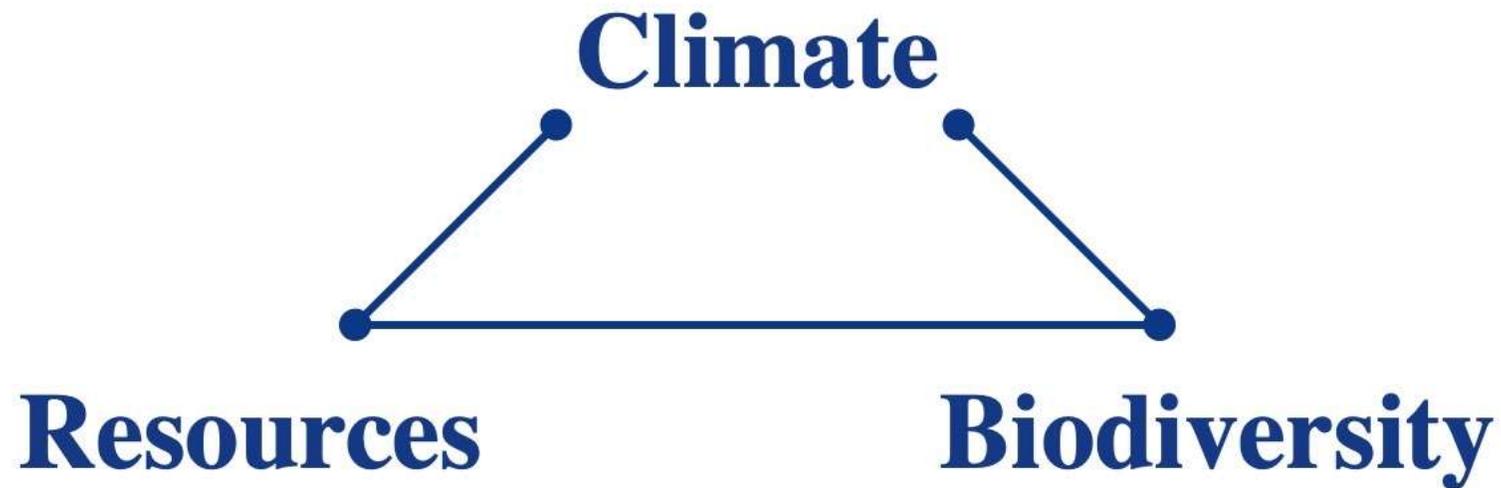


The Great Earth Plan





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DE NIET-ZO-GROENE-TOEKOMST

WOUTER VAN DIEREN

director

- Resource Wende
- Blue Cooling Initiative
- Inis Vitrin

member

- Club of Rome
- The World Academy of Art & Science

Conferentie t.g.v. 50 Jaar Natuur en Milieu Federatie Zuid-Holland

Den Haag, 21 april 2022

On Climate:

Alarm Phase 10 and the Ambulance

On Resources:

Alarm Phase 10 and the closing door

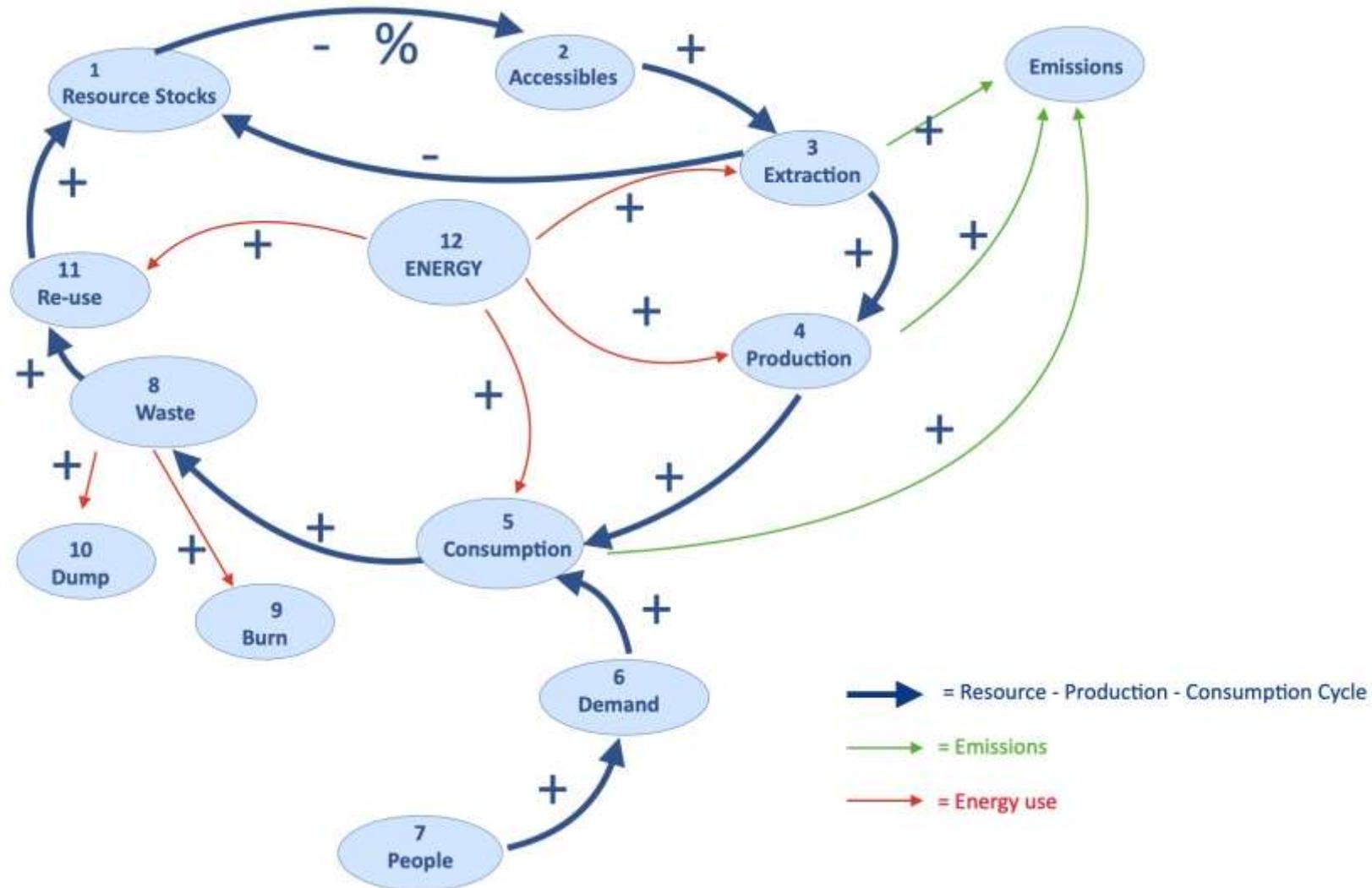
On Biodiversity:

P.M.

There is no such thing as Green Growth



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Legenda Systems Diagram



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- #1 - Resource Stocks: What is there in the Earth Crust
- #2 - What is Accessible to distract from #1.
- #3 - Extraction of the resources at volume % + emissions and energy
- #4 - Resources as the baseline for production + emissions + energy
- #5 - Consumption + emission + energy: Consumption is driven by people (#7) and their demands (#6).
Growth push is caused by #6 + #7.
- #8 - After consumption, the chain is to end in Waste (#8). Waste-handling is fueled by energy, ending in dump (#10), burning (#9) and re-use (#11)

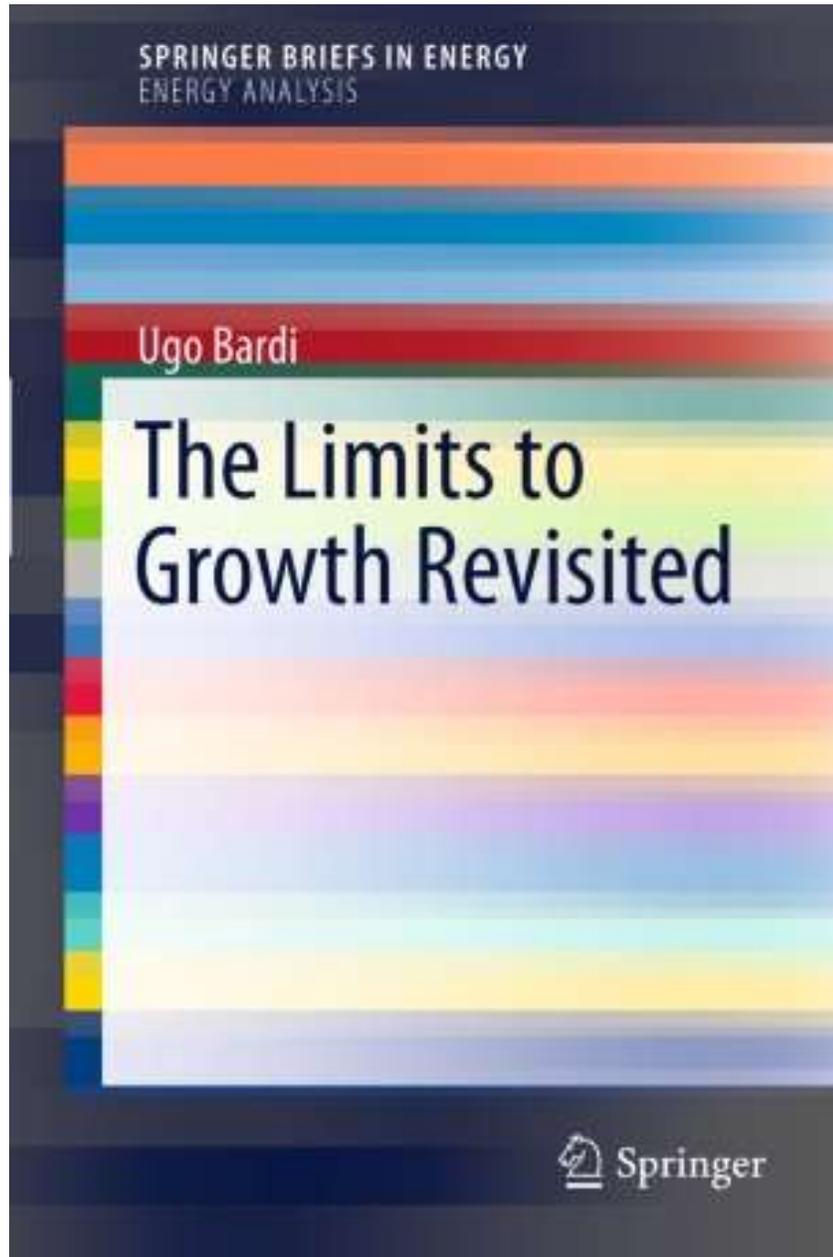
The total flow can be corrected by the innovation hypothesis.

There, as in Limits to Growth, we assume that the baseline of resources (1) and of the other variables in the cycle is pushed by a factor 2 in quantity and quality, or factor 3 and more.

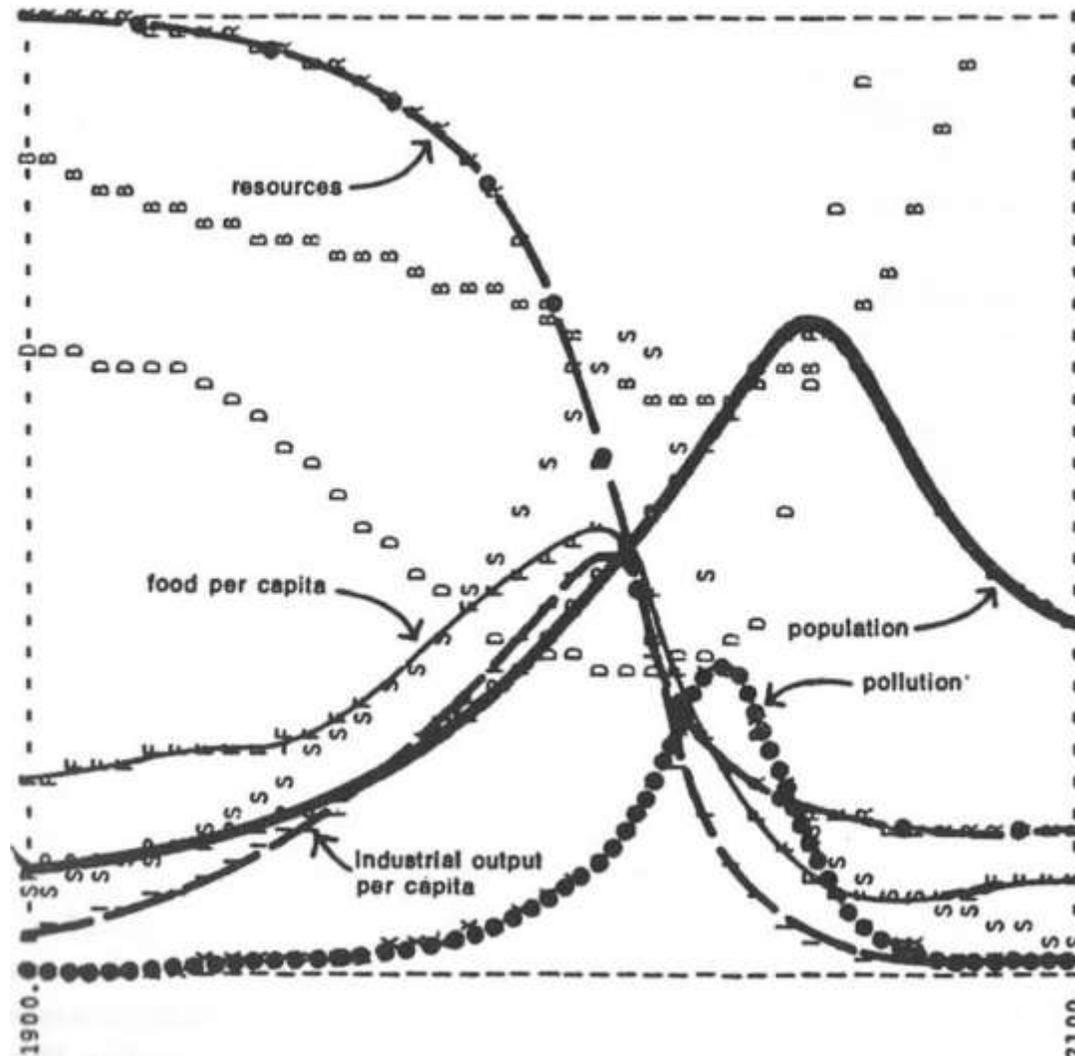
This will result in prolongation of the complete system with some years, possibly 10 or max. 20, as we have seen with the discovery of large new oilfields.

Exponentiality is the key driver.

And: There is no free lunch. And: there is always a footprint.



Ugo Bardi, 2011



Ugo Bardi, 2011

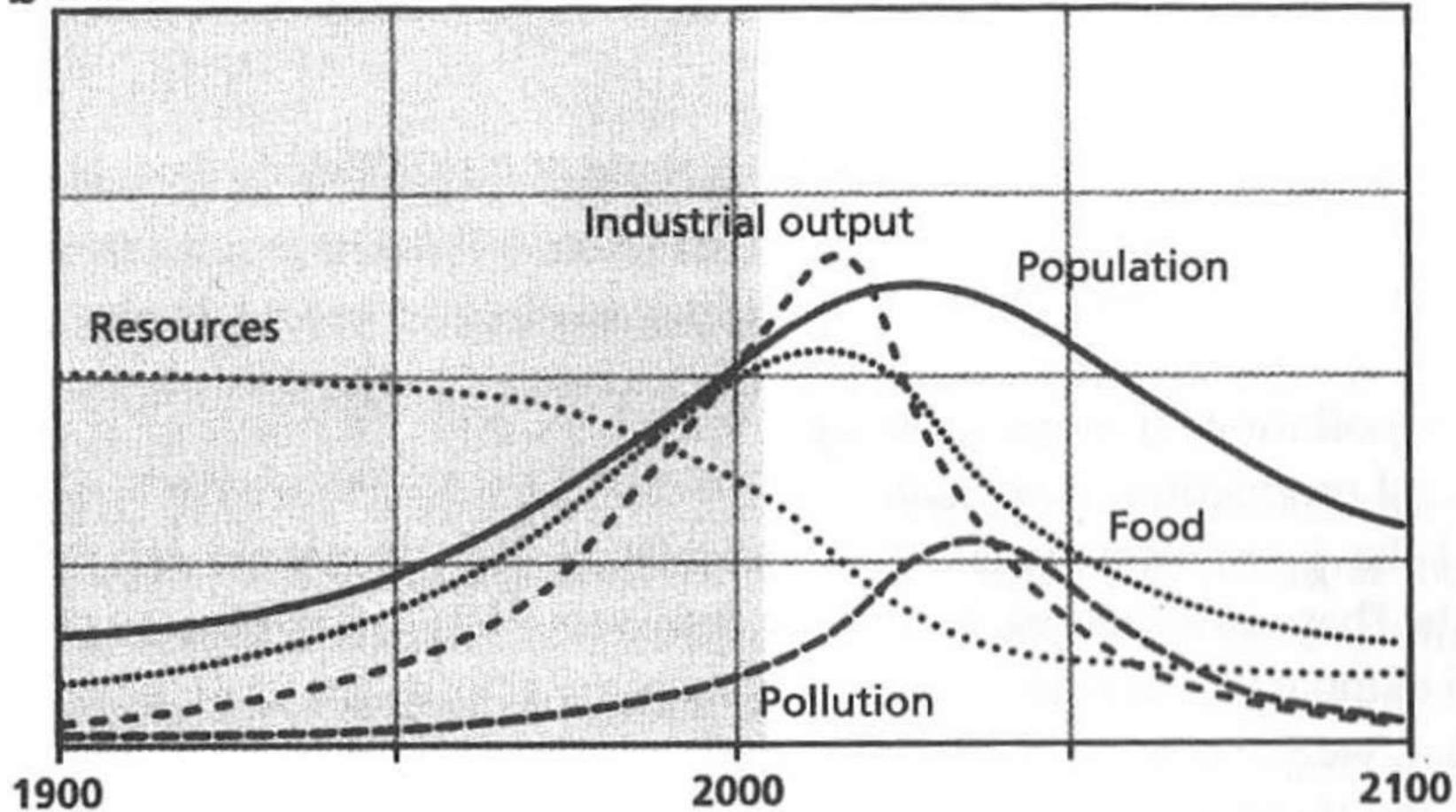
Results of the simulations for the “base case” model from the 1972 edition of “The Limits to Growth”. The base case model is the one which assumes as input parameters the values closest to the available data.



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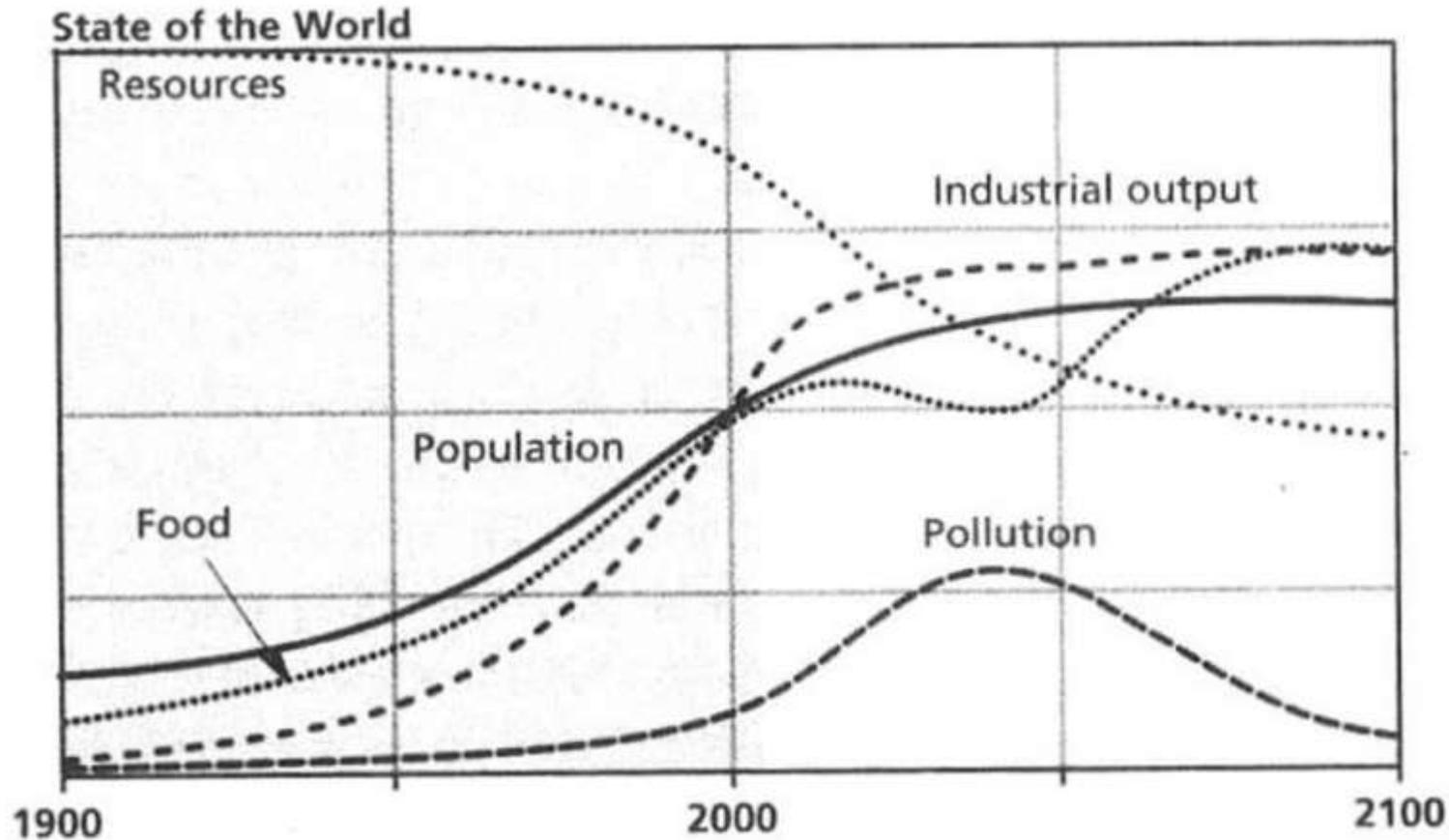


b State of the World



Ugo Bardi, 2011

Comparison of the “Base Case Model”, calculating from the 1972 and 2004 Editions of “Limits to Growth” (notice the difference in scale: the vertical scale of the 2004 run is twice as large as that of the 1972 run). From Meadows et.al.



Ugo Bardi, 2011

The “Stabilisation” scenario of LTG. A simulation that assumes a concerted intervention to control population and curb resource exploitation. With the help of reasonable technological progress, these assumptions lead to a scenario where collapse of the world’s economy does not occur within the twenty-first century.

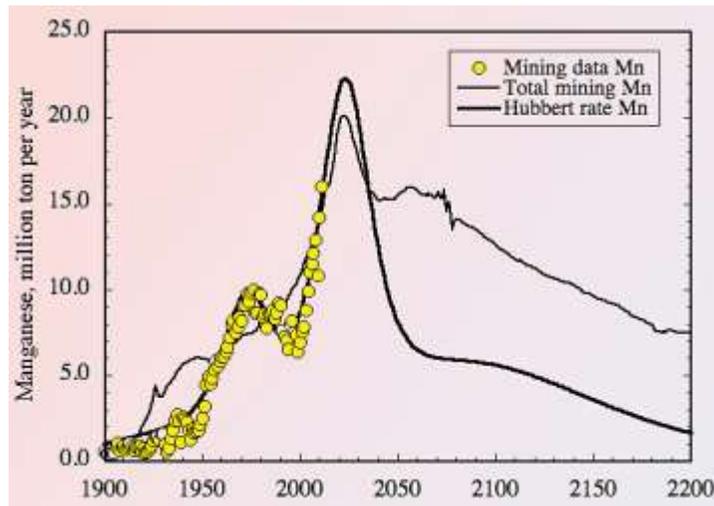
Resource Stocks: Peak principle



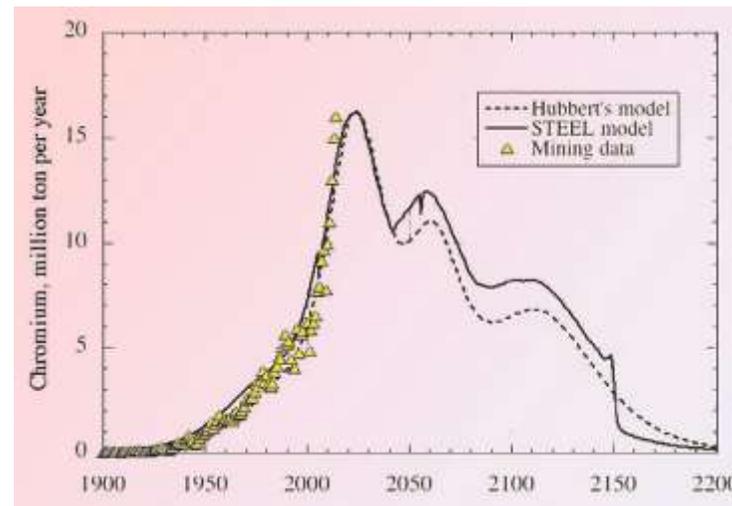
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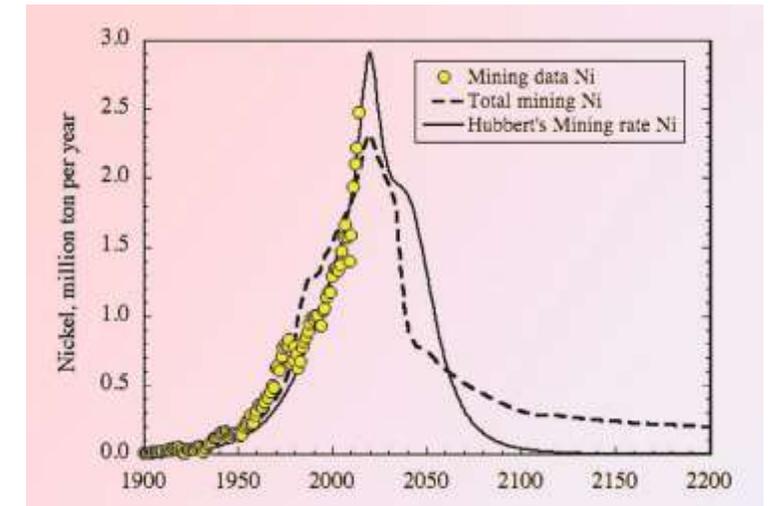
MANGANESE

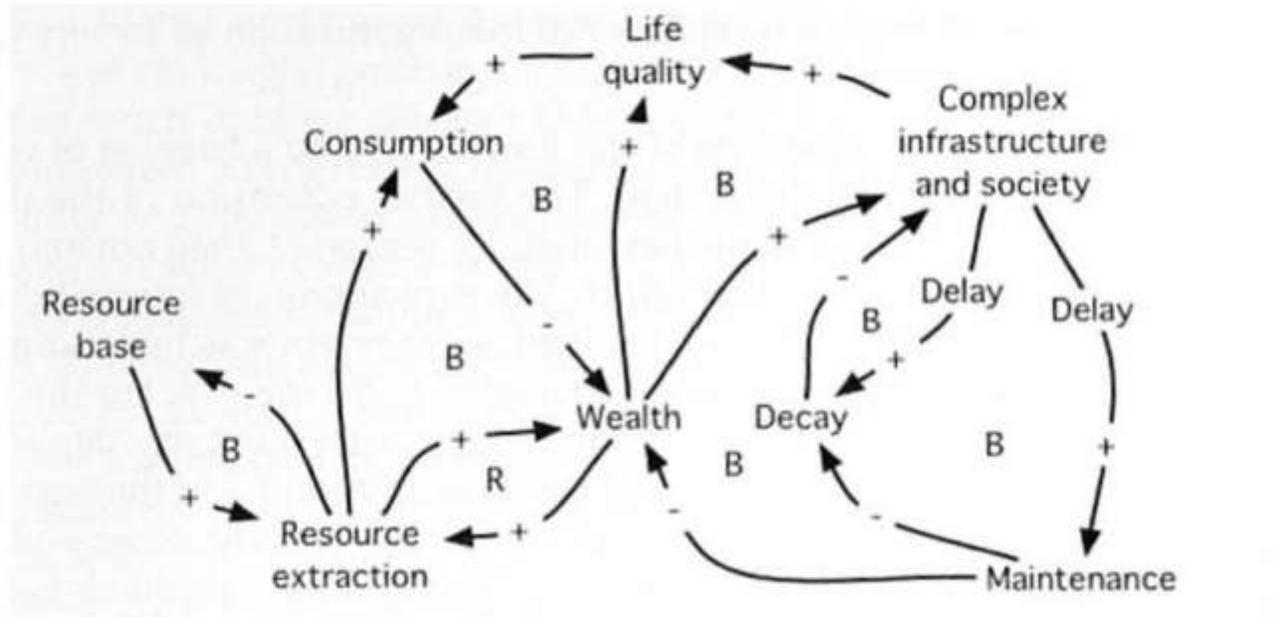


STEEL



NICKEL





Tainter's principle or model (Tainter 1988) for rise and fall of complex organisations. Resource extraction leads to wealth and consumption. With wealth we tend to build physical and social infrastructures. The costs of maintaining these have significant costs, and thus if the growth slows down, stops or declines, such systems very often experience overshoot and subsequent contraction. This is what happened to the Roman Empire, British Empire or other large empires. R are reinforcing loops keeping the system going. When we run out of resources, the reinforcing loop is weakened and the balancing loops (B) will eventually stop the system.

Empire Peaks:

Roman	AD 287 - AD 400
Norway	AD 1349 - AD 1450
UK	AD 1947 - AD 1965
Spain	AD 1700 - AD 1750
Soviet	AD 1990 - AD 2005
Russia	AD 2035 - AD 2045
America	AD 1998 - AD 2025
China	AD 2060 - AD 2080

Metal	Pessimistic	Average	Optimistic
		1962	
Mercury	-	(2010)	-
Cadmium	1900	1998	2025
Platinum	2010	2015	2030
Palladium	2010	2015	2030
Gold	2012	2013	2017
Lead	2013	2018	2023
Niobium	2014	2018	2023
Indium	2018	2020	2023
Manganese	2018	2021	2025
Selenium	2022	2025	2035
Chromium	2022	2025	2035
Zinc	2018	2025	2028
Nickel	2022	2026	2028
Iron	2025	2040	2080
Silver	2028	2034	2040
Copper	2033	2038	2042
Phosphorus	2025	2040	2100
Molybdenum	2048	2057	2065
Vanadium	2055	2076	2096
Aluminium	2030	2130	2230
Stupidium	2500	2300	2030

Essential materials in the nearby future for:

Electricity, batteries, magnets, electrolysers, catalysts, digitalisation, food, transport

Sverdrup 2014
The World 7-model

1

Metal	Pessimistic	Average	Optimistic	Comments
All ready peaked (The problem is here and now)				
Palladium	2010	2015	2025	Partly dependent on nickel. Serious challenge. Scarcity prevailing.
Rhodium	2010	2015	2025	Partly dependent on nickel and platinum mining. Serious challenge. Scarcity prevailing.
Gold	2012	2013	2017	The only real money, well conserved. Partly dependent on silver, copper and platinum.
Coming within the next 10 years (we own the problem, no escapes).				
Lead	2013	2018	2023	Limited by political action, target is 2010.
Niobium	2014	2018	2023	
Indium	2018	2020	2025	Dependent on copper-zinc mining.
Gallium	2018	2020	2022	Dependent on copper-zinc mining.
Manganese	2018	2021	2025	
From 10 to 20 years from now (we own the problem).				
Selenium	2022	2025	2035	Dependent on zinc.
Chromium	2022	2025	2035	
Zinc	2018	2025	2028	This is a serious challenge!
Cobalt	2020	2025	2030	Dependent on copper, nickel and platinum mining.
Nickel	2022	2026	2028	This is a serious challenge!
Iron	2025	2040	2080	This is a serious challenge!
From 20 to 30 years from now (escape possible; next generation gets the problem)				
Silver	2028	2034	2040	Partly dependent on copper and zinc.
Rhenium	2030	2035	2040	Dependent on molybdenum.
Copper	2032	2038	2042	This is a serious challenge!
Phosphorus	2025	2040	2100	This is a very serious challenge! Size of URR is disputed (16-60 billion tonnes) but it only shifts the peale by some centuries.
From 30 to 50 years from now (escape possible; next generation gets the problem).				
Molybdenum	2048	2057	2065	
More than 50 years from now (escape possible; our grandchildren get the problem).				
Vanadium	2055	2076	2096	Dependent on iron.
Aluminium	2030	2130	2230	This is a challenge!

2

3

4

5

The unknown perspectives

Sverdrup 2014

The World 7-model





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The door to the future is locked

The market-economist says the solution is with market reallocation.

The techno-optimist says that innovation will come to the rescue.

The politician is sceptical about science, and calls for more science.

The populist says that the earth-crust is thick, and endlessly rich.

The green claim to know all about the unknown miracles of green growth.

Example of Green Growth vision

- Imagine every Dutch house has a heat pump
- To replace oil, coal, gas now
- Materials + production + labourforce + time
- Results: job done by 2170.





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Political ad-hoc Ignorance

'No compensation now for high energy prices'

'War is part of entrepreneurs' risks'

'The market must resolve it'

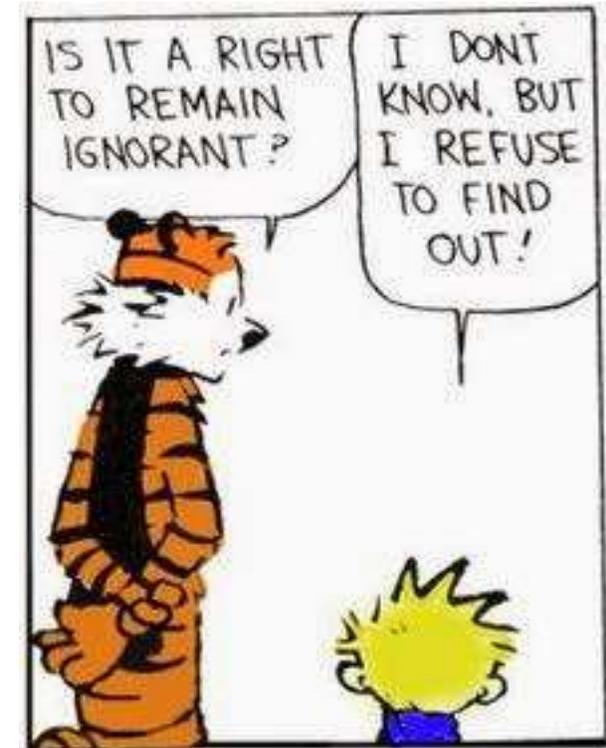
'Financial compensation (gas, oil) delays desired collapse of the fossil fuel industry'

'Catalyse energy tech from fossil to renewables NOW'

'Transfer to nuclear NOW'

'Transfer to all electric NOW'

In all systems: Delay times are a technical condition *sine qua non*





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70% of the global infrastructure is still to be built.

Basic conditions are:

steel, sand, wood, polymers, water, space, energy, skills.

High tech materials such as:

Cobalt, Copper, Lithium,
Phosphorus, Platinum Group
Nickel, Oil, Zinc, Niobium





Resource Wende International

- To inform about the World 7- Model
- To calculate the immediate stress factors on resource availability
- Beginning with the Netherlands, Sweden, Germany and France
- Which will reveal the shortcomings, e.g. The Netherlands: no resources other than gas and deep water harbours
- Bottleneck: dependance on the unstable abroad
- Global bottlenecks: at 6% Chinese growth, containerships from Asia to queue up
1,000 miles from Suez Canal entry = 3 months delay
- The end of Rotterdam Harbour expansion?

Origins of Resource conflict

- The neo-liberal agenda
- There, neglect of physical conditions
- Instead: market forces do the job
- Absence of sustainable industry policy scenarios
- Absence of sustainable energy scenarios
- ‘The Plunder of the Commons’
- ‘Green dreams say yes, but science-checks say no’



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Resource Wende Coalition

- Inland University of Norway (lead)
- Government of Sweden (EU-chair 2022)
- European Environmental Bureau (Copenhagen)
- IIASA International Institute for Applied Systems Analysis (Vienna)
- EU-Science
- Club of Rome
- UN-International Resource Panel
- Gordiaan project Netherlands (To design sustainable Industry Policy Systems)
- World Council of Churches

Climate Data Q1, 2022

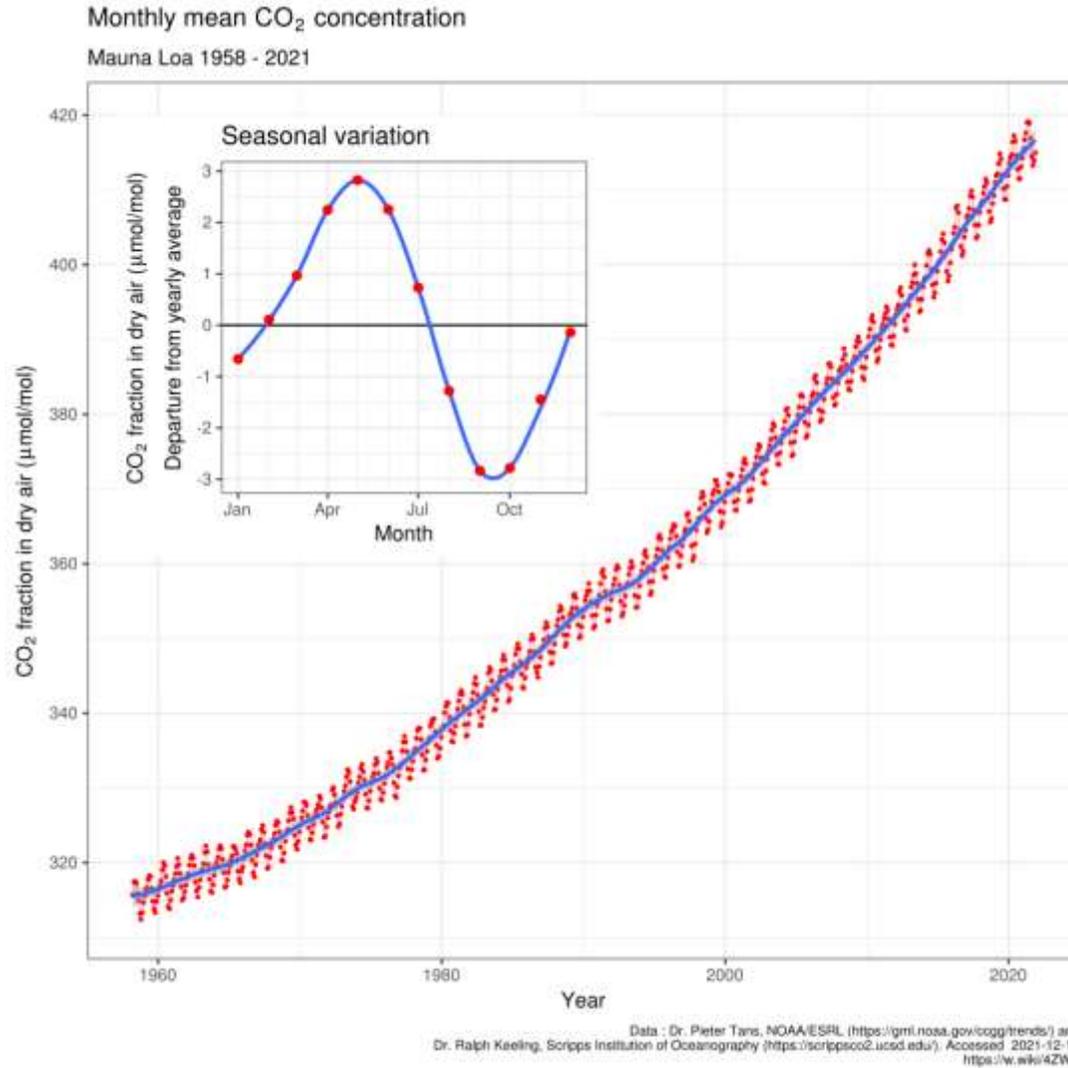


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- Reality check: + 1.5 °C is out of reach
- Prospect now + 3 °C in 2100
- Sea level rise + 2 or 3 meters in 2100
- When uninterrupted + 70 meters in 2700
- 4 billion people in lowland coastal regions displaced (2020 - 2120)





Keeling Curve



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A Climate Paradigm Shift

- All hands on deck
- All target to repair the hull
- Stop disputes on deck of the Titanic
- Mitigation to enforce by Adaptation
- Adaptation is not surrender but the ambulance
- All GHG removal technologies mobilised

- **Global Coastal Defence Plan**

(Van Oord + IFCCC, Q4 - 2018)

= 40,000 km coastline mapped out

Construct Defense = 100 years

Costs = Average 500 million/38 km



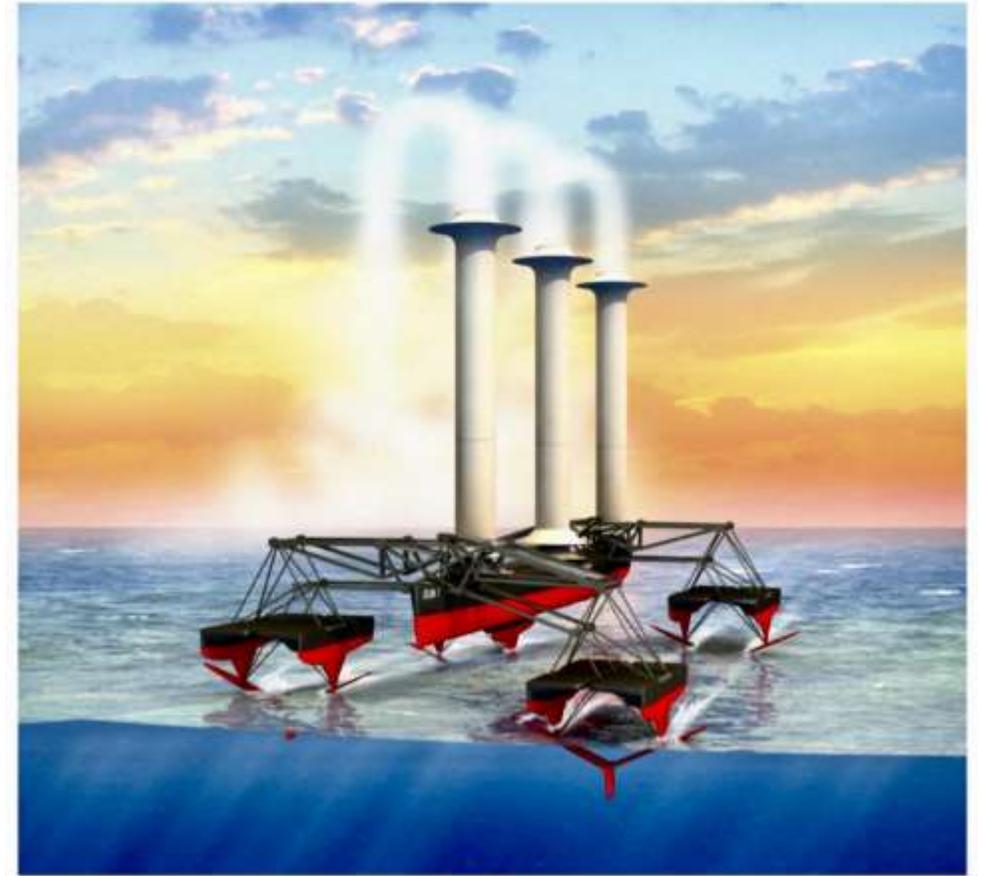


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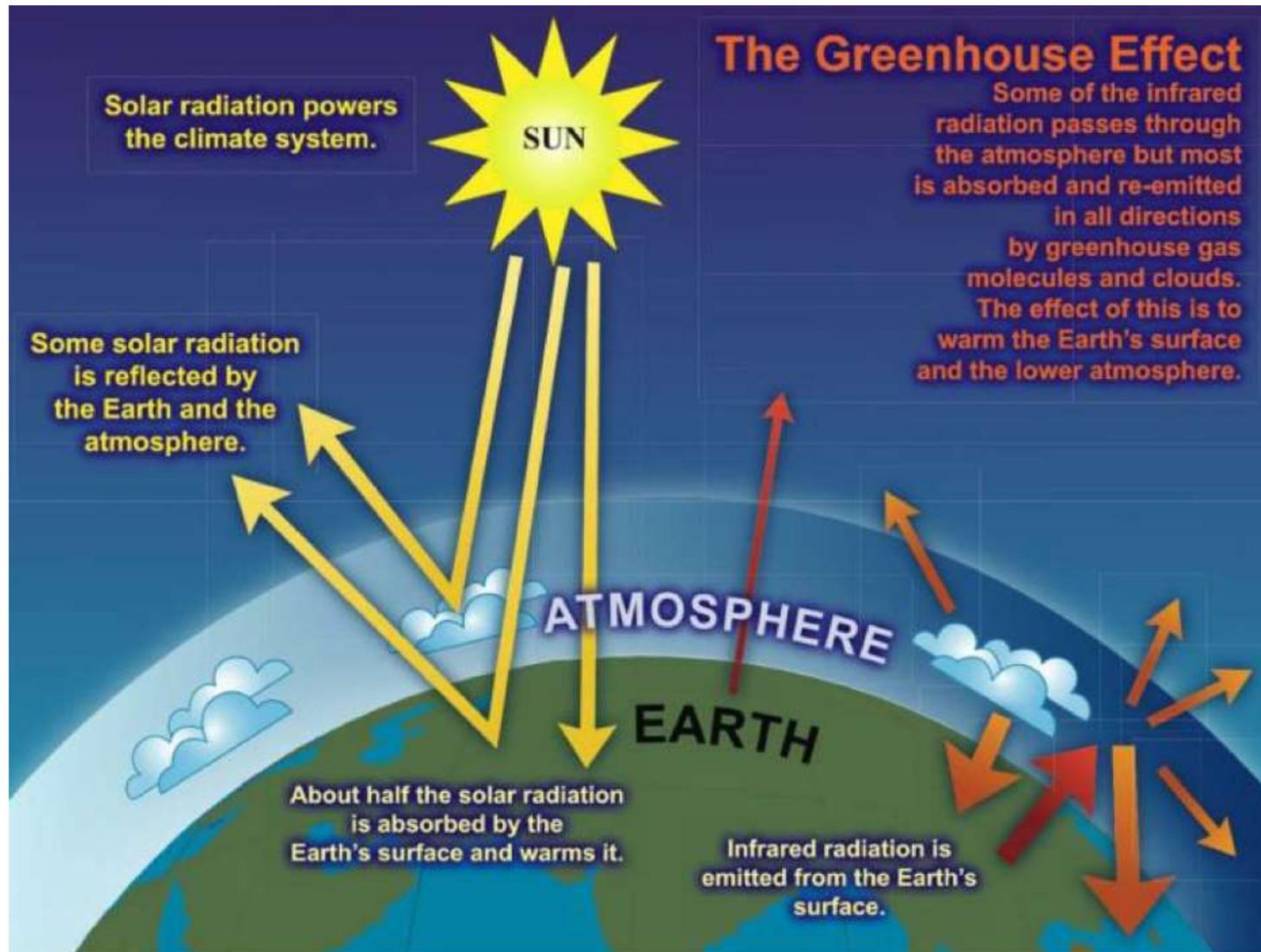
Climate Alarm phase 10

- **Marine Cloud Brightening MCB**
- White Cloud Cover reflect sunrays
- Cooling the atmosphere
- Cooling the oceans
- Natural process: salt particles from the ocean to the atmosphere
- 500/1000 Spray Vessels
- Investment US\$ 11 billion
- Slow down Global Warming by 70 years = buying time





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Blue Cooling Initiative

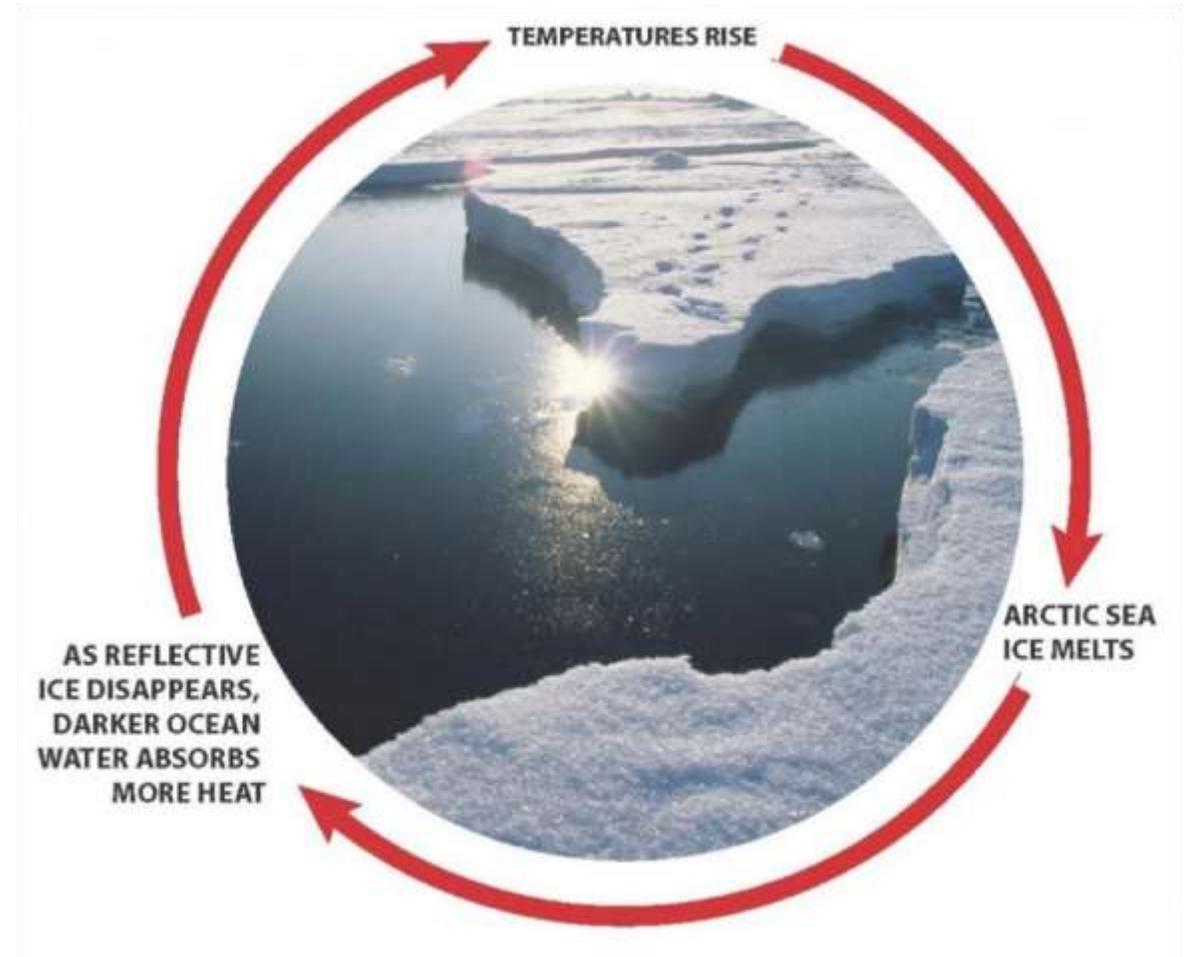
- University of Cambridge
- Technical University of Edinburgh
- University of Washington, Seattle
- Technical University of Delft
- University of Sydney
- IF-CCC, IPCC
- UNDP
- Brussels Coalition
- Business, Policy, NGOs



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Blue Cooling Initiative

Presented in Glasgow (Oct. 2021)

Sir David King, Cambridge

Sir David Attenborough, Cambridge



“
Refreezing the Arctic, were it possible, would be a huge defence against the global catastrophes currently threatened by continued global warming.

And it is exactly that possibility that is being investigated by the Cambridge Centre for Climate Repair.

SIR DAVID ATTENBOROUGH



CLIMATE
REPAIR

Short Term Targets

Planning 2022 - 2025 - 2030

- Fundraising short term (R&D) € 5 million
- Prototypes € 10 million
- Testing 2 years € 10 million
- Management organisation 15 countries € 15 million
- Fleet plan + Construction € 7 billion
- Monitoring plan € 9 billion
- Technology base € 50 million
- Atmospheric Weather Stations expanded P . M .

Netherlands as the heart of the new global system