



A Presentation Of

The North Texas Skeptics

Working to help people avoid dumb ass mistakes since 1987

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Anthropogenic Global Warming (AGW)



AGW Basics

- **Earth maintains a temperature balance due to a number of factors.**
- **Solar energy flux (in)**
- **Nuclear decay (in)**
- **Tidal dissipation (in)**
- **Reflective radiation (out)**
- **Thermal radiation (out)**



Thermal Balance Factors

- **Solar flux varies over million-year cycles.**
- **Nuclear decay declines exponentially.**
- **Tidal dissipation declines.**
- **Reflective and radiated losses are affected by atmospheric absorption and can be impacted by human activity.**



The Bad News

- **Human activity supplements long-term changes in biosphere (air, water) temperatures.**
- **AGW produces temperature rises much more rapidly than would ordinarily occur.**
- **The Earth biosphere will not well tolerate a rapid rise in temperature.**



The Real Bad News

- **AGW can produce 3 C rise this century.**
- **Warming oceans will expand, raising sea level 3 feet.**
- **Melting land ice can raise sea level tens of feet.**
- **Regional climate changes (warmer, cooler, wetter, dryer) can disrupt economies**



Worst Case

- **Warmer temperatures → less snow**
- **Less snow → less reflection**
- **Less reflection → warmer temperatures**
- **Repeat (positive feedback—runaway warming)**
- **Can result in catastrophic melting of polar ice**



Atmospheric Facts

- Atmosphere weighs at most 5.665×10^{15} tons.
- Atmosphere is presently 0.0004 CO₂ by volume.
- 3348 billion tons of CO₂ in the atmosphere.
- One ton of carbon (coal) → 3.67 tons CO₂
- One ton petroleum → 3.32 tons CO₂
- 0.221 tons per automobile per year

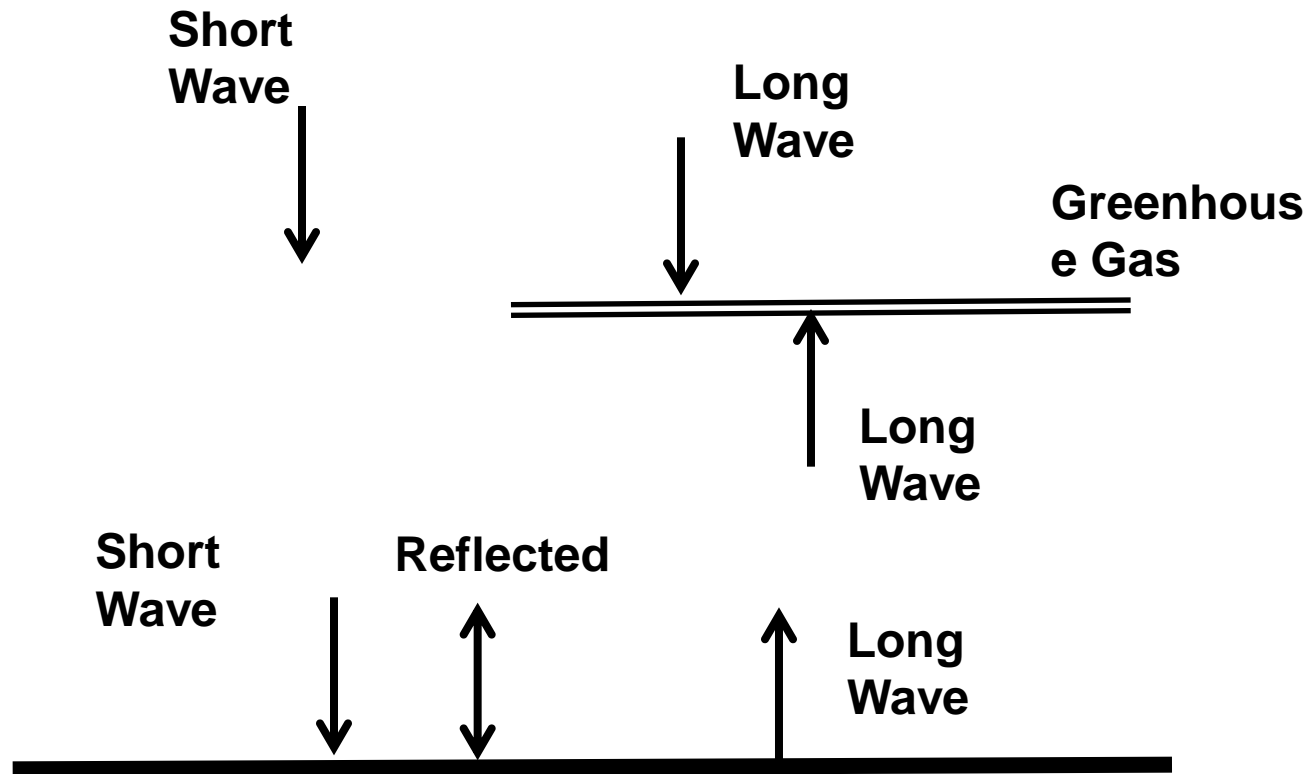


Greenhouse Gases

- **Water**
- **Carbon dioxide**
- **Methane**
- **Absorb long-wave infra red radiation**
- **Earth would be 33 C cooler without greenhouse gases.**

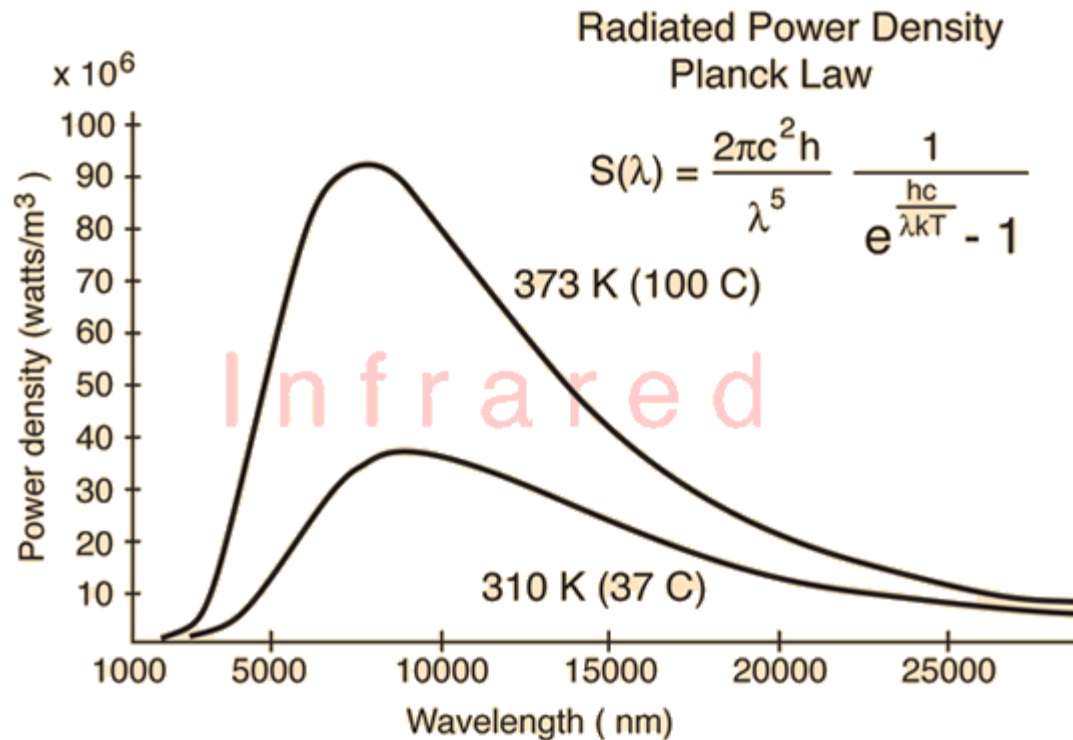


Greenhouse Effect



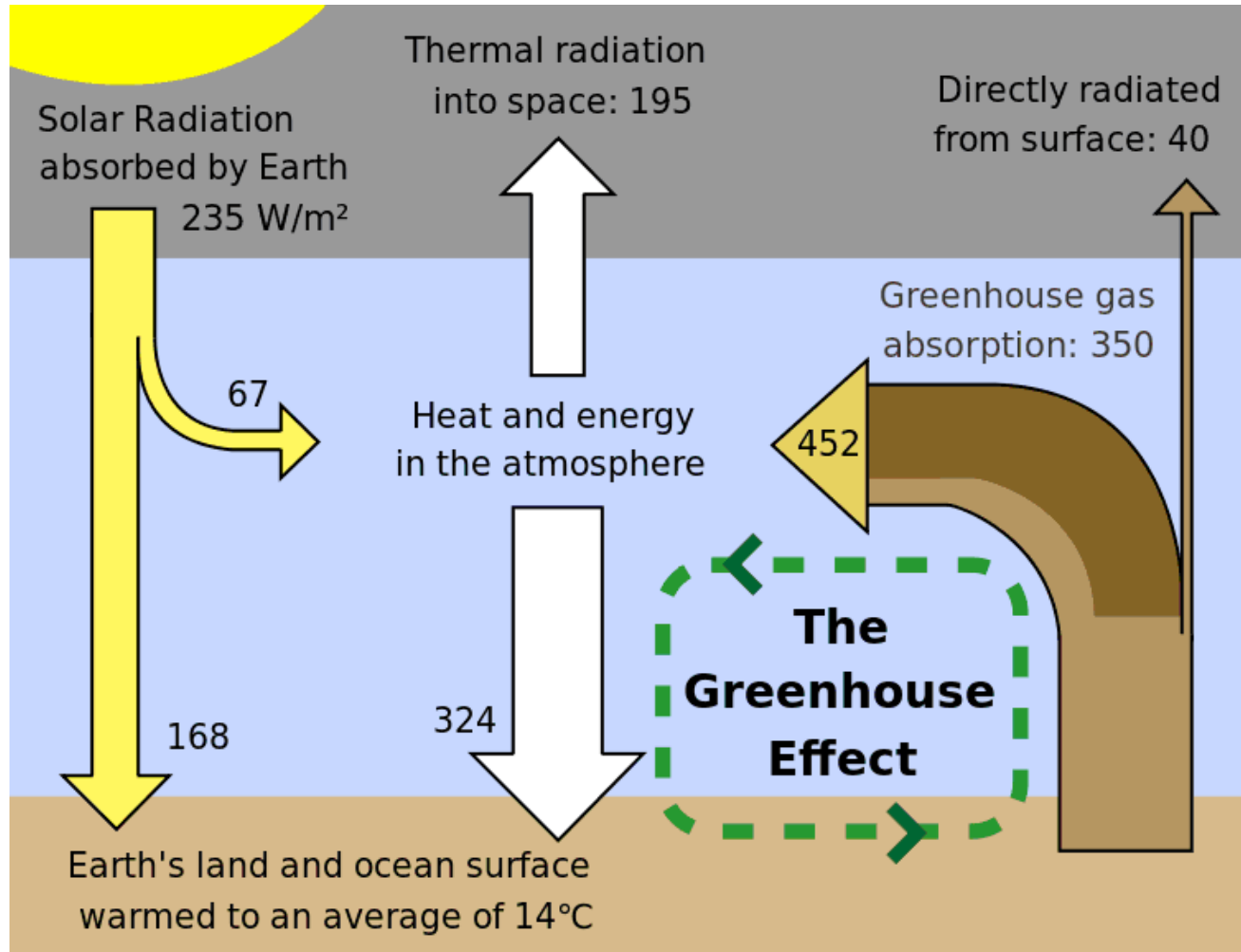


Black Body Equilibrium



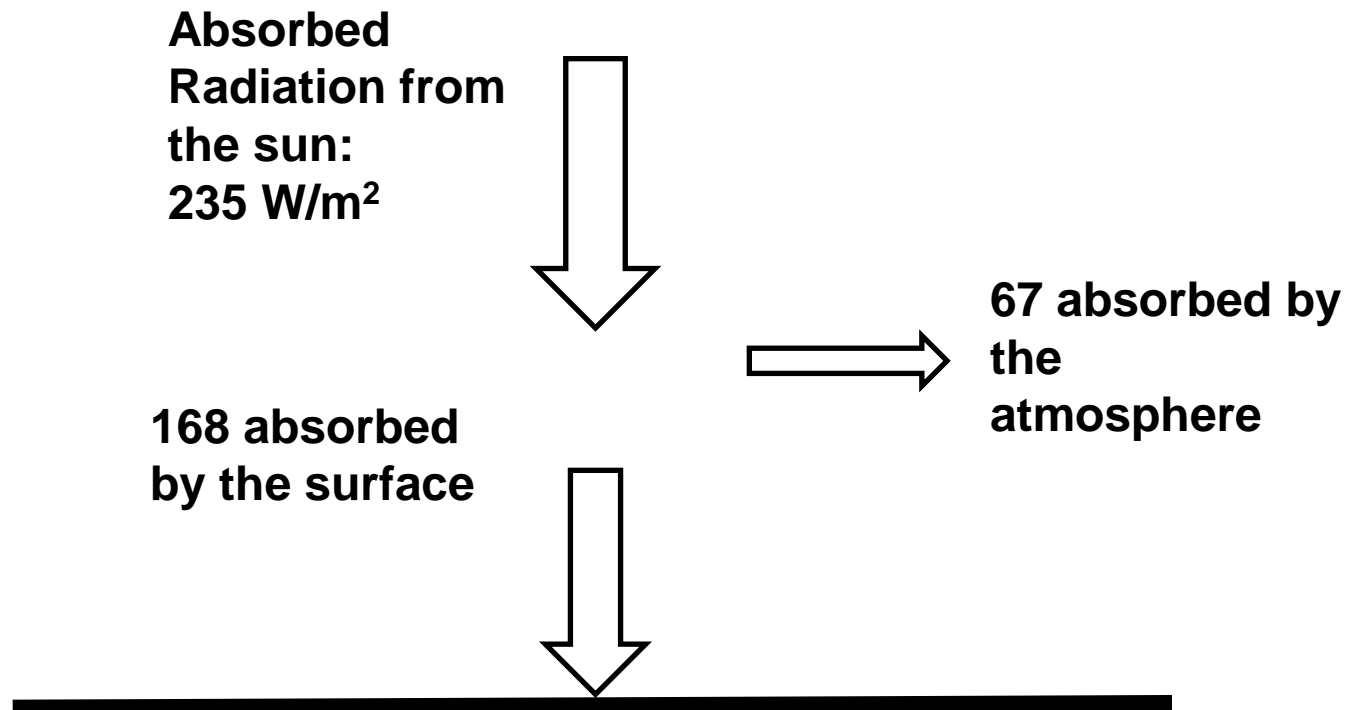


The Greenhouse Effect



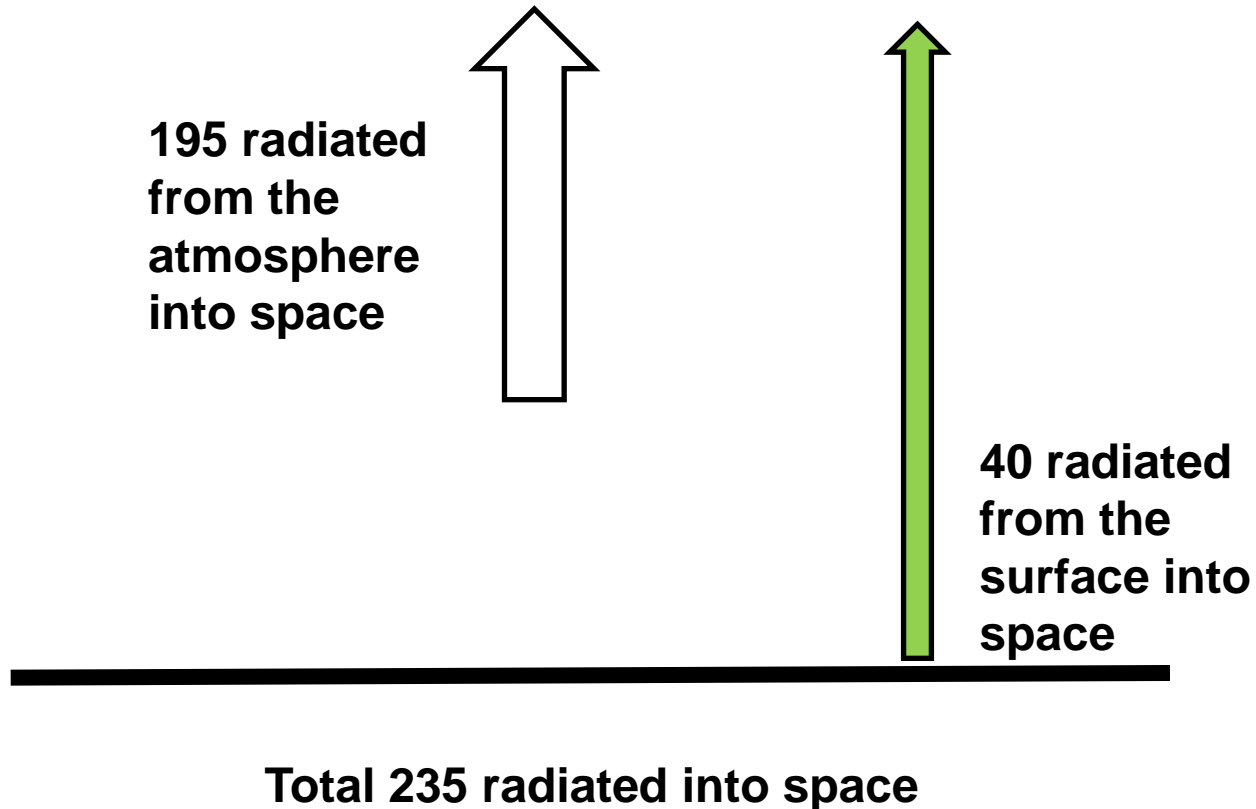


The Greenhouse Effect



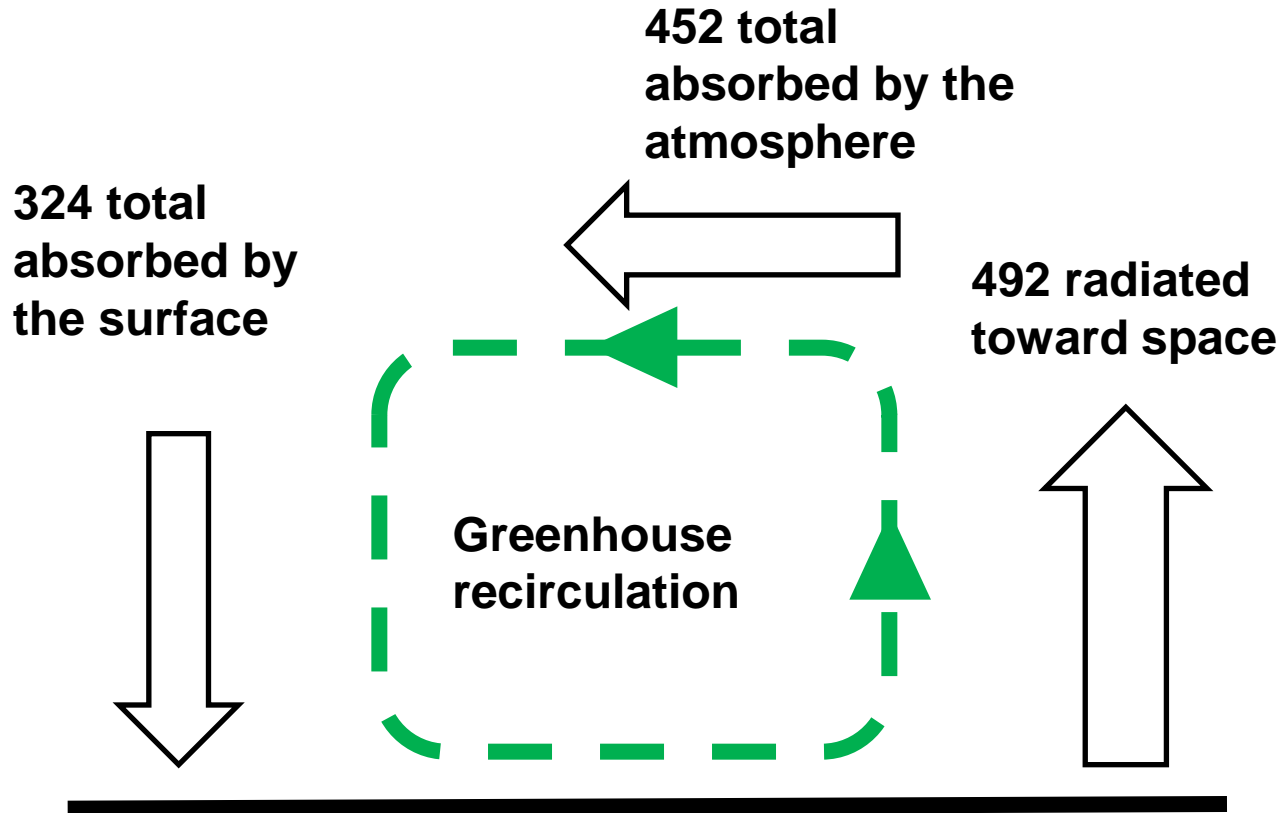


The Greenhouse Effect





The Greenhouse Effect

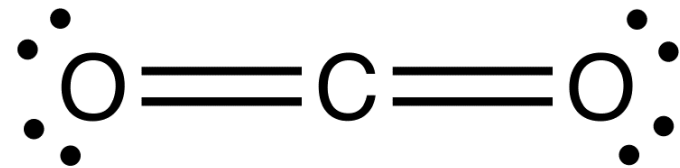




The Physics

Carbon dioxide is a [greenhouse gas](#), transparent to incoming visible light from the sun but absorbing outgoing infrared radiation from the ground at its two infrared-active vibrational frequencies (see Structure and bonding above). Like all gases, the absorbed energy can be redistributed by molecular collisions which heat the atmosphere.

[Source: http://en.wikipedia.org/wiki/Carbon_dioxide]



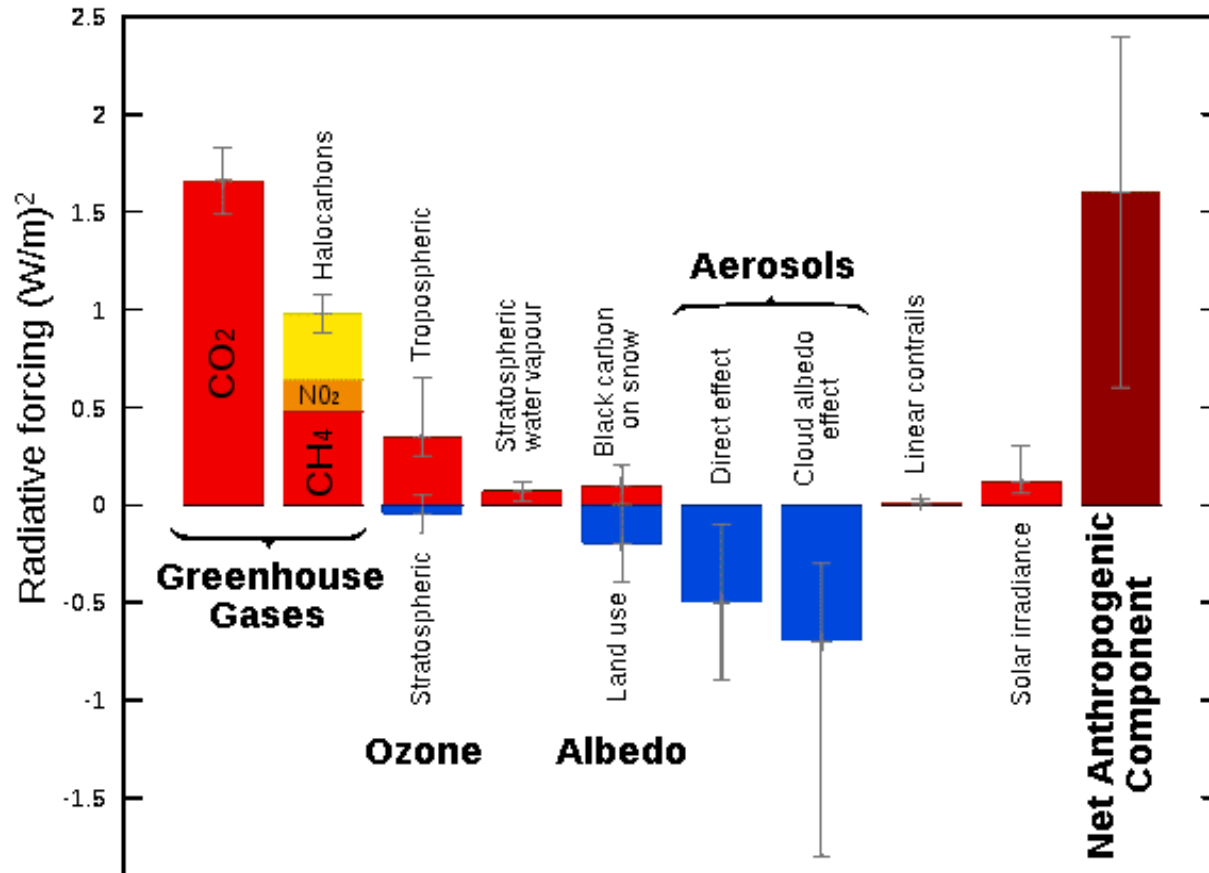
Formal Charge	0	0	0
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Oxidation State	2-	4+	2-
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Relative Forcing

Radiative Forcing Components





Greenhouse Gases

Compound	Formula	Contribution (%)
Water vapor and clouds	H ₂ O	36–72%
Carbon dioxide	CO ₂	9–26%
Methane	CH ₄	4–9%
Ozone	O ₃	3–7%



Life Of Greenhouse Gases

Atmospheric lifetime and **GWP** relative to CO₂ at different time horizon for various greenhouse gases.

Gas name	Chemical formula	Lifetime (years)	Global warming potential (GWP) for given time horizon		
			20-yr	100-yr	500-yr
Carbon dioxide	CO ₂	See above	1	1	1
Methane	CH ₄	12	72	25	7.6
Nitrous oxide	N ₂ O	114	289	298	153
CFC-12	CCl ₂ F ₂	100	11 000	10 900	5 200
HCFC-22	CHClF ₂	12	5 160	1 810	549
Tetrafluoromethane	CF ₄	50 000	5 210	7 390	11 200
Hexafluoroethane	C ₂ F ₆	10 000	8 630	12 200	18 200
Sulfur hexafluoride	SF ₆	3 200	16 300	22 800	32 600
Nitrogen trifluoride	NF ₃	740	12 300	17 200	20 700

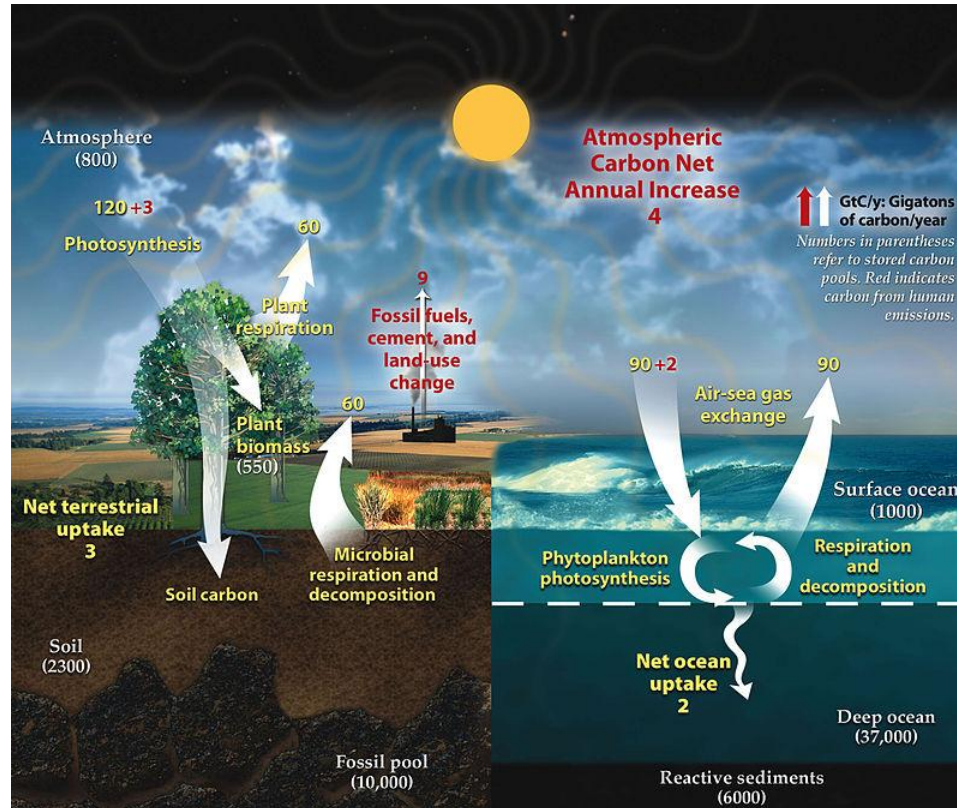


Concentration

Gas	Pre-1750 tropospheric concentration ^[43]	Recent tropospheric concentration ^[44]	Absolute increase since 1750	Percentage increase since 1750	Increased radiative forcing (W/m ²) ^[45]
Carbon dioxide (CO ₂)	280 ppm ^[46]	395.4 ppm ^[47]	115.4 ppm	41.2%	1.88
Methane (CH ₄)	700 ppb ^[48]	1893 ppb / ^[49] 1762 ppb ^[49]	1193 ppb / 1062 ppb	170.4% / 151.7%	0.49
Nitrous oxide (N ₂ O)	270 ppb ^{[45][50]}	326 ppb / ^[49] 324 ppb ^[49]	56 ppb / 54 ppb	20.7% / 20.0%	0.17
Tropospheric ozone (O ₃)	237 ppb ^[43]	337 ppb ^[43]	100 ppb	42%	0.4 ^[51]



Carbon Cycle

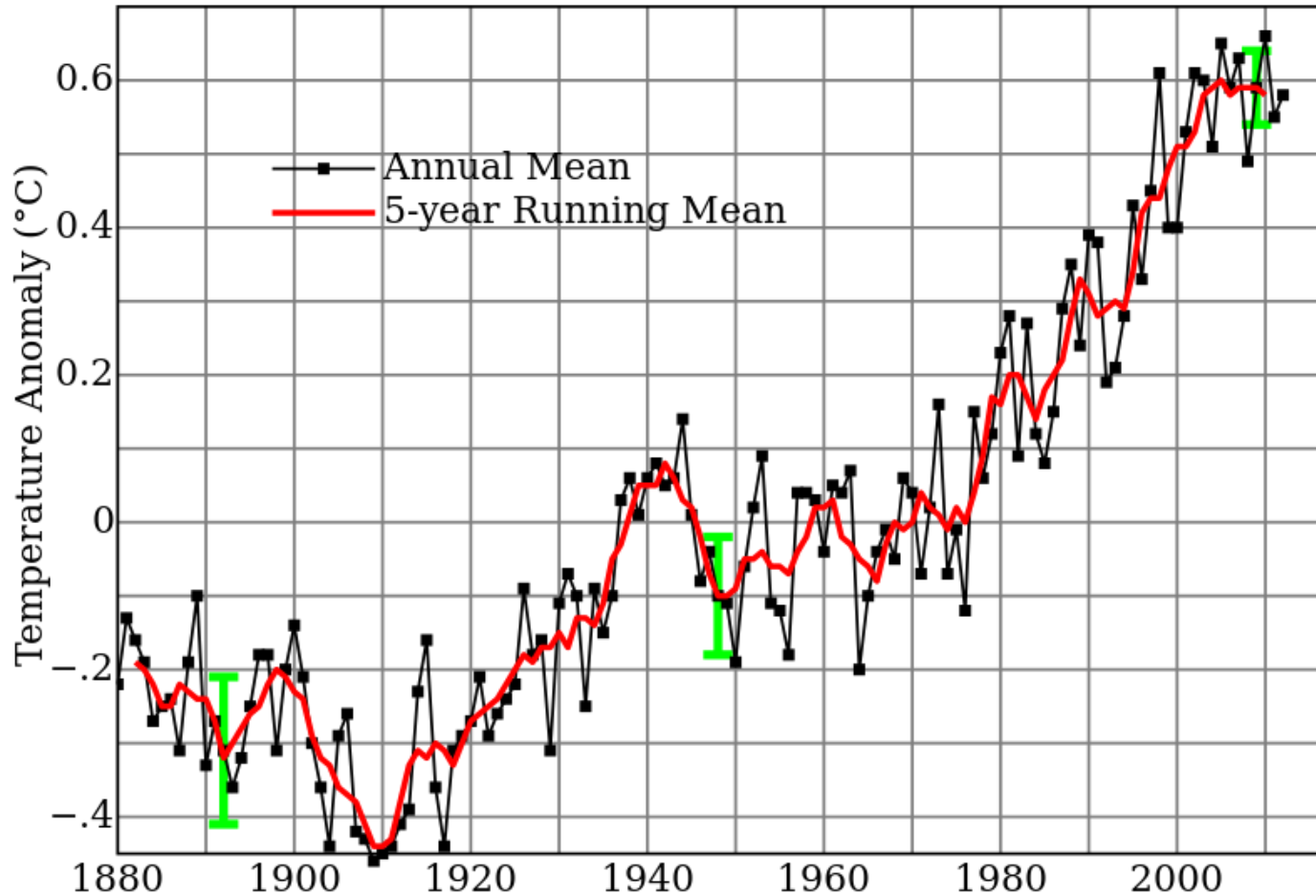


This diagram of the fast carbon cycle shows the movement of carbon between land, atmosphere, and oceans in billions of tons of carbon per year. Yellow numbers are natural fluxes, red are human contributions in billions of tons of carbon per year. White numbers indicate stored carbon.



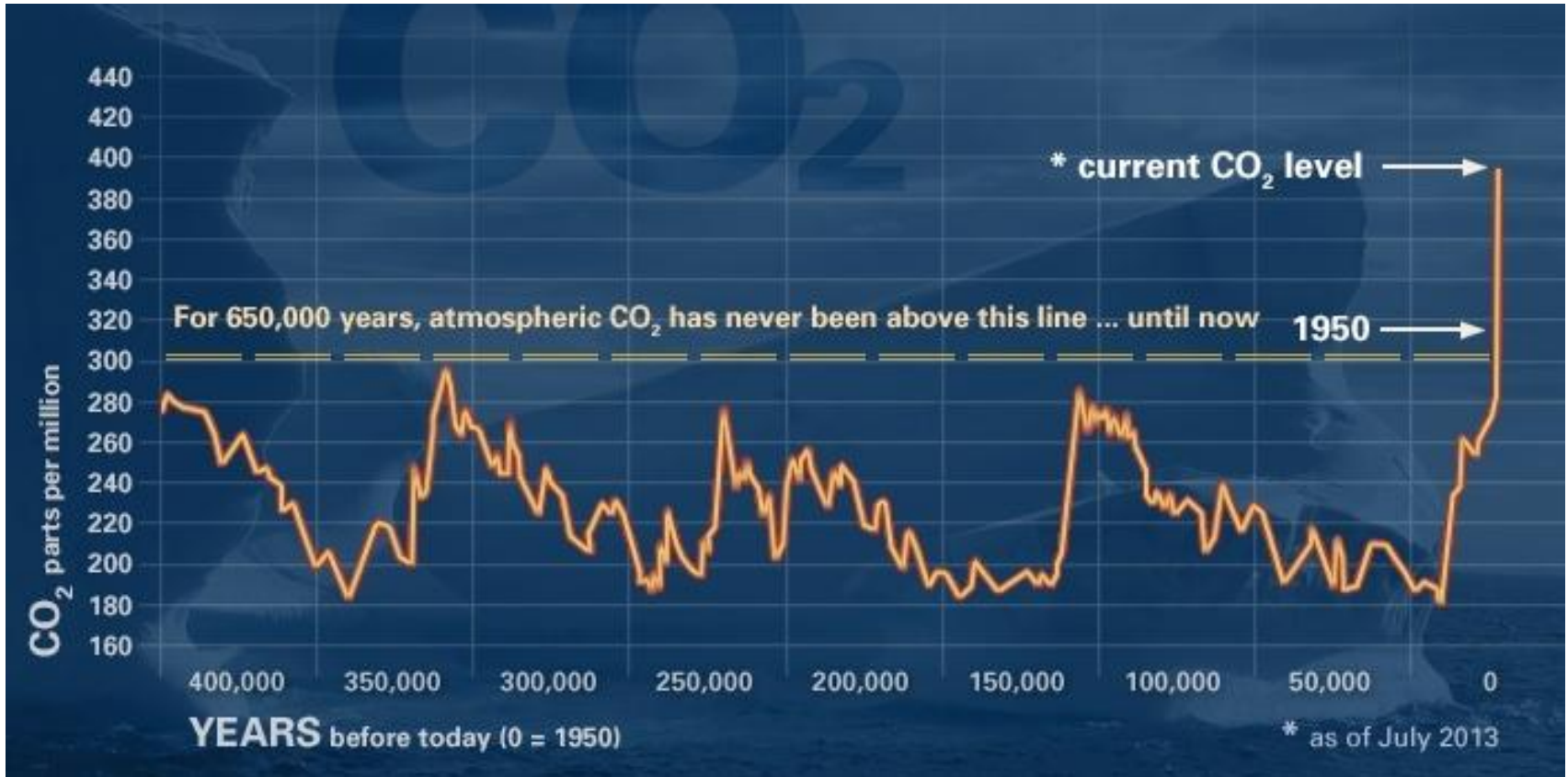
The Evidence

Global Land-Ocean Temperature Index



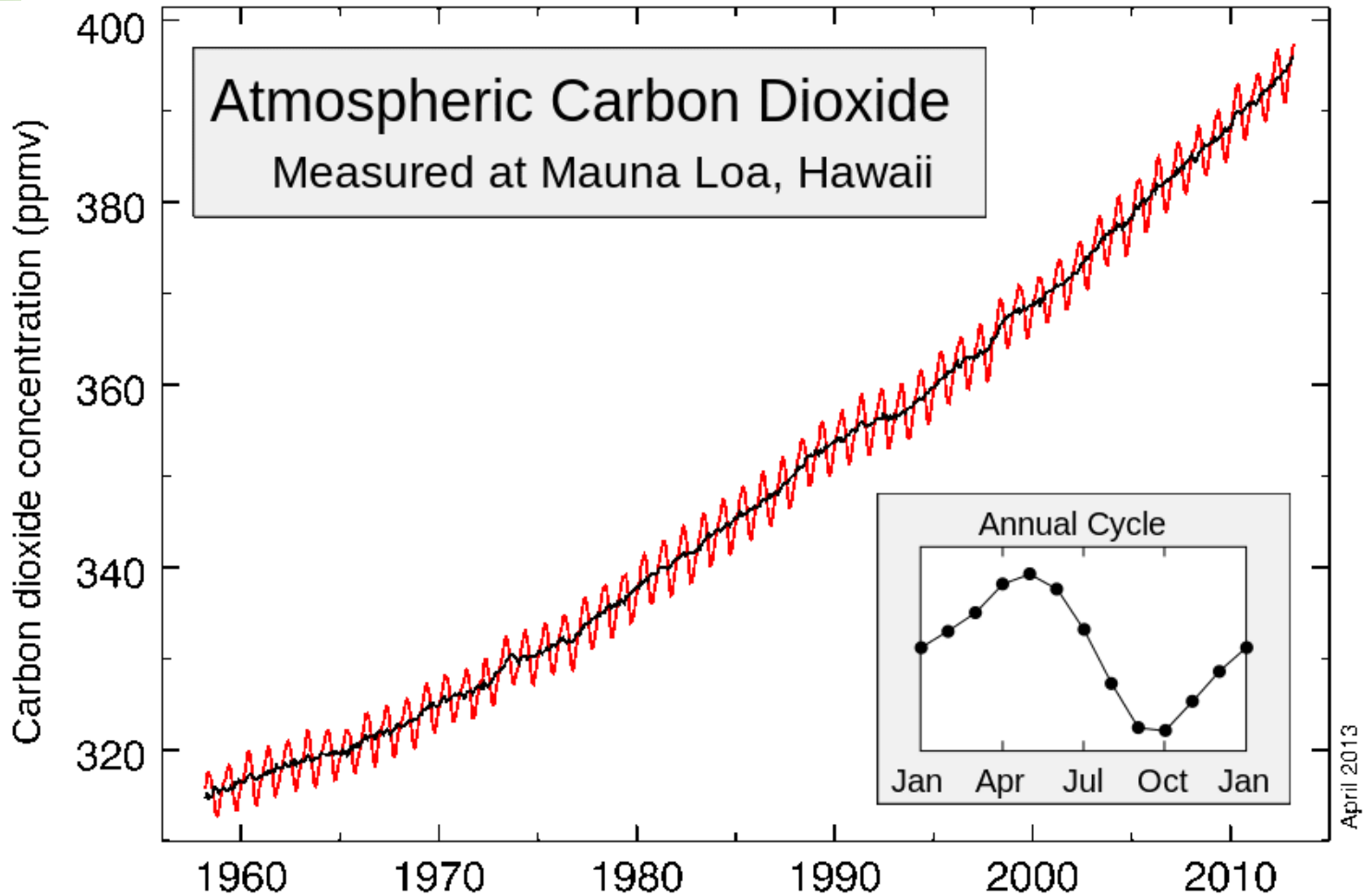


Evidence Of Warming





Evidence Of Warming





Human Contribution

Human activity since the [Industrial Revolution](#) has increased the amount of greenhouse gases in the atmosphere, leading to increased radiative forcing from CO₂, methane, [tropospheric ozone](#), [CFCs](#) and [nitrous oxide](#). According to work published in 2007, the [concentrations](#) of CO₂ and methane have increased by 36% and 148% respectively since 1750. These levels are much higher than at any time during the last 800,000 years, the period for which reliable data has been extracted from [ice cores](#). Less direct geological evidence indicates that CO₂ values higher than this were last seen about 20 million years ago. [Fossil fuel](#) burning has produced about three-quarters of the increase in CO₂ from human activity over the past 20 years. The rest of this increase is caused mostly by changes in land-use, particularly [deforestation](#). Estimates of global CO₂ emissions in 2011 from fossil fuel combustion, including cement production and gas flaring, was 34.8 billion tonnes (9.5 ± 0.5 PgC), an increase of 54% above emissions in 1990. Coal burning was responsible for 43% of the total emissions, oil 34%, gas 18%, cement 4.9% and gas flaring 0.7% In May 2013, it was reported that readings for CO₂ taken at the world's primary benchmark site in [Mauna Loa](#) surpassed 400 [ppm](#). According to professor [Brian Hoskins](#), this is likely the first time CO₂ levels have been this high for about 4.5 million years.

[Source: http://en.wikipedia.org/wiki/Global_warming]



Consequences

- **Sea level rise is the worst. A rise of just a few feet will encroach on countries like Bangladesh and the Maldives. The Mississippi Delta is at sea level. New York City and Washington D.C are just above.**
- **Effects on crops**
- **More energy in the air → stormy weather**
- **Less rain | more rain?**



The Opposition

- **Heartland Institute**
- **American Legislative Exchange Council**
- **Petroleum industry**
- **Coal industry**
- **Political fuddy-duddies**
- **Glenn Beck**
- **Senator James Inhofe**



Paid Climate Deniers

Wei-Hock (Willie) Soon

But newly released documents show the extent to which Dr. Soon's work has been tied to funding he received from corporate interests.

He has accepted more than \$1.2 million in money from the fossil-fuel industry over the last decade while failing to disclose that conflict of interest in most of his scientific papers. At least 11 papers he has published since 2008 omitted such a disclosure, and in at least eight of those cases, he appears to have violated ethical guidelines of the journals that published his work.

The documents show that Dr. Soon, in correspondence with his corporate funders, described many of his scientific papers as "deliverables" that he completed in exchange for their money. He used the same term to describe testimony he prepared for Congress.



The Real Villains

- **Not the oil companies**
- **Not the coal companies**
- **The real villains are us (we).**
- **If we stopped purchasing these products the companies would stop drilling and mining.**



The Solution

- **Stop using fossil fuel.**
- **Cannot stop pumping oil.**
- **If the oil pumps stopped today, within a year in the order of 1 billion people would starve to death.**
- **There is no hybrid jet liner.**
- **Produce carbon-based fuel from atmospheric CO₂.**



Bad Solutions

- **Ethanol**
 - Not carbon neutral
 - Competes for vital resources
- **Hydro power**
 - Limited resource
 - Does not scale well
 - Ecological and geological disruption



Good Solutions

- **Solar power**
 - 1000 Watts per square meter
 - Only works when the sun shines
 - Becoming competitive
- **Wind power**
 - Only works when the wind blows
 - Currently competitive
- **Nuclear power (hydrogen?)**
 - No hydrogen solution in sight
 - Finite uranium source



A Basic Fact

**Human well being, health, longevity,
satisfaction of life—all are proportional to
individual energy consumption.**



The Hydrocarbon Solution

- **Hydrocarbons are the ideal energy storage medium.**
- **Ethanol is not a hydrocarbon.**
- **Source from natural vegetation**
- **Source from atmospheric CO₂**
- **Low down-channel impact**
- **Technology is lacking.**



Fuel From Plants

- **Plants are harvested for the carbon.**
- **Removing the plants also removes plant nutrients from the growing area.**
- **For sustainable production the nutrients need to be returned to the growing area.**



Arguments Against AGW

- **Human contribution is insignificant compared to natural variations.**
- **AGW is a liberal conspiracy to promote overbearing government regulation.**
- **AGW research is driven by greed for grant money.**



Contact Us

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Contact John Blanton jf_blanton@yahoo.com

This presentation is on-line at ntskeptics.org.+