Why Net Zero?

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11th October 2022

NET ZERO

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From Aart...

...to Zoe

YOU WILL DIE OF OLD AGE I'LL DIE OF CLIMATE CHANGE

© Thomas Moore @skynewsthomas

Climate policy before net zero

3 Solution – contraction and convergence
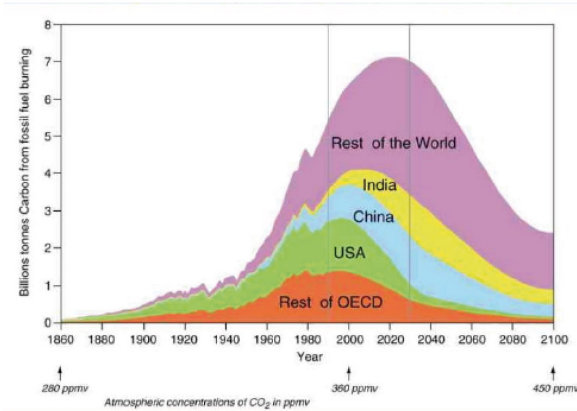
First advocated in 1990 by Aubrey Meyer
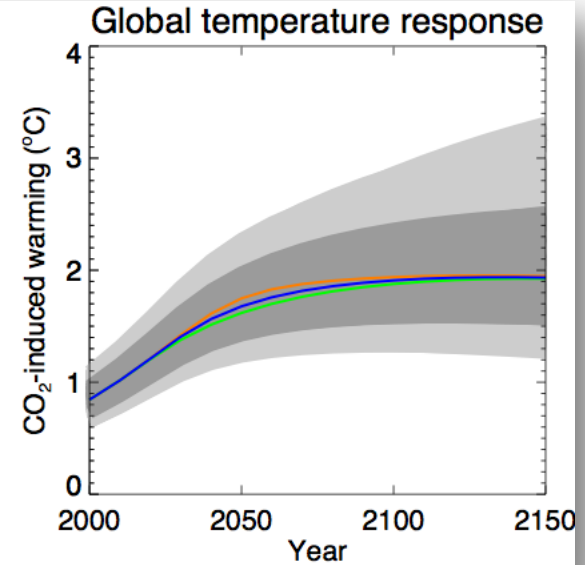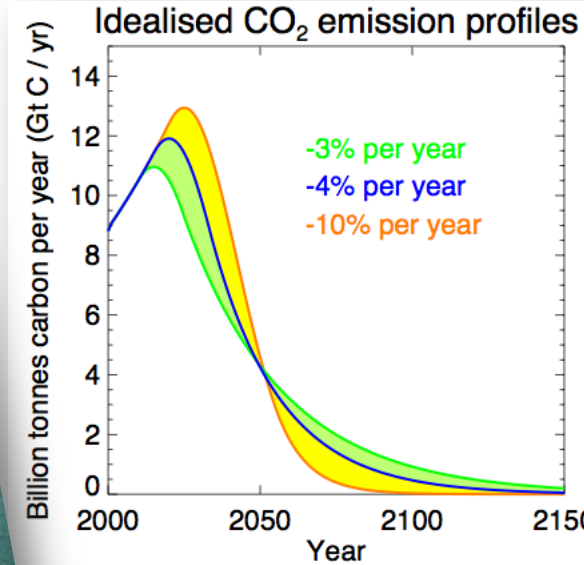
"Long-term convergence of per capita emissions is ... the only equitable basis for a global compact on climate change"

Manmohan Singh, 30 June 2008

Mike Hulme, UEA
2010 CIBSE
annual lecture

The 2009 result: cumulative carbon dioxide emissions determine peak warming…

...so warming continues until CO_2 emissions reach net zero
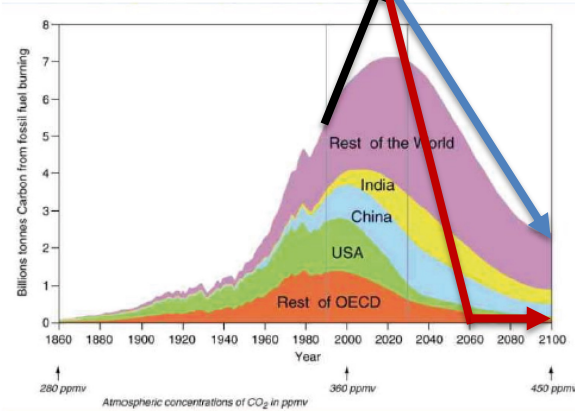
Climate policy before net zero

Emissions since 1990

What they thought was needed to stop climate change

Mike Hulme, UEA 2010 CIBSE annual lecture

3 Solution – contraction and convergence

First advocated in 1990 by Aubrey Meyer

"Long-term convergence of per capita emissions is ... the only equitable basis for a global compact on climate change"

Manmohan Singh, 30 June 2008

What is actually needed to stop climate change

How long have we got? The climate braking time

- If it's 1.5 seconds before you reach the junction, you have 3 seconds to stop if you start braking now.

- If it's 15 years before you reach 1.5°C, you have 30 years to stop if you start reducing emissions now.

- On current trends we will reach 1.5°C before 2035, so we need to stop the warming by 2050.

So, we need to stop fossil fuels
from causing global warming…

Credit: © Stuart Franklin / Magnum

…before the world stops using fossil fuels.

Is nature the solution?
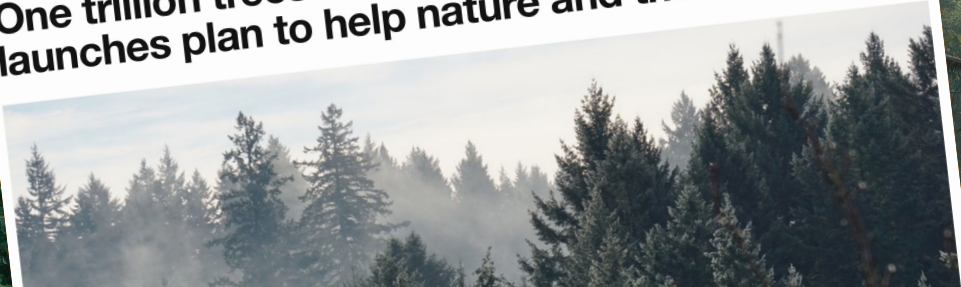
Lots of people would like to think so

One trillion trees - World Economic Forum launches plan to help nature and the climate

DRIVE CARBON NEUTRAL

By protecting and replanting forests

Shell GO+

GOOD THINGS HAPPEN WHEN YOU GO+ IT

GO WELL

We need to protect the biosphere, not rely on it as a carbon dump

So do we have to ban fossil fuels entirely?

Climate scientists: concept of net zero is a dangerous trap

Keep it in whose ground?
"Wells to watch 2022"
geoexpro.com
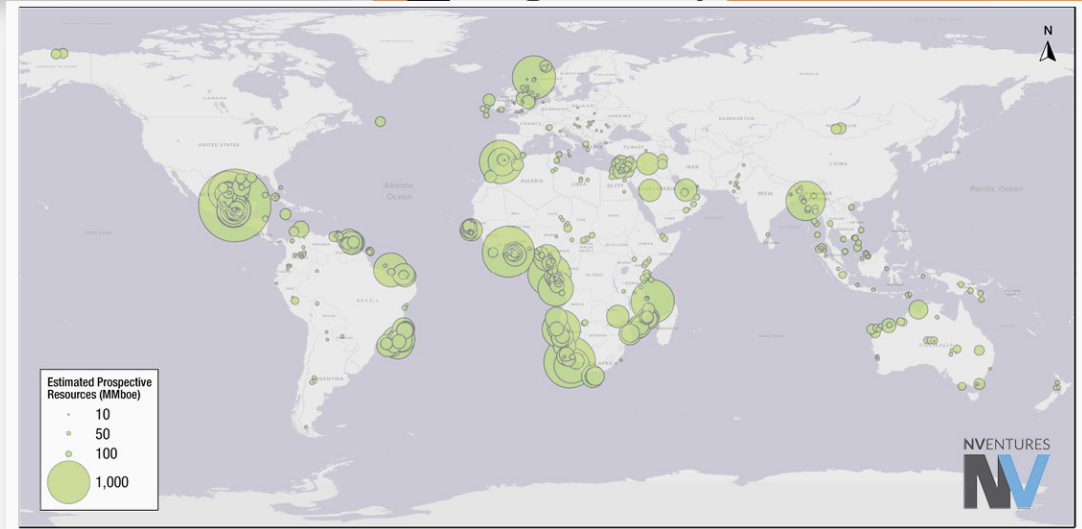
a Current situation

Human-induced carbon flows into and out of atmosphere are **imbalanced**; climate warms

ATMOSPHERE

+

Emissions from fossil fuels and industrial processes

Emissons from land-use change

Sinks from land-use change

LAND AND OCEAN BIOSPHERE

−

GEOSPHERE

Allen et al, *Annual Reviews of Environment and Resources*, 2022
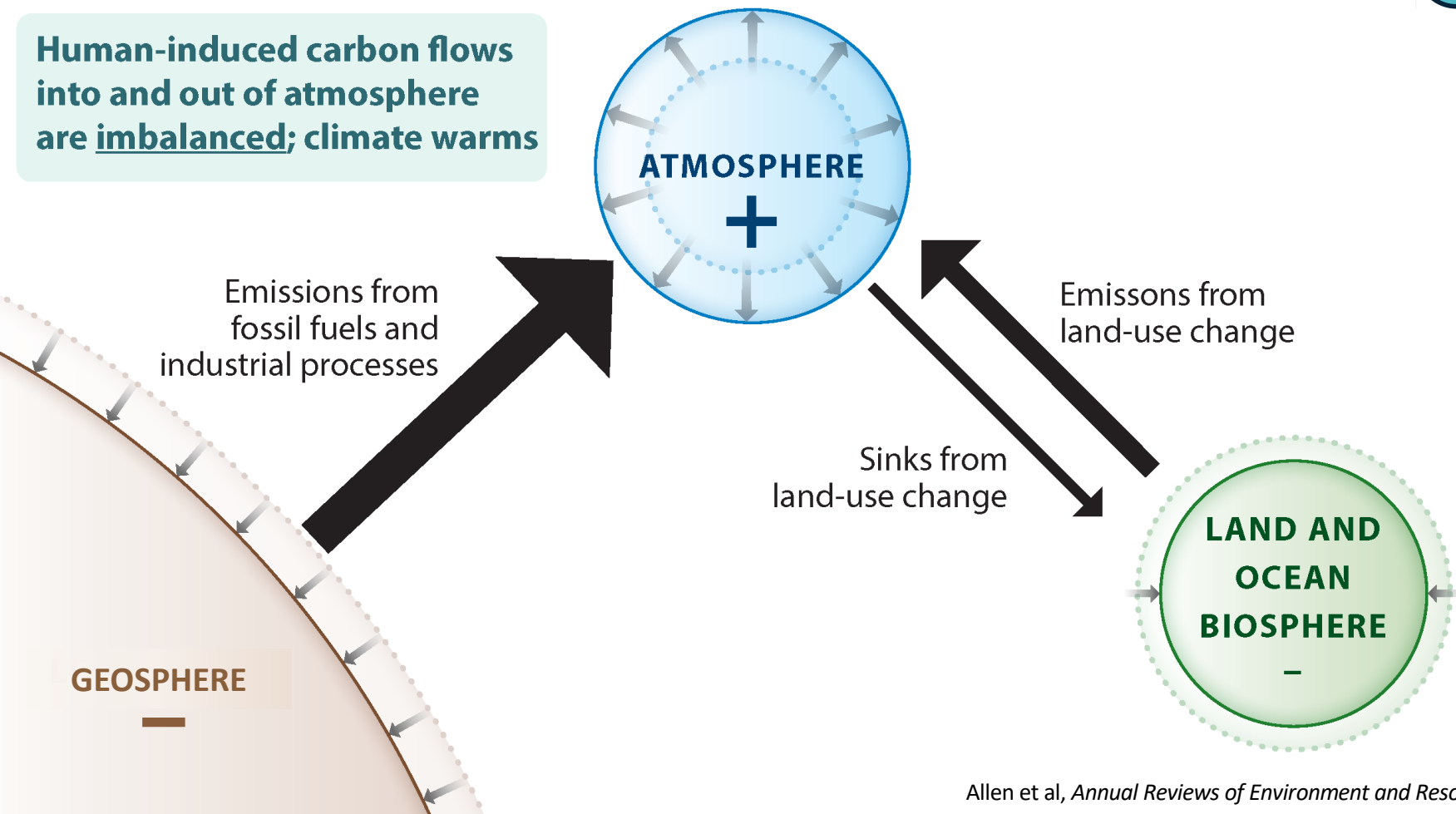
b Net zero

Human-induced carbon flows into and out of atmosphere are _balanced_; temperature stabilized temporarily

ATMOSPHERE

Emissions from fossil fuels and industrial processes

Emissons from land-use change

Sinks from land-use change

Sinks from air capture and geological storage

LAND AND OCEAN BIOSPHERE

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GEOSPHERE

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Sinks from biomass capture and geological storage

Allen et al, *Annual Reviews of Environment and Resources*, 2022
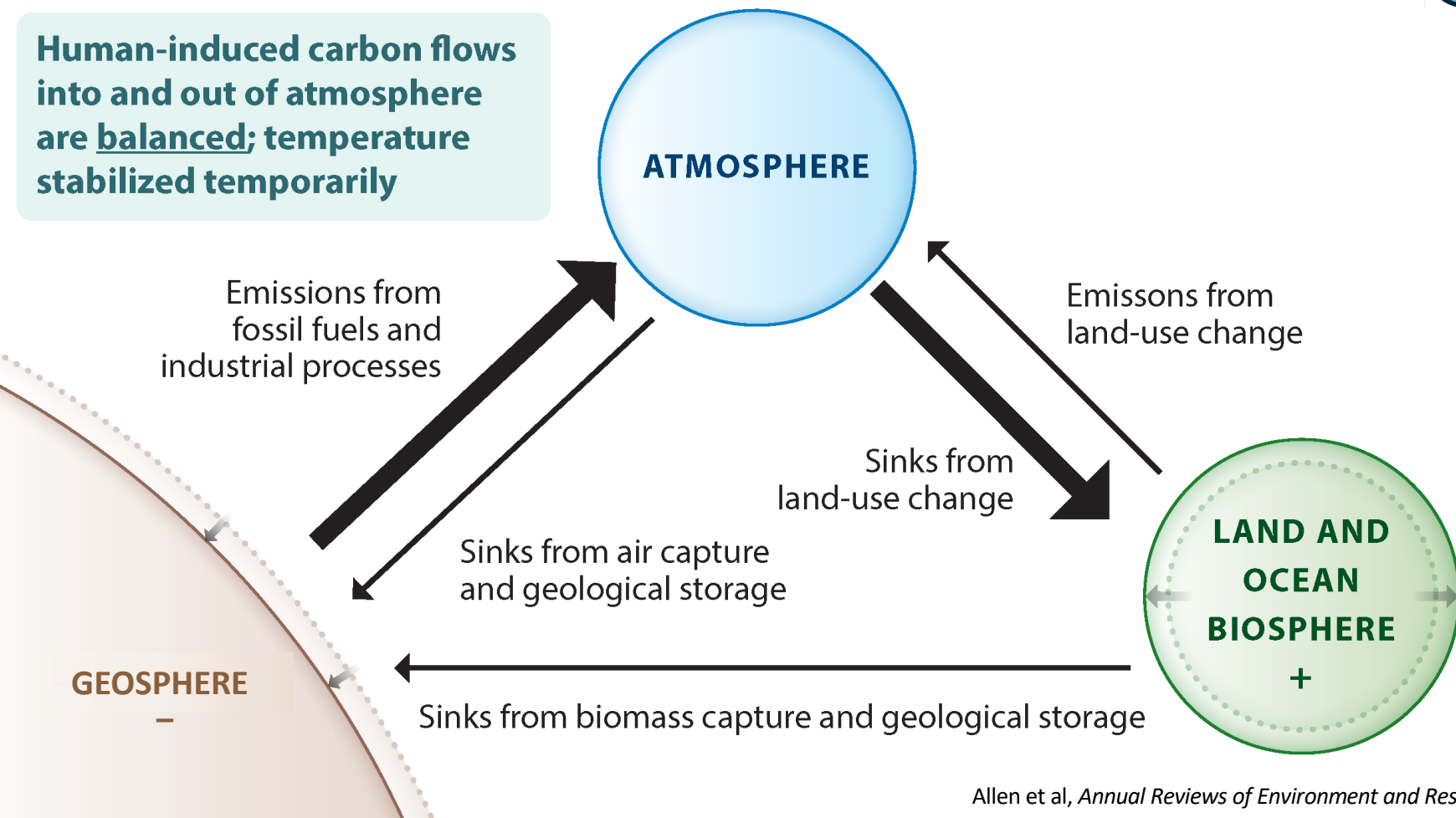
c Durable net zero

Human-induced carbon flows into and out of each sphere are <u>balanced</u>; temperature stabilized sustainably

ATMOSPHERE

Emissions from fossil fuels and industrial processes

GEOLOGICAL NET ZERO

Emissons from land-use change

Sinks from land-use change

Sinks from air capture and geological storage

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LAND AND OCEAN BIOSPHERE

GEOSPHERE

Sinks from biomass capture and geological storage

Allen et al, *Annual Reviews of Environment and Resources*, 2022
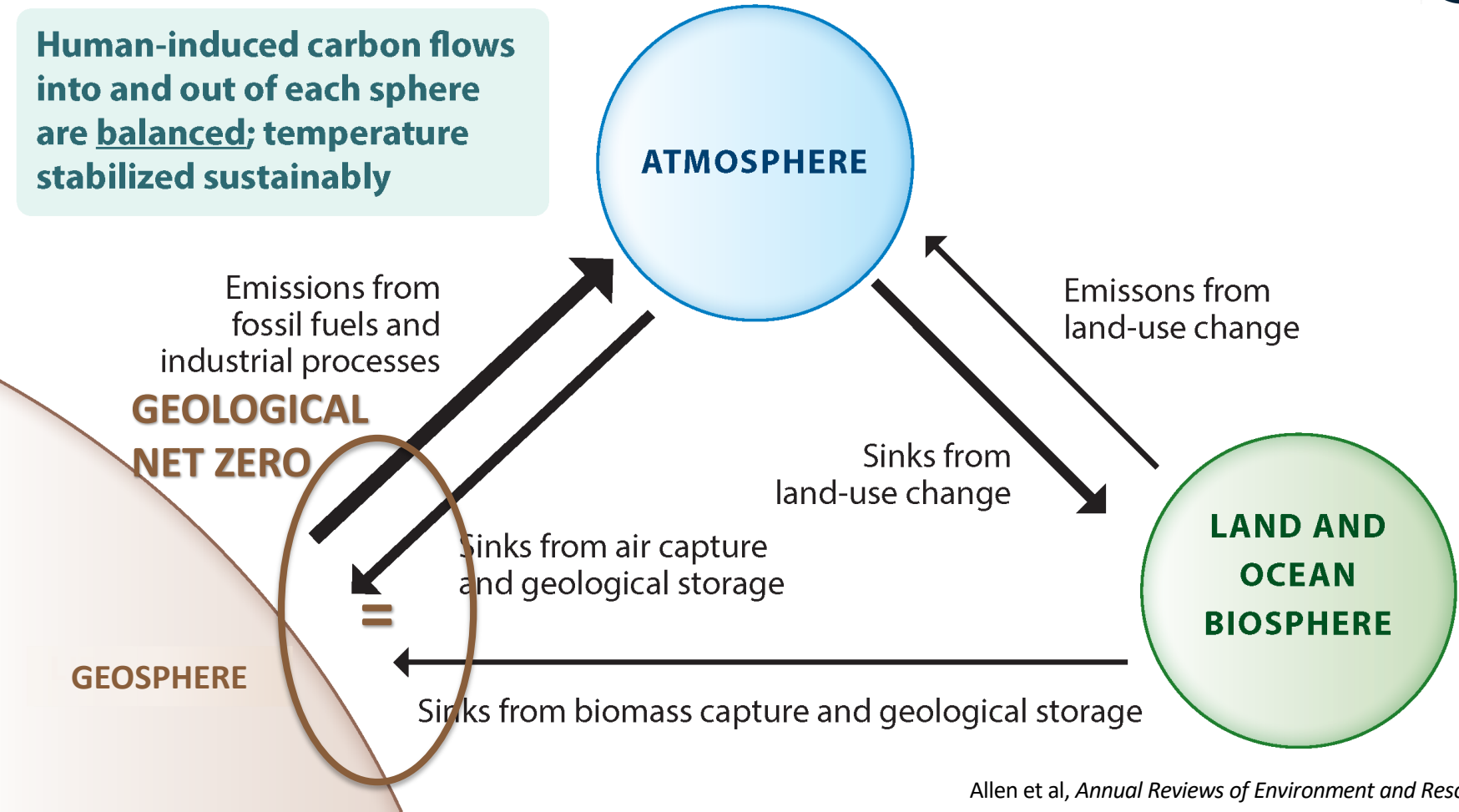
How to stop fossil fuels from causing global warming

Industrial CO_2 production and storage in average "technology neutral" 1.5^oC scenario.

Annual CO_2 emissions ($GtCO_2/yr$)

Burn less

Total CO_2 produced

Store more

Net CO_2 emissions to atmosphere

Total CO_2 sequestered

CO_2 capture

CO_2 transport

CO_2 storage

the Global CCS Institute

Net CO$_2$ emissions = CO$_2$ production minus CO$_2$ storage

($/tCO$_2$)

Measures to reduce CO$_2$ production

Measures to increase CO$_2$ storage

Cost of reducing net emissions

Potential for reducing net emissions (billion tCO$_2$/year)
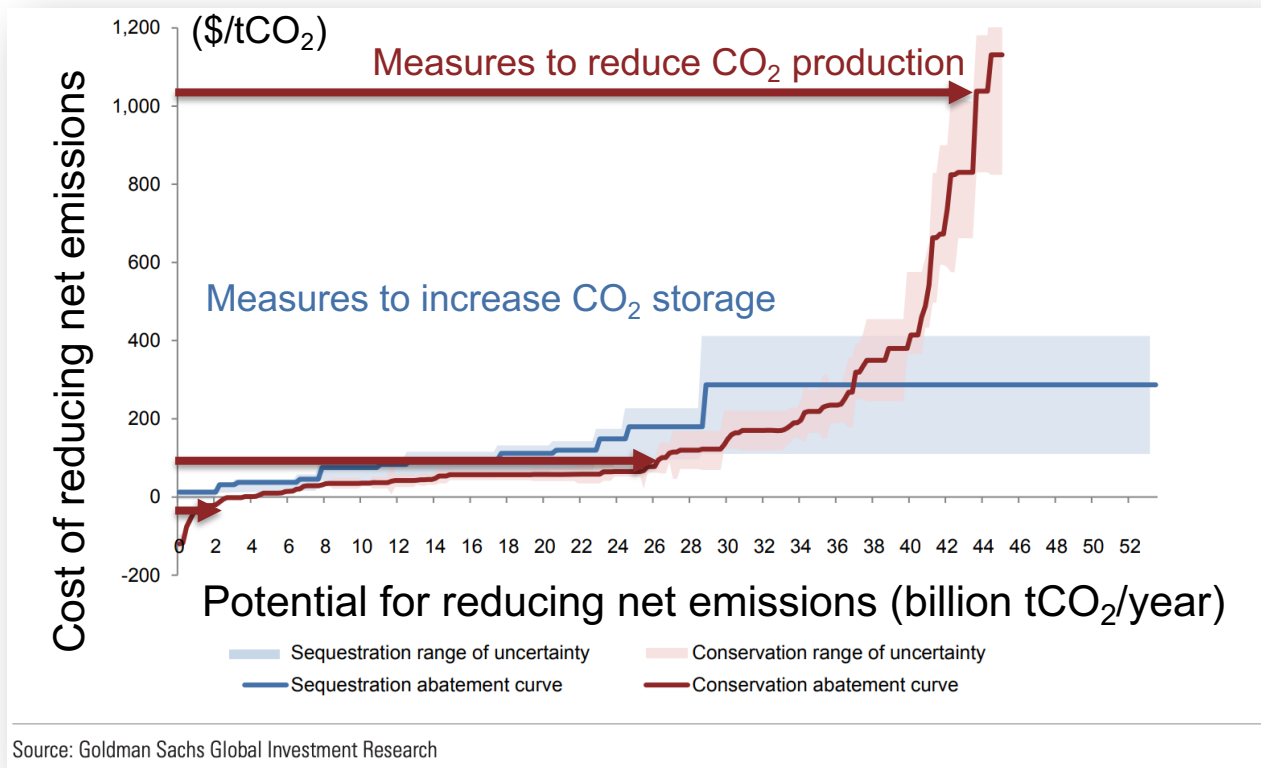
Sequestration range of uncertainty   Conservation range of uncertainty

Sequestration abatement curve   Conservation abatement curve
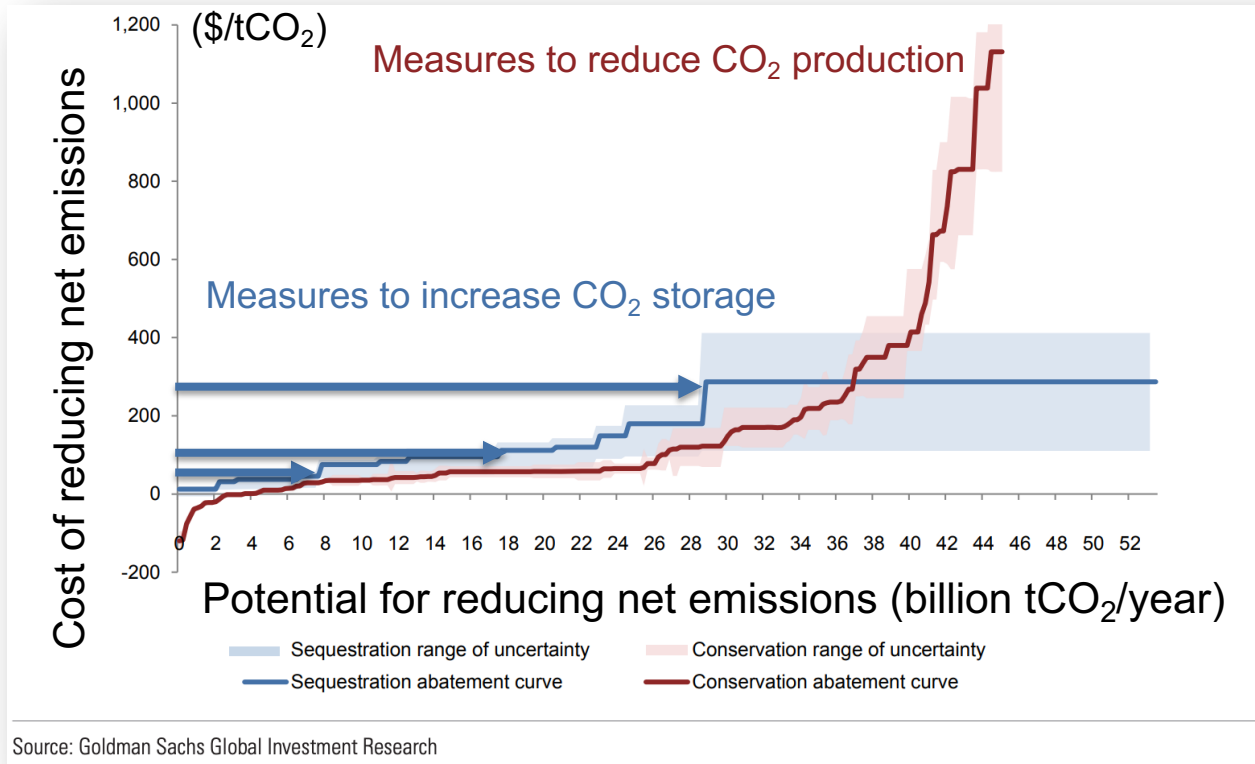
Source: Goldman Sachs Global Investment Research

Synthetic transport fuels for over $1000 per tonne of CO$_2$ avoided

Decarbonizing electricity generation for less than $100 per tonne of CO$_2$ avoided

Eliminating subsidies (negative cost)

https://www.goldmansachs.com/insights/pages/gs-research/carbonomics-10-key-themes-from-the-inaugural-conference-f/report.pdf

Net CO_2 emissions = CO_2 production minus CO_2 storage

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Potential for reducing net emissions (billion tCO_2/year)

Sequestration range of uncertainty   Conservation range of uncertainty

Sequestration abatement curve   Conservation abatement curve

Source: Goldman Sachs Global Investment Research

Direct capture of CO_2 from the atmosphere

Capture and storage of CO_2 from power stations and industrial sources

Low-cost forestry projects (durable?)

https://www.goldmansachs.com/insights/pages/gs-research/carbonomics-10-key-themes-from-the-inaugural-conference-f/report.pdf

But can we really suck carbon dioxide out of the air and pump it back underground for less than $300 per tonne?

Carbon Engineering

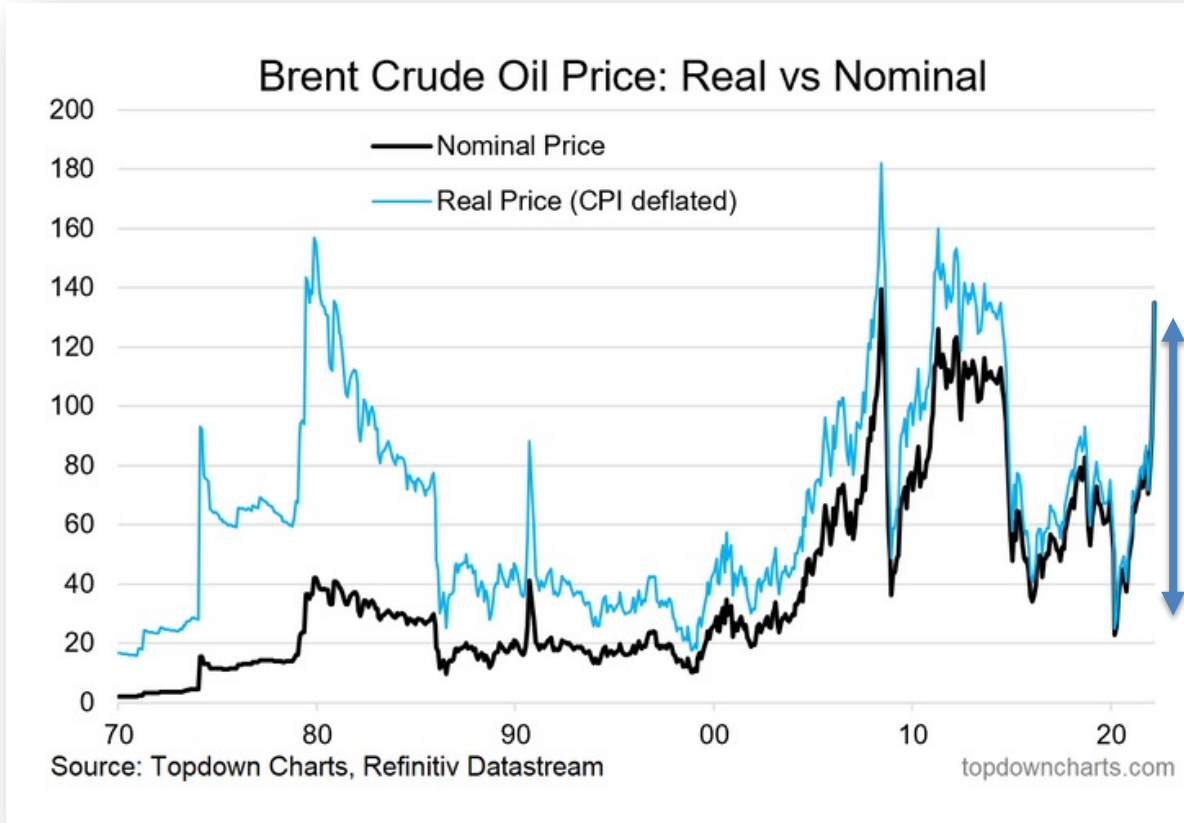Pilot direct air capture facility, British Columbia
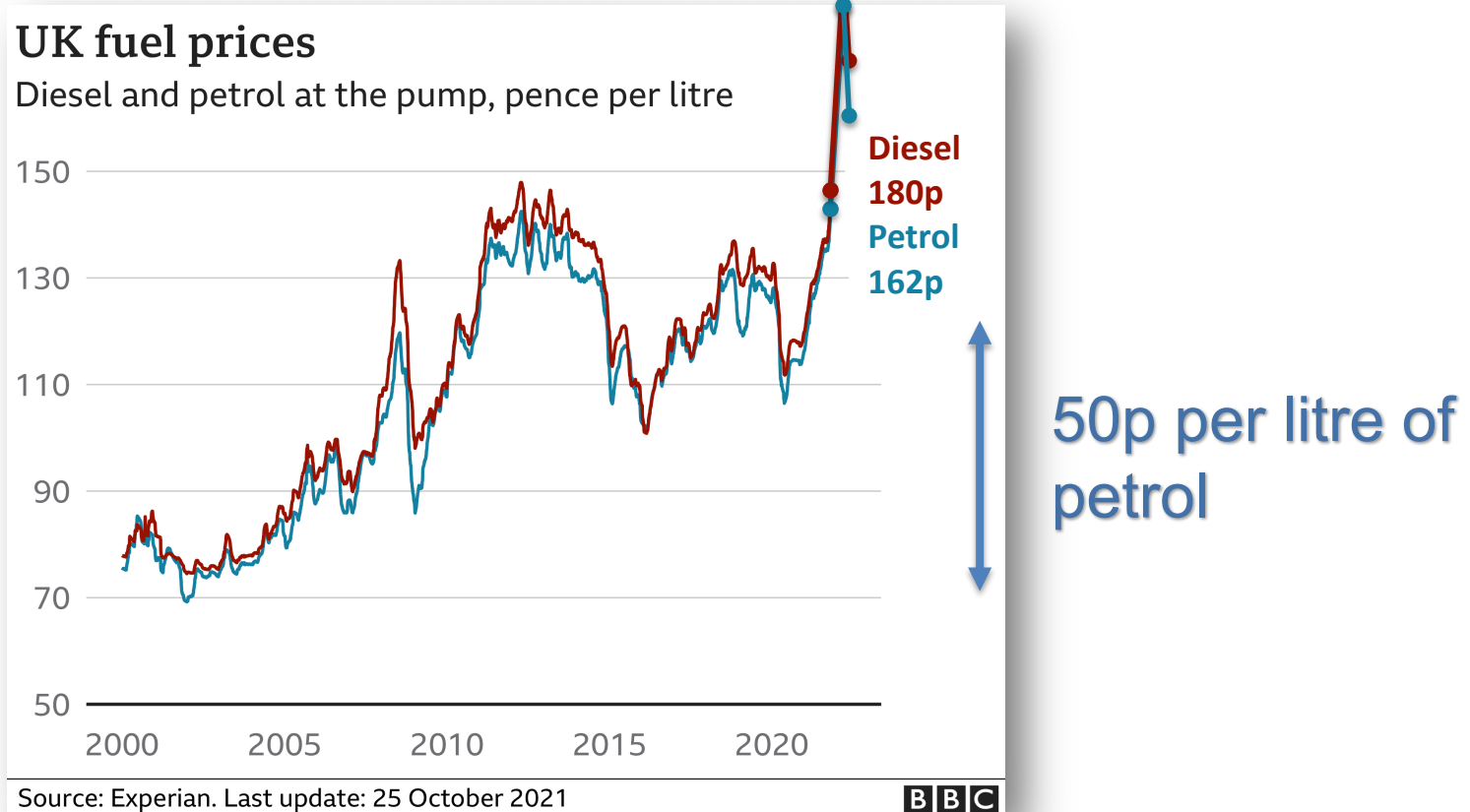
Pilot direct air capture facility, North Lincolnshire

What does a $250 per tonne cost of disposing of carbon dioxide mean?

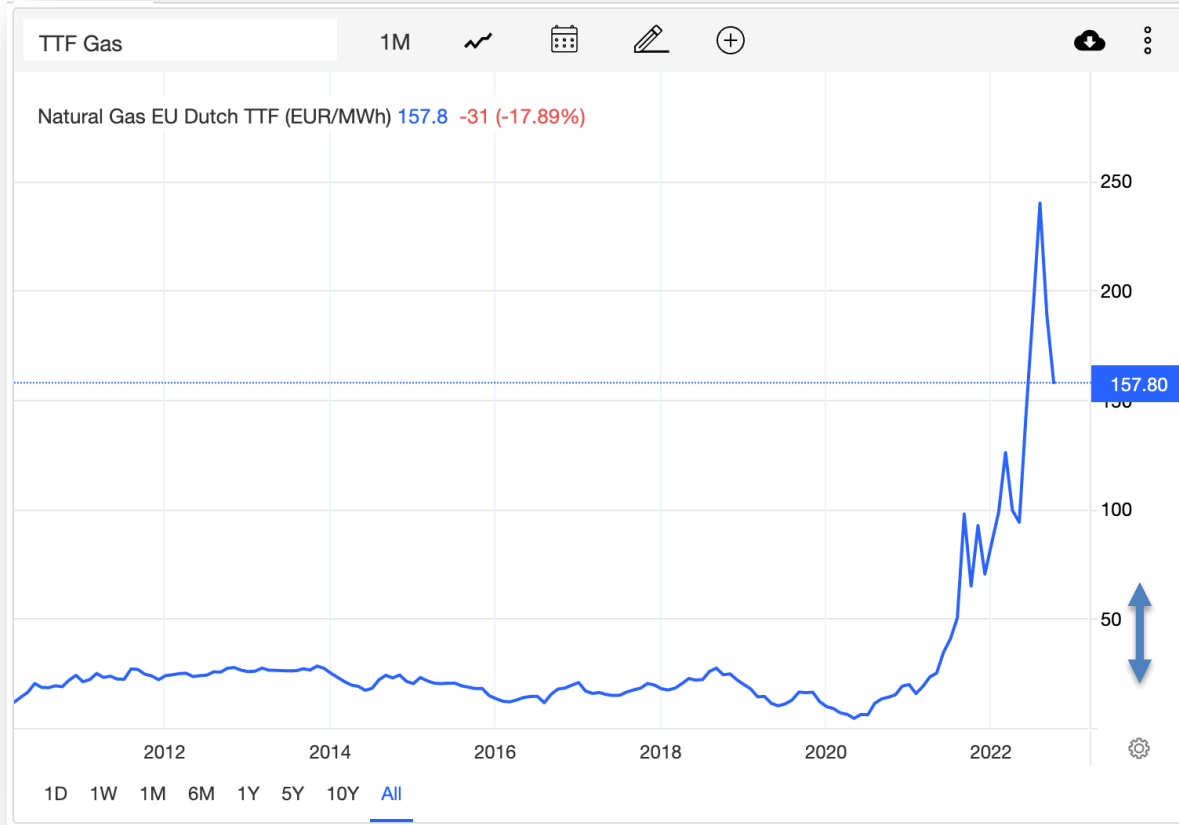# What does a $250 per tonne cost of disposing of carbon dioxide mean?

Brent Crude Oil Price: Real vs Nominal

— Nominal Price
— Real Price (CPI deflated)

Source: Topdown Charts, Refinitiv Datastream

topdowncharts.com

$100 per barrel of oil

What does a $250 per tonne cost of disposing of carbon dioxide mean?

UK fuel prices
Diesel and petrol at the pump, pence per litre

Diesel 180p
Petrol 162p

50p per litre of petrol

Source: Experian. Last update: 25 October 2021

BBC

What does a $250 per tonne cost of disposing of carbon dioxide mean?

Natural Gas EU Dutch TTF (EUR/MWh) 157.8 -31 (-17.89%)

TTF Gas
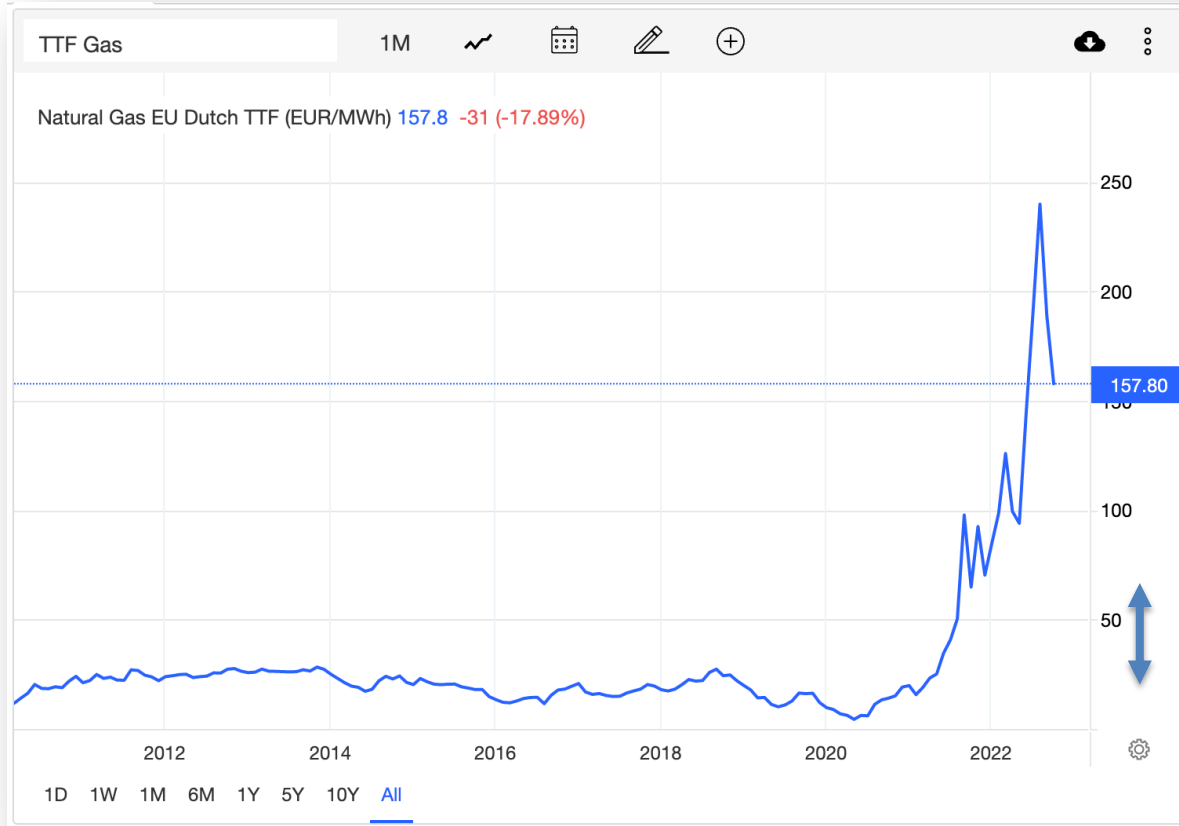
157.80

€45 per MWh of natural gas

What does a $250 per tonne cost of disposing of carbon dioxide mean?

4p per kWh of natural gas

What does a $250 per tonne cost of disposing of carbon dioxide mean?

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It means combined royalties and profits in what we pay for gas are enough to capture every single molecule of CO_2 that gas generates back out of the atmosphere and pump it back under the North Sea.

What does a $250 per tonne cost of disposing of carbon dioxide mean?

It means combined royalties and profits in what we pay for gas are enough to capture every single molecule of CO_2 that gas generates back out of the atmosphere and pump it back under the North Sea. Twice over.

Reconciling Aart and Zoe

Why Net Zero?

We need to stop fossil fuels from causing global warming: Geological Net Zero.

So we either ban fossil fuels, or decarbonize fossil fuels by permanent disposal of CO_2.

11th October 2022