Business perspectives on climate change

One molecule changing the earth

André de Ruyter
April 2026

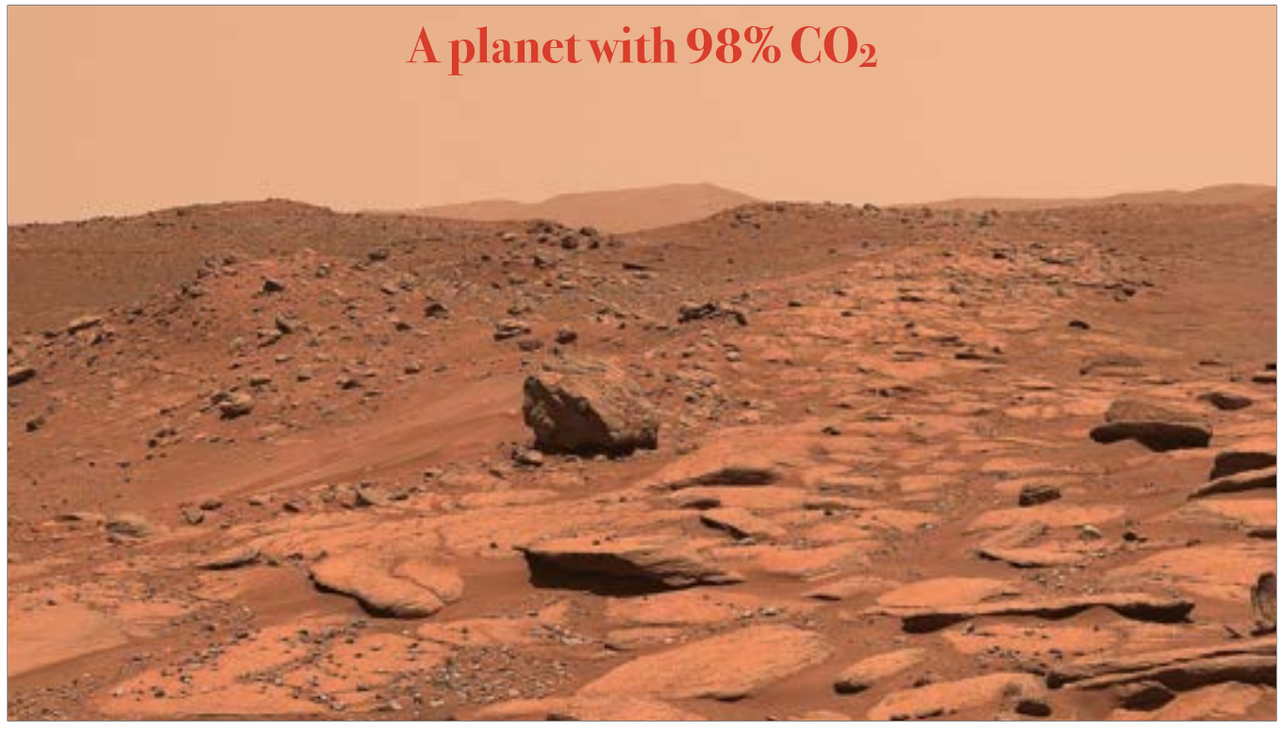
The molecule that changes the world

Generated notes (Beta). Check for accuracy.

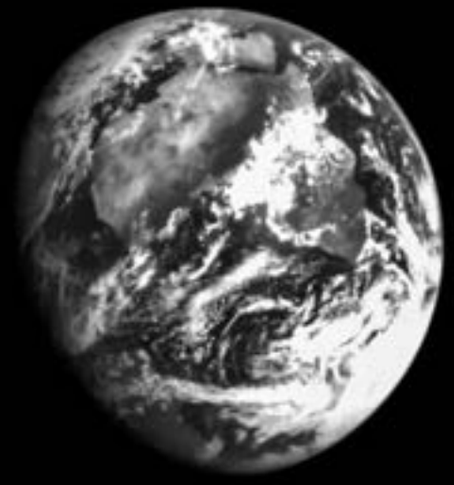
- Just one molecule making all the difference
- It’s easy to overlook how powerful a tiny fraction can be
- CO2 makes up only a sliver of our atmosphere
- Yet its influence on climate is profound
- A small presence, but an enormous impact
- This is the molecule that’s reshaping our world

A planet with 96% CO_2

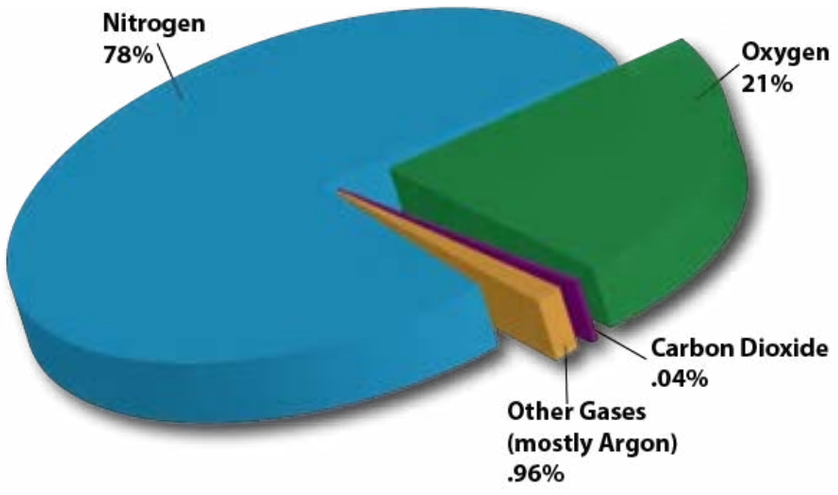
A planet with 98% CO_2



A planet with 465 ppm CO_2



CO_2 is rarer than Argon



Carbon capture - 390 million years ago

Carboniferous era of 60 million years from the end of the Devonian to the beginning of the Permian

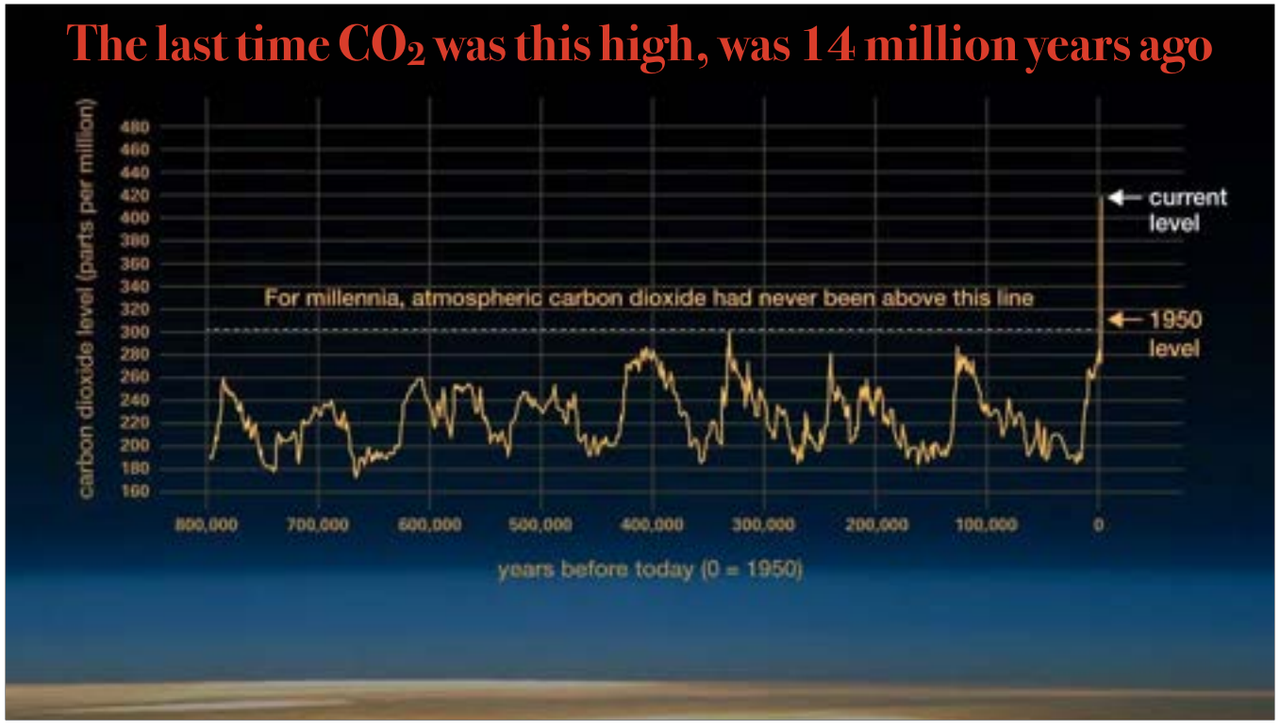
Global temperatures on average 20 degrees at start of era

CO2 concentrations at 8x current levels

By end of era average temperatures had dropped to 12 degrees, and CO2 levels to current levels

Humanity is now releasing millions of years of captured carbon in the space of a century by burning fossil fuels

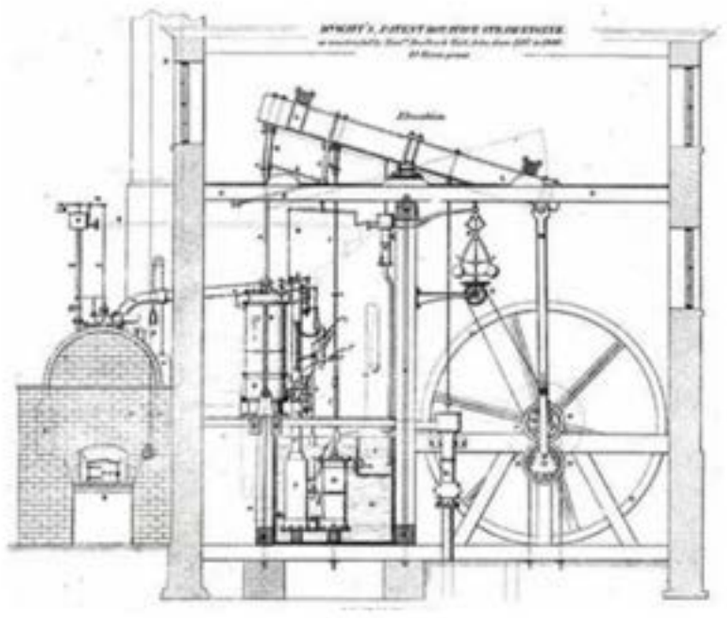
The Carboniferous cooling is being reversed



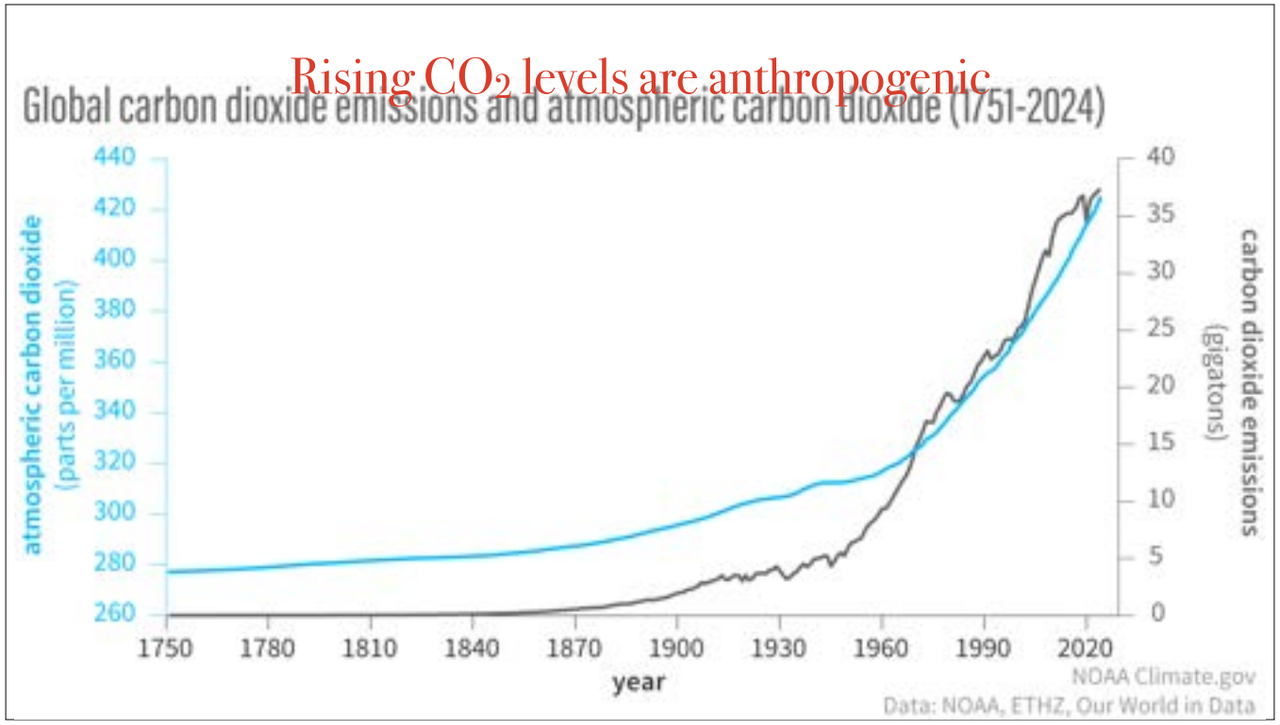
Generated notes (Beta). Check for accuracy.

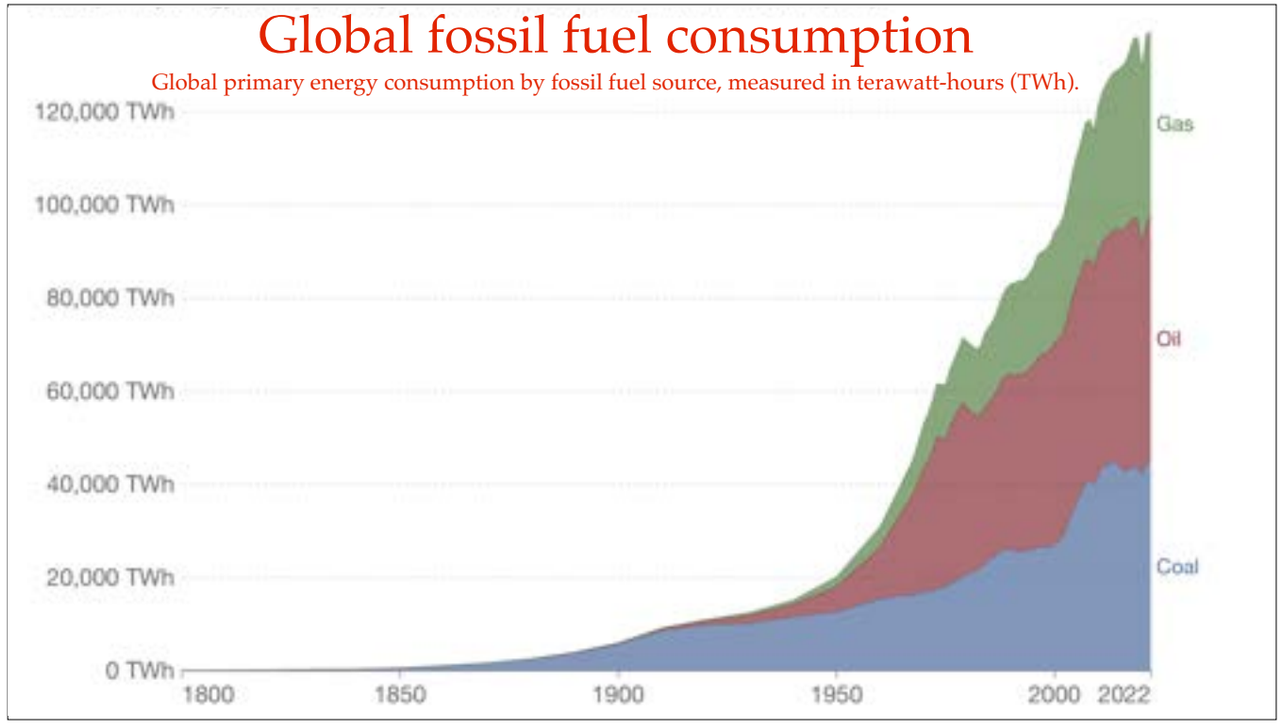
- We are now living in a time when atmospheric CO2 levels have reached heights not seen for 14 million years
- This is far beyond anything experienced in human history or even recent earth history
- For millions of years, CO2 concentrations never came close to this line
- It’s a stark reminder of just how dramatically we’ve altered the composition of our atmosphere
- We need to understand the magnitude of this change to grasp what’s at stake

Burning coal drove development like nothing else



Rising CO_2 levels are anthropogenic

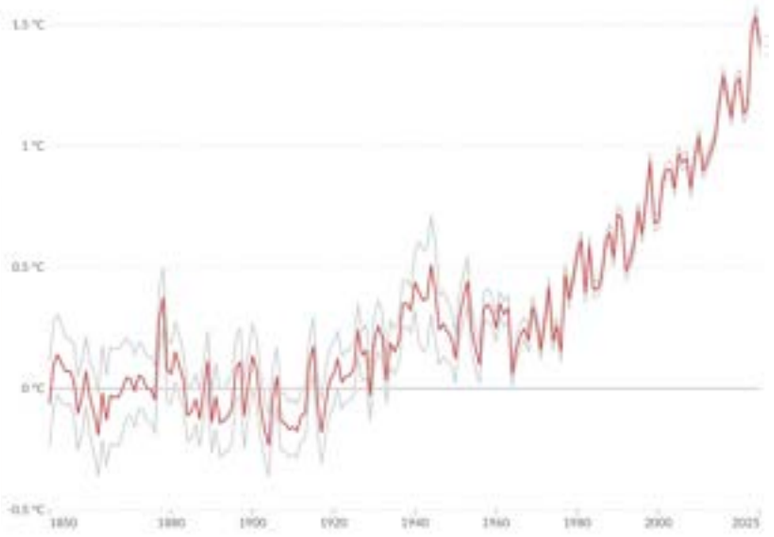




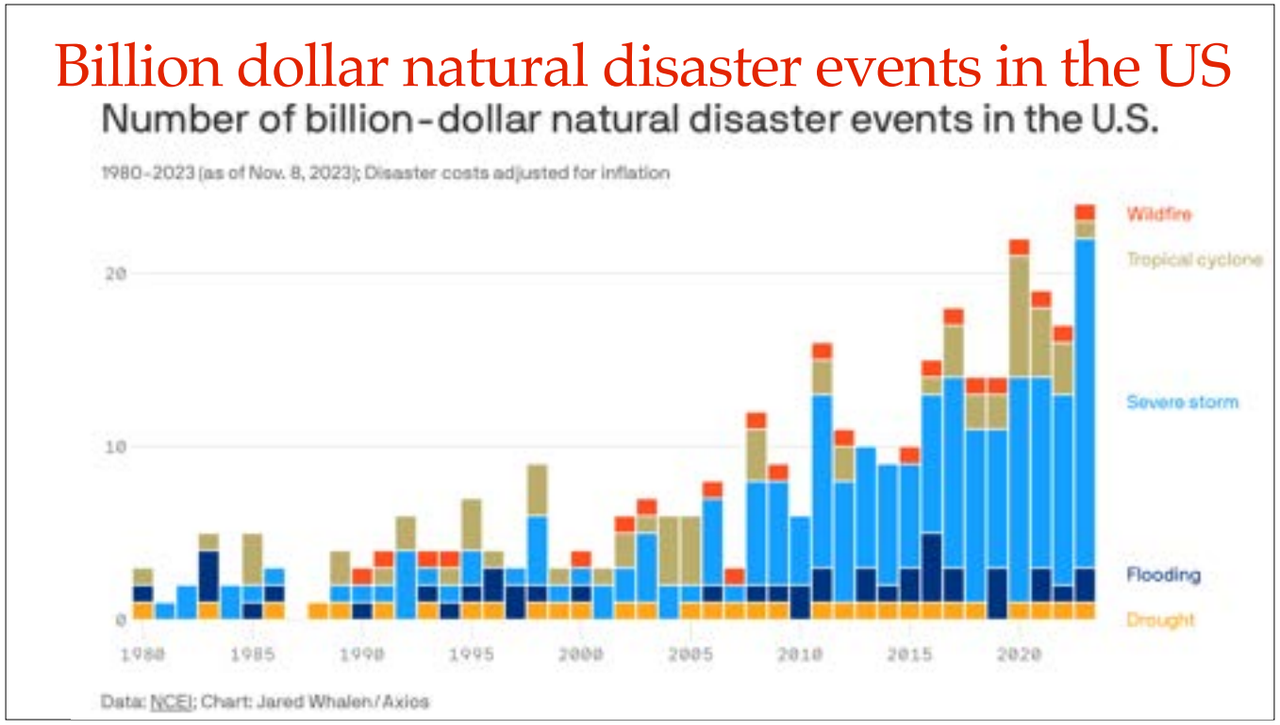
Generated notes (Beta). Check for accuracy.

- This chart tells a powerful story
- We've seen explosive growth in fossil fuel consumption over the past century
- Coal, oil, and gas have driven industrialisation and modern life
- But this rapid increase comes with serious consequences for our climate
- Every major spike in the graph represents more carbon released into the atmosphere
- Our energy choices have brought prosperity, but also a new level of responsibility
- Understanding this history is key to seeing why change is now so urgent

The earth is running a temperature…



Billion dollar natural disaster events in the US

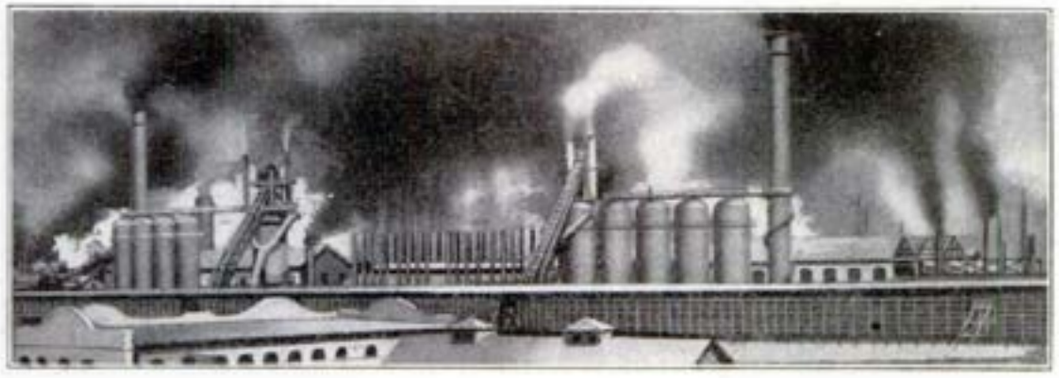


Generated notes (Beta). Check for accuracy.

- Insurance companies are facing unprecedented claims from climate disasters
- They're starting to push these costs back onto those responsible for emissions
- The markets are pricing climate risk like never before
- We're seeing a shift where emitters are no longer shielded from the consequences
- Ultimately, businesses contributing to climate change will pay a growing share of the bill
- This is changing the landscape of accountability and risk

But we didn't know…

March, 1912 POPULAR MECHANICS 341



The furnaces of the world are now burning about 2,000,000,000 tons of coal a year. When this is burned, uniting with oxygen, it adds about 7,000,000,000 tons of carbon dioxide to the atmosphere yearly. This tends to make the air a more effective blanket for the earth and to raise its temperature. The effect may be considerable in a few centuries.

The "enormous" quantity of coal that the magazine foresaw would produce these effects was a piffling 540 million metric tonnes every year. Today, with all our knowledge of climate change, we are burning a wildly reckless 7.2 billion metric tonnes annually. The Popular Mechanics team tried to put a positive spin on things, looking forward to balmy weather and more rainfall.

The Tragedy of the Commons

n a seminal essay published in 1968, an American ecologist called Garret Hardin elaborated on a concept first identified as far back as 1833 by a British economist, William Forster Lloyd. Lloyd correctly observed that cattle farmers tended to overgraze land allocated for use by everyone in a community, known as “the commons”, because they have no vested interested in preserving the land. The logic was simple: if a farmer did not allow his cattle to graze, another unscrupulous cattle farmer would take advantage of the last scraps of grass remaining on the commons to fatten his own calves, rather than to let his neighbour gain an unearned advantage. Hardin called this concept “the tragedy of the commons”, and related the size of a natural resource for common exploitation to the number of users. As soon as the capacity of the resource is less than the demands imposed on it by the users, the resource will inevitably be downgraded by the selfishness that Smith and Lloyd have observed. The ultimate “commons” for humanity has to be the atmosphere - the very air that we breathe. Without food, a human survives for weeks. Without water, death comes in days. Without air, we suffocate in minutes. Yet the atmosphere is what we have treated with the most disdain, probably because it is invisible. The problem with the atmosphere is that it is ubiquitous. Atmospheric pollution knows no boundaries - aerosol propellants sprayed into North American armpits, and chlorofluorocarbons that kept European refrigerators cold caused an enormous hole to appear in the ozone layer over the Antarctic. In a rare example of united international action, most countries in the world have ratified the Montreal Protocol, which banned more than a hundred ozone-gobbling chemicals from 1 January 1989. Only recently have scientists discovered that CFCs and other chemicals, when degraded by sunlight in the upper troposphere, turned into earth-warming greenhouse gases. By banning CFCs, the world inadvertently mitigated global temperature increases by up to 30%. Similarly, the carbon emitted by rich countries in the global north has global impacts, also on developing countries predominantly in the global south, who have negligible carbon footprints, or who have not yet had the opportunity to industrialise with scant regard for the free ride that carbon emissions have historically given to emitters.

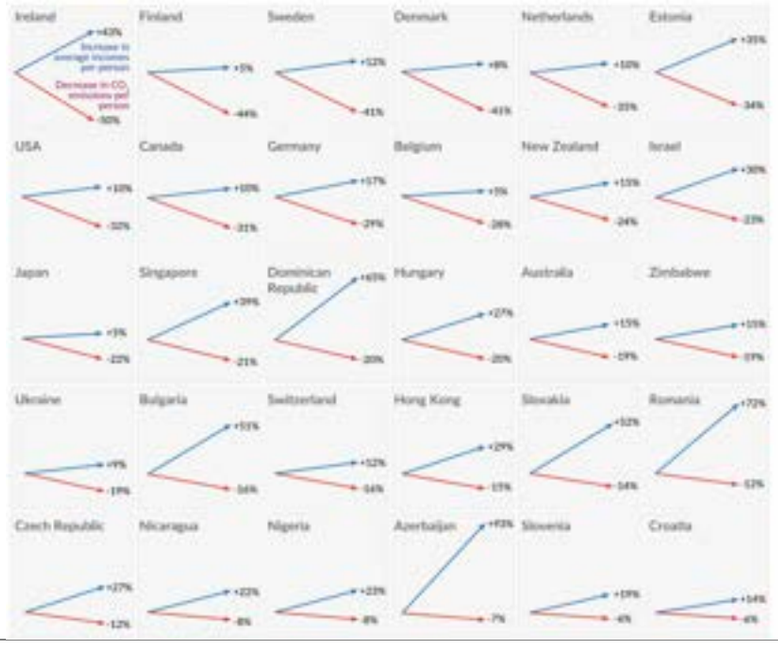
Firms with poorer environmental performance give better equity returns Bolton & Kacsperzyk 2023 - moral hazard for managers
But those firms have a higher cost of capital on the bond market - Kim and Pouget 2023 - own experience

Rising CO_2 levels have made us richer – up to a point

Generated notes (Beta). Check for accuracy.

- CO2 emissions and economic growth have gone hand in hand for centuries
- The industrial revolution unleashed unprecedented prosperity fueled by fossil energy
- Rising CO2 meant rising GDP and living standards worldwide
- But this link only holds true up to a certain point
- We now see a divergence—economic growth can continue even as emissions decouple
- The question is, can we sustain wealth while bending the emissions curve downward
- That’s the challenge and opportunity for our era

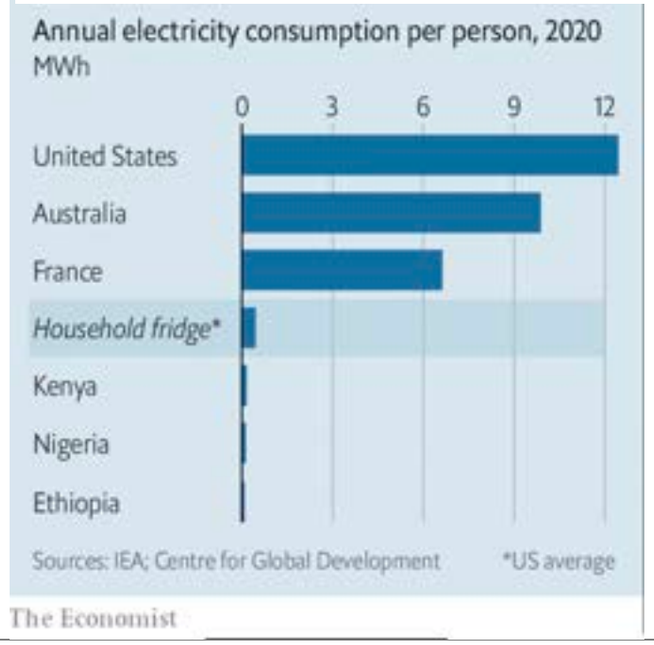
CO_2 is no longer an indicator of wealth (2005 - 2020)



Generated notes (Beta). Check for accuracy.

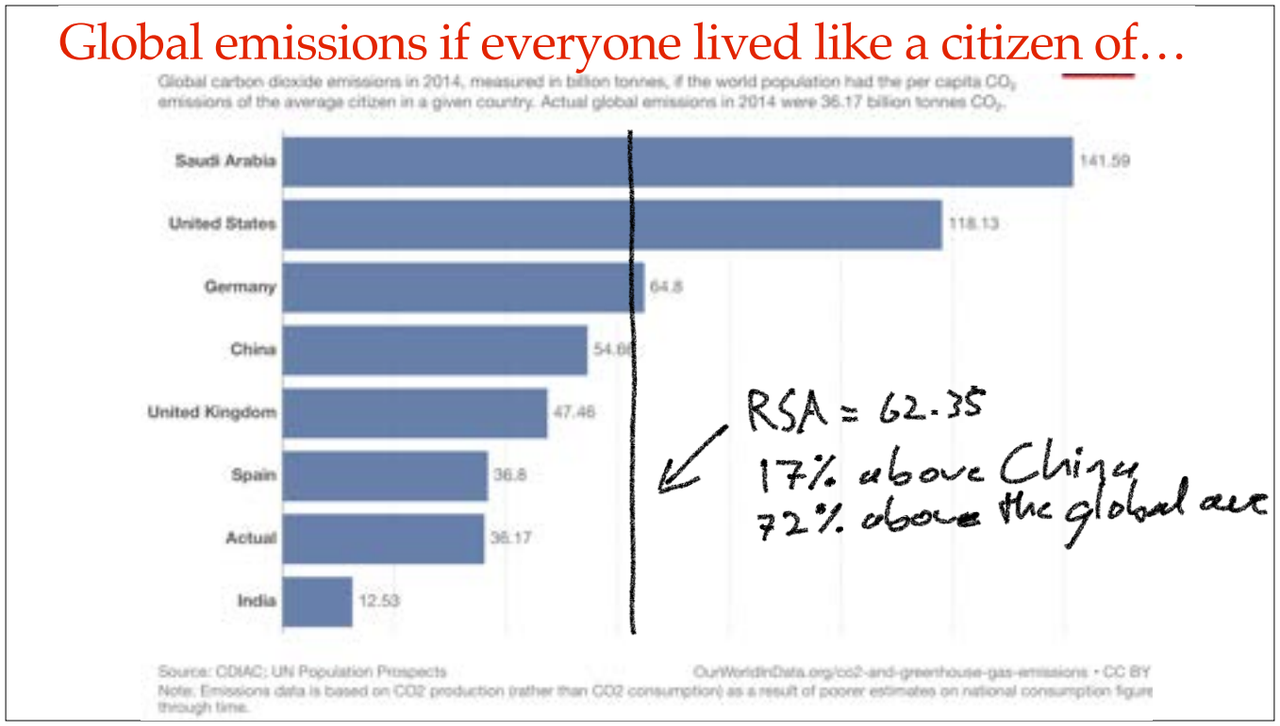
- We've entered a new era where the old link between emissions and prosperity is breaking down
- Now we see countries growing their economies while lowering their carbon output
- Decoupling is possible and it's already happening in many places
- We can no longer point to CO2 as a simple indicator of national wealth
- The challenge ahead is to build on this momentum and accelerate the separation
- A low-carbon economy is not just an ideal—it's becoming the new reality

Who needs to decarbonise?



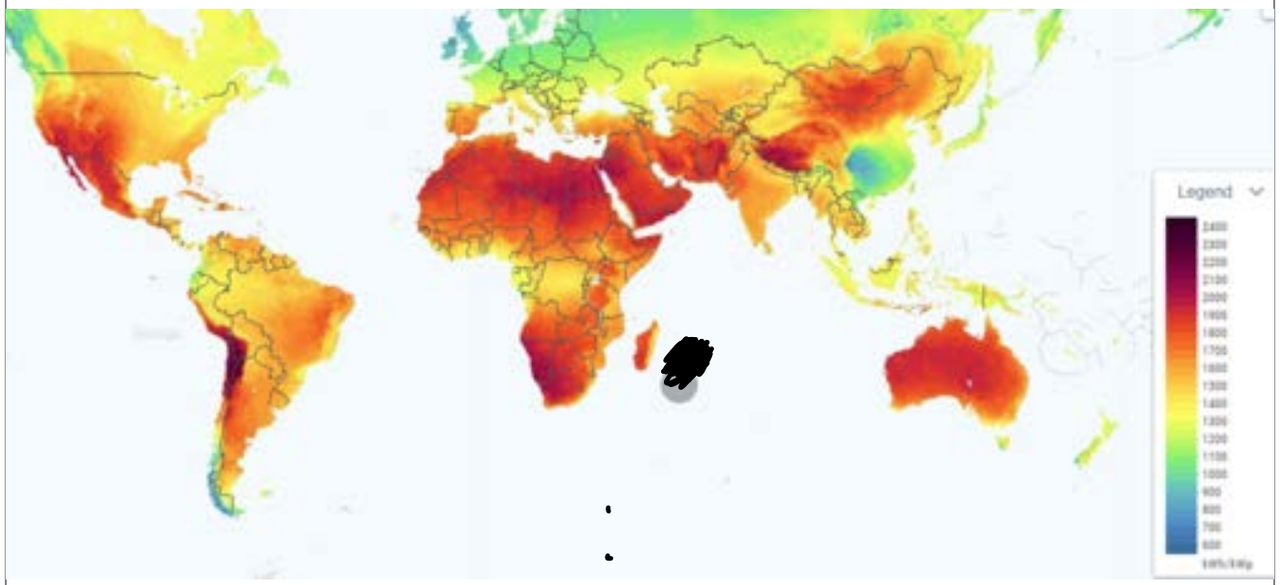
The Economist

Global emissions if everyone lived like a citizen of…

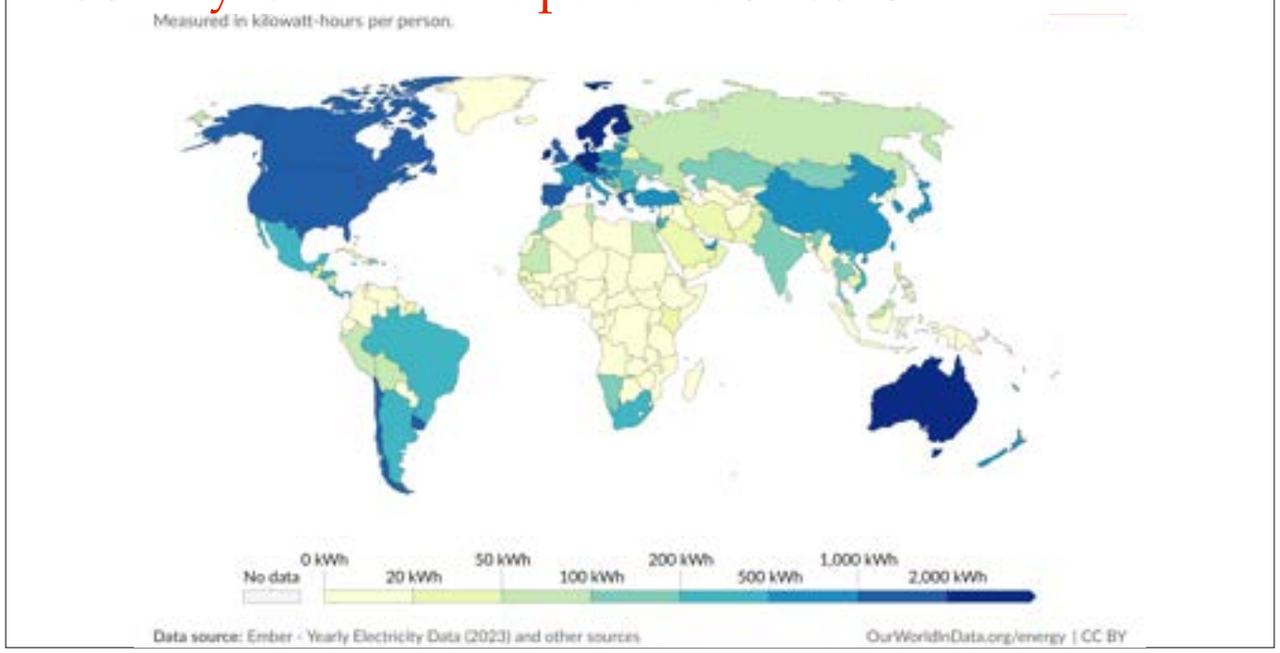


Energy poverty and global inequality - why worry?

Global South has some of the best RE resources



So why is renewable penetration so low in Africa?



The more sunshine, the higher the risk?

Country	S&P Rating	Climate Investment Risk Premium (CIRP)	Cost of Debt (Climate Project)	Required Rate of Equity Return (Climate Project)
Germany	AAA	1%	2.6%	8.2%
Australia	AAA	0%	3.4%	8.4%
Sweden	AAA	2%	3.4%	8.4%
USA	AA+	2%	5.3%	10.3%
UAE	AA	2%	4.0%	12.6%
Saudi Arabia	A	6%	9.3%	14.2%
Chile	A	10%	12.1%	14.4%
Indonesia	BBB	9%	9.1%	14.7%
Morocco	BBB-	10%	12.6%	15.3%
India	BBB-	9%	11.4%	17.2%
Vietnam	BB	12%	14.0%	19.4%
Peru	BBB	6%	11.7%	21.3%
Brazil	BB-	14%	7.8%	22.2%
South Africa	BB-	13%	21.3%	23.8%
Ghana	B-	19%	22.7%	26.0%
Tanzania	B	18%	24.1%	29.6%
Nigeria	B+	17%	25.2%	30.6%
Egypt	B	18%	29.0%	32.1%
Uganda	B+	17%	30.2%	33.6%
Mozambique	CCC+	22%	32.6%	38.3%
Tunisia	CCC+	23%	36.6%	42.1%
Sri Lanka	D	16%	38.1%	42.3%
Zambia	CCC-	29%	43.4%	47.2%
Argentina	CCC+	24%	54.1%	57.7%

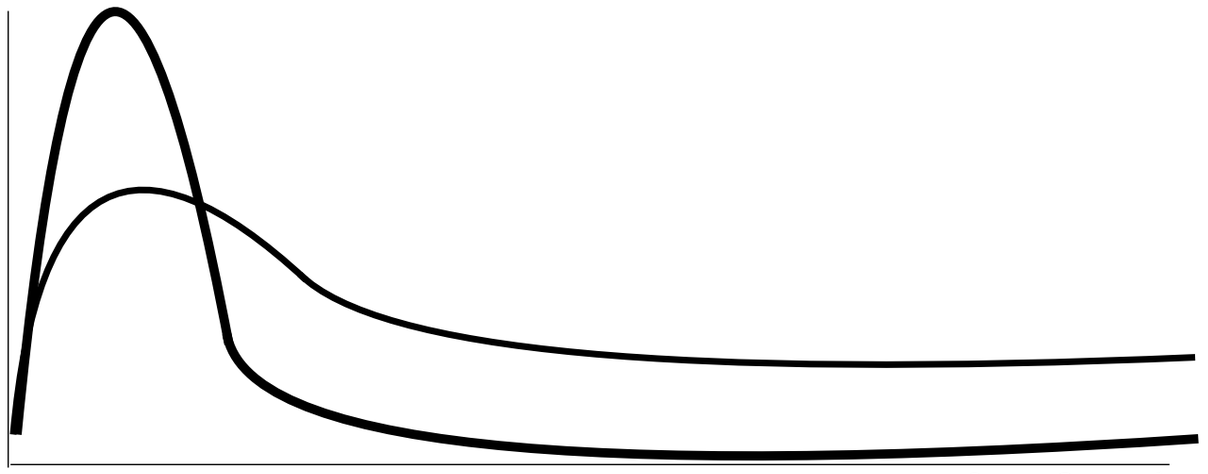
Source: Climate Policy Initiative

Higher WACCs penalise higher initial capex technologies
Bias against RE technologies because of shape of cash flow curve
An increase in WACC from 2% to 10% doubles the LCOE
A CCGT project has a 4.4% higher LCOE in Tanzania than in Germany
A PV project has a 23.4% higher LCOE in Tanzania than in Germany

Transfer of $1.2 trillion per annum required to enable just transition
JET-P = $12bn for SA, $20bn for Indonesia, $7bn for Vietnam
Bridgetown Initiative = Special fund to alleviate climate change impacts, $500bn in Special Drawing Rights, lower lending rates, loss and damage fund to be set up

Transfers of cash, and government funds have a political reality and will not meet the challenge, in spite of the undisputed moral obligation. Possession in 9/10ths of the law

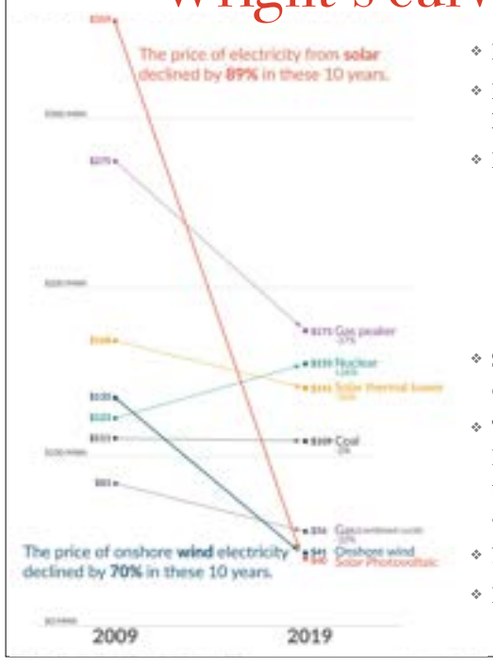
Cash-flows for different technologies impact LCOE



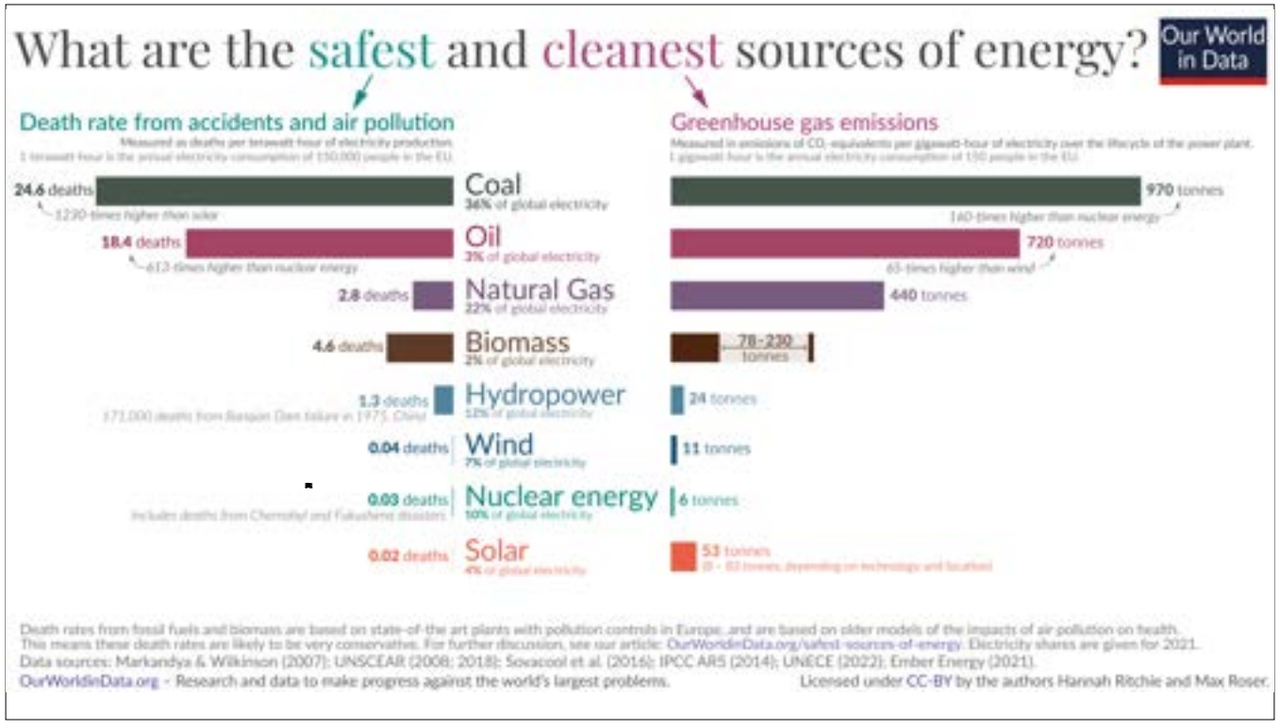
Source: Own analysis

Who gains from carbon credits?

Wright's curve is pushing down RE cost



- In 1975, solar was $100/W. Today, it's $0.20 - a **99.8% decrease**
- In 2004, it took a year to install 1GW of solar. In 2016, a week. By 2023, **24 hours**.
- Installed solar capacity
  - 228 GW in 2015, 1% of global electricity
  - 759 GW in 2020, 3% of global electricity
  - 2919 GW in 2025, 10% of electricity, more than nuclear
  - 9000 GW by 2030, 20% of global demand
- Solar was 72% of all capacity additions of 632 GW in 2024, wind 18%, gas 4%, coal 3%, hydro 2% and nuclear 1%. In 2025, **solar was 83% of new capacity**
- The cost of **Battery Energy Storage Systems (BESS)** has plummeted to record lows, with global average turnkey prices falling by **31% year-on-year** in 2025 to **$117/kWh**. This follows an even sharper **40% drop** recorded between 2023 and 2024.
- Battery costs are expected to **fall even further by 47%** from current
- New chemistry (sodium) will **reduce cost by another 30%**



Carboniferous era of 60 million years from the end of the Devonian to the beginning of the Permian

Global temperatures on average 20 degrees at start of era

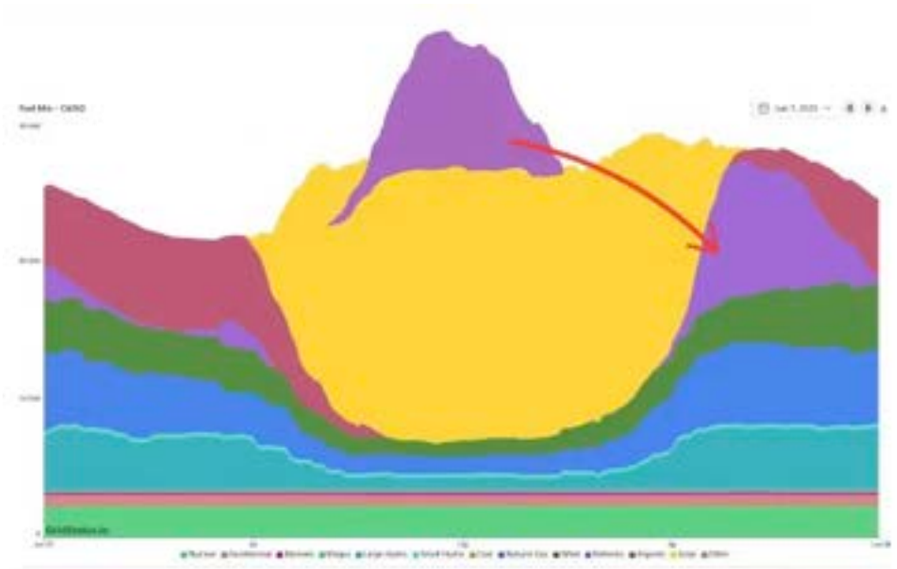
CO2 concentrations at 8x current levels

By end of era average temperatures had dropped to 12 degrees, and CO2 levels to current levels

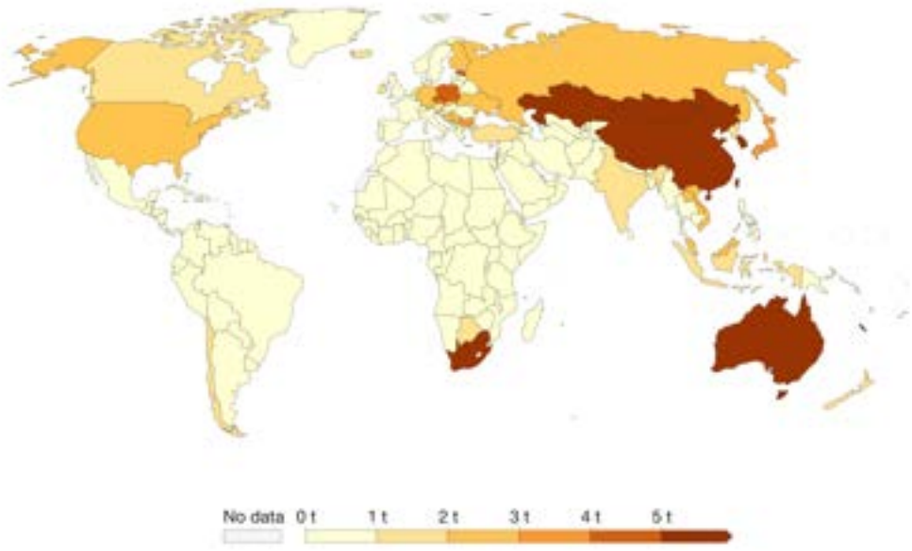
Humanity is now releasing millions of years of captured carbon in the space of a century by burning fossil fuels

The Carboniferous cooling is being reversed

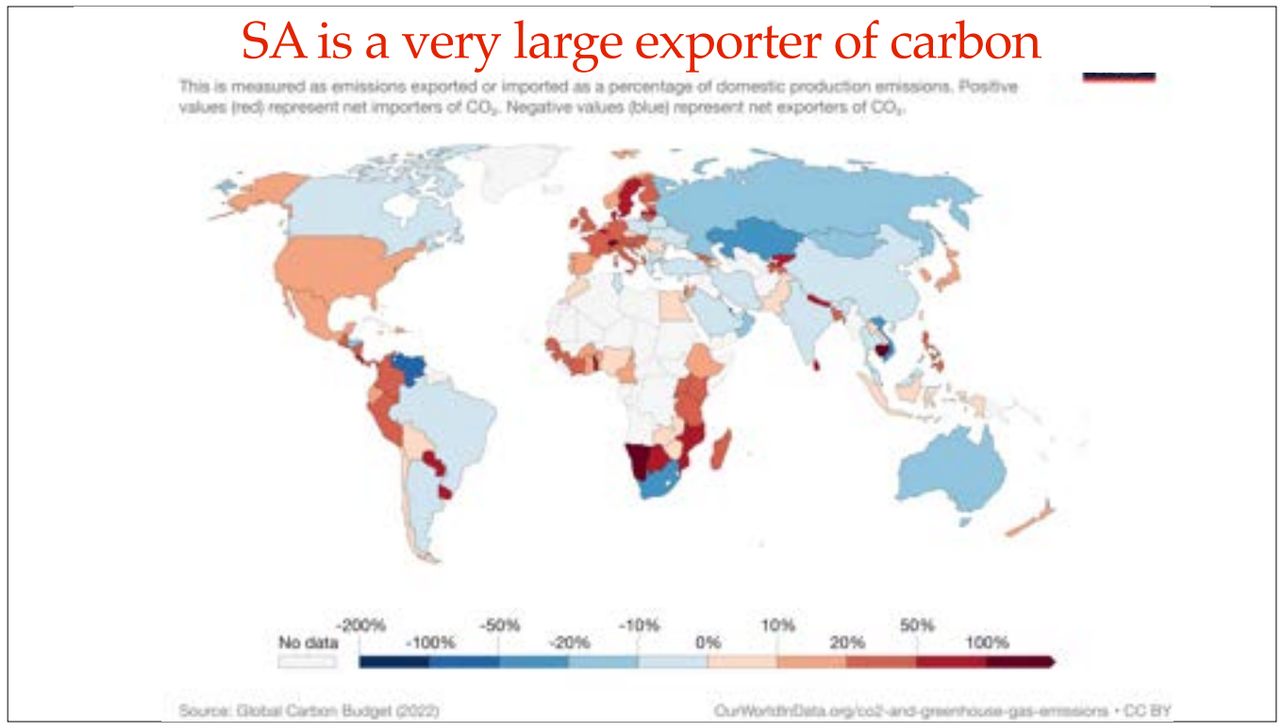
Battery technology allows dispatchable electricity



SA one of the most carbon-intensive in the world



SA is a very large exporter of carbon



Developed countries are imposing carbon taxes, emission trading schemes or cap-and-trade schemes to reduce emissions and impose a cost on carbon

European Union most advanced with a carbon price of EUR80/tonne (SA at EUR3/tonne, with numerous exceptions

Carbon leakage presents a threat to jobs in countries with emission taxes or costs - manufacturers will relocate to areas with more lax emissions

In response, the EU introduced Carbon Border Adjustment Mechanism (CBAM) in October 2023

CBAM will add an import duty at the border of the EU to impute a price to the cost of carbon contained in the imported goods

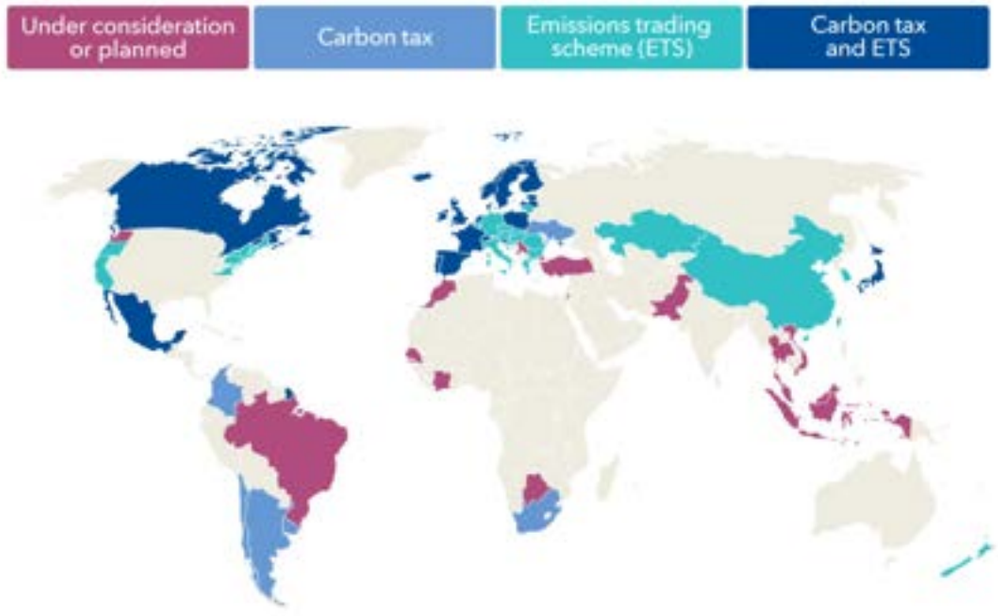
US Congress considering four draft laws with similar scope, enjoying bipartisan support

Inflation Reduction Act is industrial policy aimed at climate change - very aggressive import duties and subsidies

Canada, Japan and others are considering similar taxes to CBAM

WTO intervention unlikely, in spite of appeals

More countries are pricing externalities

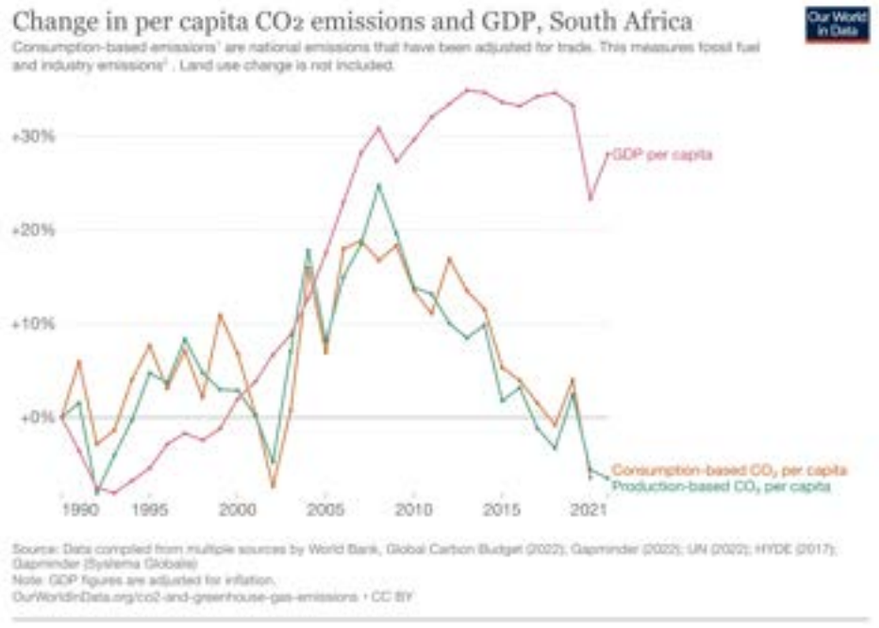


SA Reserve Bank is worried about CBAM

	Scenario 1 All countries impose carbon border tax similar to CBAM		**Scenario 2** All countries impose carbon border tax covering all sectors	
Total GDP	2030 -0.3%	2050 -0.9%	2030 -1.8%	2050 -9.3%
Total employment	2030 -64 000	2050 -351 000	2030 -581 000	2050 -3 999 000
Total exports	2030 0.0%	2050 0.1%	2030 0.6%	2050 -10.1%%

Source: SARB
April 2024

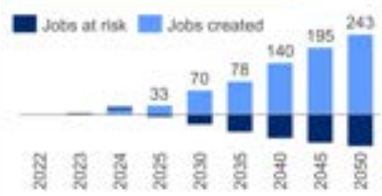
Moving away from fossil fuels will kill our economy! (Or will it?)



South Africa had a plan…

Net jobs created by 2035

Cumulative net jobs created by 2050



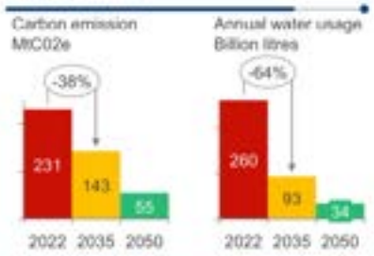
Local economy and global competitiveness

Taking advantage of **existing grid capacity** in the region, brings **invaluable investment**

Carbon taxes avoided protecting competitiveness of South African exports and protecting tourism, local manufacturing and trade

New industries and local manufacturing born from transition due to opportunities in the renewables value chain

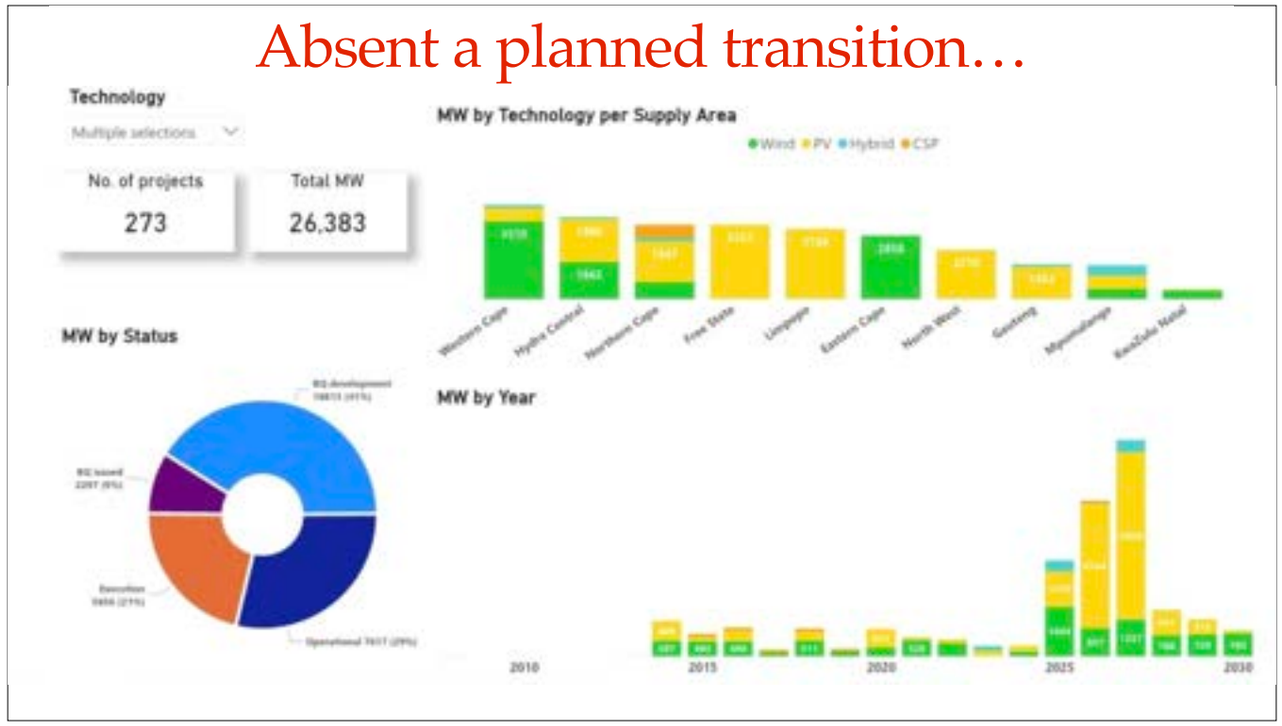
Health and environmental improvements

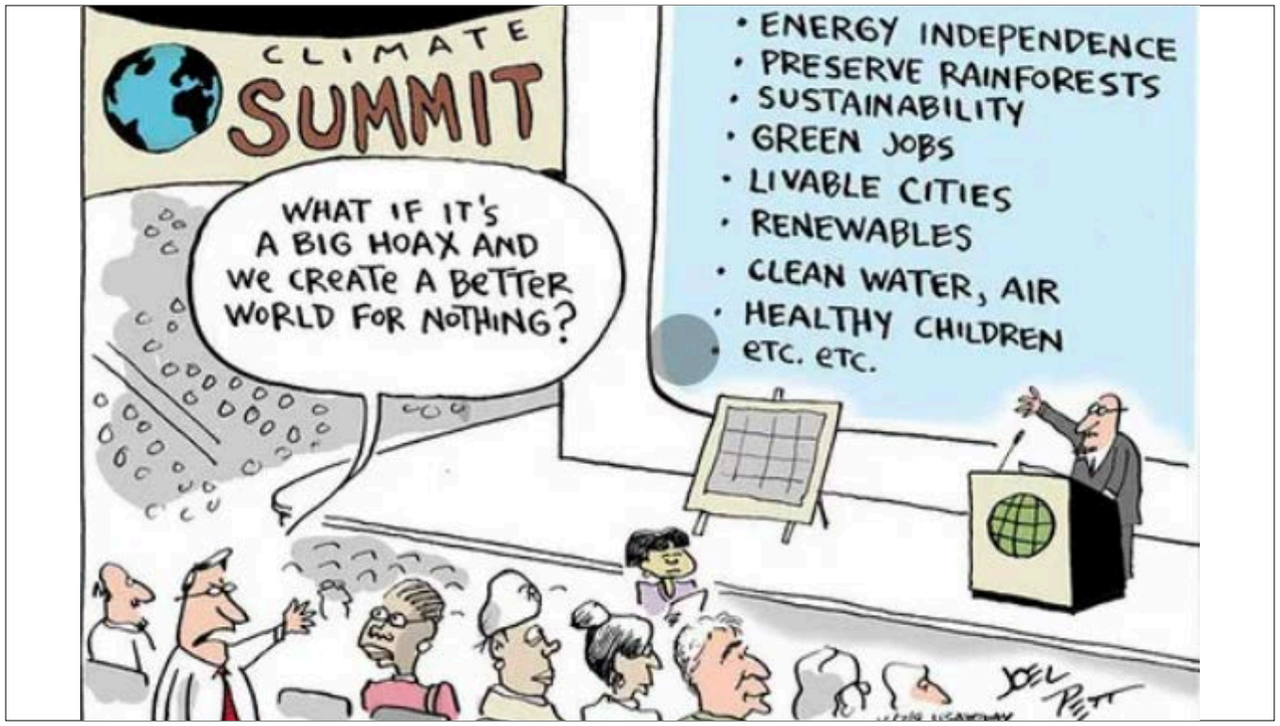


By 2035:

- **Thousands of lives improved as less people fall ill** from air pollution, reduction in energy poverty
- **~50%** reduction in CO2, **66%** reduction in SO2 emissions; **58%** for PM
- **~170bn litres of water** previously used for power generation can be **made available for agricultural uses**

Absent a planned transition…




CLIMATE
SUMMIT
WHAT IF IT'S A BIG HOAX AND WE CREATE A BETTER WORLD FOR NOTHING?
• ENERGY INDEPENDENCE
• PRESERVE RAINFORESTS
• SUSTAINABILITY
• GREEN JOBS
• LIVABLE CITIES
• RENEWABLES
• CLEAN WATER, AIR
• HEALTHY CHILDREN
• ETC. ETC.

ENERGY & WASTE ANALYSIS

SOLAR VS COAL

30 kg sample — lifetime comparison

METRIC	30 KG SOLAR PANEL	30 KG COAL
ELECTRICITY GENERATED	**26,600 kWh**	~16 kWh
SOLID WASTE	**30 kg — once, at 25 yrs**	9 kg ash — immediate
CO_2 EMITTED	**0 (operational)**	~66 kg
ENERGY RATIO	**1,660× more electricity**	baseline
WASTE PER KWH	**~1.1 g / kWh**	562 g ash + 4,125 g CO_2

Solar: 620W panel · 4.7 peak sun hrs/day · 25 yr lifetime
Coal: 4,800 kJ/kg CV · 30% ash · 87% boiler · 40% turbine efficiency

GENERATED BY CLAUDE

Generated notes (Beta). Check for accuracy.

- Look at how much more electricity we get from the same mass of solar vs coal
- A solar panel generates over 1,600 times more electricity than the same amount of coal
- Coal produces piles of ash and a mountain of CO_2, while solar's only waste is the panel itself
- Solar's waste is dealt with just once in 25 years, while coal's comes immediately every time it's burned
- And zero operational emissions from solar—every kWh is clean energy
- Per kWh, coal leaves behind not just ash, but an enormous carbon footprint
- This stark comparison really underlines why clean energy matters
- It's not just about carbon—efficiency and waste are on a completely different scale