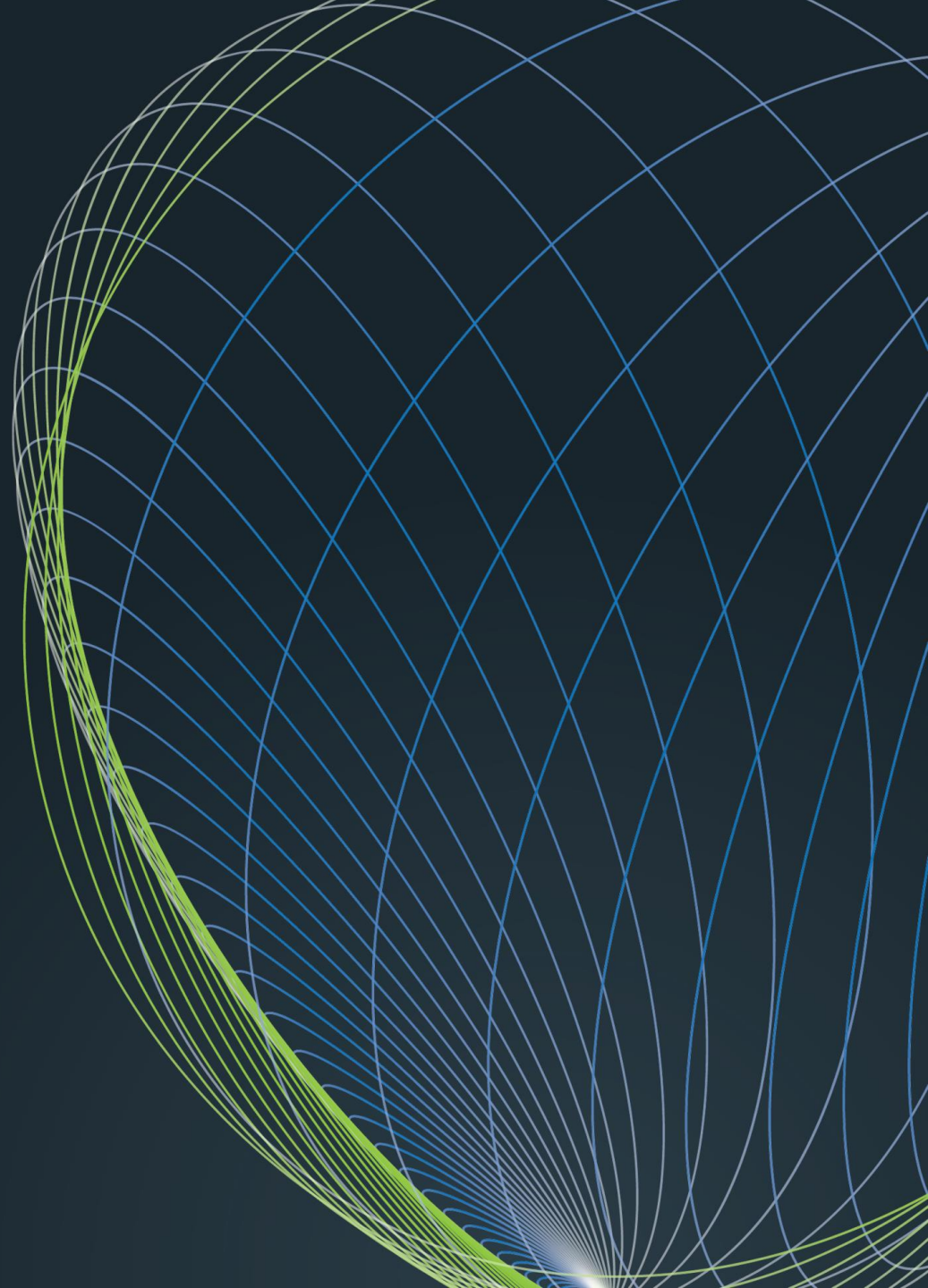
UNIVERSITY OF EXETER | GLOBAL SYSTEMS INSTITUTE

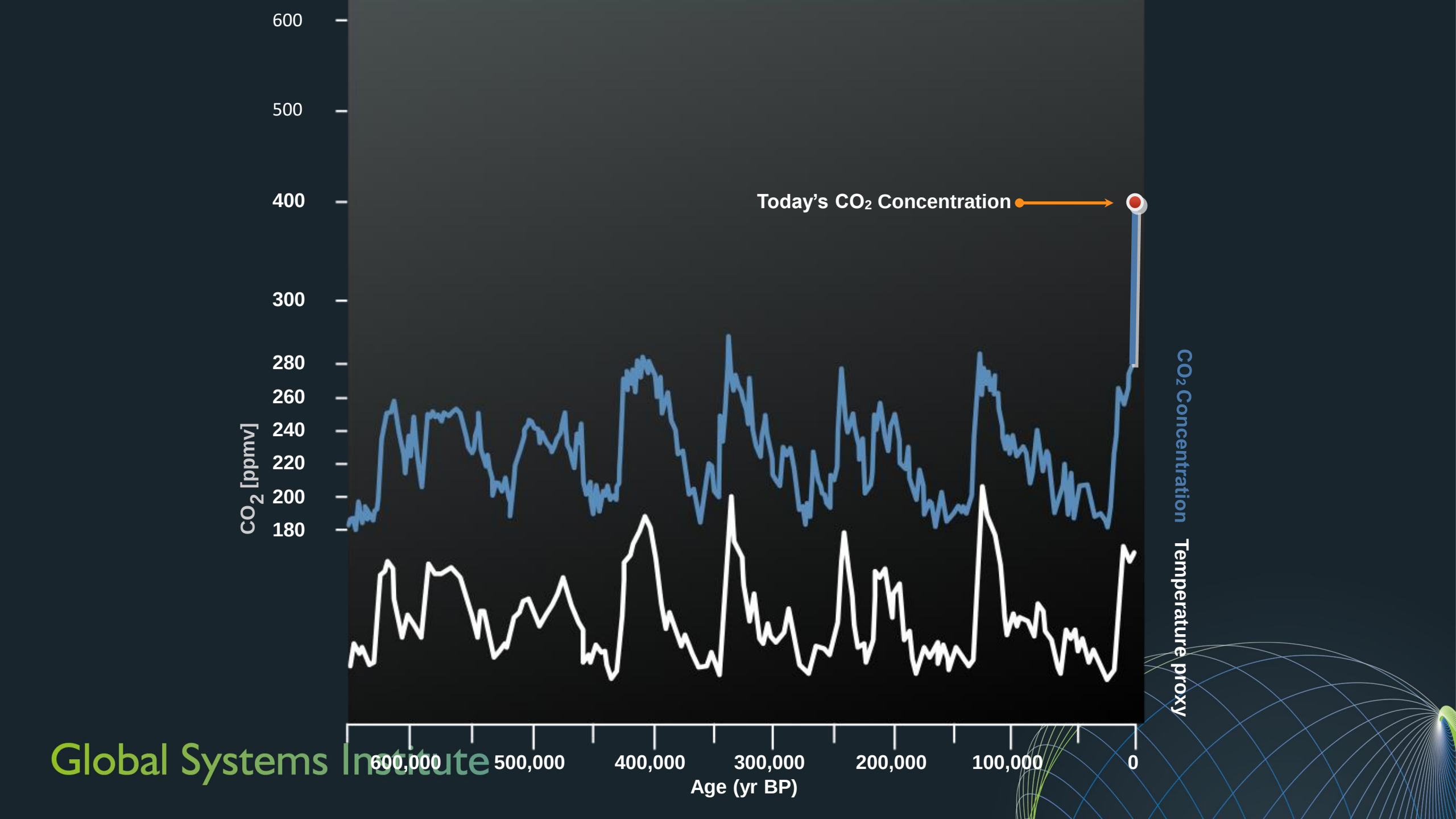
Positive tipping points to avoid climate tipping points

Tim Lenton

Director, Global Systems Institute, University of Exeter
t.m.lenton@exeter.ac.uk

exeter.ac.uk/**gsi**





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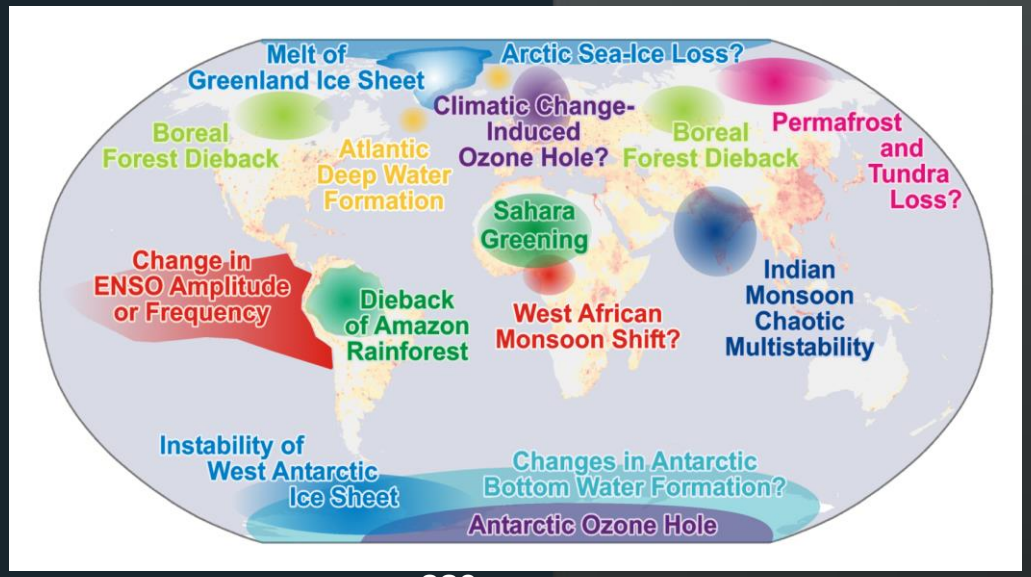

600

In the rest of my lifetime?

Today's CO_2 Concentration

280
260
240
220
200
180

CO_2 [ppmv]

CO_2 Concentration

Temperature proxy

600,000 500,000 400,000 300,000 200,000 100,000 0

Age (yr BP)

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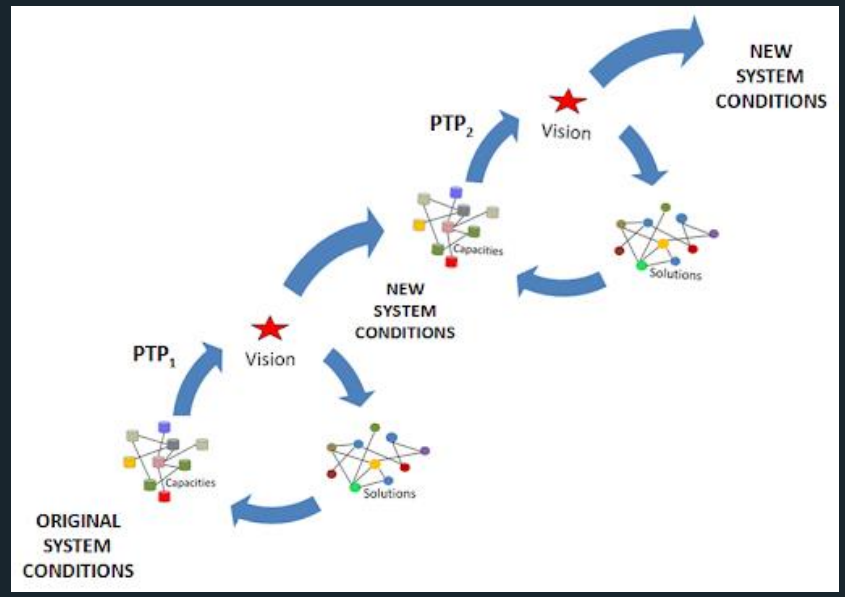
Outline

Climate tipping points

Positive tipping points



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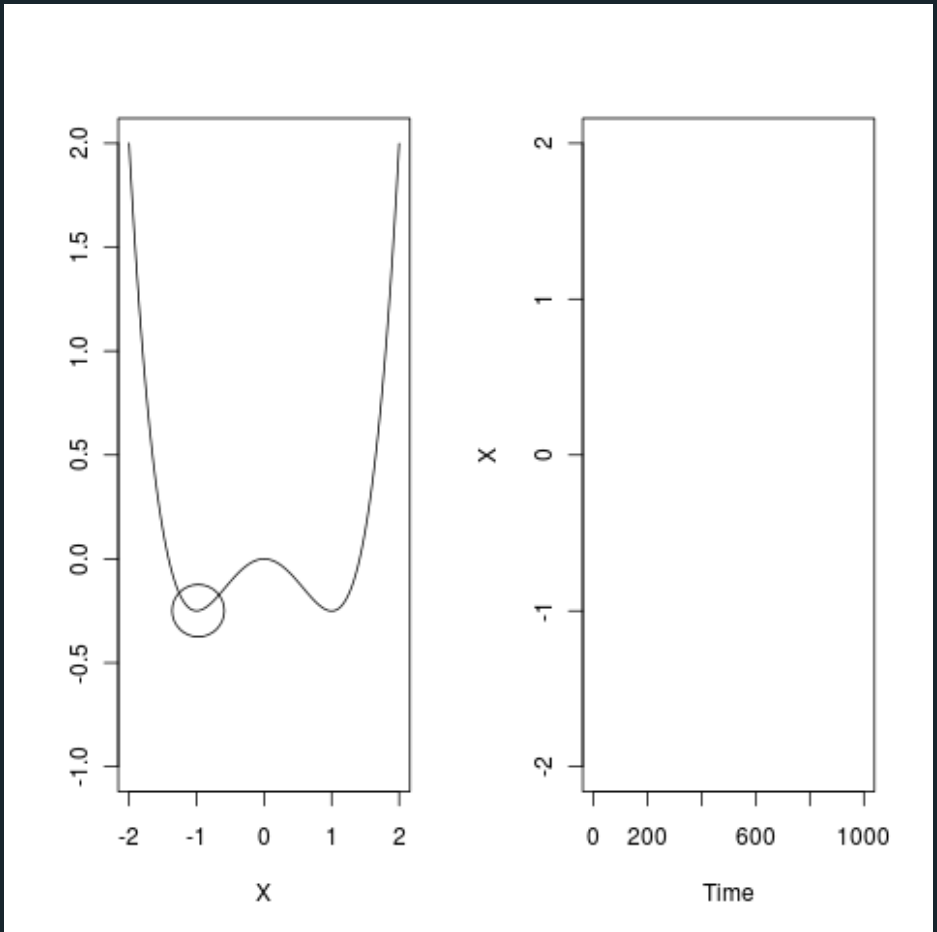
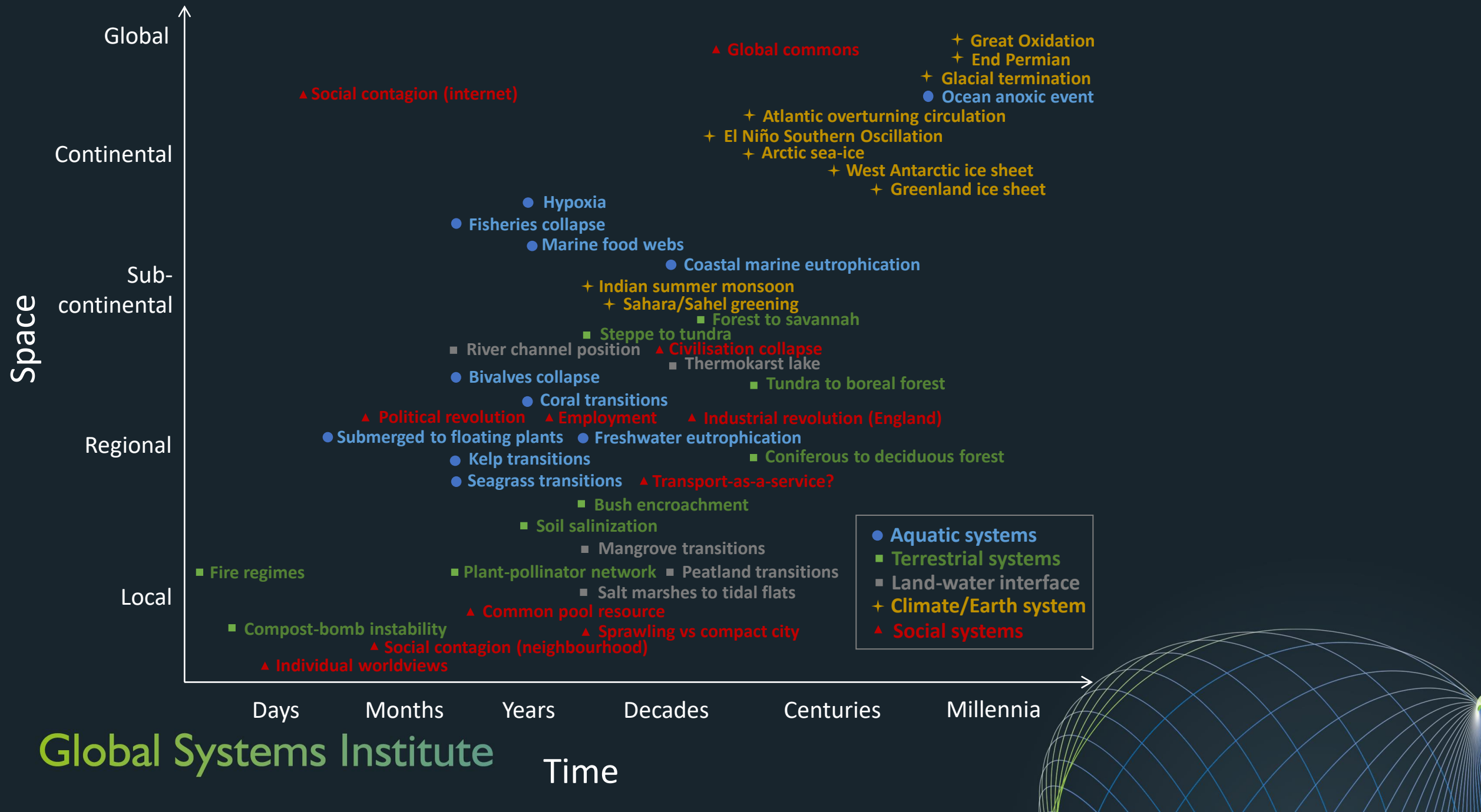
Generic example of passing a tipping point





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Climate tipping points

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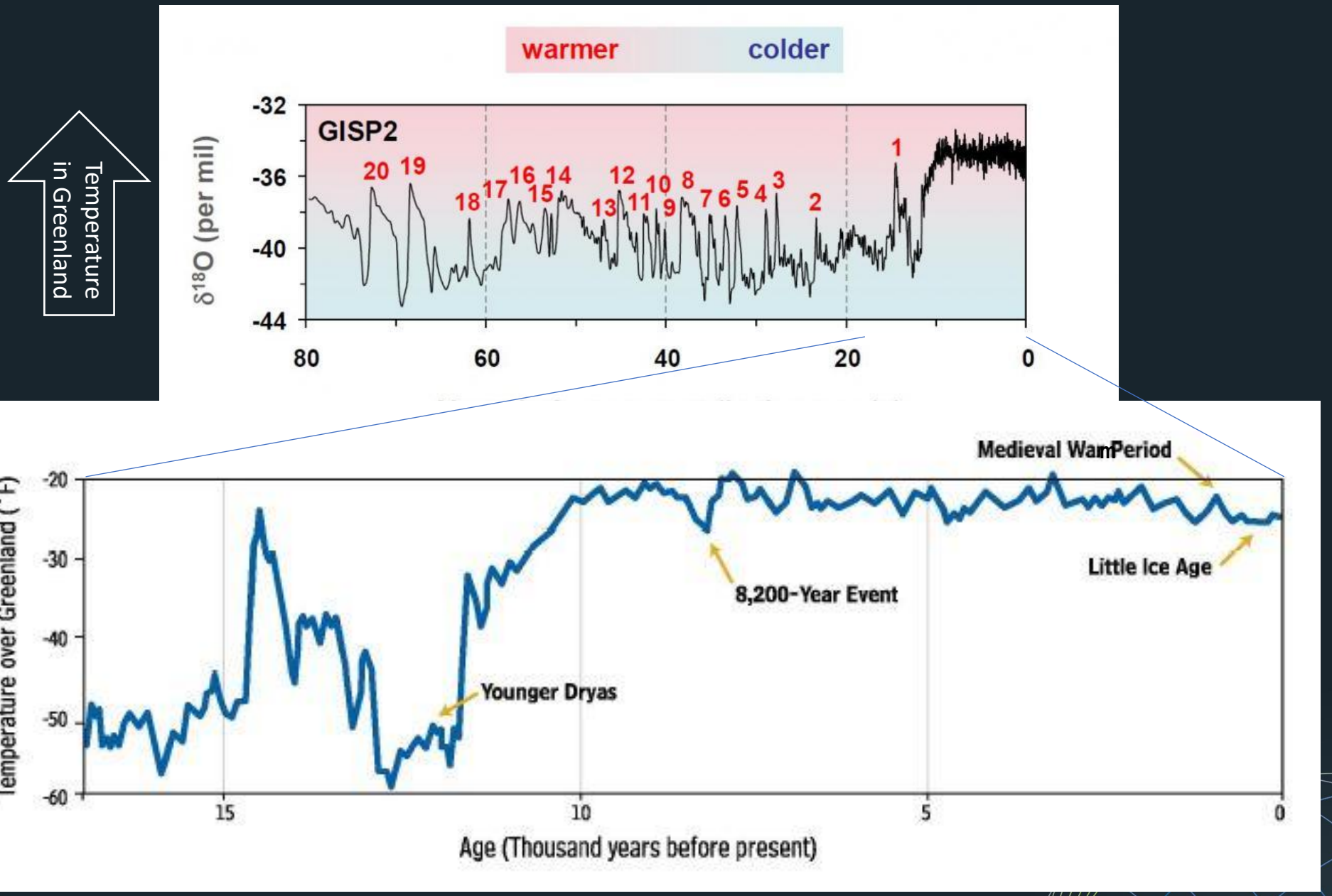

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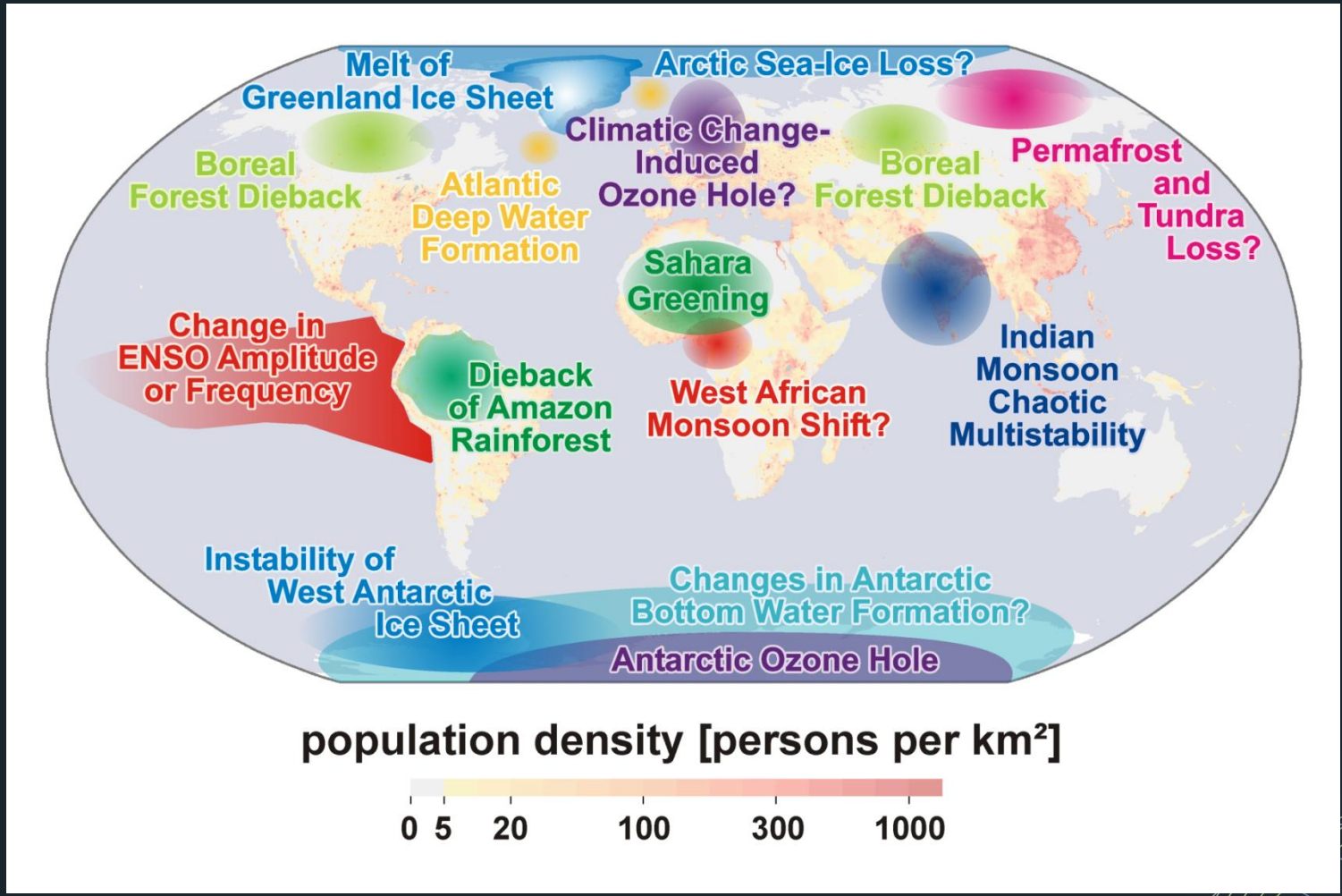
Climate tipping elements



Lenton et al. (2008) *PNAS* 105:1786-1793

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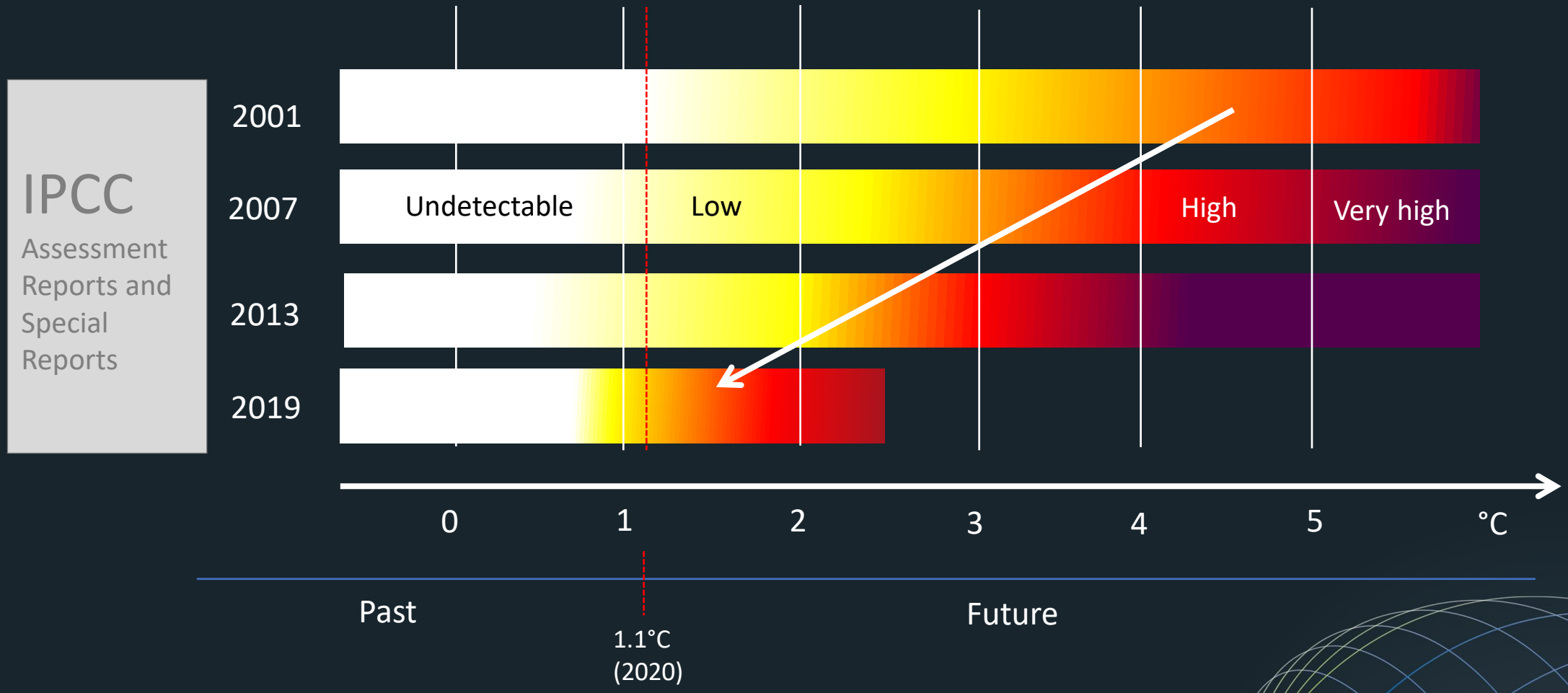
Changing risk assessment of tipping points



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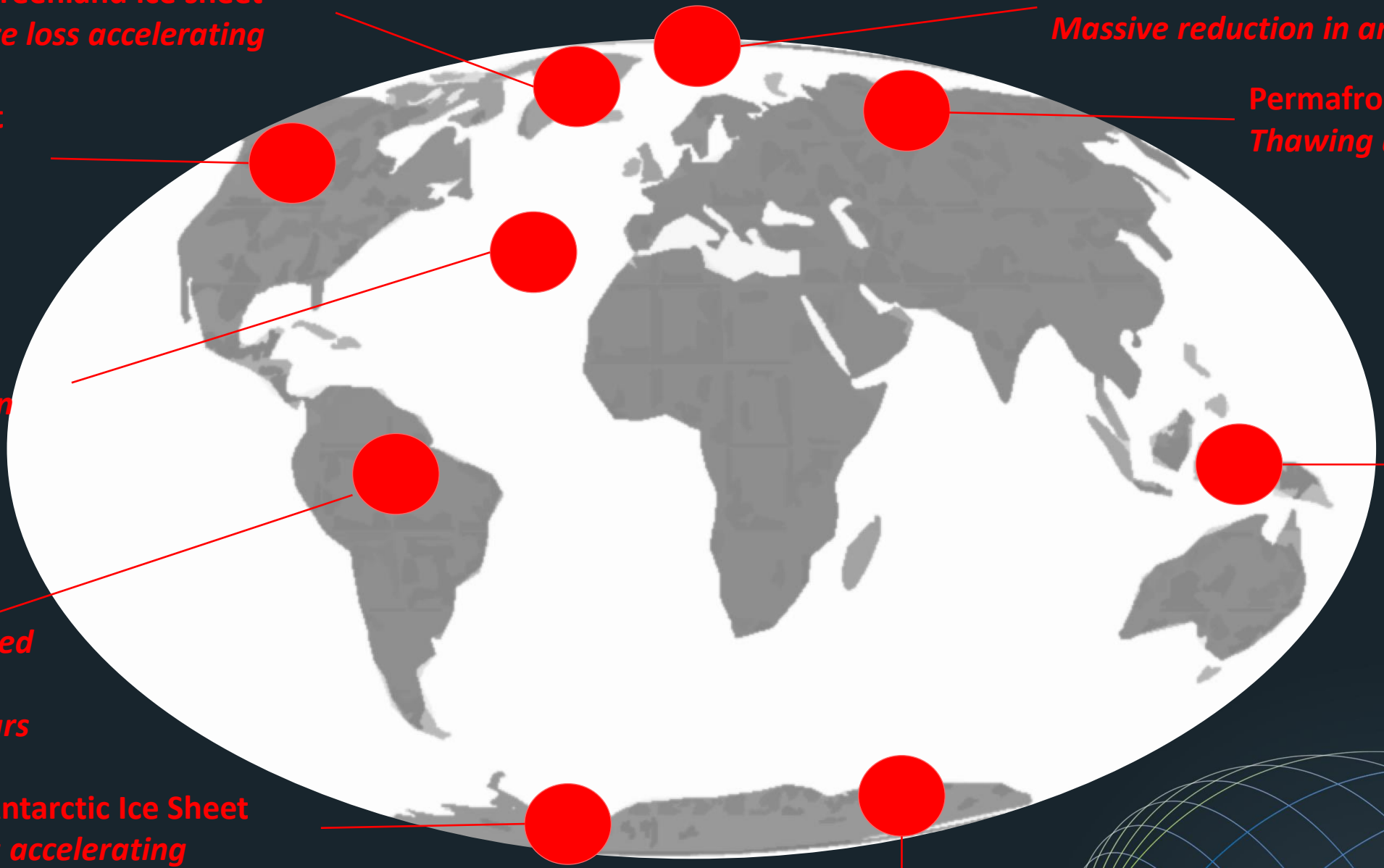
Lenton et al. (2019) *Nature*



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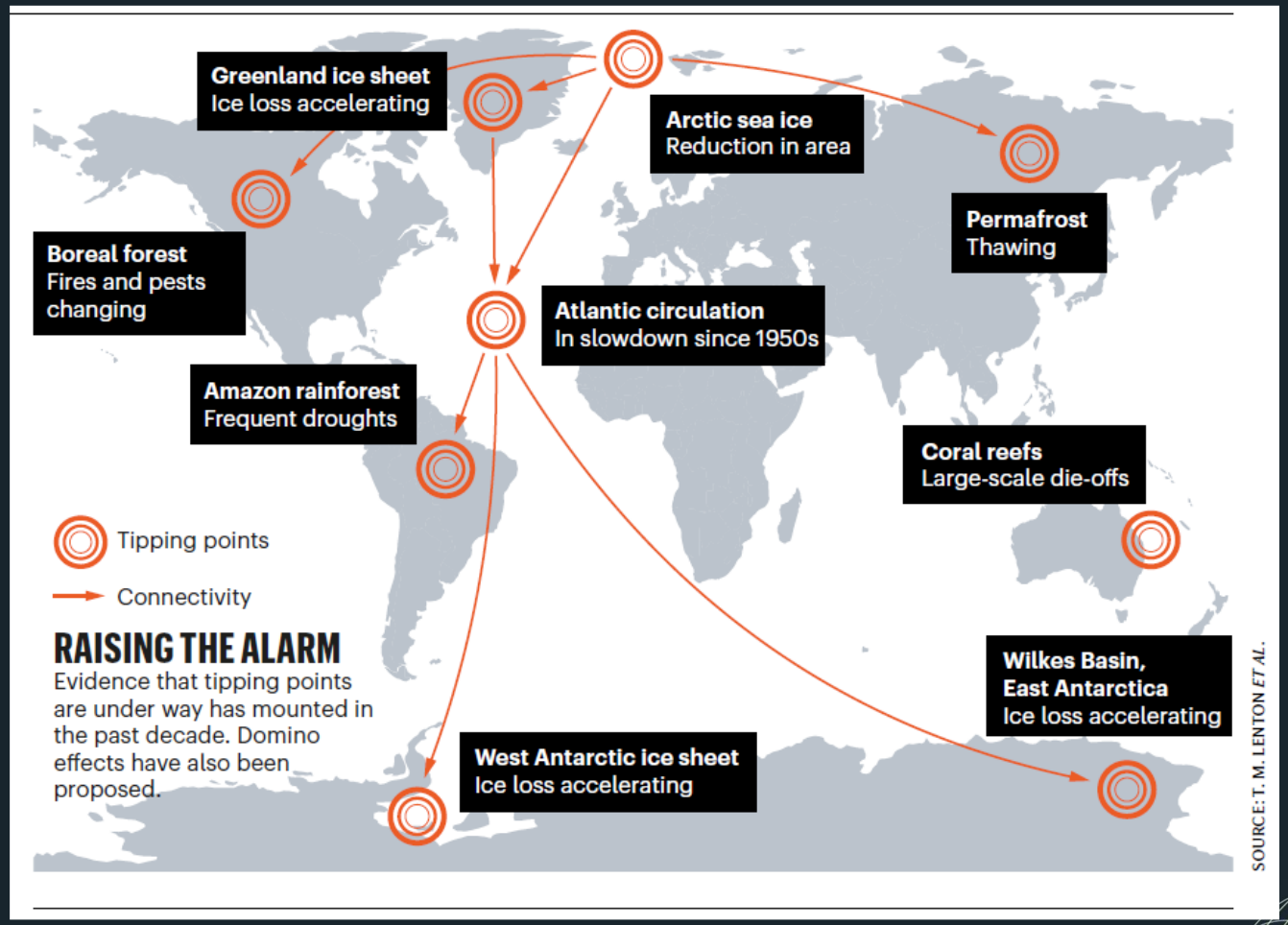
Lenton et al. (2019) *Nature*

Coupling between tipping elements



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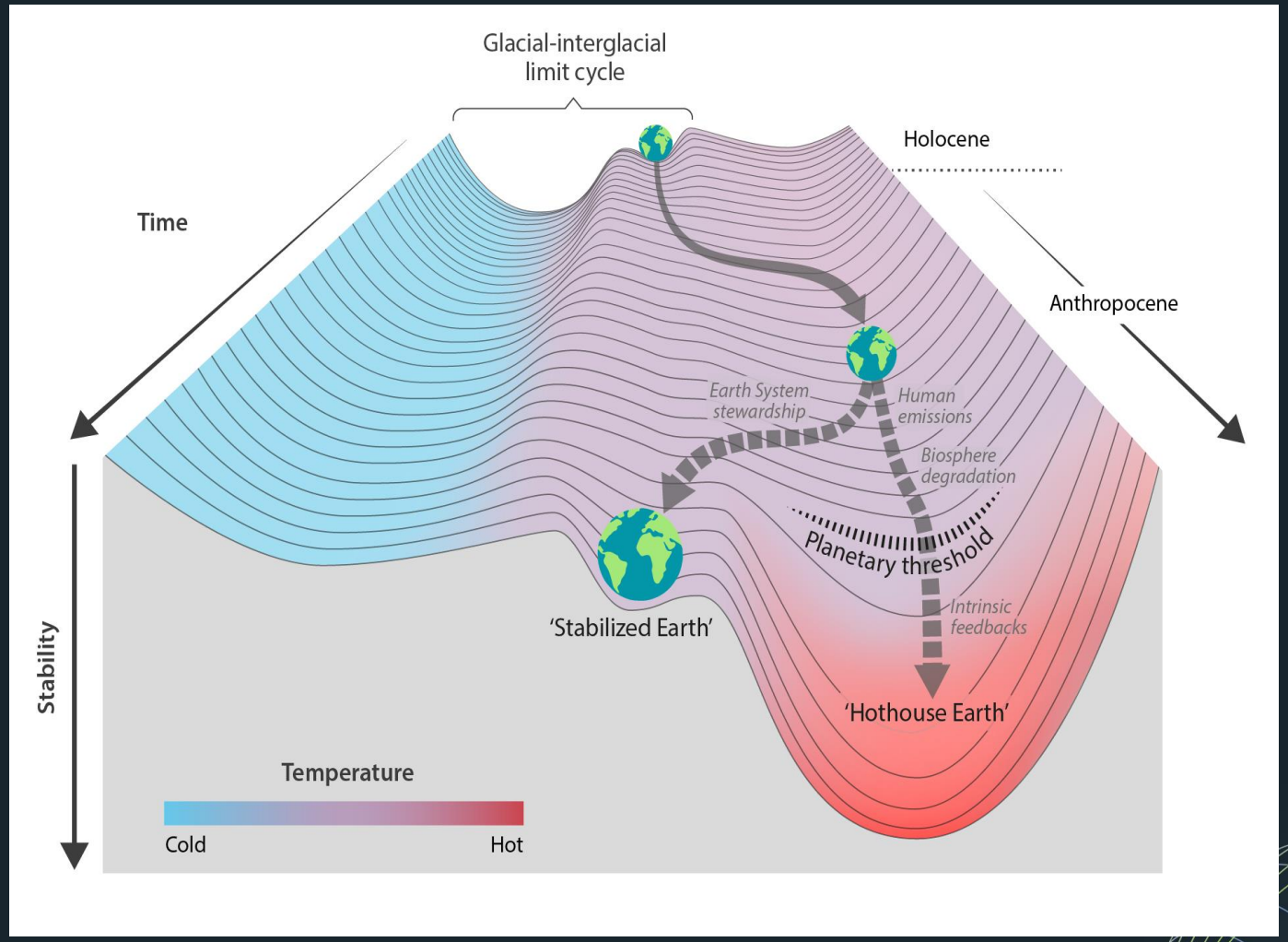
Lenton et al. (2019) *Nature*

A global tipping point?

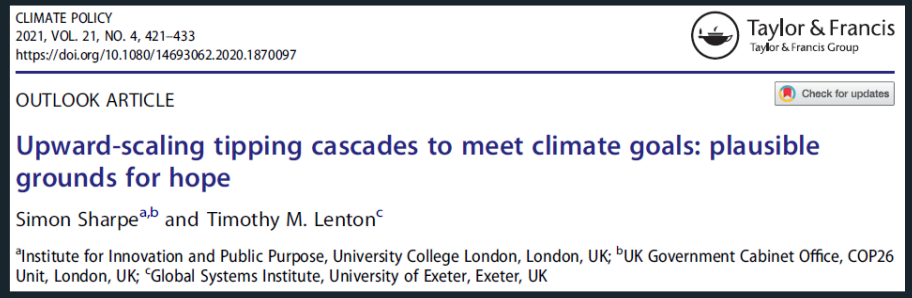


Steffen et al. (2018) *PNAS* 115:8252-9

Global Systems Institute

Positive tipping points

In collaboration with: Simon Sharpe (COP26 Unit), Scarlett Benson, Talia Smith, Theo Ewer (SYSTEMIQ)


CLIMATE POLICY
2021, VOL. 21, NO. 4, 421–433
https://doi.org/10.1080/14693062.2020.1870097

Taylor & Francis
Taylor & Francis Group

OUTLOOK ARTICLE

Check for updates

Upward-scaling tipping cascades to meet climate goals: plausible grounds for hope

Simon Sharpe[a,b] and Timothy M. Lenton[c]

[a]Institute for Innovation and Public Purpose, University College London, London, UK; [b]UK Government Cabinet Office, COP26 Unit, London, UK; [c]Global Systems Institute, University of Exeter, Exeter, UK


Working paper series number 2021/01

Operationalising Positive Tipping Points towards Global Sustainability

Timothy M. Lenton[1]*, Scarlett Benson[2], Talia Smith[2], Theodora Ewer[2], Victor Lanel[2], Elizabeth Petykowski[2], Thomas W. R. Powell[1], Jesse F. Abrams[1,3], Fenna Blomsma[4], Simon Sharpe[5,6]

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[4]Universität Hamburg, Faculty of Business, Economics and Social Sciences, Hamburg, Germany
[5]Institute for Innovation and Public Purpose, University College London, London, UK
[6]UK Government Cabinet Office, COP26 Unit, London, UK

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Creating Transformative Solutions

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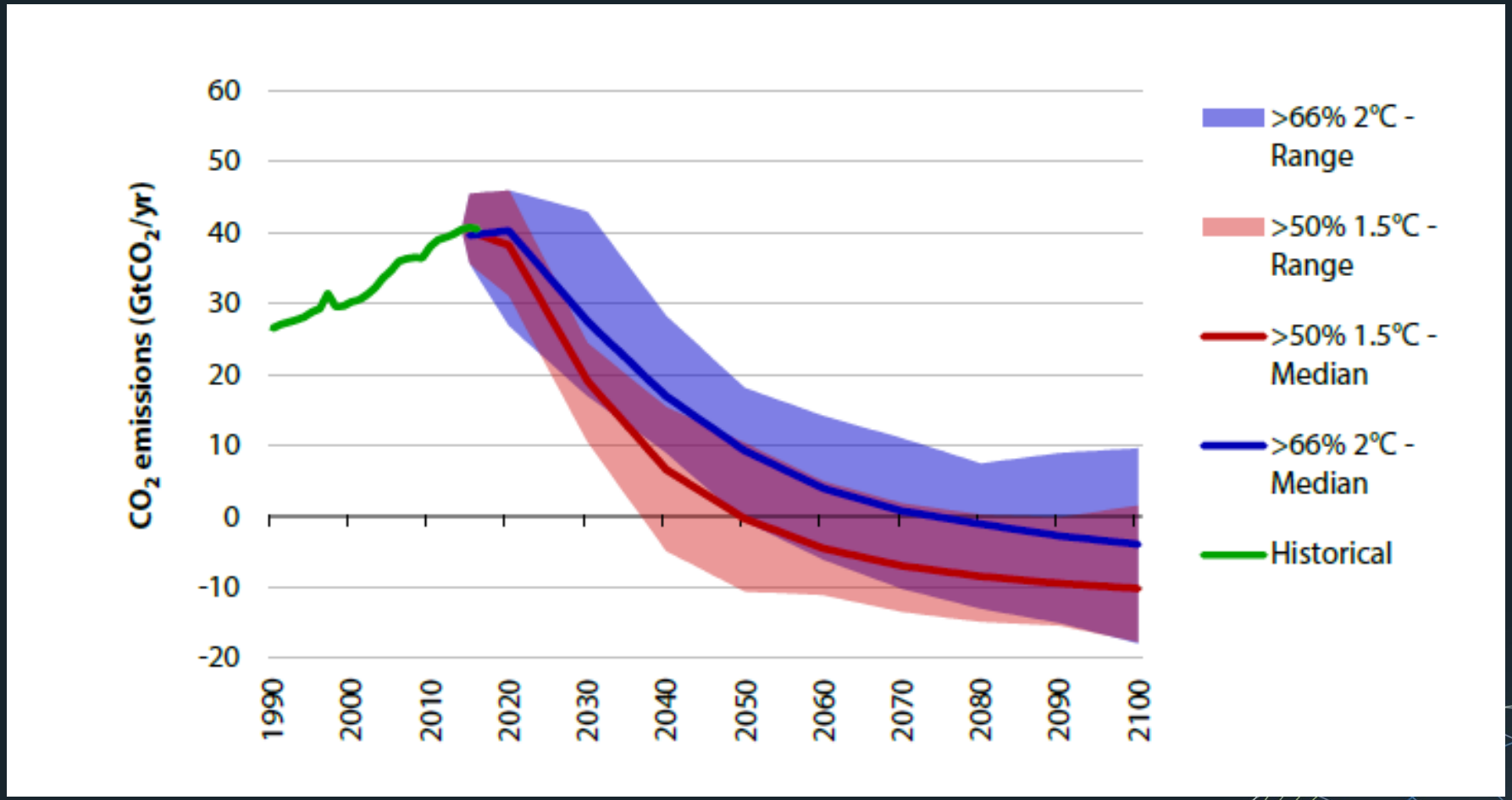
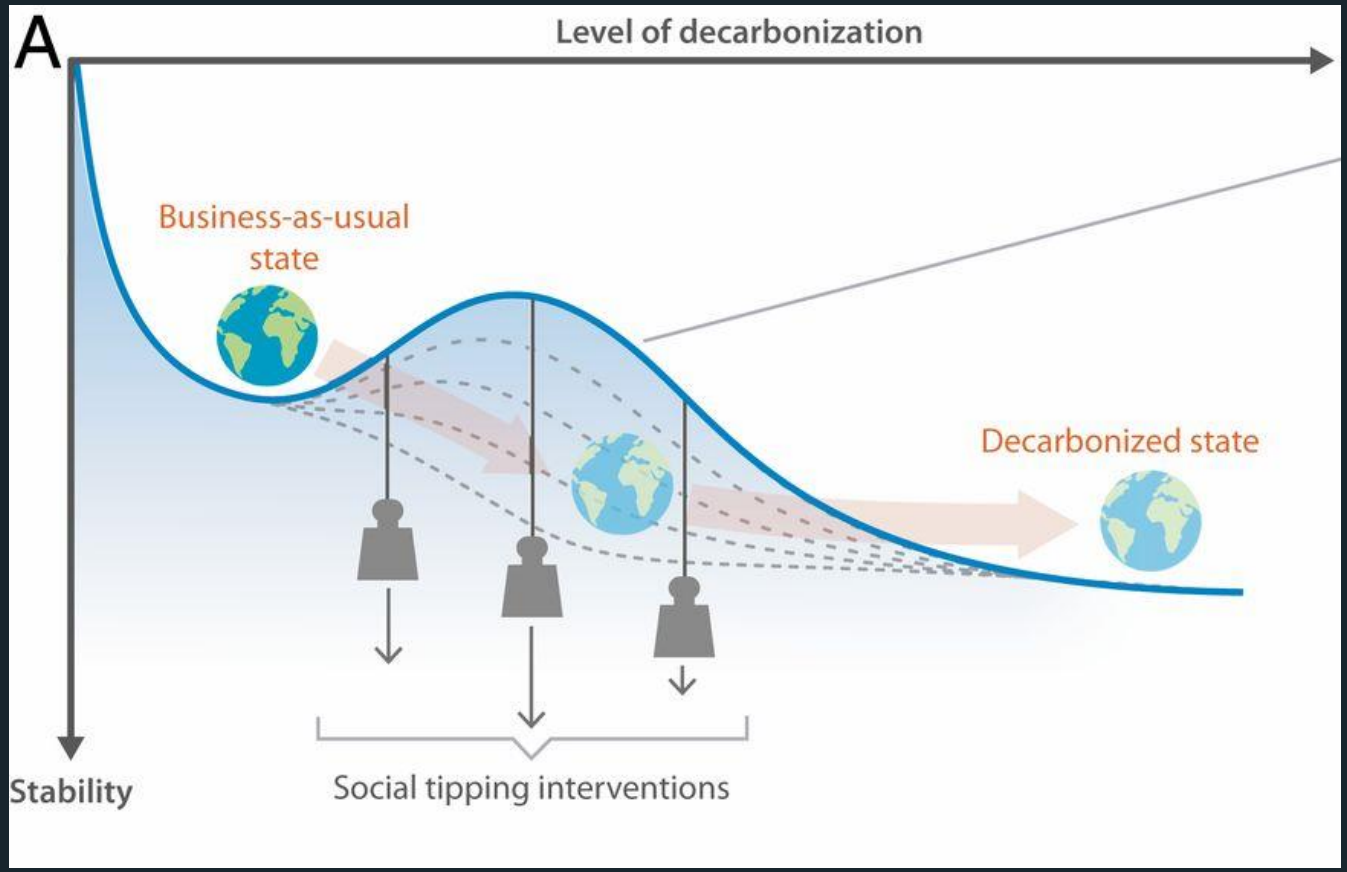
Global CO_2 emissions to meet Paris goals



Global Systems Institute

Committee on Climate Change (2019) *Net Zero: The UK's Contribution to Stopping Global Warming*

Tipping positive change



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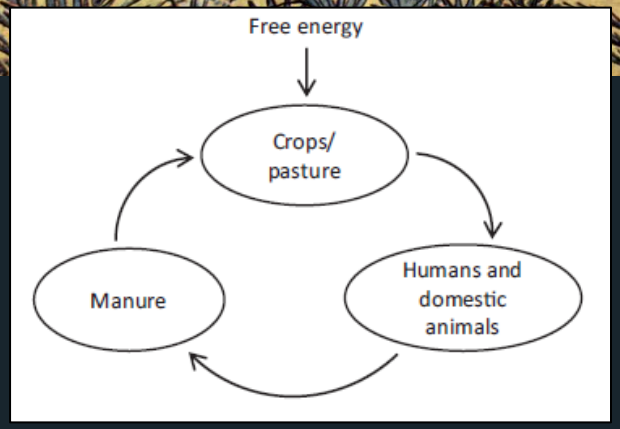
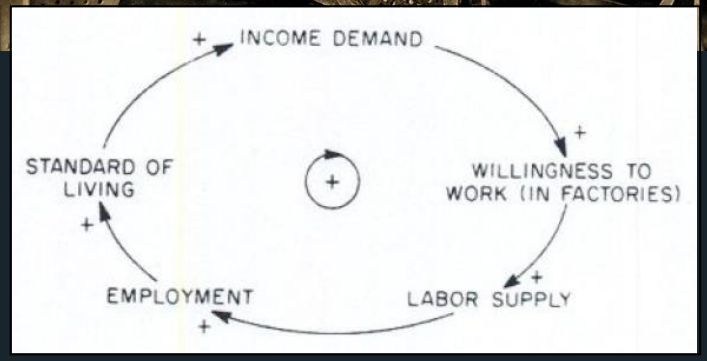
Otto, Donges *et al.* (2020) *PNAS* 117(5): 2354-2365

Have we been here before?

Neolithic (agricultural) revolution



Industrial revolution



Green revolution

Global Systems Institute

A past tipping point

Easter Parade, 5th Avenue, New York City

1900: Spot the automobile

Source: US National Archives.

1913: Spot the horse

A recent tipping point

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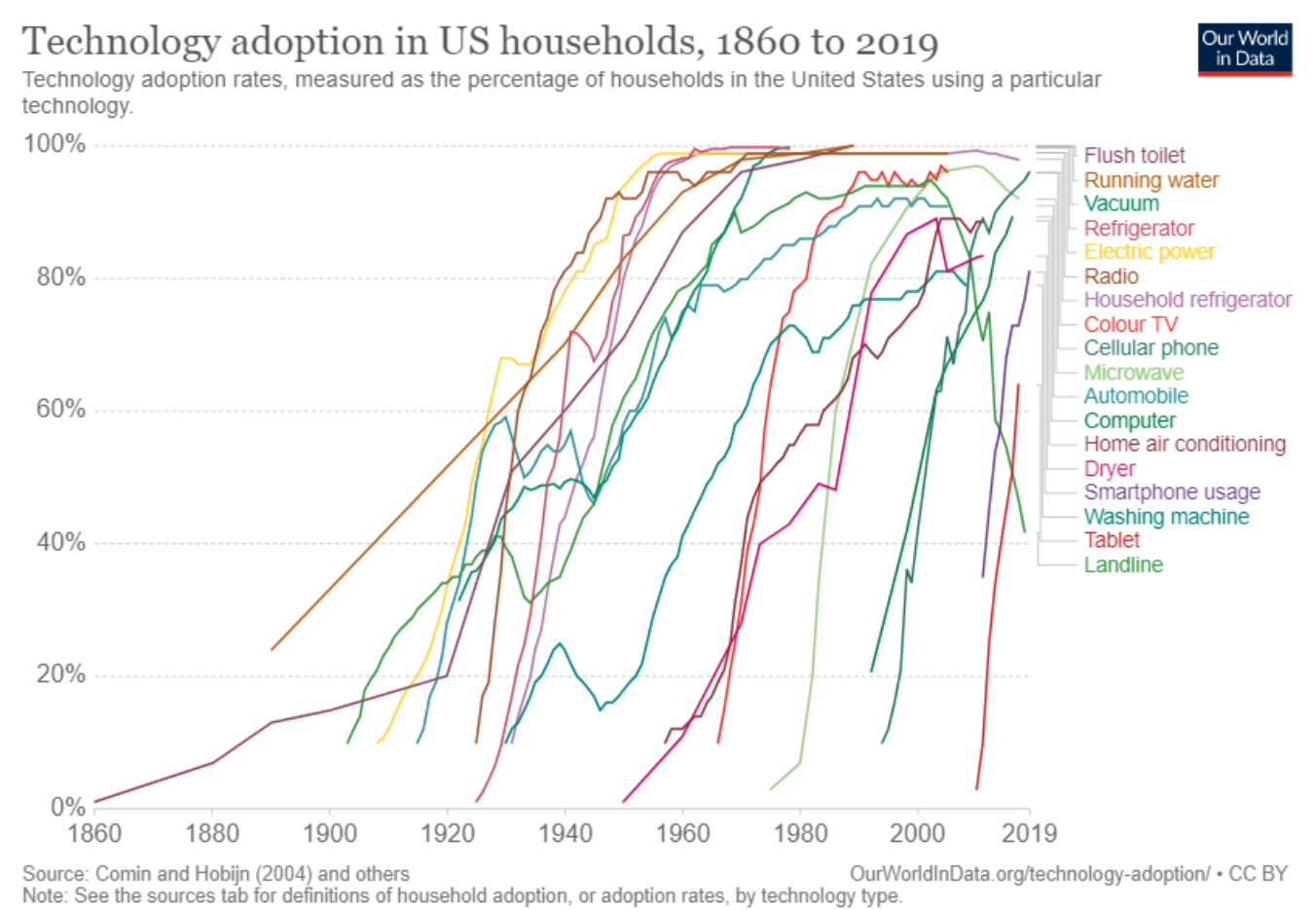
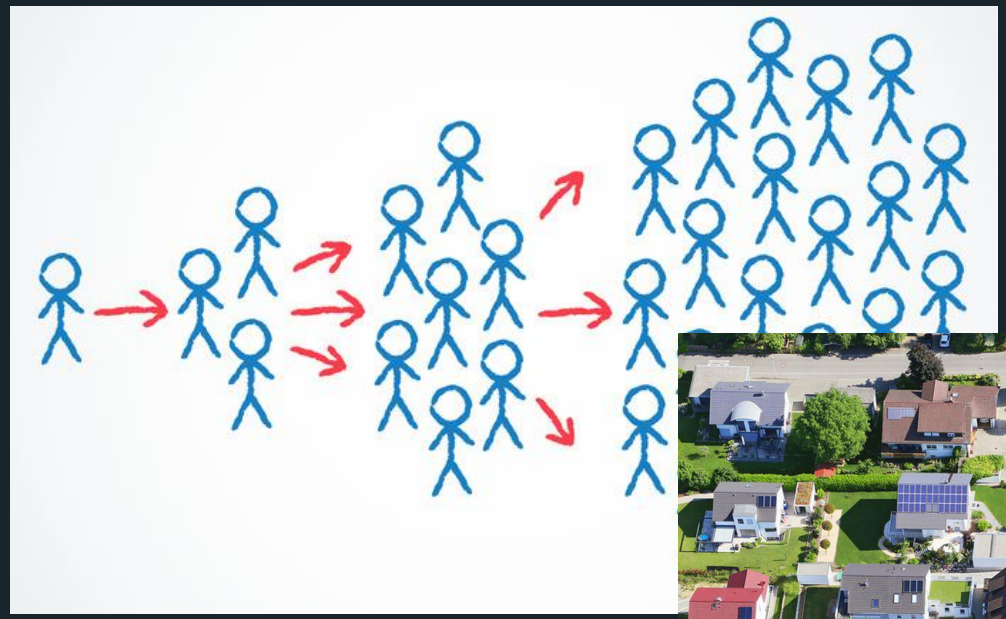
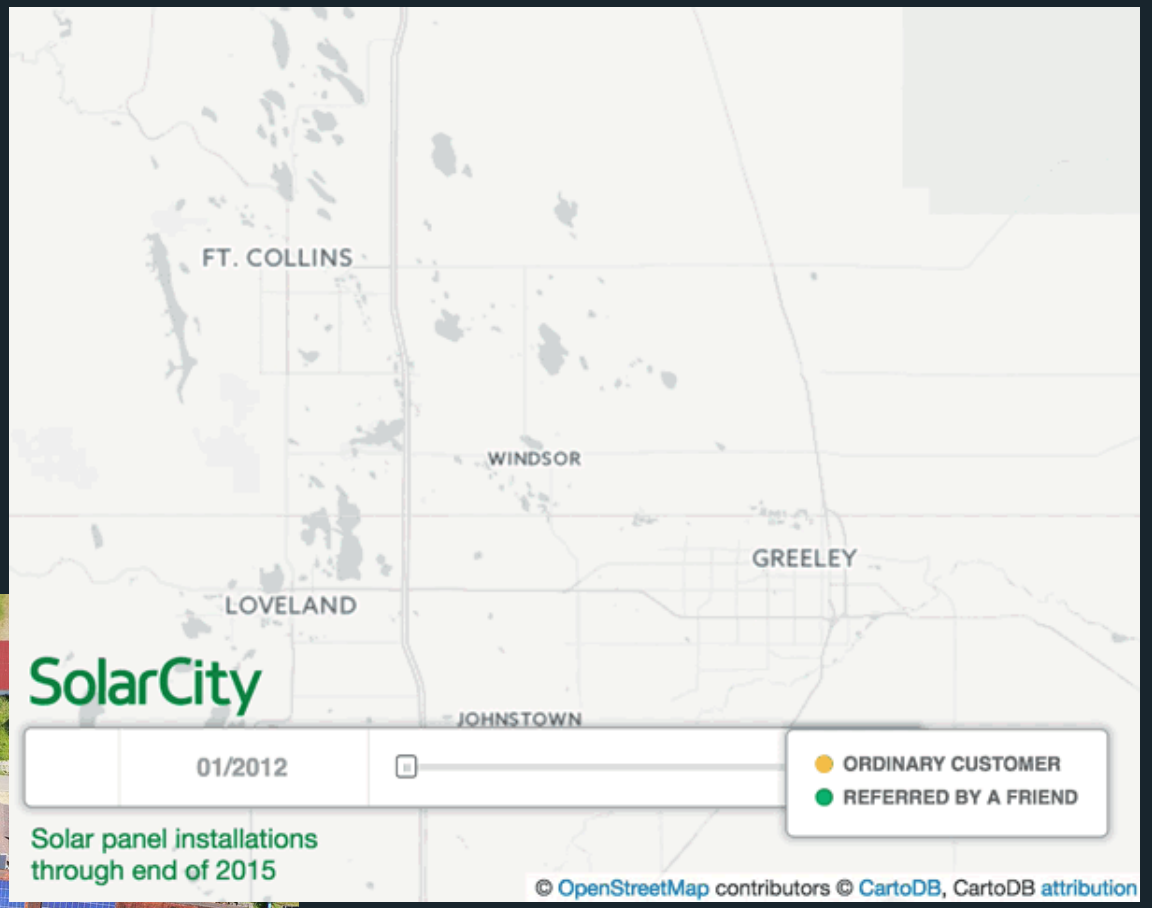
Reinforcing feedbacks



- The more something is made the better it can be made (learning-by-doing)
- The more something is made the more cheaply it can be made (economies of scale)
- The more something is used the more technologies emerge that make it more useful

Social contagion





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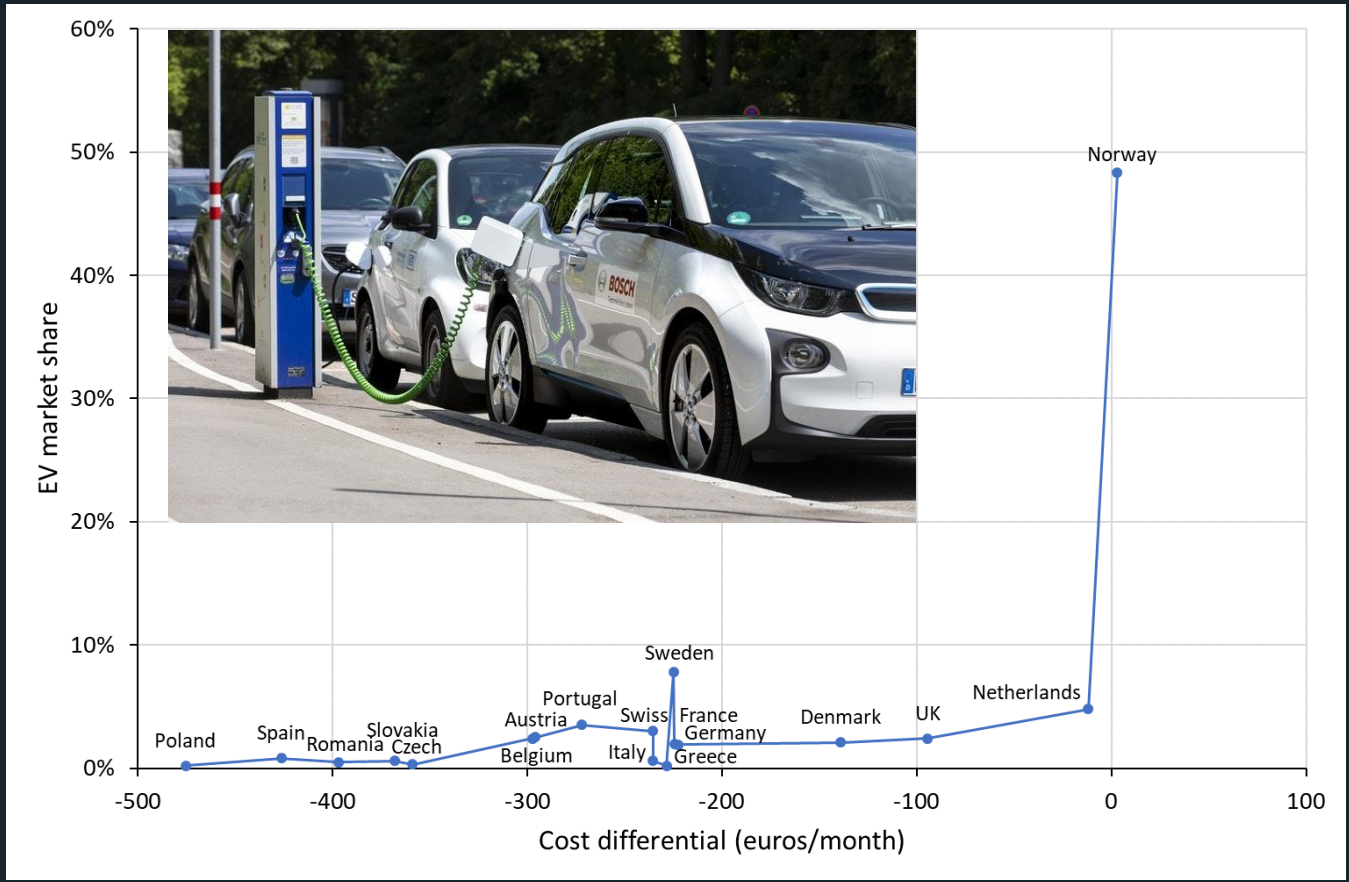
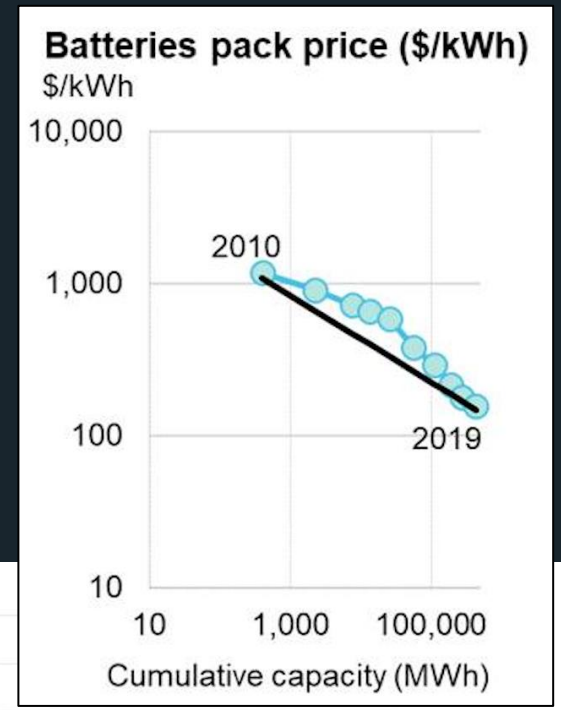
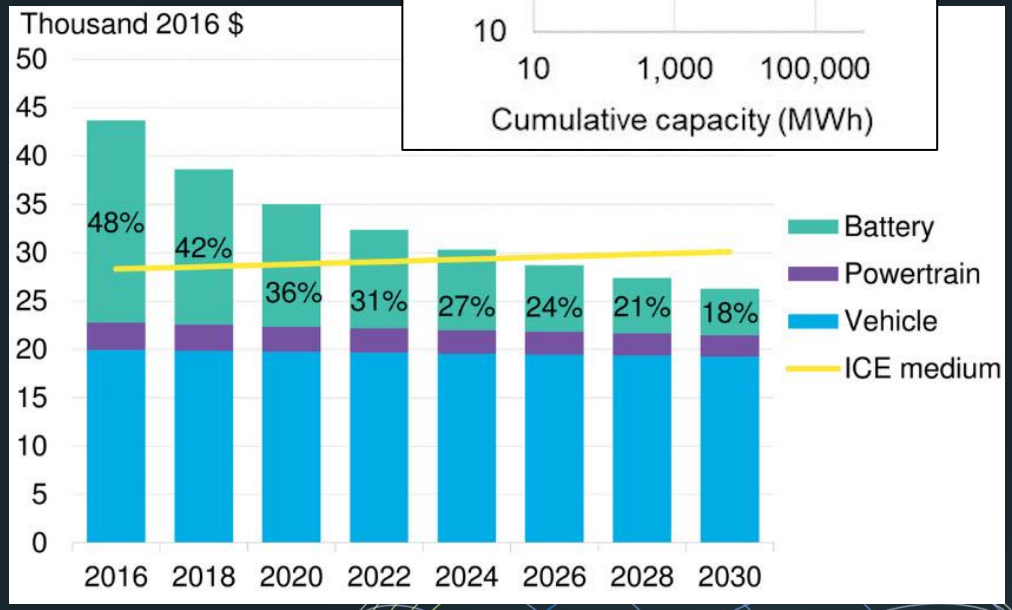
Electric vehicles (EV)

Market share as a function of cost difference to petrol/diesel car





Cost of vehicle



Bloomberg NEF

Global Systems Institute

Sharpe & Lenton (2021) *Climate Policy*

Robbie Andrew
@robbie_andrew

I doubt there are many outside of Norway that know that the Norwegian pop group A-ha was critical in the introduction of electric car incentives in Norway. I certainly didn't. Read on...

11:24 am · 9 Jan 2021 · Twitter Web App

3,604 Retweets **1,331** Quote Tweets **9,821** Likes

Robbie Andrew @robbie_andrew · 9 Jan
Replying to @robbie_andrew

In 1989, two members of the group, Morten Harket and Magne Furuholmen were in Switzerland with environmentalist Frederic Hauge, when they came across a hobby-converted Fiat Panda. Stated range: 45 km. They snapped it up and imported it to Norway.

Photo: In Switzerland (Bellona)

8 82 801

Robbie Andrew @robbie_andrew · 9 Jan

They were unhappy with "disincentives" to owning an electric car, including road tolls. So they drove repeatedly through toll stations without paying. Every time, they received a fine, which they didn't pay. According to the rules, the car was then confiscated.

Photo: Bellona.

7 44 599

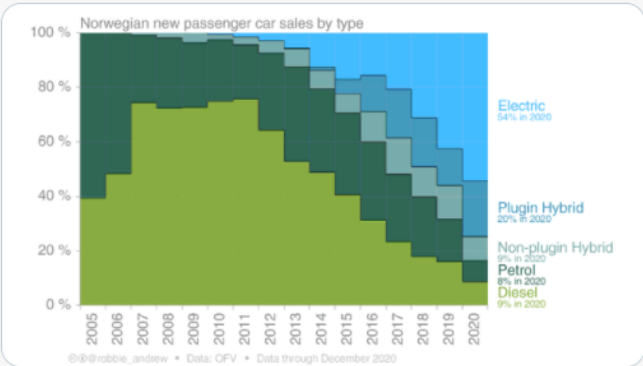
Robbie Andrew @robbie_andrew · 9 Jan

Finally, in 1996, the team had their way and electric cars were exempted from paying road tolls, the star power of A-ha helping along the way. Presumably the government just gave up, since exempting one car wasn't going to break the bank.

Source:

Robbie Andrew @robbie_andrew · 9 Jan

These early efforts were important in the long process (starting with the oil crises in the 1970s) of developing interest in electric cars in Norway, from a few individuals through to 2020's extraordinary record 54% of all new cars sold being battery-electric.



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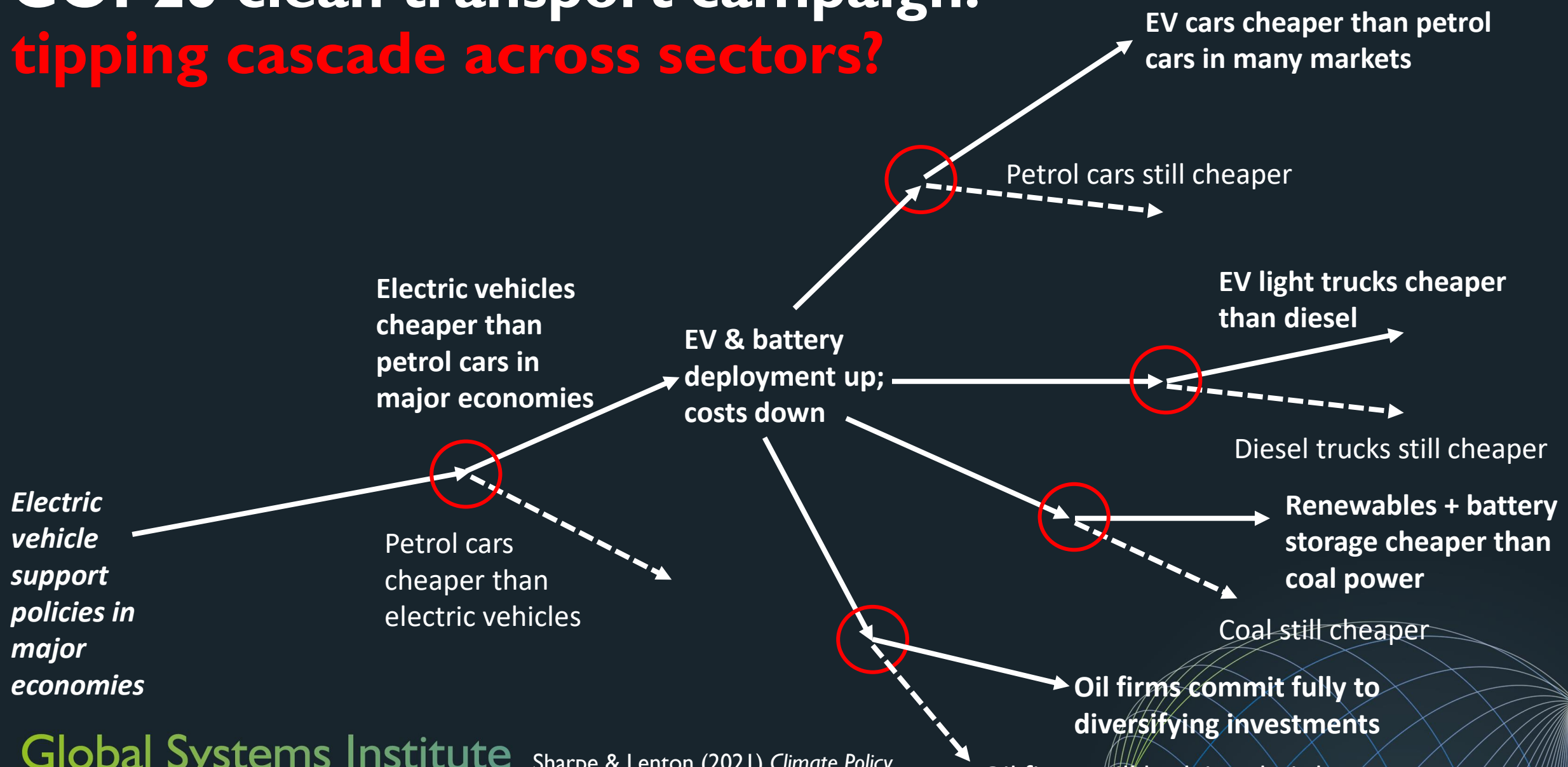
Robbie Andrew @robbie_andrew · 9 Jan

Note that while some sources say that the converted Fiat Panda was in 1989 the first electric car in Norway, the history goes a bit further back.

Norges eldste elbil ga rekkeviddeangst allerede i 1902. Fremdeles skre...
– Å kjøre den er uvant, ubehagelig og ukomfortabelt.
tu.no

25 28 536

COP26 clean transport campaign:
tipping cascade across sectors?



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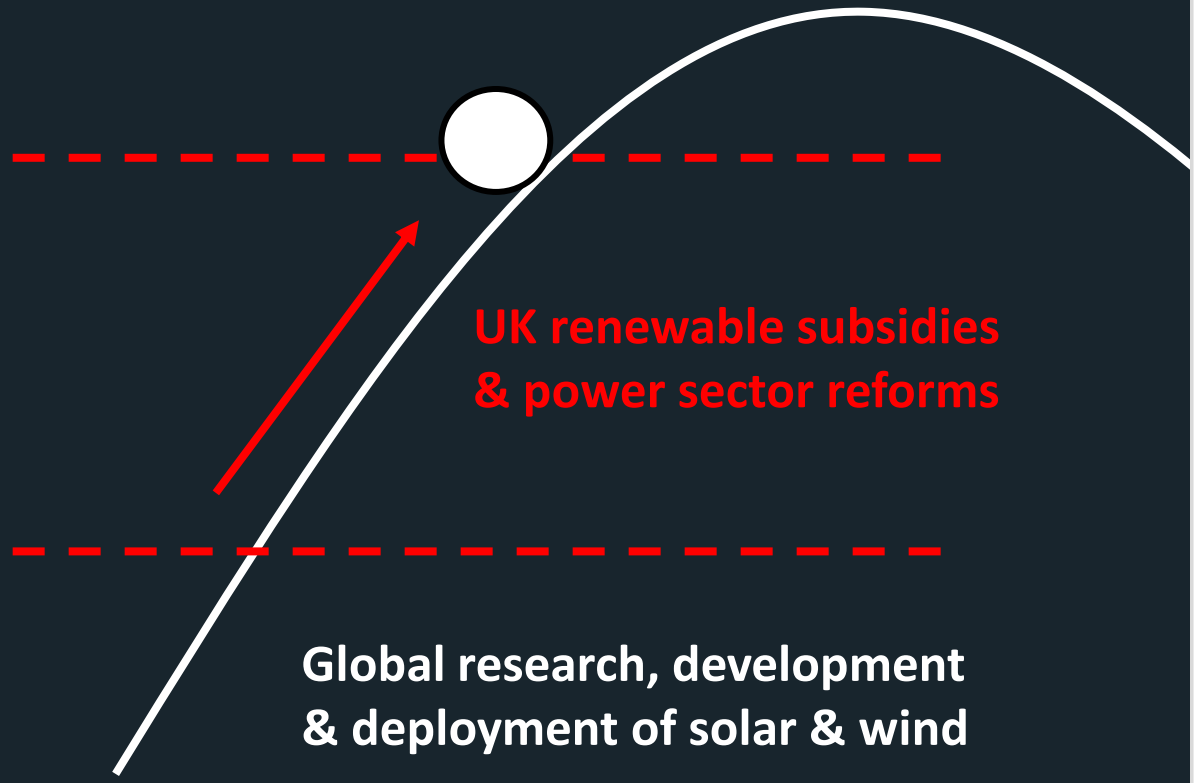
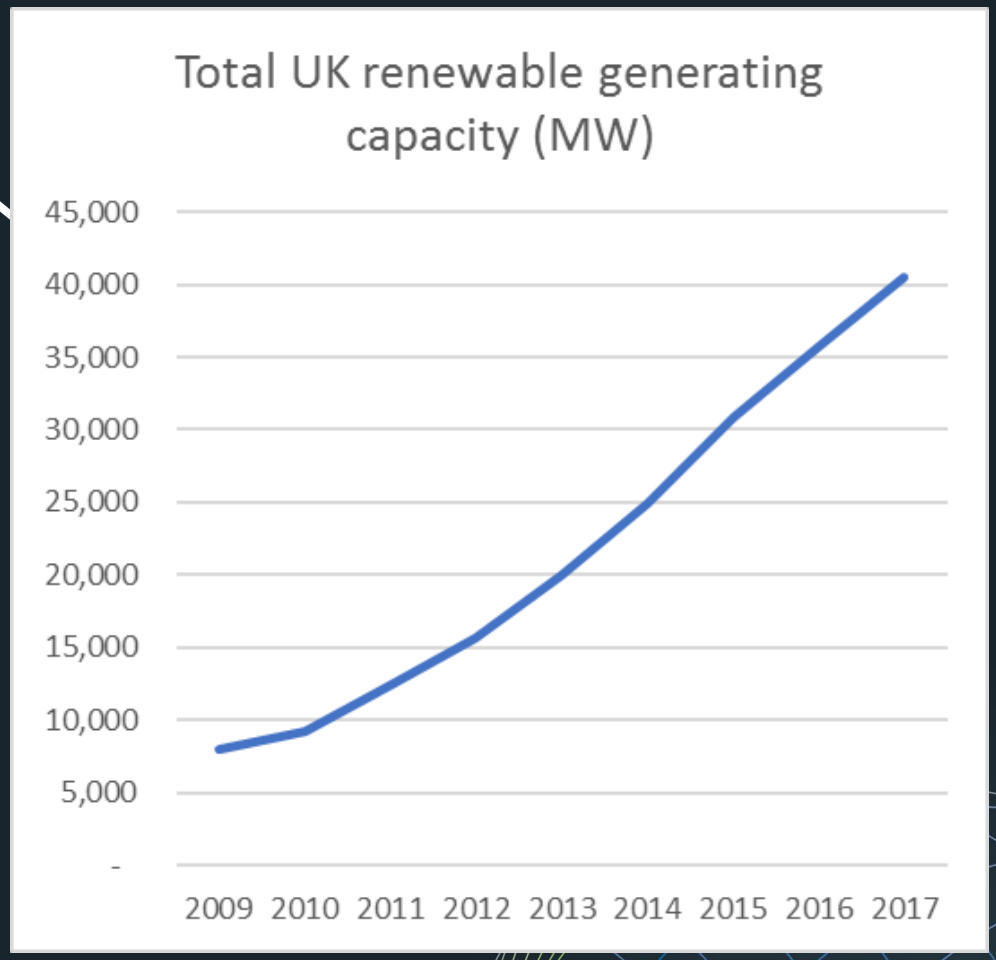
UK power sector: growth of renewables





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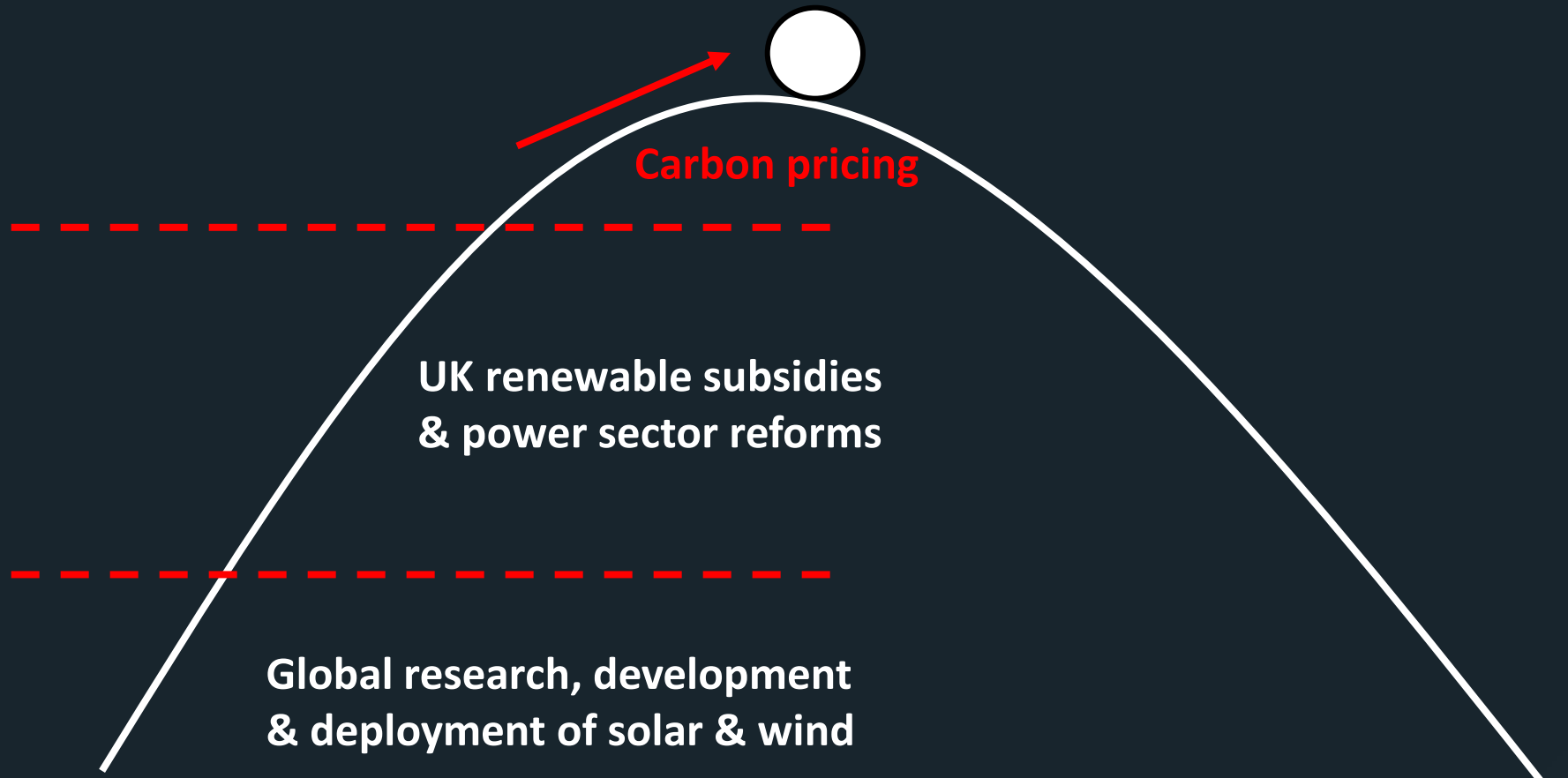
Sharpe & Lenton (2021) *Climate Policy*

UK power sector: carbon pricing



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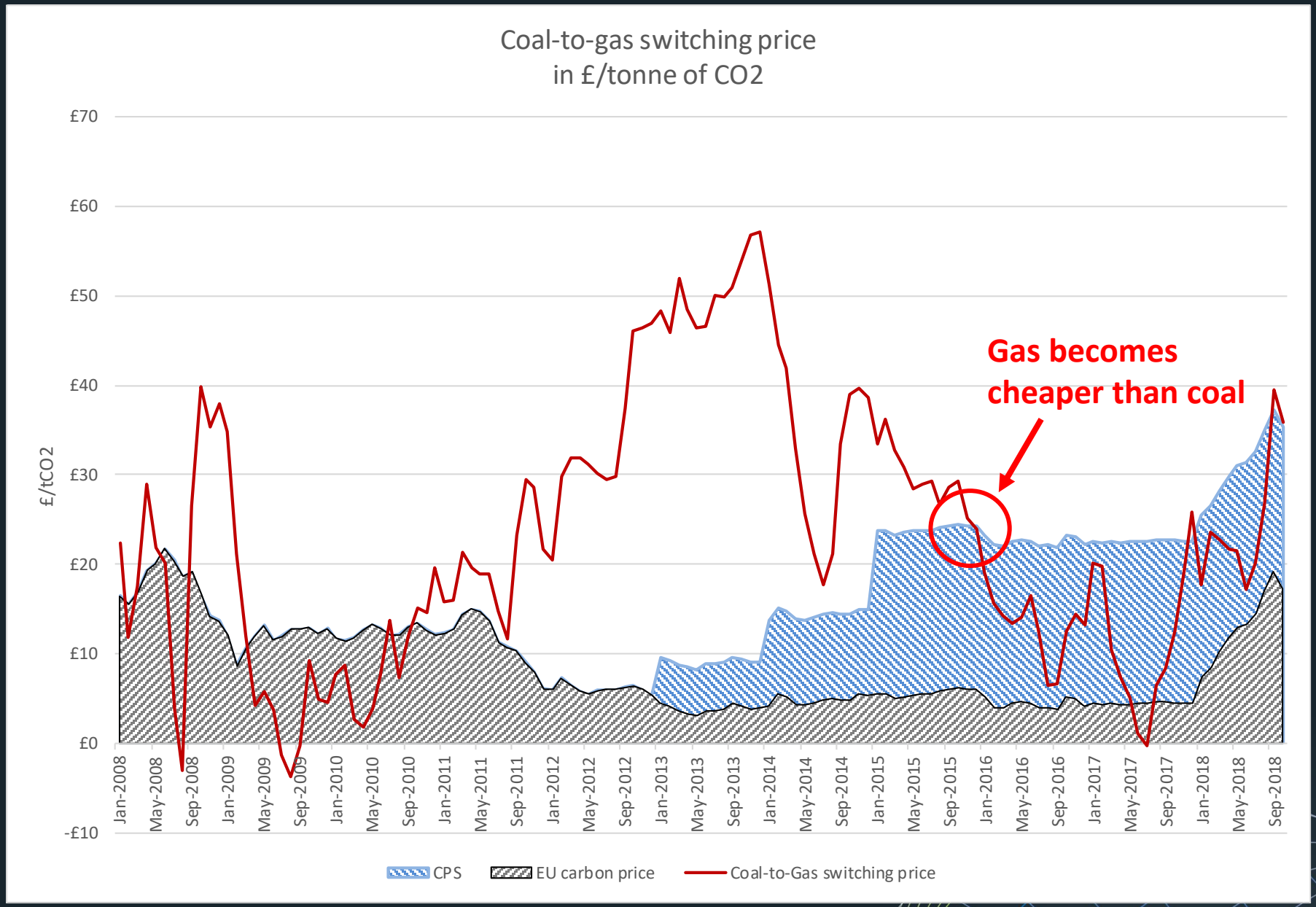
Sharpe & Lenton (2021) *Climate Policy*

Tipping point 1: coal to gas switching



Data from ICIS, Intercontinental Exchange and Bloomberg. Chart created by Philippe Guiblin

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Tipping point 2: coal – from profit to loss

"The economics of coal have deteriorated dramatically over the last 18 months… the increase in the carbon tax… flipped the economics over from barely profitable to loss-making." **Peter Atherton, utility analyst, April 2016**

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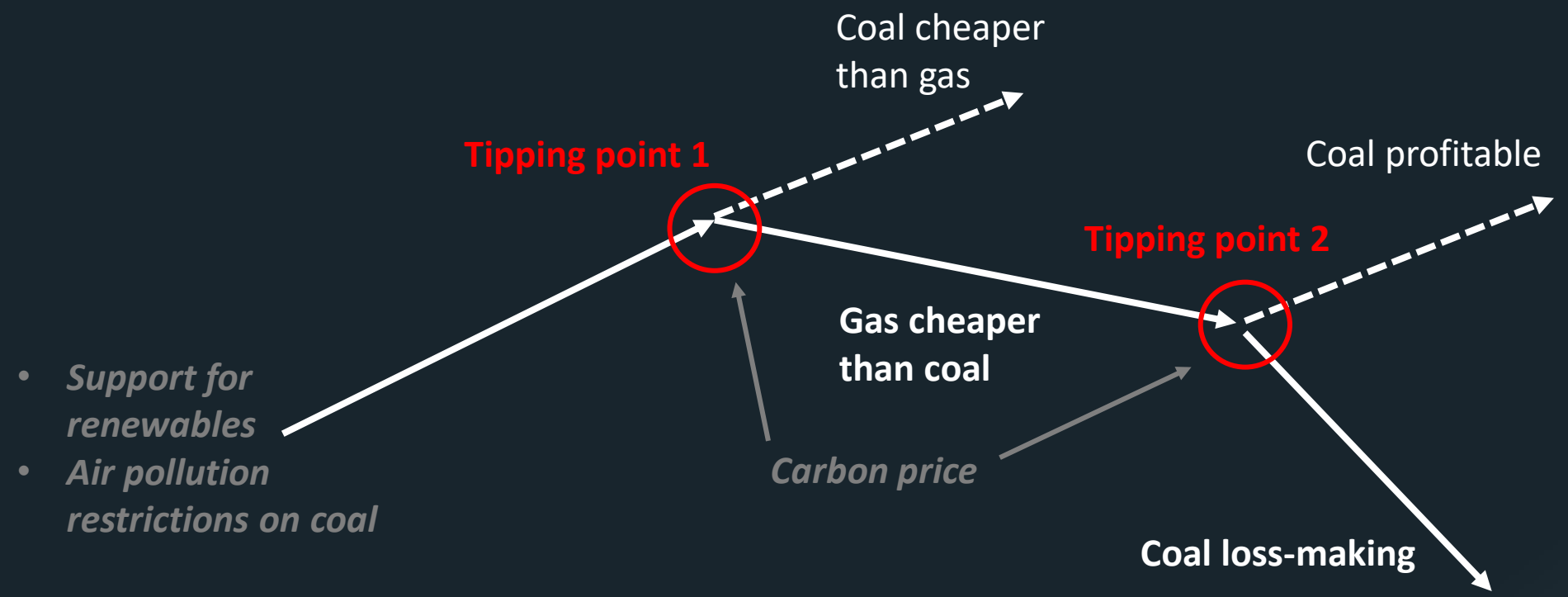
UK power sector: tipping cascade



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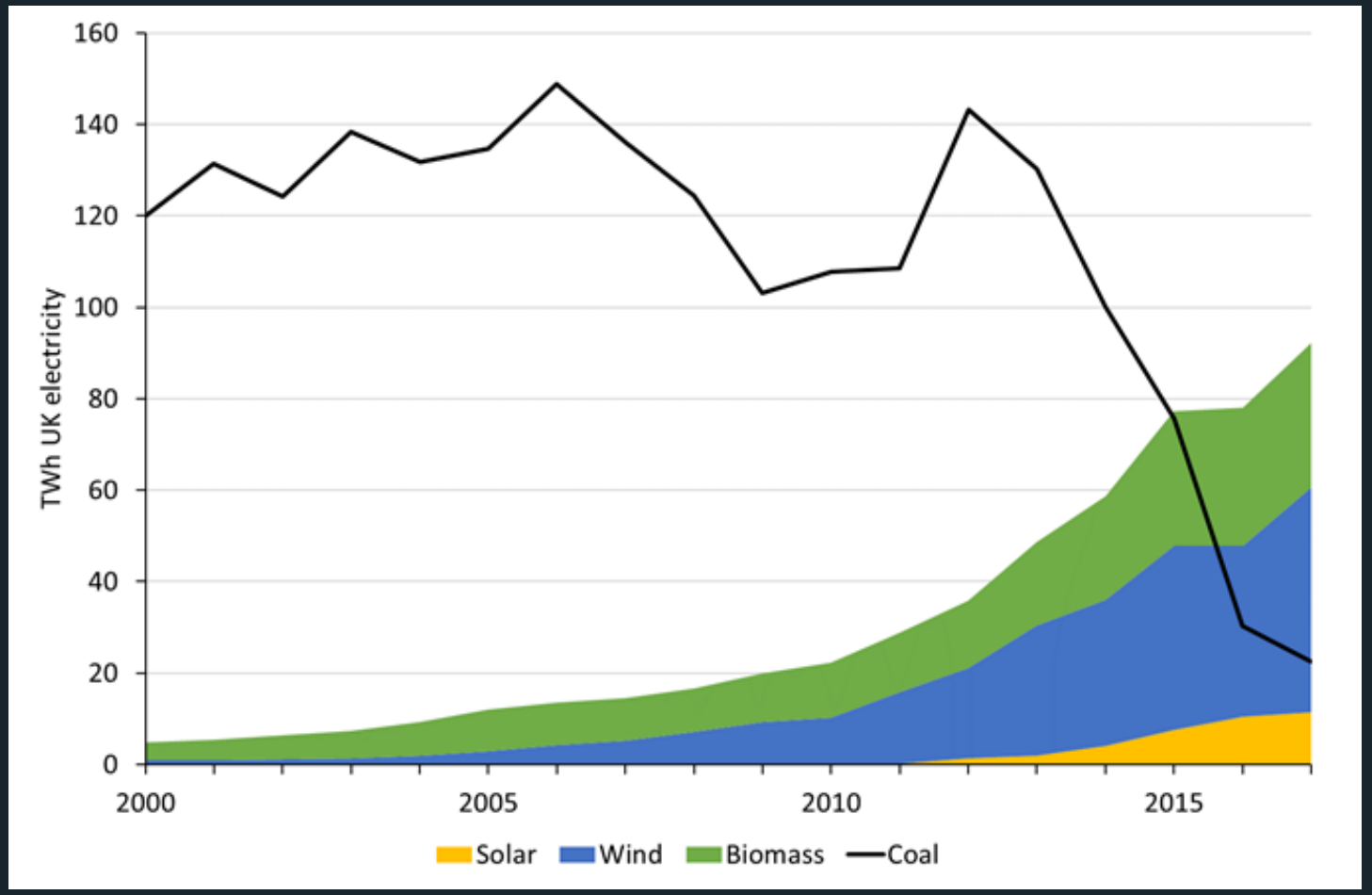
UK power sector: tipping coal out of the system



2012: coal = **40%** of UK power generation

2019: coal = **2%** of UK power generation

2020: UK goes **67 days** without coal power

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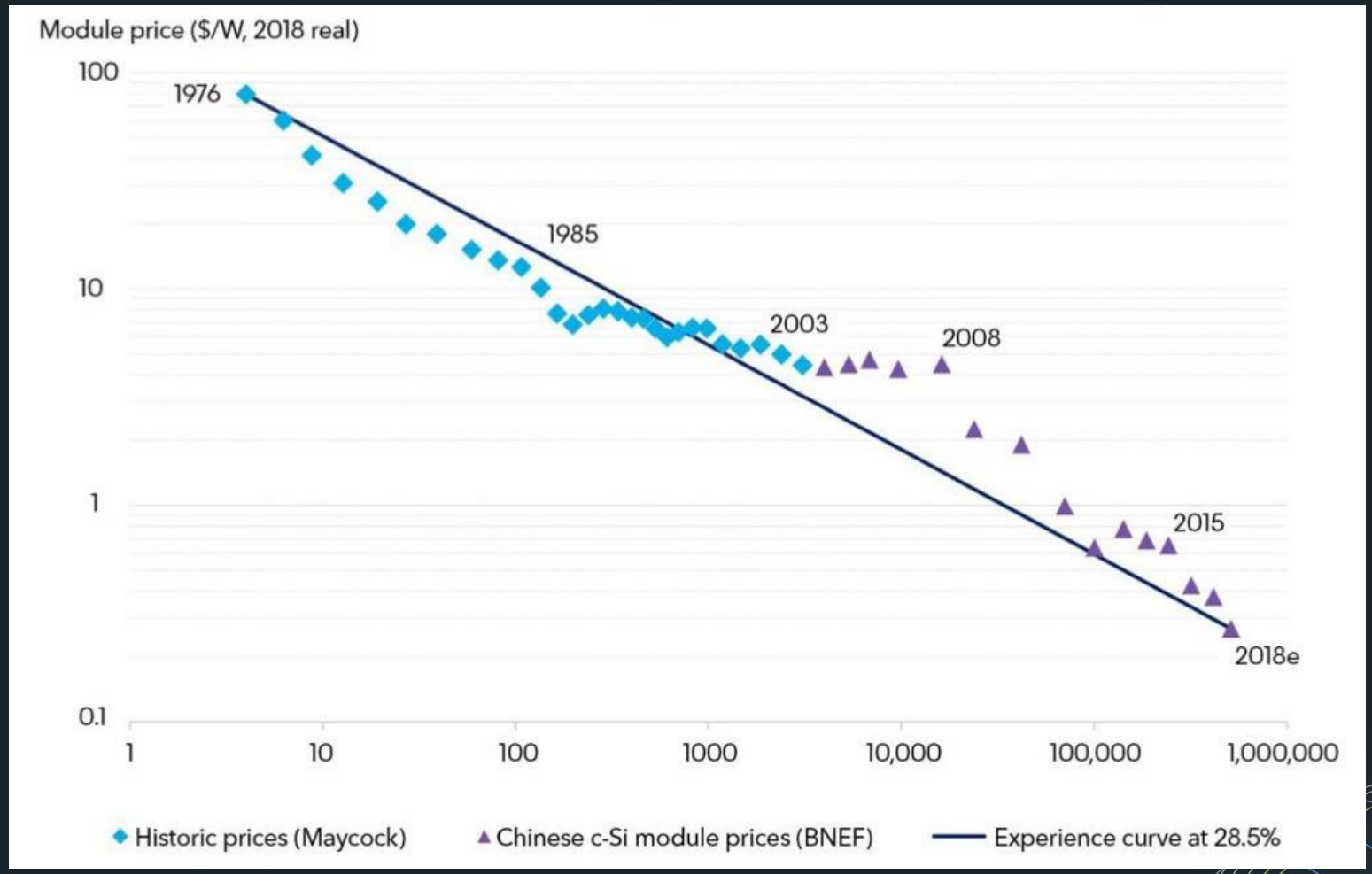
Global power sector: solar PV economies of scale



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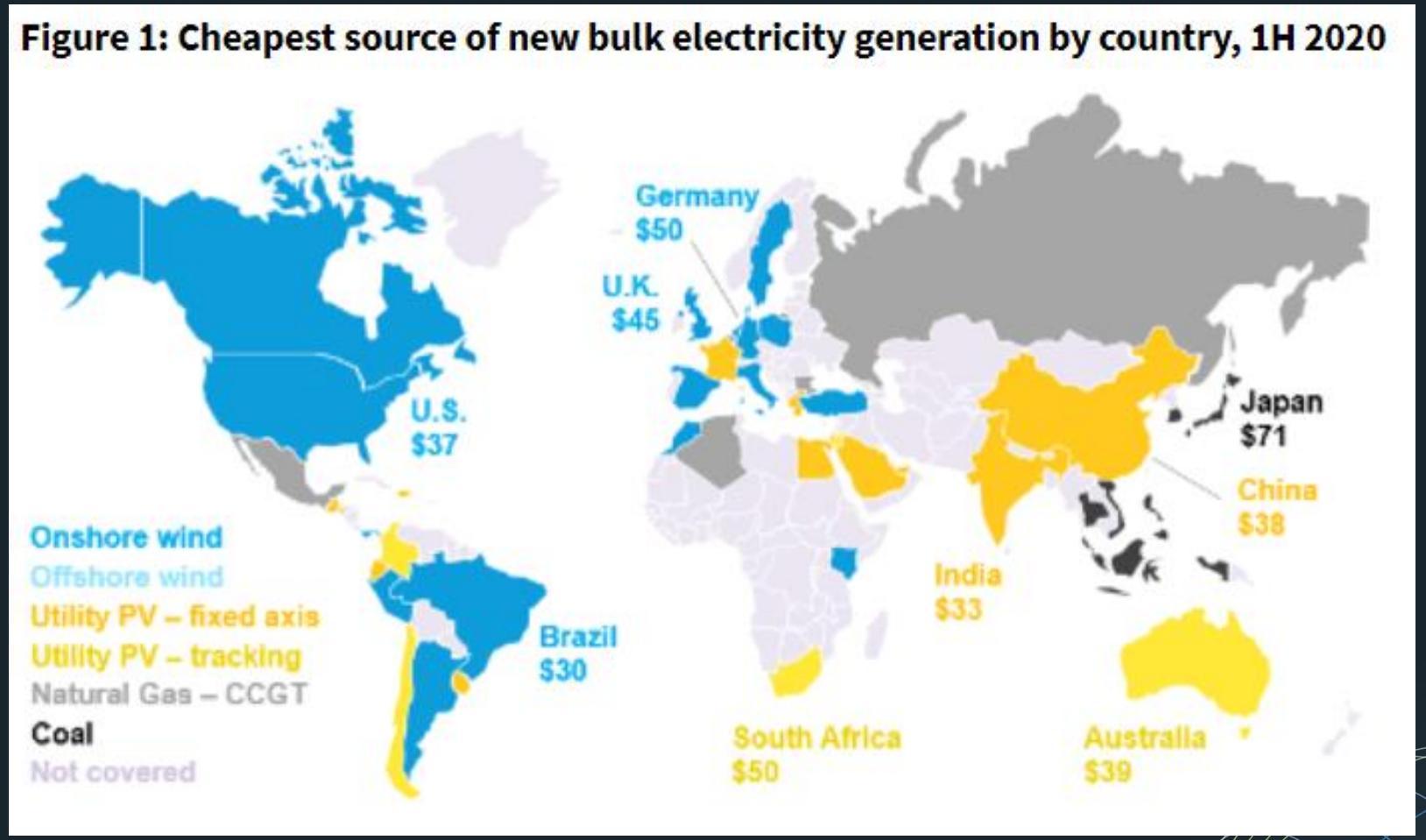
Bloomberg New Energy Finance, Paul Maycock

Global power sector: tipping cascade across countries



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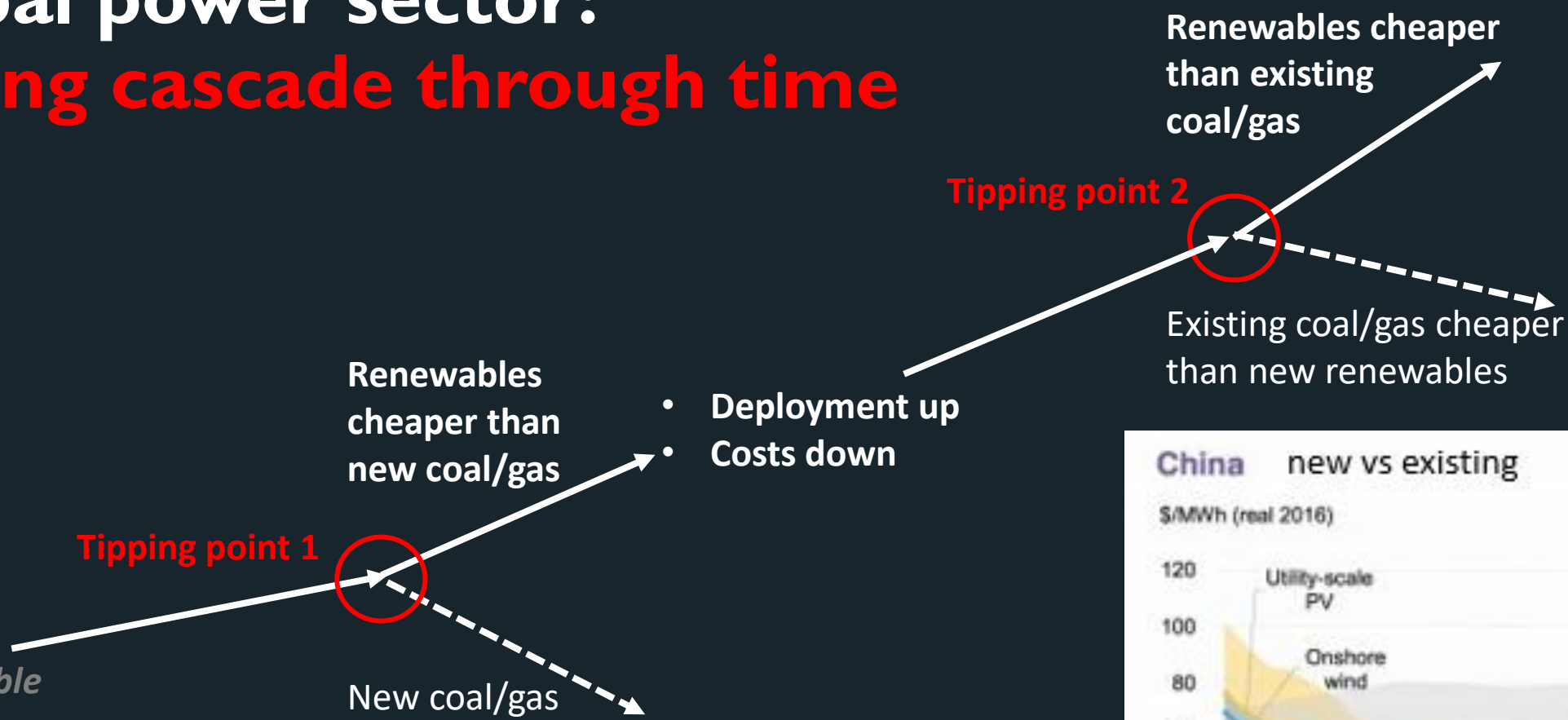
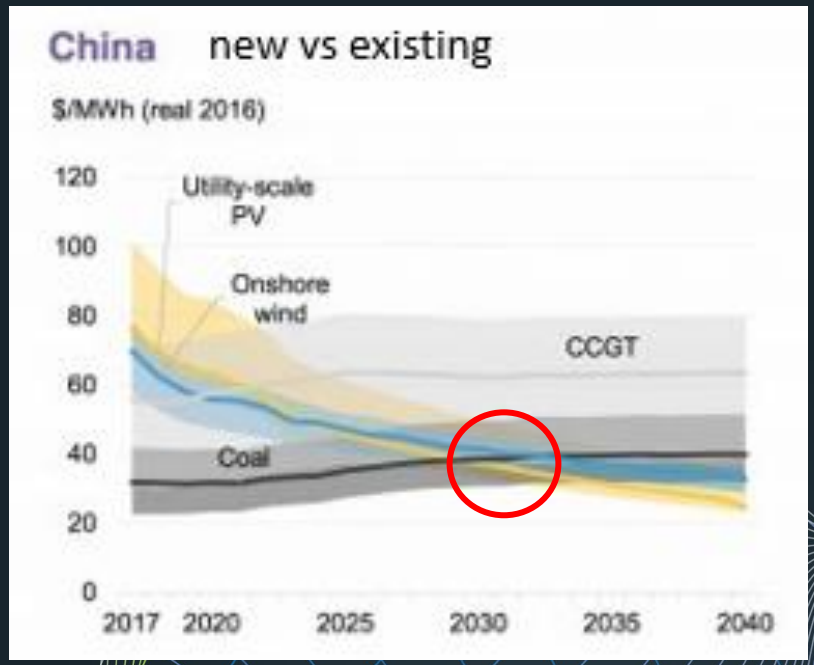
Bloomberg NEF (calculations excluding subsidies or tax credits)

Global power sector:
tipping cascade through time





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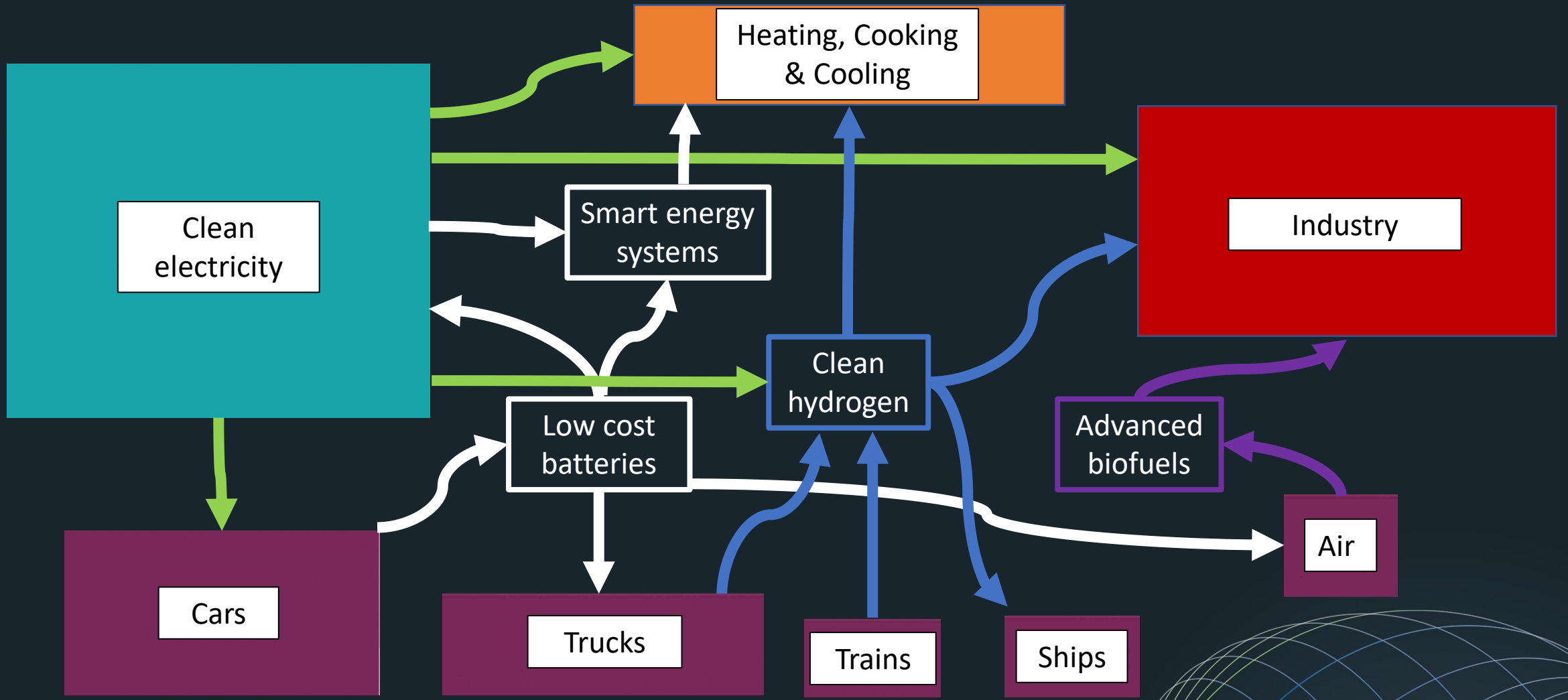
Upward-scaling tipping cascades



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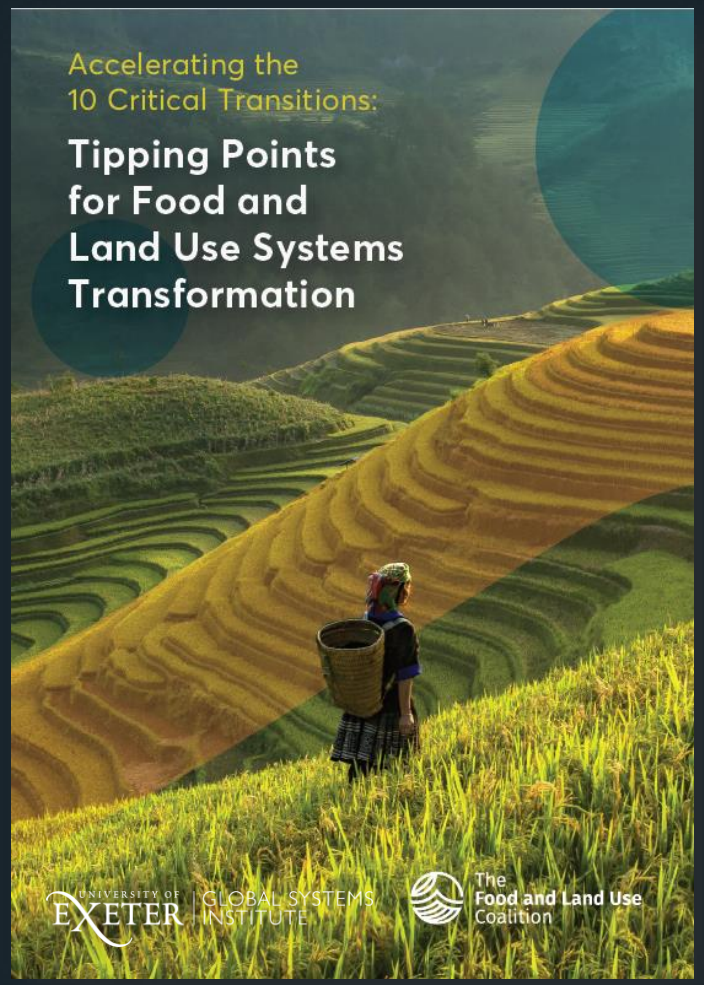
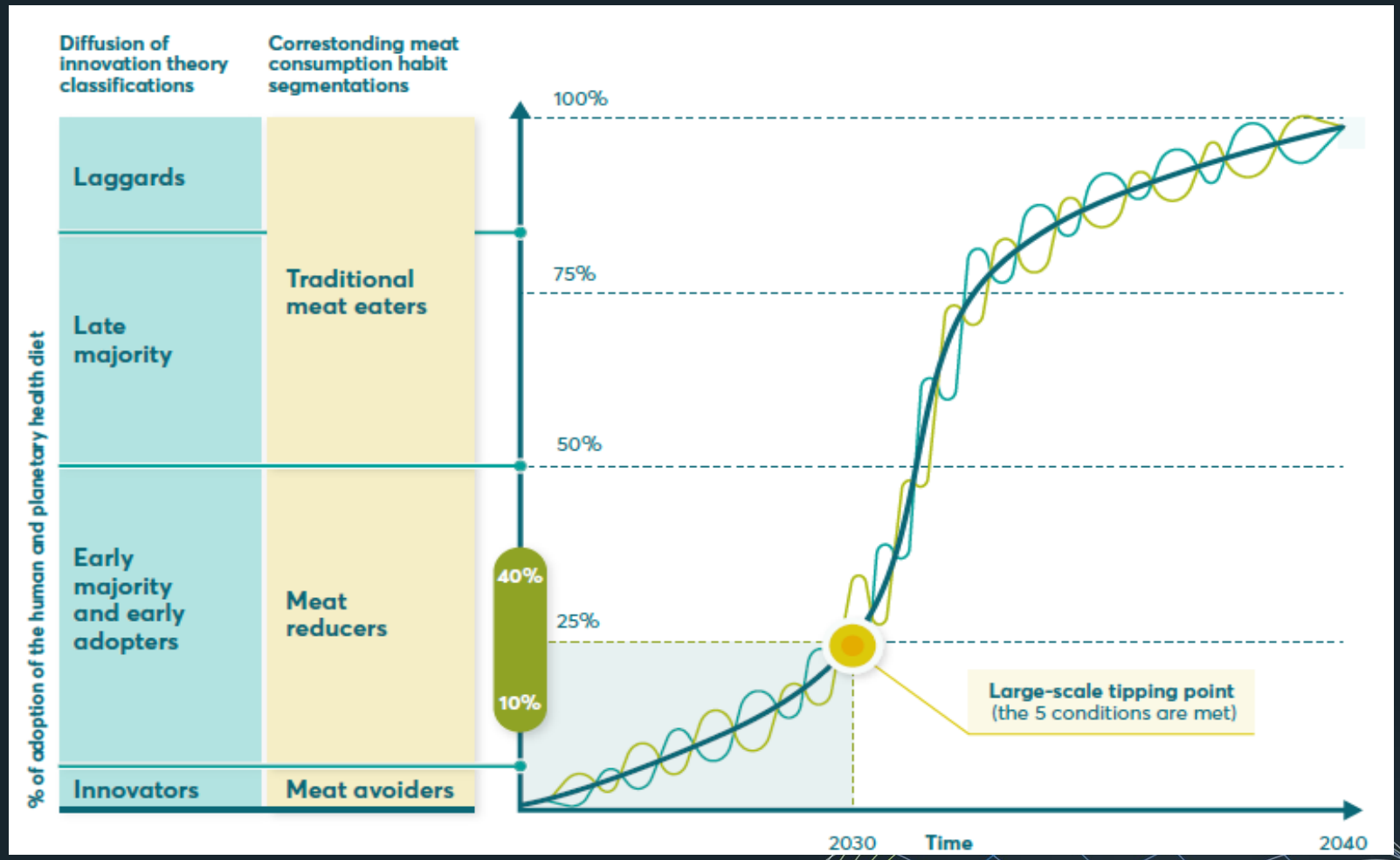
Food and land use system positive tipping points





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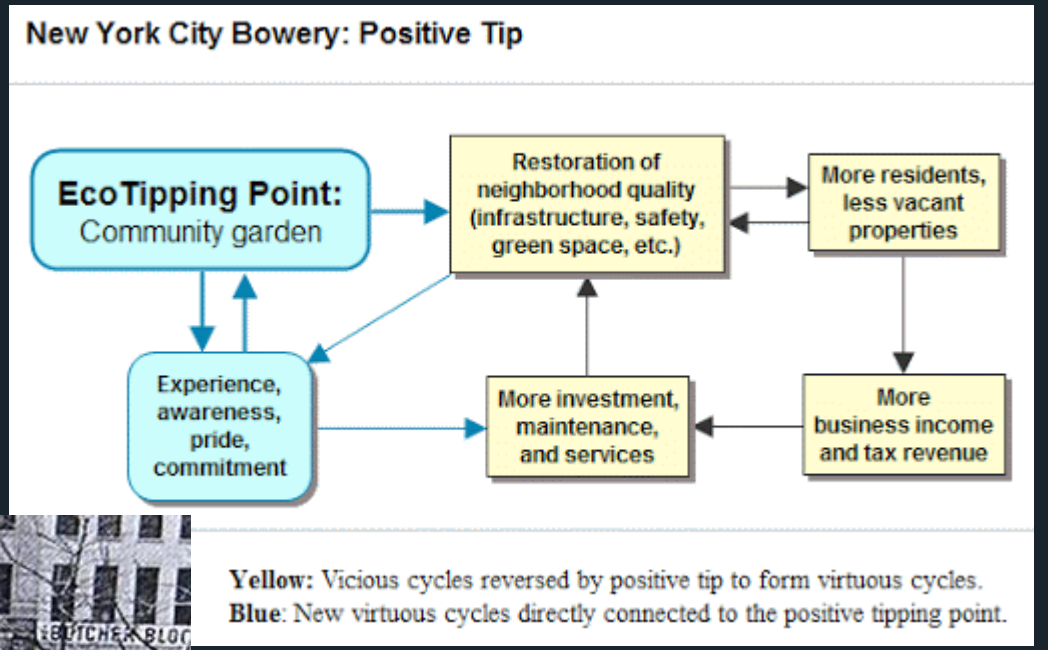
Community gardens

ecotippingpoints.com



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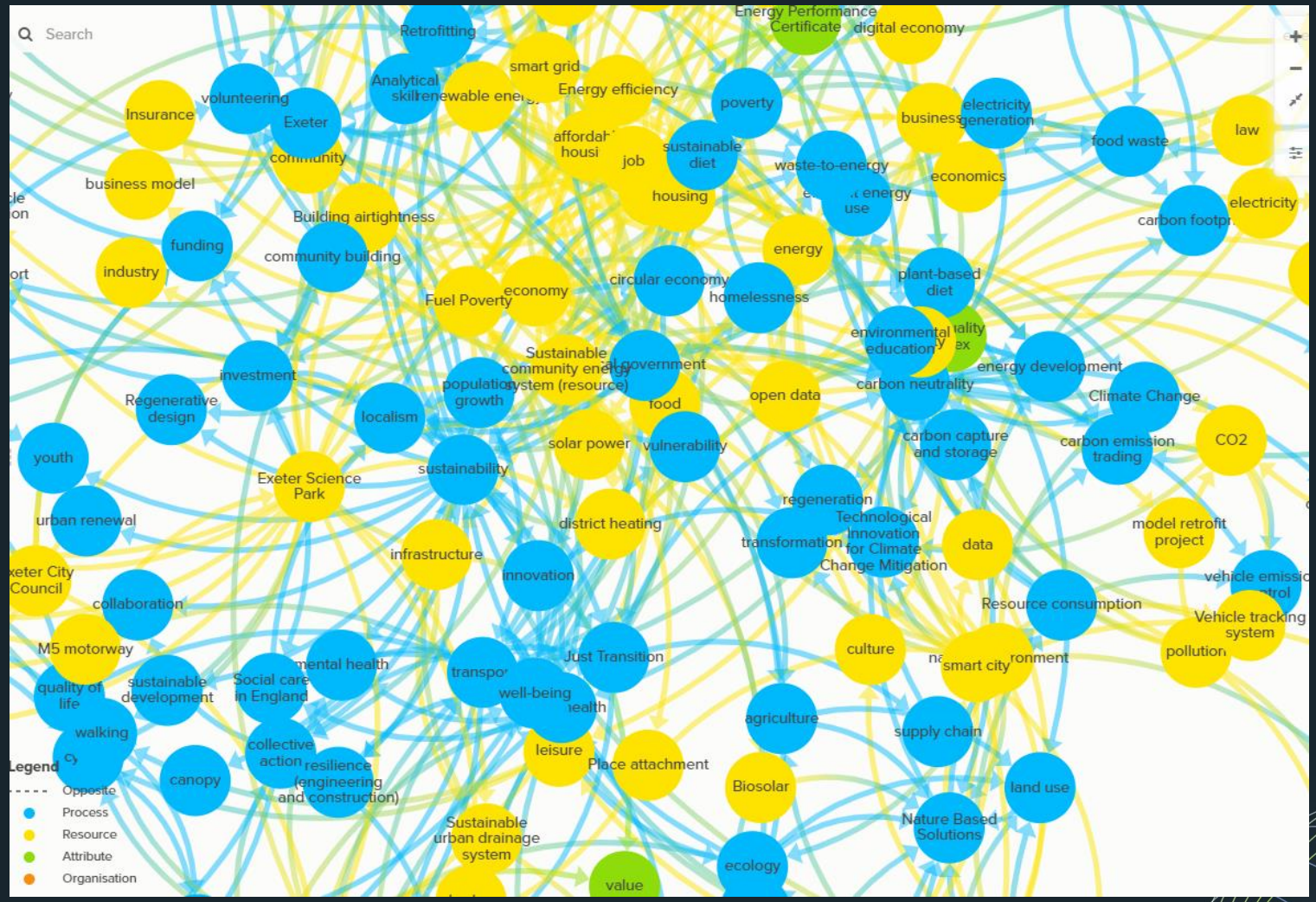
Exeter Living Lab

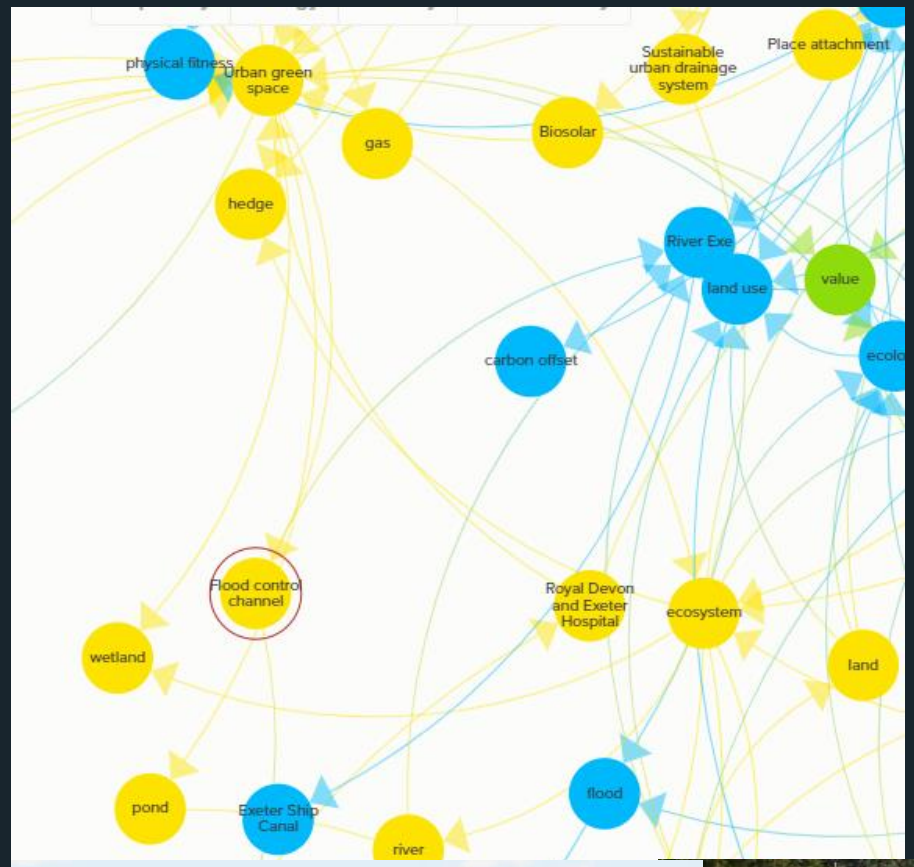


EXETER CityFutures

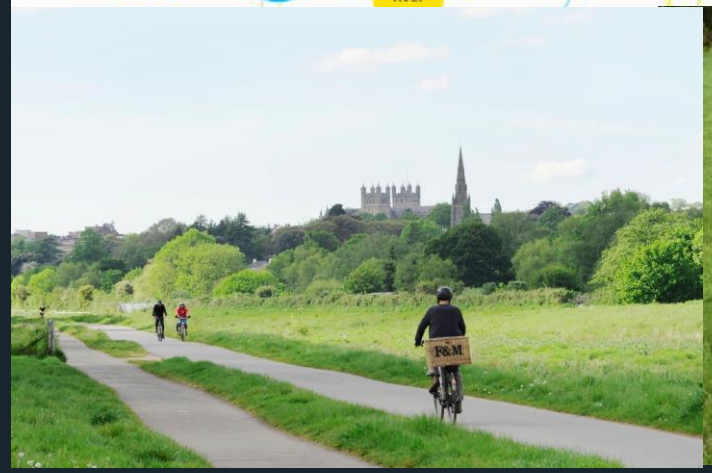
pivot projects

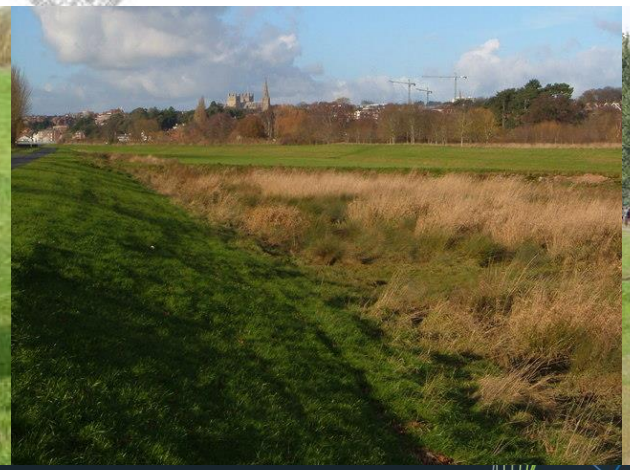
Global Systems Institute

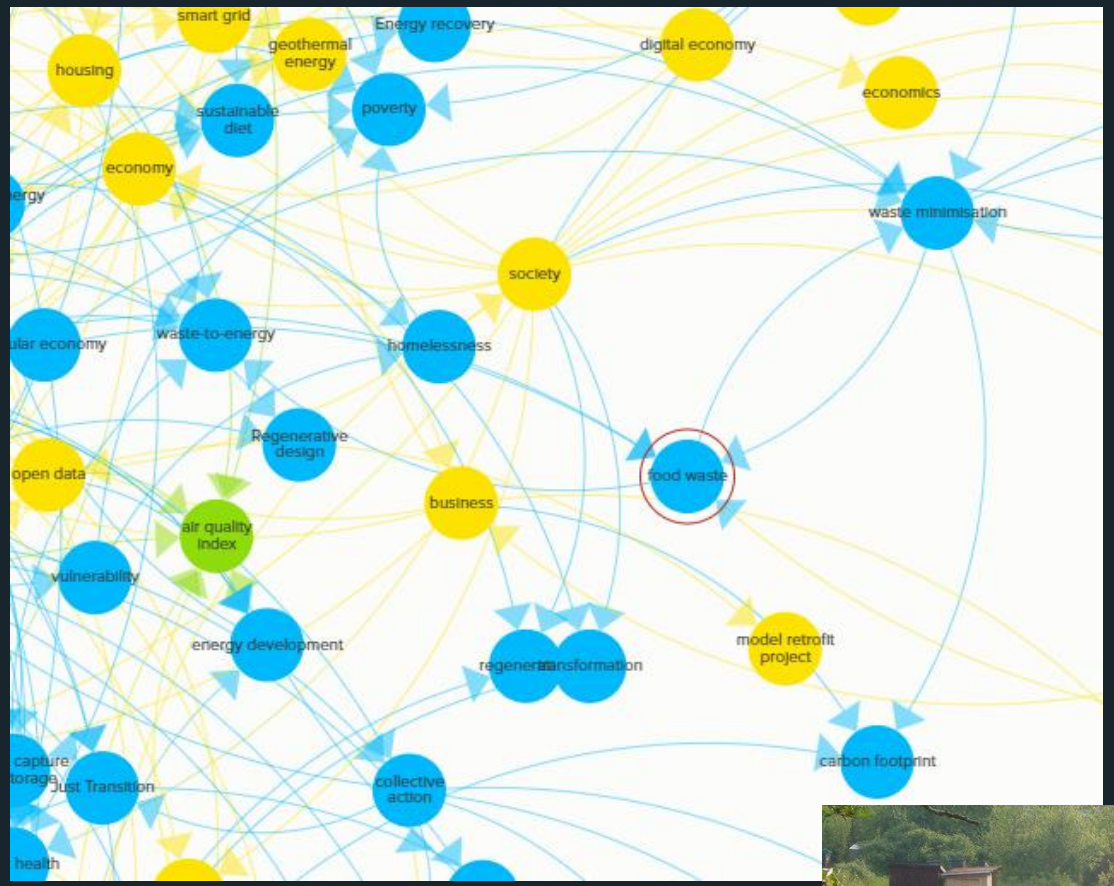
https://kumu.io/James543/exeter-living-lab#exeter-living-lab-systems-map



River Exe – Flood control channel - urban green space - …
- mental health - well being - ordinary water course - ecosystem - wetland/hedge
- walking / cycling – physical fitness – sustainable transport - reduced pollution - well-being
- community building and place making







Food waste – food – localism – energy- renewable energy – waste to energy – food waste – waste minimisation – sustainable diet – food

Food Exeter

Global Systems Institute

Summary

- We are in a climate emergency! Some damaging climate tipping points may already have been passed and we are approaching others
- Limiting global warming to "well below 2°C" now requires positive tipping points to accelerate transformative social change
- Deliberate interventions and reinforcing feedbacks within society, coupled to technology and ecology, are already starting to tip accelerated decarbonisation
- This should give us all back a sense of power in the face of a daunting problem – we can all be part of triggering positive tipping points

Global Systems Institute