

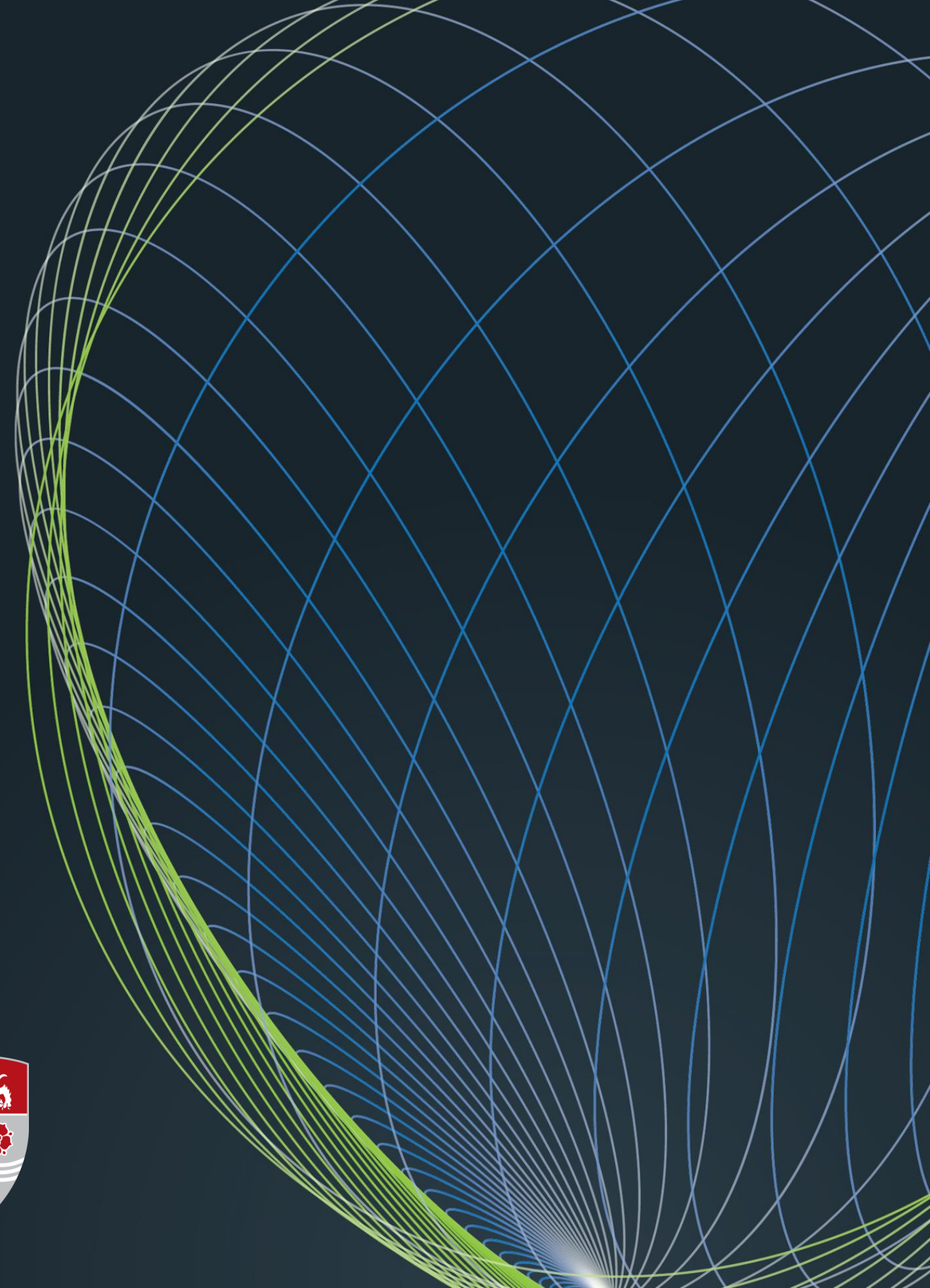


TIDE: Timescales and Investment Dynamics in the Economy

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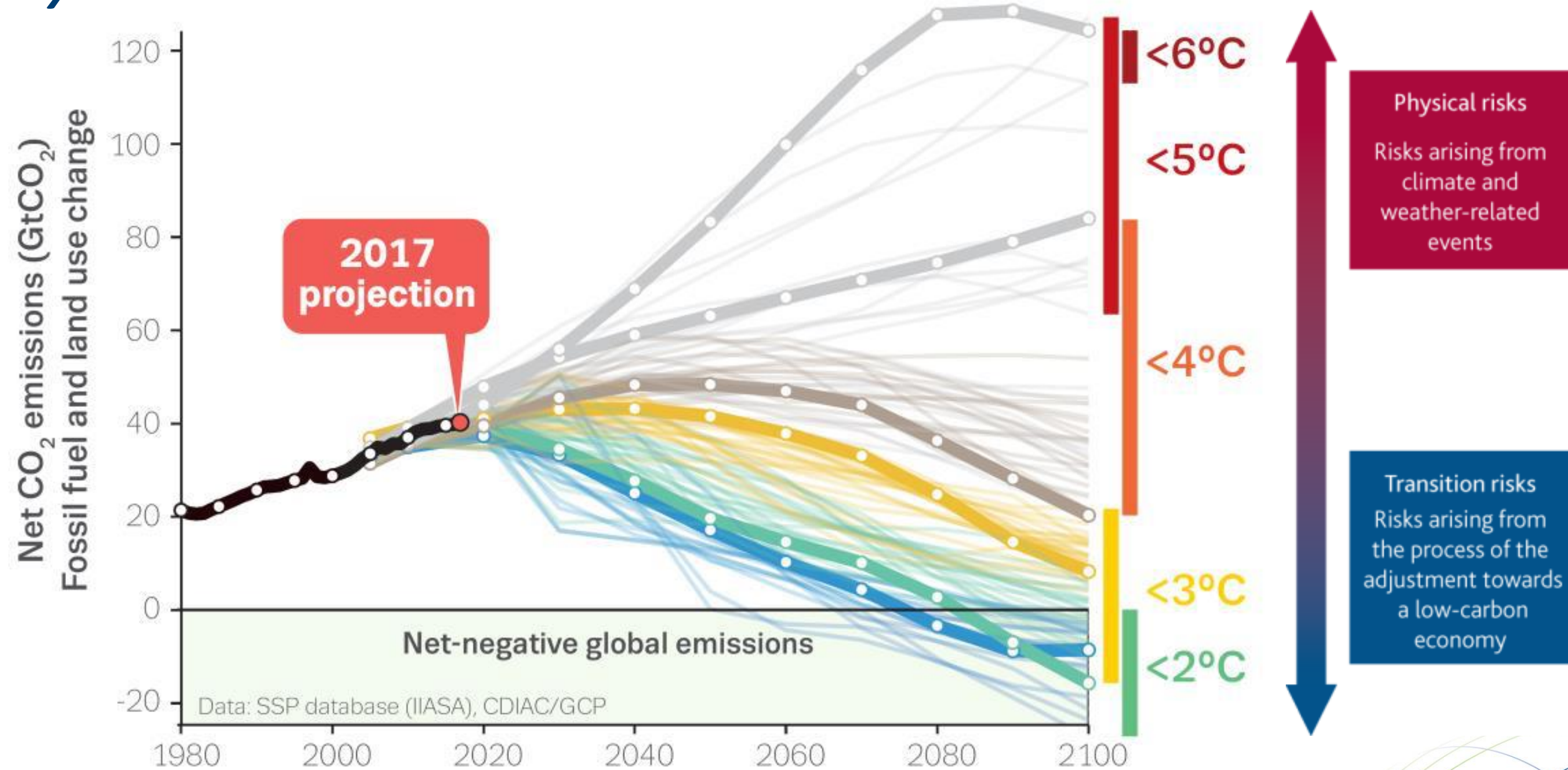


The economy thrives on change...
but it also can't handle change!



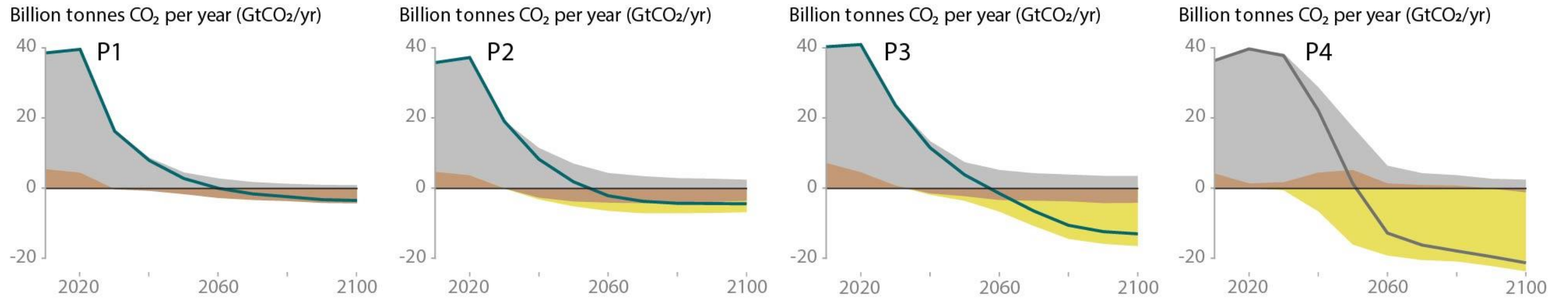
Financial risks and the impacts of climate change

According to the **Bank of England**, 2 types of climate-related financial risk:
Physical risks and **transition risks**



Pathways discussed in the IPCC report SR15

4 Scenarios proposed: unprecedented rates of change

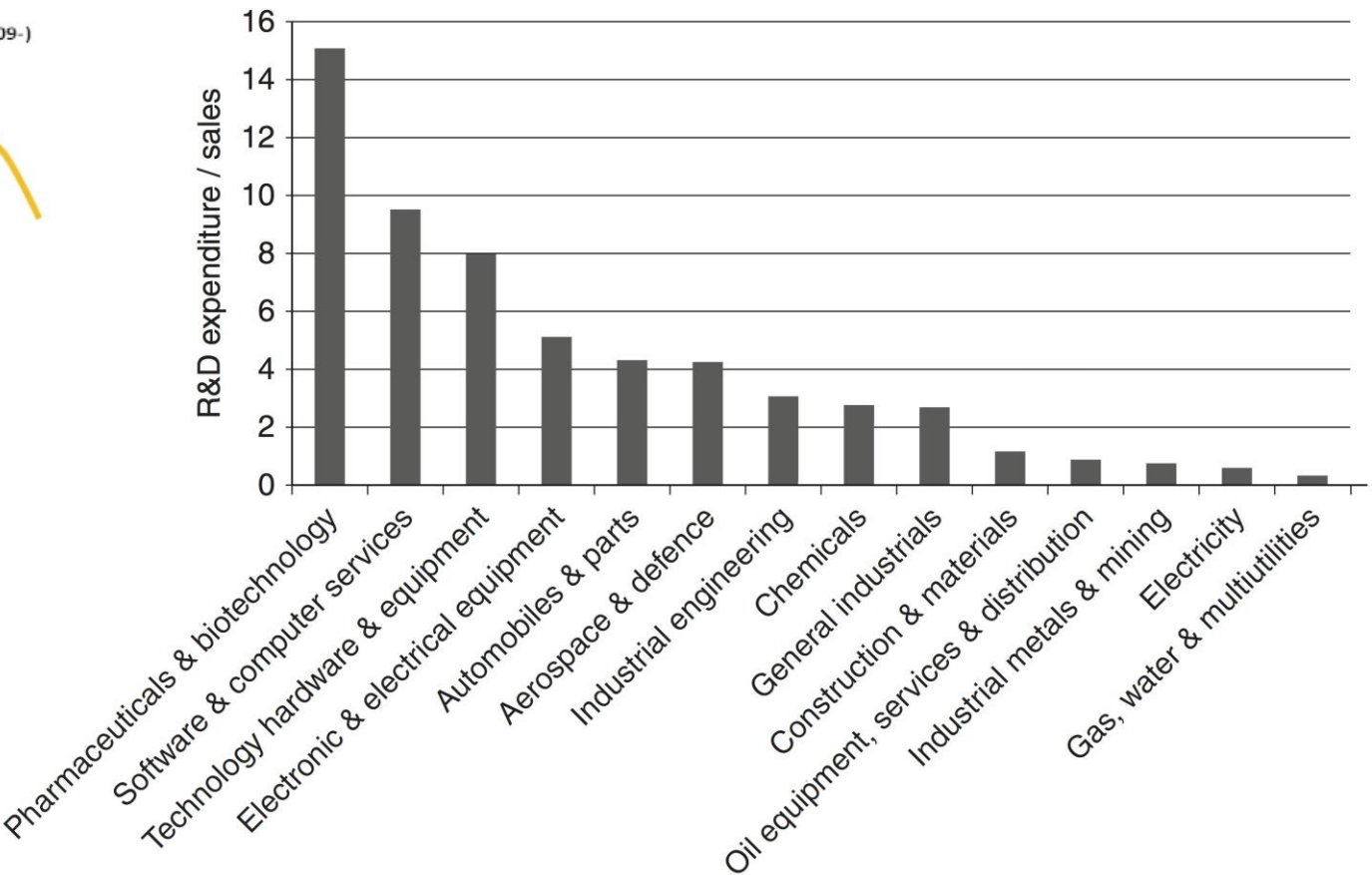
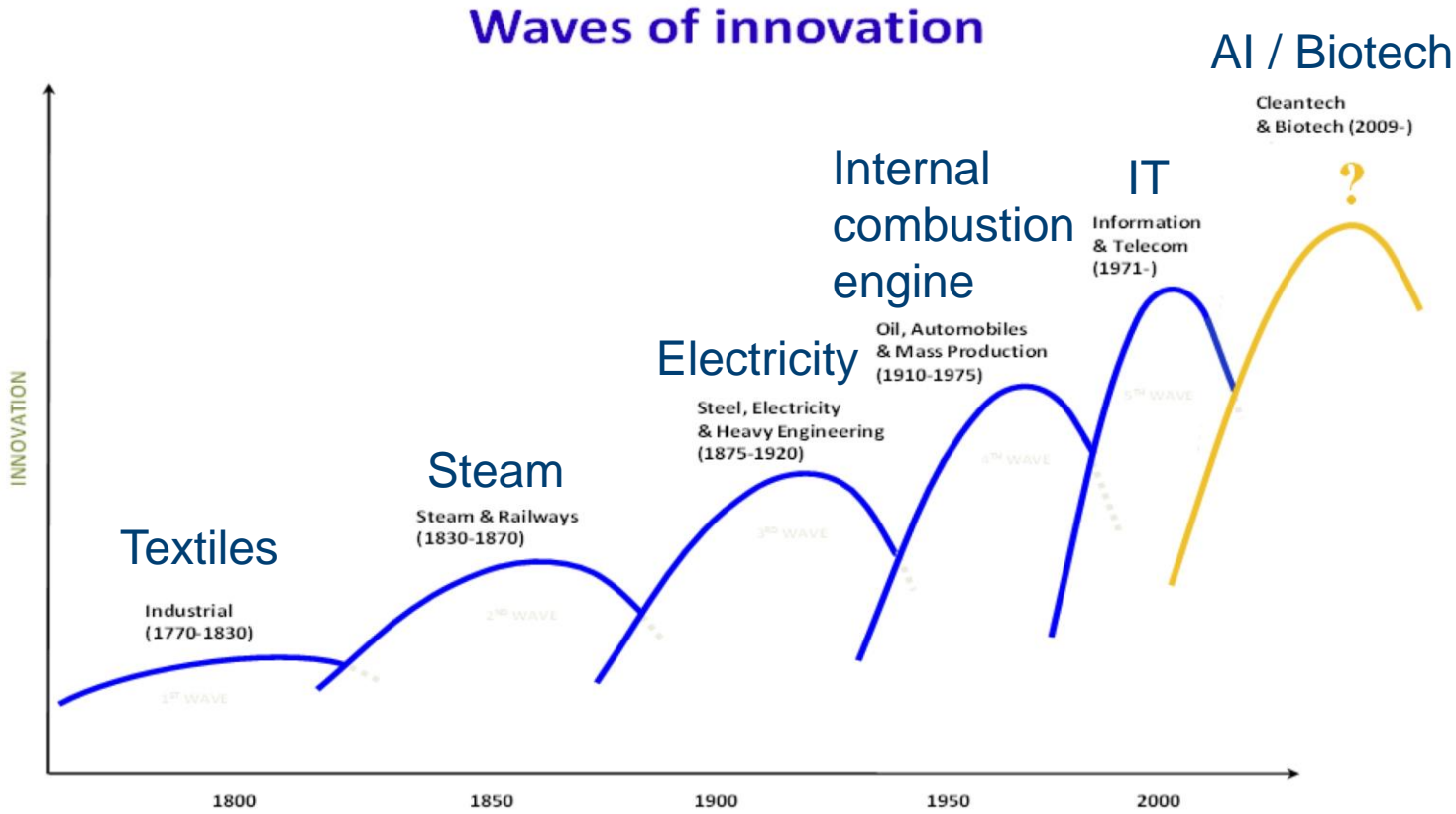


Ultra-rapid transformation: can the economy go around the bend?

The economy is characterised by substantial inertia



Great waves of innovation historically



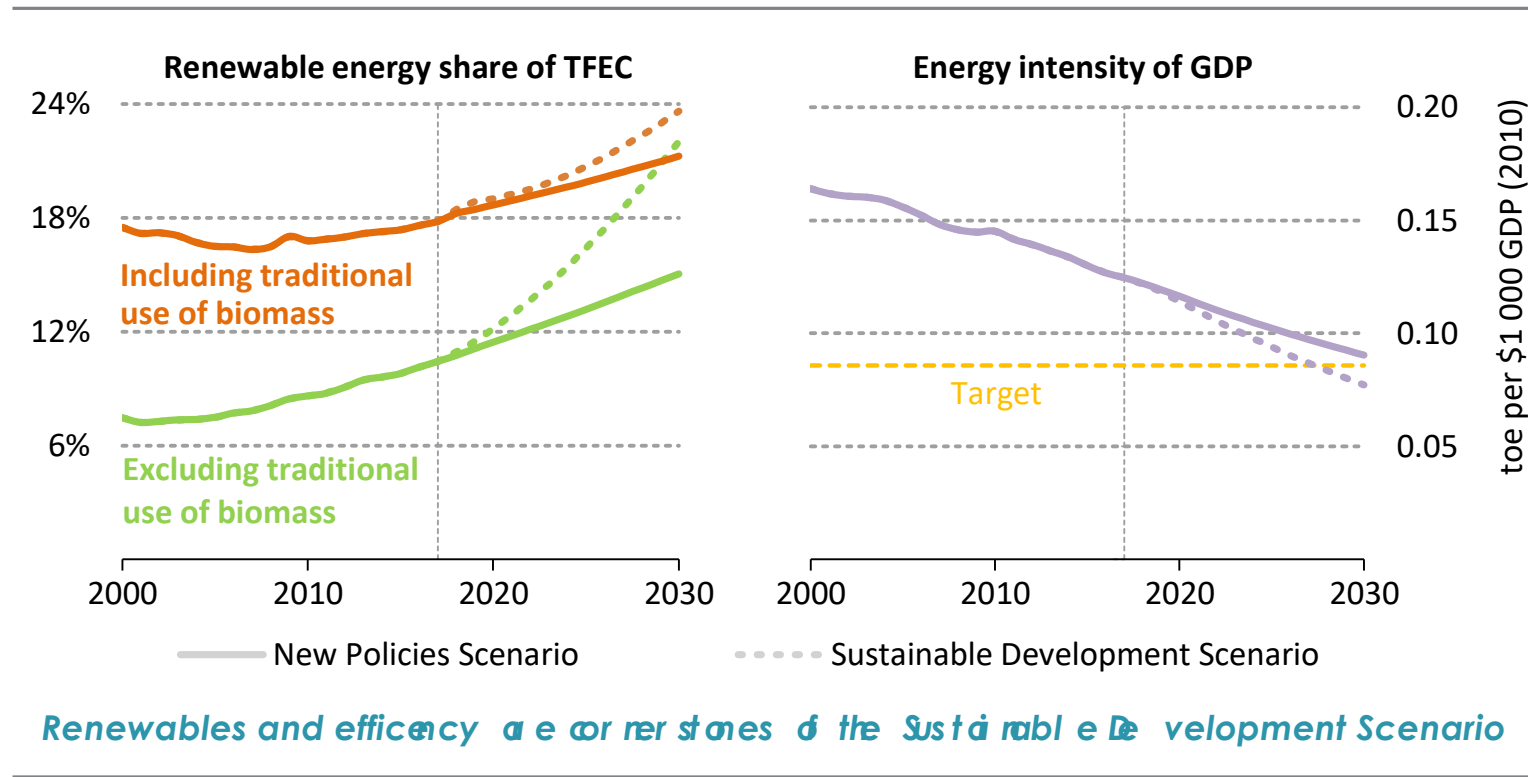
Socio-technical change and creative destruction happen all the time!

Grubb, Planetary Economics, Ch 11 p420 and Ch 9 p 321 (2014)
 Freeman & Louça (2001) and C. Perez (2001)



Are we in a low-carbon transition?

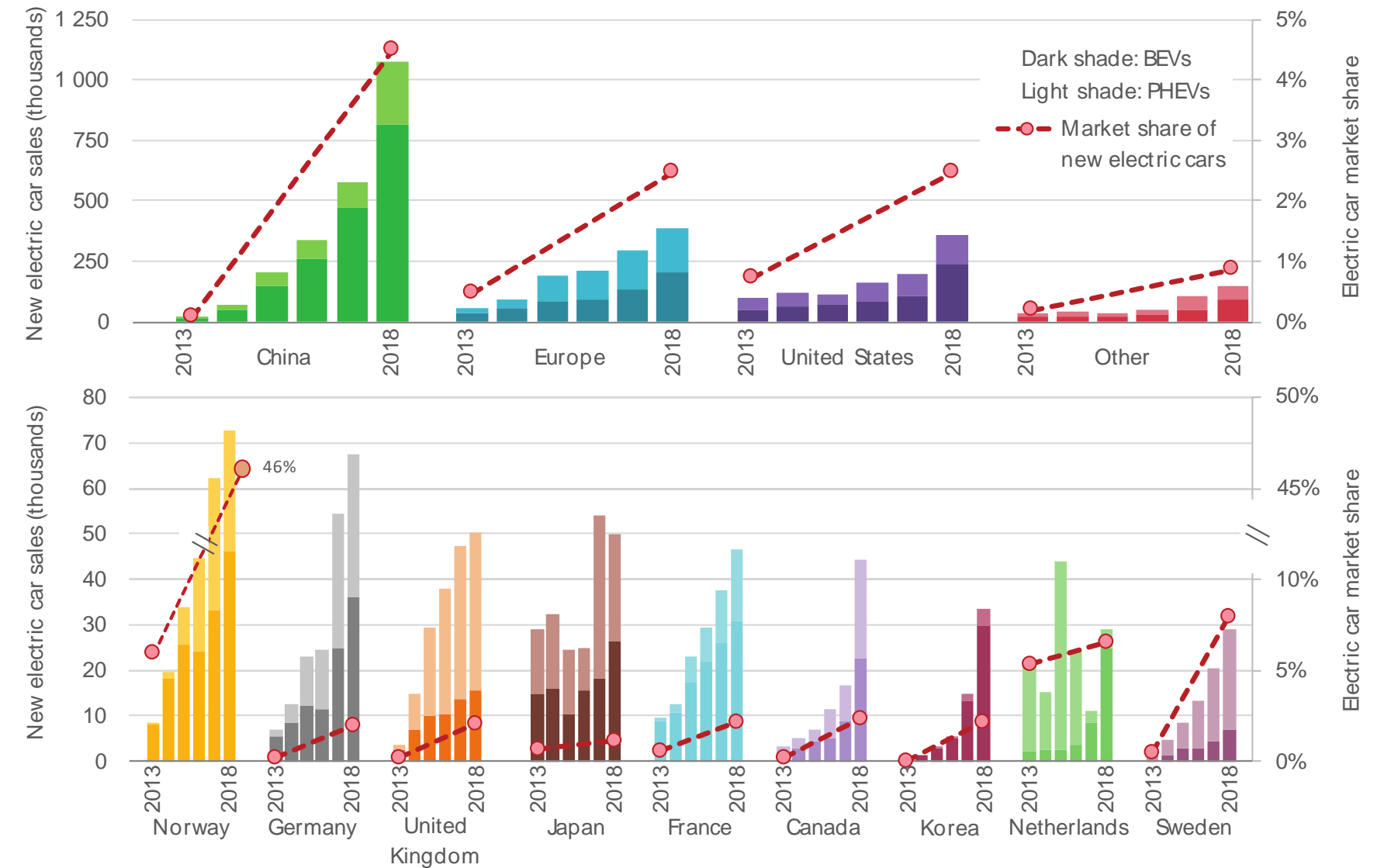
Figure 6.8 Progress towards SDG 7.2 and 7.3 in the New Policies and Sustainable Development scenarios



Note: TFEC = total final energy consumption, which excludes non-energy use.

IEA World Energy Outlook 2018

Figure 1. Global electric car sales and market share, 2013-18



IEA Global EV Outlook 2019

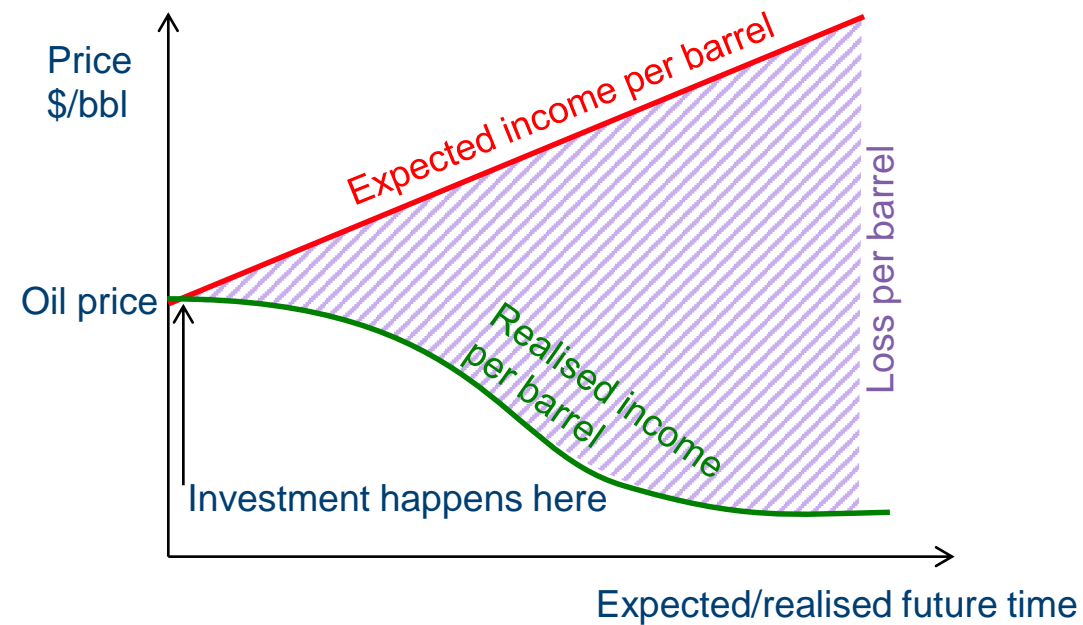
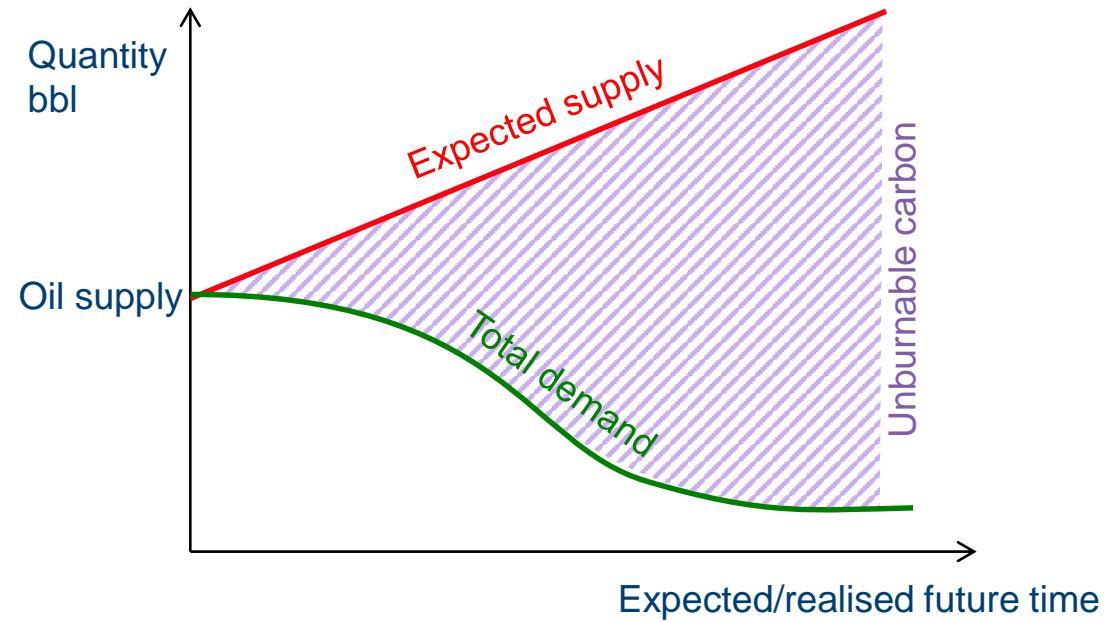
Stranded fossil fuel assets?



- Assets can be **reserves**
- Assets can be **physical capital** with have long lifetimes
- Both equity and **bank finance** are involved
- Companies **take out finance**, expect return
- Large **changes in prices** can make projects unprofitable, and companies **insolvent**
- Who invests: pension funds, investment funds, banks ...



Stranded fossil fuel assets?

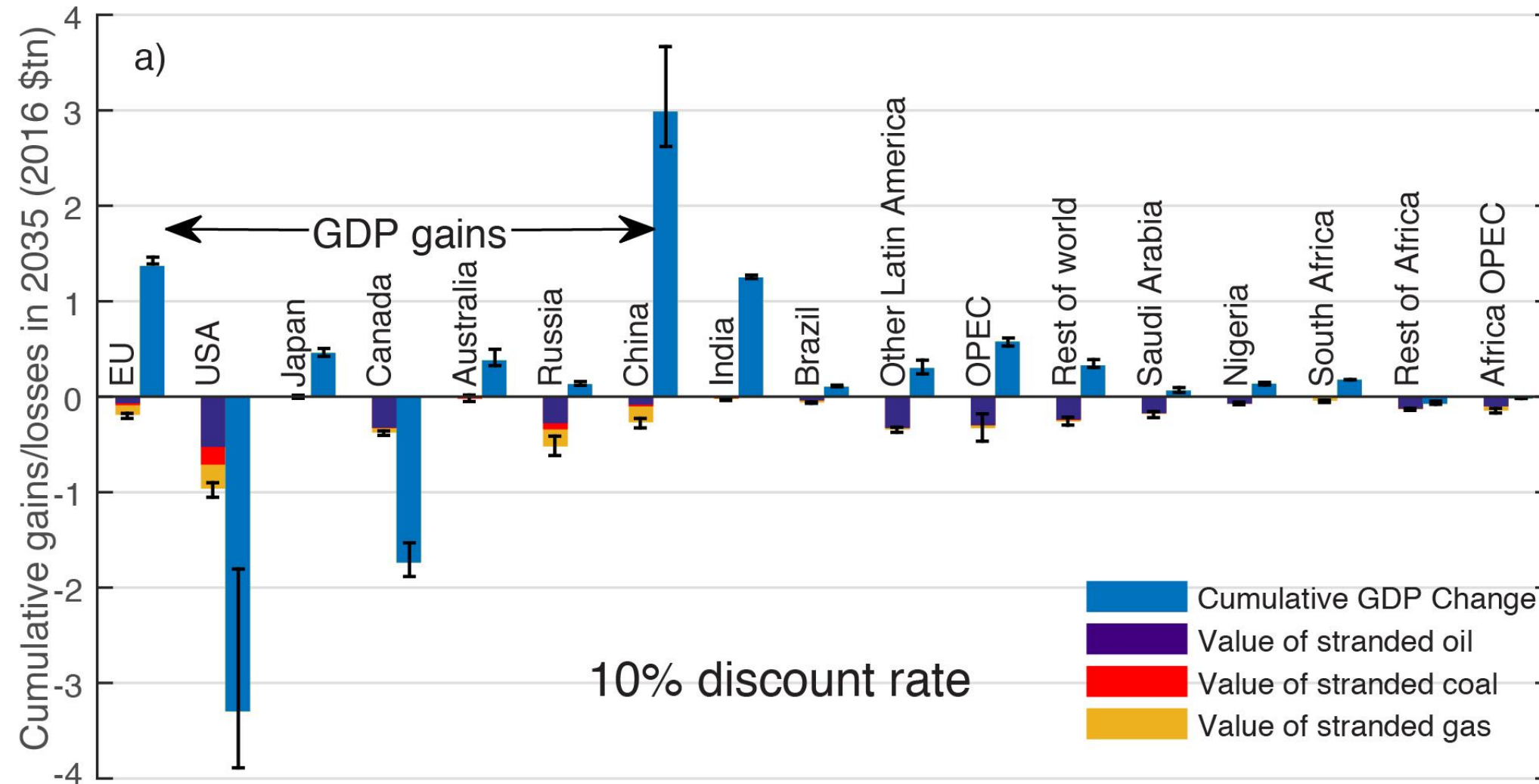


Stranded Fossil Fuel Assets:

Sum of discounted (price x quantity) until 2035



Rapid transition leads to stranded capital:



Worldwide loss to 2035:

\$1-4tn (discounted 2016 10%)

\$6-12tn (undiscounted)

Mercure et al, Nature Climate Change (2018)





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Chilling 'carbon bubble' study warns dramatic decline in demand for fossil fuels could wipe TRILLIONS from the global economy

- New research suggests a dramatic decline in demand for fossil fuel in the near future will trigger a 'carbon bubble' built on long-term investments to burst
- Advances in clean energy are expected to leave companies with stranded assets
- One to four trillion US dollars could be wiped off the global economy
- Slump is likely to occur before 2035 regardless of any new climate policies

By MOLLIE CAHILLANE FOR DAILYMAIL.COM

PUBLISHED: 19:15, 5 June 2018 | UPDATED: 19:24, 5 June 2018

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Plummeting demand for fossil fuel and an increase in demand for clean energy could trigger a 'carbon bubble' that researchers say could trigger a global financial crisis.

New research has found that an expected dramatic decline in demand for fossil fuels before 2035 could cause a loss of one to four trillion dollars, and warns it will happen regardless of any new climate policies.

The 'carbon bubble' bursting will cause losses greater than the 2008 financial crisis, and the US and Canada will be hit the hardest, the chilling report warns.

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THE GLOBAL economy is looking at a time bomb due to a 'carbon bubble' from investment in fossil fuels which is likely to burst, wipe off trillions from the global economy and bring devastation to the planet, according to terrifying new research.

By MATT DRAKE

PUBLISHED: 00:17, Wed, Jun 6, 2018 | UPDATED: 01:13, Wed, Jun 6, 2018

The Guardian UK edition

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B. REYNOLDS

Ben Webster, Environment Editor

June 5 2018, 12:01am, The Times

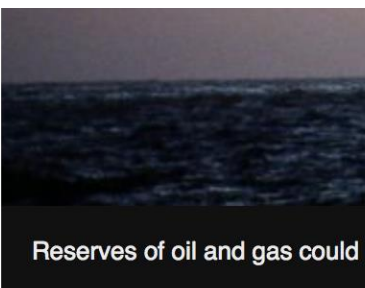
Labour Party

UK politics

Education

Energy

Donald Trump



Reserves of oil and gas could r

A rapid reduction in demand could cause losses of \$1-4 trillion by 2035

How fast can we transform the economy?

- 1- What explains rates of structural economic change in an adaptive economy?
- 2- What is a sustainable rate of transition to achieve current climate targets?



Ultra-rapid transformation: can the economy go around the bend?



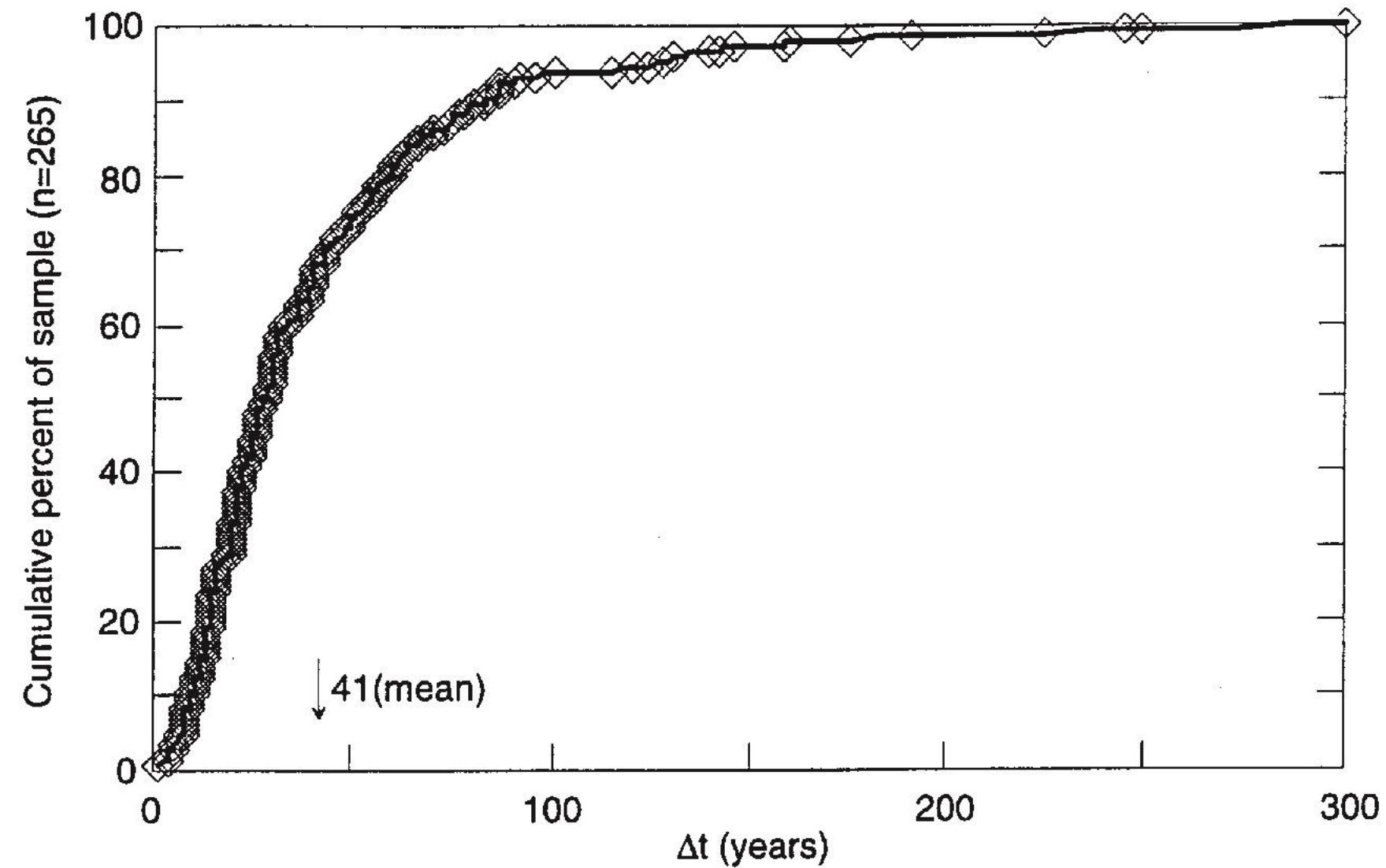
We observe three stylised features of the economy

1. Global economic growth happens at $\approx 3\%$ pa since 1900
 - Some countries grow faster, some slower
 - Globally it is quite stable
2. The rate of return on investment is around $\approx 3-4\%$
 - Risk-return profiles vary
 - Overall returns globally stable over time
3. Capital turnover follows a timescale of around 30-40 years
 - Capital has distributed lifetimes at all time scales
 - Average turnover of 30 years $\approx 3\%$ growth/return



Distribution of capital payback times

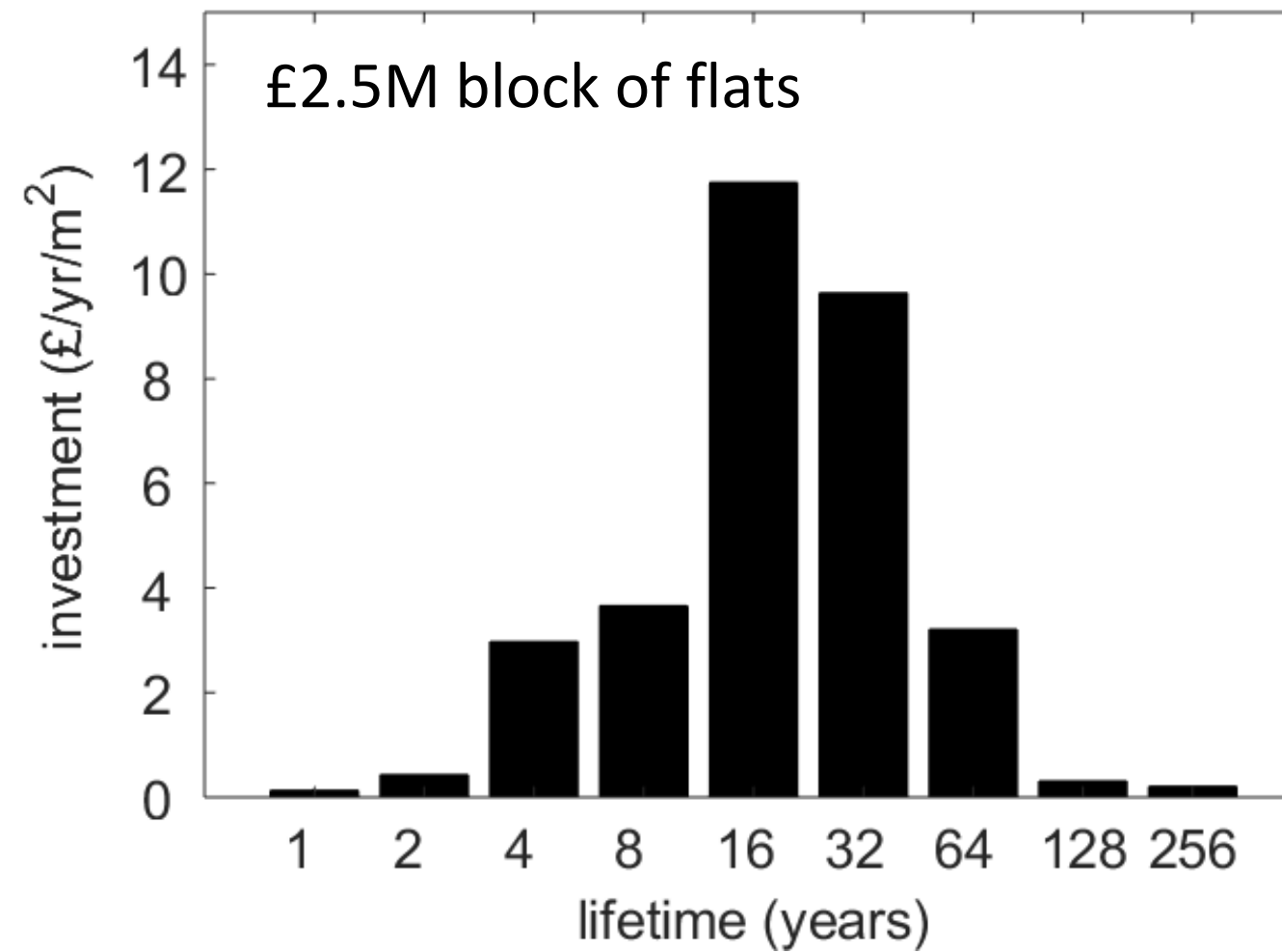
Unknown, but distribution of diffusion rates is known:



Grubler et al, Energy Policy (1999)



Distribution of capital payback times



- We think of assets have single lifetimes. e.g. a house = 50 years, a car 15 years
- But assets are made of many parts, each with differing lifetimes.
- Think of the building we're in?

Jarvis *et al* in preparation (2019)

TIDE project: Method and expected results:

1. Review **process-based life-cycle analysis** literature
 - Literature review,
 - Data mining
 - Retrieve a representative range of capital lifetimes
 - Construct relationship between
 - Exergy investments (and monetary)
 - Lifetimes
 - Disaggregate *long-term assets at risk of stranding*
2. Assess the capital turnover of **existing transition scenarios**
 - Incorporate to an integrated assessment model
 - Explore real economy effects of rapid turnover
 - Estimate implications for value invested in current infrastructure
 - Understand who the winners and losers are



Who ultimately owns all these assets?

Rank	Issuer	Market Value
1	ROYAL DUTCH SHELL PLC	463.02
2	ROCHE HOLDING AG	395.12
3	MICROSOFT CORP	384.88
4	TENCENT HOLDINGS LTD	347.44
5	ALIBABA GROUP	332.34
6	NESTLE SA	325.42
7	SAMSUNG	322.48
8	MASTERCARD INC	293.63
9	PRUDENTIAL PLC	274.12
10	DIAGEO PLC	261.71
11	ALPHABET INC	247.91
12	FLUGHAFEN ZURICH AG	239.84
13	TAIWAN SEMICONDUCTOR MANUFACTURING CO LTD	238.35

- USS UK's pension fund largest private pension fund
- Trustees under legal obligation to maximise returns
- Focus of financial sector on returns suitable for **working lifetime** of people

USS pension fund website (2019)



Financial decisions as a source of transformative change?

1. Divestment is partly a red herring:
 - It downgrades asset in terms of risks, but the assets do not disappear!
 - Assets are ***traded on as junk!*** (unless unprofitable)
 - It is climate policy, not divestment, that reduces emissions
2. Financial disclosure for financial institutions:
 - New climate risk disclosure policy imposed by financial regulators
 - Requires companies/funds to self-assess and disclose their climate risks
 - ***Physical risks, transition risks***
 - Helps smoothen the transition!
3. So, what is the policy remedy to stranded assets?
 - Need to understand the structure of capital
 - High-carbon vs low-carbon: are they the same?
 - **Understand who the losers are!**



Thank you!



Global Systems Institute

