

Long term future of Humanity

Climate Change, Energy and a plea for Reason.

Clive Best

My background

- PhD High Energy Physics (Liverpool)
- CERN Fellowship
- Rutherford Lab
- JET (Nuclear Fusion)
- EU Joint Research Centre
- IT Spin-off 2008 – 2010

Blog: <http://clivebest.com> 14 years !

Climate Science

- Climate science has become way too politicized (IPCC)
- It often behaves like a closed shop, closing ranks rather like a football team.
- The debate is never over in science.
- So I decided to first understand the physics.

Earth's atmosphere is unique in the Solar System because of life !

CO₂ = 0.03% O₂ = 20% N₂ = 80% H₂O = ~0.25

(Venus & Mars= 95%)

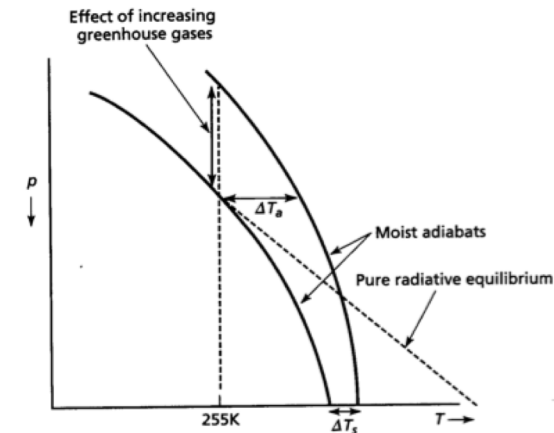
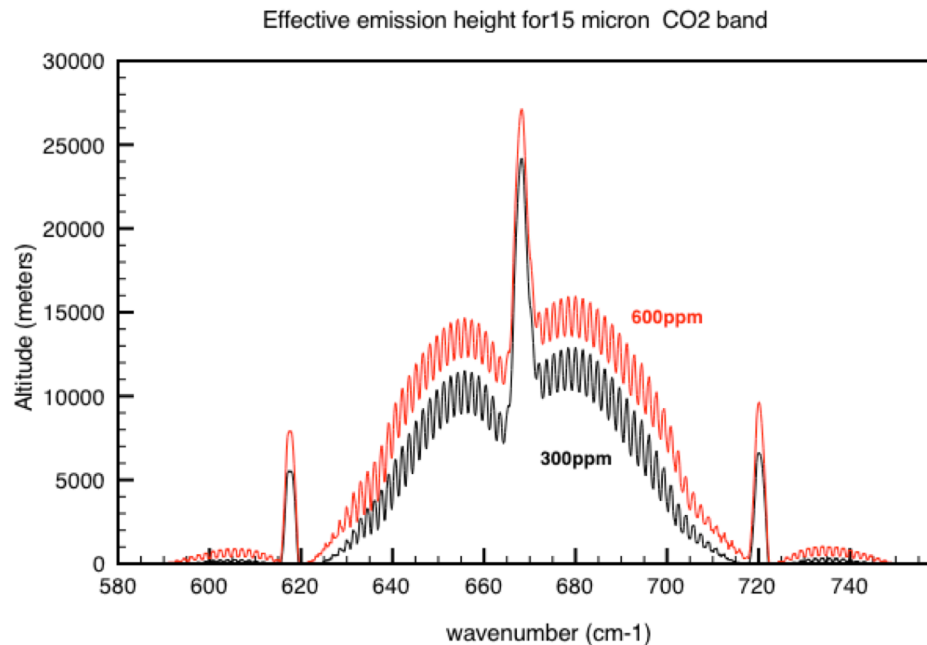
~2 billion years ago cyan bacteria evolved in oceans “solving” photosynthesis - consuming CO₂ and releasing O₂ while producing hydrocarbons (“food” for animals yet to evolve).

Atmospheric CO₂ levels are the result of a balance between plants, animals and plate tectonics.

The atmosphere keeps the surface warm enough for life to thrive – thanks to the greenhouse effect !

CO2 Greenhouse effect

It is not obvious! You need Hitran for line by line radiative transfer.
More CO2 raises the emission height to space. Central band lies in Stratosphere



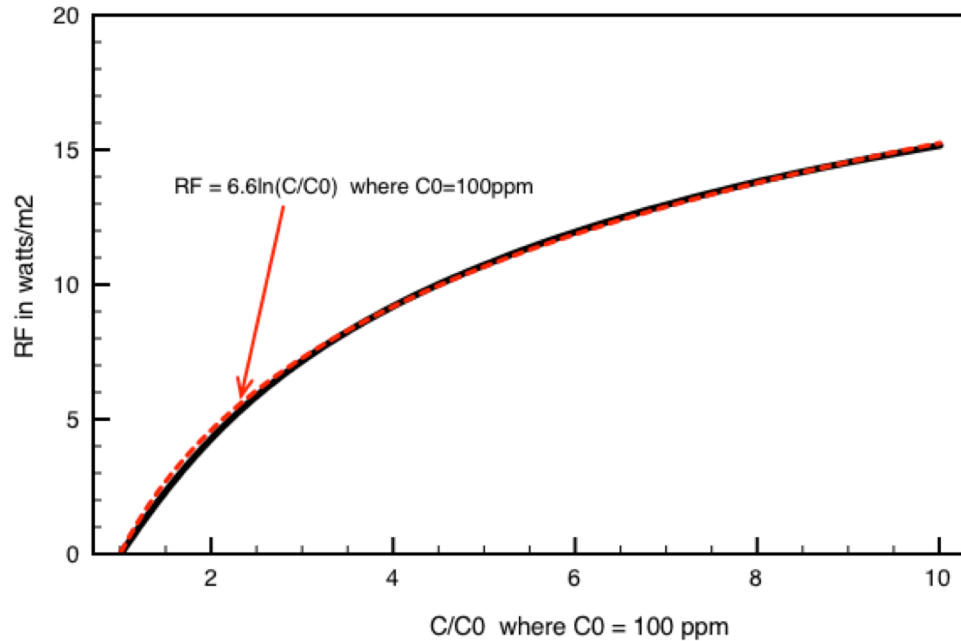
Greenhouse Effect. FIGURE 2. The Effect of Convection and of Increasing Concentration of Greenhouse Gases. Pressure decreases upward and temperature increases to the right. The two thin, solid lines are moist adiabats; convection keeps the temperature profile close to curves of this shape. In the absence of convection, the temperature would be close to a state of radiative

equilibrium, shown by the thick dashed line. Increasing greenhouse gases, particularly in the upper troposphere, near and above the level at which the temperature equals 225K, moves the altitude at which $T = 255K$ upward. This causes an increase in upper tropospheric temperature of ΔT_a and a corresponding increase of ΔT_s in the surface temperature.

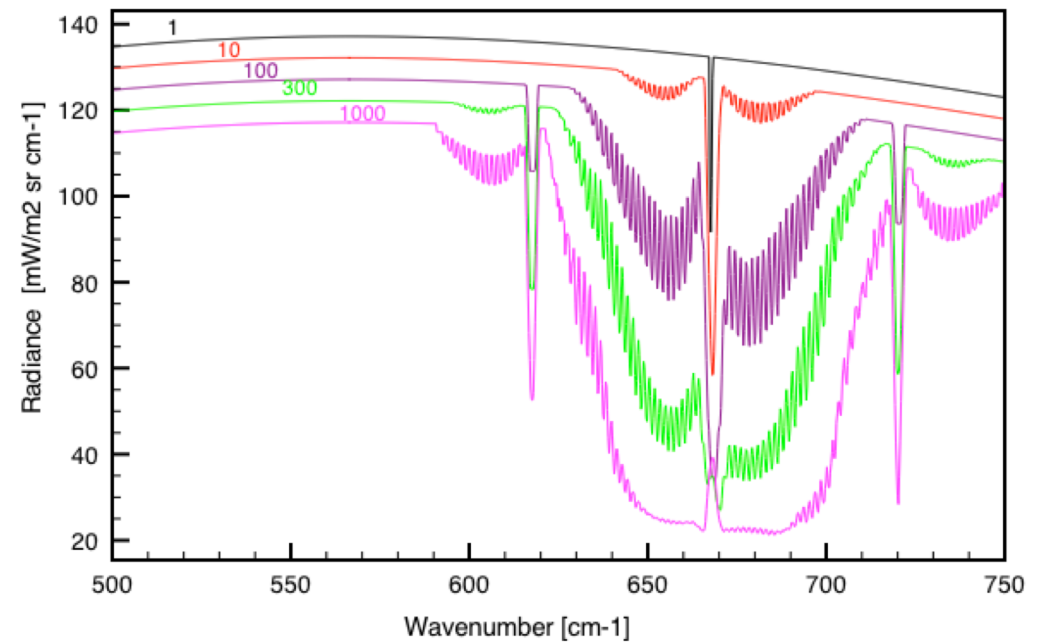
Radiative Forcing of CO2 !

- Surface warms to re-balance energy at the new emission height through convection.

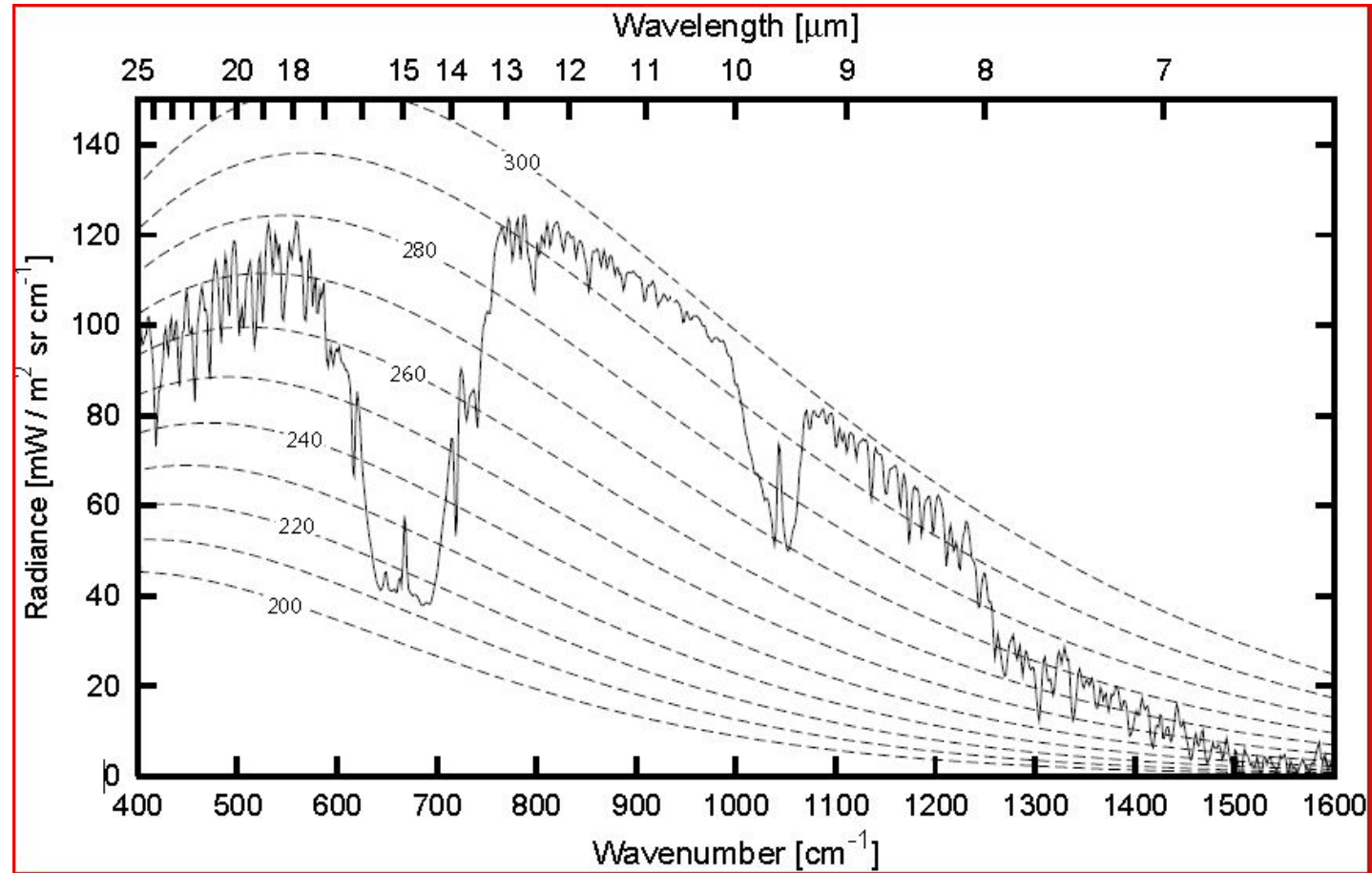
Radiative Forcing as a function of fractional increases in CO2 concentration



Compare spectra for different CO2 concentrations. Each spectra offset by 5 mW/m²cm⁻¹

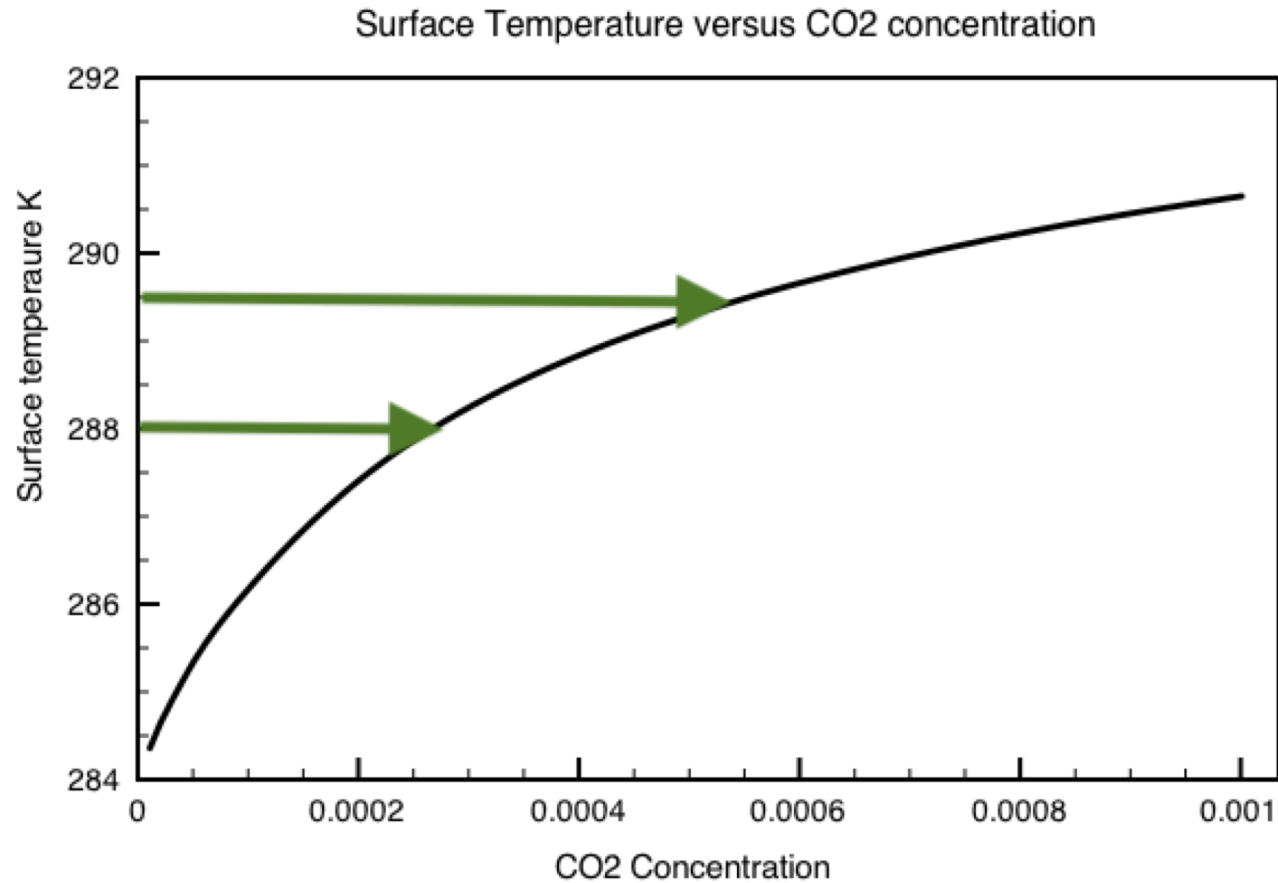


IR Spectra over equator



Temperature dependence on CO2

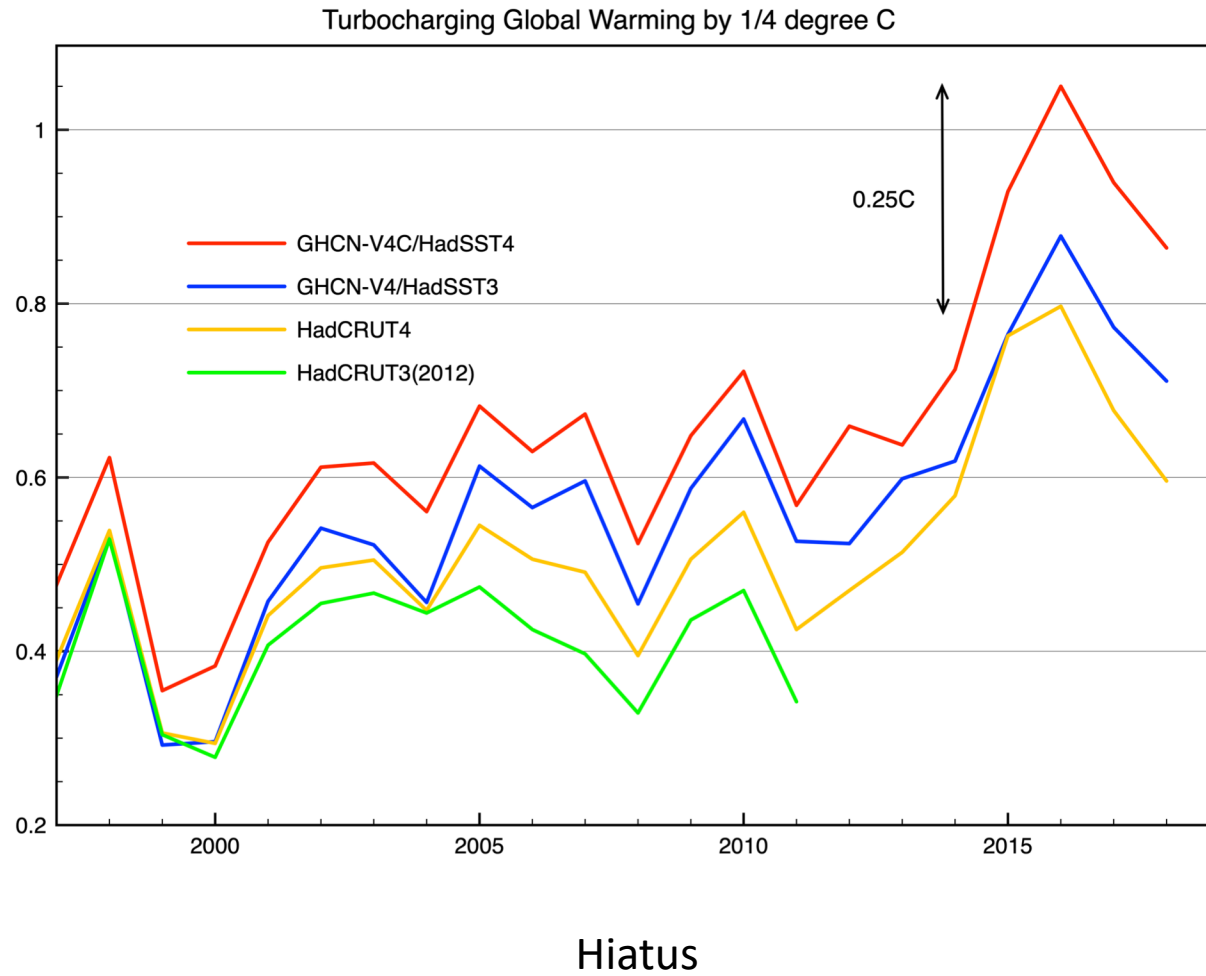
Doubling of CO2 ~ 1.5 C



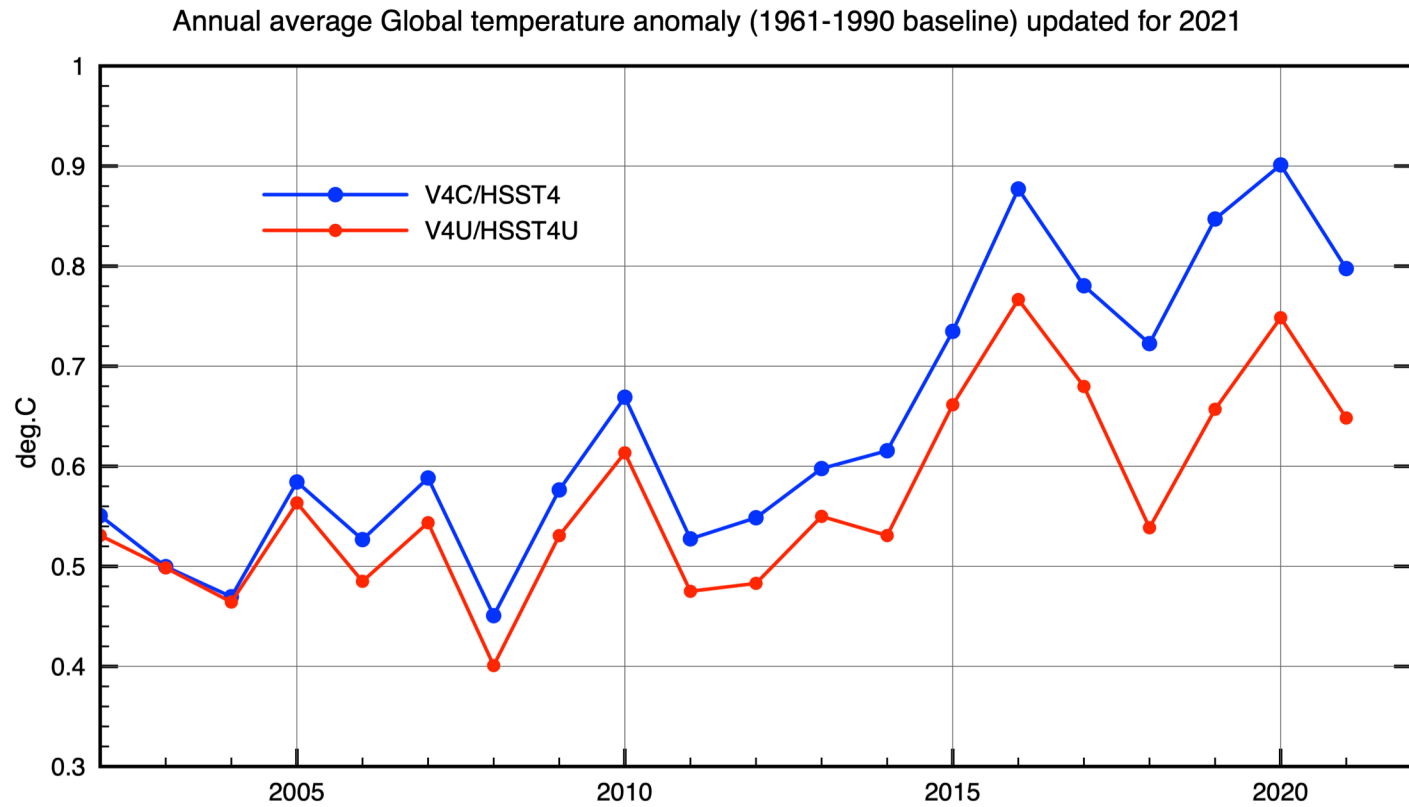
Can we measure earth's temperature ?

- Not directly so we use some tricks are instead.
- Use temperature anomalies relative to a 30 year average for each weather station, ship or buoy - DT
- Homogenize “faulty” stations
- Area weighted average DT is the global average.
- Recently kriging is used where poor coverage (Arctic, Antarctic)

Data - measured temperatures evolve (1)

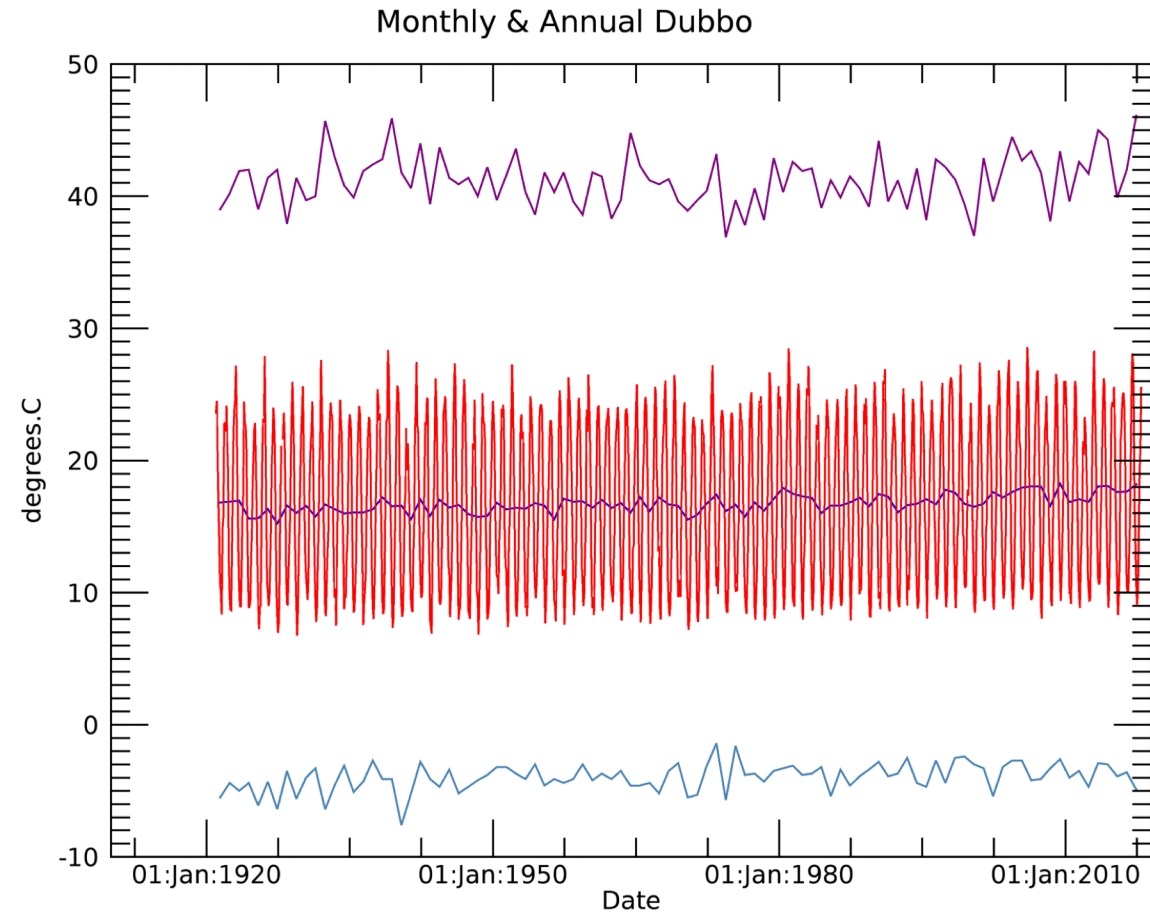


Temperatures evolve(2) – Homogenisation



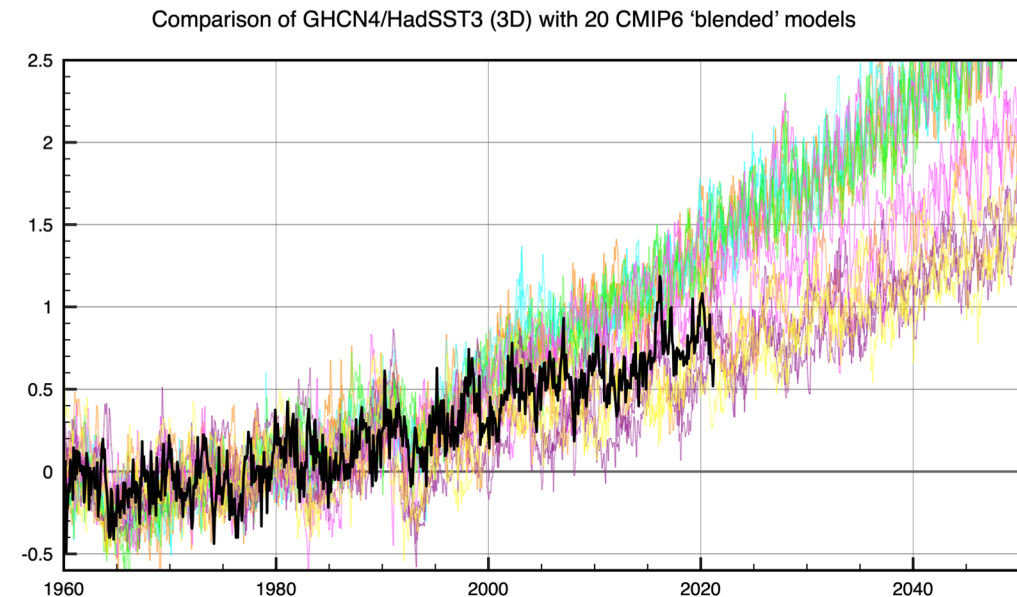
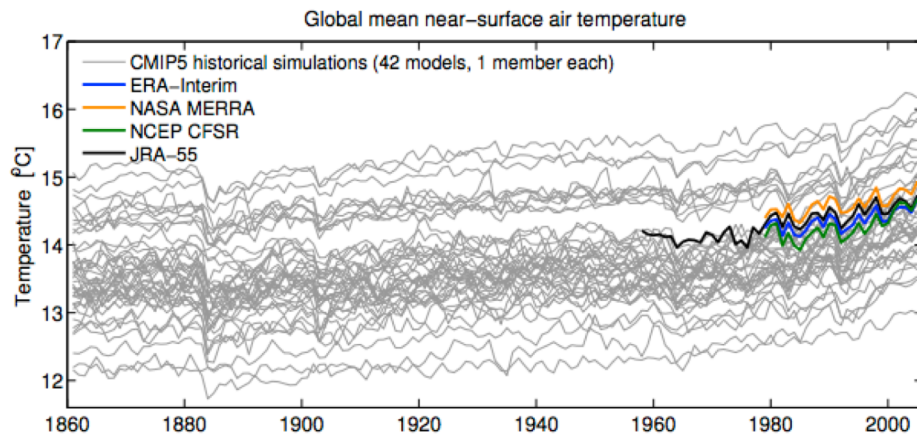
Systematic Errors

Homogenization example



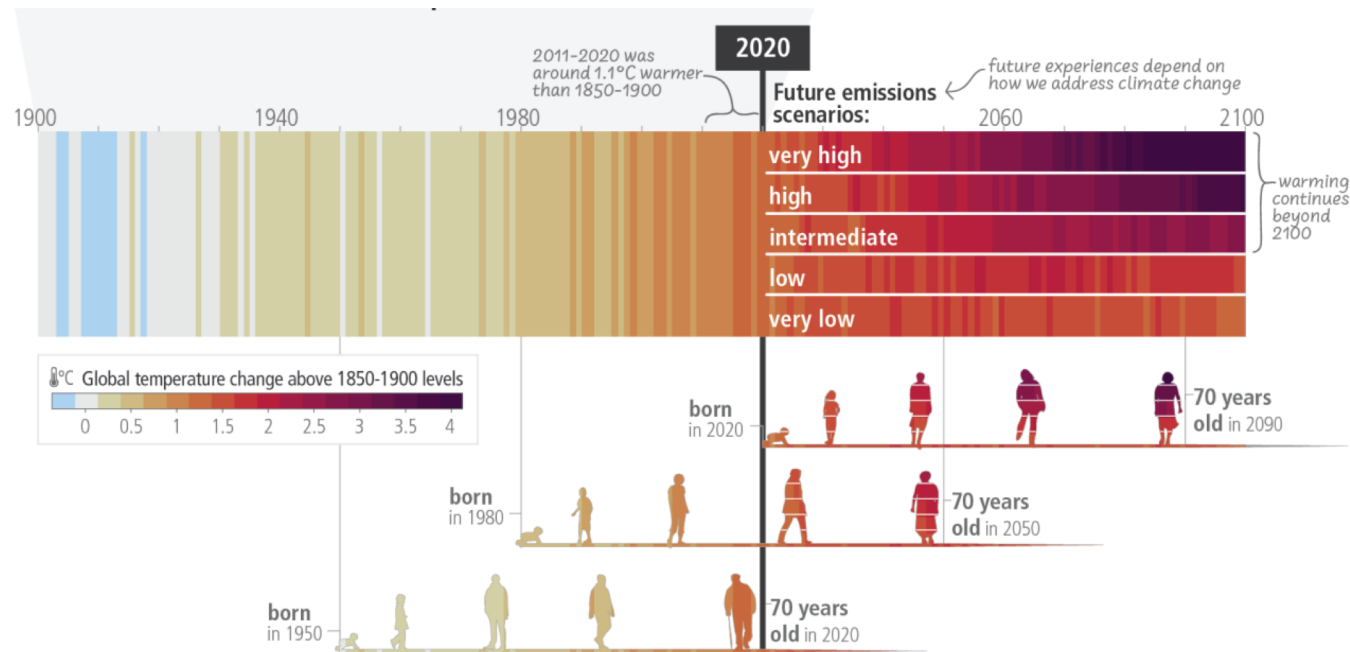
Model Comparisons rely on “anomalies”!

- Anomalies – because even models even can’t get absolute temperature right !



So how bad is global warming really?

- Temperatures on earth range from -50C (Siberia) to +50C (Tunisia)
- A 1.5 degree increase in mean temperatures is hardly noticeable.
- Yet latest IPCC warming assumes + ive feedbacks 4C !

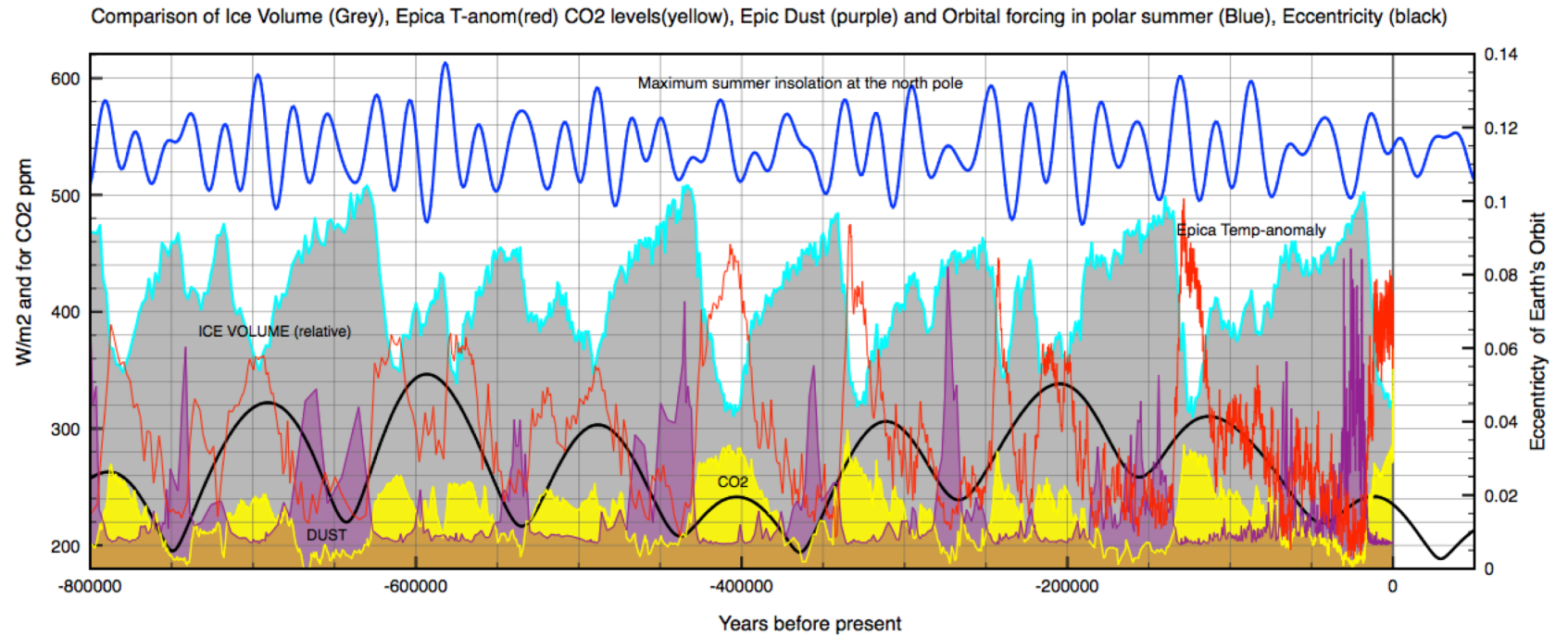


So what are we supposed to do about it?

- Simple - Cut emissions to zero !
- How ? Renewable Energy ?
- Wind turbines & solar panels need steel, rare earths, concrete !
- Modern agriculture relies on fertilizers !
- Roads use tarmac ! Trains and bikes need steel/aluminium.
- Electric cars rely on batteries, steel, rare earths, shipping, rubber etc.
- It won't work.
- We need a long term plan

Devastating climate change - Ice Ages !

- Ralf Ellis
- Dust albedo



Ice model including Dust Albedo

(Imrie & Imrie Ice model)

$$-\frac{DV}{DT} \propto (1 \pm b) \times S(1 - \alpha)$$

$$\alpha(t) = 0.5 - fac \times (dust(t - 15))$$

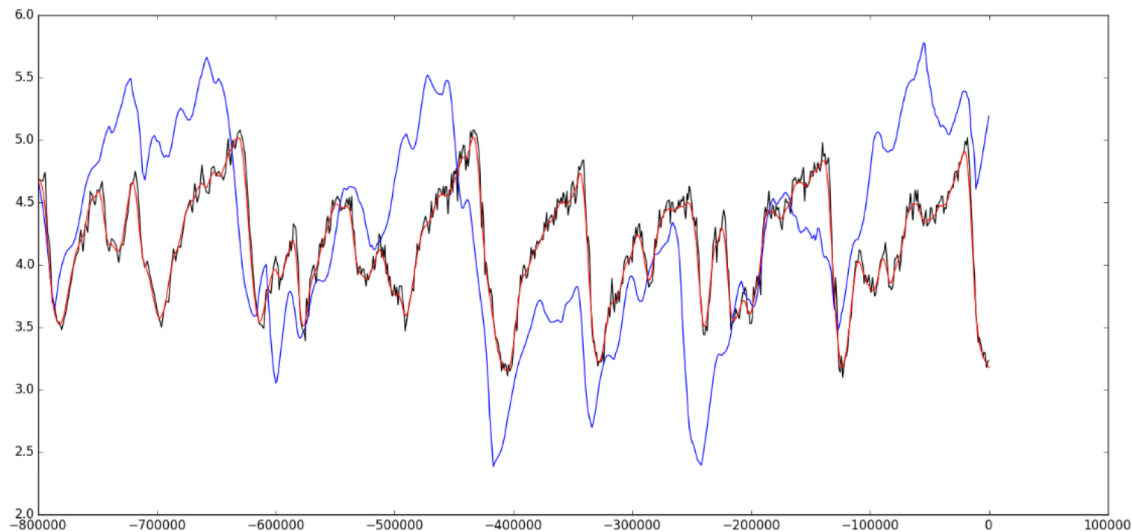
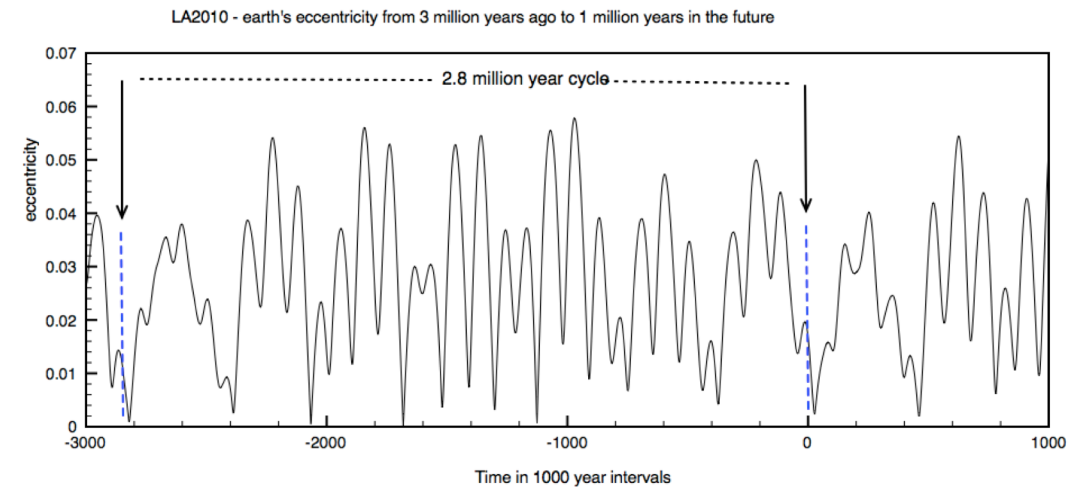
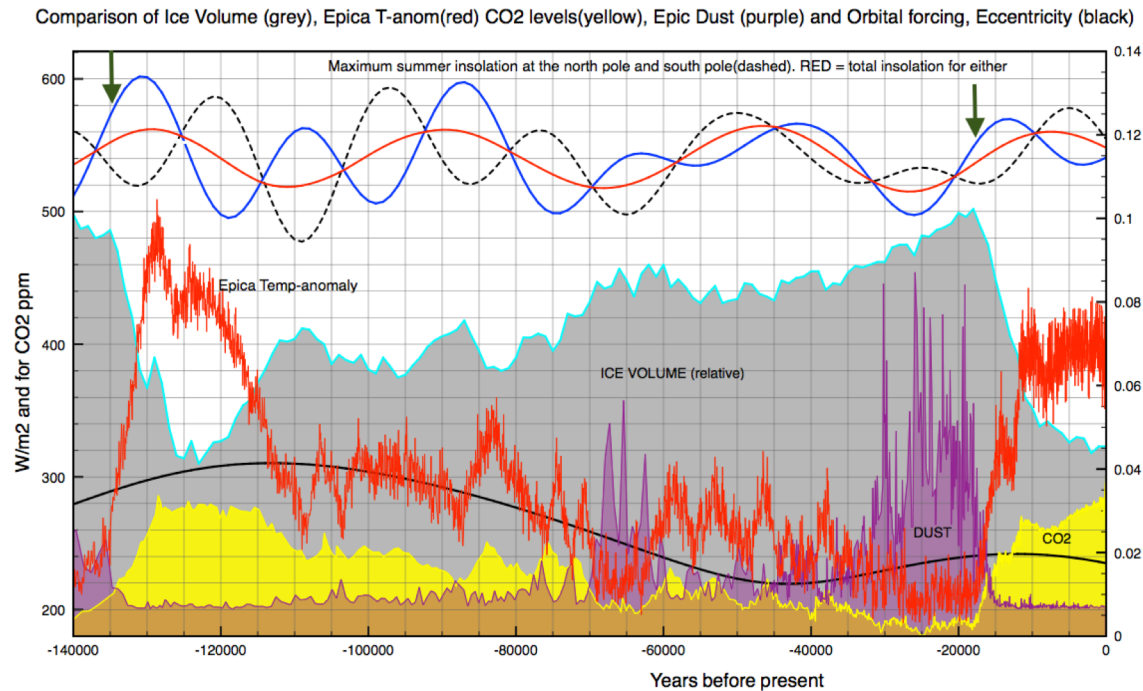


Figure 7: Simulated Ice Volume results by integrating the delayed dust albedo model B forward in time. This is compared to the actual LR04 ice volume data in black/red. as in Figure 5.

Next Ice Age could be the deepest & longest in the last 400k Years like Anglian !

- The Eemian interglacial was warmer than the Holocene but only 'lasted' about 10,000 years.



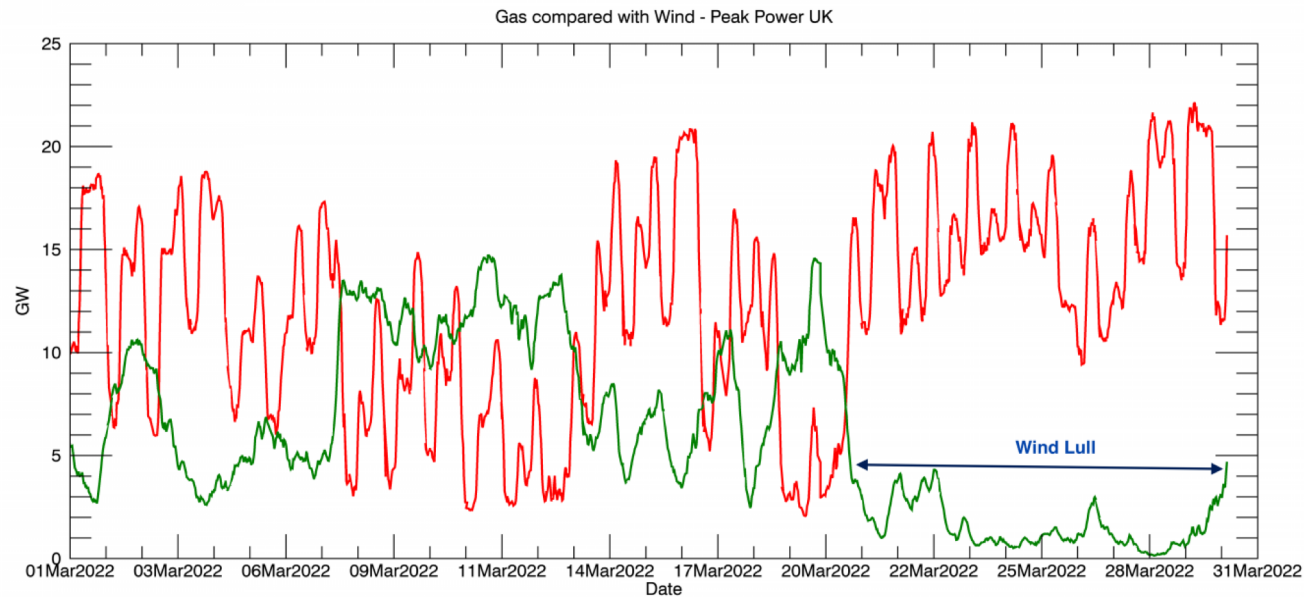
Energy

- Climate change is a symptom - not the fundamental problem
- Acid Rain, London Smogs, Disease, Ozone & even horse manure were huge threats
- All were resolved.
- Oil may anyway become too scarce – Peak Oil ?
- How do we avoid a looming energy crisis and maintain living standards ?

- Here is why the renewable energy bandwagon can't work !

Renewable Energy Politics !

- The “Climate Change” Act commits the UK government **by law** to reducing greenhouse gas emissions by 100% of 1990 levels (net zero) by 2050. Wind and solar have guaranteed income even if discarded !



Sustainable Energy without the Hot Air

- David Mackay recognized that 100% renewables can't work (see his last Interview on you tube)
- To get through winter we need - Nuclear, Biomass, CCS
- But if we install this then we don't actually need renewables at all!
- This is why the renewable lobby is vehemently anti-nuclear !
- Long term (200 years?) we will get nuclear fusion power.
- So the future must be Nuclear.
- Otherwise we return to 18th Century subsistence !!

Climate Emergency Activists & Carpetbaggers

- Are more dangerous than actual climate change itself....Why?
- They force governments to react & placate them by closing Gas & Coal plants, building ever more wind & solar farms.
- These are temporary, unreliable and unsustainable half cocked-solutions.
- Instead we need a long term nuclear plan like France had in the 1980s following the OPEC crisis
- 10 large EPR stations of 3GW could supply all UK power!
- UK acting alone won't actually change global CO2 levels

Conclusion

- Human civilization will either thrive or disappear over the next 2000 years, depending on the choices we make now.
- “Renewable energy” can’t renew itself every 20 years..
- International trade depends on shipping. What will replace them - Sailing ships ?
- Nuclear Energy is our last chance to live in harmony with nature for the long term. Excess energy at night = synthetic fuel....
- All primary energy on earth is anyway of nuclear origin (sun, geothermal).
- Accept this fact and future generations will be fine!