

Climate change: can tourists easily fly 'green'?

By
Roy
Thompson

Scottish Travellers
Exploring the Planet
(STEP) 4 March 2019



Outline

1. Climate change

2. Scotland's energy and greenhouse gas emissions

3. Can Scottish tourists easily fly 'green'?

HOW TOURISM COMPARES ...

TOP 10 EMITTING COUNTRIES (2012)

China **25.9%**

USA **15.9%**

India **15.9%**

Russia Fed. **5.2%**

Japan **3.8%**

» **TOURISM 3.7%**

Germany **2.4%**

Korea **1.9%**

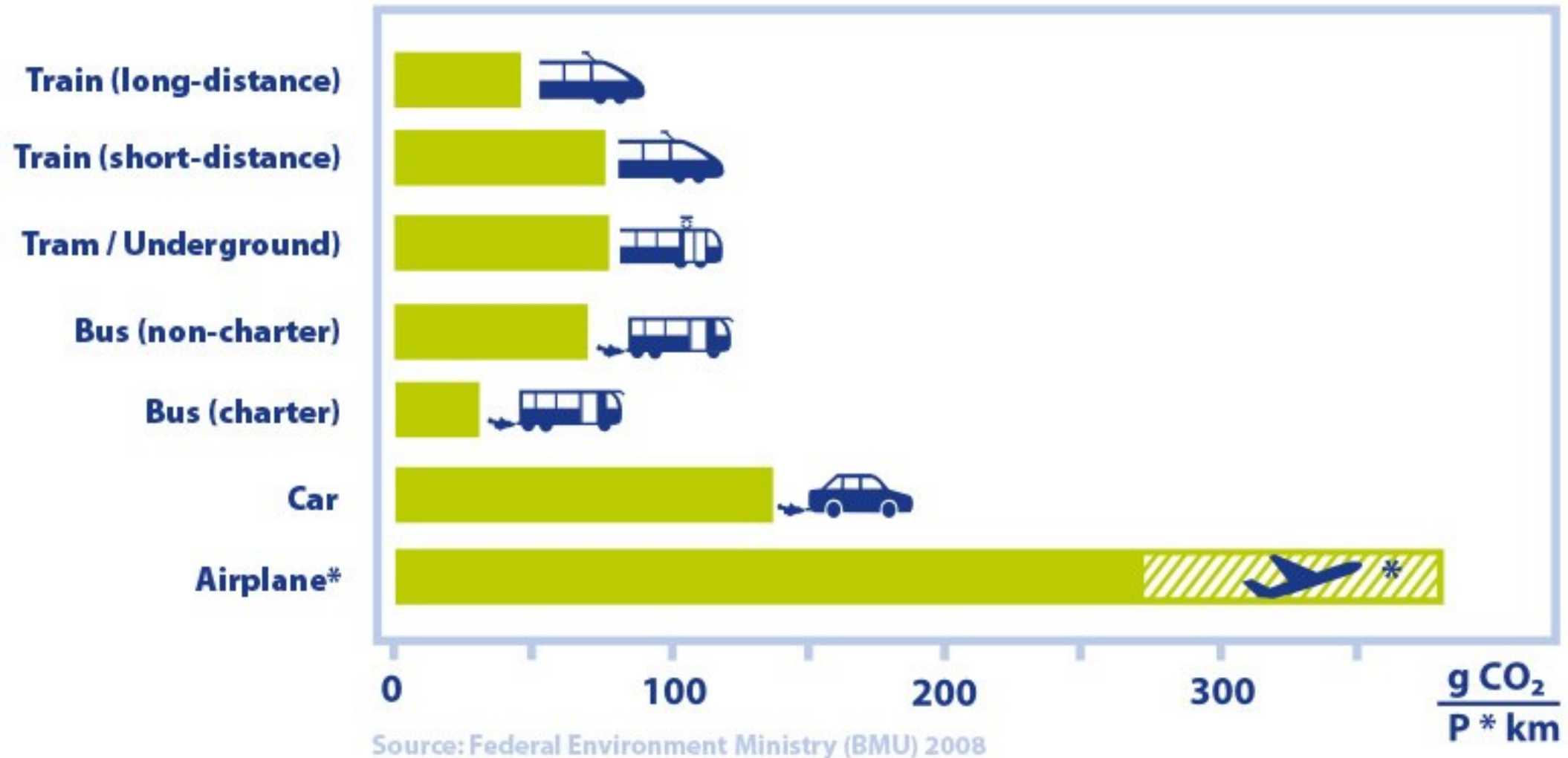
Canada **1.7%**

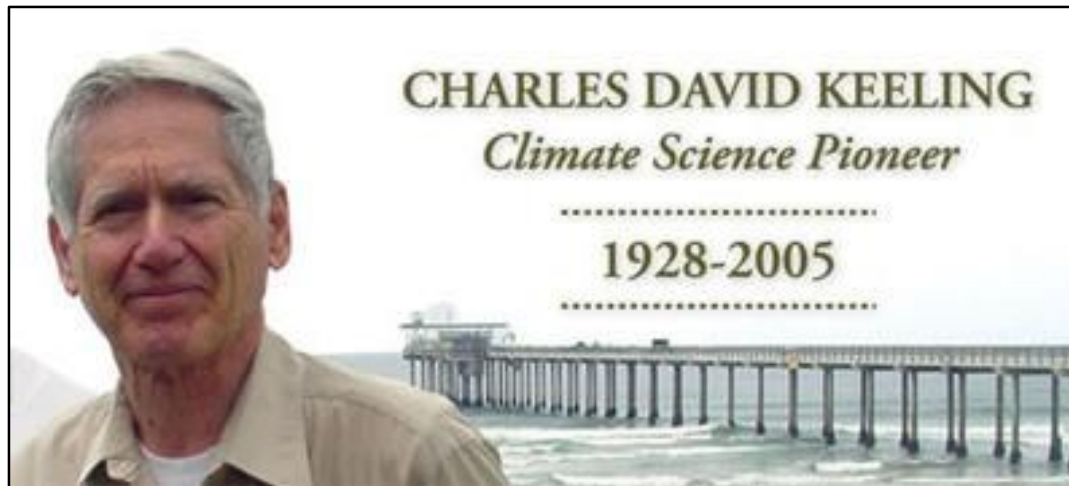
Iran **1.7%**

Saudi Arabia **1.4%**

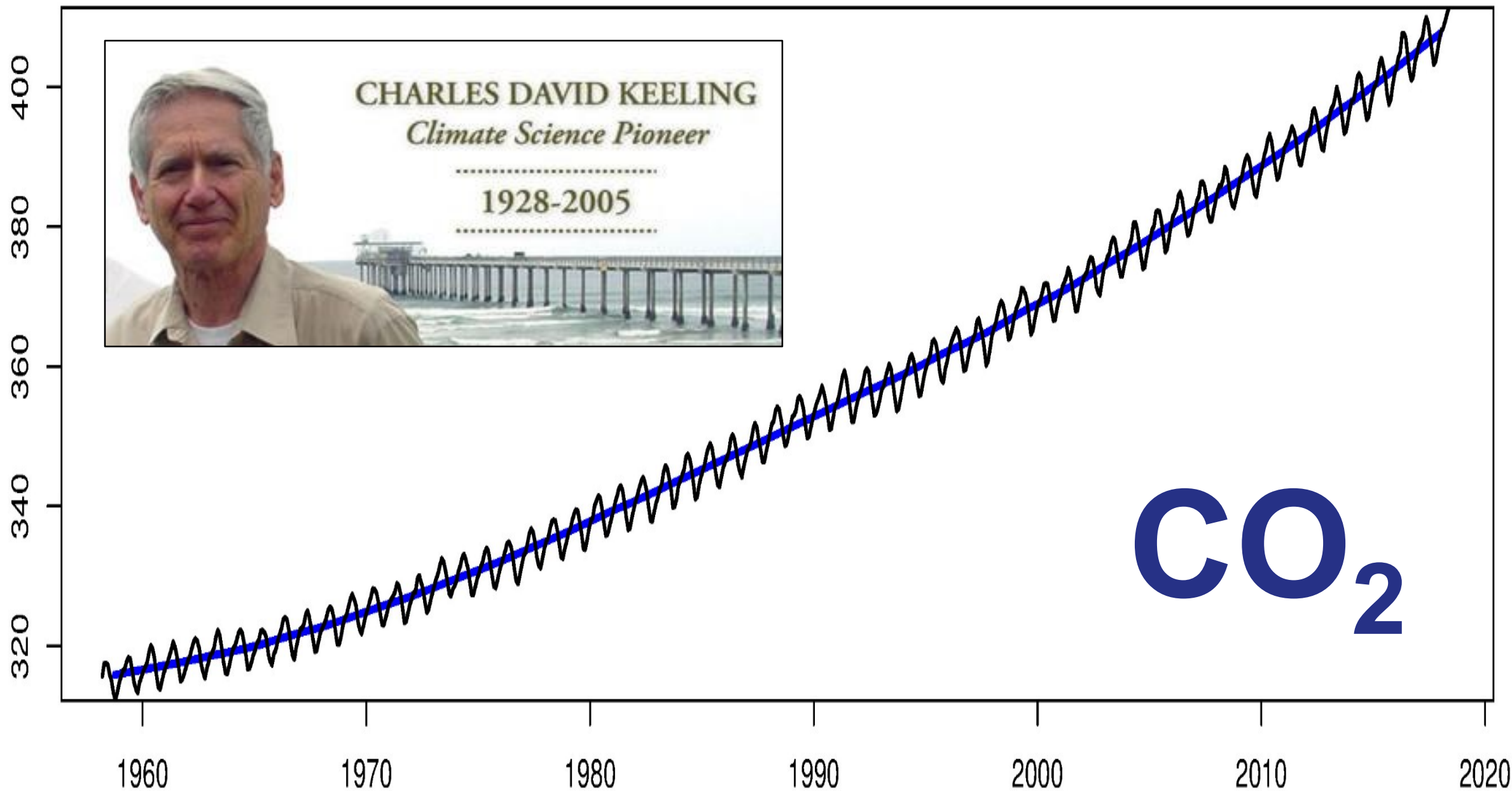


Greenhouse gas emissions from transport





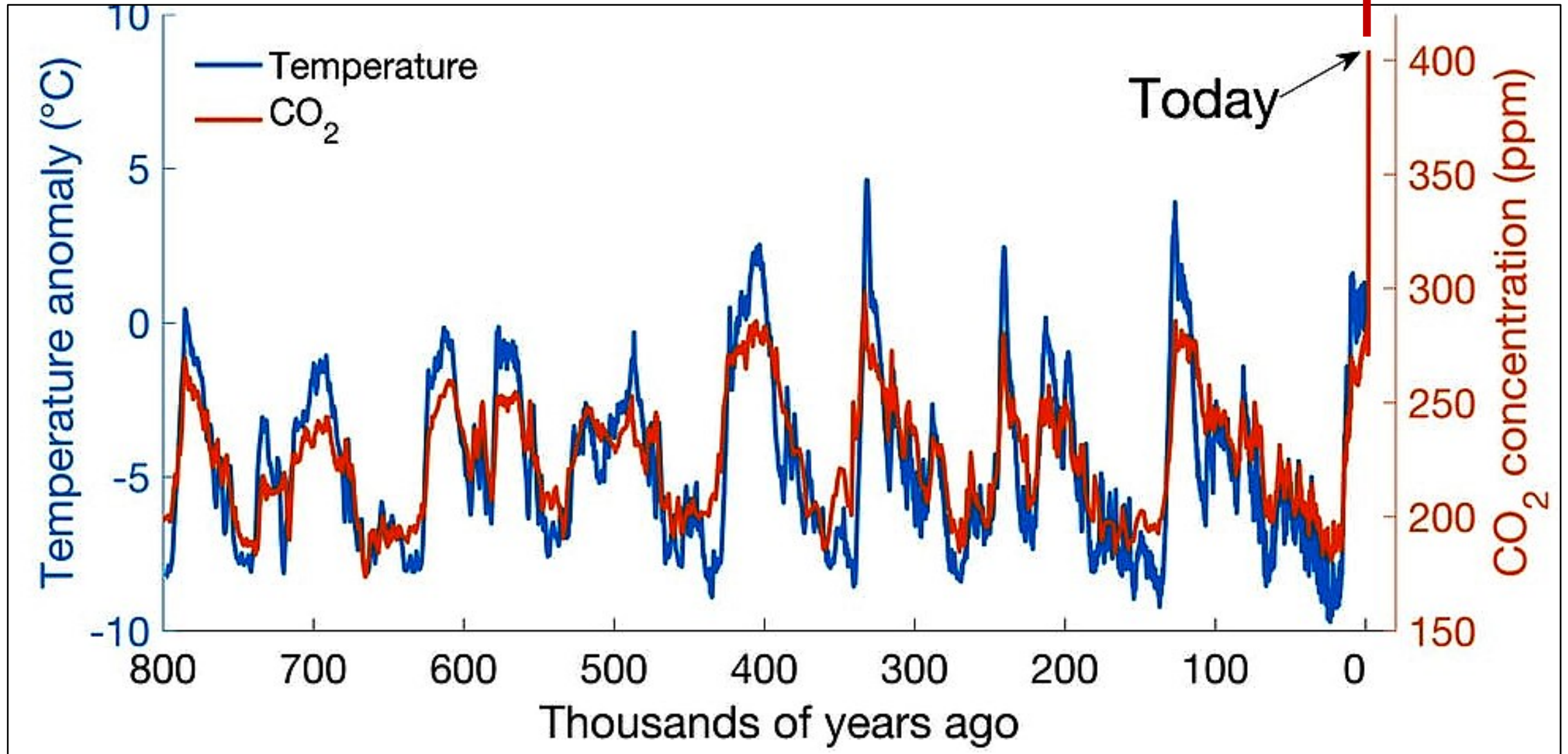
CO₂ (ppm)



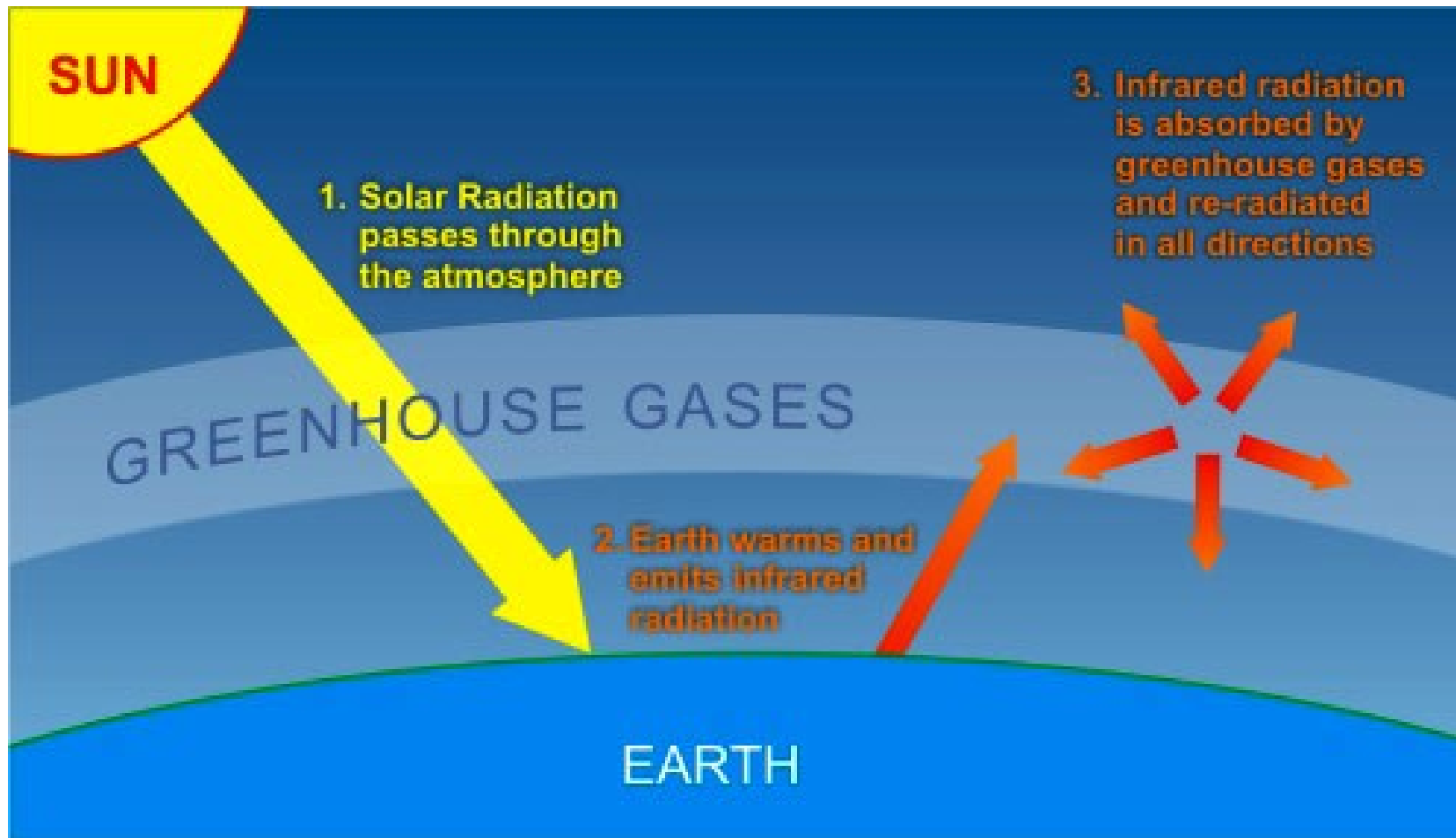


Ice Cores – Measuring Earth's
atmosphere thousands of years ago

Antarctic Ice



How does CO₂ trap heat?



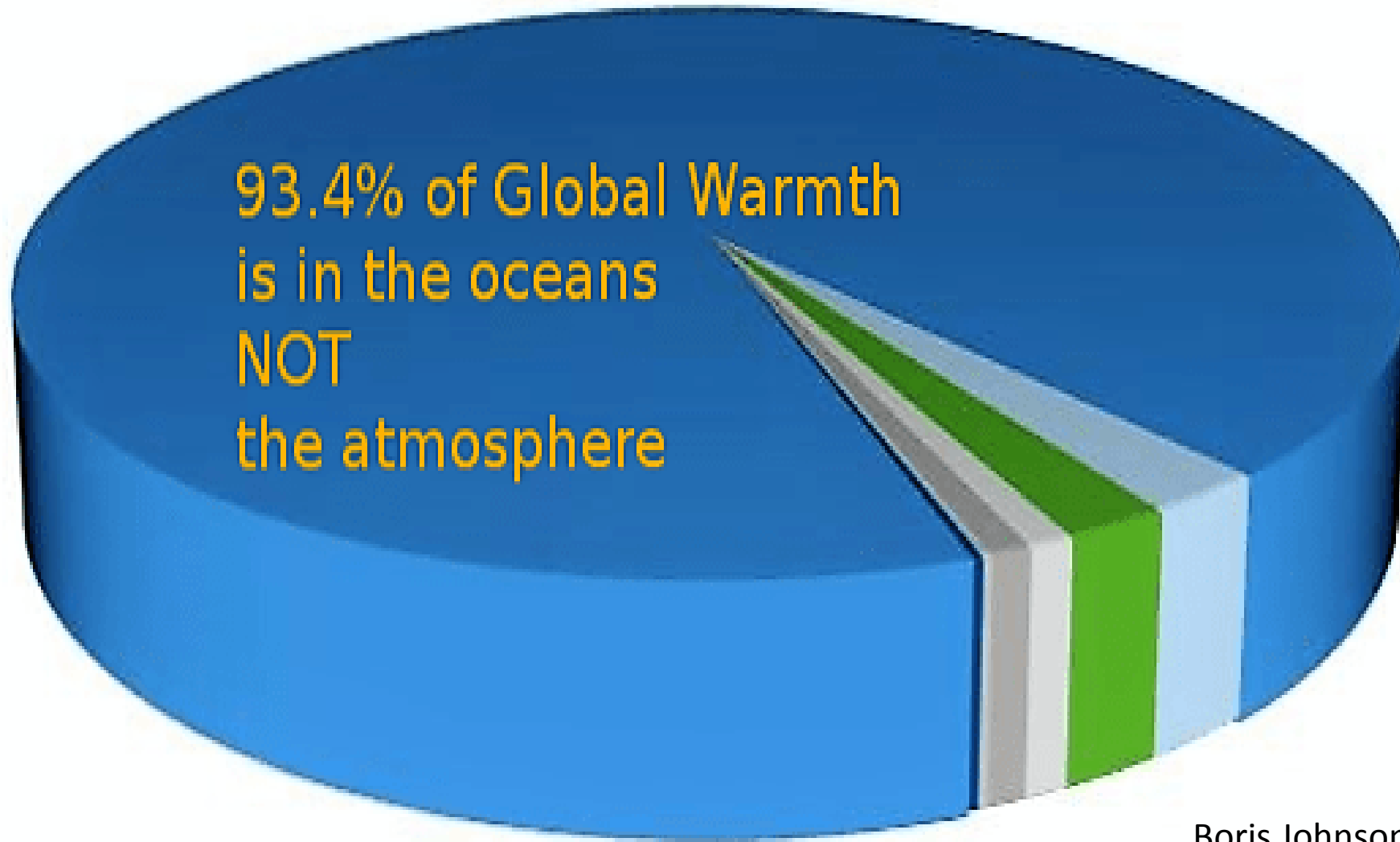


Atmospheric warming is because of **insulation** by greenhouse gases.

Darren and his dog, Indie, under Waterloo Bridge.

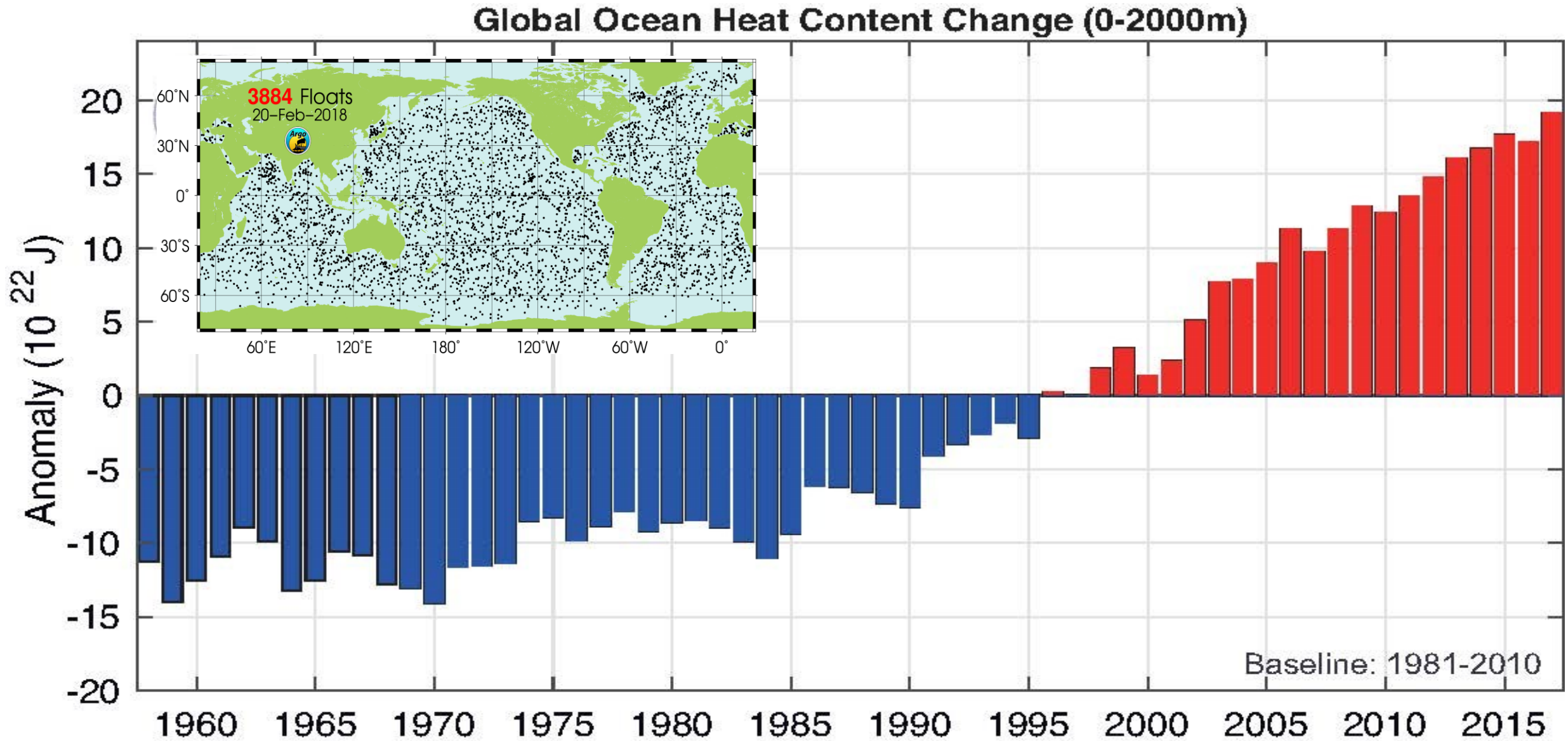
*Traces of warmth:
thermal images of
London's homeless*

Where is greenhouse warmth going?

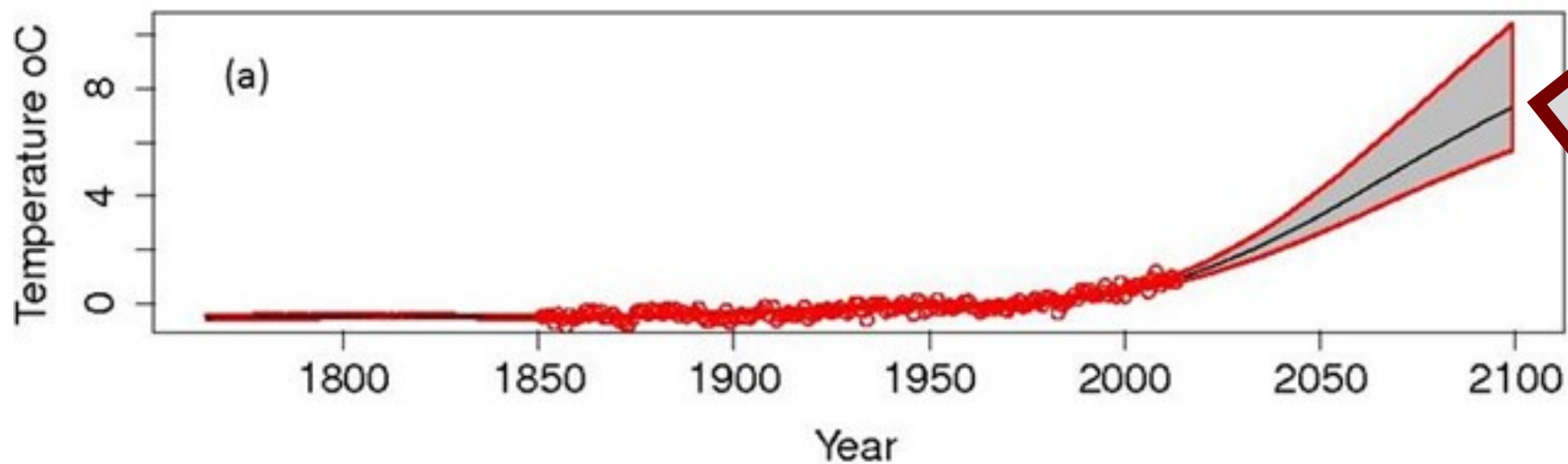


Boris Johnson holding a Met Office Argo float used for ocean temperature and salinity measurement.

Argo a global array of 4,000 free-drifting floats measuring ocean temperatures.

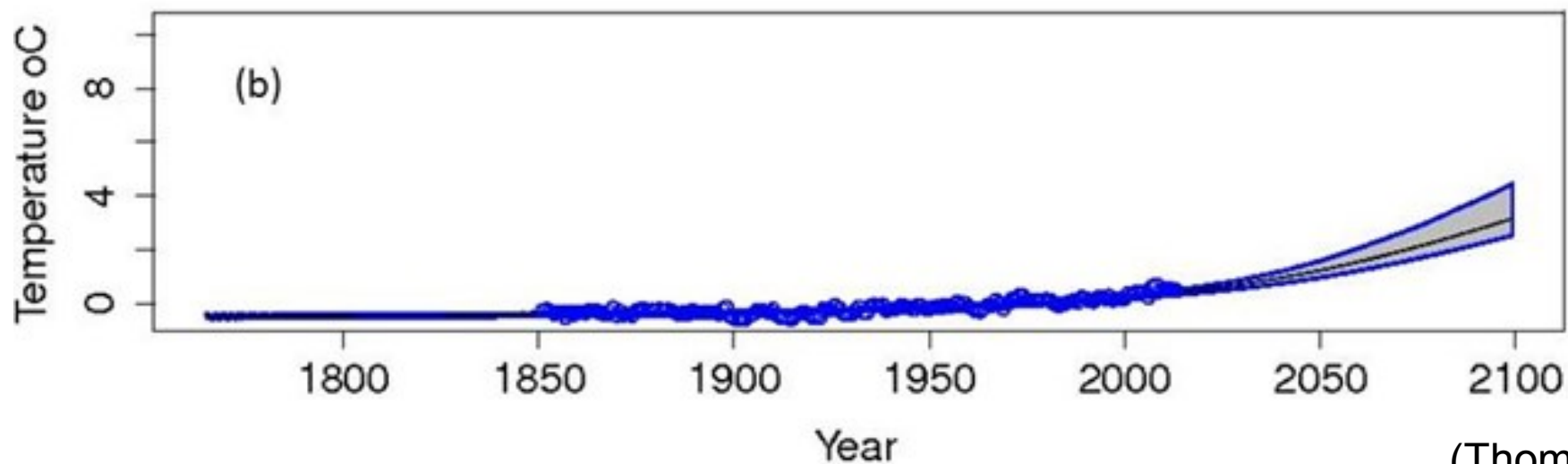


Land (RCP_8.5)



Land
+7.9K
by 2100

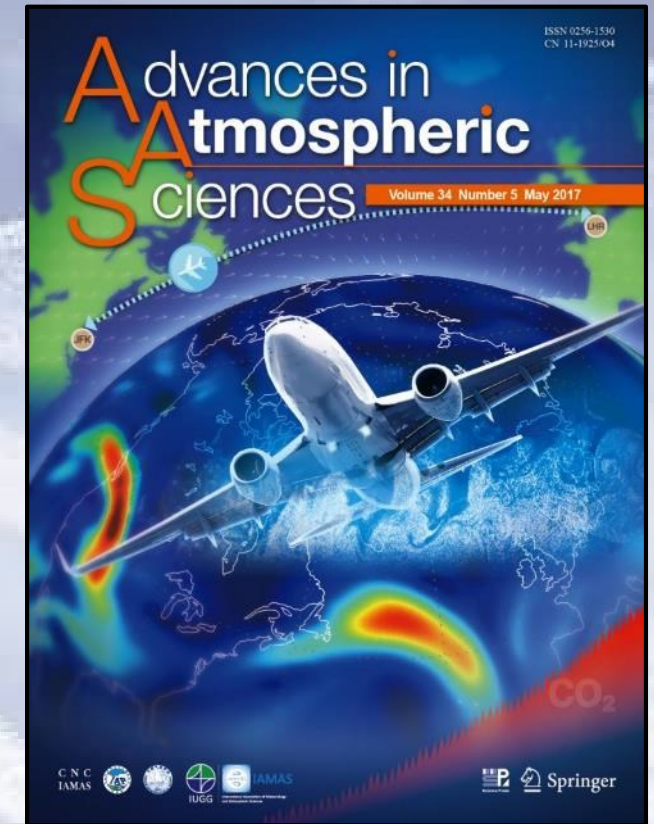
Ocean (RCP_8.5)



(Thompson Trans. R. Soc. Ed., 2015)

How climate change affects air travel, *Ad. Atmos. Sci., Williams, 2017*

- The climate is changing, not just where we live at ground level but also where we fly at 35,000 feet with significant consequences for air travel.
- **Rising sea levels threaten coastal airports.**
- Warmer air at ground level reduces the lift force and makes it more difficult for planes to take-off.
- **More extreme weather will cause flight disruptions and delays.**
- Clear-air turbulence is expected to become up to 40% stronger and twice as common with enhanced wind shear.
- **Transatlantic flights will take significantly longer because of changes to the jet stream.**





2. Scotland's energy and greenhouse gas emissions

“Scotland: a small industrial country with a large ambition to be a leader in climate action.”

Scottish Greenhouse Gas Emissions, 2016.

EMISSIONS

Waste Management: 1.6



Transport (including
International Aviation and
Shipping): 14.4

Agriculture and Related
Land Use: 10.0

Business and Industrial
process: 8.6

Energy Supply: 7.2

Residential: 6.3

Development: 2.0

Public Sector Buildings: 1.1



CARBON SINKS

Forestry: -12.7

**Transport
(14.4 million
tonnes CO₂) is
a particularly
challenging
sector for
emission
reduction**

TUESDAY, MARCH 28, 2017

Daily Record

NEWSPAPER OF THE YEAR 65p

WHO DECKED
CORRIE

March 28, 2017

Weatherfield
whodunnit
PAGES
12&13

BILLION-BARREL DISCOVERY

OIL BOOM TWO

BY CHARLIE GALL

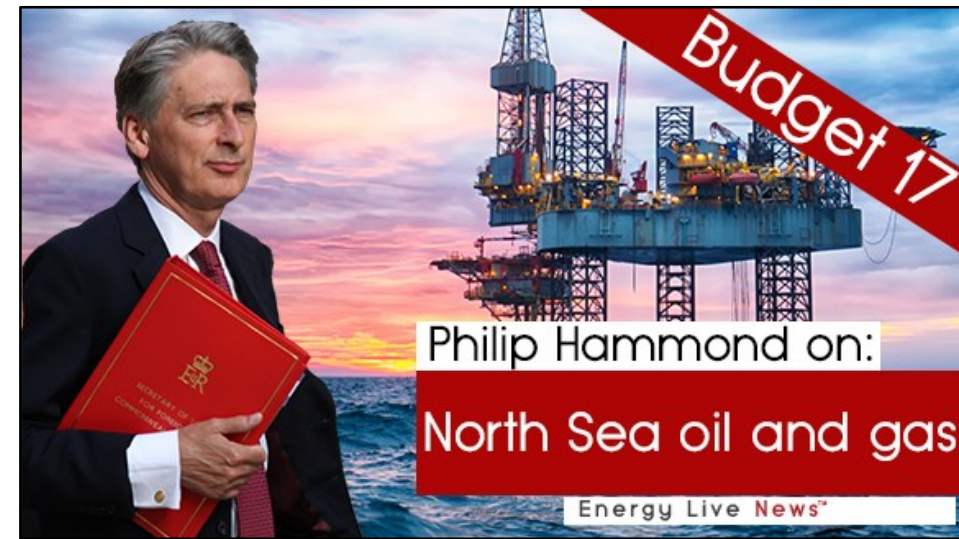
AN ENERGY exploration firm yesterday announced the UK's largest new oil field this century.

Up to one billion barrels could lie in an area 60 miles west of Shetland, Hurricane Energy said.

The news was welcomed by the industry, which has been struggling since the oil price collapsed three years ago.

FULL STORY PAGE 2

**Chancellor Philip Hammond
said the basin “*still holds up to
20 billion barrels of oil*” 2017**

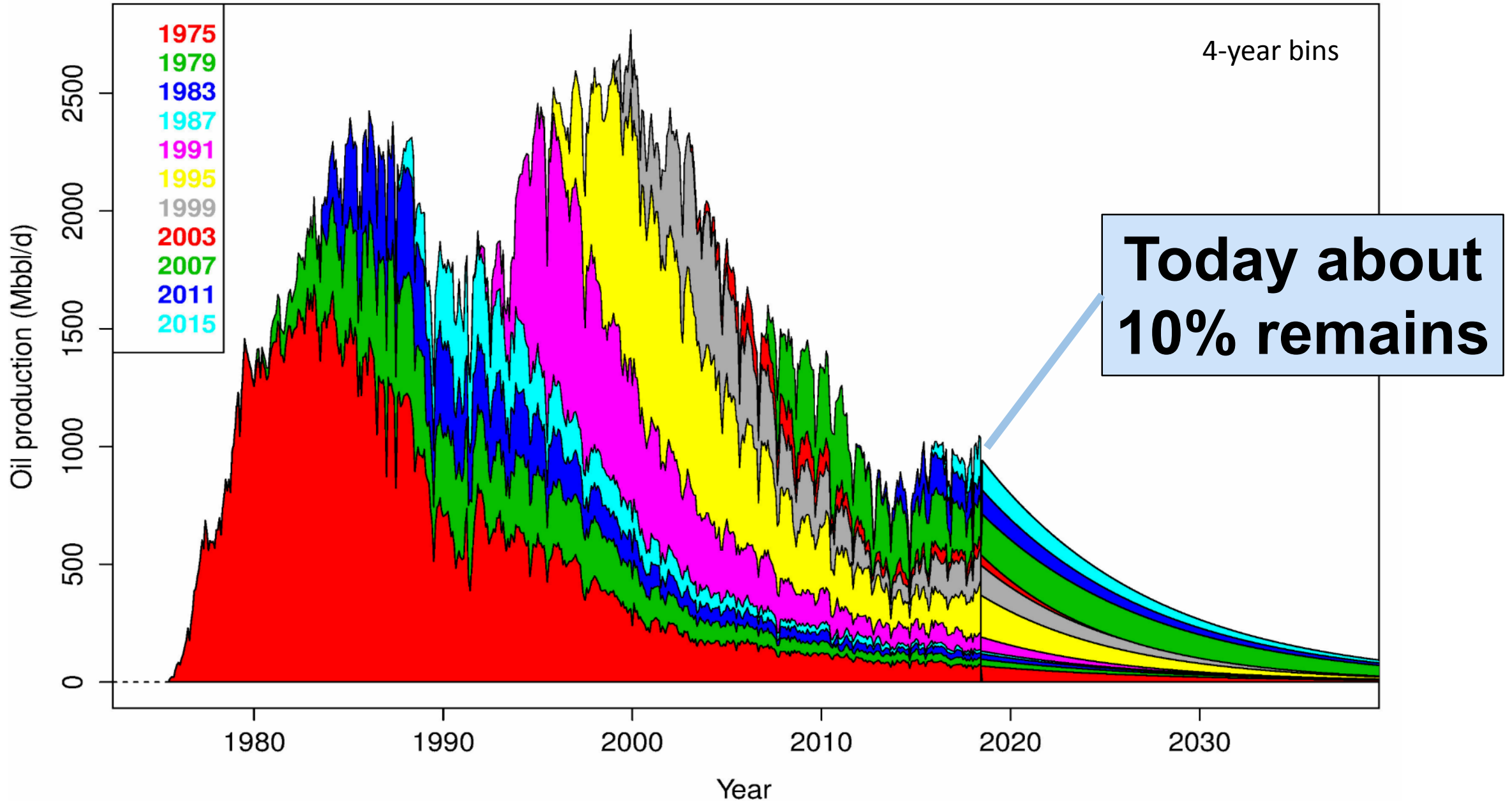


**Paul Wheelhouse “*The North Sea has a
bright future, with up to 20 billion barrels
of oil equivalent of known reserves*” 2018**

**Regional organiser Tommy Campbell (Unite)
believes “*further help from Westminster is
needed to ensure the remaining 20 billion
barrels of oil are recovered*” 2018**



UK oil production



Fracking

In 2018 the government gave the green-light to hydraulic fracturing.



**Where do
companies
want to frack
in Scotland?**



Johna field: Old tight gas field reinvigorated by infill drilling and fracking





←←←← Pumphreyston oil-shale →→→→



Nuclear

Germany's Nuclear Waste Disaster

126,000 drums of nuclear waste dumped at the Asse II salt mine are now threatened by water leaking through collapsing and cracked walls. The race is on to dig it all up before radioactive residues are flushed to the surface.

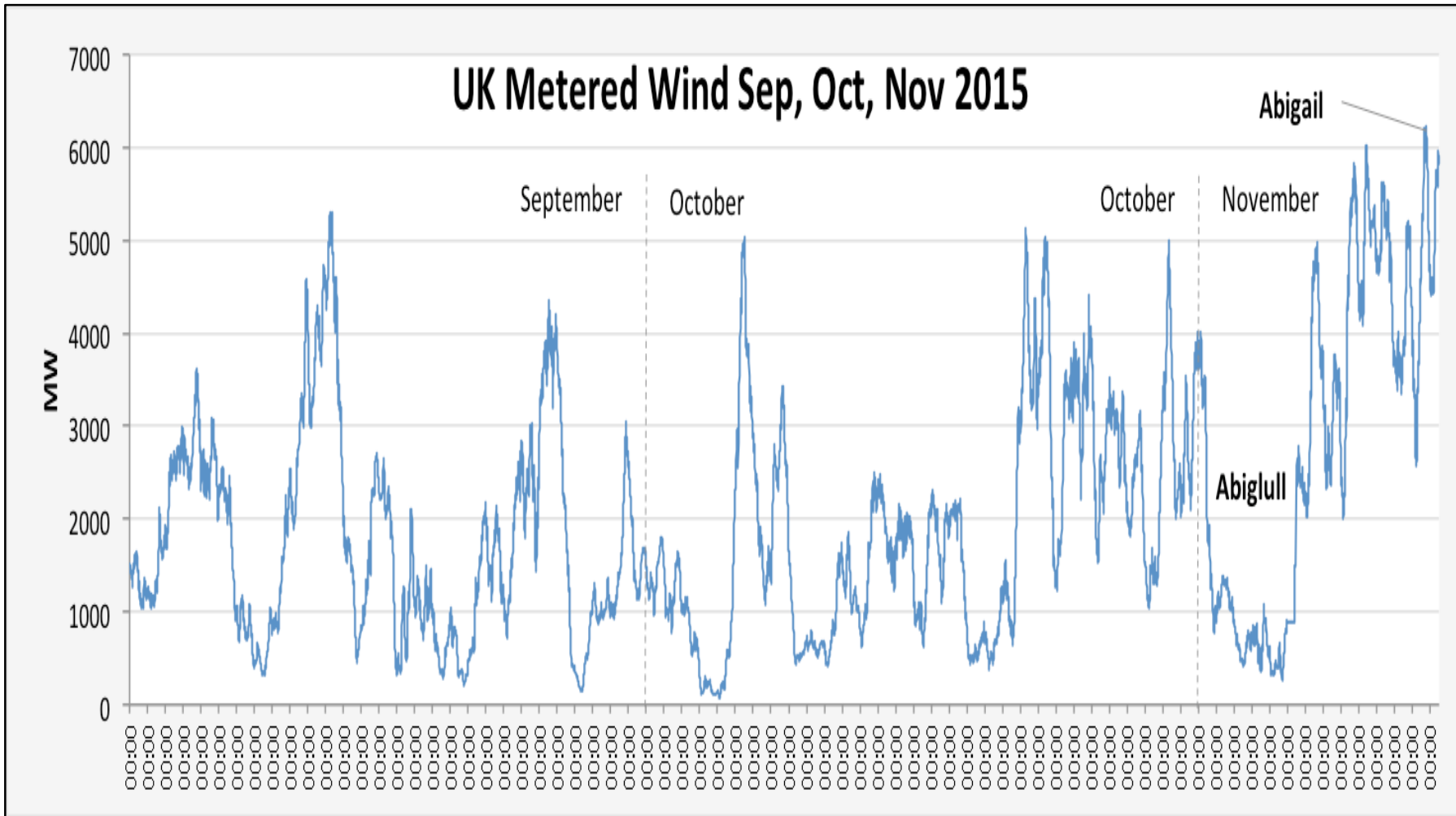


Clean energy

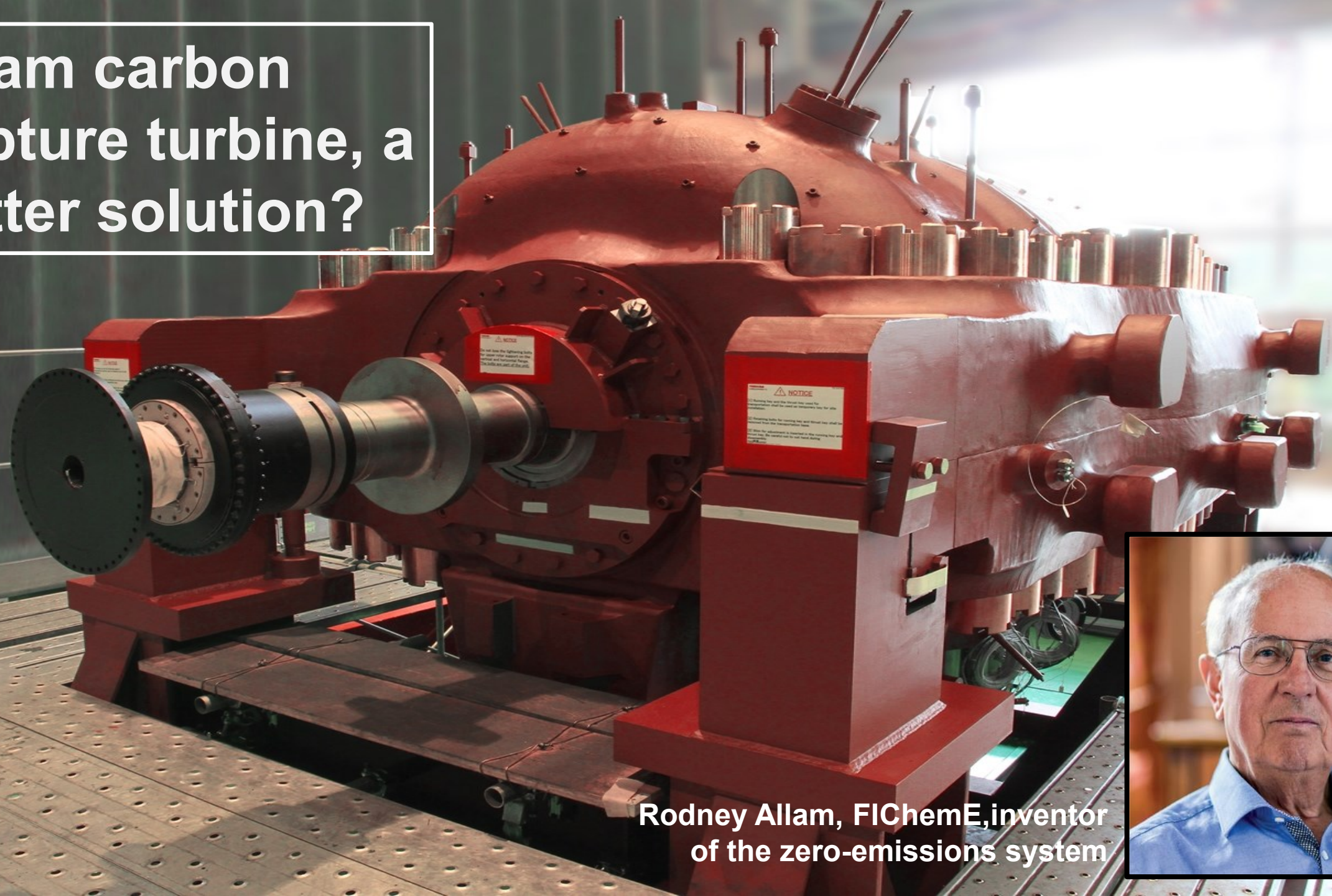


**UK's largest onshore
windfarm Whitelee 551 MW
East Renfrewshire**

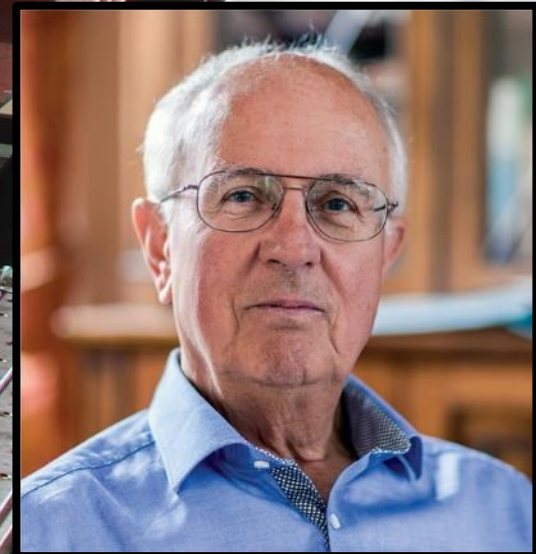
Renewables and the security of supply problem



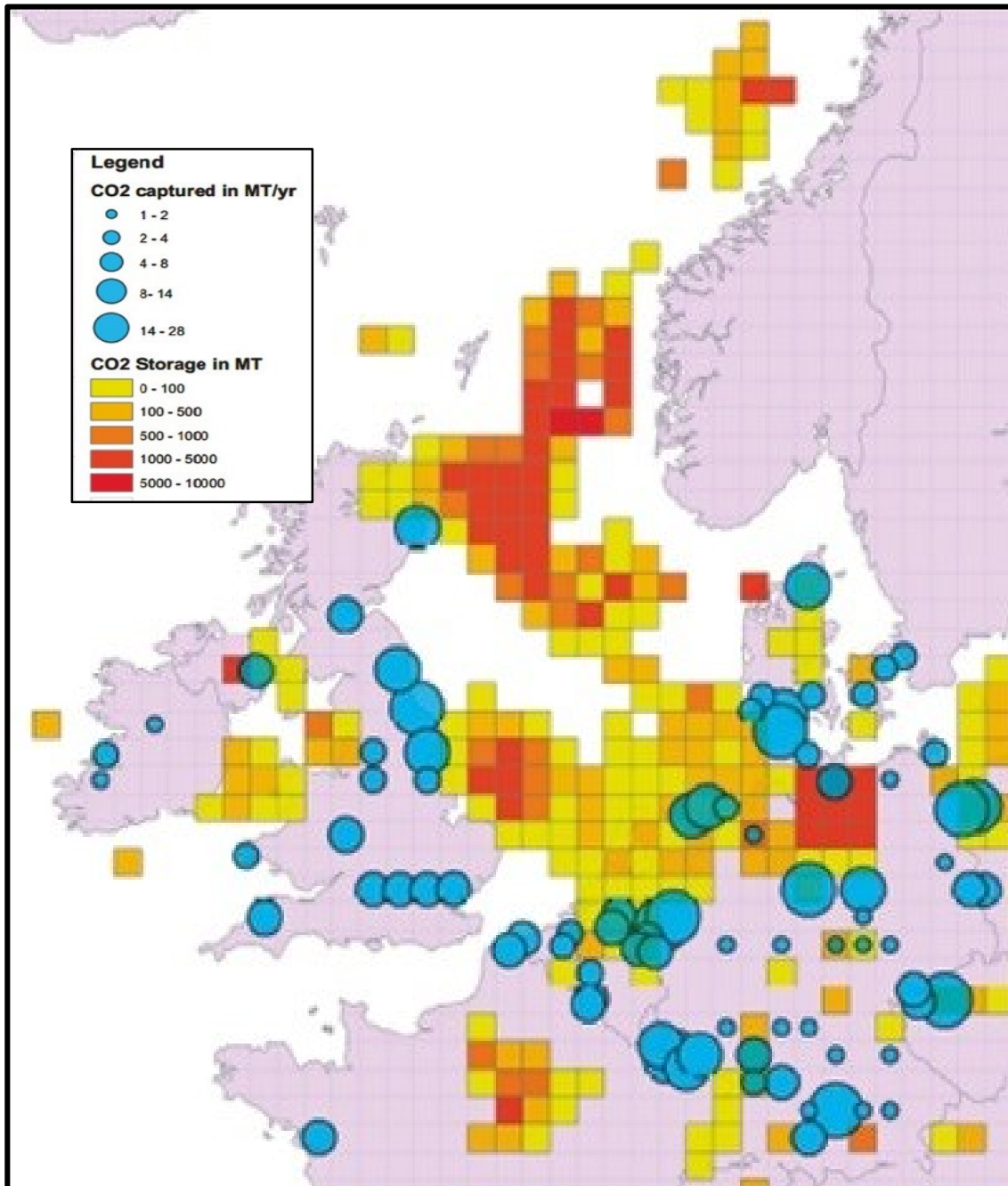
Allam carbon capture turbine, a better solution?



Rodney Allam, FIChemE, inventor of the zero-emissions system



Aquifers offshore Scotland are a CO₂ storage asset of EU importance



The Sleipner field – CO₂ Treatment and Injection

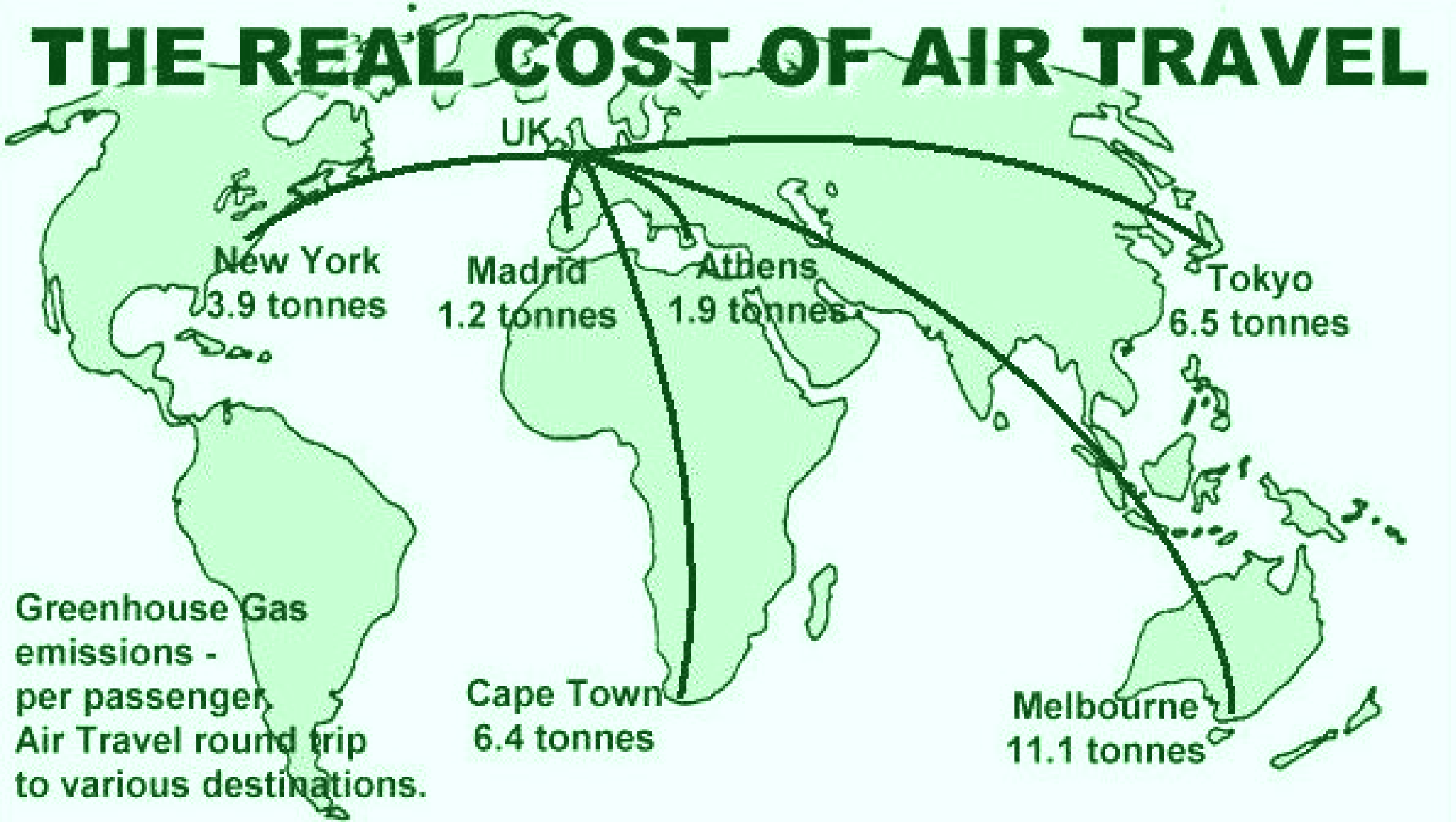


StatoilHydro

3. Can Scottish tourists easily fly 'green'?



THE REAL COST OF AIR TRAVEL



**What
does
1 tonne
of CO₂
look
like?**





offset your carbon footprint

If you fly, please donate to
a tree planting scheme

#CNNGoGreen



Budding eco-warriors plant trees for Woodland Trust

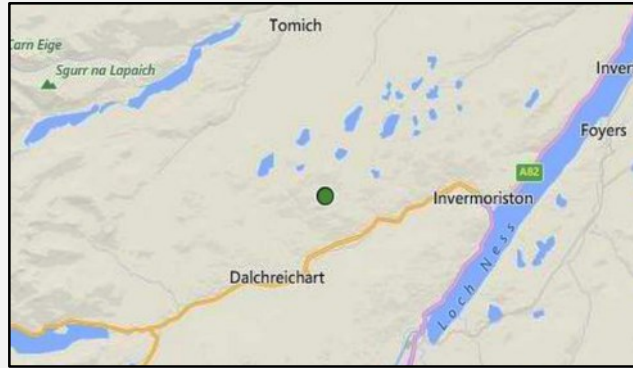


“If you wish to mitigate your carbon in the UK, the cost is as little as £10 per tonne of CO₂”

Dundreggan:

Flagship forest restoration Project that aims is to bring back the globally unique Caledonian Forest and all its wildlife to the Scottish Highlands.

A hive of conservation activity. Each year over 60,000 native trees are grown.



Nursery Assistant, Emma Beckinsale, and 8,000 downy willow seedlings. This is comparable to the entire population of the species left in the wild in Scotland.

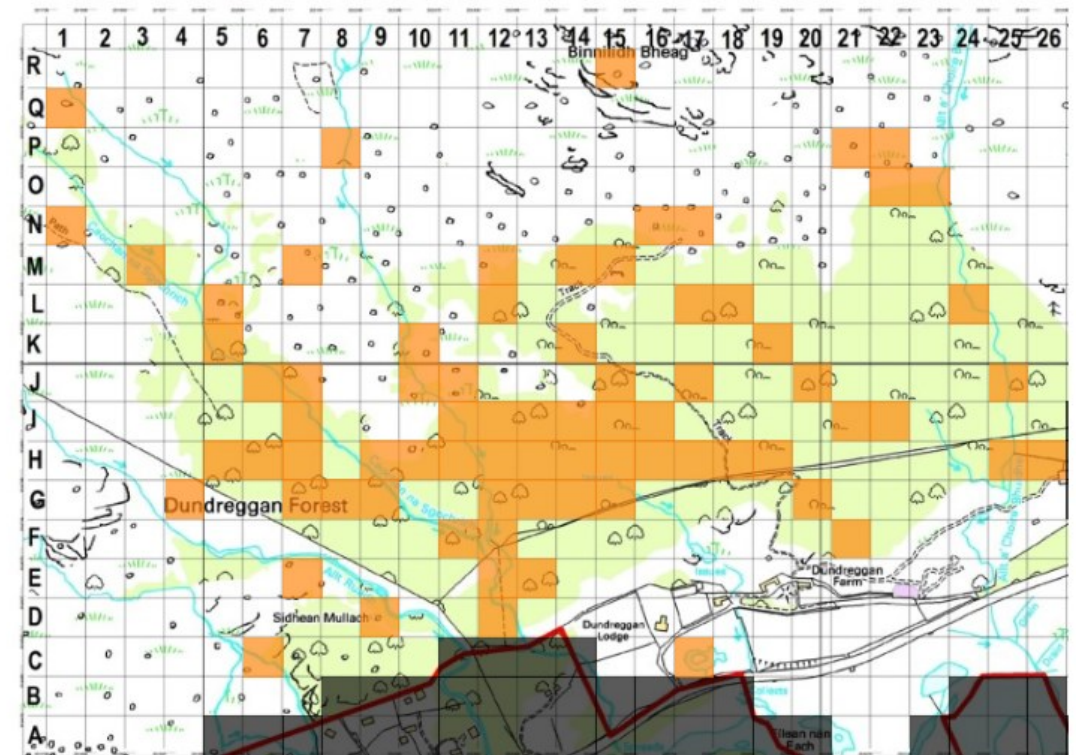
Trees for Life

<https://treesforlife.org.uk/support/sponsor-an-acre>

Sponsor an Acre for one year for £60



Thank you for choosing to sponsor an acre of Dundreggan to help restore wildlife habitats. Please select the acre you would like on the map below.



Acres already sponsored Acres outside estate boundary Acres you have selected

Alt Coire Ghaidheil

Illustrates how nature responds when the pressure of overgrazing is removed.



23.5 acre exclosure erected in 1994. In the last 25 years a profusion of blaeberry and other shrubs have sprung up.



Natural regeneration at Coille Ruigh na Cuileige

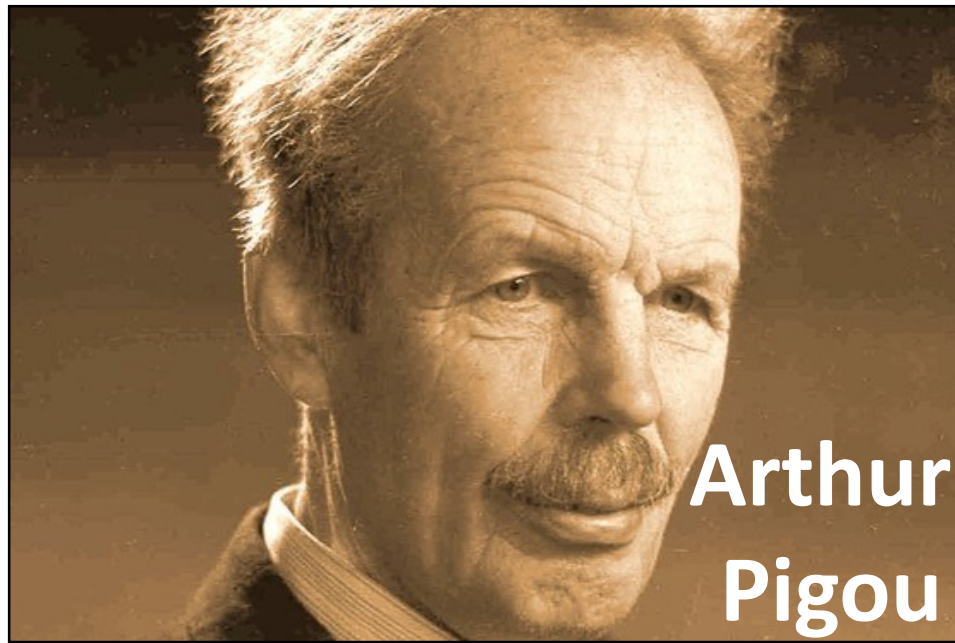


A Scots pine showing it's growth from 1992 to 2015

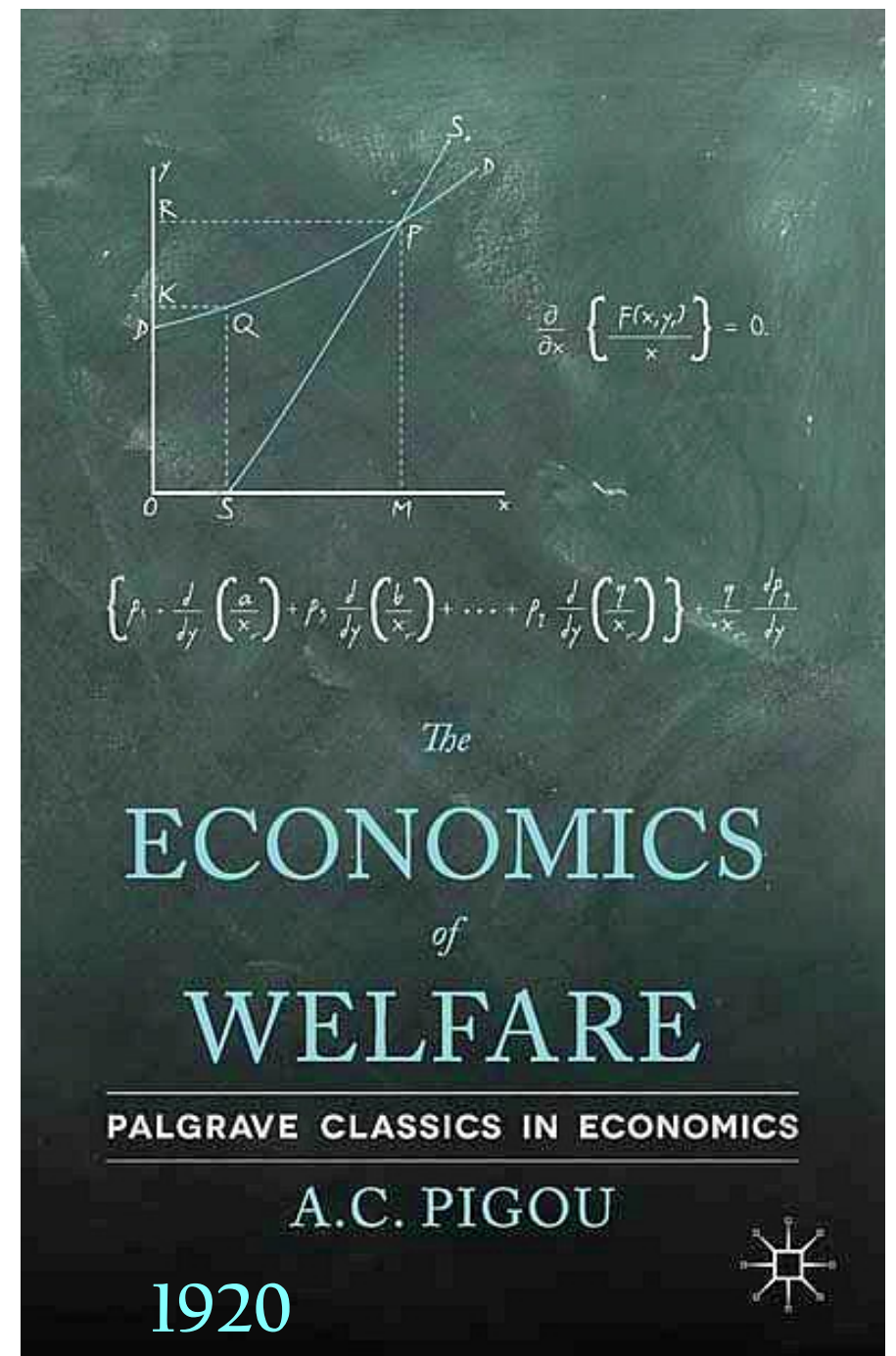
Scottish gamekeepers and mountaineers oppose tree-planting plan



**The
Guardian**



A Pigovian levy,
in a true market economy, is the
most effective way to correct an
environmental (negative)
externality and avert its
unnecessary costs on society.



➤ **All revenues returned to households**

A high-enough carbon price would shape millions of choices, small and large, about what to buy, and how to invest. People would prioritize the easiest changes — stimulating innovation without governmental diktats.

➤ **Simple and inexpensive to administer**

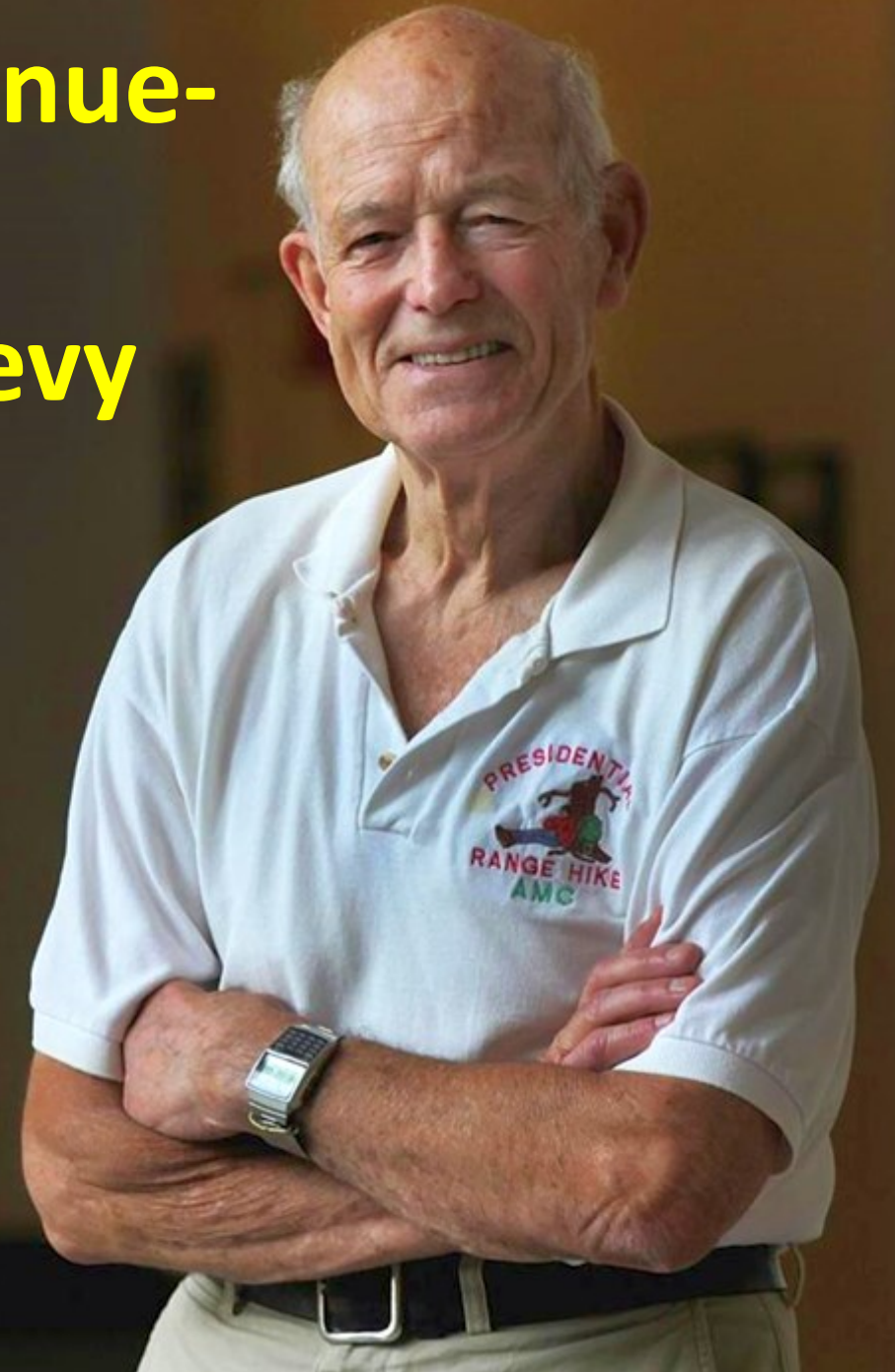
Scope for corruption / lobbying greatly reduced.

➤ **Gradual**

Predictable for business.

The revenue-neutral energy levy

David G.
Wilson



Summary

1. Global warming

- Science => CO₂ is a powerful greenhouse gas
- Business-as-usual => +7.9 °C by 2100

2. Scotland's energy and greenhouse gas emissions

- Oil & gas production in terminal decline
- Transport remains as Scotland's biggest emissions reduction problem
- Renewables (e.g. wind) => security risk
- Scotland needs to begin a programme of rapid reforestation & land-use change

3. Can tourists easily fly 'green'?

- Yes => Donate to local reforestation charities (e.g. Trees for Life)
- Pigou / Wilson => Carbon pricing, Rebate => innovation