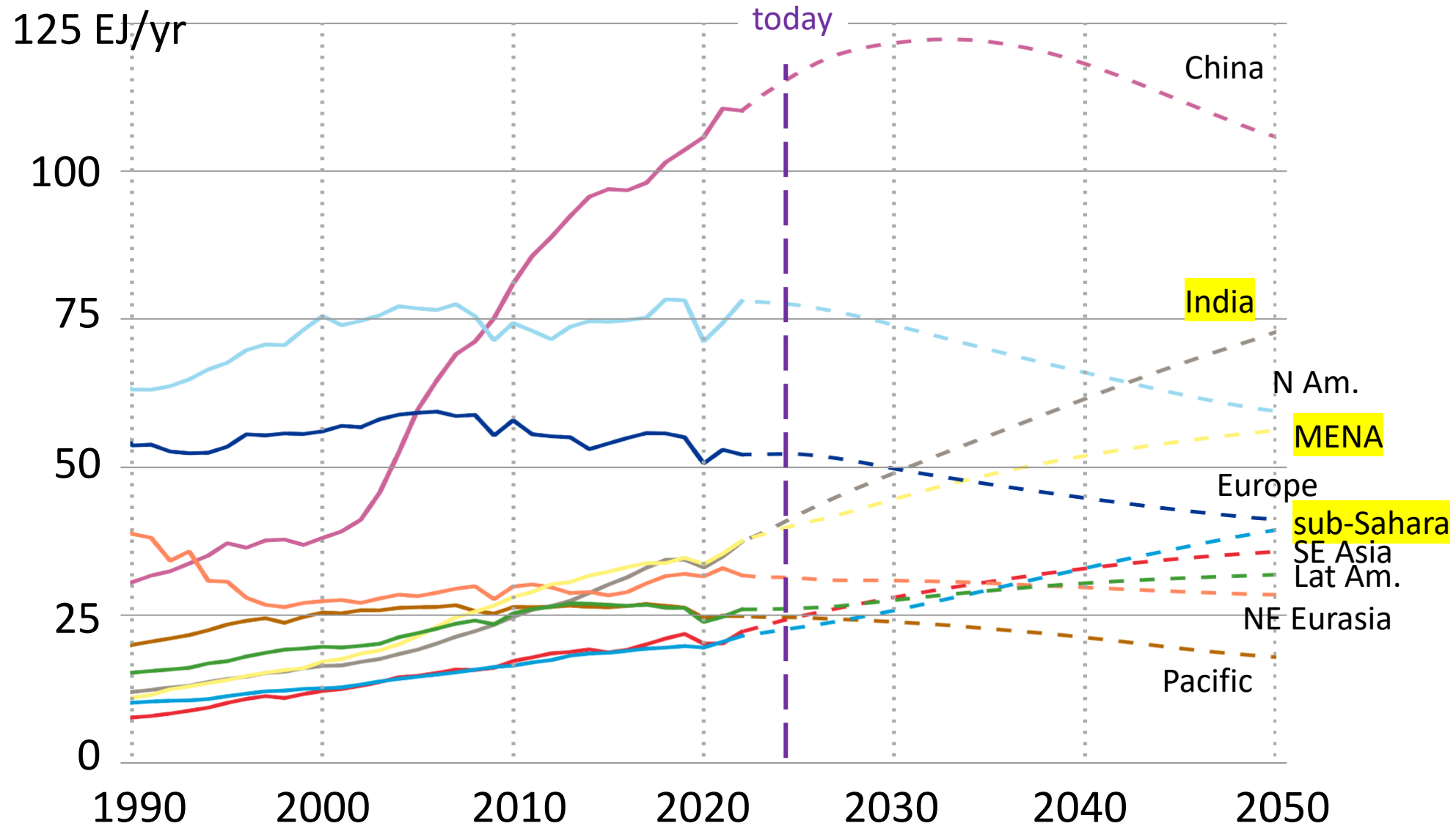


based on Rumsfeld (2002)

Advantage Energy – a strategic asset



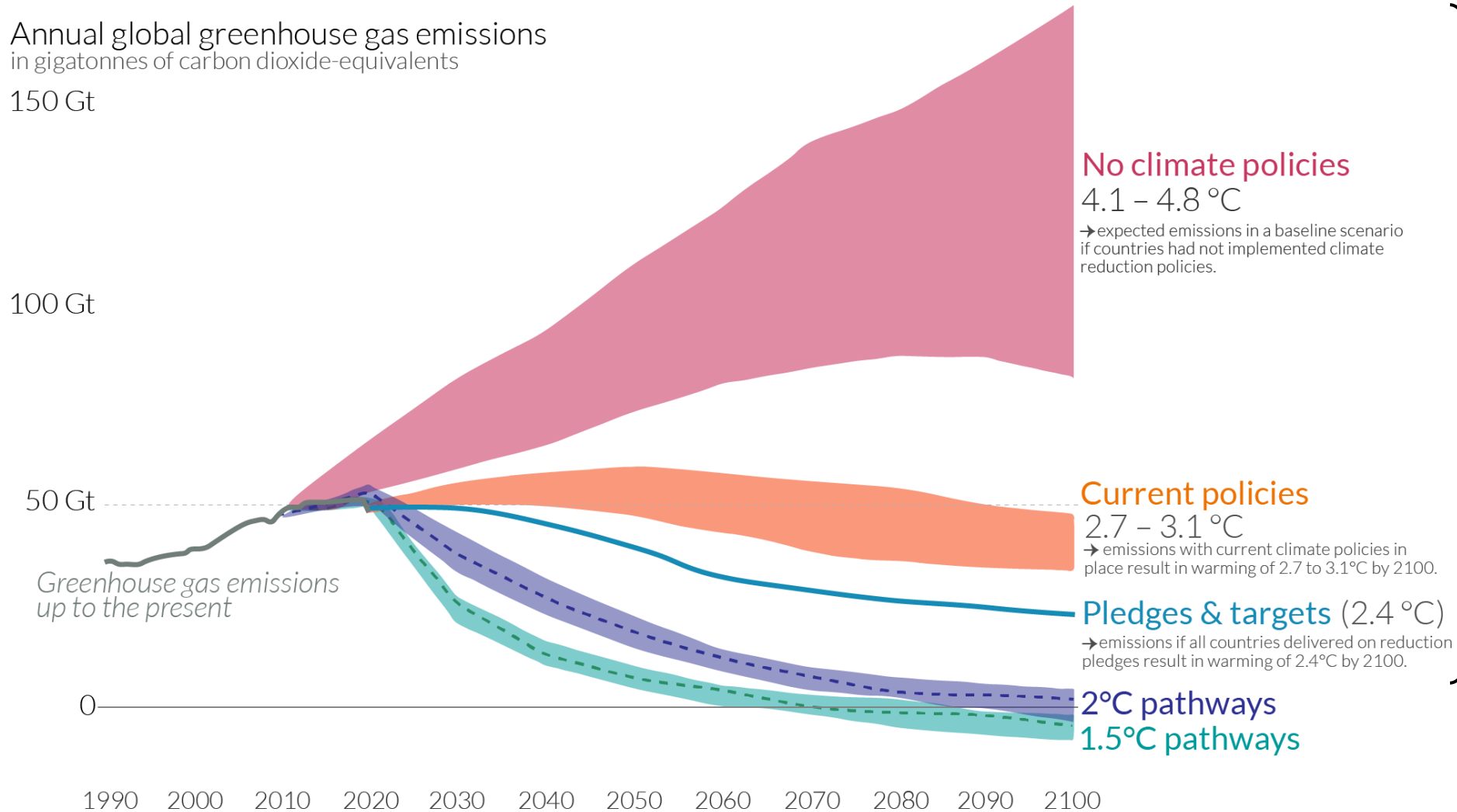
An energy-needy world



IAE (2023)

Missing the target? (1)

Annual global greenhouse gas emissions
in gigatonnes of carbon dioxide-equivalents
150 Gt

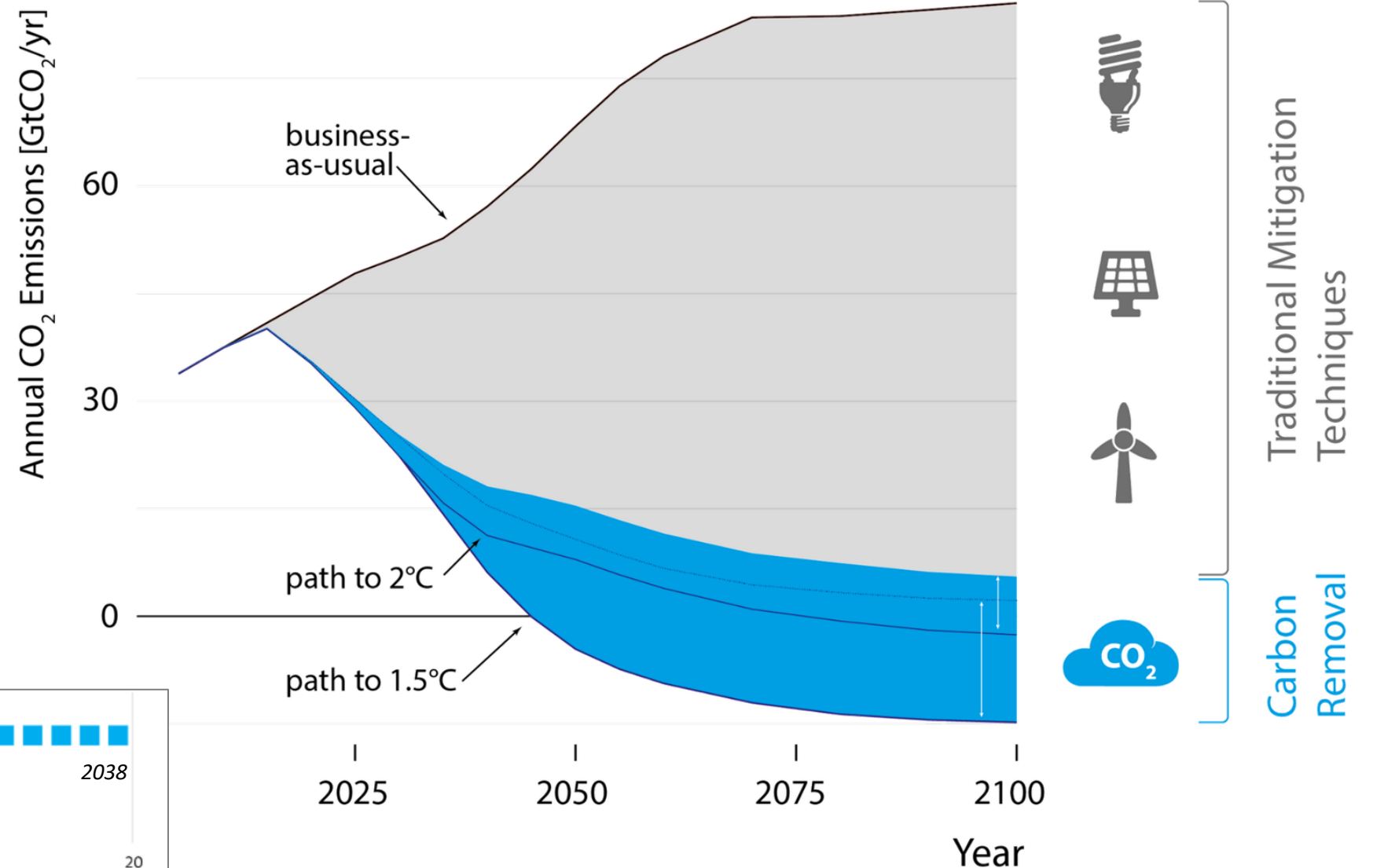
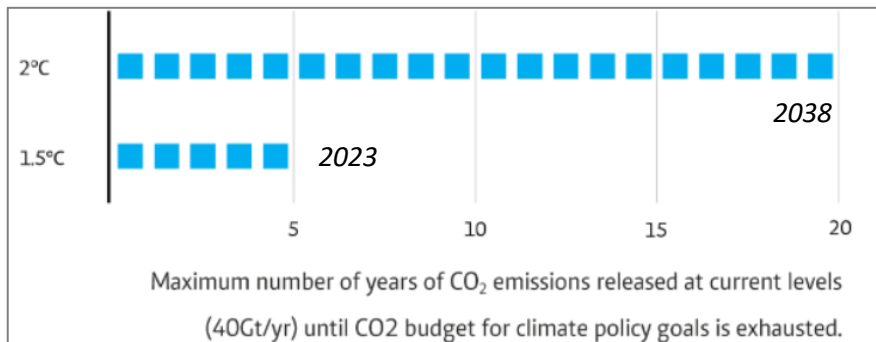


These outcomes are
predicted to have
catastrophic
consequences.

Missing the target? (2)

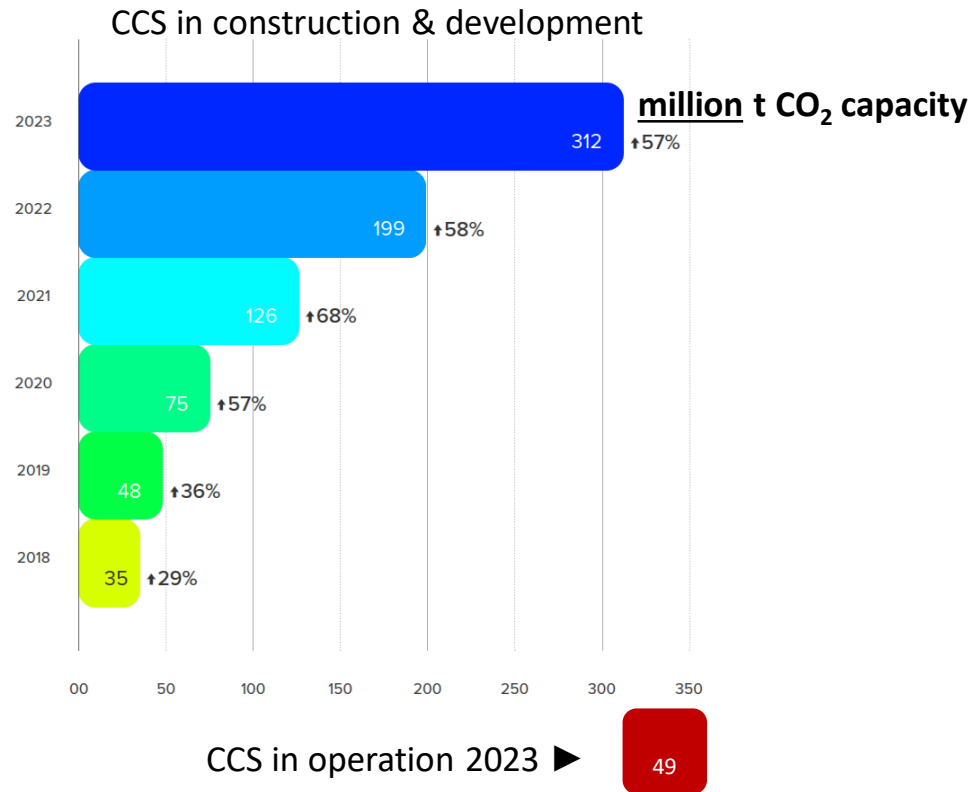
37 Gt emitted in 2023
(Global Carbon Project 2023)

For +1.5°C-scenario 20 Gt/a CO₂ will have to be removed by 2050
(+2°C → 7.5 GT/a CO₂)
additional to all other mitigation



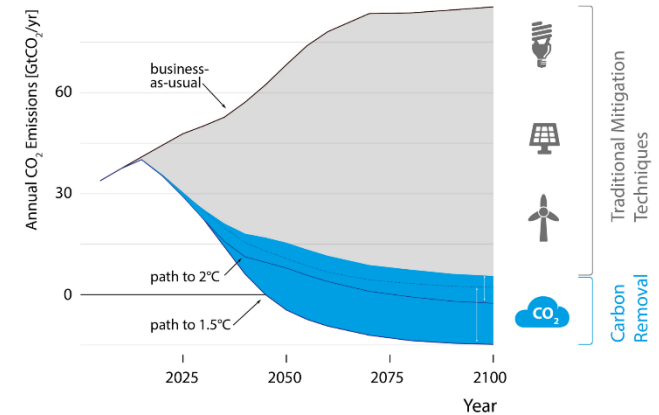
Living in CCS-Land

Global CCS
Institute (2023)



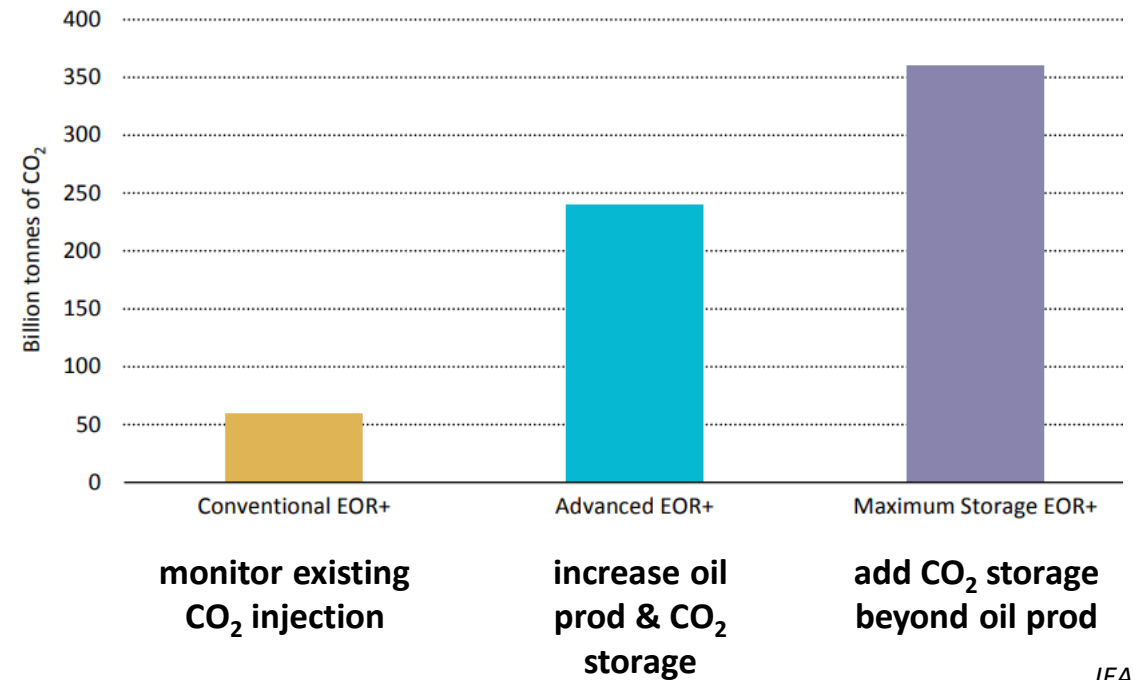
CCS storage capacity if projects rise at the same trajectory as above: 10 Gt/a CO₂ by 2050

For +1.5°C-scenario 20 Gt/a CO₂ will have to be removed in 2050 (+2°C → 7.5 Gt/a CO₂) **additional to all other mitigation**



MCC (2018)

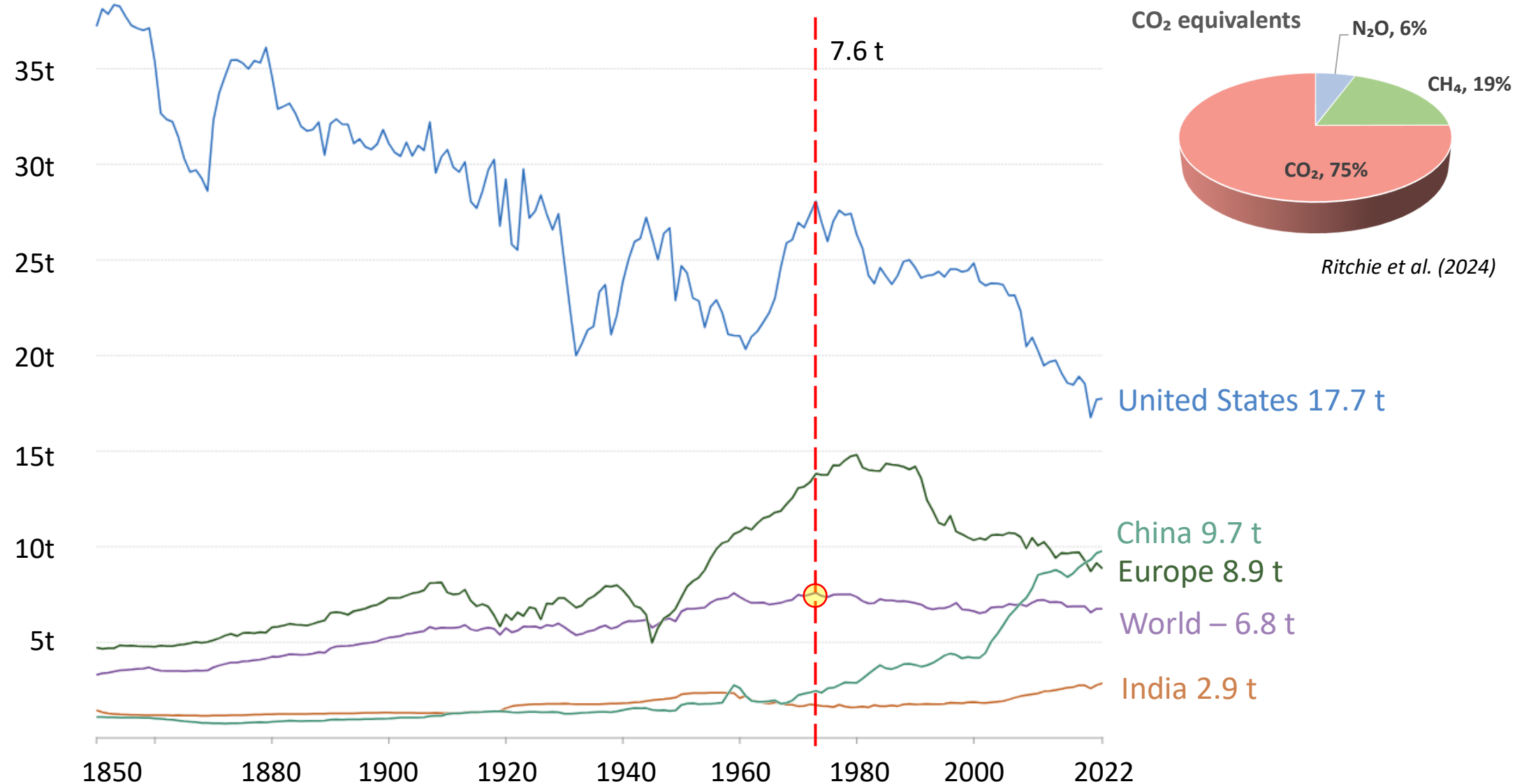
Worldwide CO₂ EOR Potential (total)



IEA (2015)

total capacity in EOR: 9 years of 2023 CO₂ emissions

Hope: the world has peaked in 1973 – GHG per capita



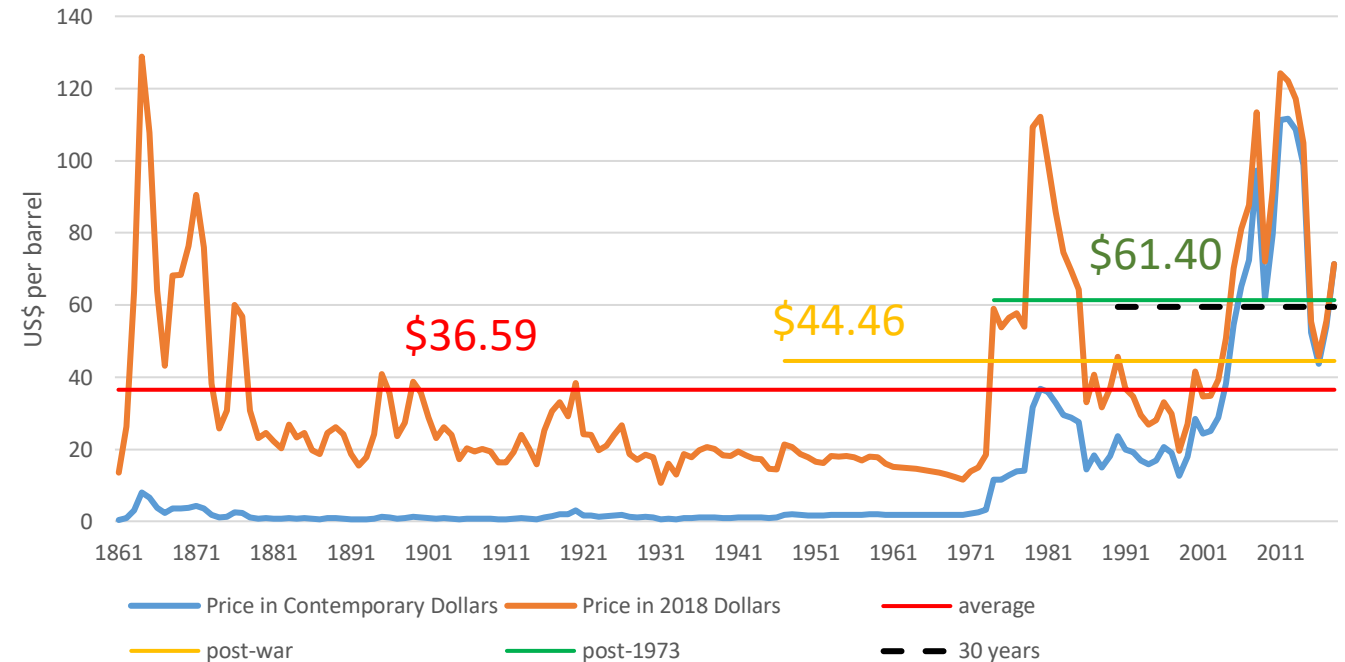
Past crises in the oil industry



- price volatility
- 30% of O&G companies disappear each decade
 - ❑ excessive expectations & misjudgement: overestimating resources & reserves etc.
 - ❑ unbalanced portfolios & lack of cash flow: overstretch (~large projects)
 - ❑ lack of viability at dropping oil price: lack of efficiency, unsustainability of prior economic assumptions

historical oil price

\$82.58

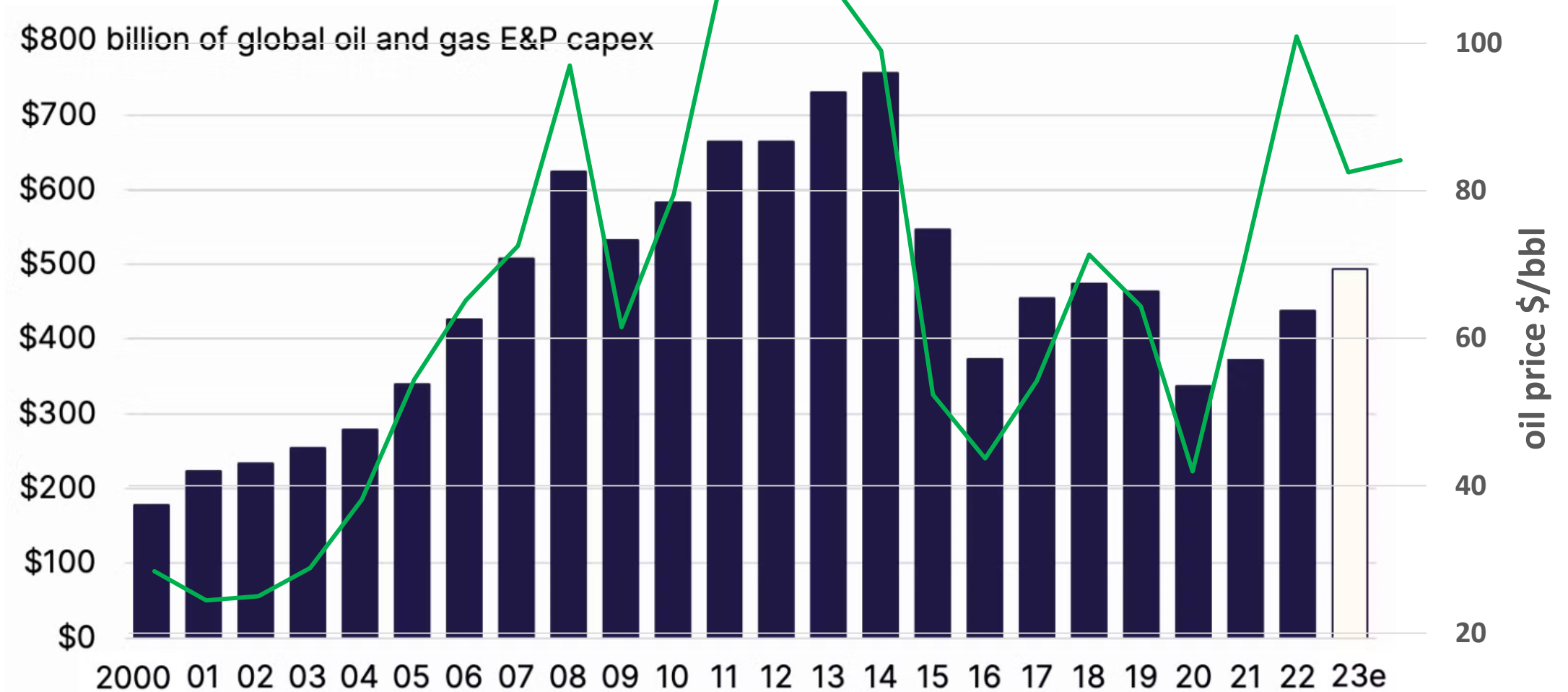


Crude Oil Prices from 1861. \$US per barrel. 1861-1944: US average.
1945-1983: Arabian Light posted at Ras Tanura. 1984-2010: Brent Dated.
https://www.quandl.com/data/BP/CRUDE_OIL_PRICES

E&P less wanted?



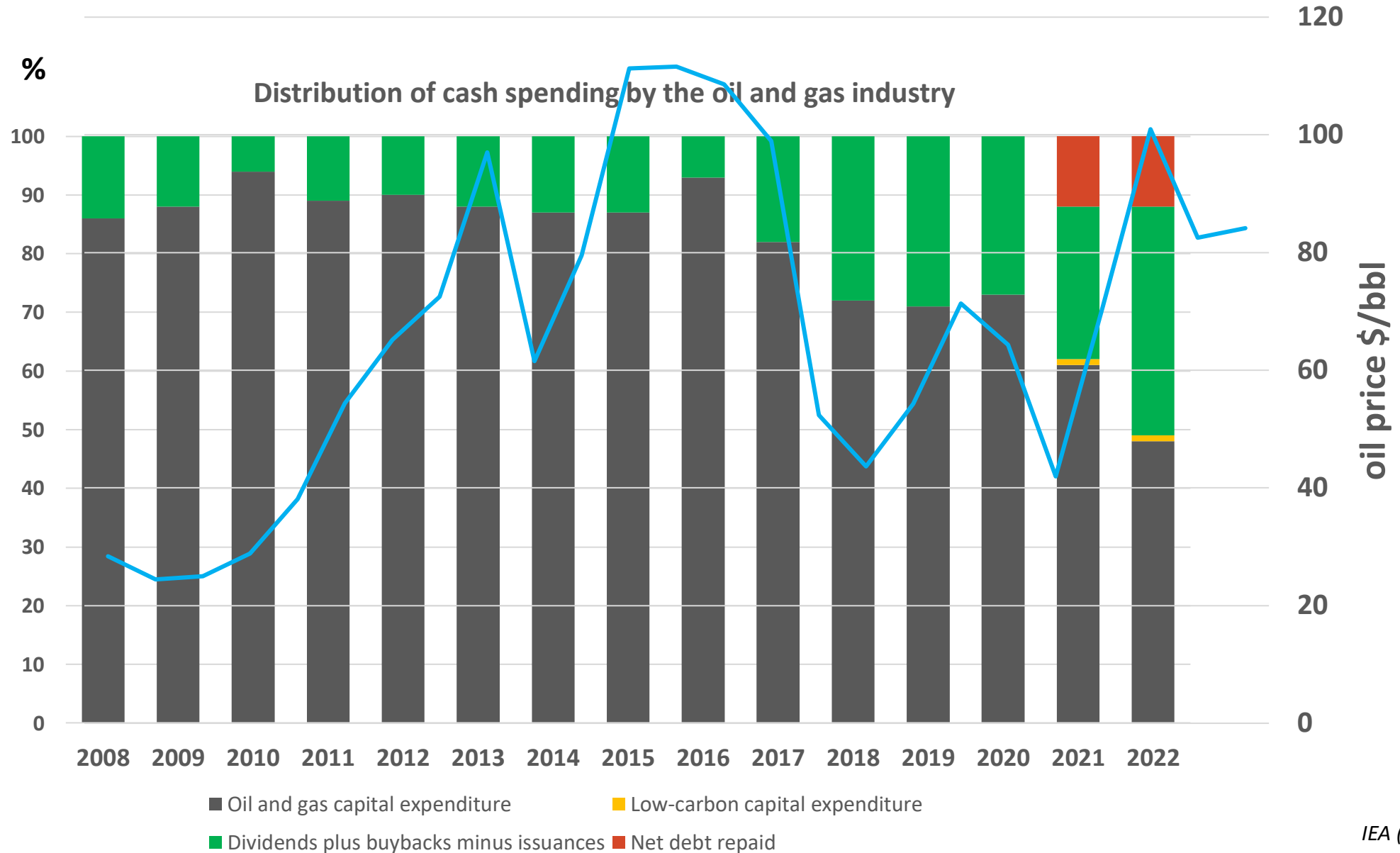
120



modified from Bullard (2024)

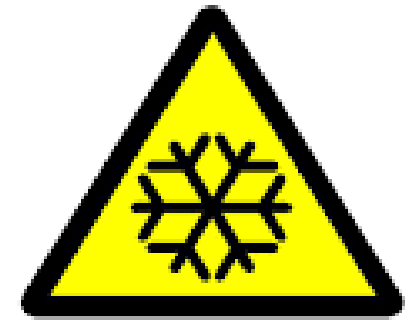
0

From re-investment to re-distribution



IEA (2023)

Crisis? What crisis?

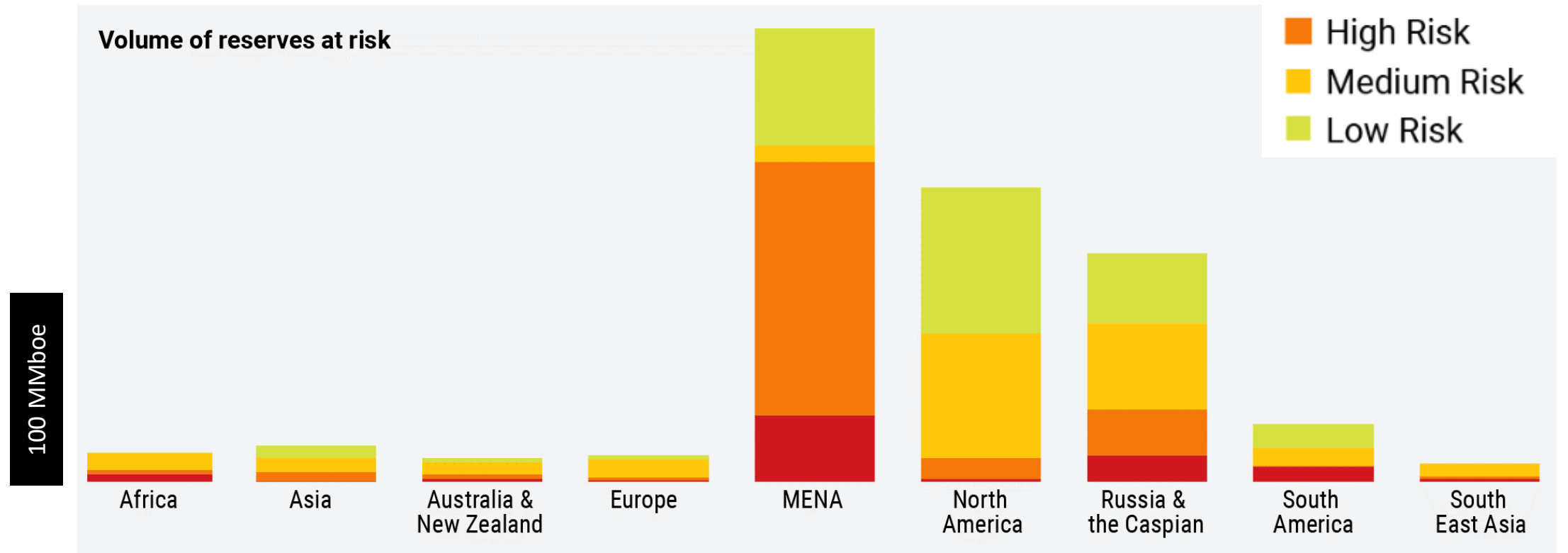


THREATS



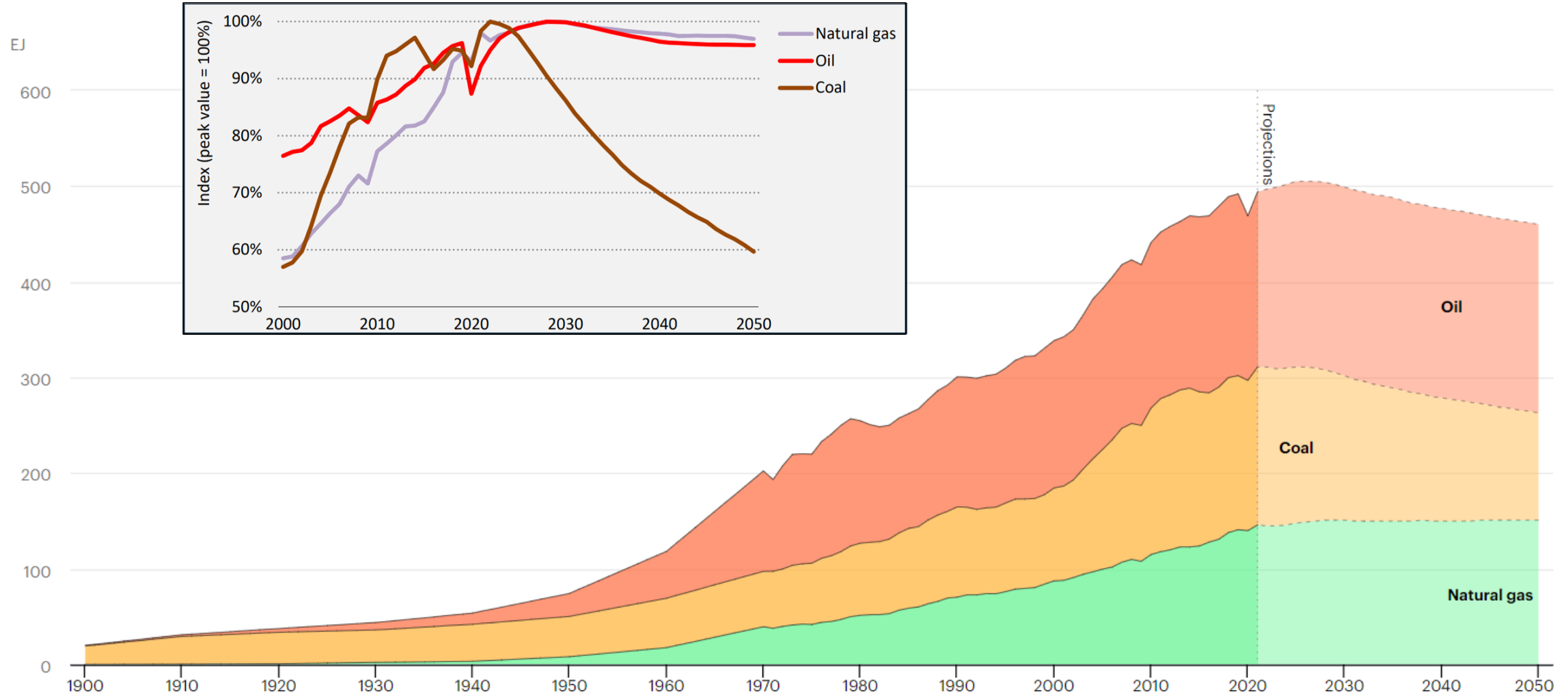
#1 Physical harm

- physical harm to assets & infrastructure



Nichols & Clisby (2021)

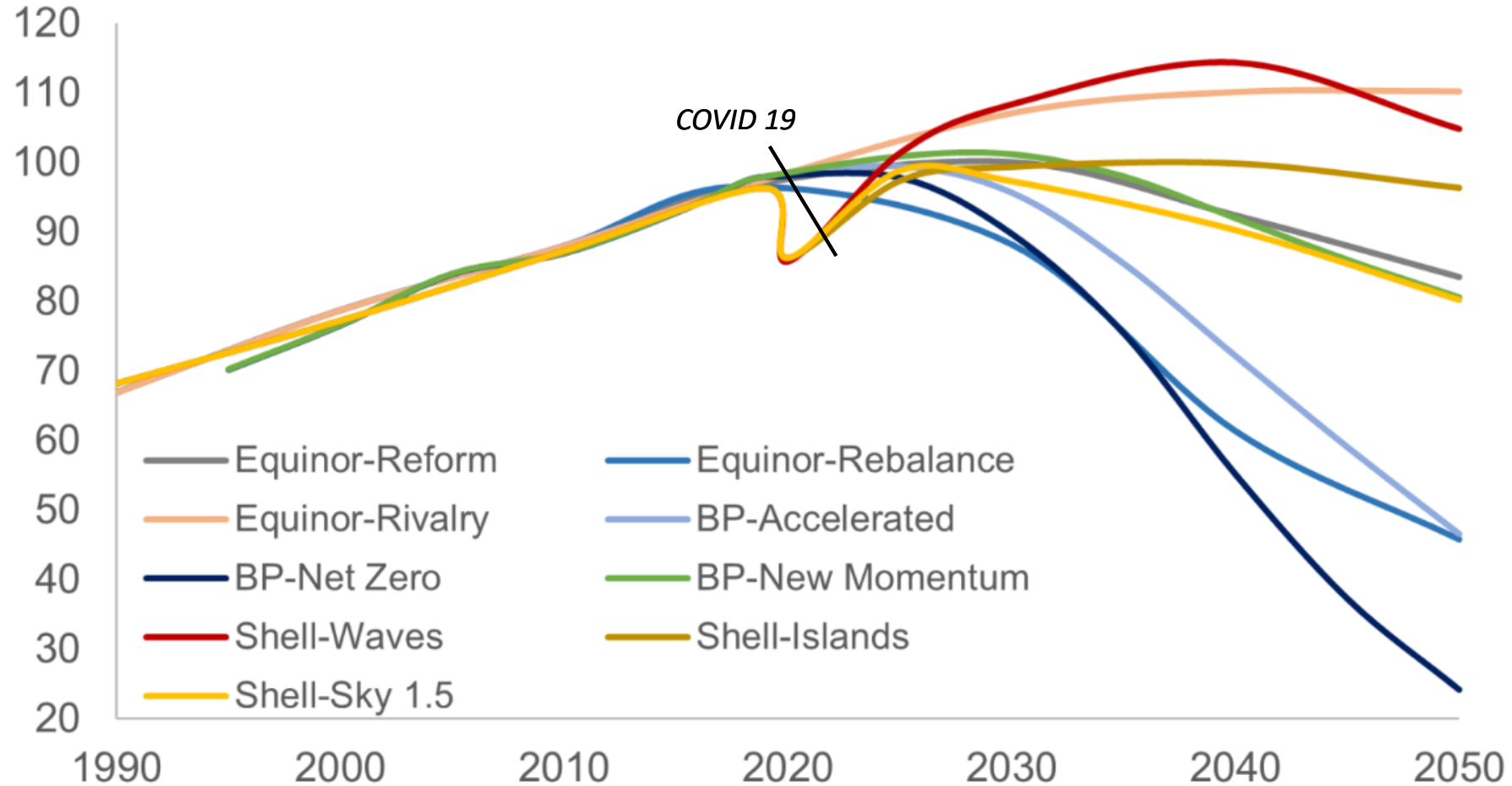
#2 Fossil fuel demand peaking in 2030



IEA (2022) STEPS (+2.4° scenario)

#2 Fossil fuel demand peaking – scenarios

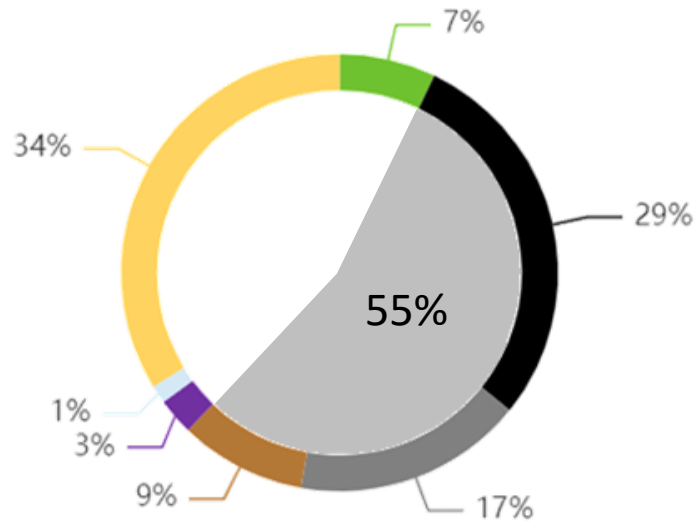
Peak oil demand forecasts - Million barrels per day



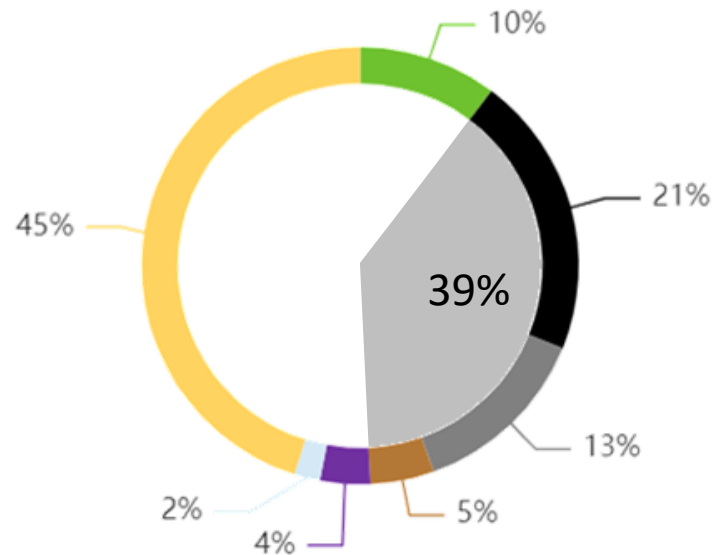
Crystol Energy (2022)

#2 Fossil fuel share dropping by 2050

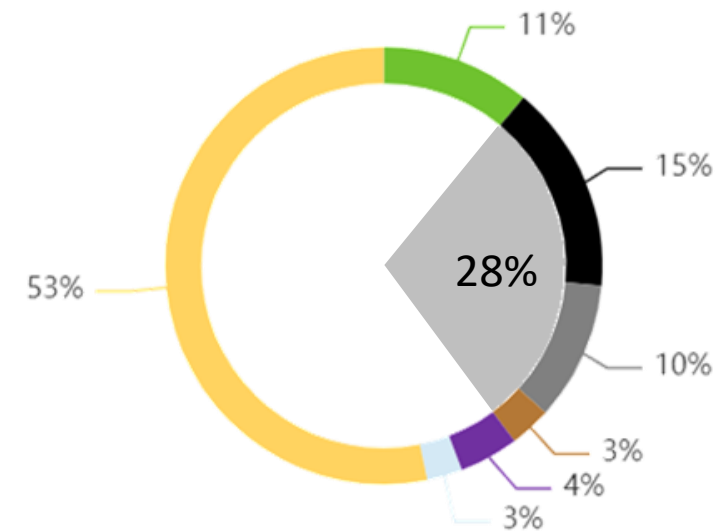
business as usual
+3 °C



achieved pledges (NDC)
+2.5°C



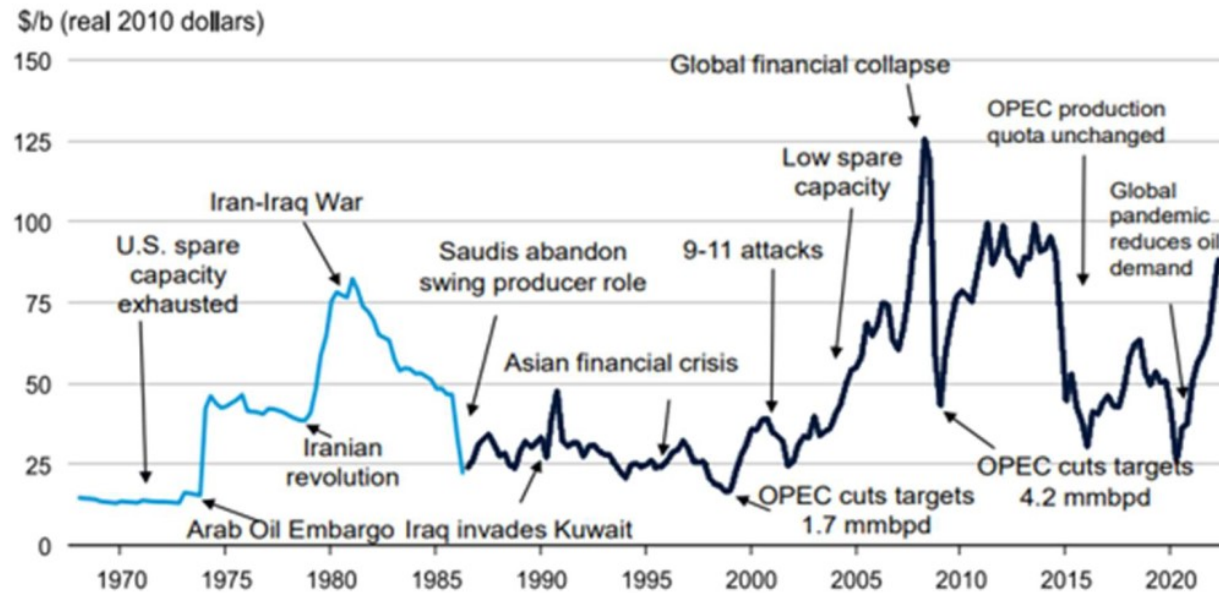
overachieved pledges
<2°C



Biomass Oil Gas Coal Heat
hydrogen Electricity

Enerdata (2024)

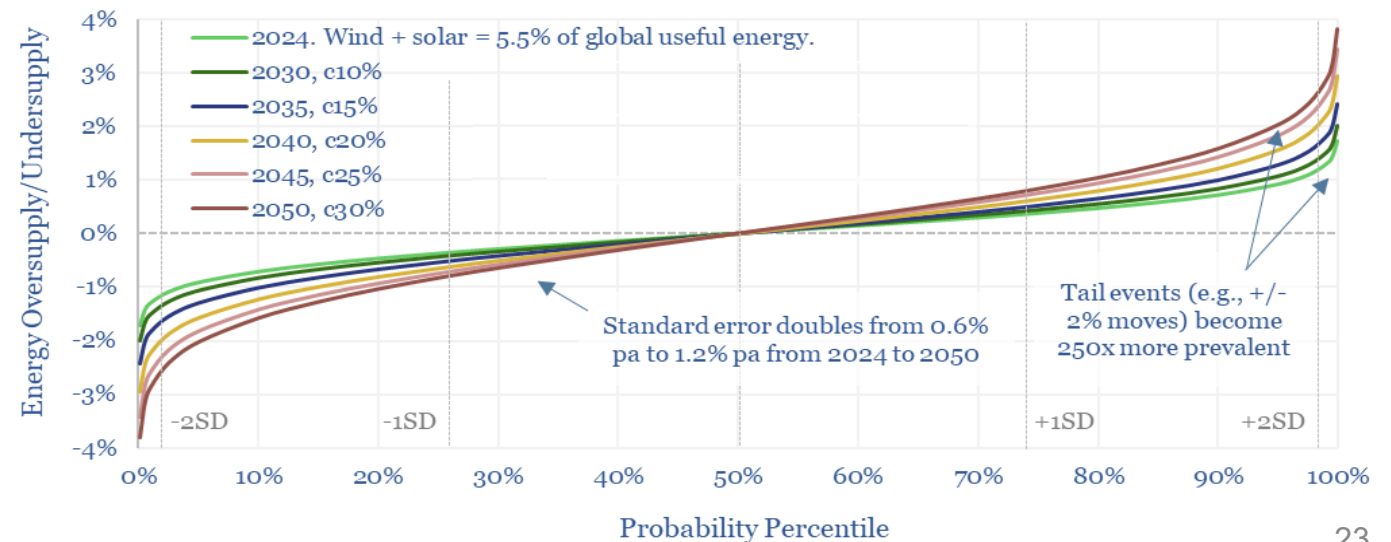
#3 Price shocks



US Energy Information Administration (2022)

- shrinking petroleum share
- more frequent supply imbalance
...unless storage improves

Thunder Said Energy (2024)

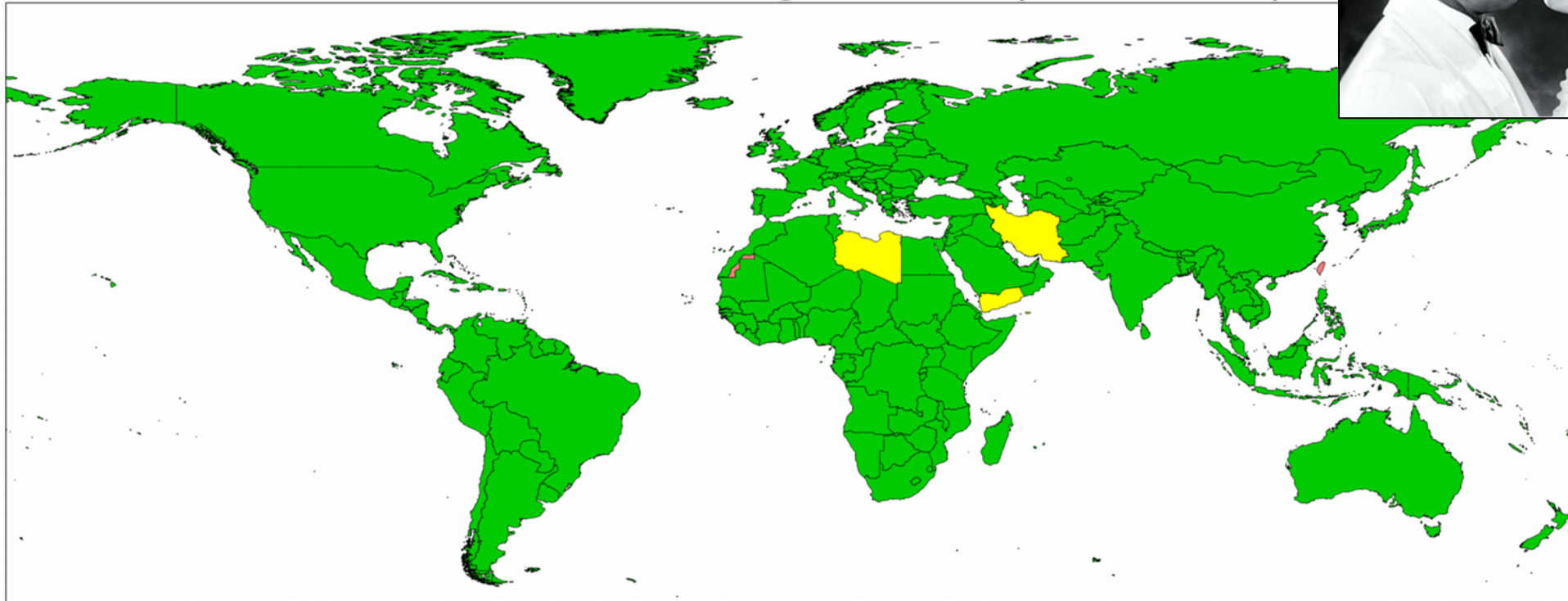


#4 ...but we'll always have Paris (?)

Bogart & Bergman (1942)



Status of the Paris Agreement (June 2024)

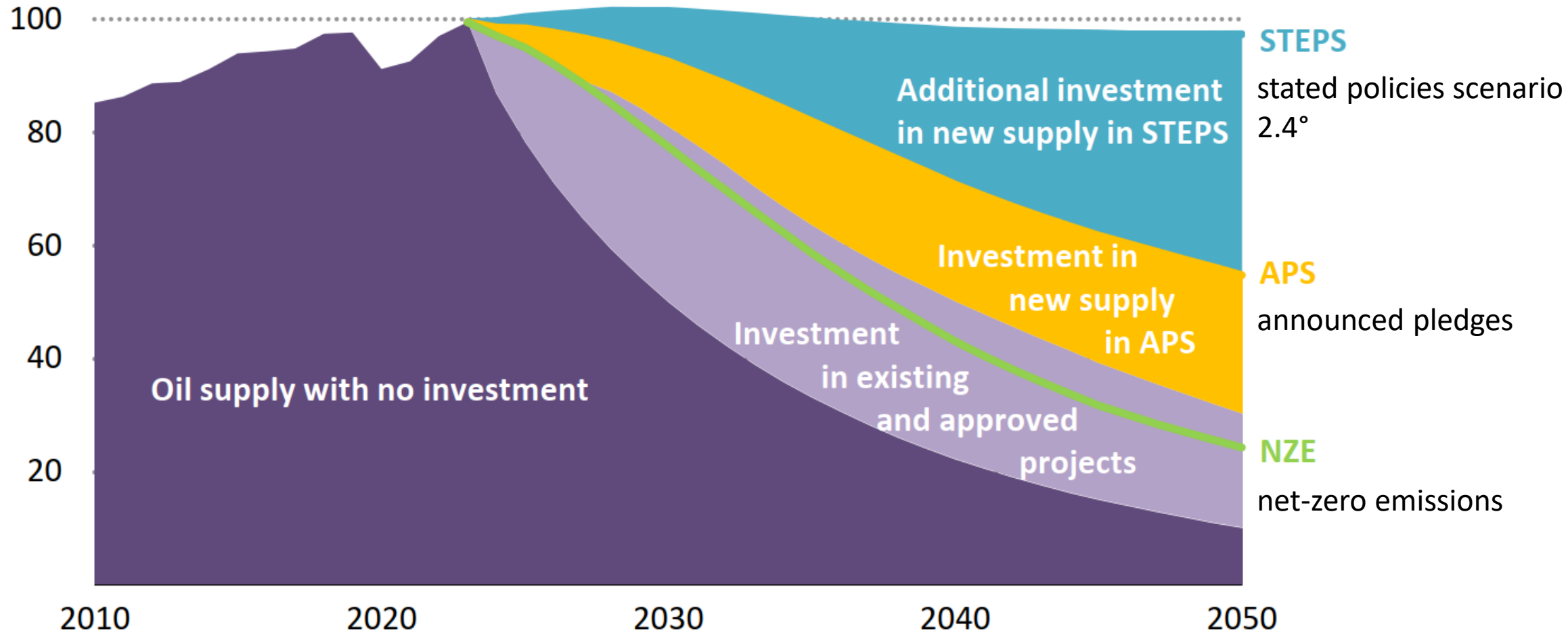


	N	GHG Emissions	Population	Fossil Fuel Reserves
Signed and Ratified	194	97.9 %	98.1 %	90.6 %
Signed but not yet Ratified	3	1.4 %	1.5 %	9.4 %
Not Signed	0	0.0 %	0.0 %	0.0 %
Non-member / Ineligible	*	0.7 %	0.3 %	0.0 %

#4 Complying with NZE-2050 means to stop FID-ing



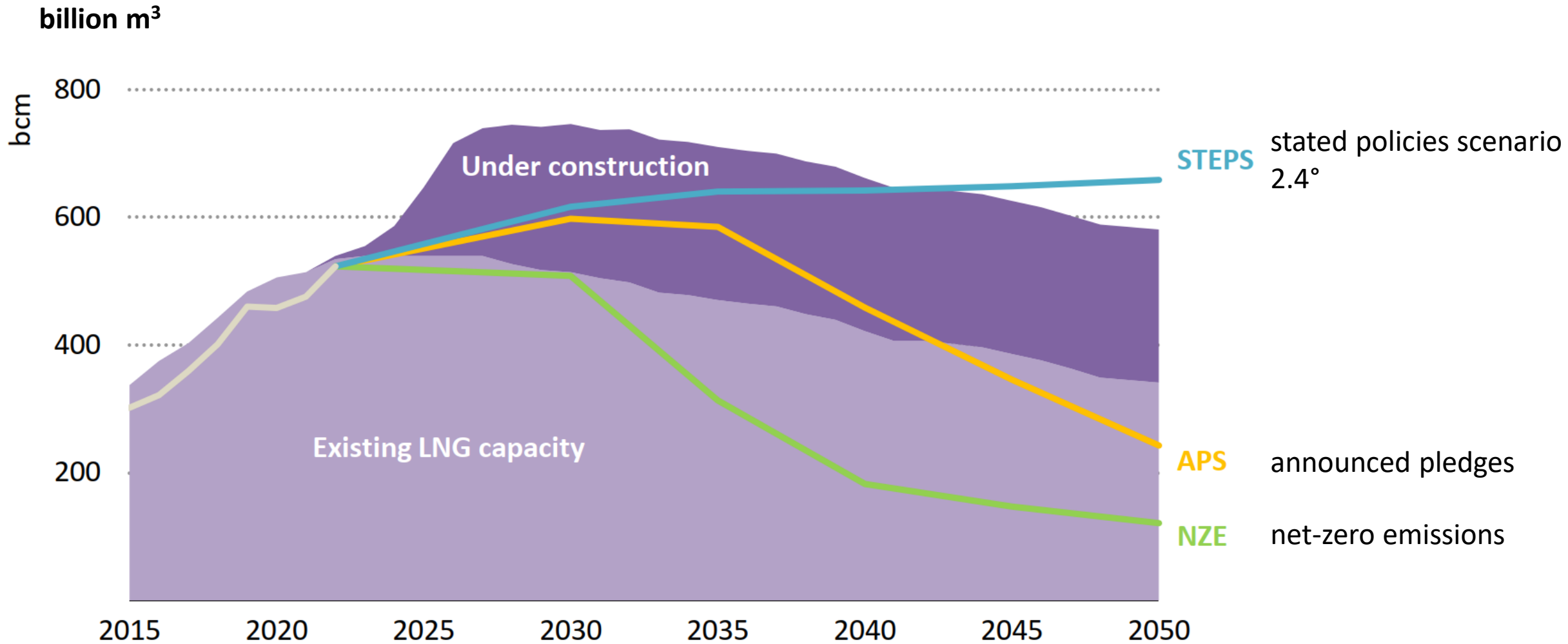
million bbl/d



similar for gas

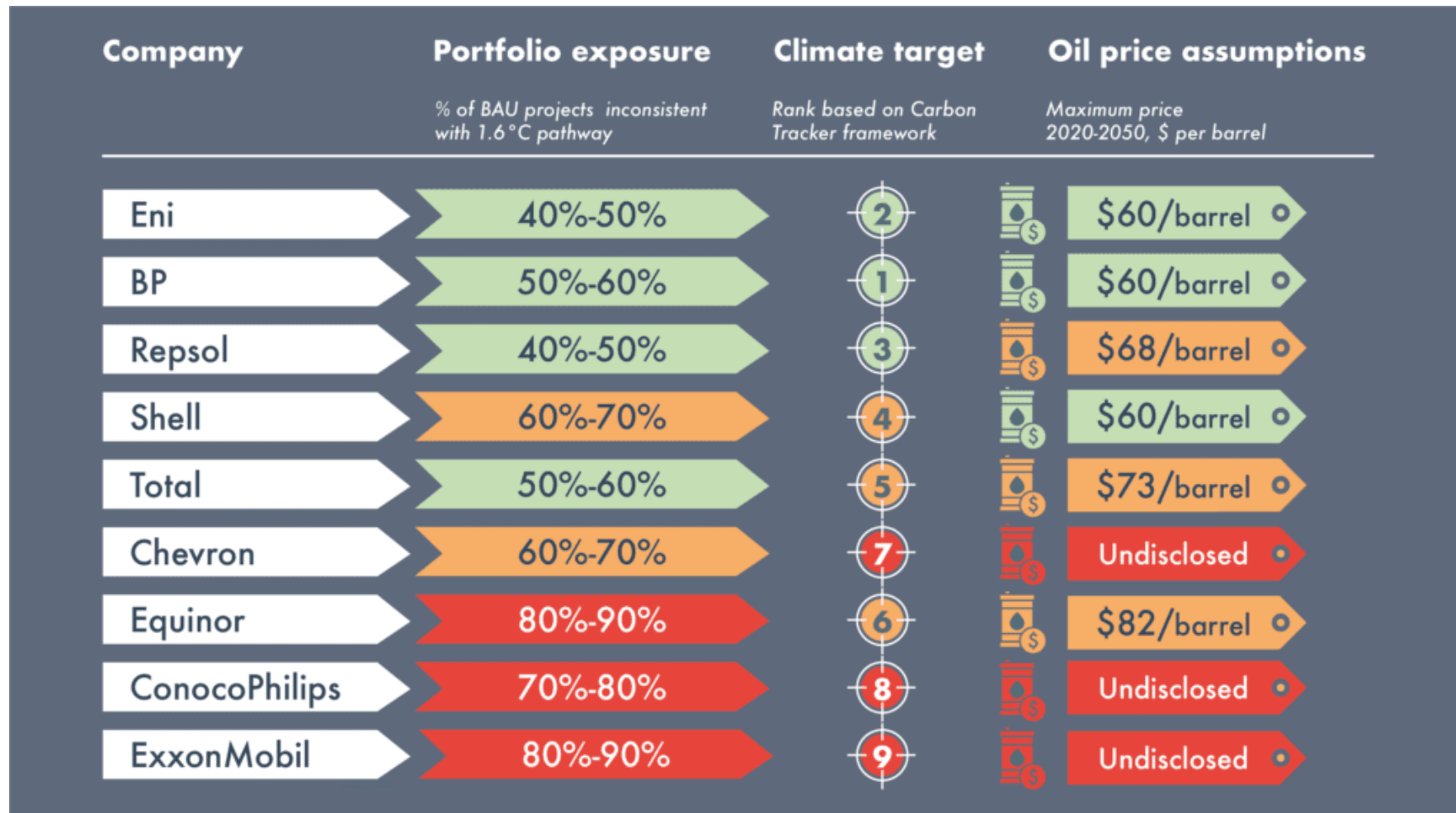
IEA (2023)

#4 LNG overshoot



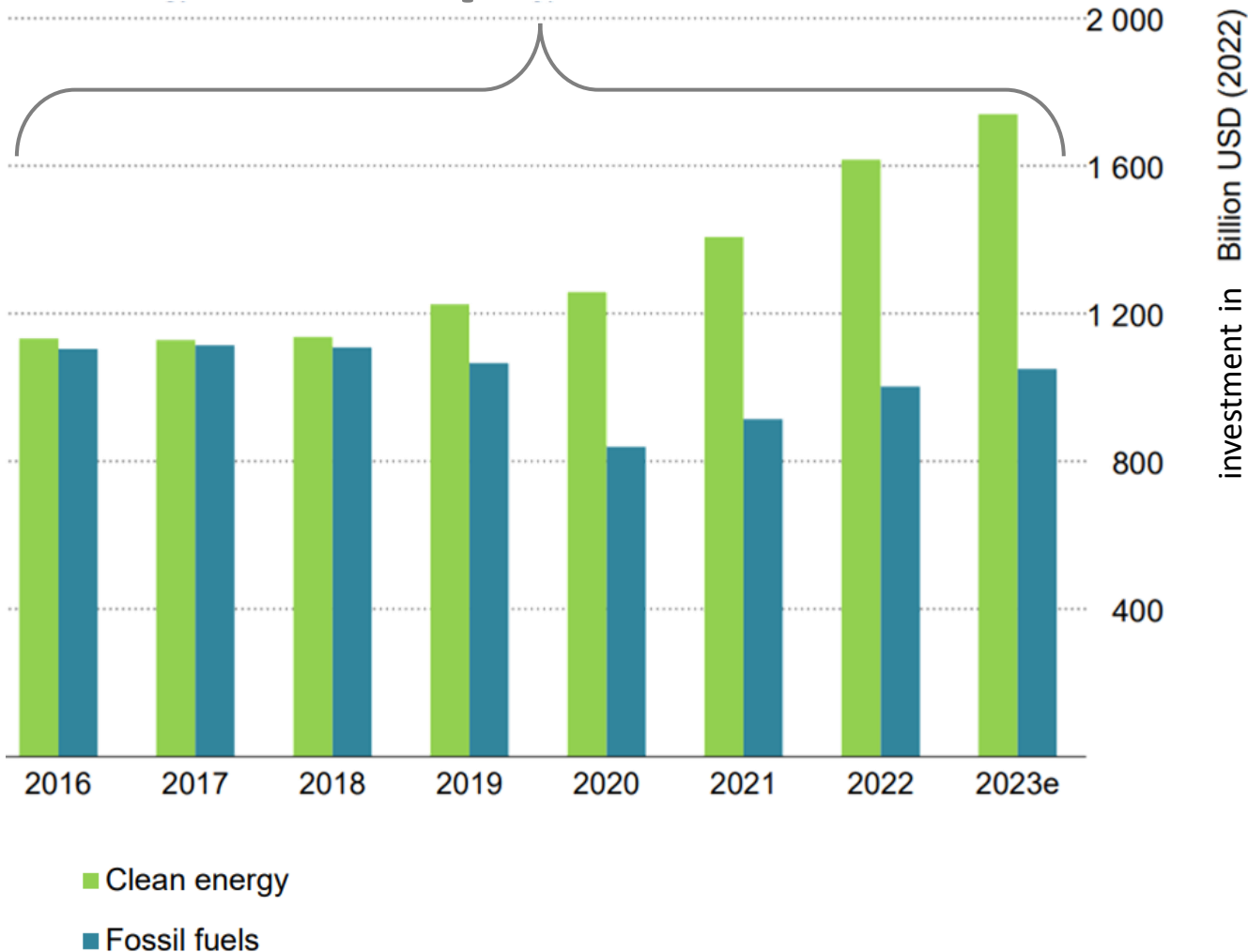
#5 Stranded assets

- by 2040, \$7-11 trillion of fossil fuel assets at risk; by 2050 up to \$100 trillion



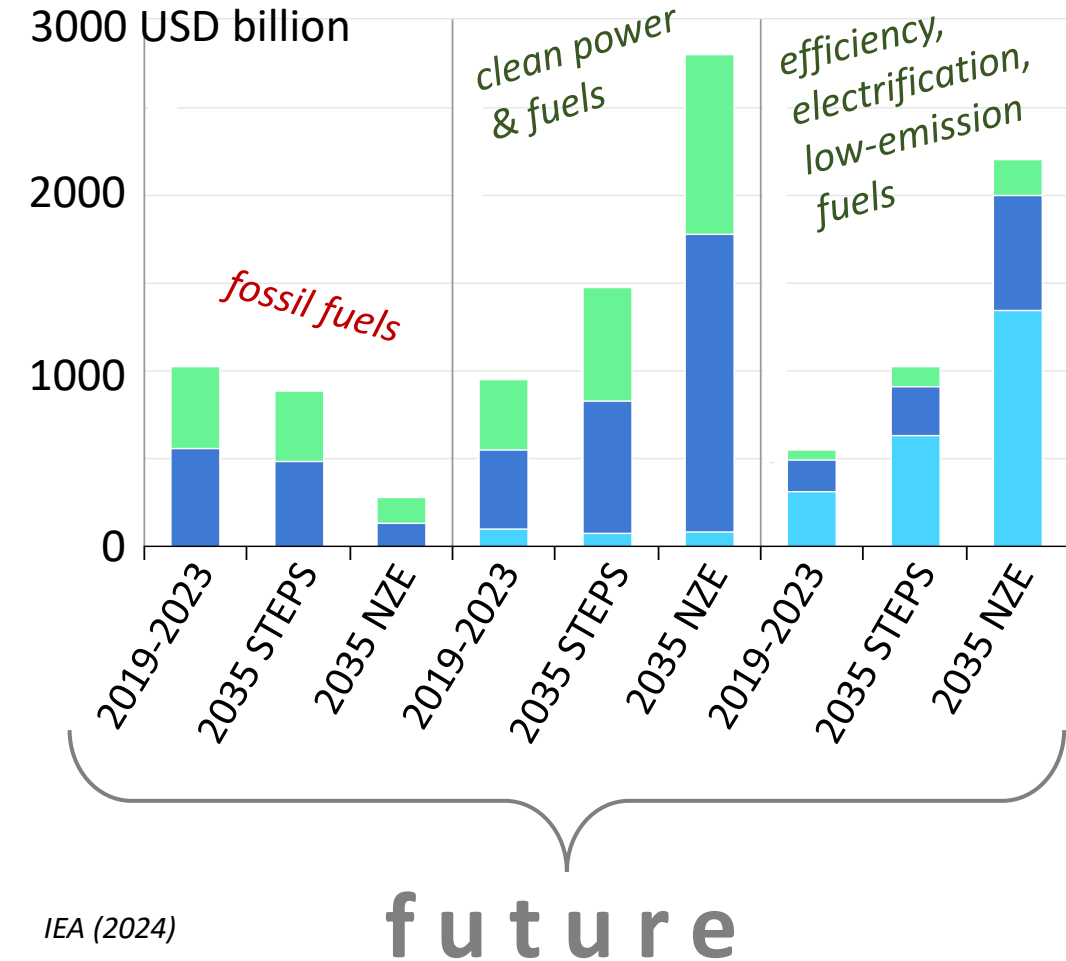
#6 Divestment: clean trumps fossil

past



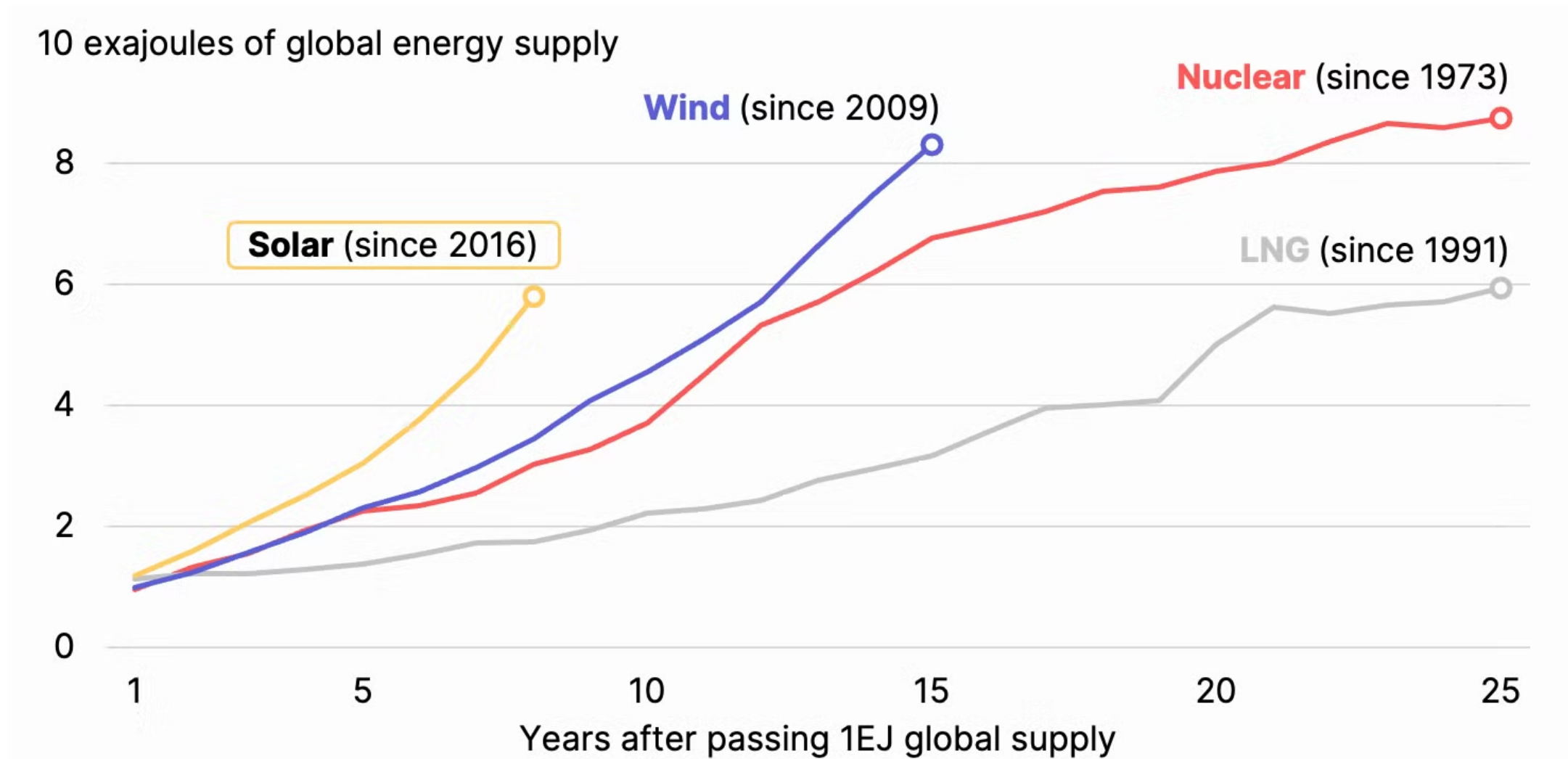
IEA (2023)

public private households



IEA (2024)

#6 The crown joules: renewables adding supply faster



#6 Divestment: China moves – the World follows?

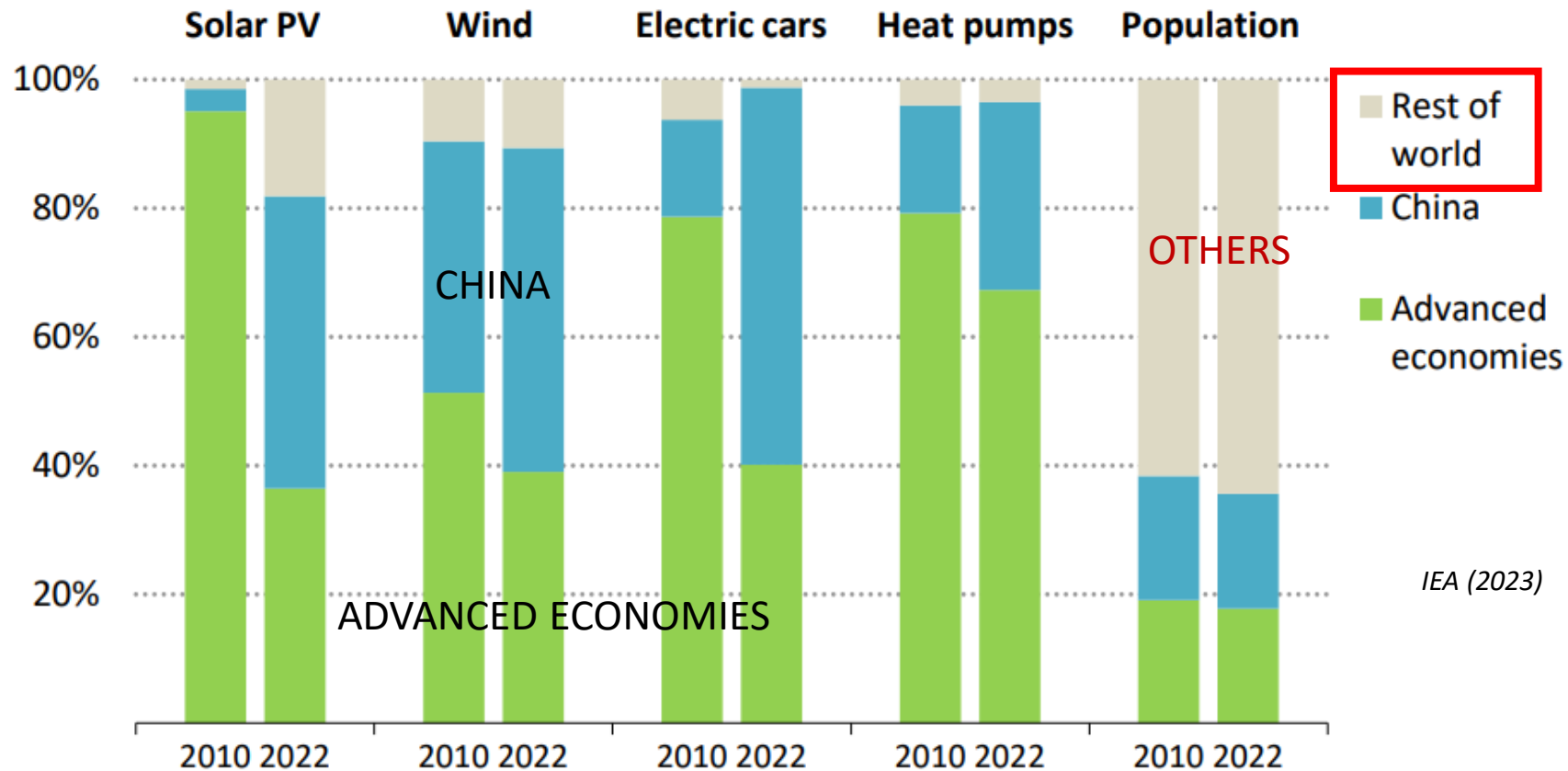
China's demand growth was covered by renewables in 2023.

	Country	Investment (Billions of US\$)	% of Global Total
1	China	266	35
2	United States	114	15
3	Germany	47	6
4	United Kingdom	31	4
5	France	27	4
6	Japan	26	3
7	India	14	2
8	South Korea	13	2
9	Brazil	12	2
10	Spain	11	2

ChinaPower (2021)

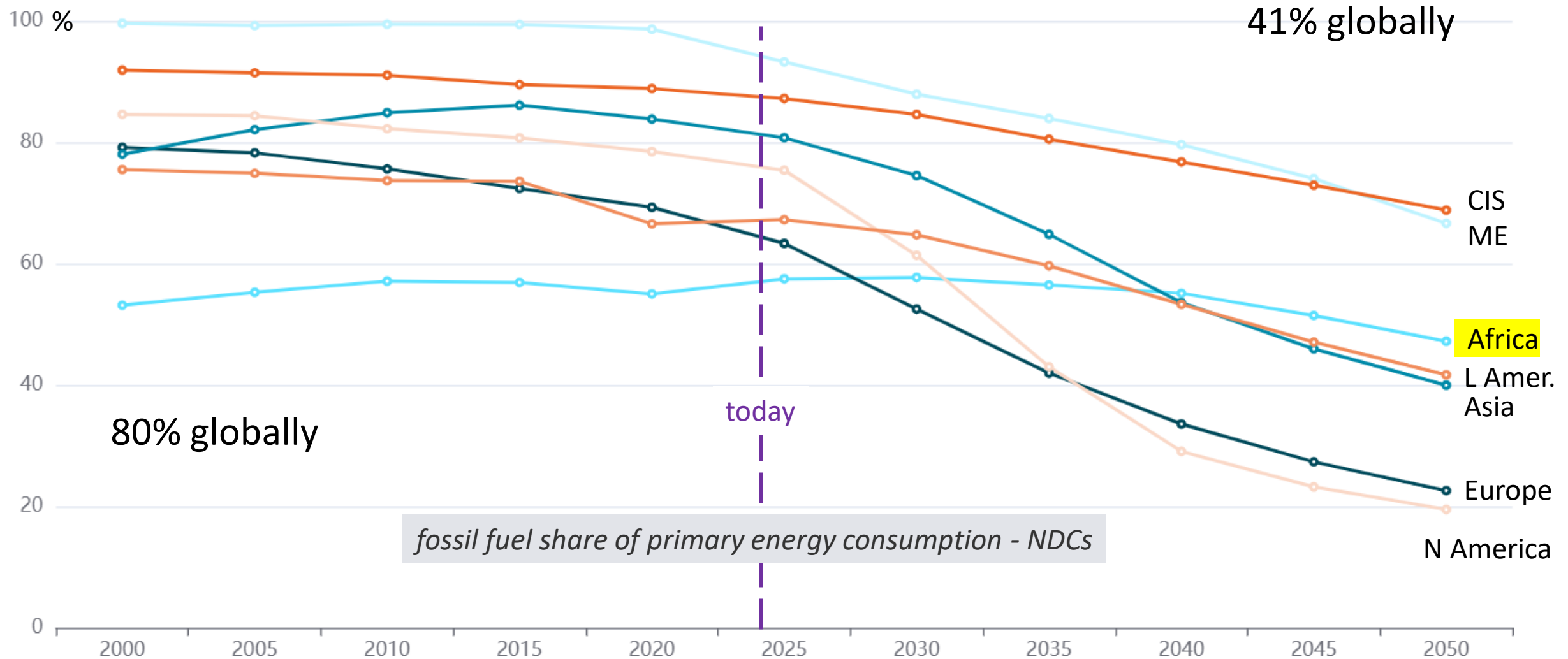
#6 Divestment: the World has not followed yet!

Share of global deployment of renewables & technology

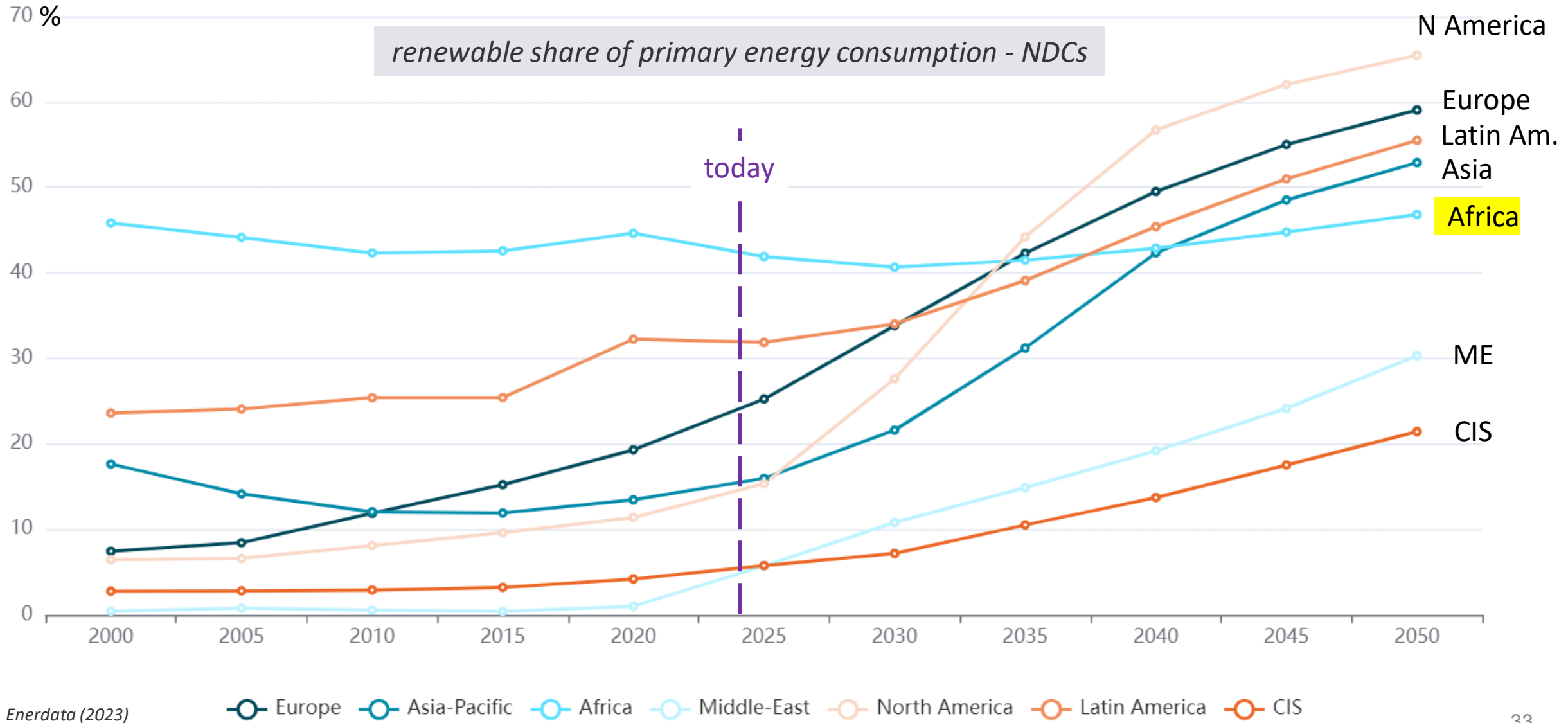


Notes: Solar PV and wind indicate capacity additions. Electric cars and heat pumps indicate sales.

#6 Divestment: ... but it will! And Africa bucks the trend!

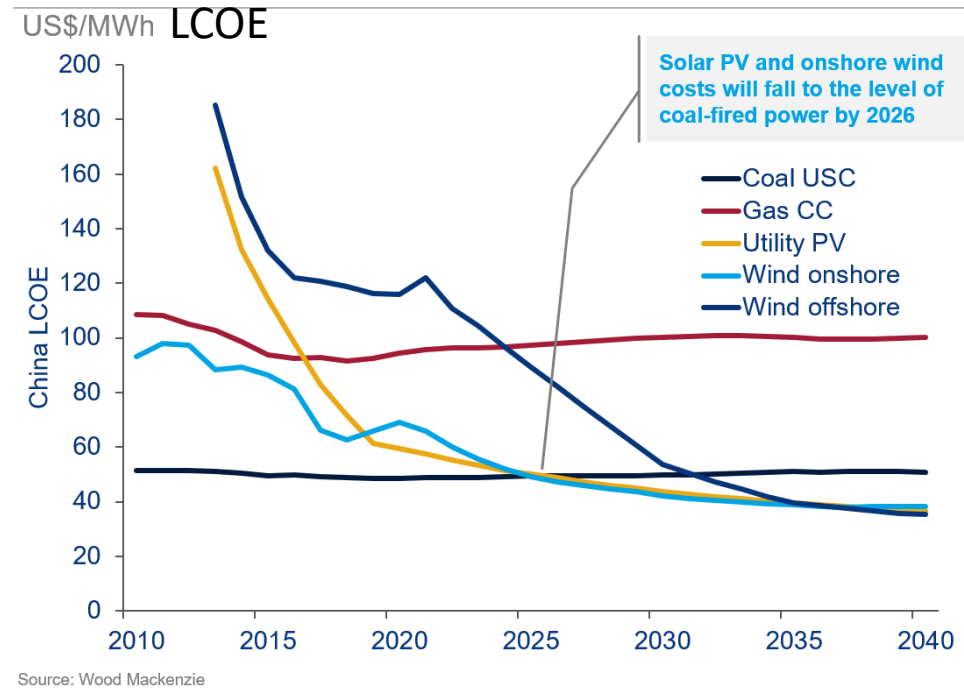


#6 Divestment: ... but it will! And Africa bucks the trend!



#7 How's the competition?

China ▶



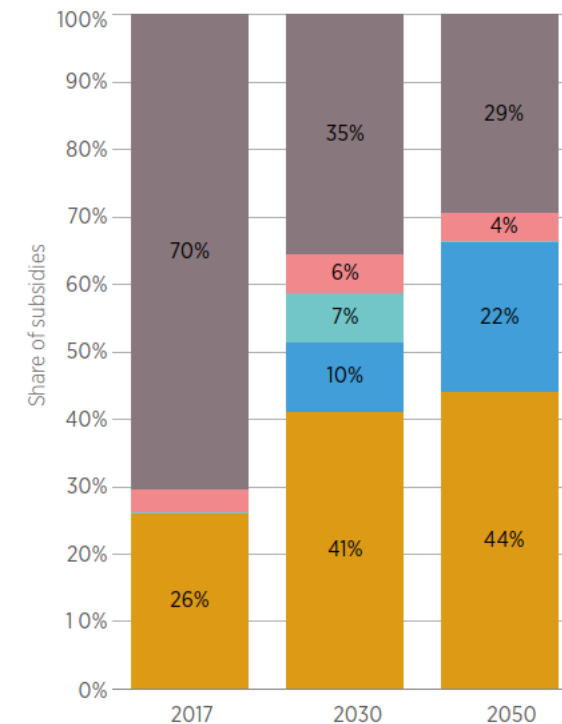
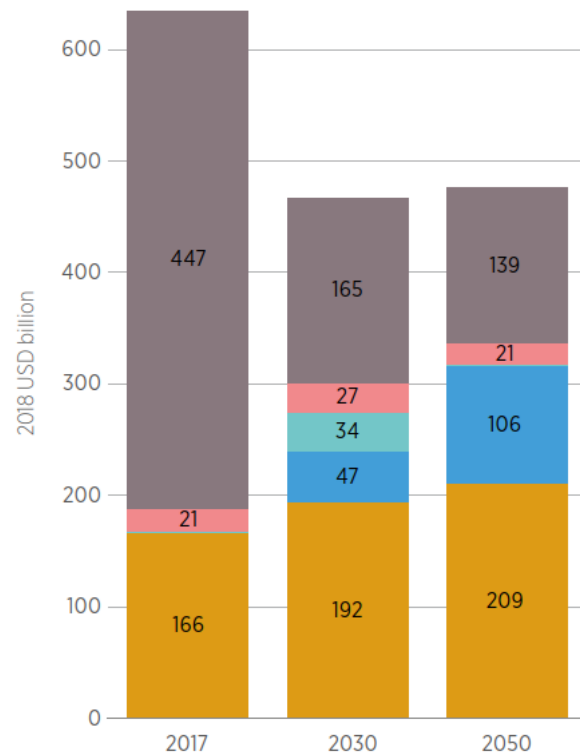
Woodmac (2020)



Lazard (2023): levelized cost of energy for the U.S.

#7 How's the competition...without subsidies?

- global fossil fuel profits average 1970-2020: **\$1,030 billion** per year *Verbruggen (2022)*
- global fossil fuel subsidies (explicit, implicit incl. e.g. undercharge of local environmental costs & forgone taxes) : **\$7,000 billion** in 2022 *Worldbank (2024)*

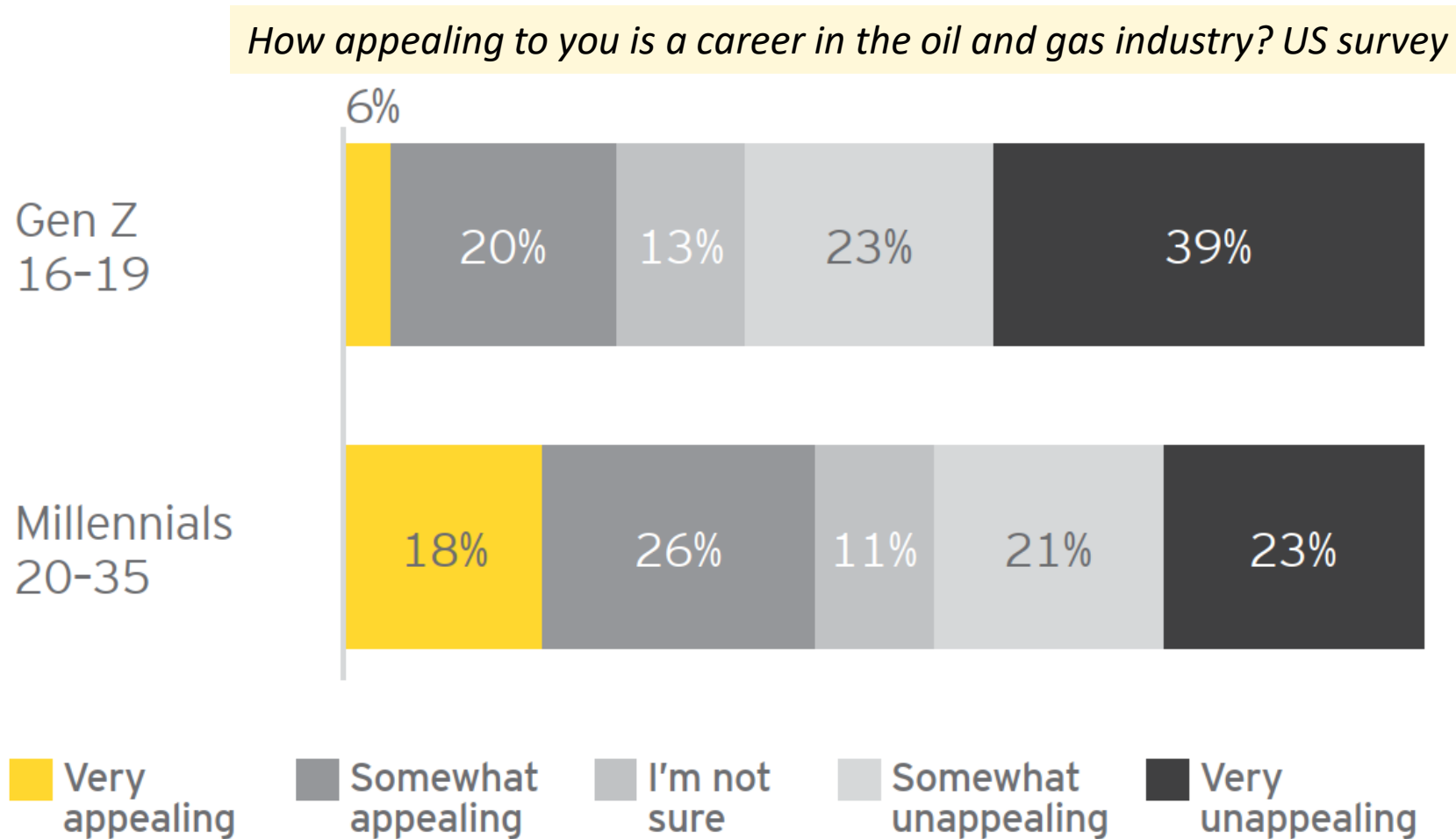


Taylor, Irena (2020)

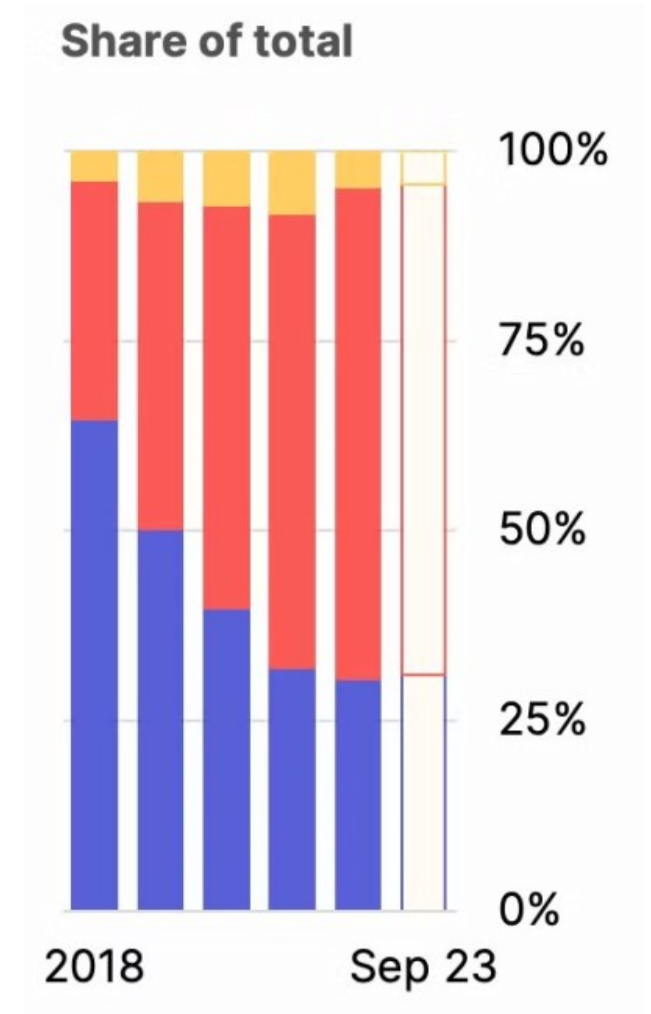
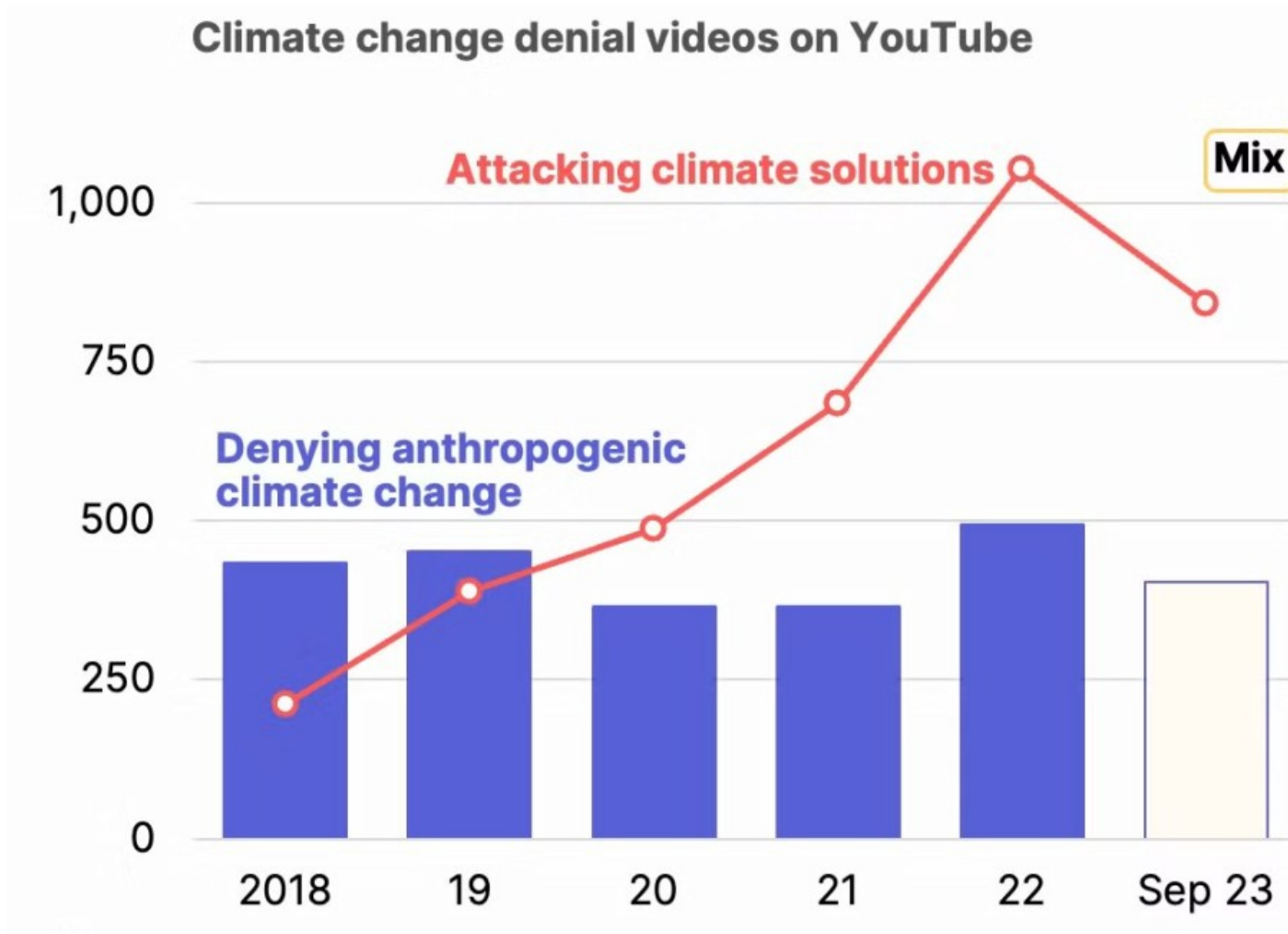
Fossil fuels Nuclear Electric vehicles Efficiency Renewables

#8 Pulling the rug

- 150,000 years of experience will be lost within 5 years



#9 'Public' opinion: denial to solutions

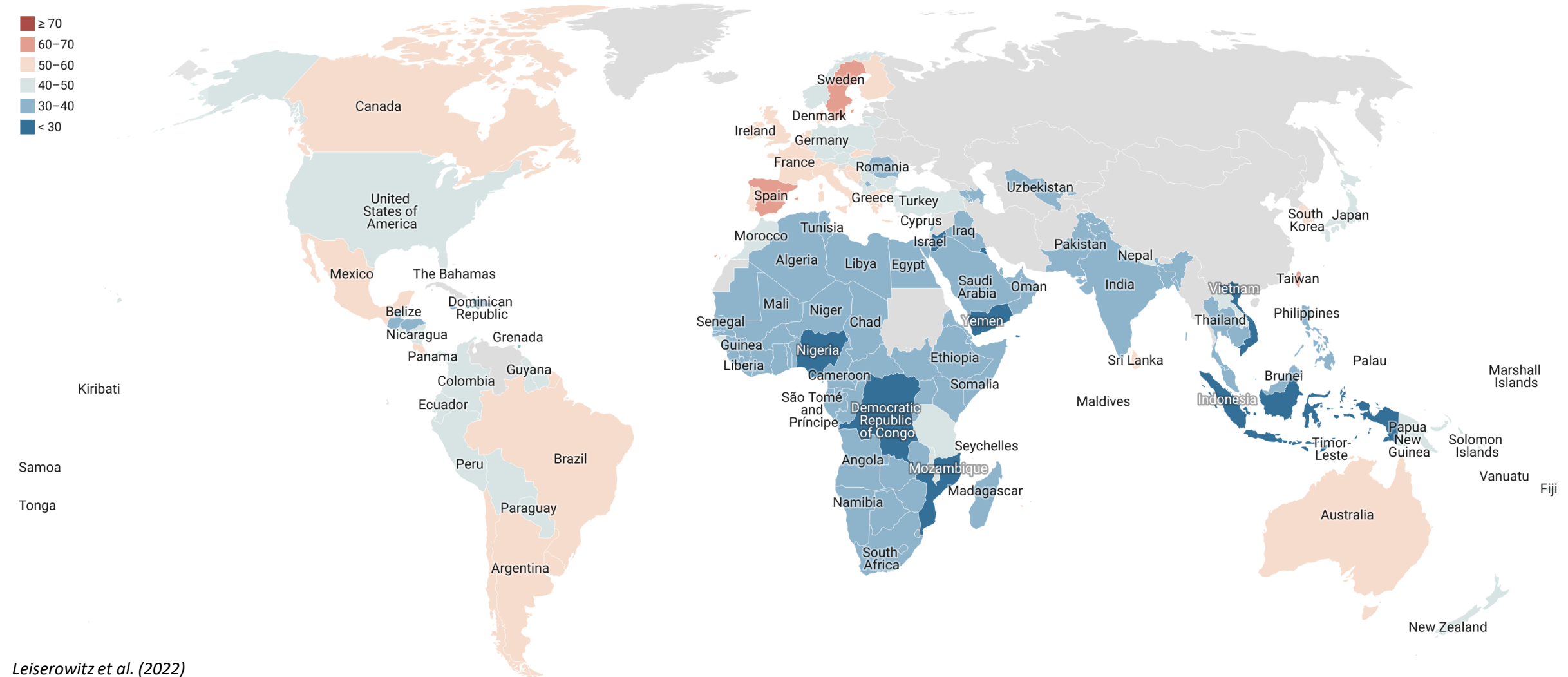
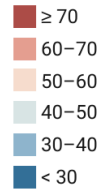


modified from Bullard (2024)

#9 The pressure of public opinion

Climate change is caused mostly by human activities

% who think climate change is mostly caused by humans



Leiserowitz et al. (2022)

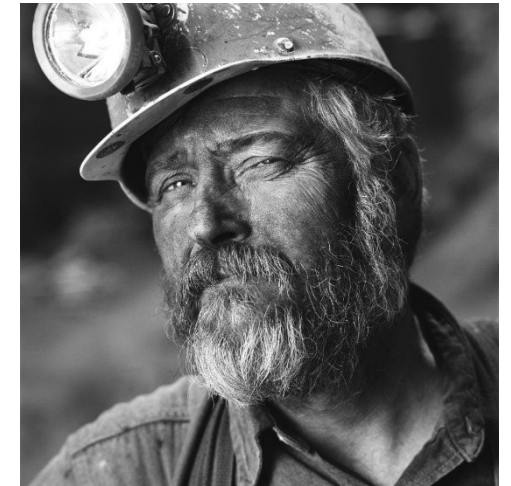
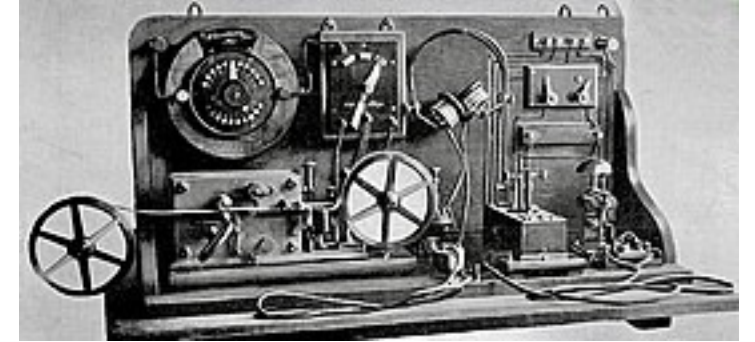
#10+ ...and more threats

- litigation
- geopolitical risks
 - resource nationalism & expropriation
 - energy war
 - attack on infrastructure
- reputation
- technological obsolescence

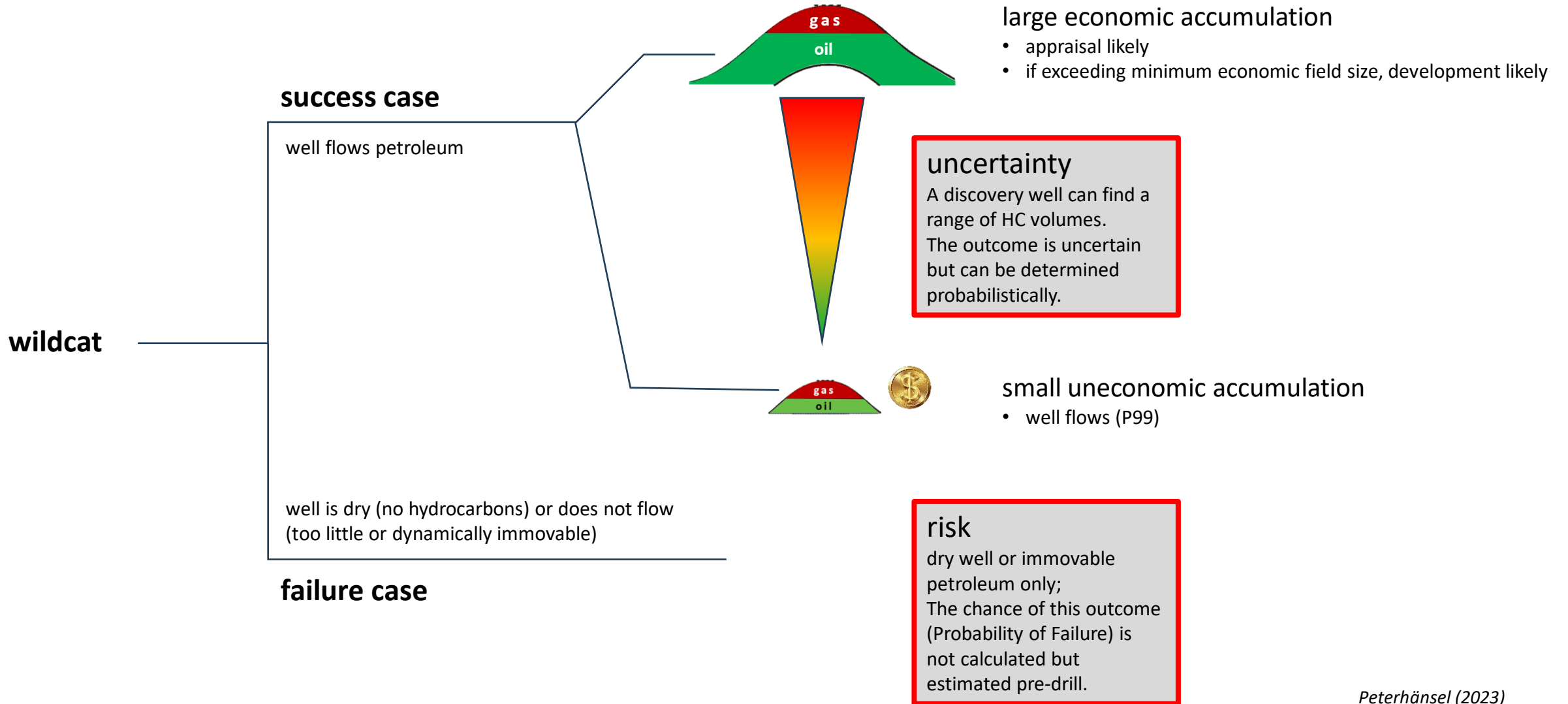


Decline & transformation

- Horse-drawn carriages & blacksmiths
- film photography
- typewriters
- CDs & DVDs
- Telegraph industry
- Coal Mining in the UK



Risk & uncertainty (1)



Peterhänsel (2023)

Risk & uncertainty (2)

energy
transition

success case

energy transition
generates profit
exceeding status quo



large economic gain

- appraisal likely
- if exceeding minimum economic size to warrant growth, expansion likely

uncertainty

Successful energy transition can make a range of profits. The outcome is uncertain but can be determined probabilistically.



small economic gain

- technical success / economic failure (P99)

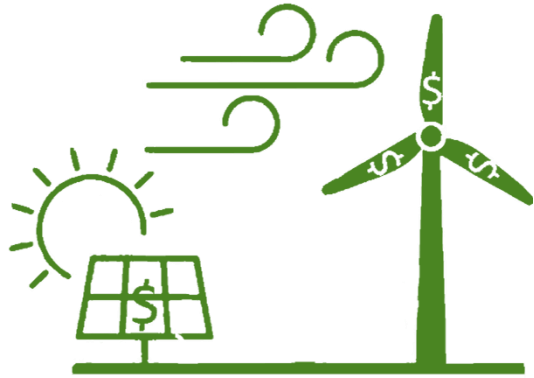
energy transition does not
generate enough profit to maintain status quo

failure case

risk

technically feasible but
economical standstill;
The chance of this outcome
(PoF) is not calculated but
estimated.

Money talks



5-10% rate of return *(in US)*

- low risk – low reward
- attractive to small investors (crowdfunding)
- big investors punishing moves to green (stock value down: BP –20%, 1/2020-12/2022)

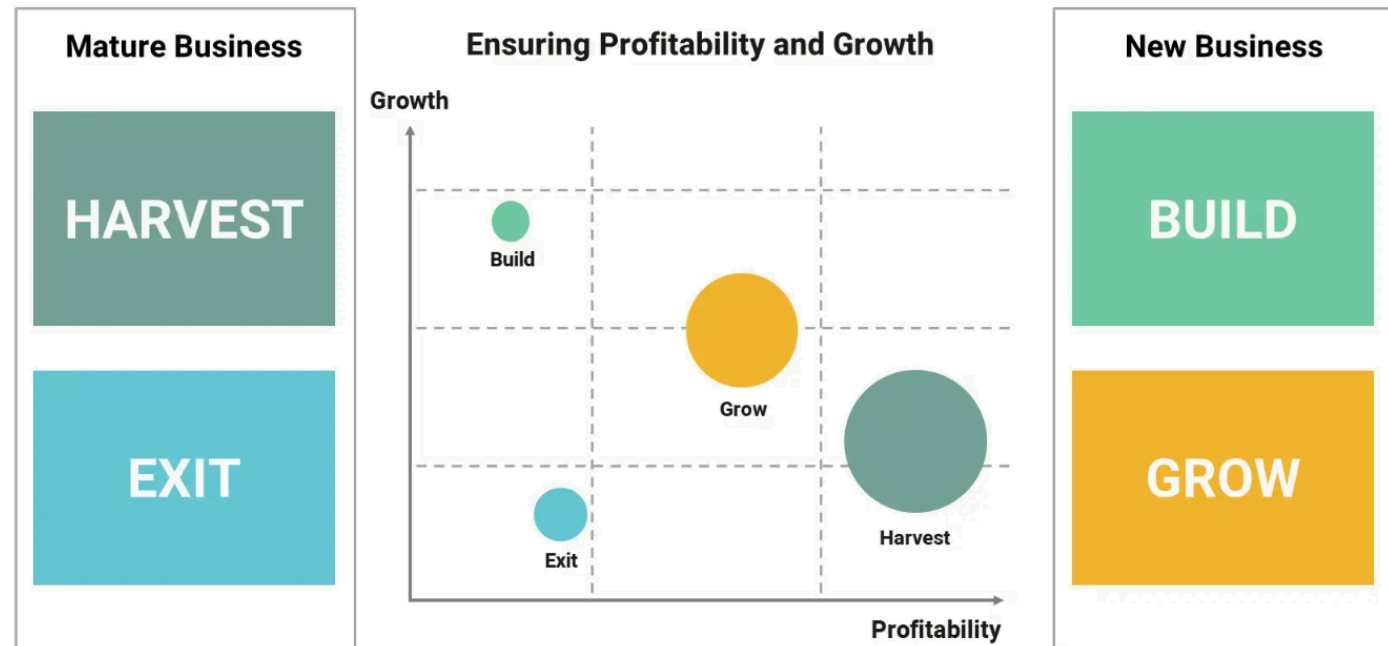
20-50% rate of return *(in US)*

- high(er) risk (volatile) – very high reward
- attractive to big investors (+pension funds)
- rewarded with stock-prices up (Exxon +57%)

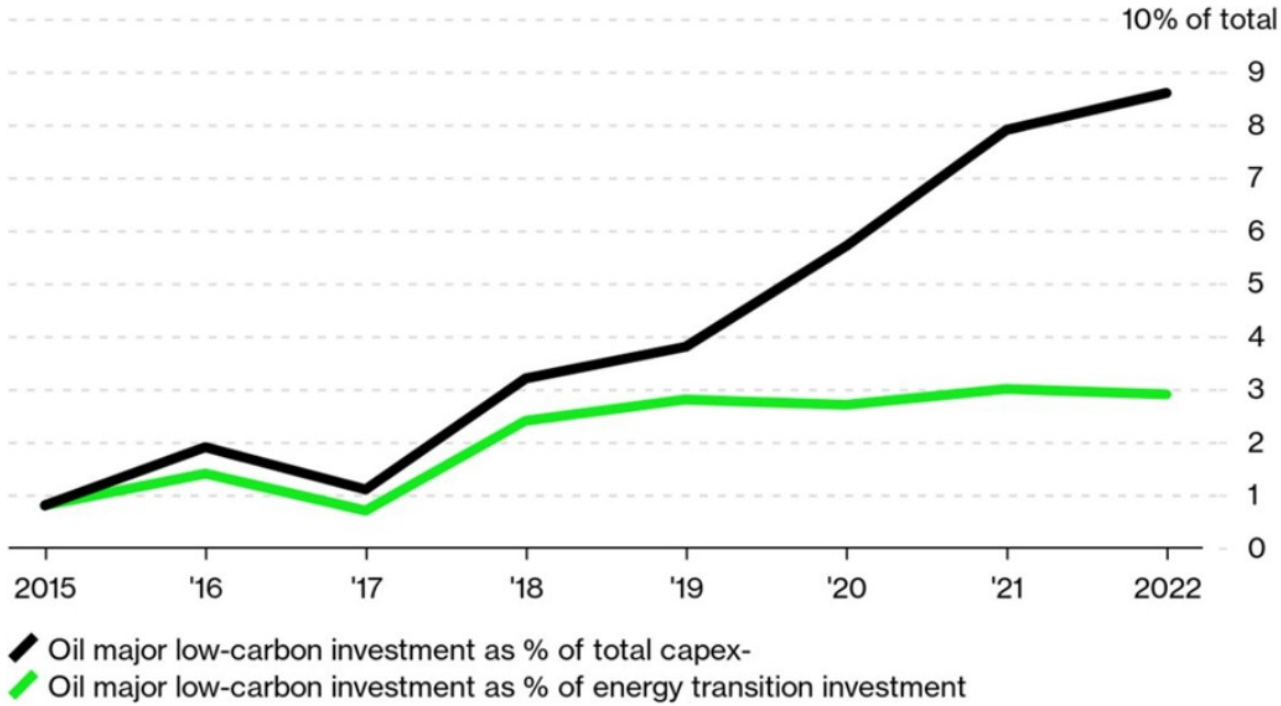
Pickering (2023)

Better bread today than fossil ~~cake~~ jam tomorrow

- Large long-life O&G projects take up to 20 years to repay investment and are more exposed to uncertainty cost of capital.
- Oil majors move away from riskier projects in E&P and focus on shorter-term projects that harvest cash flows early on. **Globally?**
- Some exit projects for fear of loss.

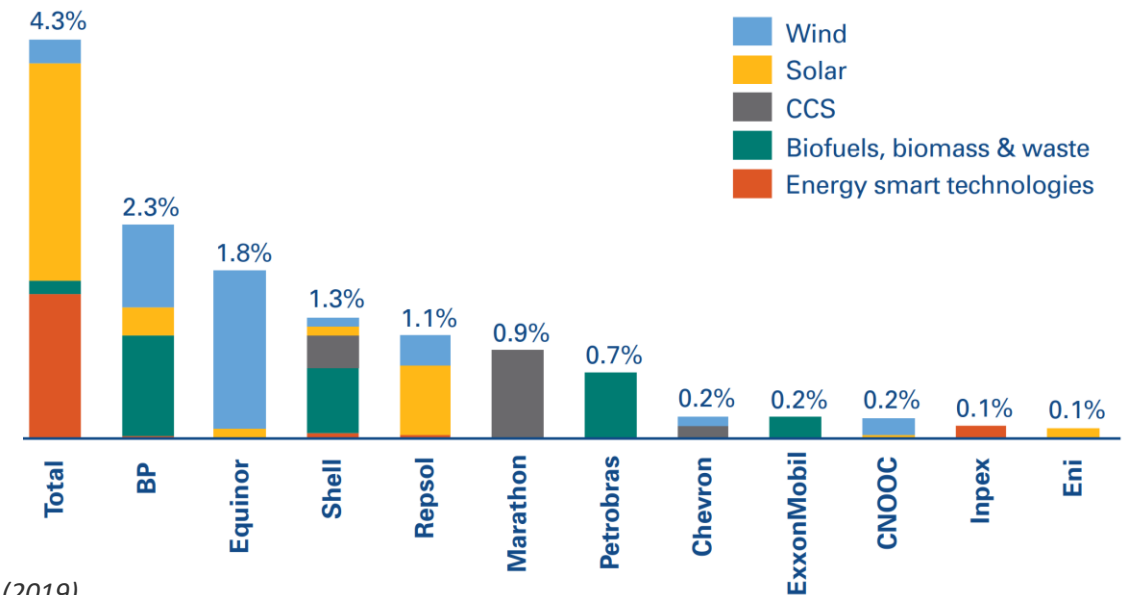


Drivers of the energy transition: not O&G



Bullard (2023)

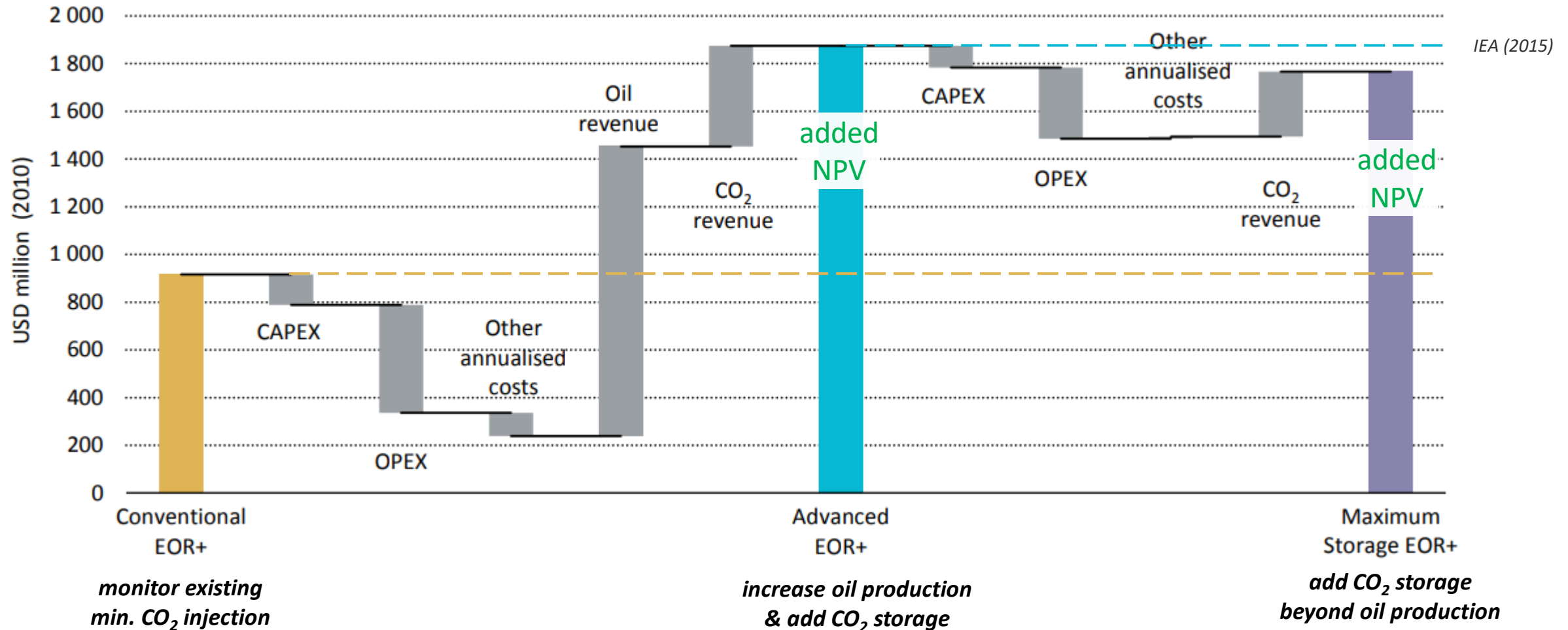
Capex 2010-Q3 2018



Reuters (2019)

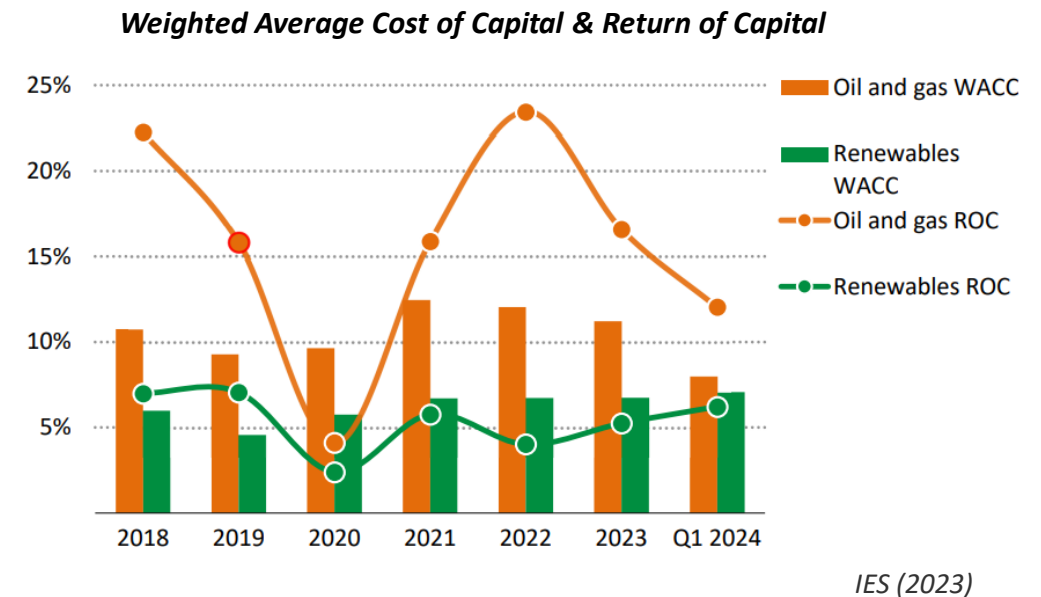
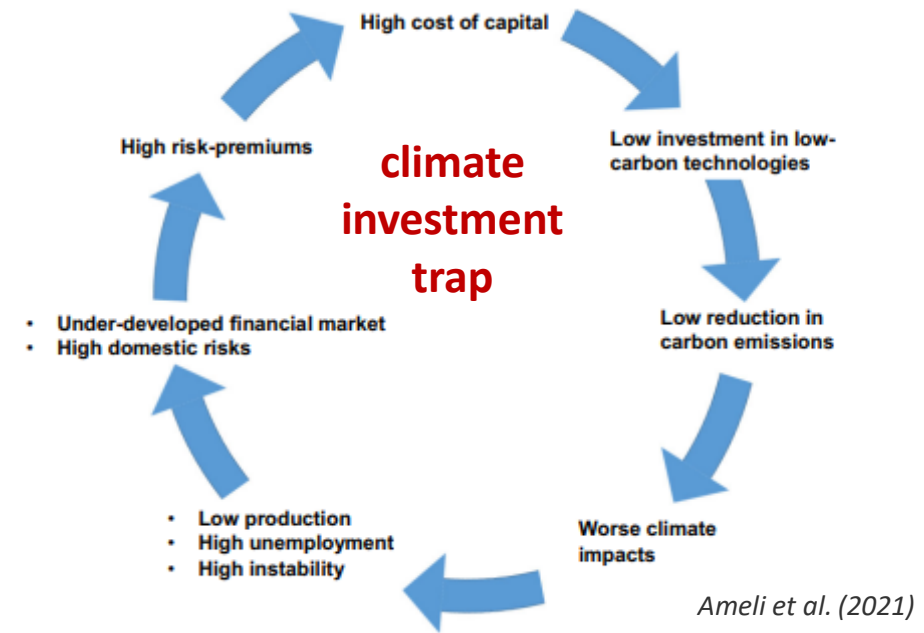
CCS–EOR is making money (because of oil)

... and some more money because of CO₂ storage (co-exploit)



The vagaries of renewables: the downs

- Funding gap in middle- and low-income countries
- much smaller margins
- difficult to gain commanding position in a decentralised / diverse sector
- resource supply constraints
- lack of workforce
- lack of versatility (energy density, efficiency etc.) compared to O&G
- energy intermittency
- lack of infrastructure: storage & grid
- environmental impact: decommissioning, disposal etc.
- ...and when does renewable become net-zero?
- policy uncertainty
- scalability



The vagaries of renewables: the ups

- less volatility / lower price risk than fossil fuels
- policy support reduces price risk
- no carbon pricing
- lower OPEX
- lower risk of loss and collateral damage
- diversification can balance portfolio
- better for the climate
- better for your conscience



\$65 billion (BP only)

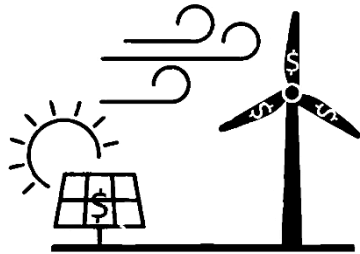


\$4.5 million

We do not want to be the baddies, but...

**contribute to social
goal of climate-
change mitigation**

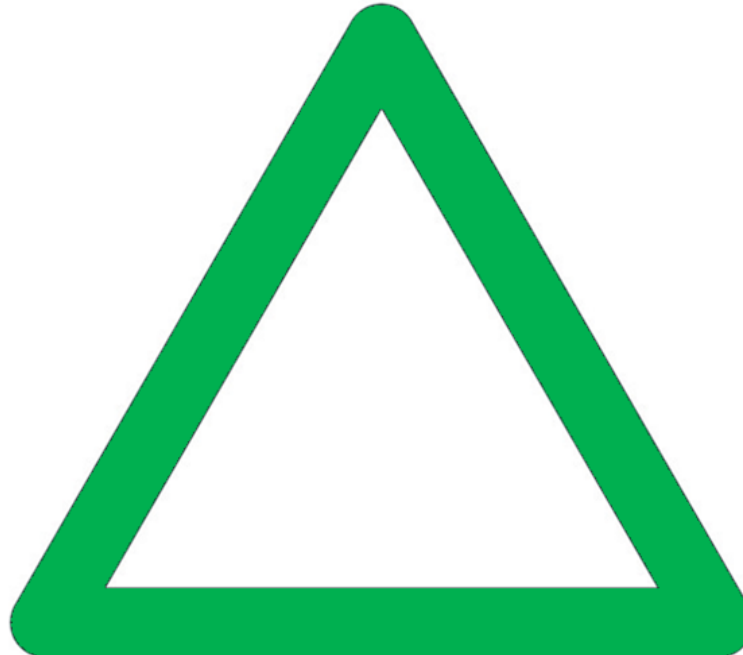
**perform financially to
meet shareholder
obligations**



shared value

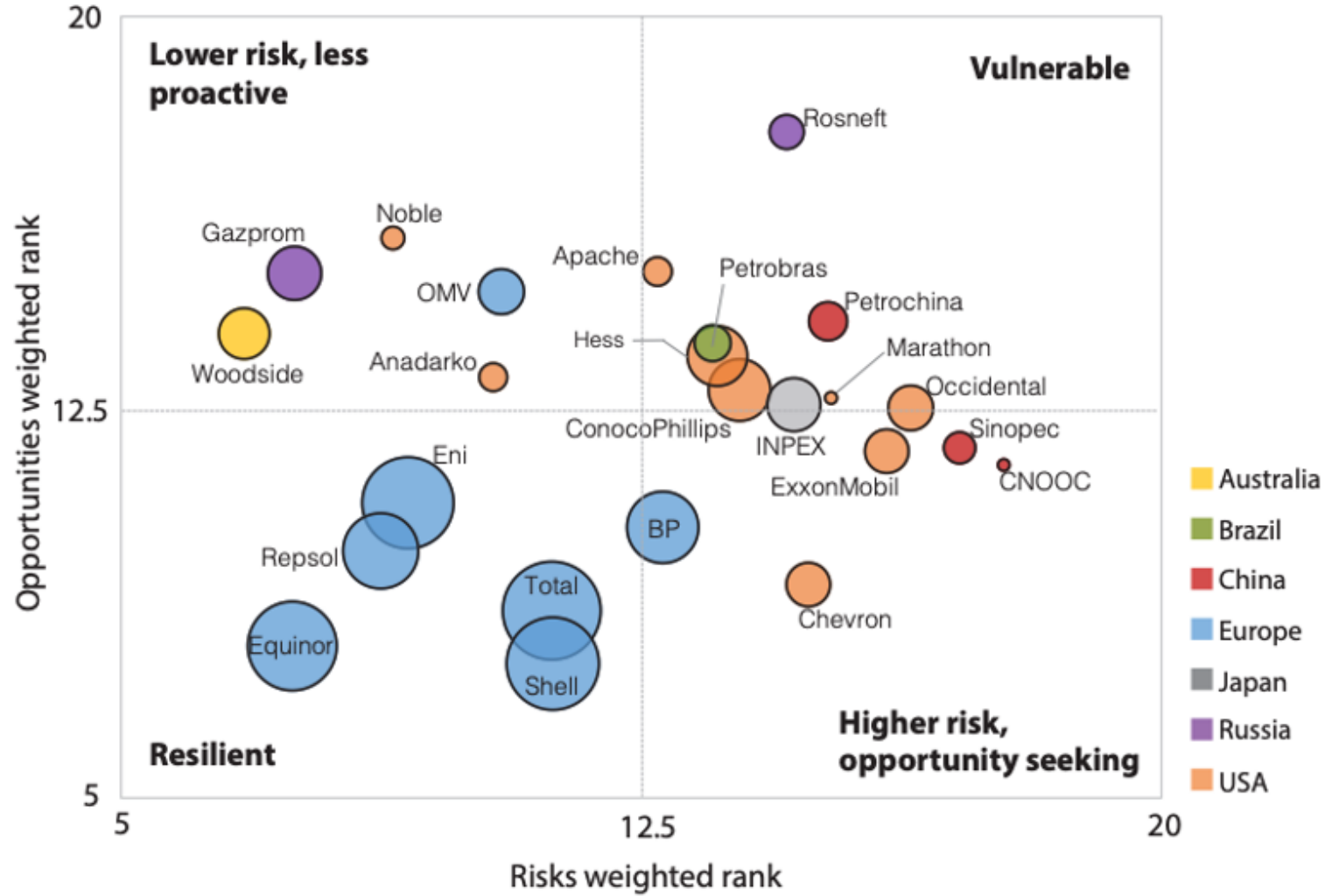


private value



Are you ready?

seeking opportunities



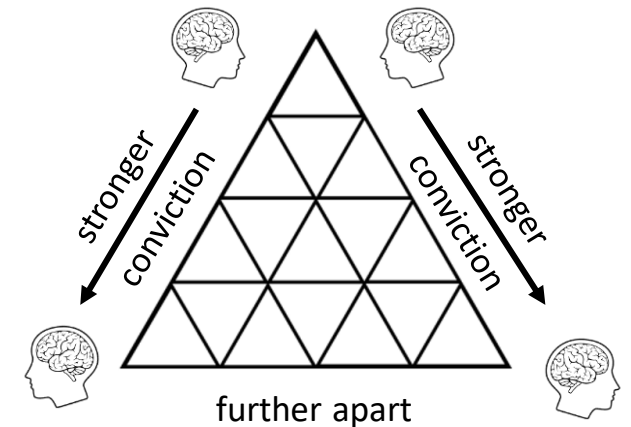
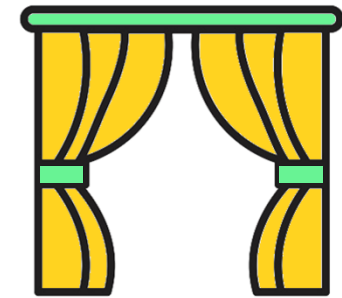
larger bubble = stronger performance on climate governance & strategy

taking risks

CDP (2018)

#1 Strategies – business as usual / dress the window

- Reinvest in oil & gas
- Lobby for ‘business as usual’ banking on malleability of leaders & public opinion
- show efforts of climate-change mediation
 - ❑ guarantees **high margins** (for now)
 - ❑ has worked for O&G for 50 years, may still work in some areas
 - ❑ avoids major disruption
 - ❑ contributes to concealing facts
 - ❑ brings about political divergence of leaders
 - ❑ polarises people
 - ❑ impacts emissions/climate
 - ❑ impacts reputation: fig-leave investments, e.g. CCS (but economics still not proven)



modified from Tavis & Aronson (2007)

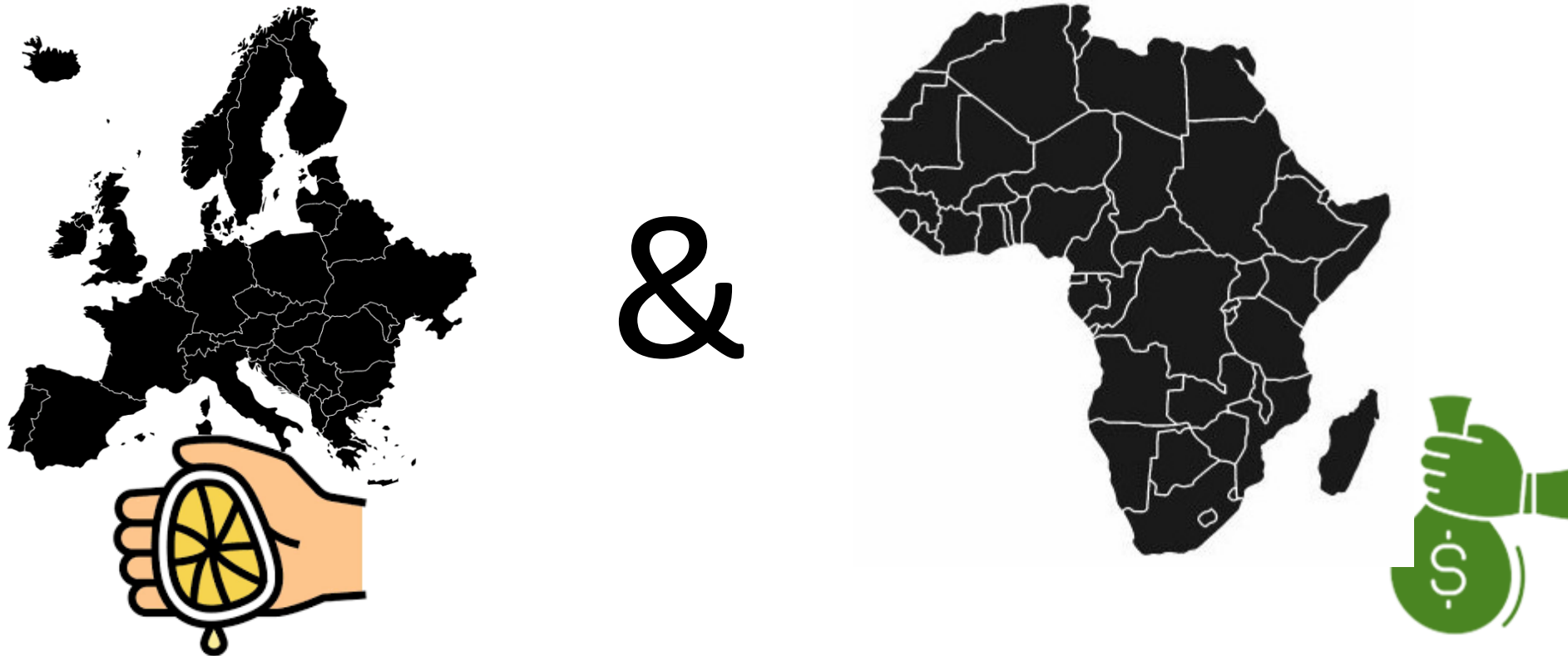
#2 Strategies – squeeze the lemon

- harvest
 - ❑ maximise cashflow from existing
 - ❑ divest non-core or restructure
 - ❑ M&A
 - ❑ improve efficiency
 - ❑ reduce cost



#3 Strategies – squeeze here & grow fossils there

- harvest in declining areas with 'renewable-favouring' jurisdictions, e.g. Europe
- invest in areas where fossil fuels are predicted to grow with less resistance, e.g. Africa, Asia



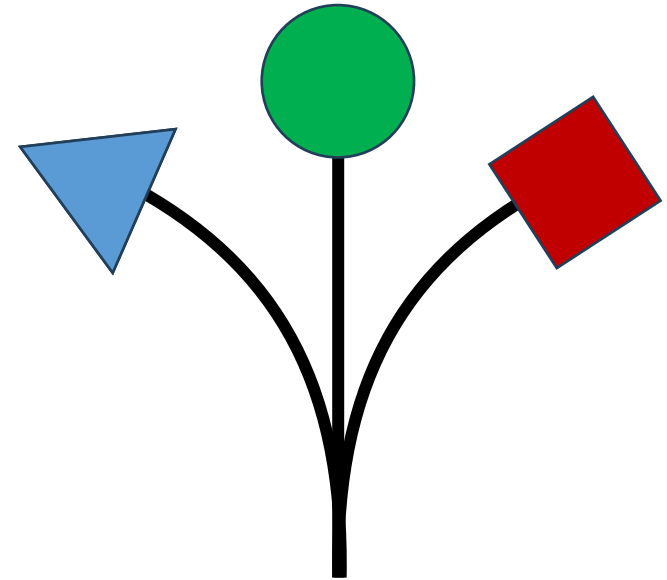
#4 Strategies – move when the time is right

- use savings to buy out renewable companies when fossils will fall from grace depending on individual companies' metrics
- or 'marry' well by merging with other companies who have advanced in green tech



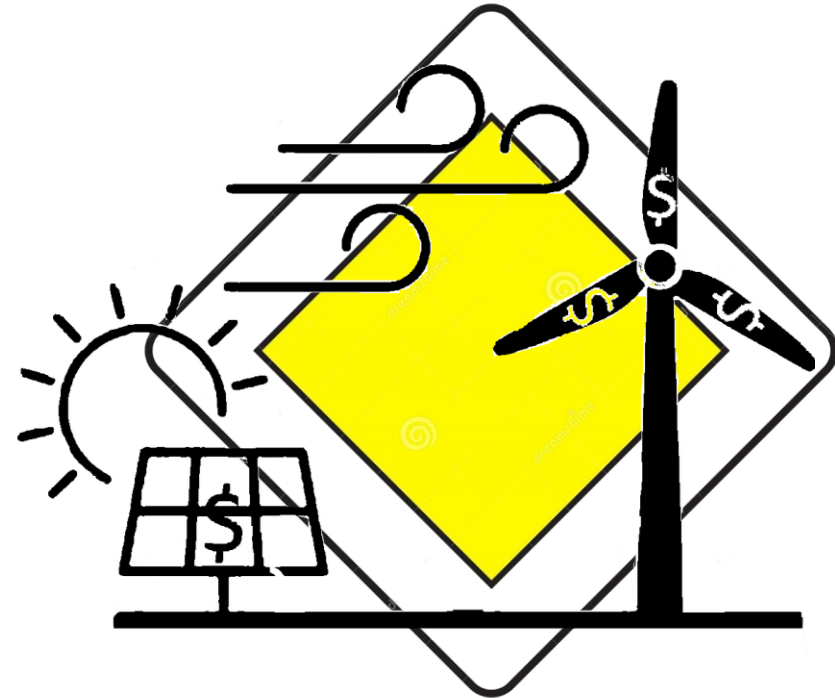
#5 Strategies – diversify and do it all

- continue in oil & gas where profitable
- acquire environmental credentials by lowering upstream carbon intensity
- invest in and build other business pillars, e.g.
 - ❑ energy storage
 - ❑ electrical vehicle charging infrastructure
 - ❑ CCS



#6 Strategies – all change & exit

- drop fossils and move into renewables
- accept smaller margins and loss of investors
- deal with teething problems
- weigh out downsides and upsides



■ Which team do you belong to?



#1
business as
usual



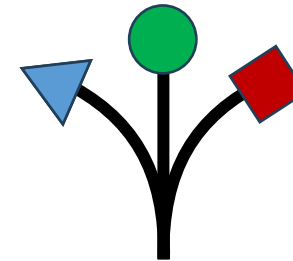
#2
squeeze
the lemon



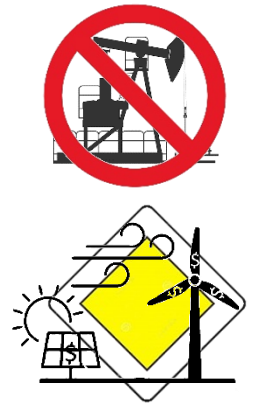
#3
squeeze here &
grow there



#4
move when
it's right
& marry



#5
diversify



#6
all change

Never change a winning horse (?) – Climate & Energy Benchmarking



#1

business as
usual



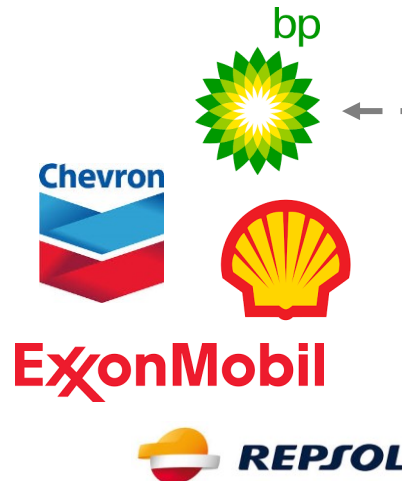
#2

squeeze
the lemon



#3

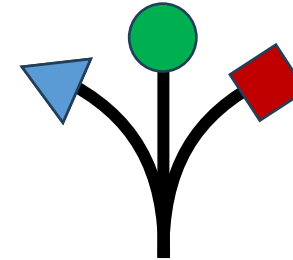
squeeze here &
grow there



#4

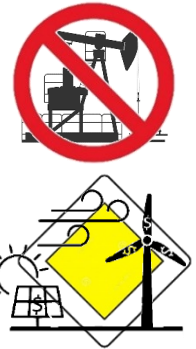
move when
it's right
& marry

scored >40/100
highest 56/100



#5

diversify
(a little)



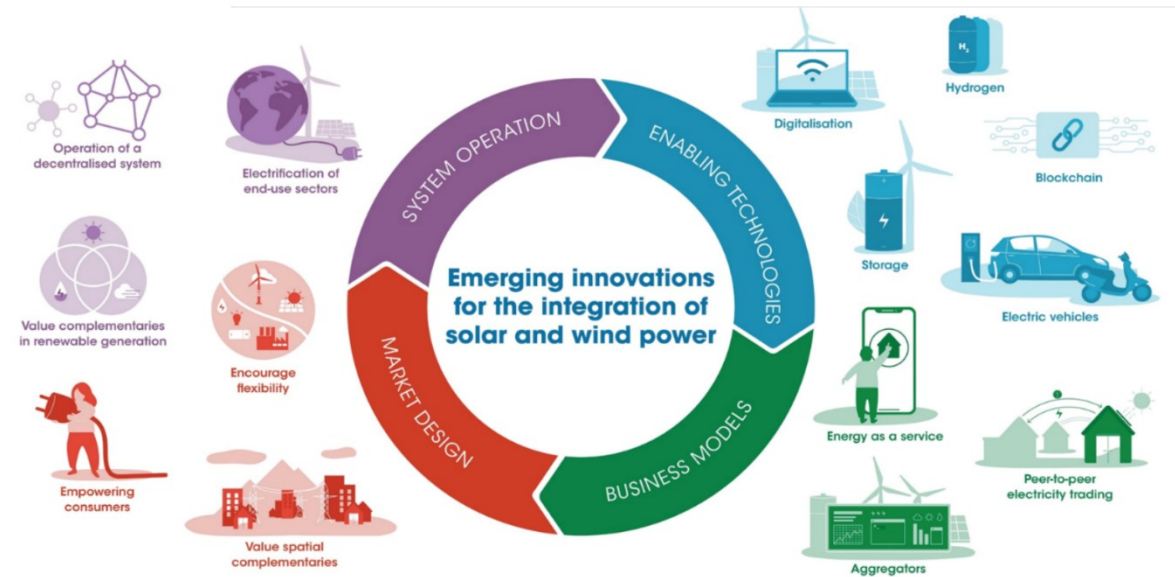
#6

all change



Energy transition – What should oil companies do?

- **Protect the interest of shareholders**
- Lower upstream carbon intensity
- Diversify to stay in the game
- Innovate, e.g. check hydrogen
- Use carbon trading and offset
- Invest in CCS, energy storage & geothermal (?)
- Invest in polymers (demand tripled in 20 years)
- Invest in electrical vehicle charging infrastructure
- Shine in project management
- Use market access and expertise
- Work with transition time
- Compare long term or short term: mix and match what is best for your business model
- Today's snapshot says, renewables everywhere and fossils somewhere (Africa, Asia – India); tomorrow's snapshot says...



Gielen & Boshell, World Economic Forum (2023)

Seize the opportunities



- Engage with the contradictory elements of the situation, and you will stay creative.
- Look forward not backward
- Leave your echo chamber
- Listen & learn to understand market trends, technological advancements & regulatory landscape
- Recognise the risks
- Leverage and build on your strengths
- Where are your priorities?
- Timing is everything

And the bottom line...

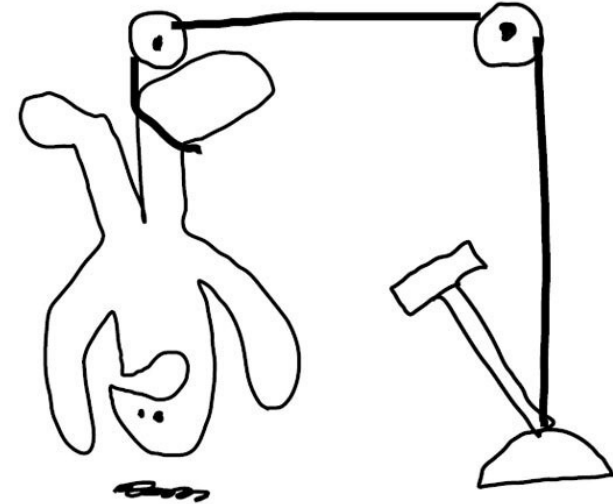
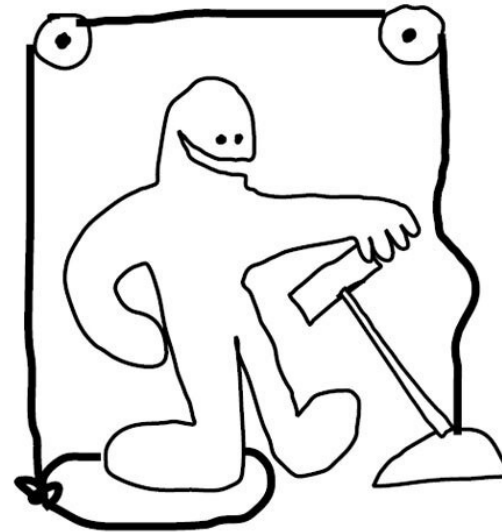
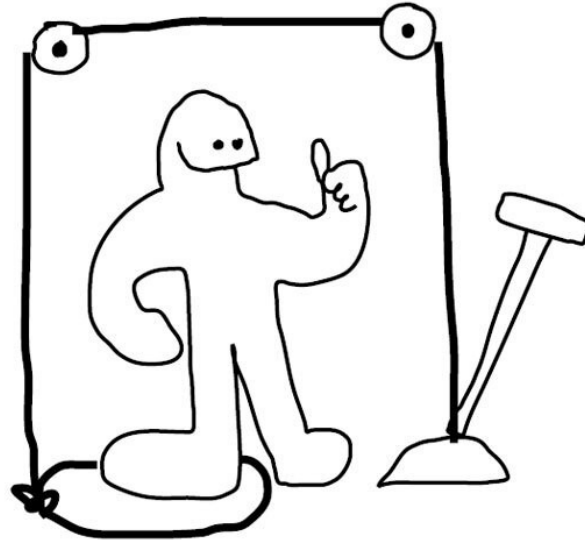
- The economist says: Unless political pressure changes the rules, stay in the oil game and you can still win big (in many places) – for now.
- The climatologist says: Unless you want to risk experiencing further extreme weather events, we need to stop emissions somehow.
- The sociologist says: Hey, sort this out fast, or it gets worse.

Have I overlooked anything?



- historical carbon debts
- carbon inequality
- climate vulnerability by area
- greenhouse gas accounting (TCFD scopes & metrics)
- geothermal
- hydrogen etc.
- negative emissions
- geo-engineering
- etc.
- etc.

Have I overlooked anything?



Bloomberg (2021)



THANK YOU!

FUSION
anyone?

