Testimony of Angelo Campanella, Ph.D., P.E., FASA

With regard to the "Hite Amendment" requesting diminished setbacks for wind turbines, I present this testimony as to the moot need for any more wind turbines in Ohio or their repositioning:

Unction has been expressed to accommodate wind turbines on the basis that they are "essential" to provide power sources alternative to fossil fuel; fossil fuel being suspected of depletion and CO2 "pollution" in the foreseeable future.

However facts have emerged that:

1- Tthere is no depletion threat; new fuel sources are being developed and discovered yearly;
2- CO2 is now recognized as as a non-pollutant, instead it fosters food crop production, and being otherwise an innocuous air constituent.
3- The only positive attribute left for Green energy is as a standby power source.
4- As such wind power is available on the average but 25% of the time and carries with it a large amount of land area and environmental nuisance not to mention maintenance and unreliability.
5- Solar is more community friendly and has a bit more time availability.

Important here is that monies and resources aimed at fostering GREEN ENERGY research and development (R&D) are being wasted.

 Wind and Solar capabilities are now really settled science. No further R&D is necessary!
Accordingly, abandon subsidies for them ASAP. Private and Public moneyed interests will balk and complain, but that's naught more than part and parcel of risk-reward investments. Time to move on.

IN SUMMARY: Energy availability in the USA is at an all-time high, CO2 is an innocuous friend and our climate is not threatened by either (attached article "InfraredClimate.pdf").
Ohio is free to balance its budget by reducing or eliminating subsidies for Green Energy and especially Wind Turbine Farms!

ABOUT THE AUTHOR:

Angelo Campanella, Ph.D., P.E., FASA - Penn State, 1955

Dr. Campanella received his Ph.D. from the Pennsylvania State University in 1955 in Physics and Electrical Engineering. He is a professional engineer in Ohio and Pennsylvania. An undergraduate elective course in meteorology sparked a life-long curiosity about atmospheric physics. He is a private pilot with over 4,900 hours of flight experience in all kinds of weather phenomena. During his 55+ year experience in infrared physics, military electronics, and applied physics he accumulated a deep understanding of the interaction of energy with space. These are combined to produce this article.

Article immediately follows:

THE GENIUS THEME

SO MUCH HAS BEEN FALSELY SAID ABOUT OUR CONSUMPTION OF ENERGY AS IF CONSUMPTION WERE IMMORAL AND WE SHOULD STOP IT.

The inference is that we (the USA) are culprits

As a scientist who has conducted years of research on movements known as "Global Warming", as "CO2" and as "Greenhouse". I find these to be faux "beliefs" that undermine our economic health and prosperity. Politically correct as they may be, these movements are counterproductive in every respect. Branching into "Climate Change" has become another ludicrous pursuit of the impossible because this AGW energy theme is FALSE. I applaud president Trump's decision to pull out of the Paris Accords.

Read On!

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Read On!

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Earth Temperature Change by
Carbon Fuel Consumption vs Solar Energy:

Angelo J Campanella

4 June, 2017. Hilliard, Ohio 43026

Background: At high noon, bright sunlight the sun gives us about a kilowatt per square yard (1,3750 watts per square meter). Some of that heats the surface receiving it. Some is immediately reflected ("Albedo"). Some is absorbed and retained for a while. Heat also arrives to countless places as the result of our burning fossil fuels. So much is now said about the threat of heat accumulation on earth due to the threat from our fossil fuel burning and the subsequent release of carbon dioxide (CO_2) into the atmosphere. These are two separate effects. The first is a heat release effect, recently termed "Anthropologic Global Warming" (AGW). The second is the "Greenhouse effect" due to CO_2 accumulation in our atmosphere, alleged because it is inaccurately compared to the sunlight warming that is promoted in vegetation-growing greenhouses.

Energy Influx: The total sunlight energy arriving on earth from the sun can be calculated from the "Solar Constant (see the data in Figure 1 for the past three decades); between 1,365 and 1,367 watts per square meter to be exact, a two watt difference. The higher amount occurs during the years of maximum sunspots occurring on the sun, and the lower value occurs when the number of sunspots is at a minimum. The sunspots are at a maximum every eleven years, and they are at a minimum 5½ years later, also every 11 years.

The calculation, detailed in Figure 3 ("InfraredAbedo.xls" spreadsheet copy available on request), proceeds as follows: Our Earth is a sphere that is eight thousand miles in diameter (12,732 kilometers to be exact). Its projected area is a disc 0that constantly intercepts and absorbs sunlight over an area of 127 million and 324 thousand square kilometers, or 127 quadrillion, 324 trillion square meters. This provides just over 174 quadrillion kilowatts of power to our planet earth. In scientific numbers, this is 1.741 times ten to the 14th Joules of energy every second. Recall that a watt-second is called a "Joule".

There are 31 million, 557 thousand seconds in a year. Combining this value with the watts per second In scientific numbers, this amounts to 5.493 times ten to the 24th joules received by the earth every year. Recall that the albedo of the earth is 0.36 (36% of the sunlight is reflected back into space by clouds), leaving only 64% of that energy, or 3.515 times ten to the 24th joules of sun energy that is retained to heat our Earth every year.

Infrared Albedo: This energy re-radiation is done constantly 24/7/52 and over the entire surface of the earth and in all directions to space, resulting in an average surface temperature worldwide of 59 F (15 C). The "infrared emissivity" averaged across all earth surfaces must be 0.88 or 88%. This means that the infrared reflectivity average across Earth must be 12%. My hypothesis is that only in the upper atmosphere (above 20,000') does the CO_2 content dominate, so that a CO_2 increase increase will increase daytime IR absorption and night tine re-radiation, altering the emissivity by a tiny amount; call it 1 %, shifting the IR emissivity up to 0.89 and the IR reflectivity (IR Albedo) down to 11%. There is little temperature change to be had from the small amount of incoming IR in sunlight compared to its light energy, but the constant IR emission night in all-directions will increase. The net effect is that our Earth can incrementally cool via atmospheric CO_2 increases.

Man's Contribution: In comparison, a total of about 500 Exajoules of energy was released by all of the fuel burning and by other modern human activities in this Earth in 2010. An Exajoule is ten to the 18th Joules. In the year 2000, man's contribution was 400 Exajoules. The United States released 100 Exajoules of that. Back in 1900, only 39 Exajoules was released world wide that year, with but 13 Exajoules being released in these United States.

If we look at the ratio of these two, 3.515 times ten to the 24th power as compared with 5 times ten to the 20th power from human energy burning, we come up with a ratio of 7,000-to-one in favor of the sunlight energy. What increase of temperature will this one seven-thousandth energy addition bring about? Small indeed.

The Sunspot Cycle: Notice that the 5.5 year sunspot variation of sunlight is two watts vs 1,365 watts, that's one-in 683, fully TEN TIMES that expected from AGW! Clearly, if we seriously want to judge the effect of "carbon" on our Climate, we should review the existing and well-known effects of sunspots on our climate and weather, then divide that by TEN! And that one-tenth is AGW!

Global Temperature Change: As for the exact AGW temperature effect: The average surface temperature of our planet Earth is determined as the balance between the energy influx of full sunlight, about 1.3 kilowatts per square meter, and the re-radiation (Black Body Infrared Radiation) of that same energy back out into cold space occurring in all directions, (24/7/52). We know this balance temperature to be about 59 degrees F (15C) on the surface where we live, and has been so historically for generations and for millennia.

Using common infrared black body physics, where the rate at which black-body radiation casts off heat energy back into cold space occurs as the fourth power of the average surface temperature, when adding those 500 Exajoules to that or 3.515 times ten to the 24th joules of sunlight energy, the recent black body balance temperature increase that results amounts to but only 0.011 degrees C (0.02F) (spreadsheet calculation accompanying) . Small AGW indeed!

It may be said that this 0.02 F value is just too small; something must be wrong with the calculation. In reality the 500 Exajoules worldwide energy emission is localized in numerous tight pockets of human activities; our "Cities". Let's assume that all the city areas in the world accrue to about 1% of the earth's surface. Thus within the areas comprising that 1%, the local heat rise would be 100 times the average value of 0.02F, or **2** degrees F. Now, that seems more reasonable; ask any weatherman about the city/country differences that he or she has noticed, and we all have noticed as well. Yes, that does match common experience!

Earth Infrared Albedo: Regarding the "Greenhouse effect": Consider this thought-experiment: "Where does the 'cold' come from that forms vegetation dew and frost on a clear night?" Not by air conduction, nor by air convection because the air is calm and the air and objects around a dew or frost site remains warm. The answer is heat energy is lost via "black body infrared radiation" directly from the vegetation surfaces and surrounding objects, passing through a largely transparent atmosphere, directly into cold outer space (this is commonly known as "Radiation Cooling").

Certainly by now, the strong inferences to the contrary of AGW are evident (e.g. the fall of the "hockey stick" theory), causing the political argument to shift first to the "Greenhouse effect" which was not properly handled by federal consultant scientists, then now to "Climate Change" which can always be a political winner because climate is already know to frequently change. This sounds a punch line in a Gilbert and Sullivan operetta (e.g. Princess Pat or Iolanthe).

"Greenhouse": The 19th Century physicist John Tyndall was the first to understand and clearly demonstrate that "transparent" air itself was capable of absorbing and also emitting infrared radiation. He also knew that the dominant gas causing this was water vapor; the CO2 concentration was orders of magnitude less and the oxygen (O2) and nitrogen (N2) were some 16,000 time less absorbent of IR! But plain air even with water and CO2 vapors is considerably less absorbent of IR than a thin layer of condensed water or "clouds". These create the overwhelming effect on earth temperature, as a clear night (no overhead clouds) is when a night chill is certain to occur, being coldest just before the dawn of the new day. Clouds offer the greatest blanket, both physically and poetically. Warm clear moist air does too when the water when both the air temperature and the air humidity are high. To be sure, some low level atmospheric warming can occur even on a "clear" night when the ambient atmosphere around and just above our buildings has a high humidity (a "sweltering" night); a recognizable "greenhouse Effect" in that case is occurring. But there are many clear winter nights where we are surrounded by cols and dry air. Those clear nights provide sub-freezing weather, definitely not a Greenhouse night, especially if there is little wind, and where we sometimes experience burst water pipes in our homes.

CO2 Change: Turning to the primary effect of more carbon dioxide (CO2) in the air: More CO2 in the air will increase the infrared emissivity of the exposed atmosphere, which may be a cooling effect on the average. This occurs by the fact that oxygen and nitrogen can neither absorb nor emit infrared radiation (Tyndall observed this first) since they are both symmetrical molecules. Only asymmetrical molecules with a dipole moment such as water vapor (H2O) and CO2 are capable of absorbing the infrared radiation energy in sunlight, and also capable of re-radiating that infrared energy back to cold space at night. Pure air is the best insulator against conduction of heat, but it is also a perfect window for infrared energy to escape. This leaves only convection (or winds) as a means the atmosphere to transfer energy to another location. Addition of H2O and CO2 vapors make air less of a window. Condensation of water vapor into clouds makes an overcast to be a warm blanket for the earth, but continues to allow heat to be radiated from cloud tops that face outer space.

"Tipping Point" and CAGW: Inferences of a "tipping point" if CO2 exceeds 400 ppm, and of CAGW (Catastrophic Anthropological Global Warming) made in recent years, are made with heavily manipulated "climate models" that do not take into consideration this fundamental infrared energy transfer mechanism known in true physics.

Cooling via Infrared Radiation: In truth, the atmospheric radiation cooling, day and night is caused predominantly by infrared radiation by the water vapor and liquid droplet and ice crystal cloud contents of the atmosphere where most of our weather occurs; i.e. near the Earth surface and up to a moderate altitude, viz to 20,000 feet. Carbon dioxide is dominant only higher in the atmosphere, above 30,000 feet (e.g. the stratosphere) where there is little or no water vapor to compete with CO2 for radiation cooling of the air, which leads to disparate temperatures at various altitudes. See Figure 2, especially the altitude around 85-90 kilometers where not only is the temperature low (about -100 C) but there is the presence of Nacreous clouds (Nuages Nacre) composed of nitric acid and water crystals, which compounds readily emit infrared energy, cooling that atmospheric layer. A similar effect occurs in the stratosphere at a height of 10 km where some water vapor may exist where the temperature dips to about -60 C. It may very well be that the coldest temperatures of the stratosphere and mesosphere also depend critically on its CO2 content, since the water vapor is almost completely absent. This means that more CO2 can result in a slightly cooler mid to upper atmosphere; likely to be noticed as the "climate change" of colder winters.

Energy Storage and Transport: Local temperature anywhere on earth is critically dependent on energy storage and energy transport of water bodies (oceans, bays, lakes, and rivers) how much solar energy has been stored and and where it is transported. The most familiar of these is, in a word; "Gulfstream". Solar energy is readily stored in seawater surfaces. That stored in the Caribbean Sea is transported in a "river" current known as the Gulfstream that reaches across the Atlantic Ocean to linger off the west coasts of Europe to warm the adjacent lands, notably the British Isles. Thus, a temperature up-tick of a several degrees C has been enjoyed those peoples for millennia. In the Pacific, we have recently been enamored by such storage and transport there (vis "El Ninio" and the recent "Blob". These huge heated bodies can travel thousands of miles to affect peoples on other continents. This storage/transport mechanism, critical to climates it affects, has largely been ignored by the politicians, the media and the scientists that so prominently address "climate" in our time.

Conclusions: I have read little new about the natural energy retention and transport mechanisms already well known thermal storage and their effect on our "Climate". Two outstanding examples are the Gulf Stream, El Nino and now "The Blob" off the coast of Seattle.; add to that the daily air mass movements. My opinion is that only when I read and hear esoteric and unbiased discussions on a better understanding of NATURAL heat energy storage and transport mechanisms extant, will I ever be convinced that such "experts" are "on the right track" regarding any man-made weather changes that might occur!

Other political "conclusions" of the greenhouse effect are likewise flawed, since there is no perceptible CO2 effect, the process of "Carbon Sequestration" and the levy of a "Carbon Tax" are a total loss of national resources, virtually a sabotage of our national wealth. I ask: Who wants to ever do such a thing?

The Future: Federal Climate resources instead must be devoted, especially to the U.S. Army Corps of Engineers, for the prevention of damage to mankind by the environmental catastrophes of floods, lightening, high winds and terrain erosion. For instance, the eastern branch of the Susquehanna River in Eastern PA still causes damaging floods because of heavy rains and ice melts. The entire upper New York State terrain south of the Finger Lakes drains into but one river, the Eastern Branch of the Susquehanna, which then courses southward through and routinely floods Elmira, Tunkhannock, Wilkes-Bare, Sunbury and Harrisburg before emptying into the Chesapeake Bay. One or more flood control dams north and south of Elmira must be immediately built. NOAA should be given ample funding to evolve new heat energy storage and transport analysis methods that will evolve into more advanced wind, rain and flood prediction & warning methodologies.

================================////\/\/\\\\\================Angelo Campanella, Ph.D., P.E.

Dr. Campanella received his Ph.D. from the Pennsylvania State University in 1955 in Physics and Electrical Engineering. He is a professional engineer in Ohio and Pennsylvania. An undergraduate elective course in meteorology sparked a life-long curiosity about atmospheric physics. He is a private pilot with over 4,900 hours of flight experience in all kinds of weather phenomena. During his 55+ year experience in infrared physics, military electronics, and applied physics he accumulated a deep understanding of the interaction of energy with space. These are combined to produce this article.

Figure 1: The incoming solar energy in watts per square meter vs time from 1975 through 2005.

Note: The 11-year cyclic irradiance annual average (red curve) variation coincides with the sunspot (visual) observations (blue curve).
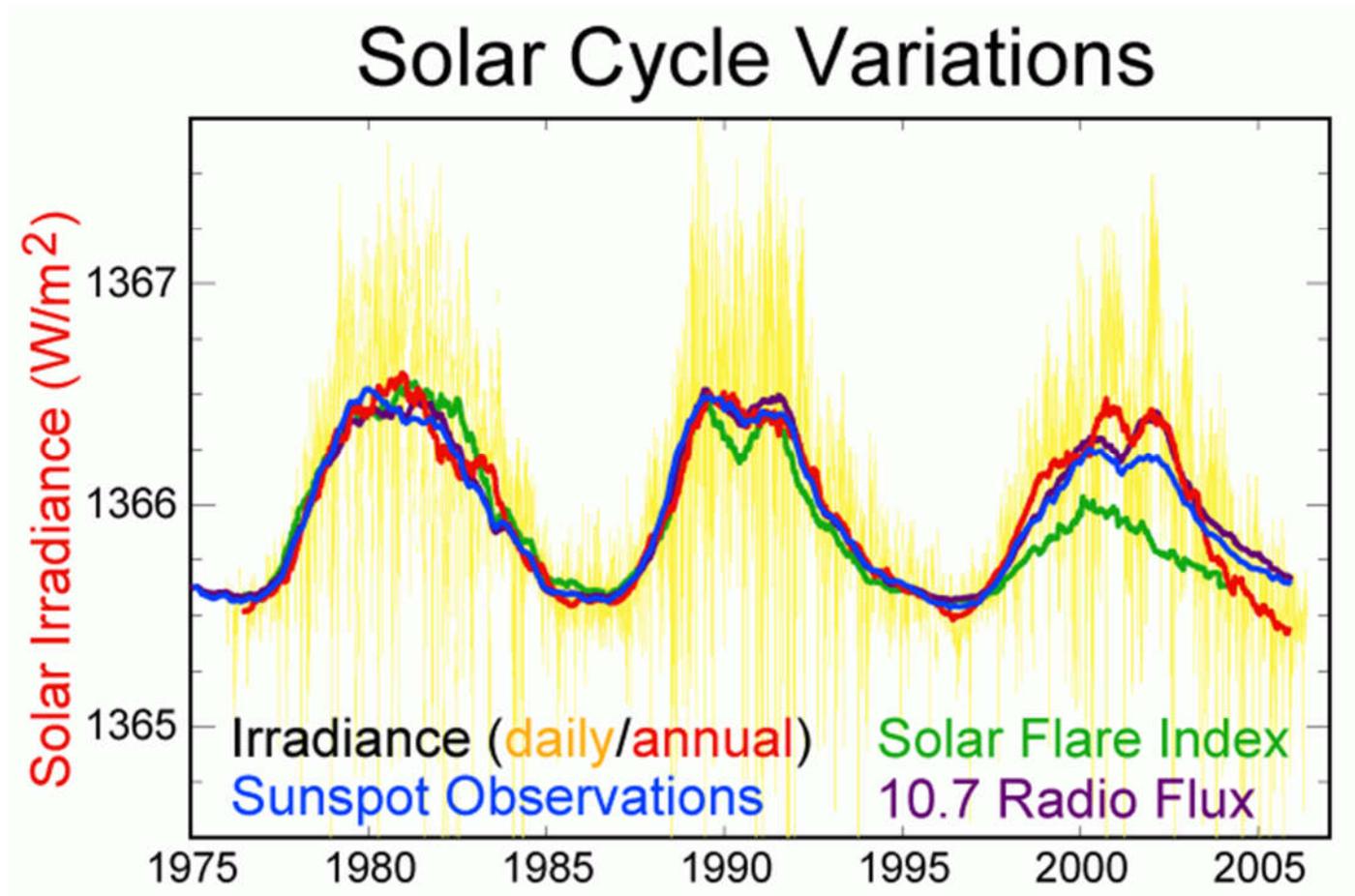

Solar Cycle Variations

Irradiance (daily/annual)
Sunspot Observations
Solar Flare Index
10.7 Radio Flux

Figure 2: The air temperature vs altitude from the surface through the atmosphere

to the outer space limit where satellites now operate.

Important to note are the two temperature minima at the Stratosphere (-45 C to -90 C, 12 km height) and at the Mesopause (-83C to -123 C at 85 to 90 km height). Long distance airliners typically cruise at 30,000 to 40,000 feet (9 to 12 km) height in the Tropopause, discharging their CO2 & water vapor directly there.

Why are the stratosphere and the Mesopause cold? Why are the Sratopause-and upper ionosphere above the Thermopause hot? I say that CO2 in the stratosphere and nitrogen oxides in the Mesopause cool those layers via IR radiation. Ultraviolet energy absorption heats the Stratopause, but the absence of CO2+H20 there results in that atmospheric level retaining heat deposited during daylight (no IR cooling at night). At the highest level, intense shortwave ultraviolet sunlight energy is first absorbed, heating the upper ionosphere. There are no polar molecules there except for ozone (O3). Ozone and other ions formed in daylight easily recombine after sundown; heat energy is retained overnight.
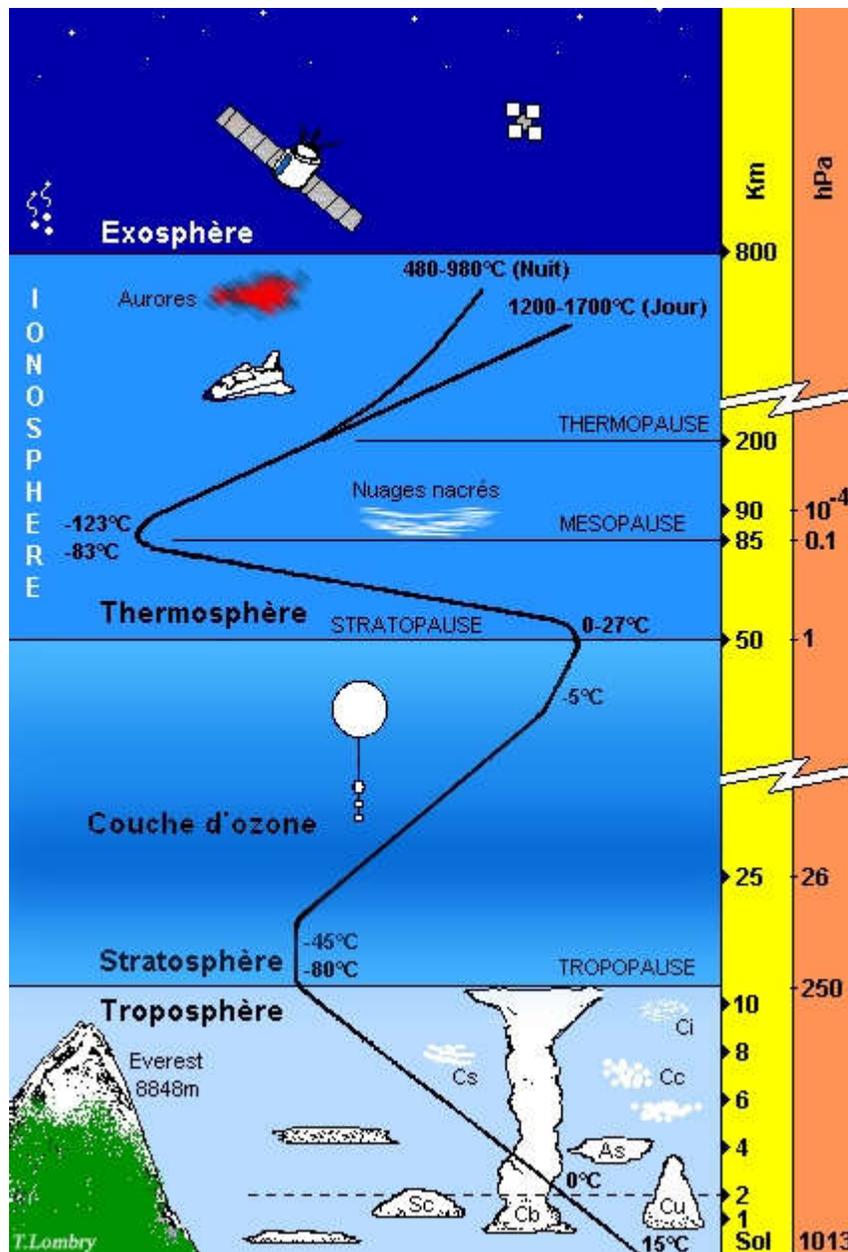
Figure 3: The Spreadsheet Calculations.

6/4/2017 // 7:27 PM   InfraredAlbedo.xls // SolarWarming & IR emissivity

Step:	First estimate... of ΔT:
Scenario	1... Poles are very cold, heating conducted from the hot core below cannot be very significant.
Heat Sources	2... Therefore heat conducted from the molten and hot core is negligible in affecting the surface temperature. (Or is this changing and melting Polar ice?)
Dimensional Definitions	3... 1 gram-calorie=4.185 watt-seconds (joules) 15066 251.9970768
" "	4... 1 Exojoule = 10^18 joules 1.00E+18
Combustion	4... Annual US & World consumption has been (Exojoules):
Annual stimates	Yr USA World (including biomass)

Yr	USA	World (including biomass)
1850	3.5	10.5
1900	13	39
1950	38	114
1970		250	Exojoule is	1E+18 joules
1987	81	300
2000	100	400
2010		500

Solar Constant — 5... Sunlight delivers 1,367 W/m^2 to all of earth
Earth Dimensions — 6... Earth Circumference is 40,000 km by definition.
disk (pi- r^2) — Radius is: 6366.197724   km = 6.366E+06 m
7... Disc Area is 1.273E+14 m^2   seconds/yr:
Solar Energy Intercept — 8... Power intercepted is: 1.741E+17 watts   max   31557600
Annually — 9... Energy intercepted: A joule is also a watt-second.
one year= 3.15576E+07 seconds, or 5.493E+24 Joules sunlight Energy intercepted each year
Solar Energy Albedo — 10... But the earth's albedo is 0.36 (64% of incident energy is retained, the remaining 36% is reflected by clouds, seas and terrain back into space).
seehttp://en.wikipedia.org/wiki/Albedo#Terrestrial_albedo
Retained = 3.515E+24 joules/yr 3.515E+06 Exojoules/yr This is eight thousand times more than the combustion energy released annually by present civilization.
Balance — 11... The earth has not been warming to any gross degree so this energy by and large must be escaping by a certain mechanism.
Increment due to combustion — I point out that IR re-radiation to cold space is the outstanding mechanism for such. It proceeds to all directions (4 pi steradians), 24-7-365.25
Earth Black Body Radiation — 12... Stefan-Boltzmann Law quantifies such black body re-radiation to space.   P=AσЄT^4   http://en.wikipe http://en.wikipedia.org/wiki/Stefan%E2%80%93Boltzmann
(4 pi) — σ=5.67x10^-8 J/(s m^2 T^4)   Annually; P=3.5E+6   Є=P/(A*σ*T^4)
Infrared Emissivity Estimate — Є="infrared emissivity")   USE "STP": T=59F=15C=288K   8.8E-01   0.88 Є="infrared emissivity")
"Infrared Albedo" — 13... IR albedo estimate: A=4piR^2=   5.1E+14   IR Albedo= 0.12
Increment due to combustion — 14... What temperature differential can exist on the average due to the addition of 500 exojoules annually (Yr2010 datum)?   delta=K(T2/T1-1)
First Estmate of delta T — 15... Let E2/E1=T2^4/T1^4:   E2/E1= 1.0001422   =(T2/T1)^4= 0.00003556   when dT= **0.0102** C when T1 is 288 Kelvin

SECOND ESTIMATE

16... **Second** estimate: T1 and E1 be the earth temperature and surface energy deposition due to sunlight (no civilization).
Let T2 be the earth temperature and surface energy deposition with sunlight plus present civilization and their combustion activities.
ALL the heat deposited on the earth's surface (plus that from volcanism) is lost to space by only one mechanism; infrared black body radiation.
Some Alternative Calculations — 17... Stephan Boltzmann Law says that the electromagnetic radiation from a hot Black Body is E=σ*ε*A*T^4 where:
σ is the Stephan-Boltzmann Constant, 5.67*10^-8 J/(s*m^2*k^4)
ε is the infrared emissivity of that body (like but not equal to the albedo), perhaps 2/3rds.   Assumes IR albedo to be 0.33
Earth Surface Area is A=4*pi*R^2 =   m^2   Assume ε to be 2/3rds; similar but not equal to the earth's albedo.
Seond Estimate — 18... Differentiate as dE/dT=4*σ*ε*A*T^3; dT=dE/(4*σ*ε*A*T^3)= **0.0111** degrees C. ΔT!   This also is trifling...

More CO2 in the Air, so what???

CO2 affect on or the overall — 19... The next thing to study is the effect of carbon dioxide in the atmosphere on ε, the infrared albedo of the Earth(0.88).
emissivity of the earth. — 20... (My opinion is that increased CO2 in the atmosphere increases the Earth IR emissivity (viz 0.89)...
thus decreasing IR albedo (viz 0.11 etc) leading to a COOLER earth. surface.)
(viz more the **first ΔT of+0.0102C** rather than the second ΔT estimate of +0.0111)
21... There appears to be no heating mechanism available other than capture-delay-reradiation-recapture by newly acquired CO2 gas in all the atmosphere, in my opinion.
Corrections and opinions?

Ange, 30 October, 2012

= end =