



Measuring Climate Risk from the Bottom-Up

Fossil companies that remain fossil are unattractive for investors

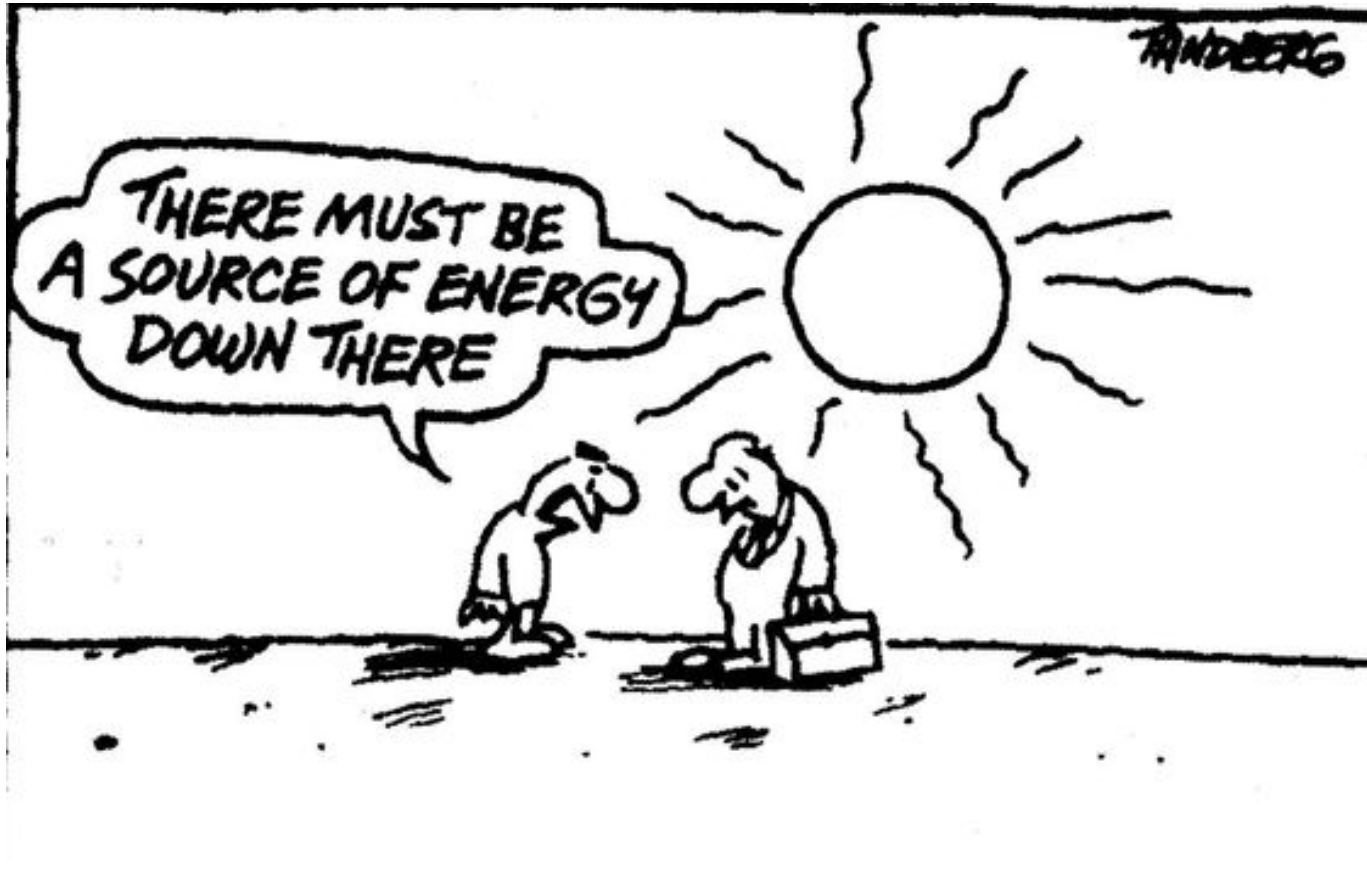
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Carbon Tracker Initiative – June 13, 2018

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Challenging Business as Usual



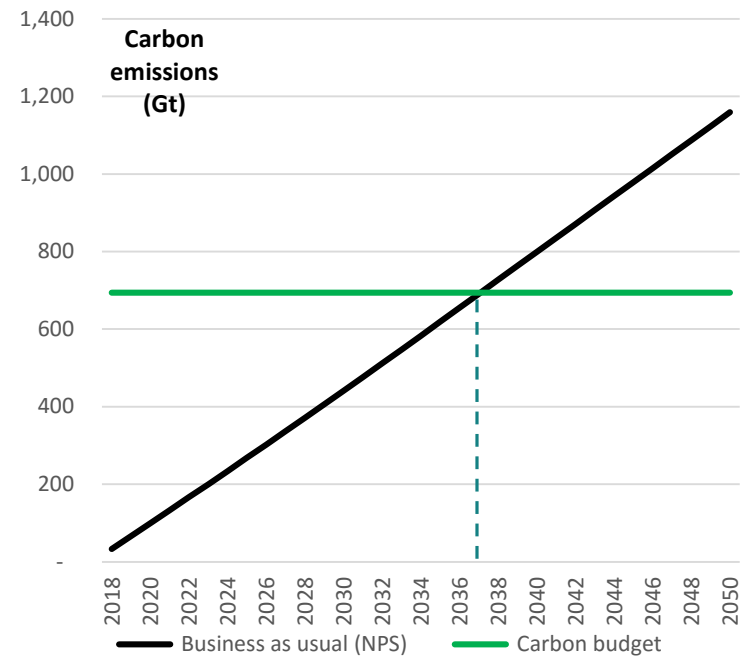
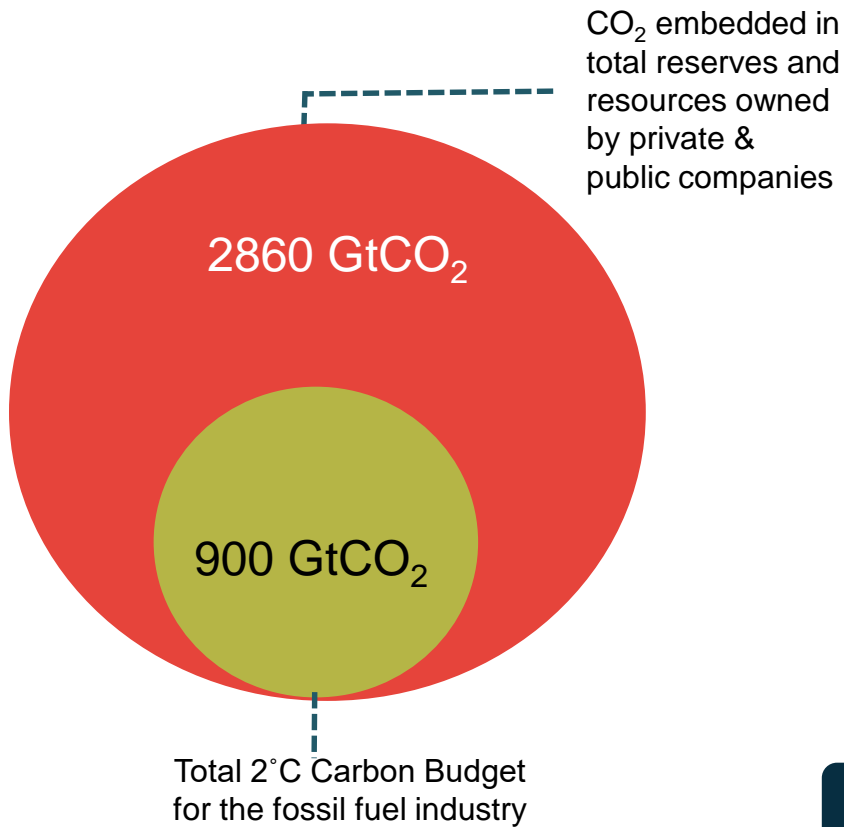
www.carbontracker.org

@carbonbubble

#strandedassets

The Carbon Bubble => *We can't burn it all*

We compared 'allowable' carbon emissions in a carbon budget to 2050 with 80% probability of staying below 2°C threshold with existing fossil fuel reserves.



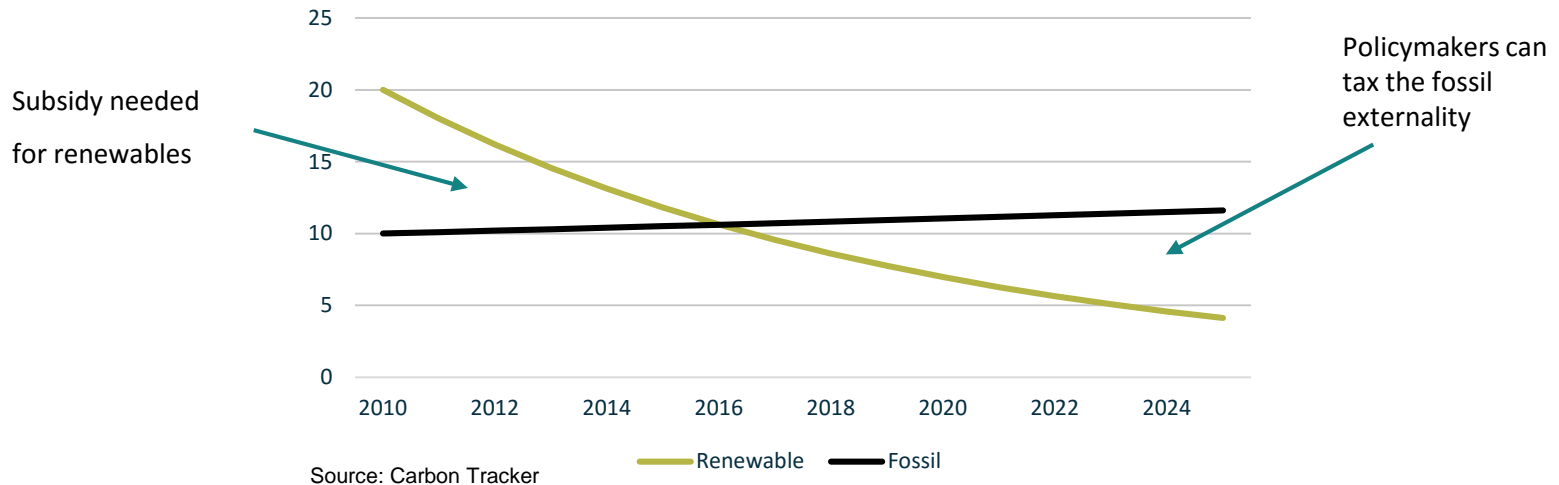
Carbon Bubble Stranded Assets

Climate financial risks

- the **physical** risks that arise from the increased frequency and severity of climate- and weather-related events that damage property and disrupt trade;
- the **liability** risks stemming from parties who have suffered loss from the effects of climate change seeking compensation from those they hold responsible; and
- the **transition** risks that can arise through a sudden and disorderly adjustment to a low carbon economy.

Energy is being disrupted by tech and learning

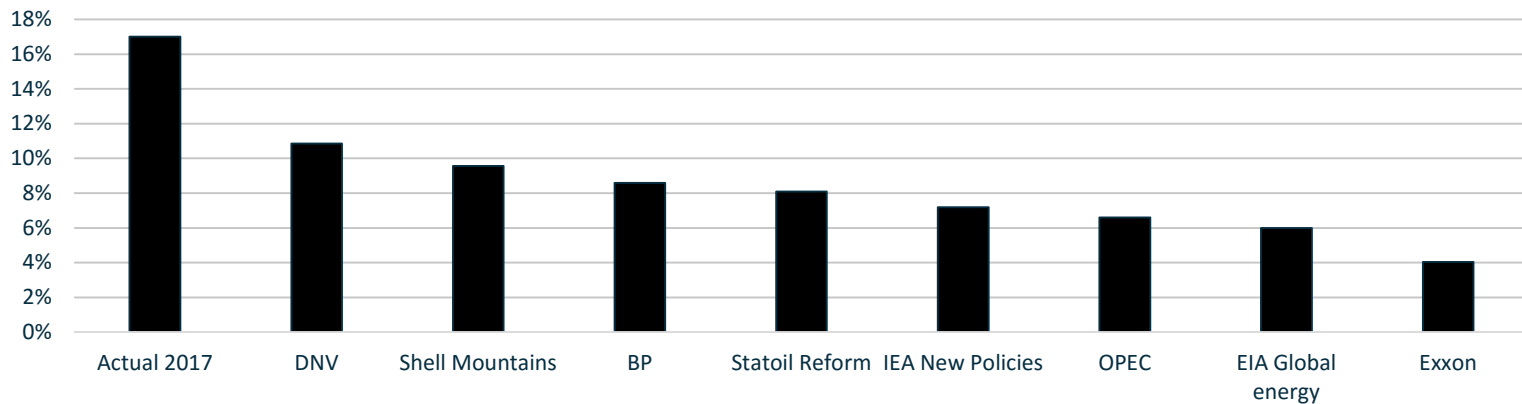
Normalised cost framework \$/unit



- Solar costs have been falling at 17% p.a. since 2010 and IRENA calculates the learning rate at 35%. In an ever wider range of locations, solar and wind are cheaper than fossil fuels.
- Battery costs have been falling at 20% p.a. since 2010 and by 2020 EV will be price comparable with oil cars.
- When renewables beat fossils, policymakers can move from subsidy to taxation.
- Cell phones ... Emerging markets will adopt renewable based energy systems.

The energy consensus is wrong

Annual growth rates of solar and wind

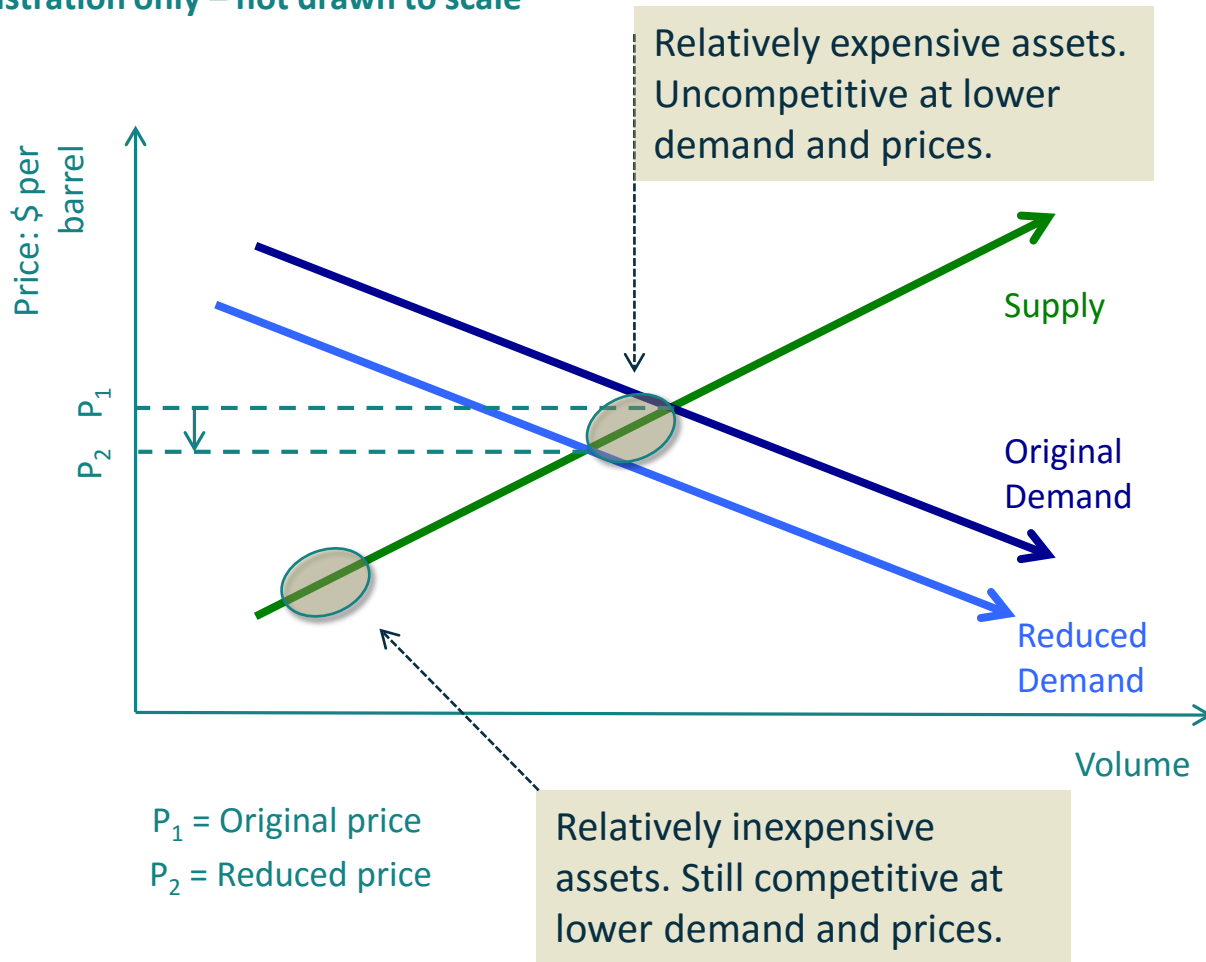


Source: Shell, BP, DNV, OPEC, Exxon, IEA, EIA. To end of modeling horizon

- The energy consensus is shaped by incumbents, expects business as usual, and makes four main errors.
- **Costs** ... They expect renewable costs to stop falling rapidly.
- **Growth** ... So they expect a rapid slow-down in the growth of renewables.
- **Timing** ... So they do not expect peak fossils for another 30 years or so.
- **Significance** ... And they think that peaking demand is not important.

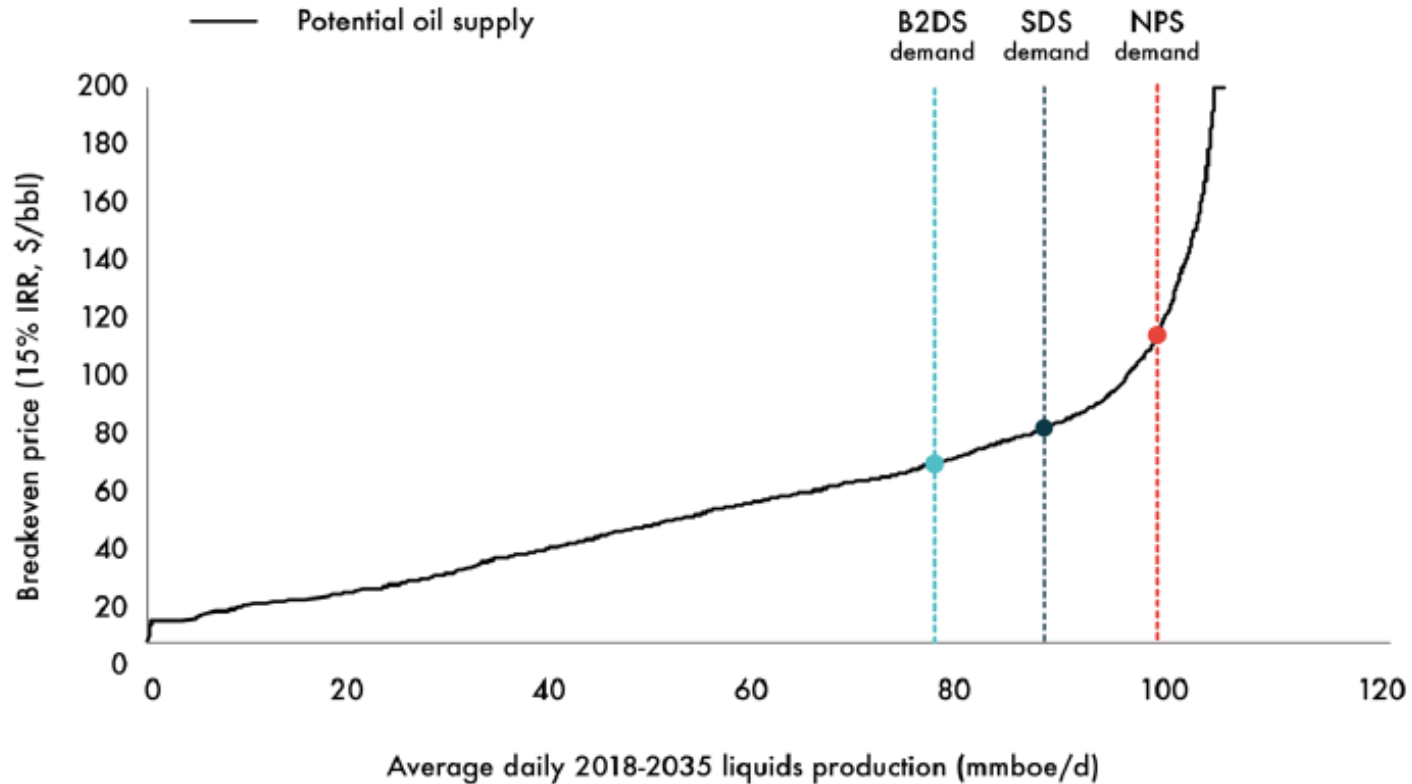
Lower expected demand creates stranded assets

Illustration only – not drawn to scale



Stranded Assets
Wasted Capex

Cost curves assume economic logic

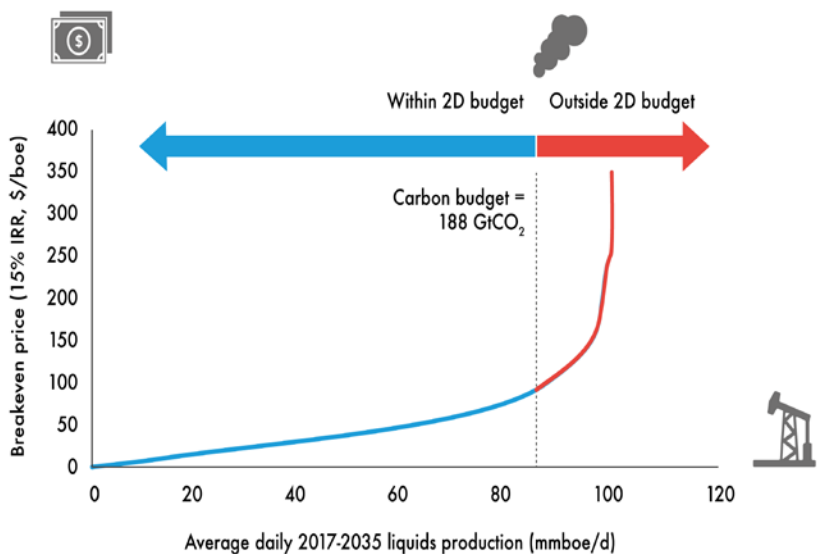


Source: Rystad Energy, IEA, CTI analysis

2 Degrees of Separation

Oil & Gas upstream scenario analysis powered by Rystad's Ucube with PRI

Oil carbon supply cost curve



Source: Rystad Energy, CTI analysis



Company	Country of headquarters	% of upstream capex outside 2D budget (% band)	2017-2035 carbon budget (GtCO ₂)	Potential CO ₂ outside 2D carbon budget (GtCO ₂)
Southwestern Energy	United States	60% - 70%	1.0	0.6
Apache	United States	60% - 70%	1.1	1.0
Cabot Oil and Gas	United States	50% - 60%	0.6	0.4
Diamondback Energy	United States	0% - 10%	0.4	0.0
Antero Resources	United States	0% - 10%	1.3	0.0
Seven Generations Energy	Canada	0% - 10%	0.7	0.0

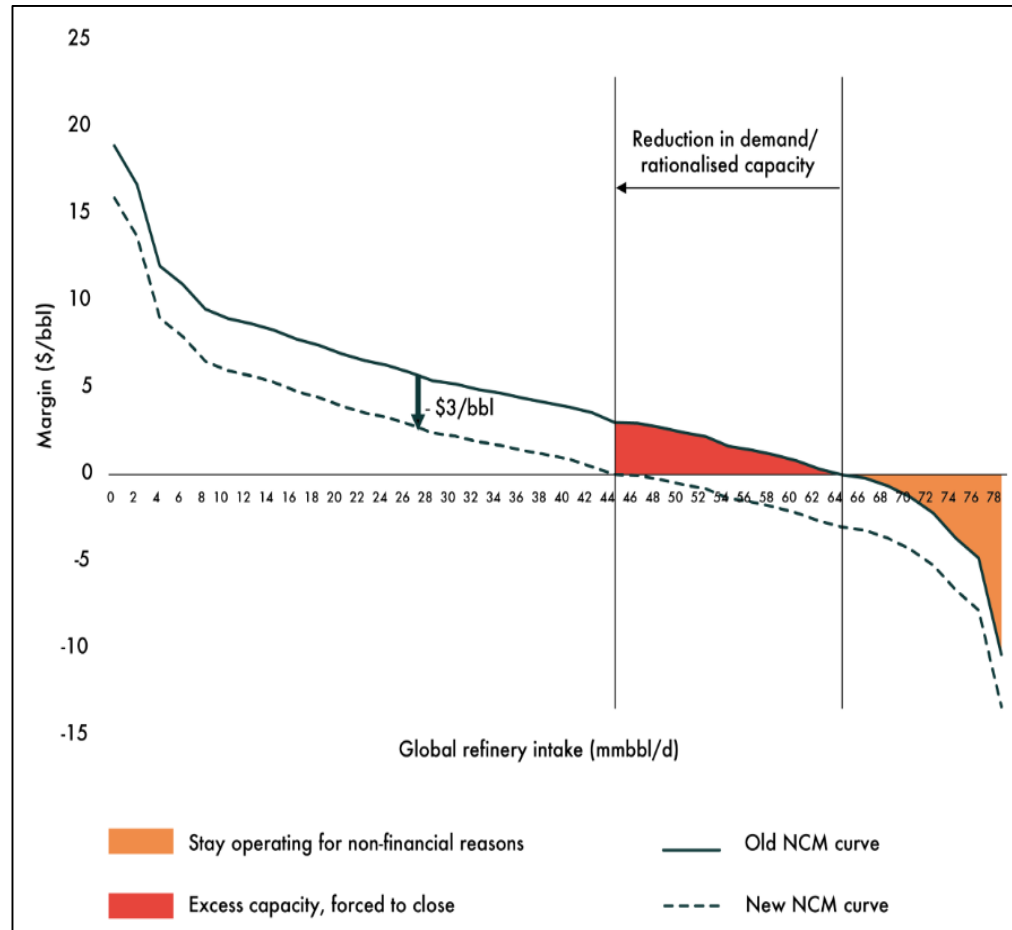
- ① US\$ 2.3 Trillion (~1/3) potential capex to 2025 is unneeded vs. Business as Usual.
- ② 2/3 of potential unneeded capex controlled by publicly traded companies.

Lower oil demand will reduce refinery margins

Typically more expensive plants can refine a larger range of higher margin products.

=> Under 2°C scenario oil demand could fall 23% by 2035.

=> Industry margin decline \$3.50/bbl causing industry EBITDA to drop ~50% by 2035.

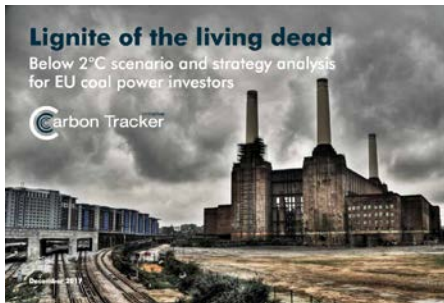
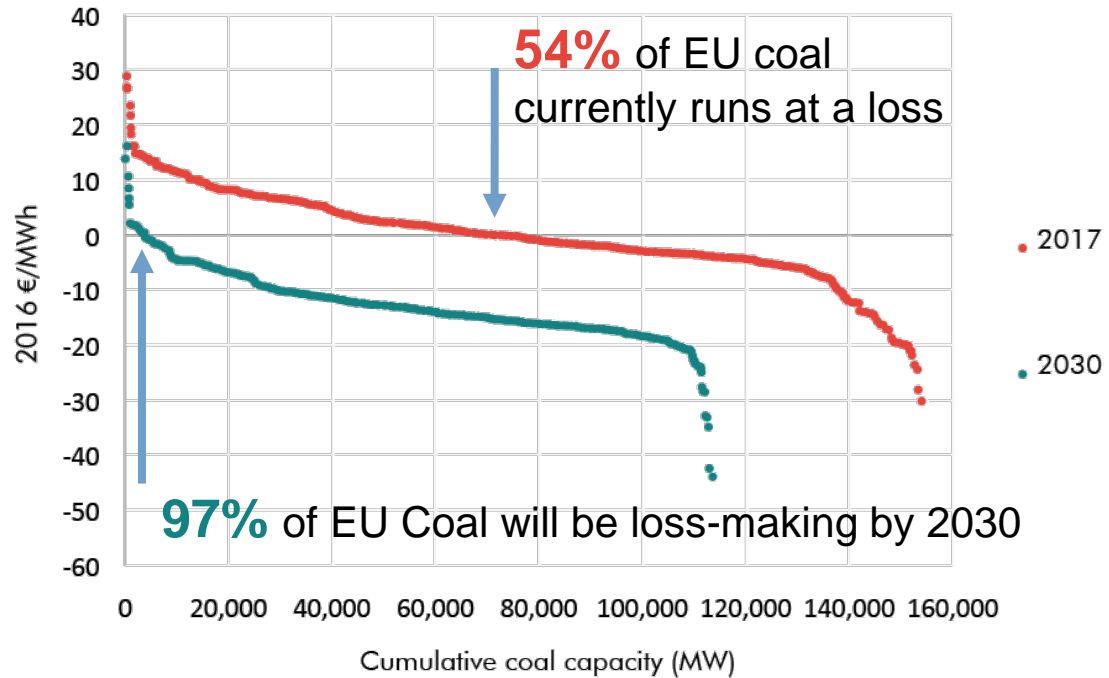


Power Generation: relative profitability all-in costs

Relative profitability for Coal vs. new CCGT/ old CCGT.

- Profit adjusted for
- Variable O&M
 - Fixed O&M
 - anticipated climate costs (pollution tech control).

Gross profitability of operating coal fleet in 2017 and 2030



EU: 2024 / US: 2021

New wind will be cheaper than existing coal

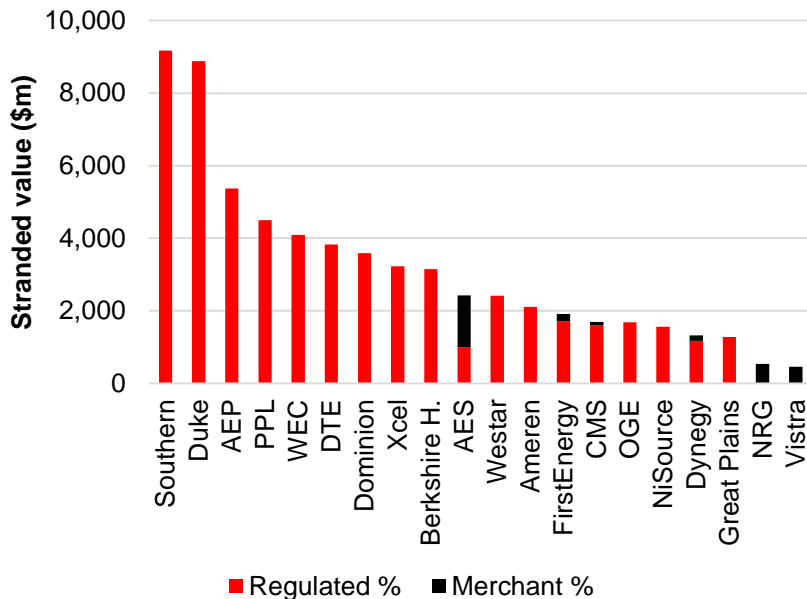


EU: 2027 / US: 2023

New solar PV will be cheaper than existing coal

Regulated markets have positive stranded values

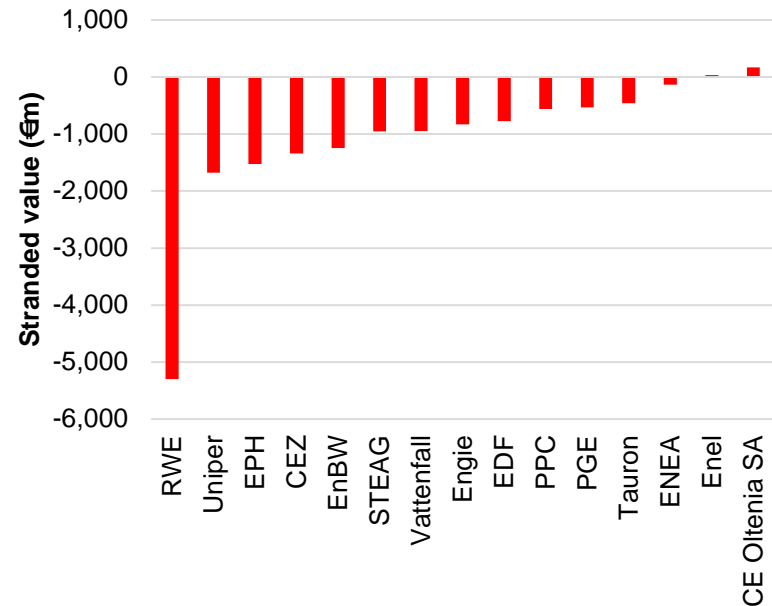
Stranded value for US coal power owners



- 2/3 of US coal capacity is regulated, making it highly profitable and thus could lose billions if the US complied with the Paris Agreement

Source: No Country for Coal Gen, Carbon Tracker (2017)

Stranded value EU coal power owners

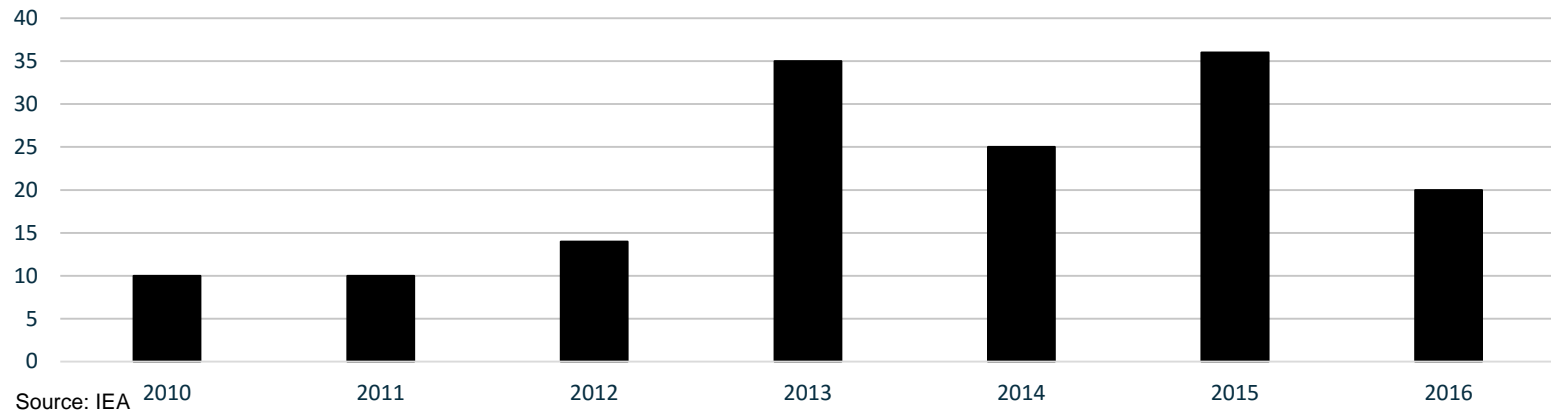


- Since most coal generation in the EU is loss-making, utilities could save money by retiring coal power in accordance with the Paris Agreement

Source: Lignite of the Living Dead, Carbon Tracker (2017)

We have seen some early victims

Electricity sector write-downs in Europe \$bn



- European electricity. \$150 bn of write-downs and a fall in sector capitalisation of over \$500bn.
- **Global coal.** Bankruptcy of sector leaders with near peak coal prices.
- **Machinery.** Collapse in demand for turbines, and in the GE share price.
- **Automotive.** The global auto sector has been forced to do a U turn towards EV over the last 18 months.

The energy transition and demand peaks

