

“You hear that Mr. Anderson? That is the  
sound of inevitability”

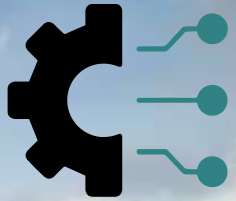
Agent Smith – *The Matrix* (1999)

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Mark Campanale  
Founder & Director, Carbon Tracker  
May 16th 2023



# THE RISE AND RISE OF CLEAN TECHNOLOGY



*"Investors are waking up to the biggest investment opportunity in the history of the world...In economics, things take longer to happen than you think they will... and then they happen faster than you thought they could."*

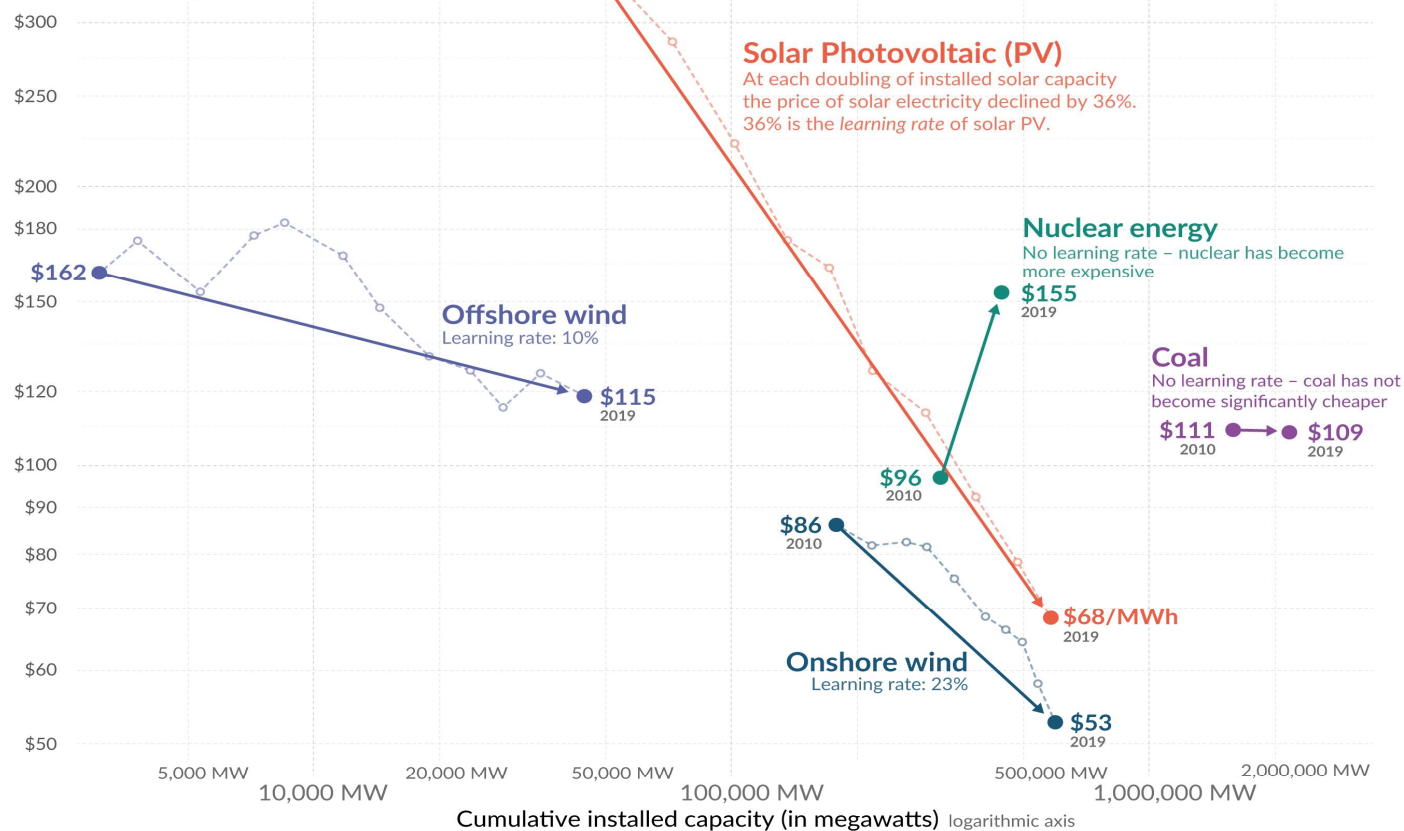
Al Gore

# Electricity from renewables became cheaper as we increased capacity – electricity from nuclear and coal did not

Our World  
in Data

## Price per megawatt hour of electricity

This is the global weighted-average of the levelized costs of energy (LCOE), without subsidies logarithmic axis and adjusted for inflation



Source: IRENA 2020 for all data on renewable sources; Lazard for the price of electricity from nuclear and coal – IAEA for nuclear capacity and Global Energy Monitor for coal capacity. Gas is not shown because the price between gas peaker and combined cycles differs significantly, and global data on the capacity of each of these sources is not available. The price of electricity from gas has fallen over this decade, but over the longer run it is not following a learning curve.

OurWorldinData.org – Research and data to make progress against the world's largest problems.

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by the author Max Roser

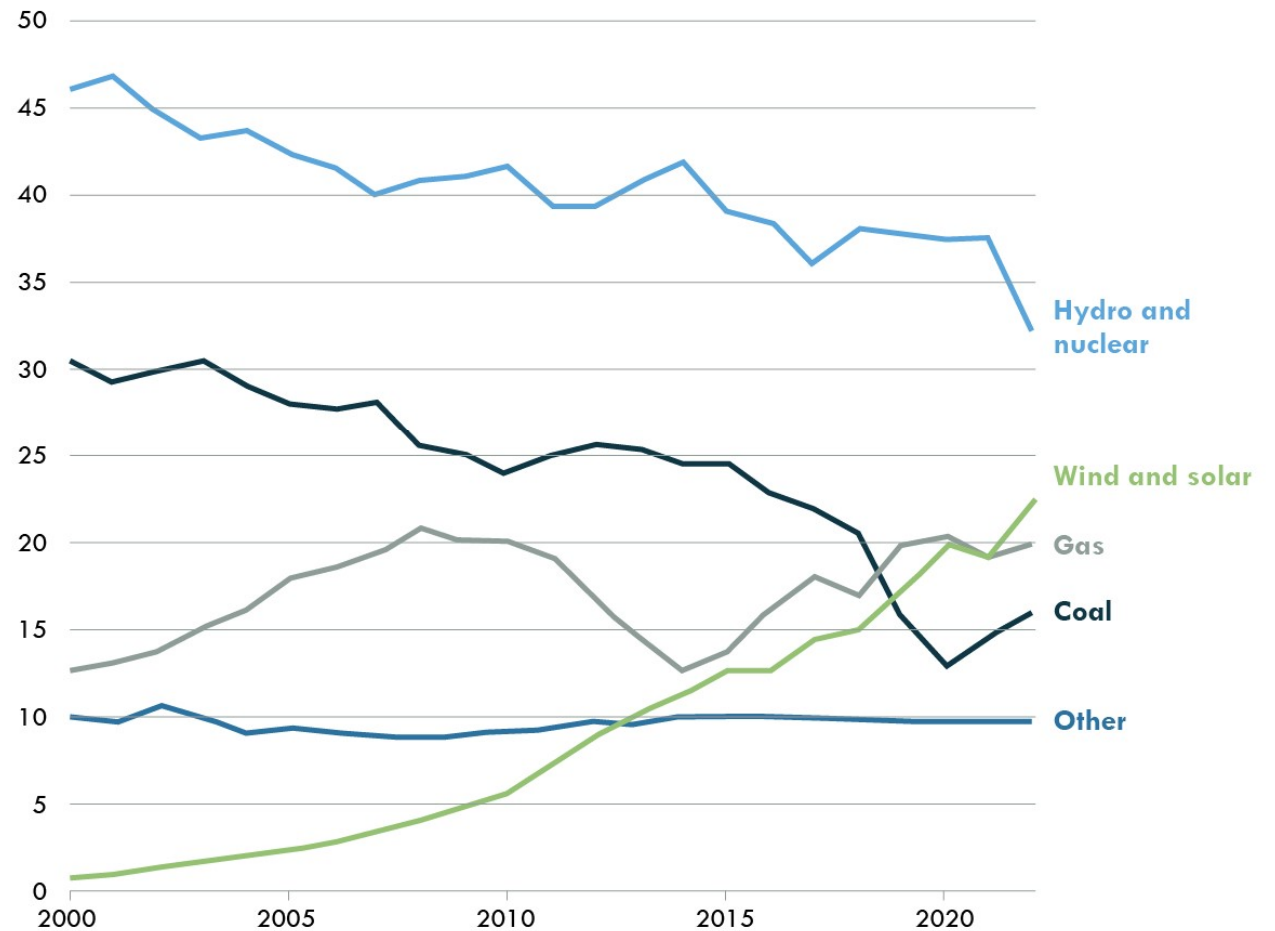
The new energy technologies of solar, wind, storage and EV batteries are not just cheap, they are now manufactured at a huge scale

In 2022,  
EU wind and solar  
generates  
more than gas  
for the first  
time

Source: Ember, 2023



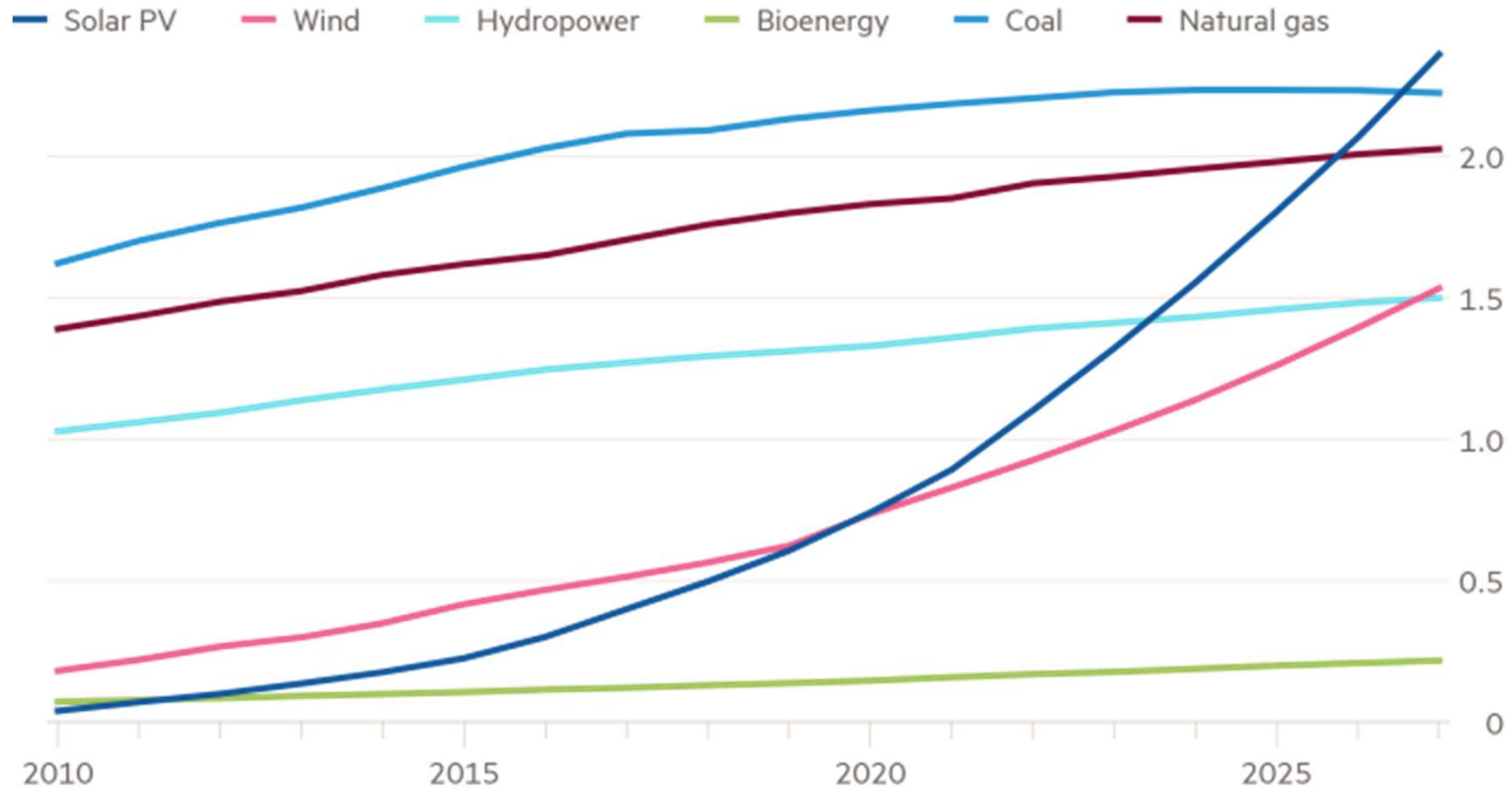
Share of electricity generation (%)



Source: annual electricity data, Ember

# Solar capacity set to overtake other power sources in 2027

Terrawatts

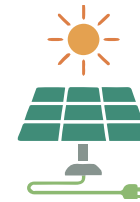
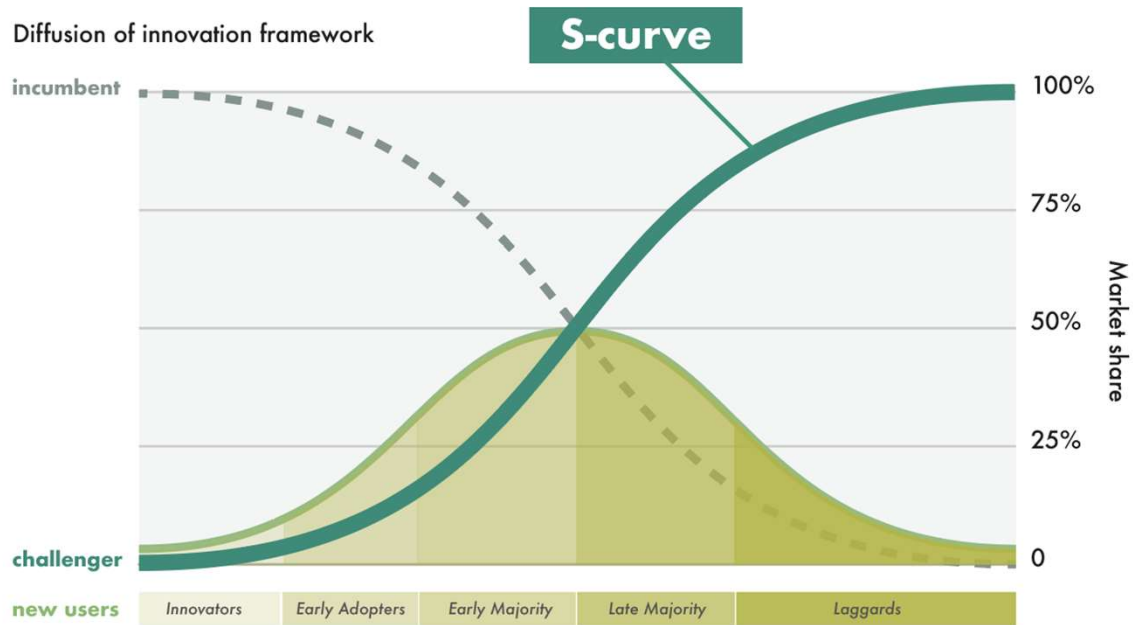


Source: International Energy Agency  
© FT

Source: FT: 27<sup>th</sup> February 2023) 5



# S-curve innovations are driving the energy transition



Solar panels



Wind turbines



Lithium-ion batteries

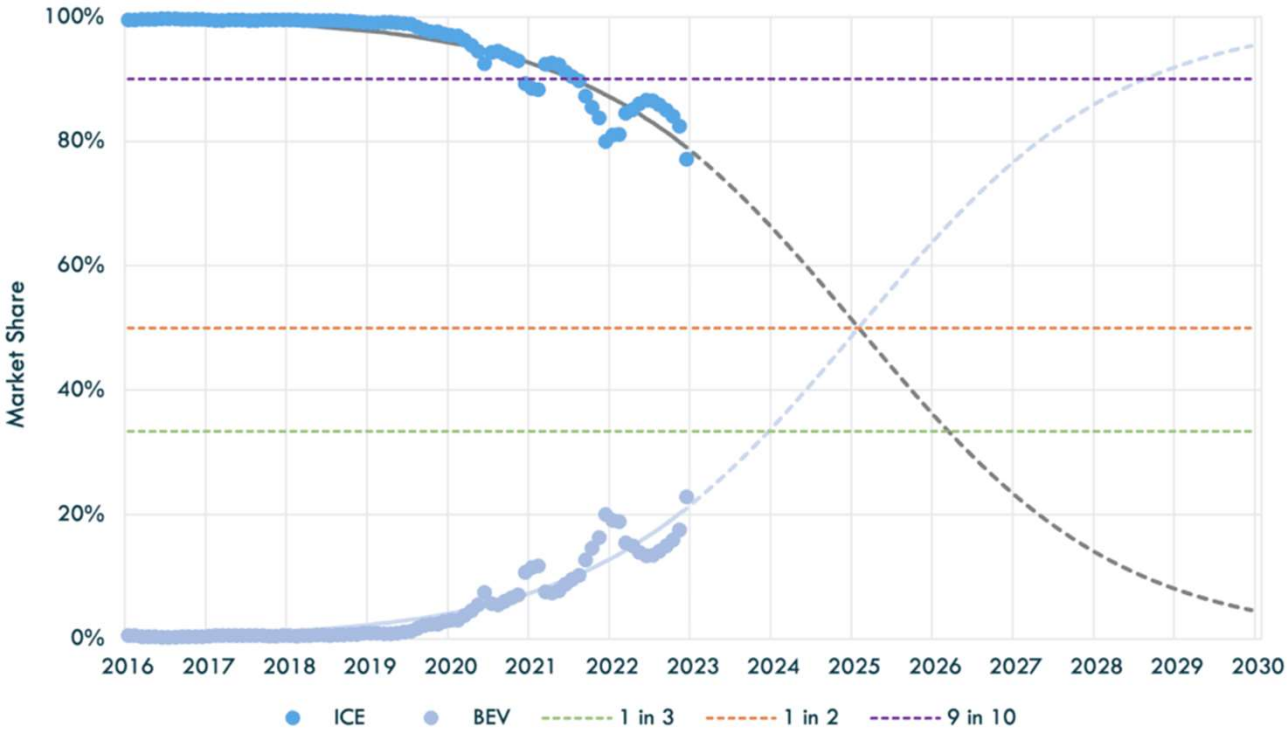


Each declined in cost **by 90%** over the past 2 decades

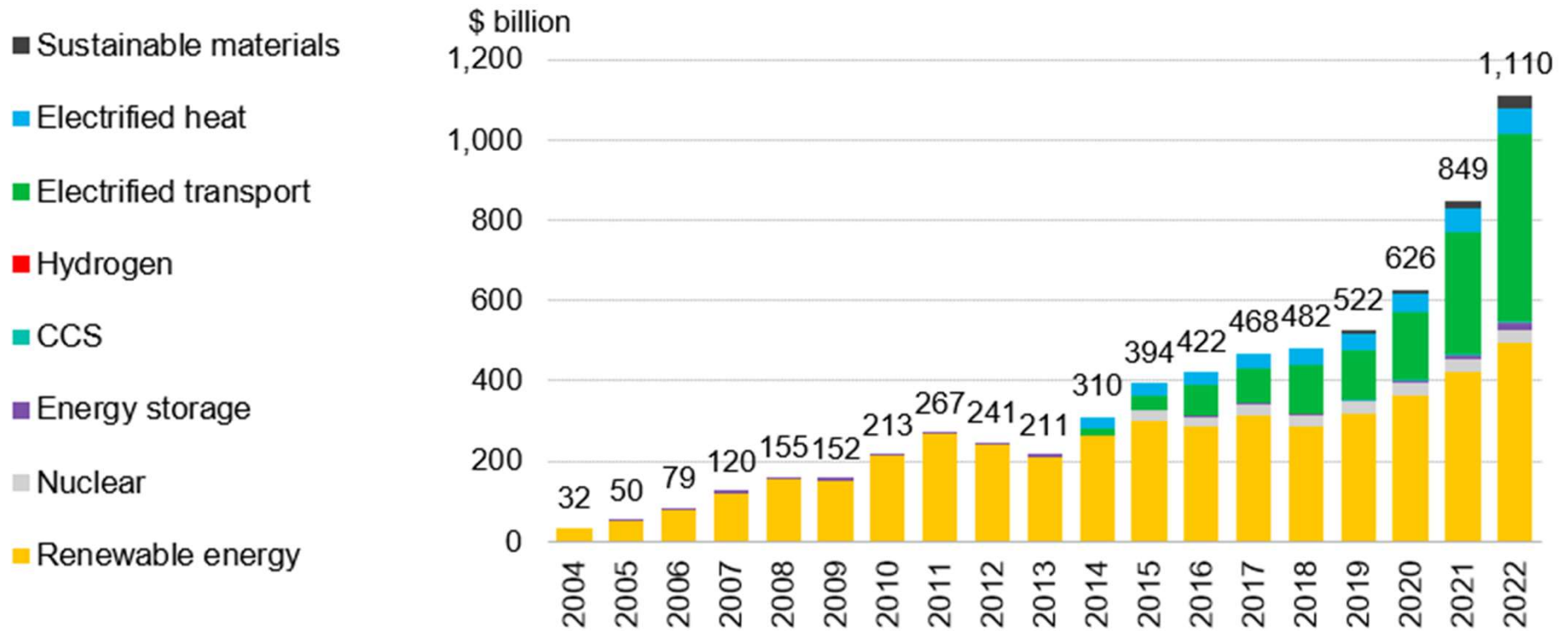


# Electric Vehicle Sales: S-Curve Oil Substitution Risk

UK New Vehicle Sales – BEV & ICE Market Share



Global investment in energy transition by sector



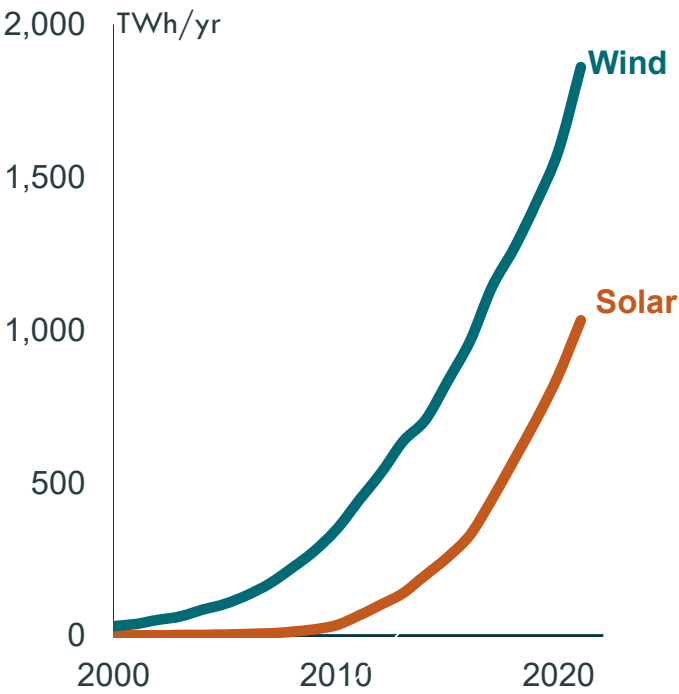
**Global investment in low-carbon energy surpassed \$1 trillion for the first time in 2022**





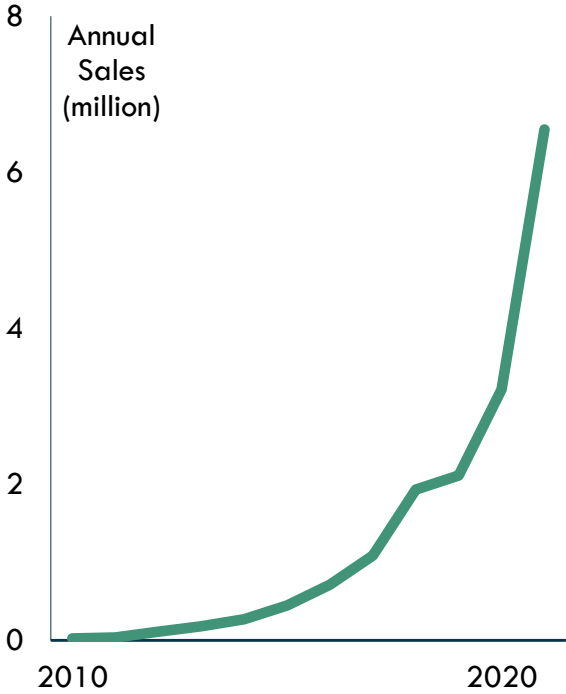
# Exponential Energy Change Is All around Us

Annual solar & wind generation



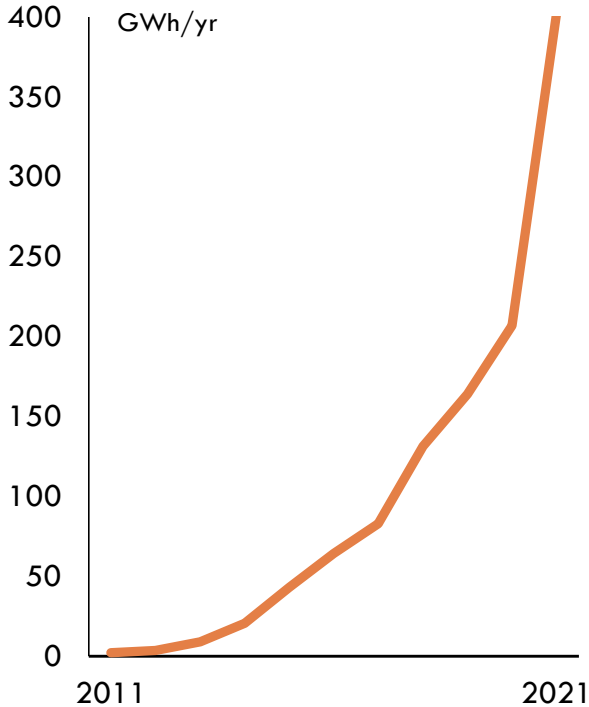
CAGR 21% 39%

Annual EV sales



68%

Annual battery sales



68%

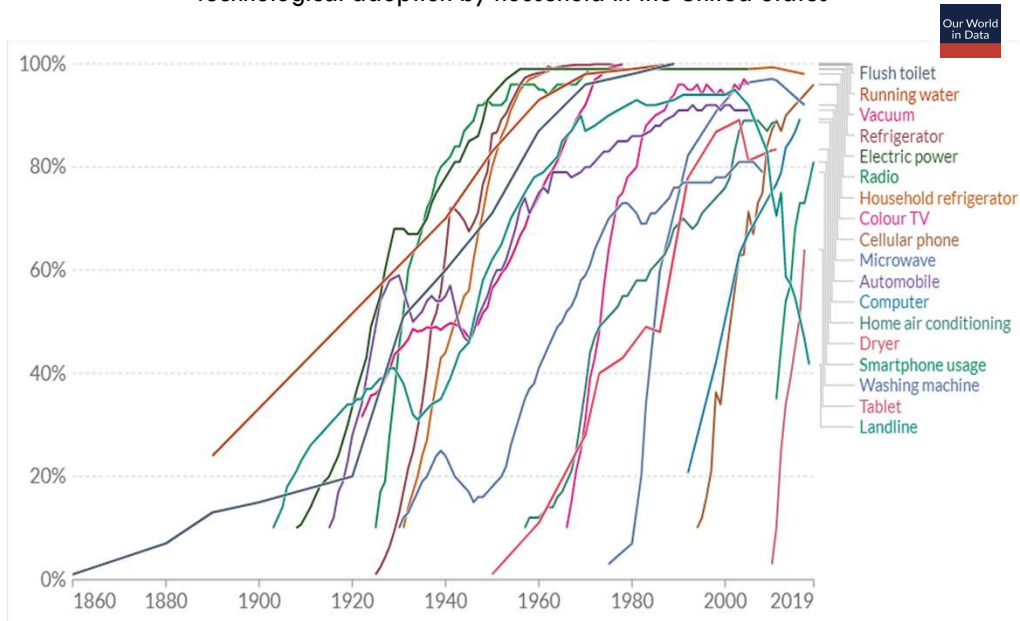


Source: BNEF, BP; Note: CAGR is the compound annual growth rate over the sample time period

# This Pattern of Growth Has Been Seen Many Times

## Individual products

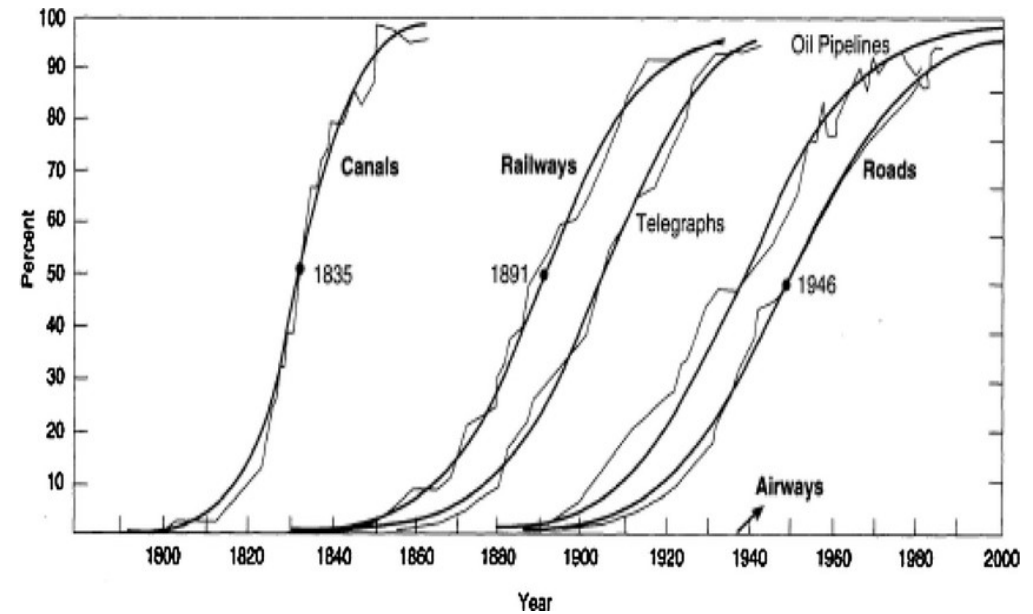
Technological adoption by household in the United States



Rapid exponential growth along S-curves is a standard characteristic of successful new technologies.

## Infrastructure systems

Share of maximum size in the United States

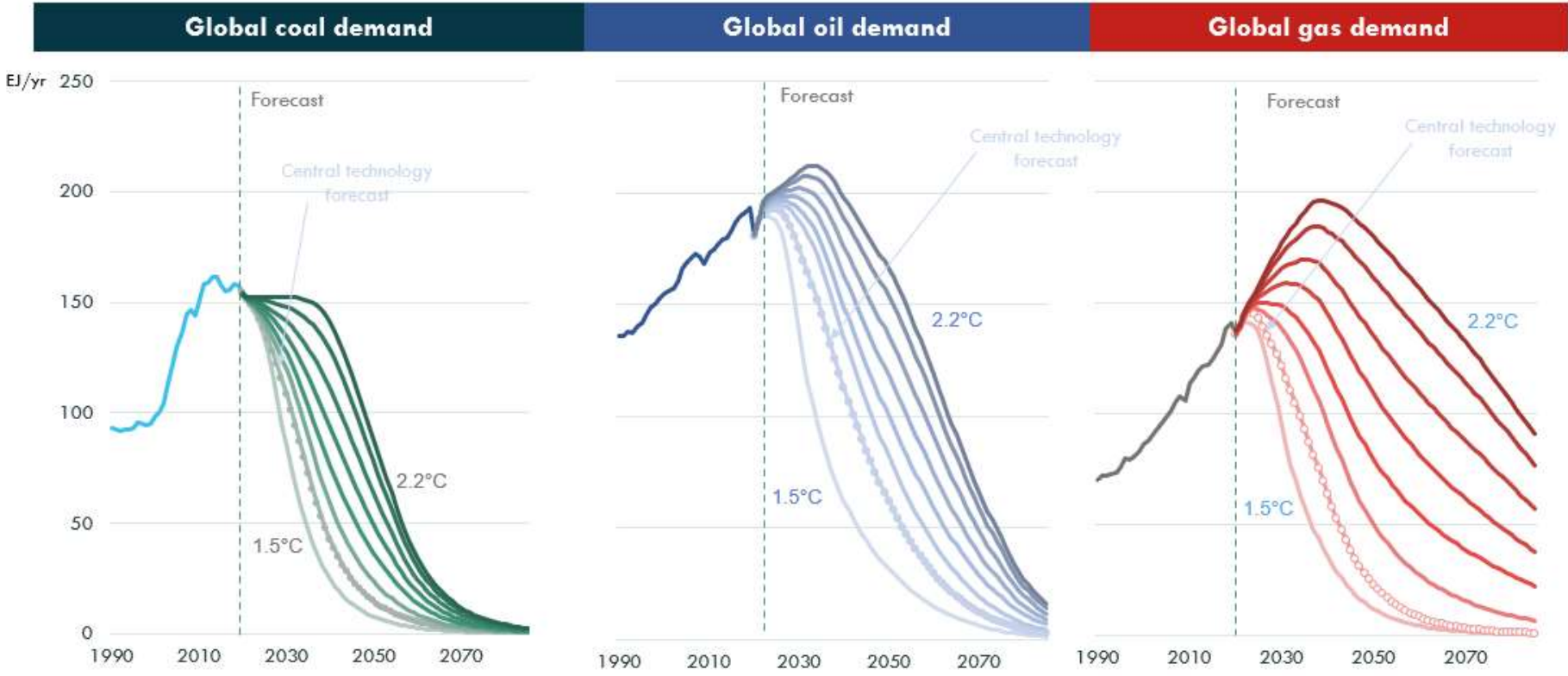


S-curve-type growth even applies to infrastructure.

Source: Comin & Hobijn via OWID (L); Grubler (R)



# Fossil Fuel Demand Will Ultimately Collapse



Coal demand is reaching the end of its plateau and is about to decline steeply.

Oil demand reached its peak in 2019 and is bouncing along the plateau.

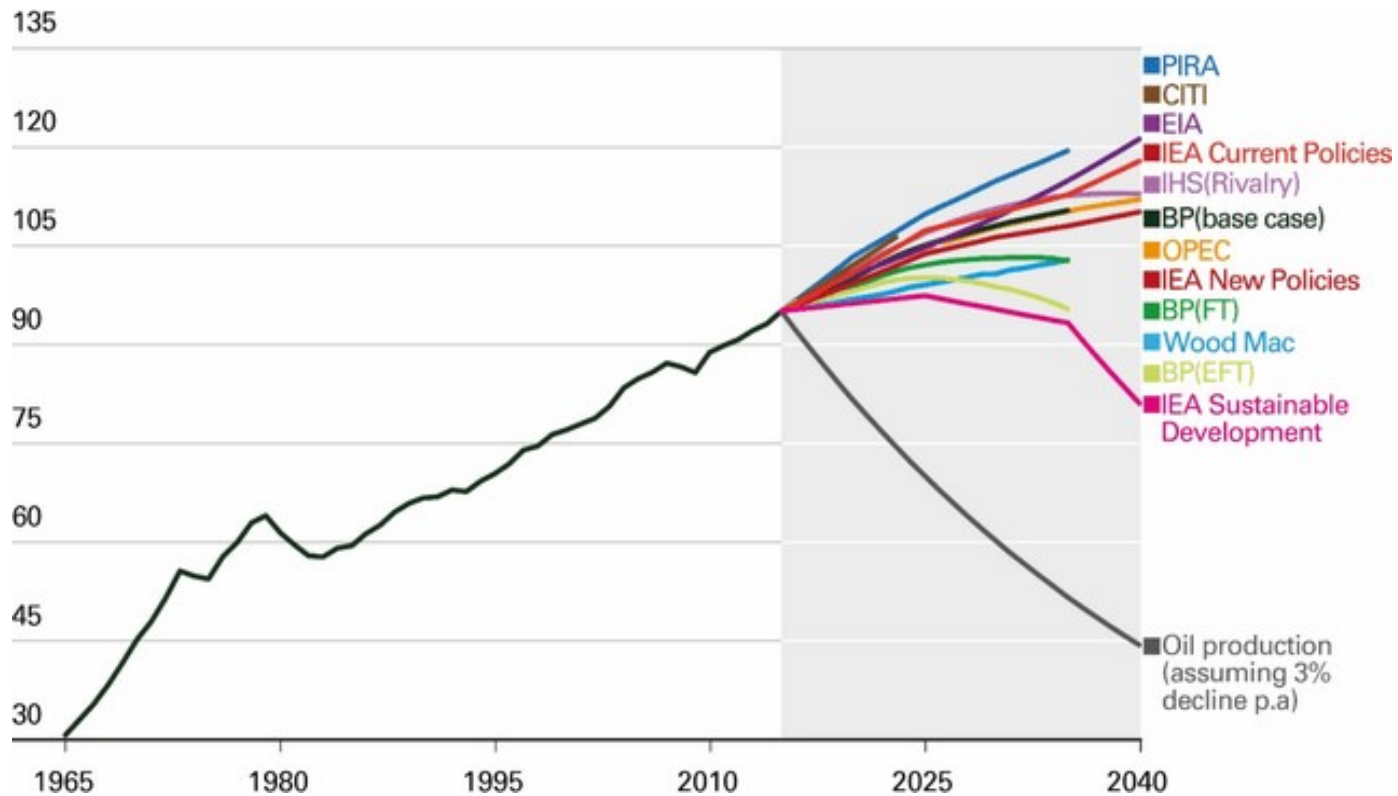
Gas demand is still rising, but the peak is near.

Source: Rystad; Note: Light to dark: 1.5°C to 2.2°C



# Fossil fuel companies plan for climate failure

The range of production scenarios



**Unburnable Carbon / Stranded Assets**



Source: BP

# Energy Transition: Incumbent Response

## “The Five Stages of Decline”

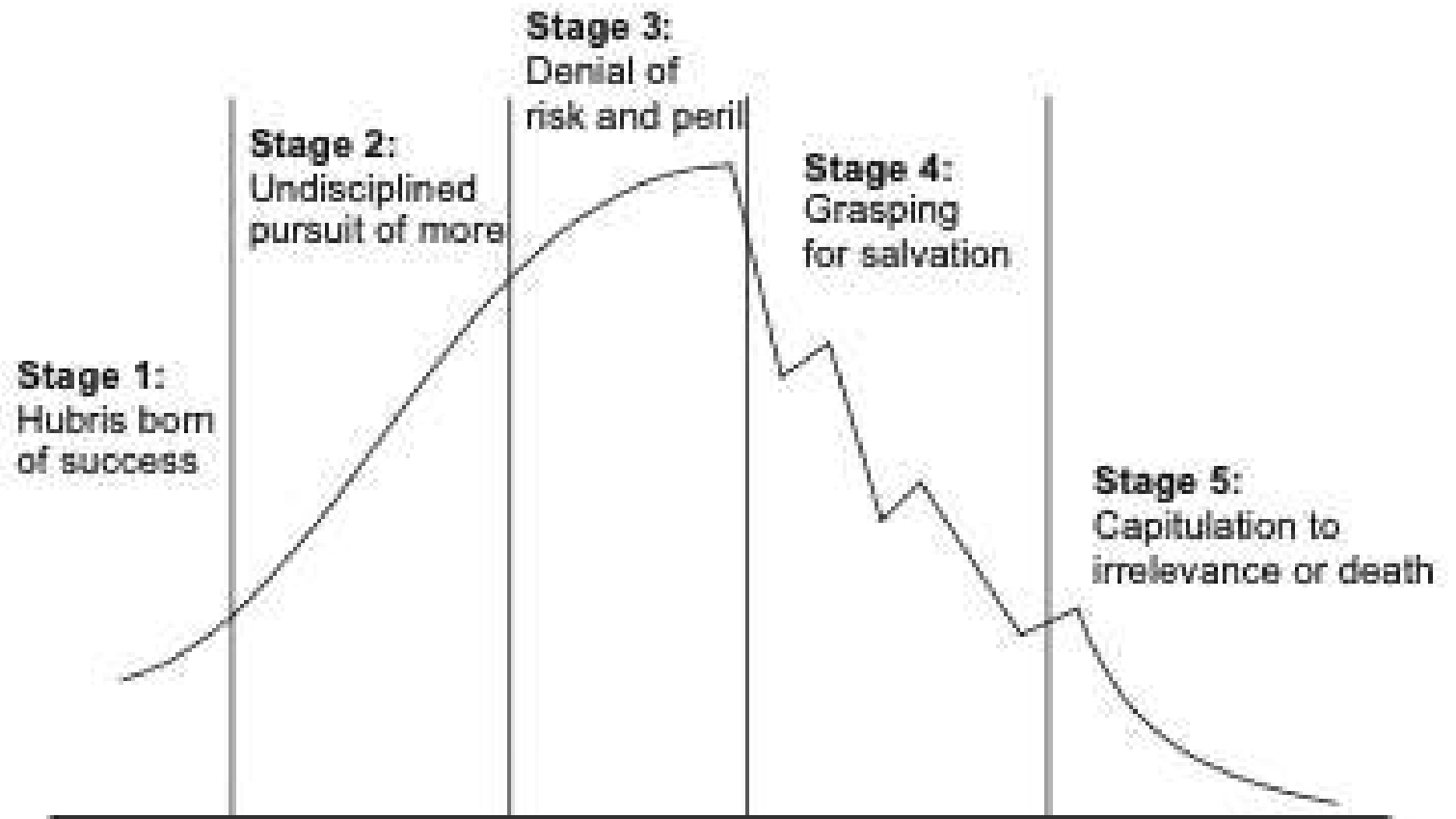
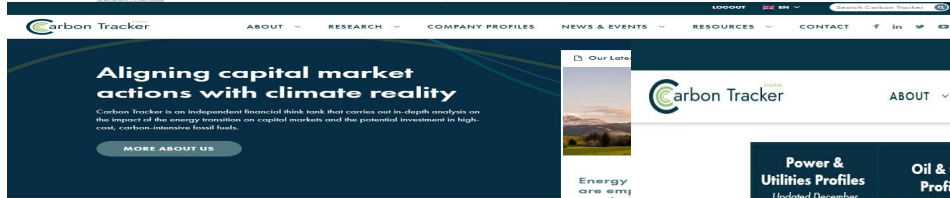
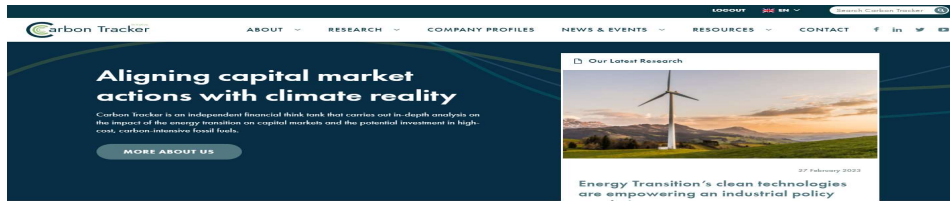


Fig. 1. The five stages of decline (Collins, 2009:20).



# Carbon Tracker's Research Freely Available



Air Liquide		Cerenity	
Chemicals, France	Revenues: EUR 23.3bn	Teksa, UK	Net profit: EUR 2.7bn
Year ended: 31 December 2021	Total assets: EUR 46.8bn		PPE, net: EUR 22.3bn
AGM date: 4 May 2022			
Accounting standards:	IFRS, as endorsed by EU		
Auditing standards:	Professional standards applicable in France*		
Audit firm / Audit partner:	EY / Jeanne Boulier and François Guillemain Pascal KPMG, Françoise Gervier and Séverine Sobier		

**OVERVIEW OF ASSESSMENT:** In 2021, Air Liquide (AL) set new climate targets, with the ambition to achieving "carbon neutrality" by 2050. It indicated that it considered climate when preparing its financial statements, including the potential impact on the useful lives of assets, impairment, its client portfolio and capex, but that the impact was not material. However, as in 2020, AL did not provide detail on how it made this determination, such as in the estimates and assumptions it used for short- and long-term carbon pricing or the useful lives on carbon-intensive assets. Similarly, there was no evidence that TAC and EY considered the impact of relevant climate-related matters in their audit beyond an indication that AL had sustainable development objectives.

Climate Action 100+ ASSESSMENT METRICS AND SCORES <sup>1</sup>	Sub-indicator 1: Financial statements (TAC)		Sub-indicator 2: Audit report identified		Sub-indicator 3: Disclosed in 2022 by 2020 (if relevant)	
	Metric 1a: Incorporate the effects of material climate-related inputs	Metric 1b: Consider with other matters	Metric 2a: how the auditor assessed impacts of climate-related matters	Metric 2b: In the company's reporting	Metric 3a: The TAC report identified that were aligned with this audit <sup>2</sup>	Metric 3b: Audit report identified that were aligned with this audit <sup>2</sup>
CCAA metrics	Reporting to 2021 AGM	Consistency v/ other reporting	Consistency v/ other reporting	Consistency v/ other reporting	Consistency v/ other reporting	Consistency v/ other reporting
FT2021 Overall score	The objectives of the assessment were not met					
Overall score	PRIOR YEAR SCORES (FY2020)					
Sub-indicator 1	0	0	0	0	0	0
Sub-indicator 2	0	0	0	0	0	0
Sub-indicator 3	0	0	0	0	0	0
Materiality	0	0	0	0	0	0

<sup>1</sup> See methodology for Environmental Review on Auditing (ERA) at <https://www.carbontracker.org/research/era-report>  
<sup>2</sup> For assessment of CA 100+ Climate Accounting and Audit Alignment Assessment (CAAA), see also "Background to the Assessment" of the audit report.  
<sup>3</sup> We also reviewed ICCC Climate Examinations for Reporting Alignment Assessment when developing the assessment methodology for this.  
<sup>4</sup> CA defined as materiality in these inputs, assumptions and estimates.  
<sup>5</sup> On the auditor performed its own sensitivity analysis on the potential implications.

[www.carbontracker.org](http://www.carbontracker.org)



# Disclaimer

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# Oil Price Implications of the transition

