

Scottish Energy Forum

Climate change and stranded assets : what are the risks?

Mark Campanale

Founder & Executive Chair, 11th November 2021

Carbon Tracker Initiative – founded in 2011

Identity

Carbon Tracker is an independent non-profit financial think tank funded by EU and US foundations interested in climate.

Vision

To enable a climate secure global energy market by aligning the capital markets with climate reality.

Mission

Mapping the transition for the fossil fuel industry to stay within a “well below” 2 degrees budget.

Strategy

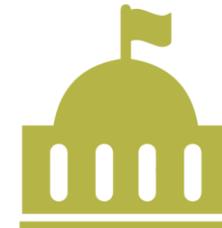
Empower **investors** to identify and switch off capital to the highest cost, highest carbon projects.



Engage with **companies** to re-assess both the viability of such projects and of their business model.



Educate mainstream **financial markets and policy-makers** over the risk of a disorderly transition.



Work with **financial regulators** to bring transparency on carbon and stranded asset risk and the fossil fuel risk premium.



Fossil Fuel Investment Risks - Key takeaways

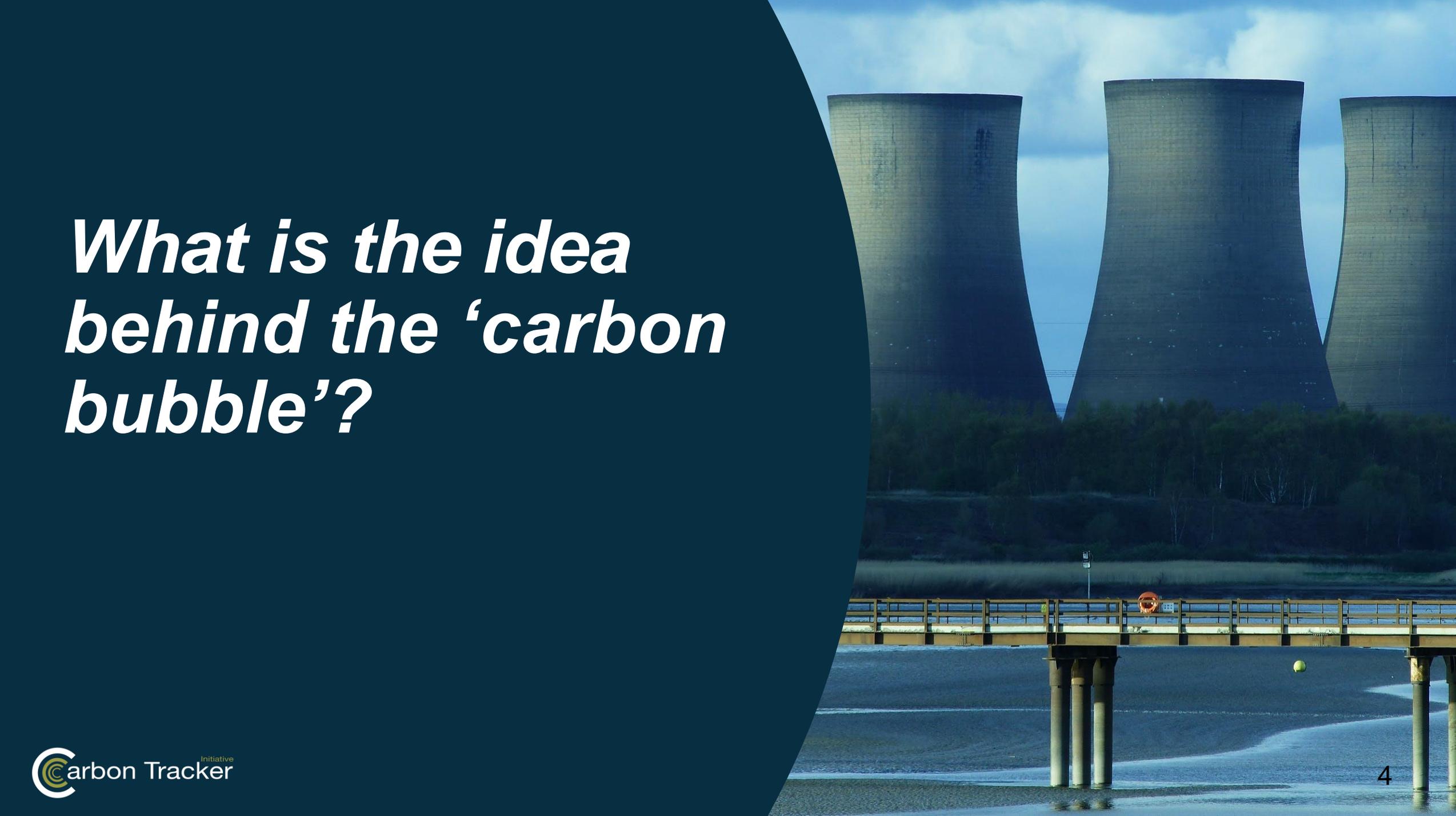
- 1 Climate science shows that there are **finite limits** to carbon emissions for any given warming outcome

The carbon budget
- 2 Far more fossil fuel is available than fits within these limits – higher cost assets run greater risk of **destroying value** in the energy transition

Stranded assets
- 3 Falling renewable costs, air pollution and import dependency drives a tipping point that the **suspending new investment in fossil fuels is clearly based on a financial imperative**

Energy disruption
- 4 **Investors lose money at the peak, not when the system has changed.** Engaging to stop fossil fuel expansion may reduce direct company balance sheet risks and prepare for managed decline

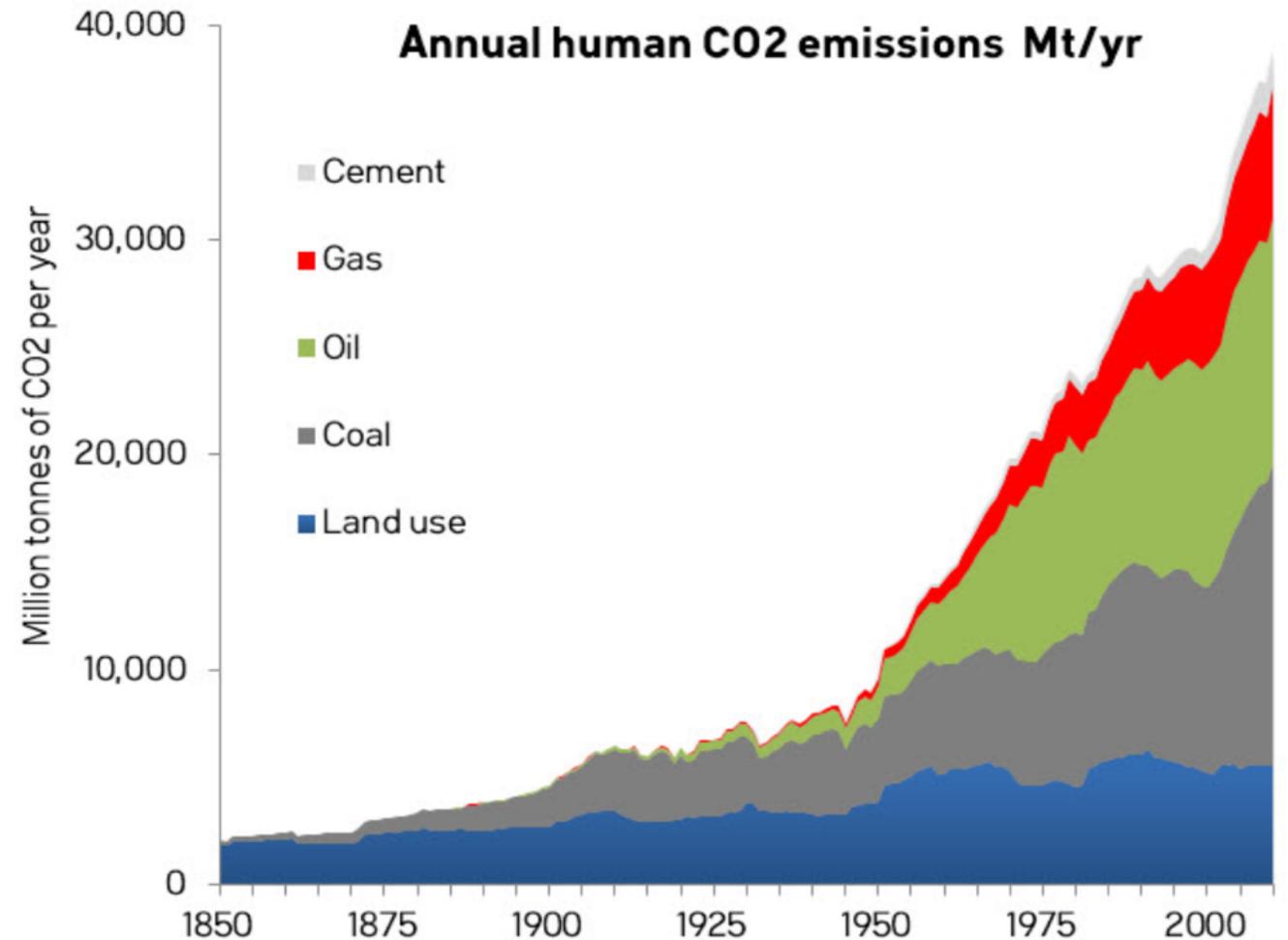
Investors need to act

A photograph of three large, grey, hyperboloid cooling towers of a nuclear power plant. The towers are set against a blue sky with light clouds. In the foreground, there is a wooden walkway with railings over a body of water, supported by concrete pillars. The water is calm, and there's a yellow buoy visible. The overall scene is industrial and serene.

What is the idea behind the 'carbon bubble'?

Fossil fuel emissions keep rising

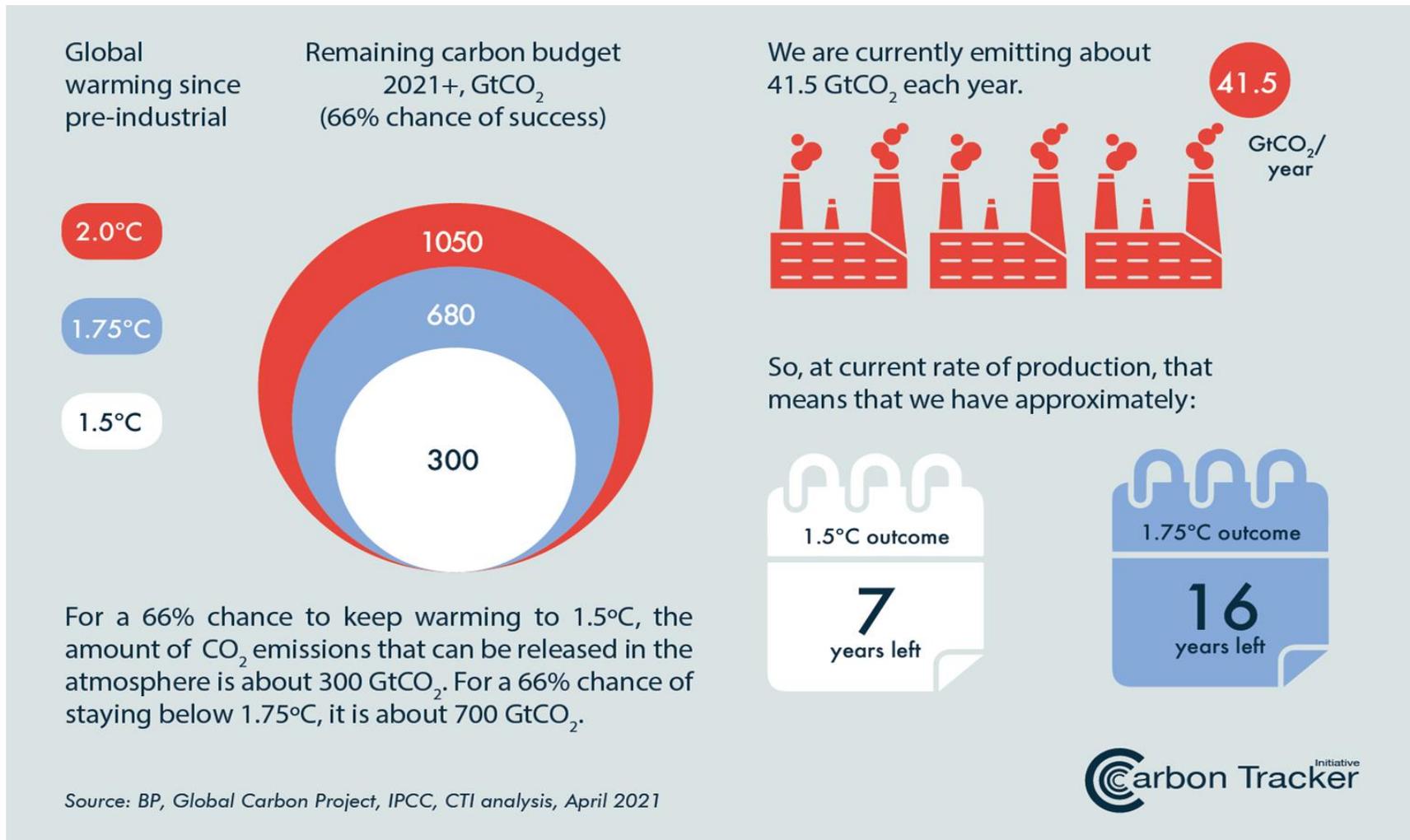
- **Emissions:** Steep rises in emissions from coal and oil in the 1960s and again in the 2000s.
- **Atmospheric CO2:** its the total accumulation of warming gases in the atmosphere that counts.
- **Duration:** Methane is short lived, but CO2 can remain for 200 years
- **Concentration:** at 416 ppm, carbon dioxide levels are higher than at any point in at least the past 800,000 years.



Source: CDIAC data and www.co2.earth

Reminder: Global Carbon Budget; its tight!

- Total GHG Emissions define the warming outcome for the planet
- To stabilise warming, we must reach "Net Zero" emissions globally
- To achieve a 1.5°C warming outcome with 66% chance there are just **7 years** left at current rates

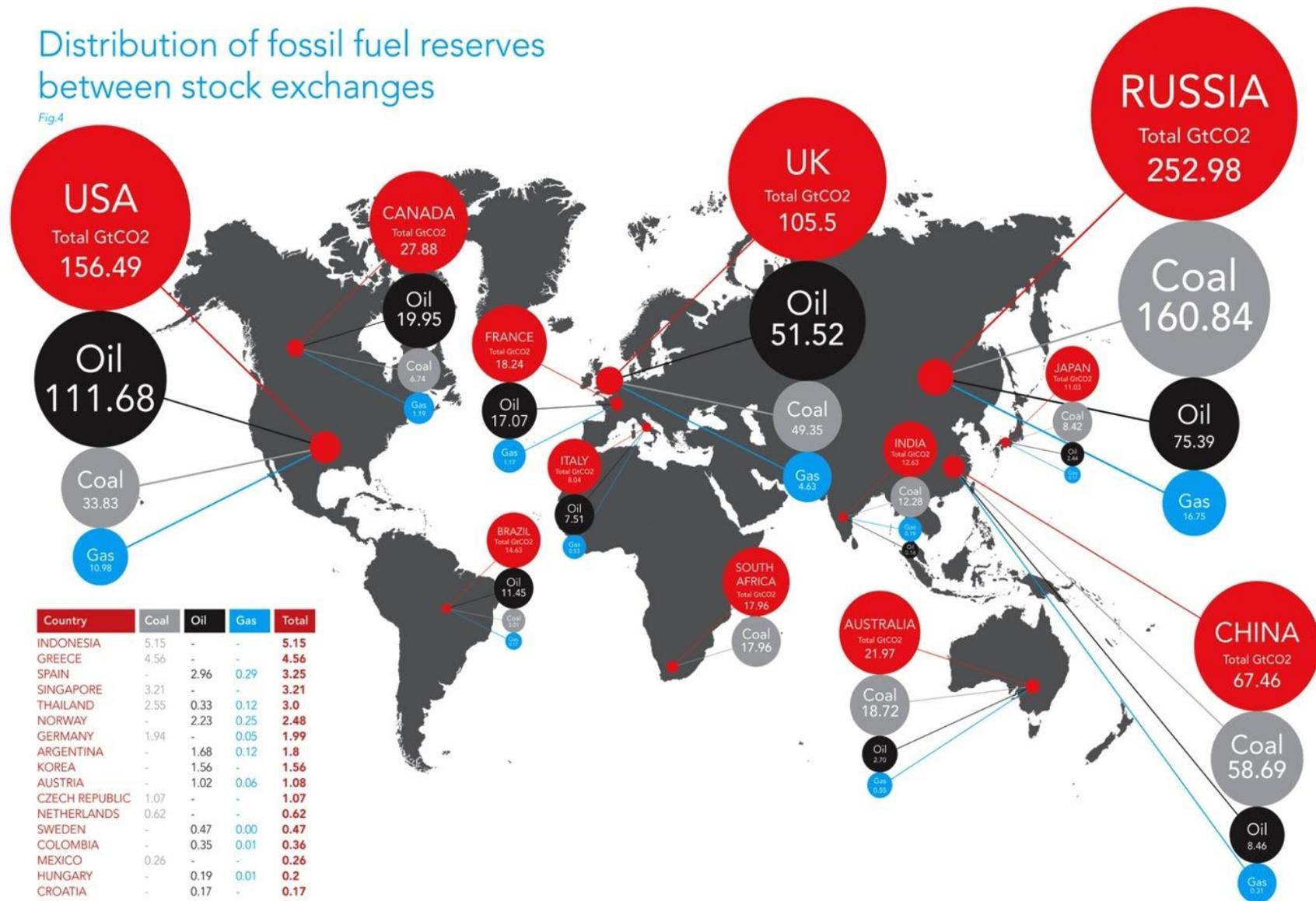


We can't burn it all

Climate risk understood through the lens of stock exchanges

Distribution of fossil fuel reserves between stock exchanges

Fig.4



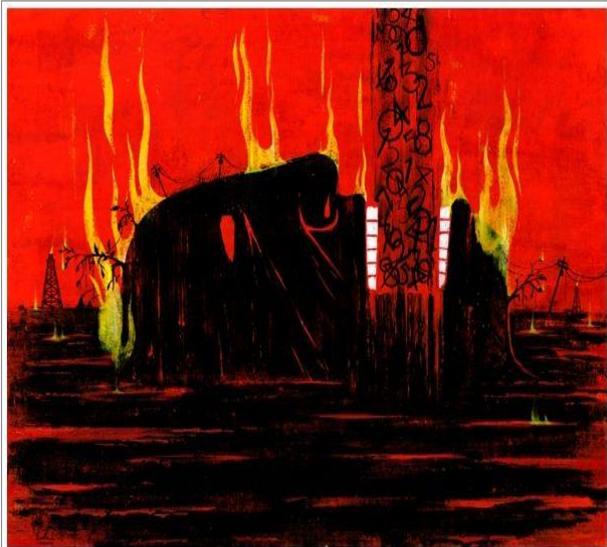
Carbon Tracker – Unburnable Carbon....



Global Warming's Terrifying New Math

Three simple numbers that add up to global catastrophe - and that make clear who the real enemy is

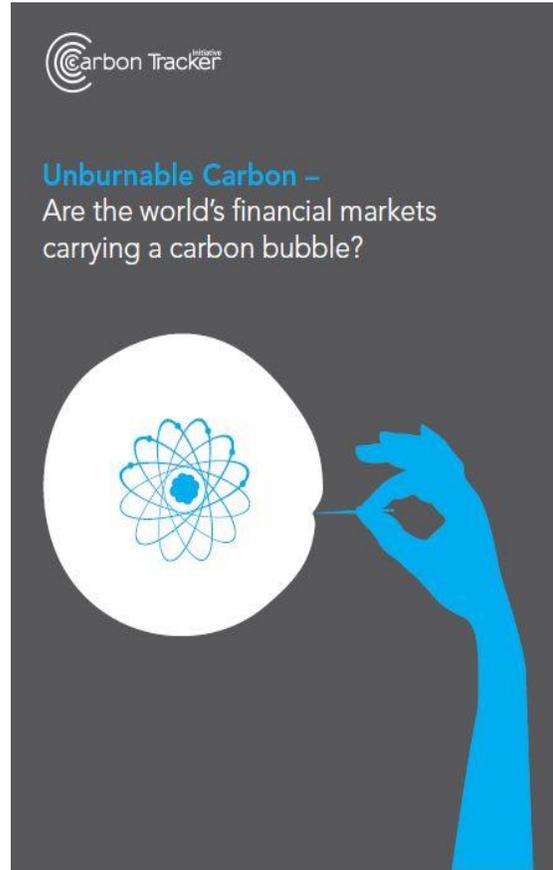
Like 139k Tweet 15.2K +1 3.9k Pin it 460 7,783 Comment 10171



"...an easy and powerful bit of arithmetical analysis first published by financial analysts in the U.K. has been making the rounds...

(it) up-ends most of the conventional political thinking about climate change. And it allows us to understand our precarious position with.... simple numbers".

Bill McKibben, 2012



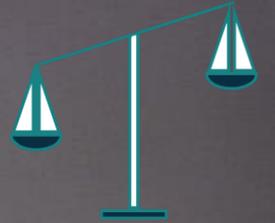
350.org

The carbon budget renders ‘the vast majority of reserves “stranded” – oil, gas and coal that will literally unburnable’.

The abrupt transition to a low-carbon future is ‘a financial stability risk’.

Mark Carney,
Governor of the Bank
of England, 2015

FINANCIAL REGULATION



Banks and rating agencies write on stranded assets



“Carbon Tracker has changed the financial language of climate change.”

theguardian 2015



From a standing start

To

Being central to the debate

STRANDED ASSETS...

An anti-fracking protester at a drilling test site near Salford. BlackRock's move suggests the fight against fossil fuels is entering the

Unusable reserves: it's hot air, say analysts A recent report by the Carbon Tracker Initiative which argues that much of the world's stock of hydrocarbon reserves can never be burnt if we are to avoid runaway climate change has met with widespread scepticism. **FINANCIAL TIMES** JULY 31, 2011

Of all the recent ideas climate change campaigners have come up with to convince the world to do more to curb global warming, none has been as potent as the concept of stranded fossil fuel assets. **FINANCIAL TIMES** September 30, 2015 5:19 pm

Fossil fuel reserves held by companies listed in London
Gigatonnes of CO₂



Source: Carbon Tracker

BlackRock's FTSE deal shuns fossil fuel companies

By Pillita Clark, Environment Correspondent

BlackRock, the world's biggest fund manager, has teamed up with London's FTSE Group to help investors avoid coal, oil and gas companies without putting their money at risk.

In a sign that a global campaign against fossil fuels is entering the financial mainstream, companies that extract or explore for such fuels are excluded from a new set of indices

specifically bar fossil fuel companies. A precise list of excluded companies has not been released but some of the best known names on the London Stock Exchange will be targeted, from oil and gas producer BP to coal miner BHP Billiton.

The groups that are included range from tech companies such as Apple, Google and Microsoft to a number of large US banks and pharmaceutical companies such as Johnson & Johnson of the US and Swit-

'Carbon bubble' drives debate

When a small London think-tank named Carbon Tracker started publishing reports on something it called the "carbon bubble" three years ago, few took too much notice, writes Pillita Clark.

Today, there is much debate about its idea that more than \$670bn is invested annually in fossil fuel assets that could plummet in value if governments try to curb

of its assets "stranded".

Others have reached different conclusions. The fossil fuel industry stands to lose \$28tn of gross revenues during the next 20 years if countries ever reach a meaningful deal to crack down on climate change, European financial services

\$28tn

fossil fuel holdings, said Kevin Bourne, a FTSE managing director.

"This is one of the fastest moving debates I think I've seen in my 30 years in markets," he said.

A US campaign modelled on the 1980s anti-apartheid divestment movement has led several small colleges and endowments in that country to sell out of their fossil fuel holdings.

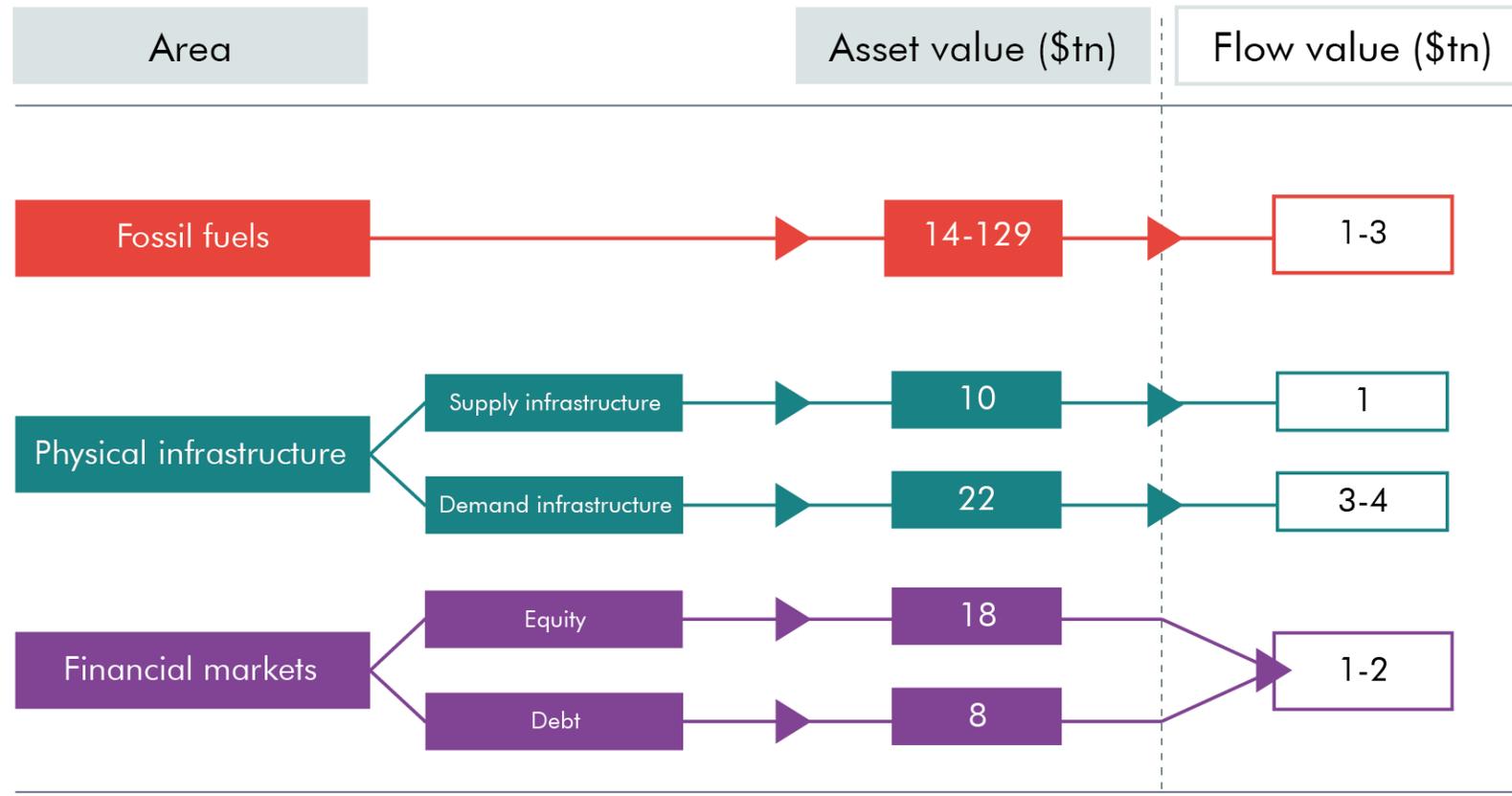
But larger groups, including Harvard University, have resisted pressure to

"So far it's been relatively niche players that have divested and that is why this launch is game-changing," said NRDC executive director Peter Lehner.

Still, hurdles remained when it came to large pension funds shifting big pots of money away from the fossil fuel industry, said Craig Mackenzie, investment director at Aberdeen Asset Management. "The question is, 'will going fossil free have an investment performance impact?' and

Financial Footprint: the fossil fuel system is huge

THE FOSSIL FUEL SYSTEM IN NUMBERS

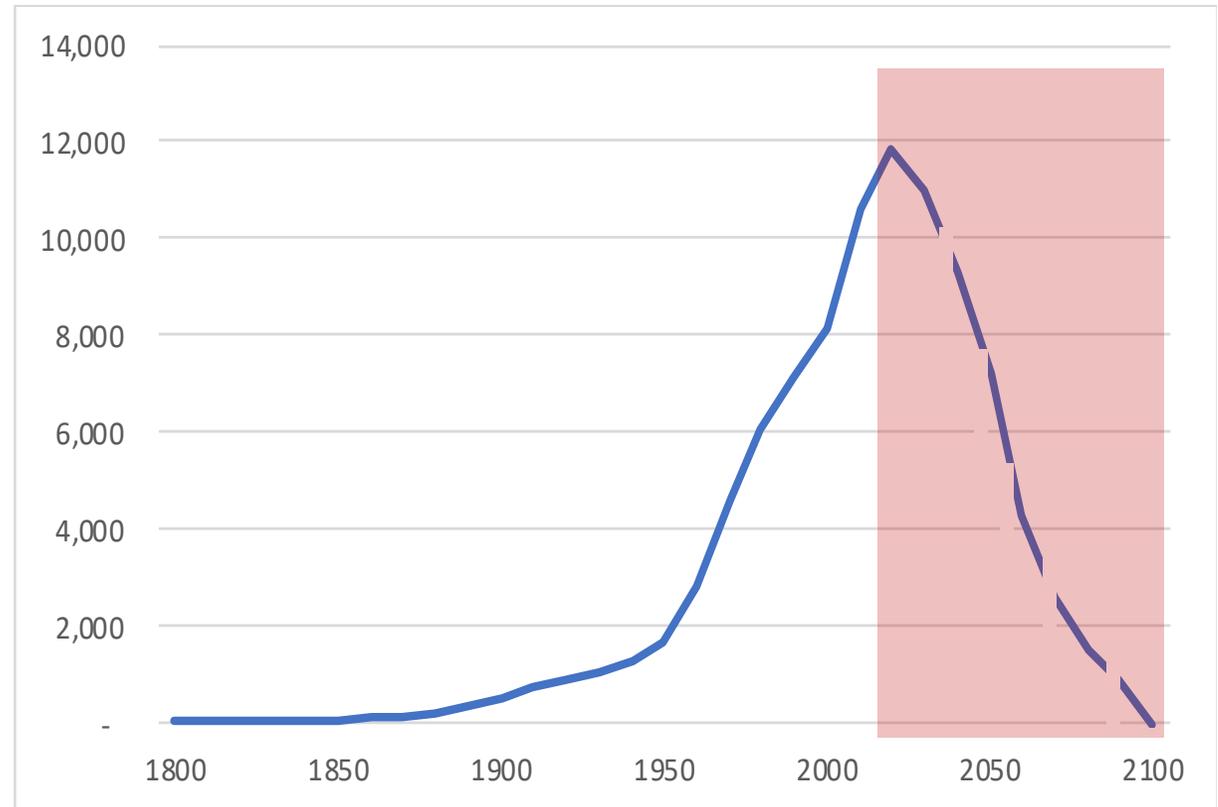


Source: CTI analysis

Energy Transition– massive change required

- We have built up an enormous fossil fuel system over the last 200 years
- **\$10tn of energy supply** infrastructure and **\$22tn of demand** infrastructure
- **25% equity** markets and **50% of non-financial corporate bond** markets
 - *Accelerated depreciations?*
 - *Impairments and asset write-downs?*
 - *Unexpected liabilities such as underfunded asset retirement obligations?*
 - *Can incumbents pivot business models?*

Fossil fuel demand (mtoe)

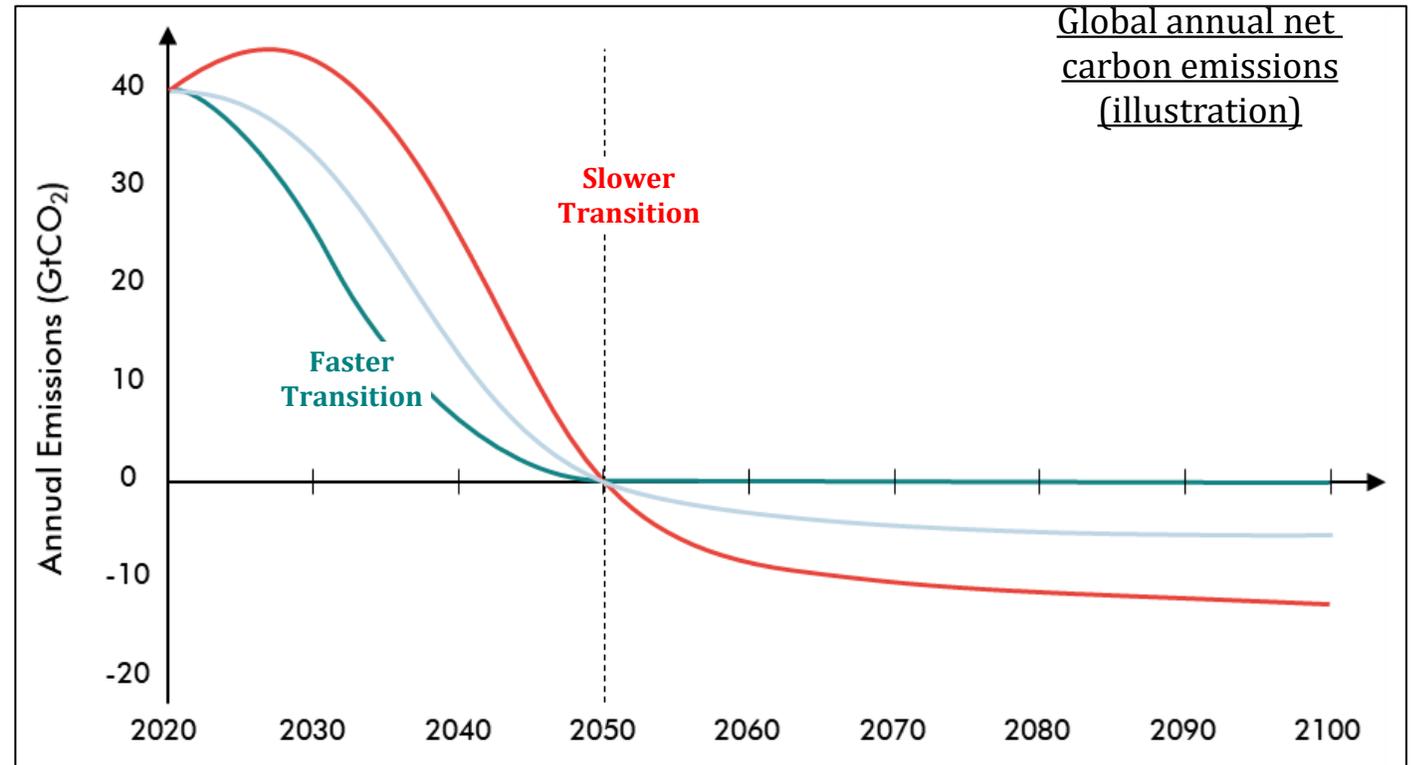


Source: Smil, BP, DNV, Carbon Tracker

**What does this all mean
for companies whose strategy is
based on fossil fuel demand
growth?**

Climate goals: the pathway to net zero matters

- Aggregate emissions => temperature outcome
- Net zero reached via **many pathways**
- Temperature “**overshoot**” may not be reversible
- Negative emissions technologies unproven



Source: CTI analysis “Absolute Impact” (June 2020)

IEA, 1.5CNZ = no new investment in fossil fuels



No new oil, gas or coal development if world is to reach net zero by 2050, says world energy body

Governments must close gap between net zero rhetoric and reality, says International Energy Agency head

EDITORS' PICK | May 18, 2021, 04:14am EDT | 2,723 views

End New Fossil Fuel Development, IEA Demands In Groundbreaking Net Zero Plan



David Vetter Senior Contributor ⓘ
Sustainability

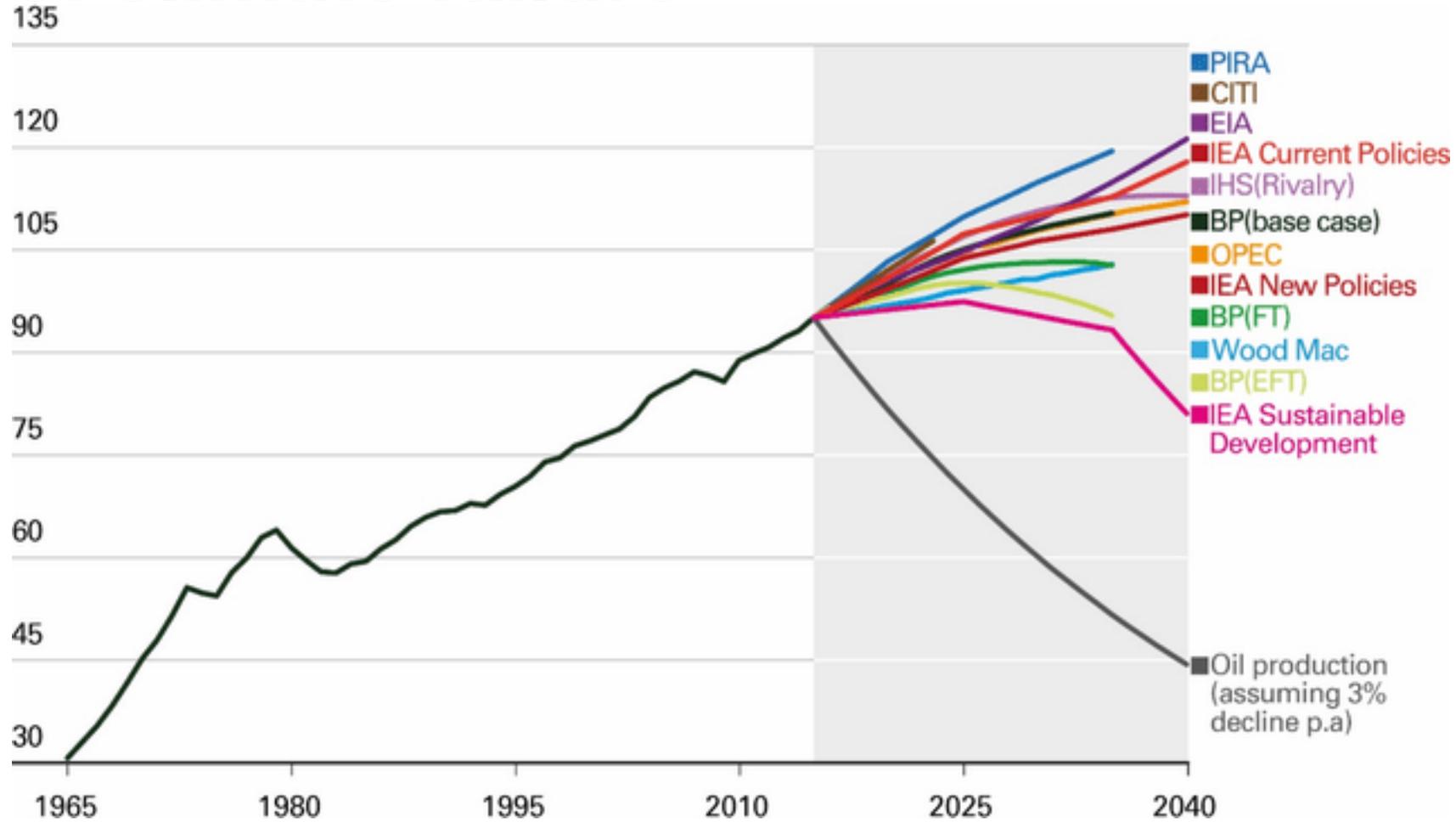
Forbes

The Guardian

... Key scenarios in oil demand modelling expect climate failure

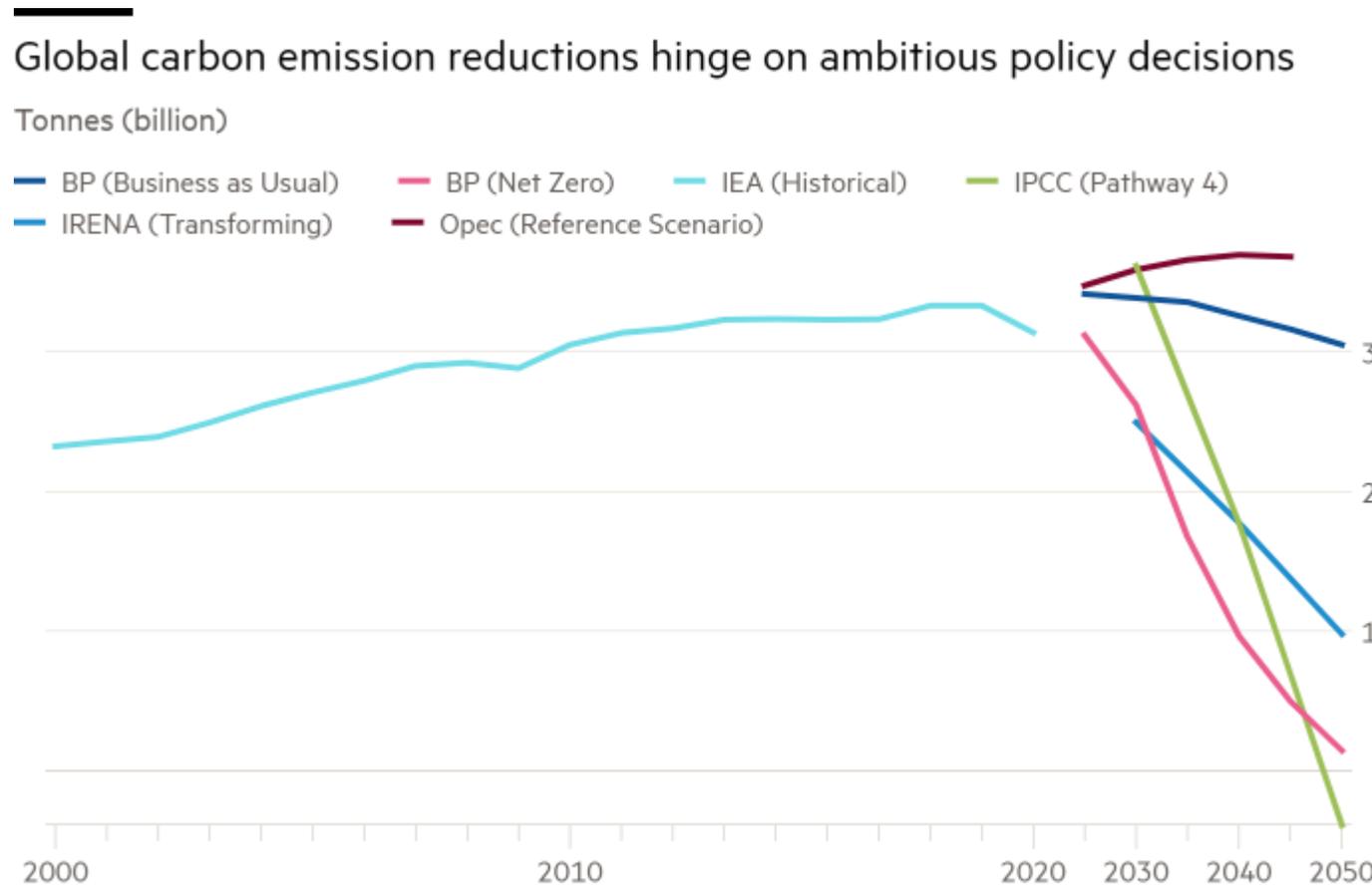
The range of production scenarios.

Source: BP



Unburnable Carbons Stranded Assets

But steep O&G production declines required under the new IEA 1.5 degree scenario



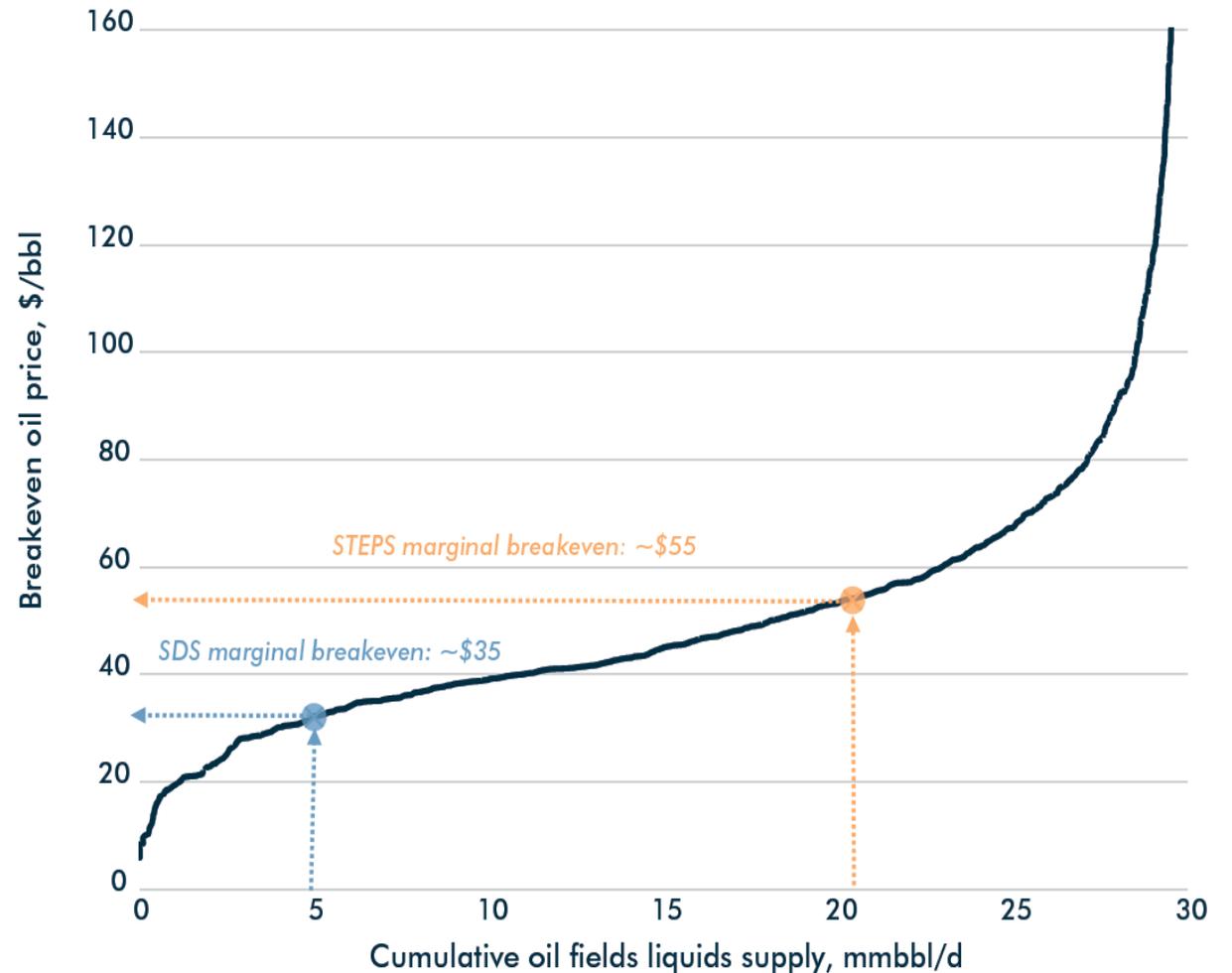
Financial Times, June 9th 2021

Source: Resources for the Future: Global Energy Outlook 2021
© FT

Least cost approach to determine stranded assets

Net Zero Emissions means zero – no new projects

- Investors want to know: Which assets are at risk of being stranded?
- Our approach is simple – new assets assumed to **compete on cost**
- Cheapest project options fill supply gap; last project sets **marginal breakeven price**

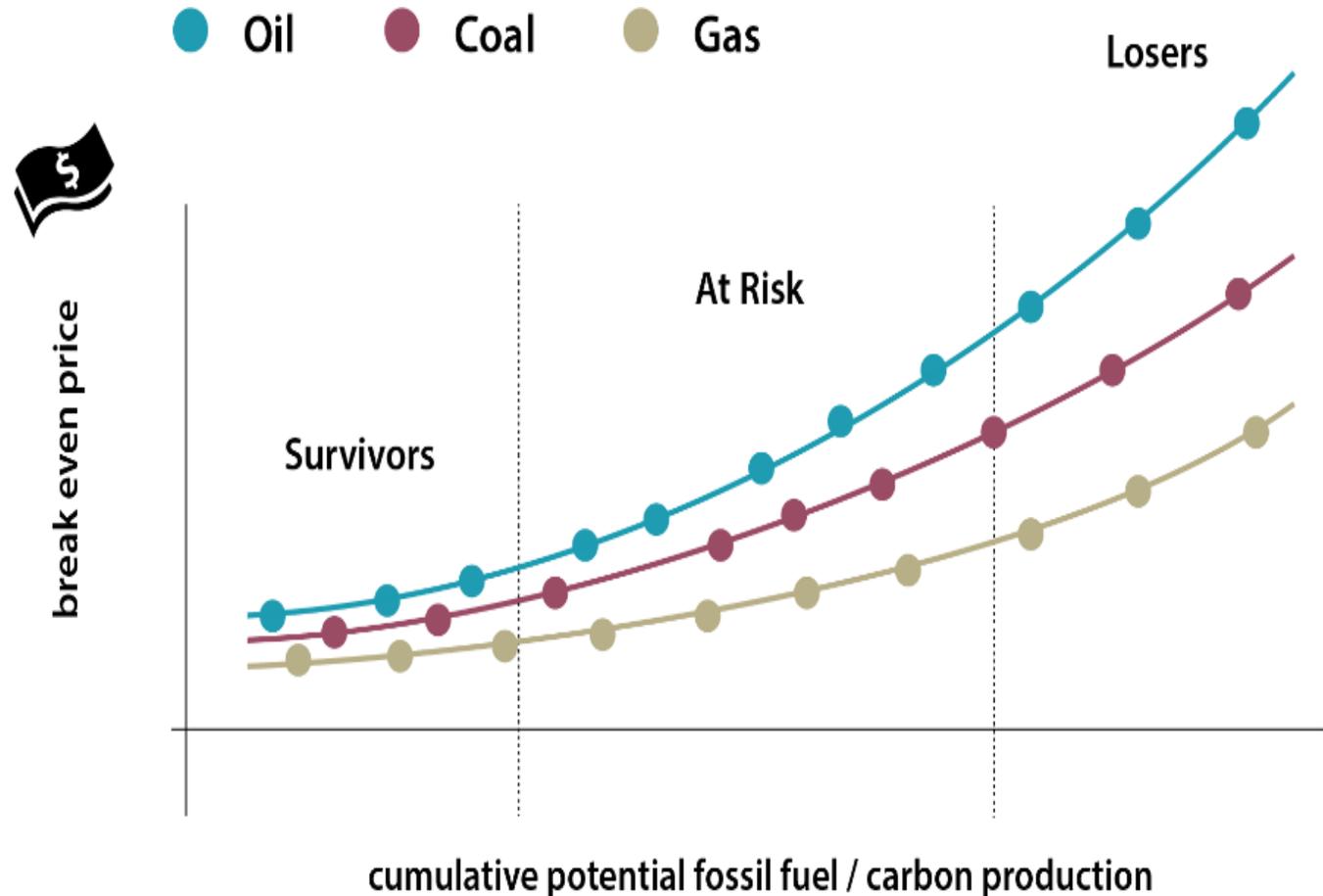


Economics backdrop: how profitable is \$70 oil?



Source: Goldman Sachs Global Investment Research. Annotated by Tom Randall/Bloomberg

Carbon Tracker's least cost framework

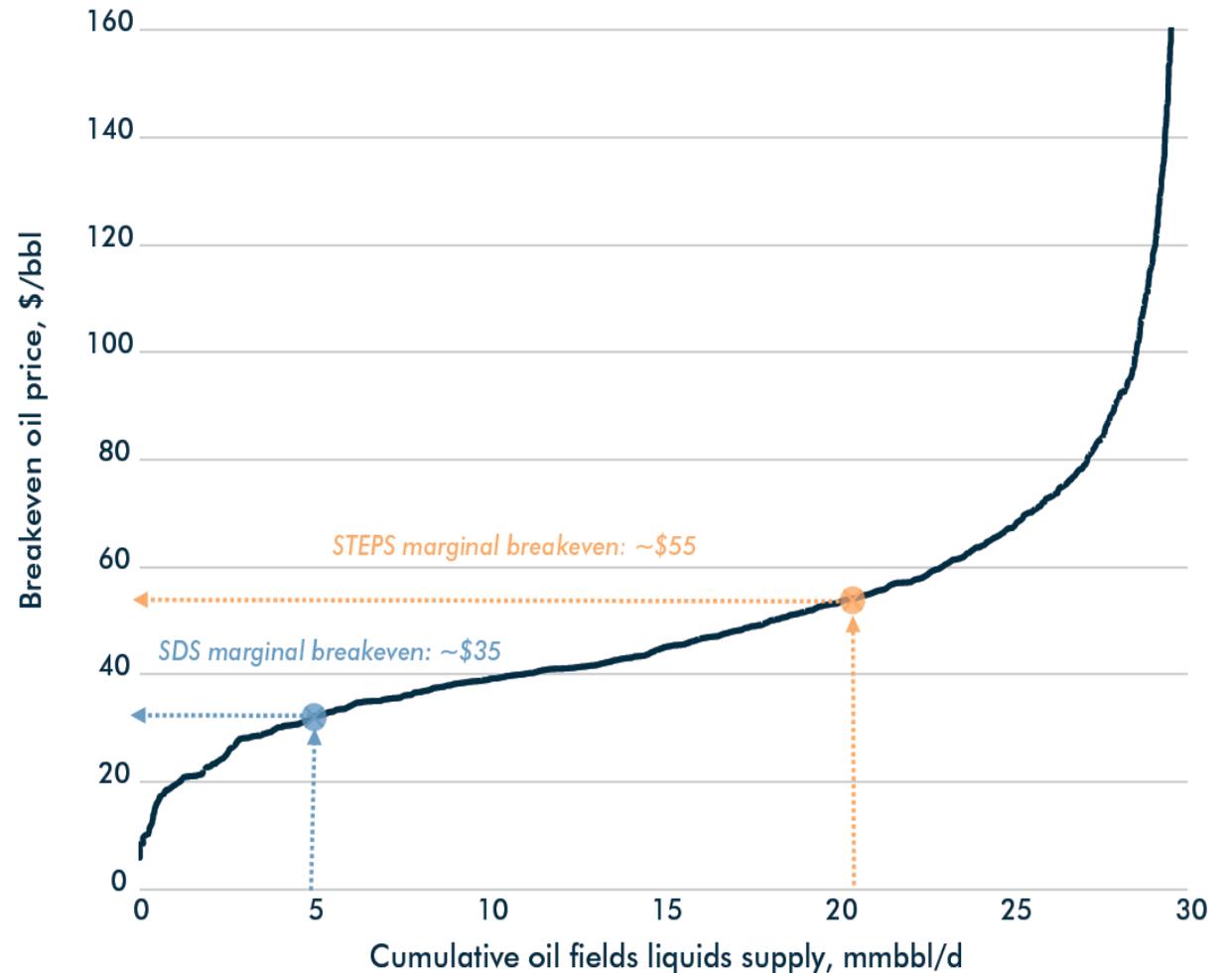


- **Relative positioning** of projects on cost curve is crucial
- **Lowest cost supply** will be most competitive for reduced demand
- Modelling used to estimate **which projects go ahead** under demand constraint
- Illustrates **price impact mechanism**

Least cost approach to determine stranded assets

Net Zero Emissions means zero – no new projects

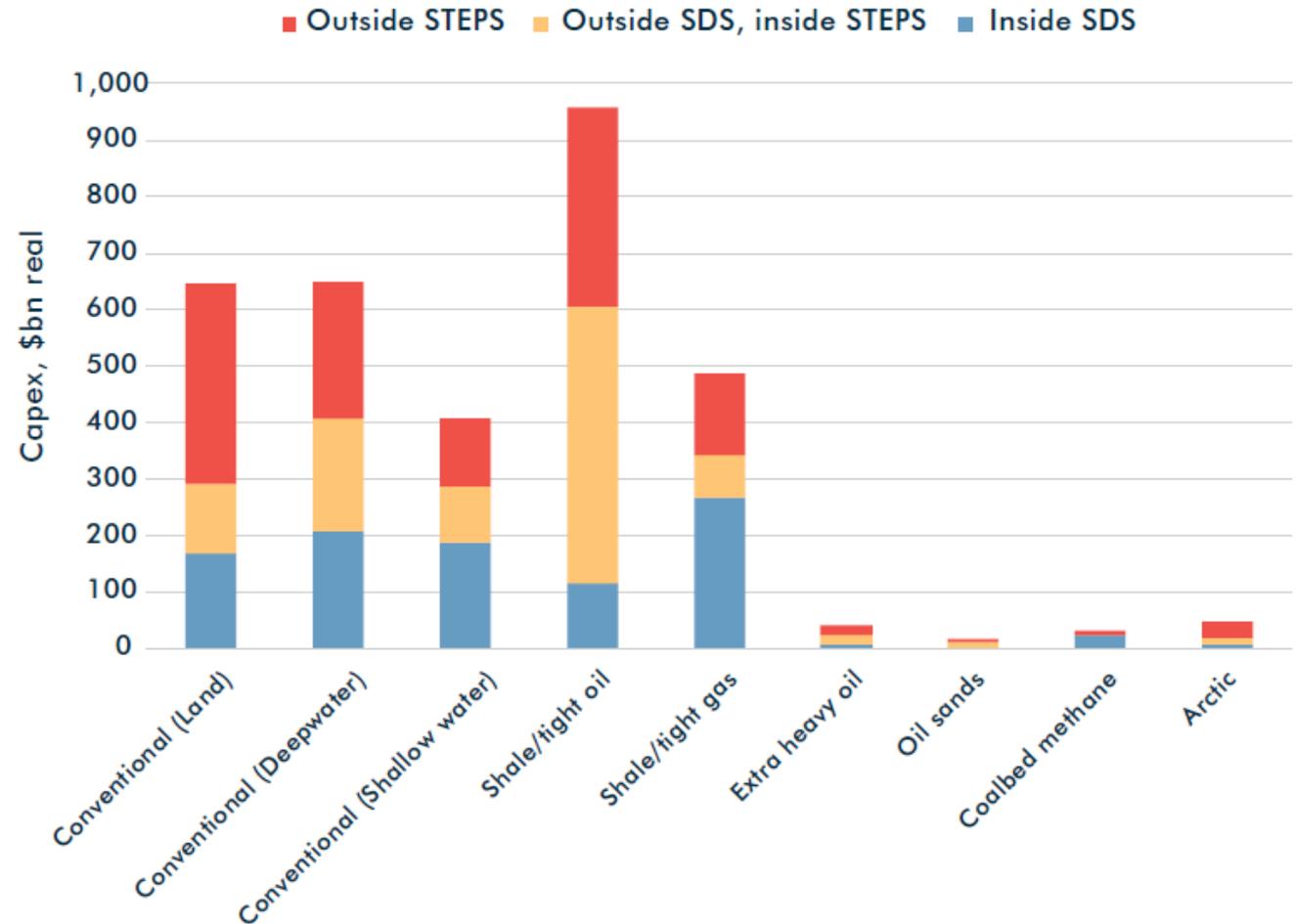
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Planning for BAU risks \$1tn of capital

Very limited space for new projects in low-carbon world

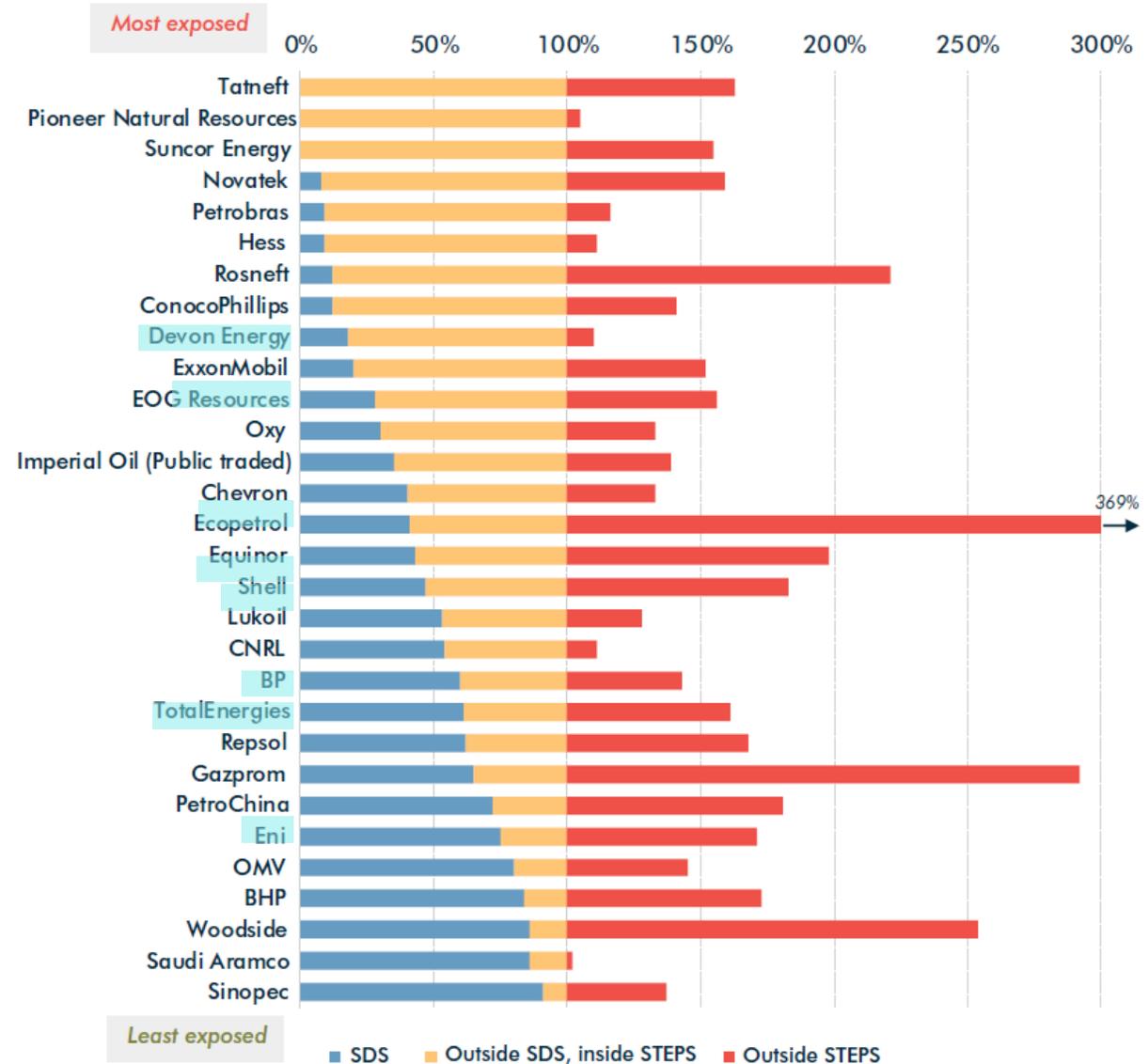
- Most project options not needed in low-carbon scenario
- Shale oil most exposed theme
- Deepwater projects higher risk
- Virtually no new oil sands
- Much like with 1.5°C, shale oil fares poorly in a 1.65 world



Source: Rystad Energy, IEA, Carbon Tracker analysis, September 2021

O&G Company exposure varies significantly

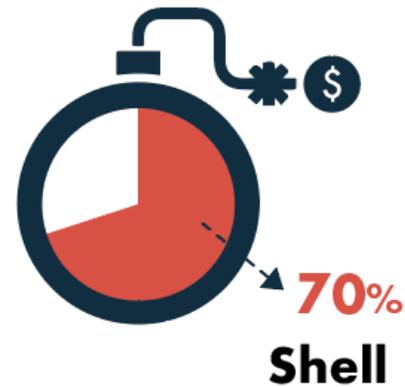
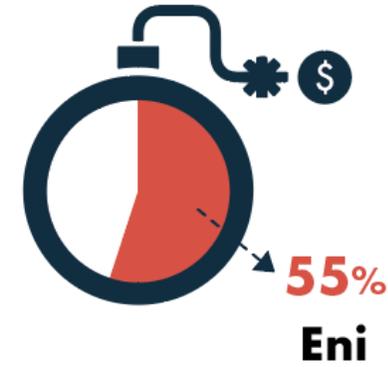
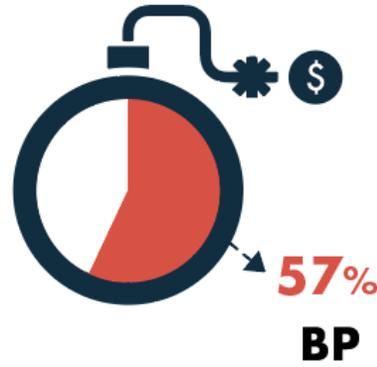
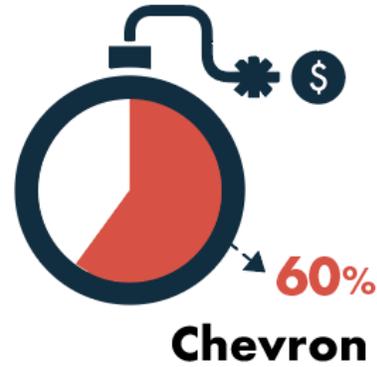
- Company capex exposure reflects portfolio project options
- Theme results echoed (deepwater, shale, oil sands)
- Projects outside STEPS portion (red bars) may still be up for sanction
- Majors' positioning matches emissions goals ranking (*Absolute Impact 2021* report)



Source: Rystad Energy, IEA, Carbon Tracker analysis

OIL AND GAS MAJOR EXPOSURE to stranded asset risk in a low-carbon world

Carbon Tracker
analysis: potential
O&G spending
(2019-2030) on new
projects outside a
1.6°C pathway.



Despite overhang, O&G exploration continues

▼ EQNR \$22.60 -0.39 1.7%

Norway awards Arctic exploration permits in widening search for oil

CONTRIBUTOR

Terje Solsvik — Reuters

PUBLISHED

JUN 23, 2021 6:53AM EDT

**Equinor, Shell,
Vår Energi (Eni
owned), OMV**

**All have net zero
2050 targets**

Source: Nasdaq, June 2021

**Chevron,
TotalEnergies,
Qatar
Petroleum,
Staatsolie**

HOME | GENERAL INTEREST

Suriname awards exploration in shallow offshore area

Staatsolie Maatschappij Suriname NV, Suriname's state oil company, awarded rights to explore Block 5 to Chevron Exploration Suriname and Blocks 6 and 8 to a consortium of TotalEnergies SE, Qatar Petroleum, and Staatsolie.

Author — OGJ editors

Jun 21st, 2021

Source: Oil & Gas Journal, June 2021

Sample of O&G current projects 'outside of the carbon budget'

A selection of the largest projects sanctioned in 2018 outside SDS budget (by a margin):

Project	Resource theme	2019-2030 capex	Country	Partners (* denotes operator)
LNG Canada T1	 Conventional (land/shelf)	\$6.5 bn	Canada	Shell* , Petronas, Mitsubishi Corp, Korea Gas, PetroChina
LNG Canada T2	 Conventional (land/shelf)	\$6.5 bn	Canada	Shell* , Petronas, Mitsubishi Corp, Korea Gas, PetroChina
Gorgon/Jansz Stage 2	 Deep water	\$3.6 bn	Australia	Shell, Chevron* , ExxonMobil , Osaka Gas, Tokyo Gas, Chubu Electric
Aspen Phase 1	 Oil sands	\$2.6 bn	Canada	ExxonMobil* , Imperial Oil
Amoca FFD	 Conventional (land/shelf)	\$1.4 bn	Mexico	Eni* , Qatar Petroleum
Zinia 2	 Deep water	\$1.3 bn	Angola	BP, ExxonMobil, Total* , Equinor

Carbon Tracker ‘Absolute Impact’ Company Ranking

- Hallmarks used to produce relative ranking of company goals
- Coverage and scale of absolute emissions reductions to 2030 critical
- “Net zero” targets vary significantly between companies
- Clear Atlantic divide; within Europe approaches vary too
- All companies invoke on CCUS / NETs – unproven at required scale

Source: Company Disclosures; CTI analysis

TABLE 1. RANKED COMPARISON OF OIL AND GAS COMPANY EMISSIONS TARGETS

Rank	Company	Metric	Characteristics		Coverage		Scale	
			End use emissions	Absolute basis to 2030 goal	Full equity share basis (global)	Down-stream products included	2030 reductions (absolute)	2050 goal
1	Eni	Emissions of all products	Yes	Yes	Yes	Yes	25%	Net Zero
2	Total ¹	Emissions of products sold in Europe	Yes	Yes	Partial (Europe sales only)	Yes	30%	Net Zero
3	bp	Emissions from O&G production	Yes	Yes	Partial (excludes Rosneft)	-	30-40%	Net Zero
4	Shell	Emissions intensity of all products	Yes	-	Yes	Yes	-	Net Zero [^]
5	Equinor	Emissions intensity of all products	Yes	-	Yes	Yes	-	“Near Zero” [^]
6	Repsol	Emissions intensity of all products	Yes	-	Yes	Only from own crude	-	Net Zero [^]
7	Occidental	Emissions intensity of all products	Yes	-	Partial (Operated only)	Yes	-	Net Zero
8	Conoco-Phillips	O&G operational emissions intensity	-	-	Partial (Operated only)	(n/a)	-	Net Zero
9	Chevron	O&G operational emissions intensity	-	-	Yes	-	-	-
10	Exxon-Mobil	O&G operational emissions intensity	-	-	Partial (Operated only)	-	-	-

Political narrative is changing however....

COP26: Nicola Sturgeon says continued oil and gas extraction is 'wrong'

Continued unlimited oil and gas extraction is “wrong”, First Minister Nicola Sturgeon has said ahead of climate change conference COP26, as she warned the summit is the “possibly last opportunity” to avert global climate catastrophe.

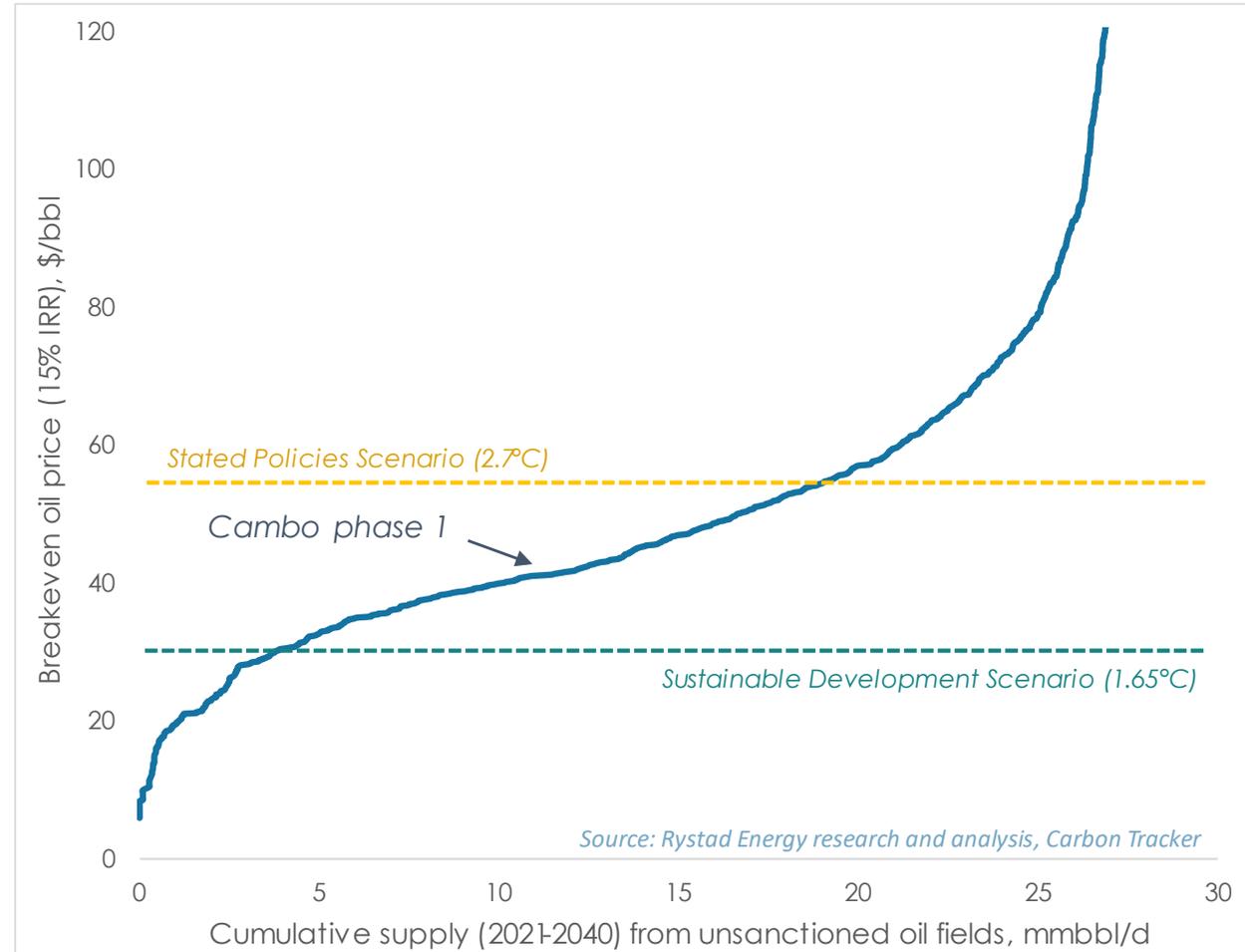
Cop26 climate summit: Scotland must ensure oil workers have jobs to go to as fossil fuels are phased out – Scotsman comment

17 days to Cop26: The speed at which Scotland is to transform into a net-zero carbon economy – a process to be completed in just 24 years, according to the Scottish government – can seem frightening.

Source: 'The Scotsman' 14/16/25 October 2021

Cambo project fails 'economic test' and is unaligned with Paris goals

Unsanctioned oil fields cost curve (2021-2040), Cambo breakeven cost and demand cut-offs for SDS and STEPS scenarios



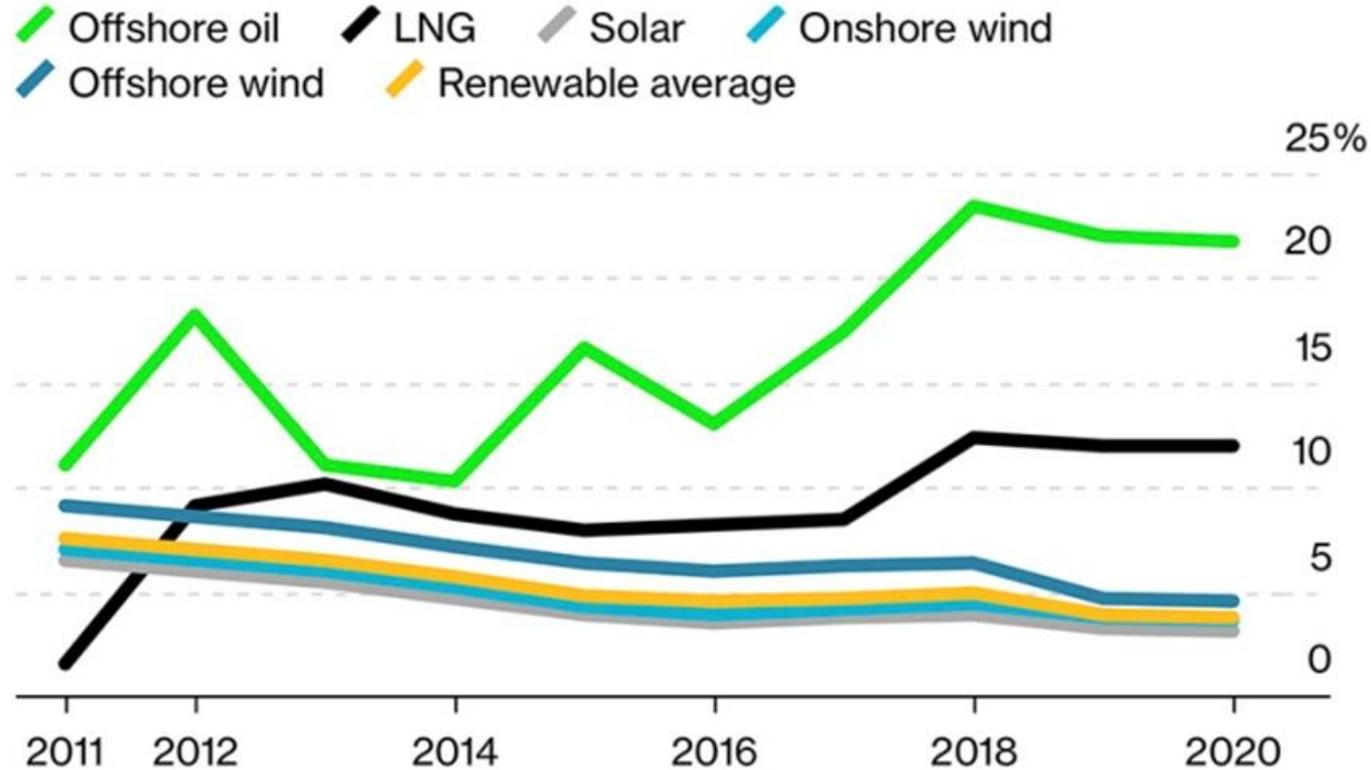
Source: 'Rystad Data, Carbon Tracker Analysis, November 2021

Speed of energy transition

1. Peaks happen when new technology take all incremental growth
2. Investors lose money at the peak, not when the system has changed

Cost of Capital: Fossil Fuels vs Renewables

Cost of Capital: Fossil Fuels vs. Renewable Energy

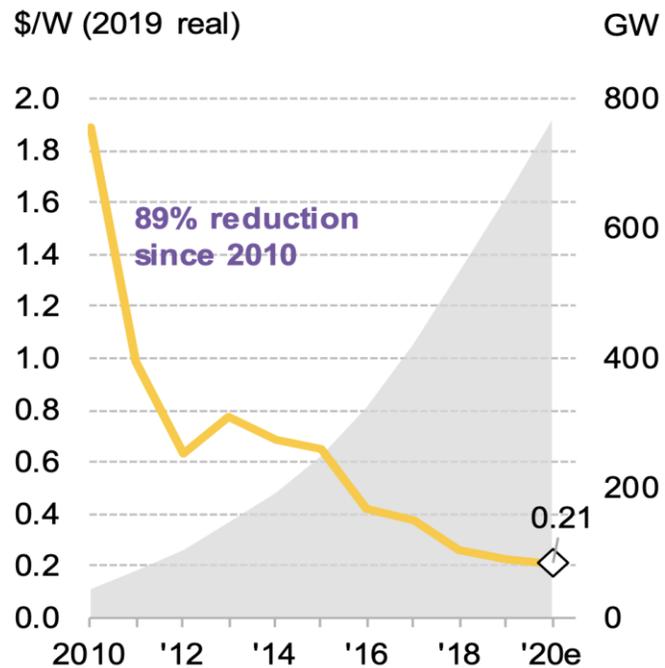


Source: Goldman Sachs
Note: Figures for 2020 are estimates.

Source Bloomberg Nov 2021

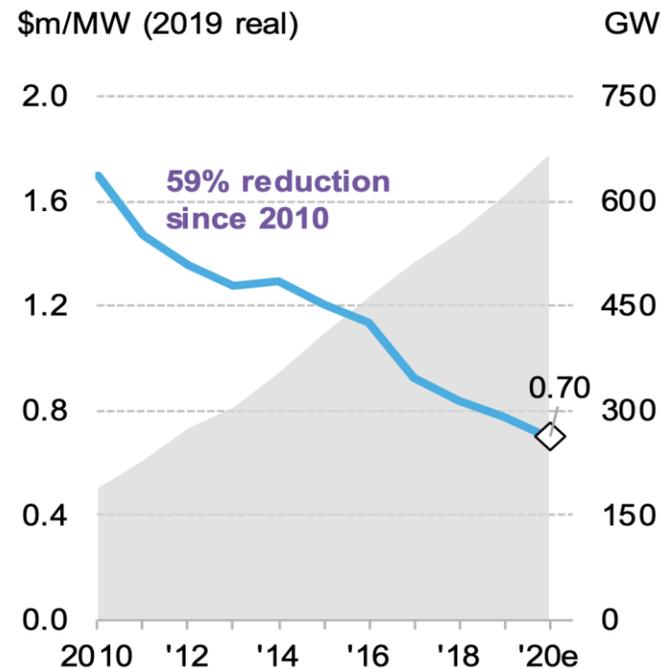
Technology Disruption: Reshaping the Global Energy Landscape

PV module price and cumulative installed capacity



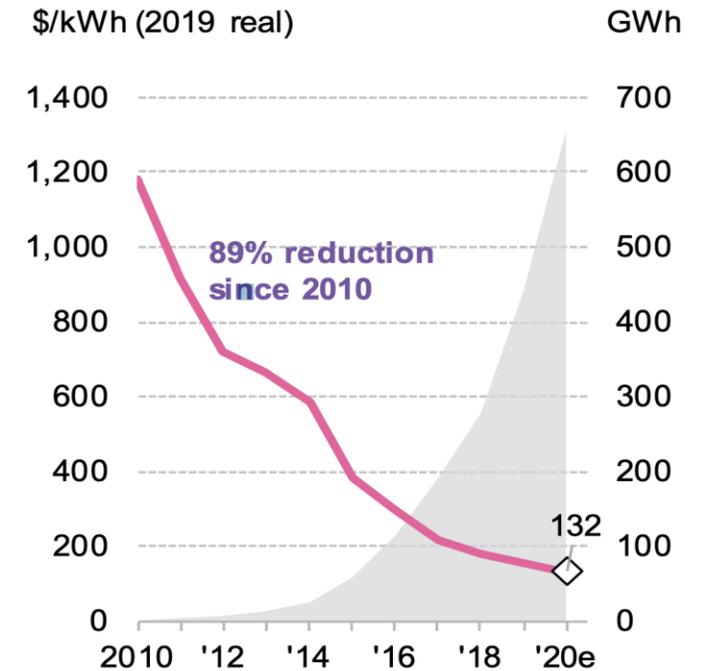
Source: BloombergNEF

Onshore wind turbine price and cumulative installed capacity



Source: BloombergNEF

Li-ion battery pack price and demand

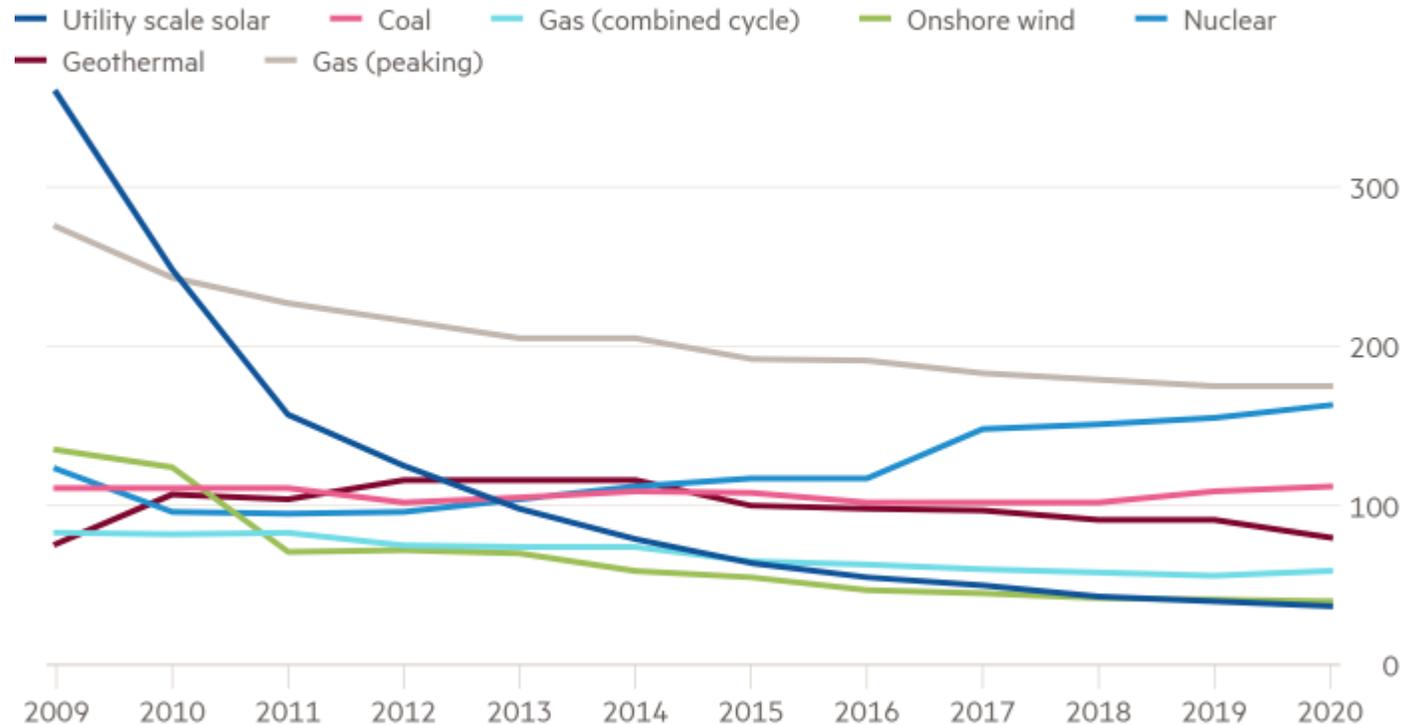


Source: BloombergNEF

Solar costs have fallen more than any other major energy source

Solar costs have fallen more than any other major energy source

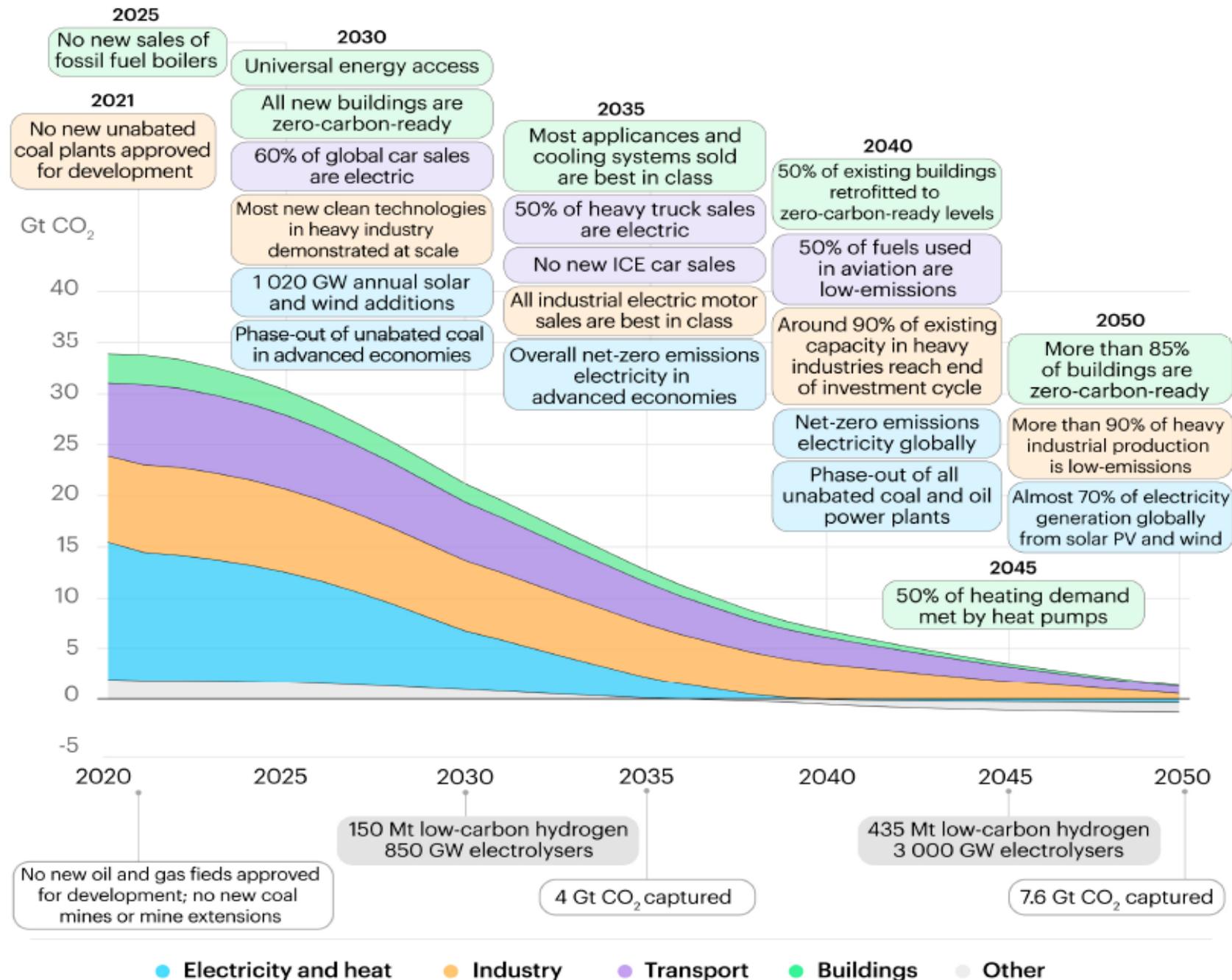
Mean levelised cost of energy (\$/MWh)



Source: Lazard
© FT

The IEA 1.5 degree scenario: key milestones in the pathway to net zero

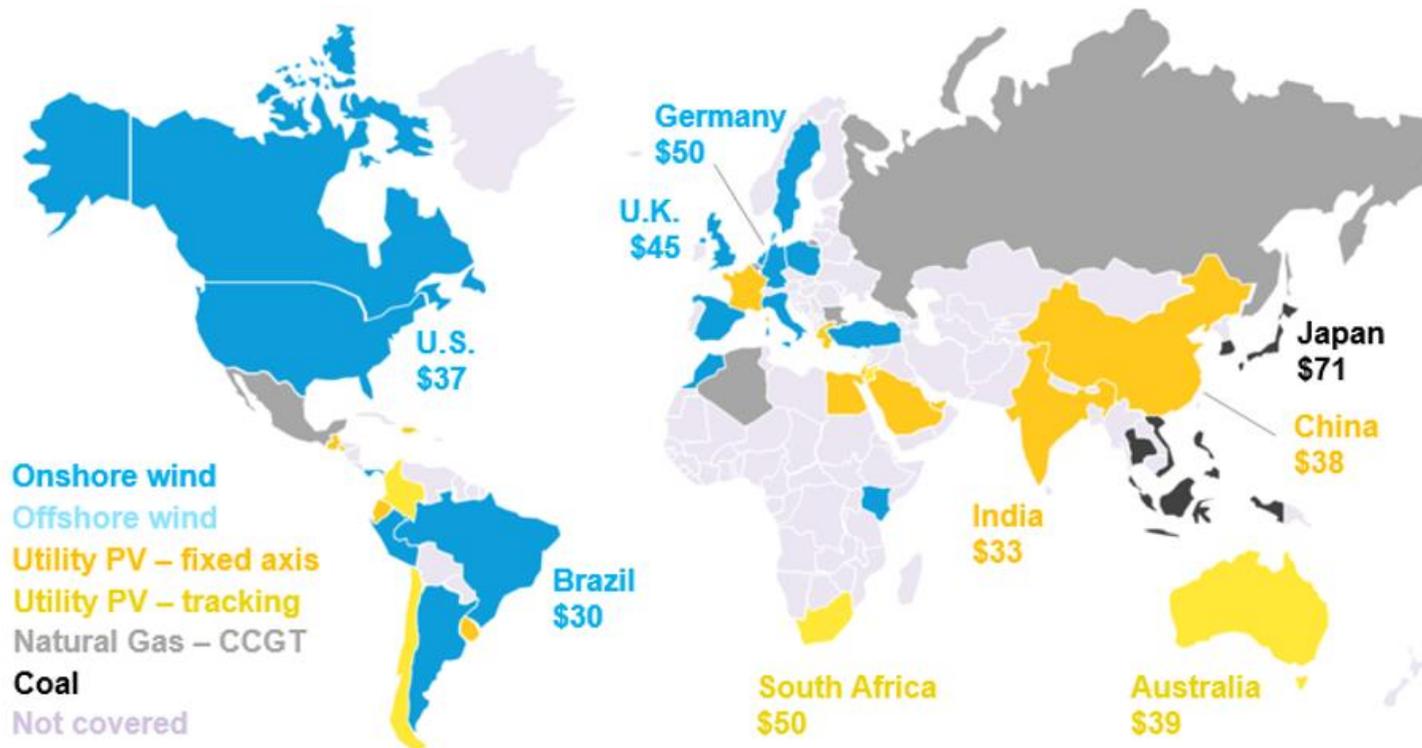
“No new investment needed in oil, gas and coal”



Source: IEA Net Zero Scenario May 2021

The undeniable economic advantage of renewables

Cheapest source of new bulk electricity generation by country (2H 2020)

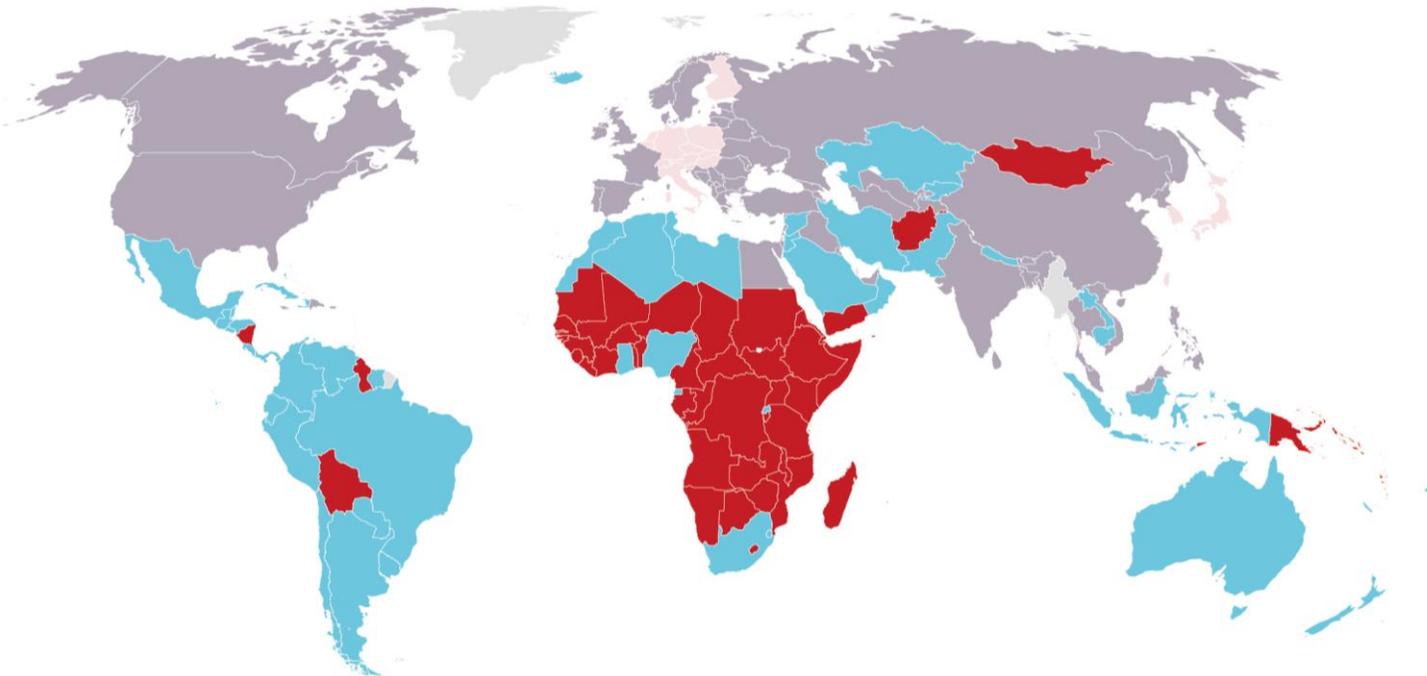
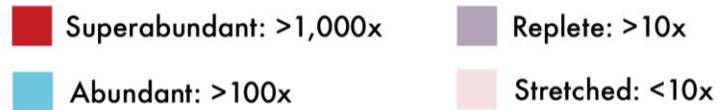


Source: BloombergNEF. Note: LCOE calculations exclude subsidies or tax-credits. Graph shows benchmark LCOE for each country in \$ per megawatt-hour. CCGT: Combined-cycle gas turbine.

- The economic potential of solar and wind today is 50 times global energy demand and it will be 100 times by the end of the decade.
- World has a global technical potential of 6,700 PWh of renewable energy potential, which helpfully is 6,700 bn MWh. So even if you ascribe just \$10 per MWh, renewable energy potential is \$67tn, about the same size as global GDP.
- For the UK, it is 11 PWh so \$110bn at \$10 per MWh, which is around 10% of GDP

Emerging markets the key beneficiaries

Solar and wind energy potential as a multiple of energy demand



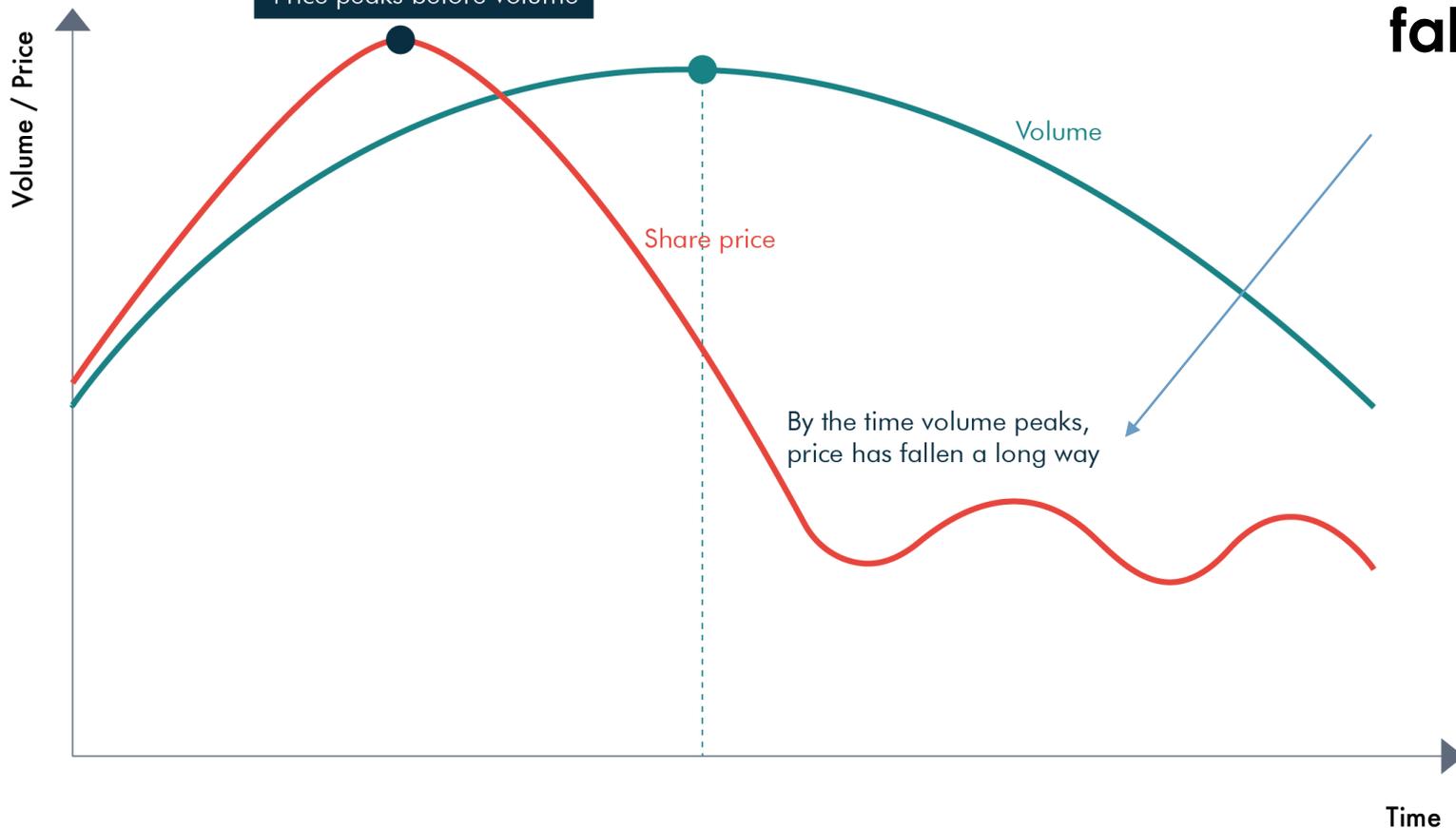
Source: EIA, Solargis, NREL

- And the greatest beneficiaries are the emerging markets
- They are superabundant in renewable energy resources. With up to 1,000 times as much as their energy demand today.
- This is the new development tool to enable them to obtain energy and justice.
- And saves them from high fossil fuel import costs.

How Equity Markets React at the Peak. Theory

FINANCIAL MARKETS AND SYSTEMIC CHANGE

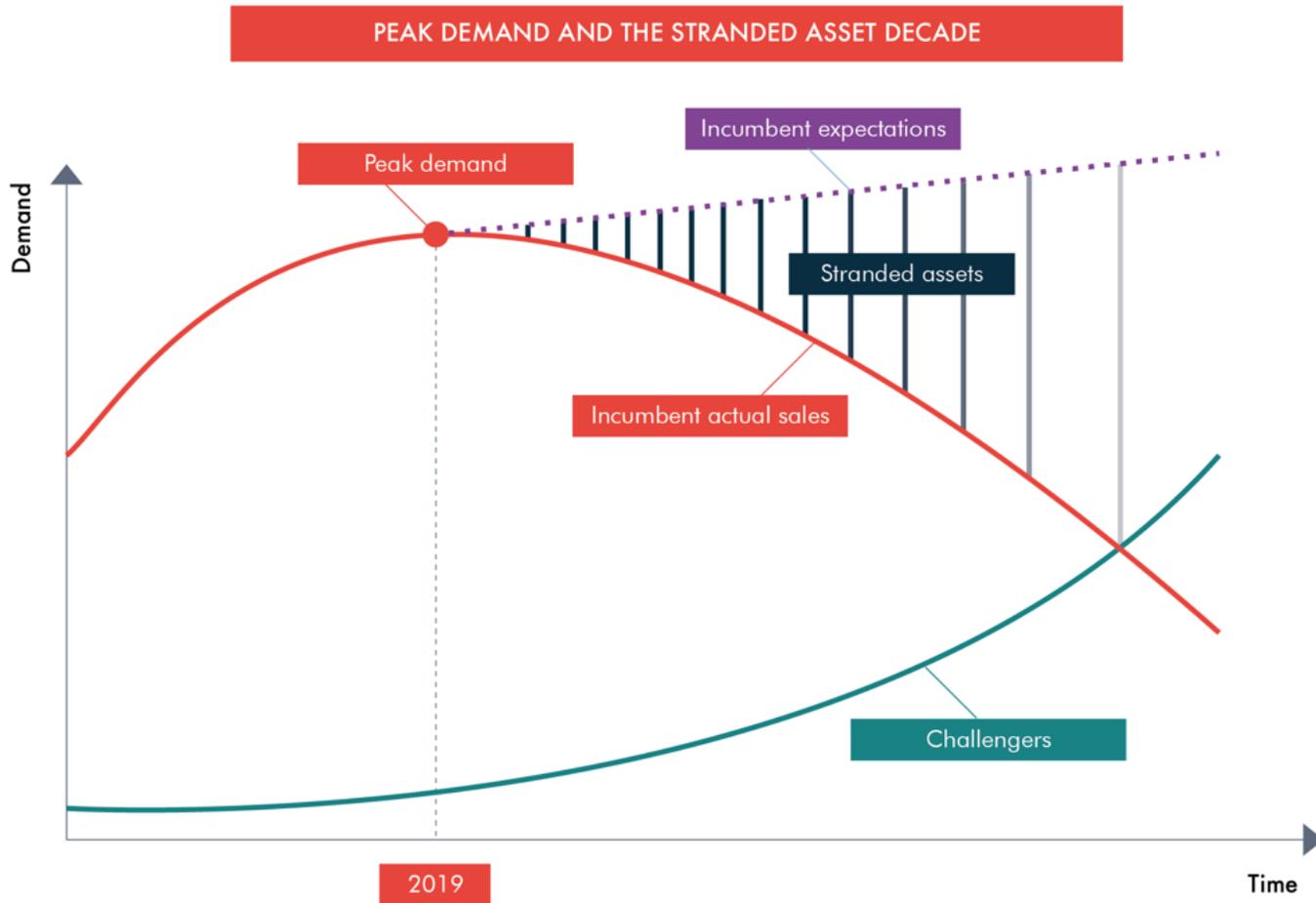
Price peaks before volume



By the time volume peaks, share prices have already fallen a long way

- Equity markets discount future expected profits
- When they see a turning point they therefore derate stocks and sectors.
- And by the time volume has peaked, price is already down a long way

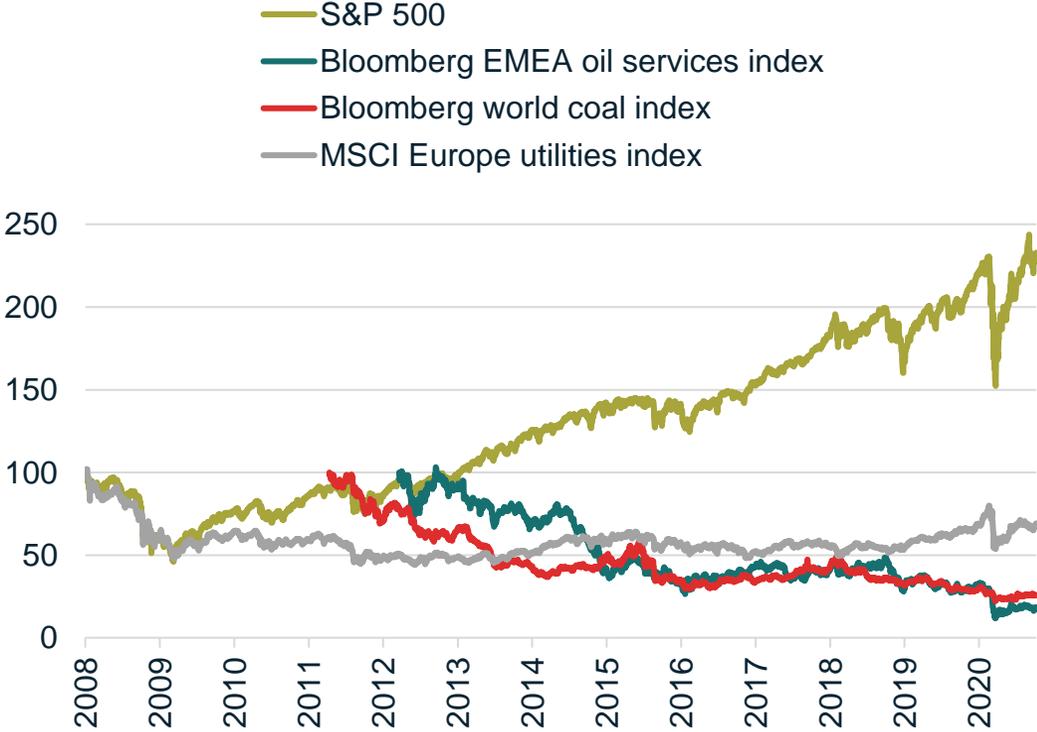
Why does the peak matter so much?



- Incumbents **expect** growth *and* they **build** for growth
- But challenging technologies will take that growth, so incumbent demand starts to fall
- Thus, opening a gap between capacity and demand ... that creates **overcapacity** and hence **stranded assets** ...

How equity markets react in practice: **They fall**

Markets have not been kind to peaking industries



Energy sector as a share of the S&P500 Index



Energy Transition: Incumbent Response

“The Five Stages of Decline”

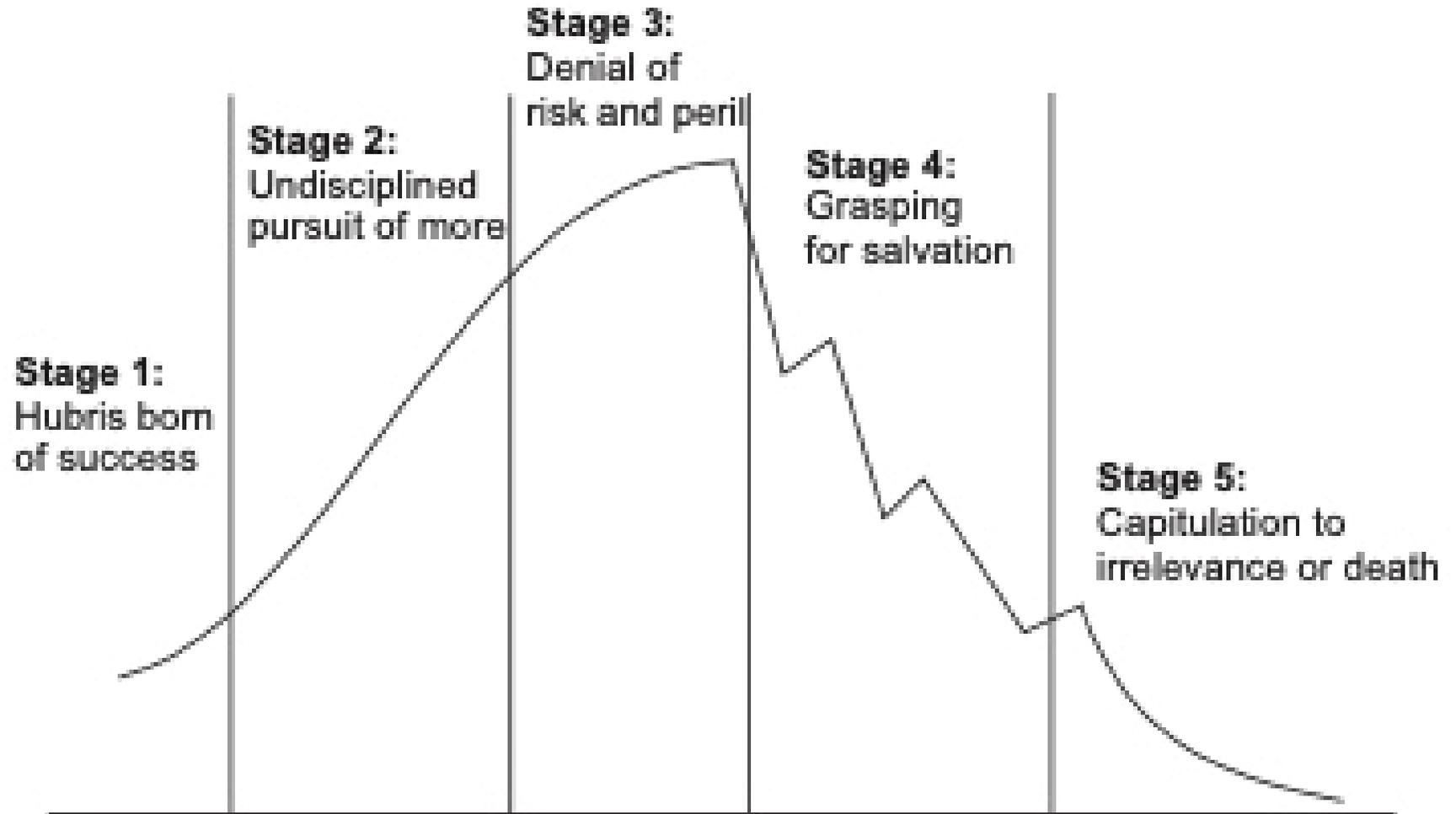


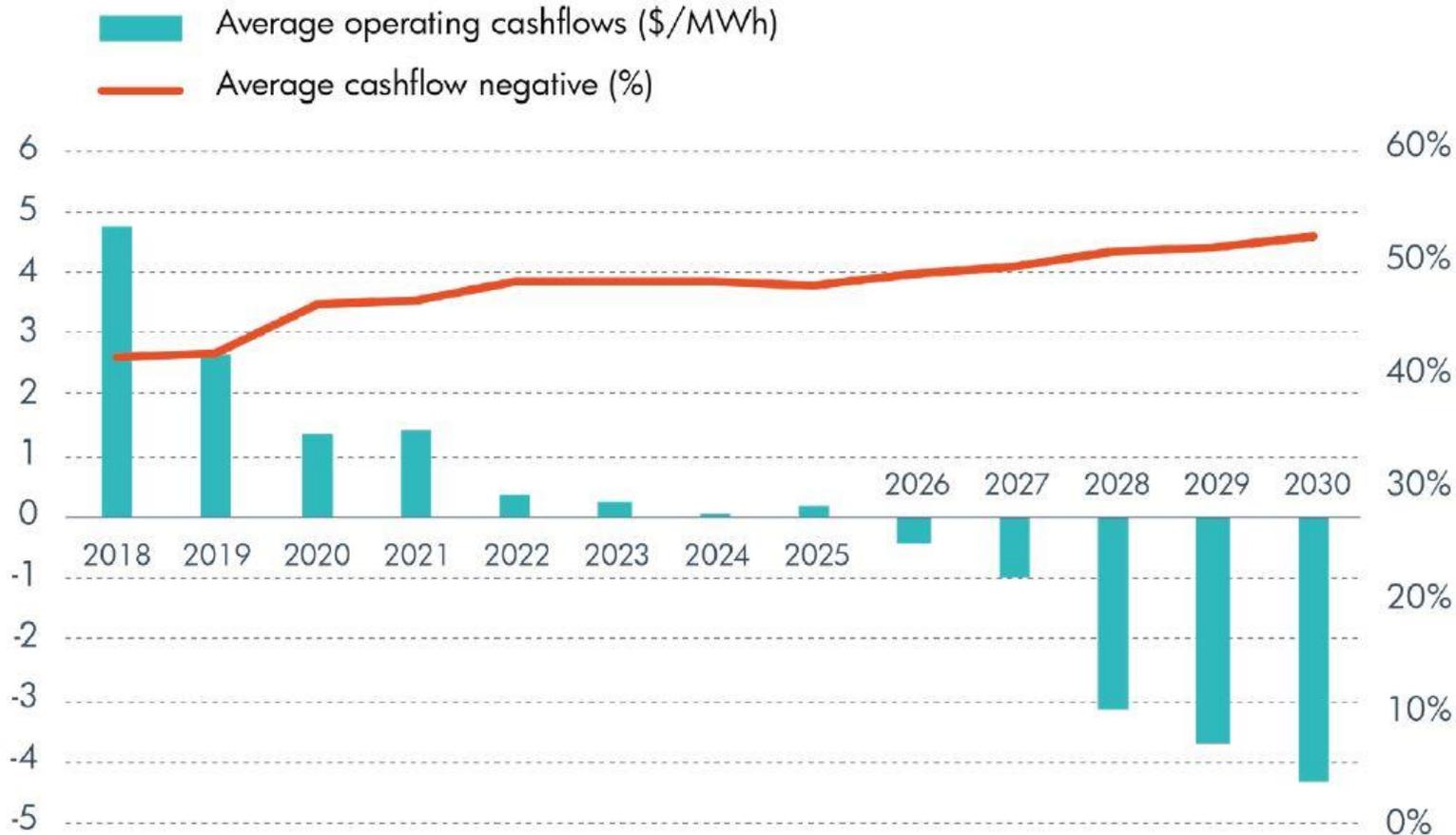
Fig. 1. The five stages of decline (Collins, 2009:20).

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FINANCIAL OUTLOOK FOR COAL OVER NEXT 20 YEARS

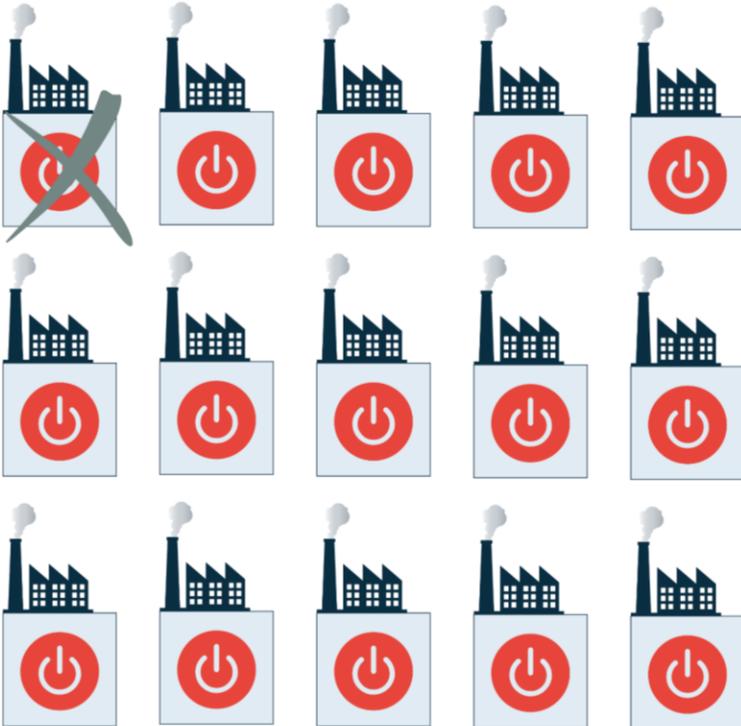
Average operating cashflow of global coal capacity from 2018 to 2030



- In 2019, **46%** of the global coal fleet may have already been **cashflow negative** (i.e. the operating costs are greater than revenues).
- By 2030, this could increase to **over half** of the global coal fleet.

Source: Carbon Tracker

2020-2040



To meet the global warming temperature target set out in the Paris Agreement

1 coal unit will need to close every day until **2040**.

Based on average size of 279 MW per operating coal unit, according to the CoalSwarm database.

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Source: Earth to investors (2018)

Thank you for listening

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