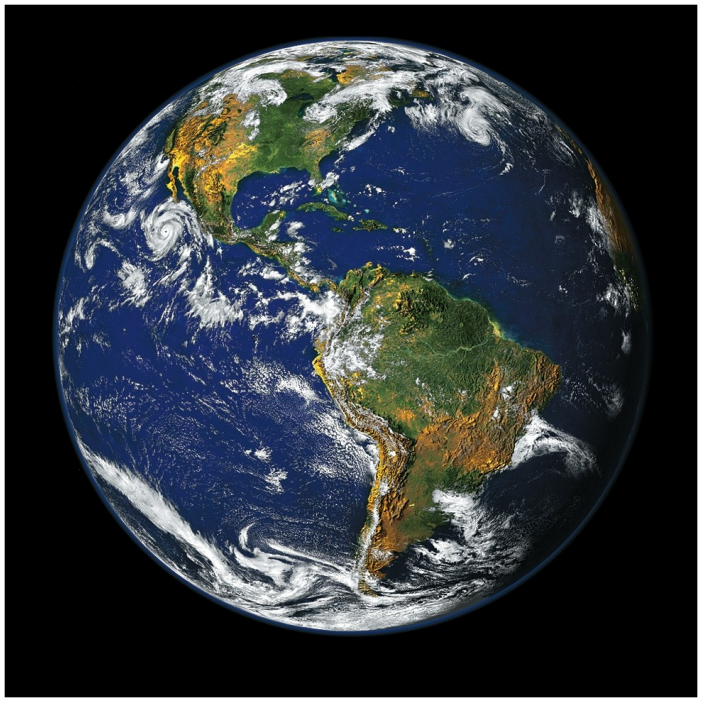

Climate Science in a Nutshell

In Celebration of Earth Day

April 21, 2015

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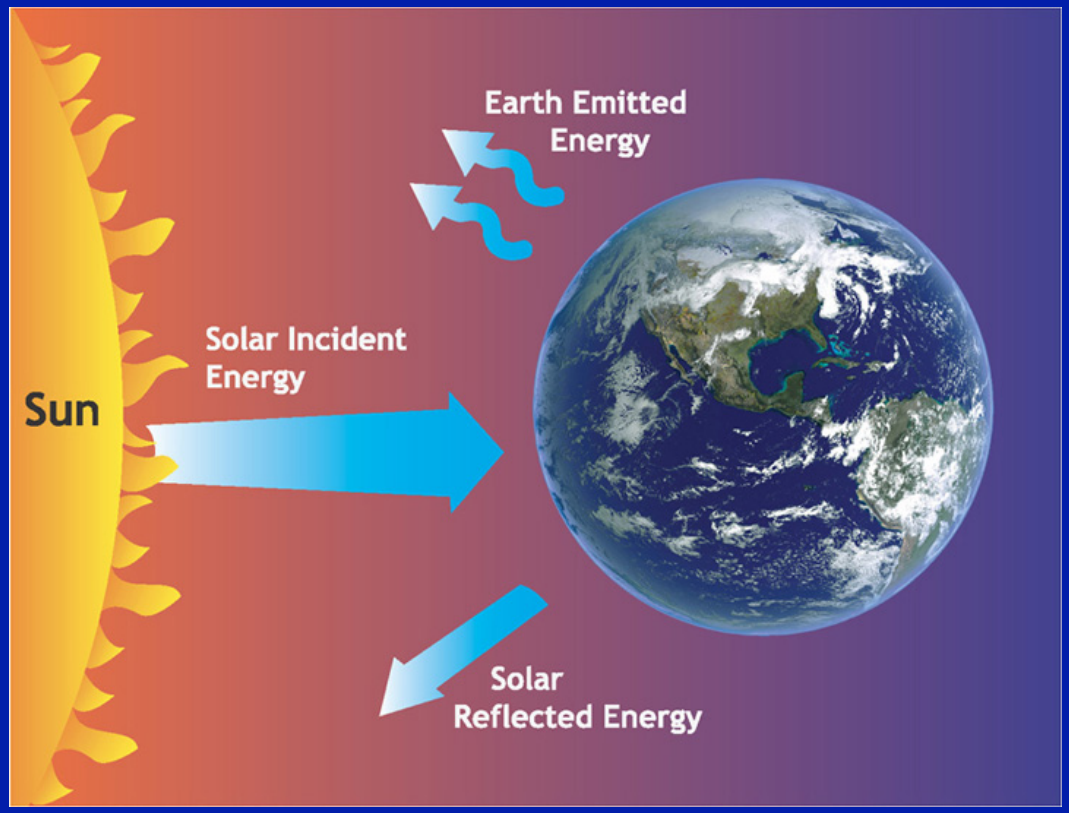
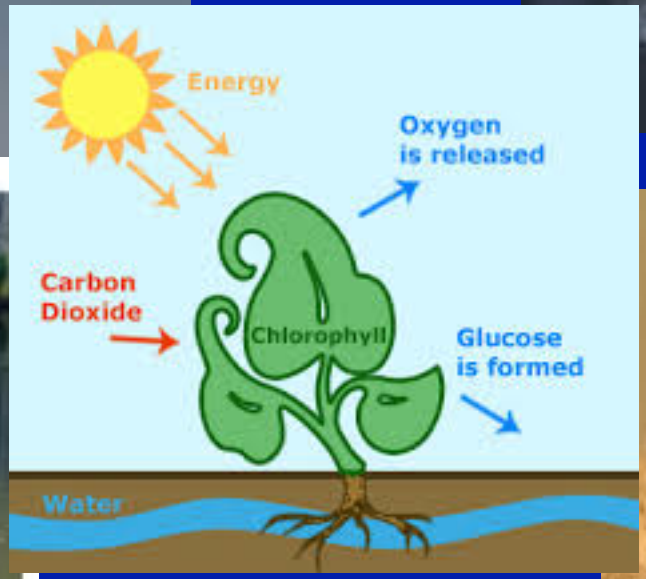
CO_2 regulates the planet's temperature through the Greenhouse effect.



The complex molecules in the air, such as CO_2, partially prevent the heat from radiating back to space, trapping the heat, thereby keeping the planet warm and habitable. Too much of it makes the planet too hot.

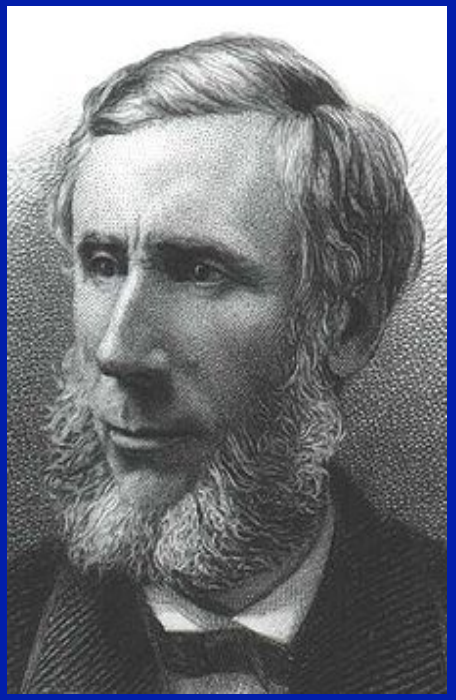
CO_2 is a natural gas.
It is released by breathing animals and taken up by plants during photosynthesis.
All life depends on it. Good gas!



The physics of the 'misnamed' greenhouse effect has been known for almost 200 years.

Joseph Fourier computed that the Earth should be much colder than it is (1824, 1827)

+ 30 °F = 18 °C



John Tyndall, January 1863

Measured the absorption and emission of radiation by CO_2 in air.

Svante Arrhenius, 1896

Calculated in detail effect of CO_2 on Earth's temperature.

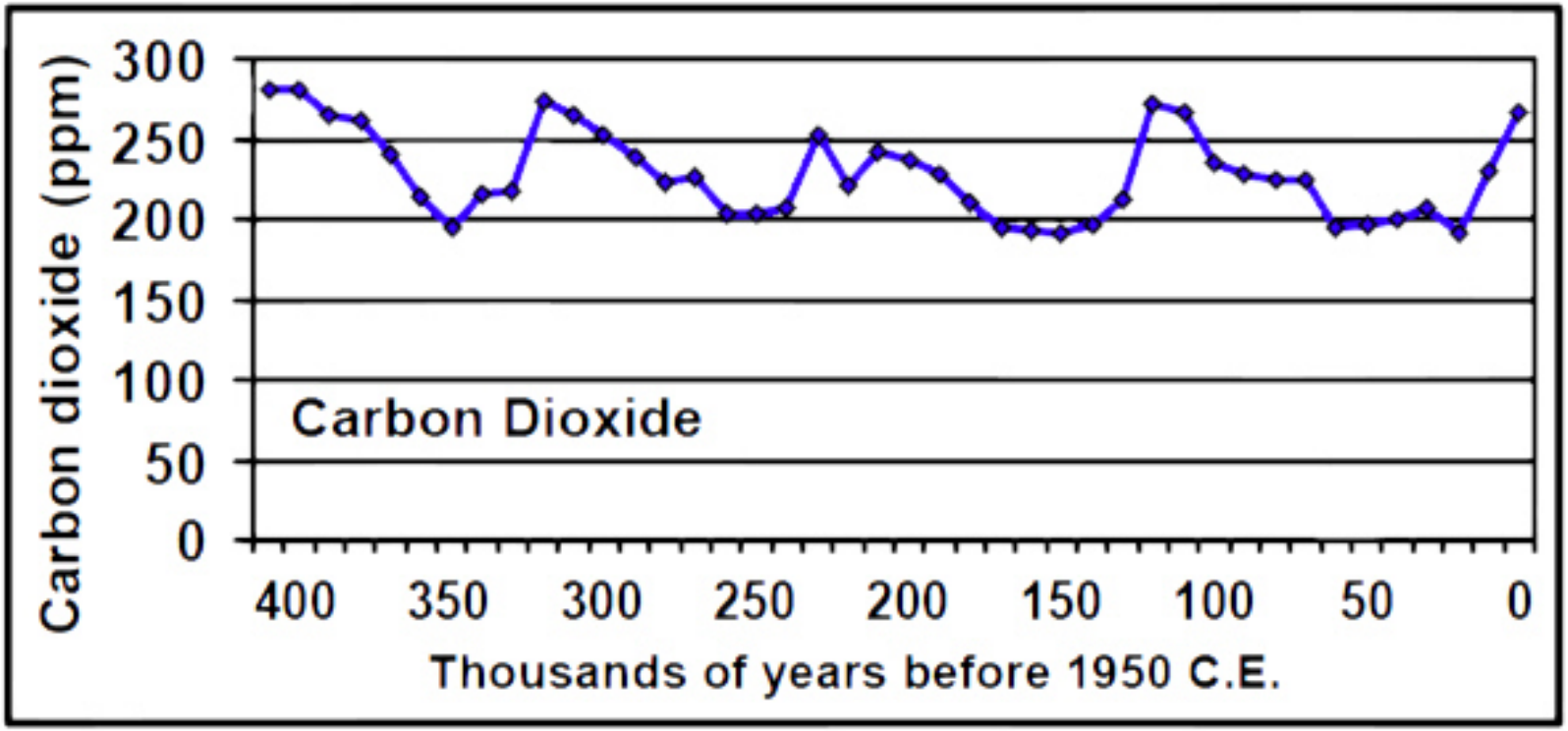
The physics is well understood and straightforward.
Does not depend on models.

CO_2 is released by burning fossil fuels.

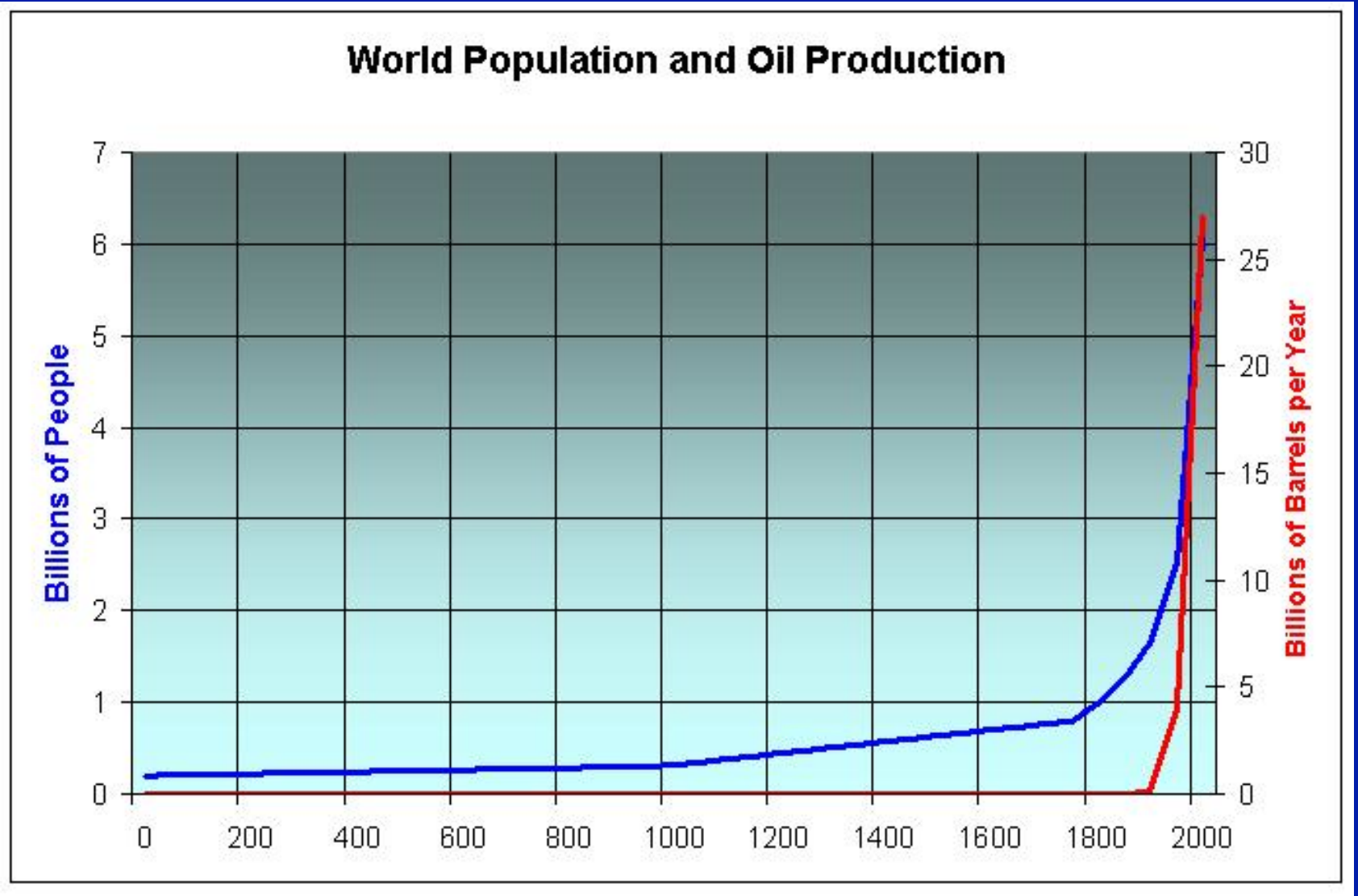
Got to love 'em: These fuels have supported an exploding population and a fantastic lifestyle for many (but not all).

Yes, denier, climate does change all the time.

CO_2 for the last half million years



Population, then oil



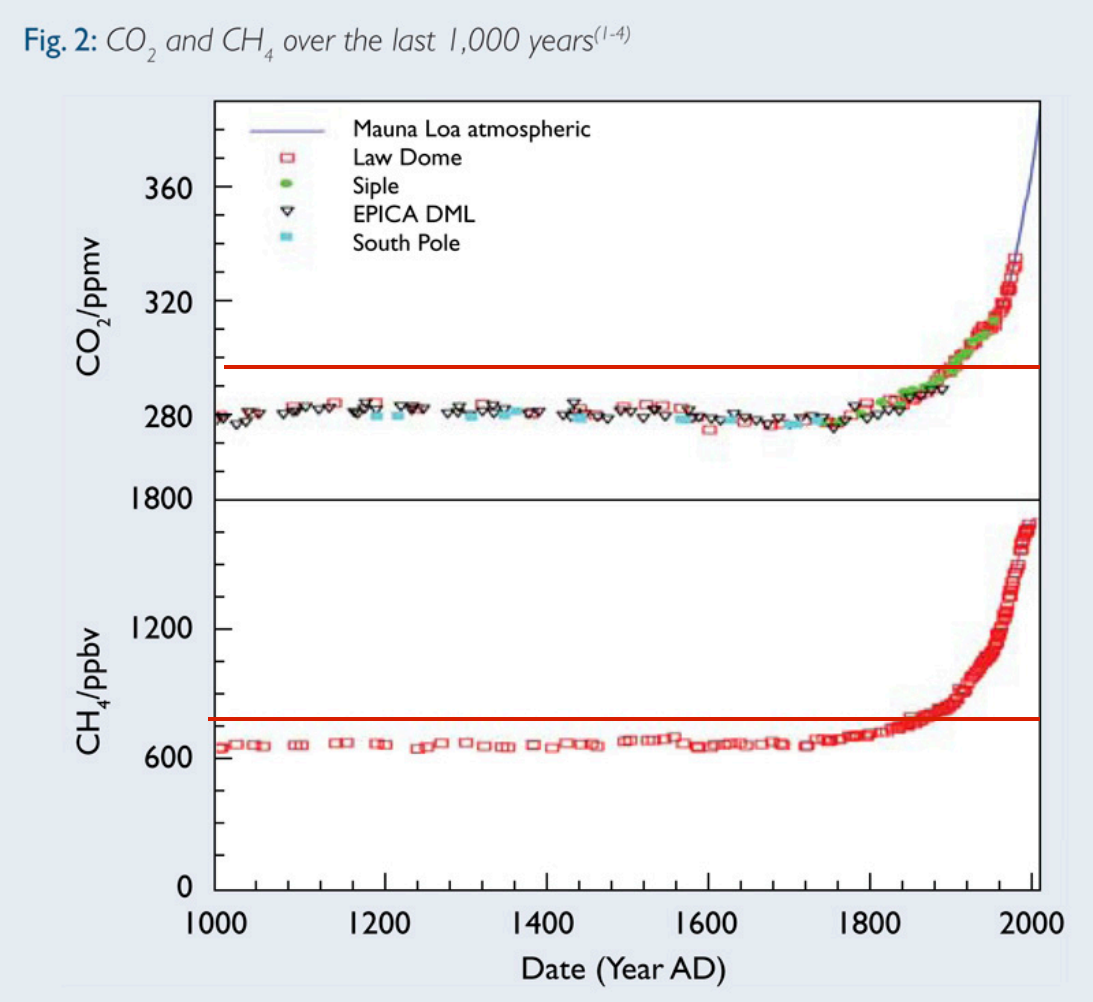
Rate of change of CO_2!!

Atmospheric CO_2 rates
Volcanoes: 0.13 gigaton to 0.44 gigaton per year
Human activities: 35 gigatons (2010)

1000 years

CO_2

CH_4

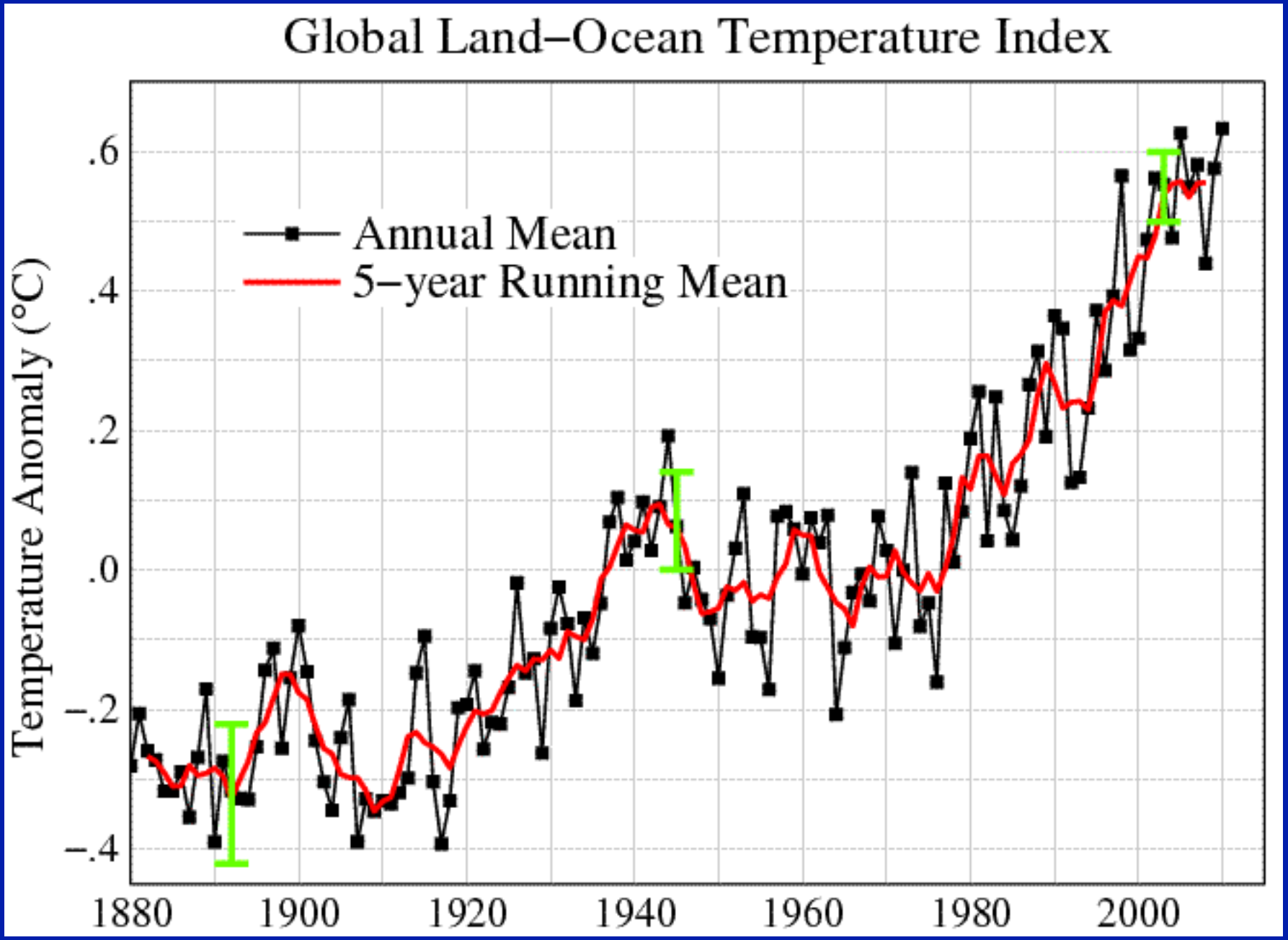


red lines indicate maximum for last ½ million years

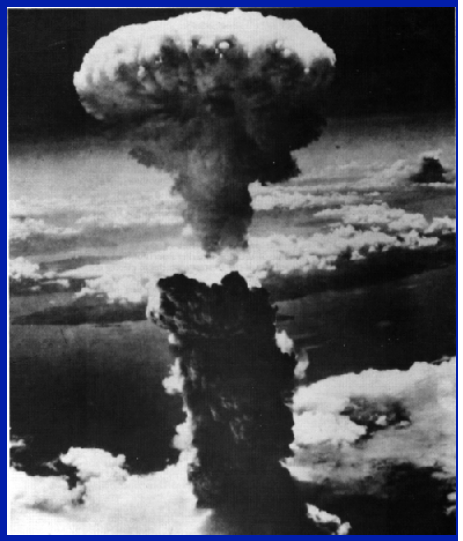
The last time CO_2 was at 400 ppm was 3 to 5 million years ago.

We are literally worried about the extinction of homo sapiens.

- Global temperatures 3 to 4 ^{o}C warmer than today (5.4 to 7.2 ^{o}F).
- Polar temperatures were as much as 10 ^{o}C warmer than today (18 ^{o}F).
- The Arctic was ice free.
- Sea level was at least 5 meters higher.
- Coral reefs suffered mass die-offs.

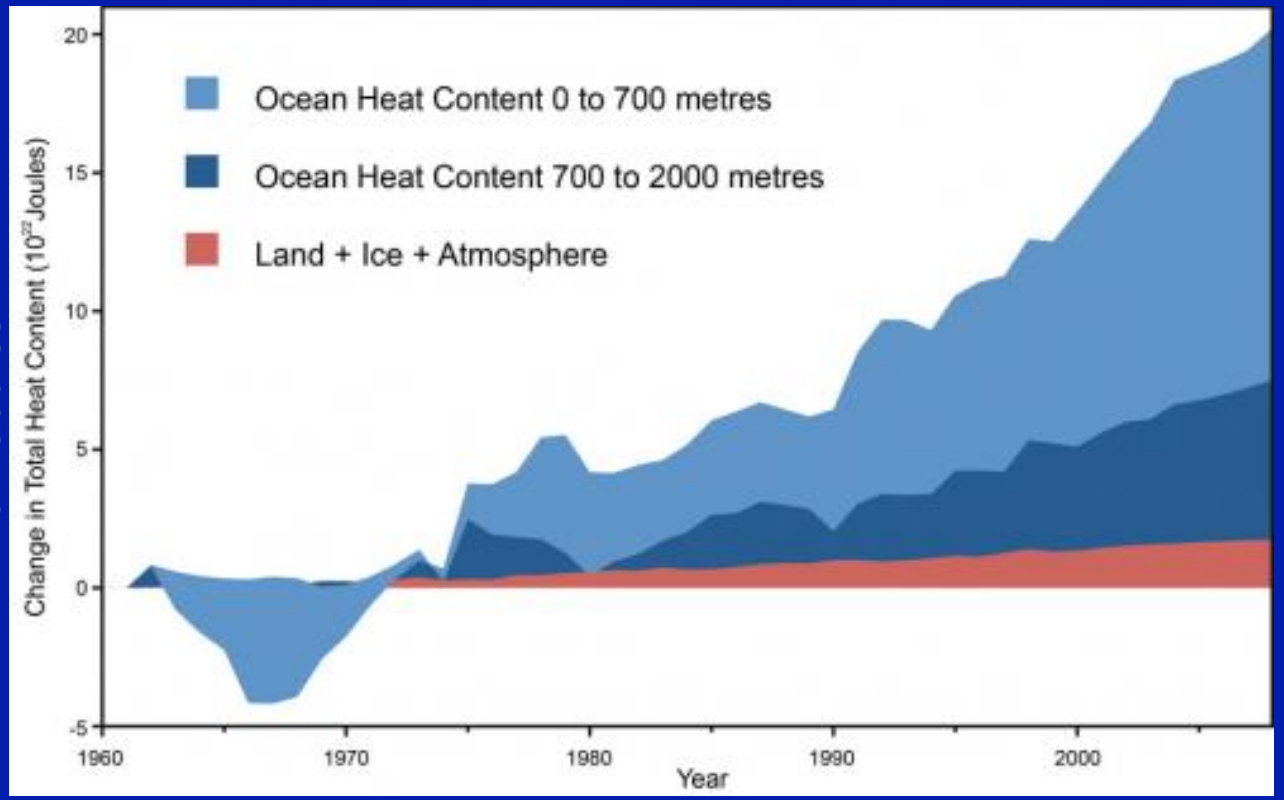

Global Land–Ocean Temperature Index
Annual Mean
5–year Running Mean
Temperature Anomaly (°C)
.6
.4
.2
.0
–.2
–.4
1880
1900
1920
1940
1960
1980
2000

Excess heat is prodigious



Our climate is accumulating
4 Hiroshima atomic bombs
worth of heat every second.

Most of the
energy is
going to heat
the oceans.



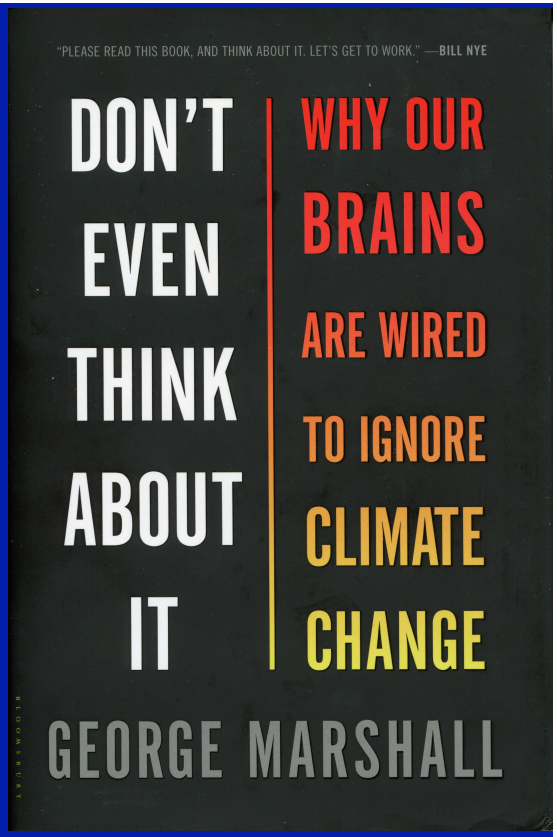
A human dilemma

CO_2 is a good thing

CO_2 is a bad thing

Can't see it or feel it or taste it.

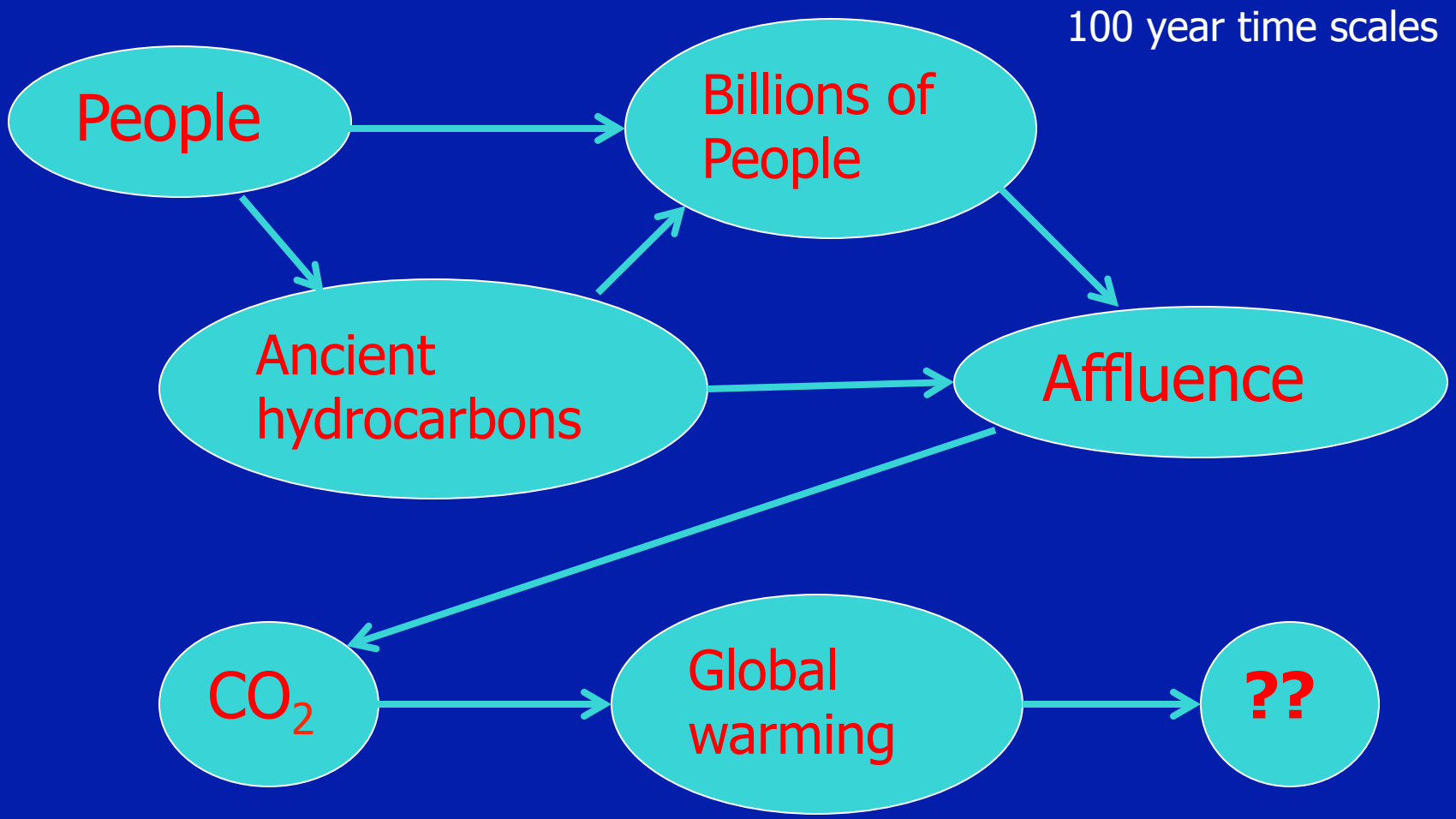
Its impacts are small and in the future.



Examples of "too much of a good thing" are part of our lives:
A glass or two of wine at dinner is a good thing; a whole bottle of wine might get you killed in an accident on the way home.

Proverbs 23:31-32
Do not look at wine when it is red, when it sparkles in the cup and goes down smoothly. In the end it bites like a serpent and stings like an adder.

Will this lead to the extinction of homo sapiens?



What to do?

Stop hunting for and burning fossil fuels!

Home, Transportation, Food, Investments and Policy

- Use less energy (your favorite here)
  - LED bulbs
  - Eat vegan, eat local, grow local
  - Recycle, divest
- Develop sustainable economics
- Convert to renewables: e.g. wind and solar
- Carbon tax to help incentivize renewables
  - Citizen's Climate Lobby (CCL) Carbon fee and dividend

Citizens Climate Lobby

Proposal

Collect fee
$15 per ton of
CO_2 at wellhead
or port of entry
[fee rises $10/yr]

All monies returned to households
1 share per adult
0.5 shares per child <18yrs
maximum 3 shares per family

2 of 3 households have net gain of $.

CO_2 emissions are reduced

Renewable energy sources are stimulated. Market will choose the best.

Paul’s Letter to the Galatians 6:9

"And let us not be weary in doing good, for in due season we shall reap, if we faint not.”