

Global Warming Comments for 26 February 2014

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http://www.roperld.com/science/GlobalWarmingComment_26Feb2014.pdf

1. Climate Sensitivity is the amount Earth average temperature rises when CO₂ concentration in the atmosphere is doubled (logarithmically); it is **~3°C** (~5.4°F) for short-term positive feedbacks and **~6°C** (~10.8°F) for long-term positive feedbacks. These numbers are determined by studying recent global warming and ice cores back ~500,000 years. The Earth would be totally covered with ice if there were no CO₂ in the atmosphere.
2. CO₂ concentration has changed from **~285 ppmv in year 1700**, before burning fossil fuels became huge, to **~400 ppmv** now, a ratio of ~1.4, not quite doubled. Thus, the eventual temperature rise since year 1700 due to the current ~400 ppmv should be from **~1.5°C** (~2.7°F) for short-term feedbacks to **~2.9°C** (~5.2°F) for long-term feedbacks. There are other greenhouse gases (GHG) humans spew into the atmosphere, most notably methane and nitrous oxide, which make sizeable contributions to global warming. So, the eventual range of temperatures since year 1700 is most likely to be **~2.5°C** (~4.5°F) for short-term feedbacks to **~4°C** (~7.2°F) for long-term feedbacks.
3. Global warming causes more evaporation of water on the Earth, and this water vapor is a powerful GHG. The vapor does precipitate out rapidly, but at different locations than precipitation occurred before global warming, causing large rain and snow storms in some areas and droughts in other areas. Wet areas become wetter and dry areas become dryer.
4. The Earth average temperature will continue to increase as the GHG concentrations increase, and the concentrations are increasing at an increasing rate! Some climatologists fear an eventual change in temperature since 1700 of **~6°C** (10.8°F) or higher.
5. There is a time delay of **~1500 years** for the full global-warming caused by a GHG change to come into effect. So, if humans decide to reduce spewing GHG into the atmosphere, it will take a long time for the global warming already underway to reduce.
6. There are some effects that counteract atmospheric global warming due to GHG, such as sulfur dioxide, dust and other aerosols spewed into the atmosphere and warming of the deep oceans. Some scientists are recommending spewing aerosols into the atmosphere to mitigate global warming; most of such aerosols are detrimental to human health. There are other proposals to mitigate global warming by massive expensive projects to reduce the sunlight striking the Earth. There likely would be unintended, perhaps disastrous, side effects to such geoengineering.
7. Such high temperatures eventually will melt all the Arctic sea ice during summers, which may occur within the next few years. The revealed dark water absorbs large amounts of solar energy that was previously reflected back into space by the ice. Thus, Arctic air warms faster than air in temperate regions, such as the United States.
8. The lower temperature differential between Arctic and temperate areas weakens the polar vortex that circumnavigates the Arctic, which occasionally causes the jet stream to turn up into western Canada to pull warm air into the Arctic, further warming the Arctic, while dipping down into eastern United States to pull cold polar-vortex air into eastern United States. Thus, extreme cold spells can occur in eastern United States even though the Earth is rapidly warming on average. There is a graph at the end of this document that shows extreme heat for western US and extreme cold for eastern US for January 2014.
9. Collision of Arctic cold air with south-Atlantic Ocean, south-Pacific and Gulf-of-Mexico warm moist air causes extreme storms with high precipitation in eastern United States, which reduces western United States precipitation, causing extreme droughts and subsequent forest fires. The extreme storms often involve many massive tornadoes and massive rain and snow storms.

10. Warming of the oceans' surface water can cause more powerful hurricanes/typhoons, because they get their energy from the heat of surface water.
11. Melting Arctic sea ice causes moderate sea-level rise because warm water occupies more volume than cold water (thermal expansion). However, melting ice on land, such as Greenland and Antarctica, can cause great sea-level rise. If all the ice on Greenland melted, sea level would rise by **~7 meters** (~23 feet). If all the ice on Antarctica melted, sea level would rise by **~60 meters** (~197 feet). Predictions for sea-level rise by **year 2100** range from **0.5 meters** (1.64 feet) to **5 meters** (16.4 feet). This rise will be disastrous for coastal cities and many island nations. Even a small sea-level rise coupled with a massive hurricane or storm from the Atlantic Ocean can inundate a coastal city in the United States.
12. It is well known that drastic rapid climate events have occurred in the past. Current climatology is not able to predict which and when drastic rapid climate events will be triggered. One possible trigger event that may be underway already is rapid massive release of the powerful **GHG methane in the Arctic and on the continental shelves**, which greatly accelerates global warming. Massive amounts of methane have been observed bubbling up in the Arctic Ocean.
13. The only sure way to mitigate global warming is for humans to quit burning fossil fuels, especially coal and unconventional fossil fuels such as tar-sands oil. Currently, although extraction of crude oil and natural gas for the world is expected to peak within the next decade, **coal extraction for the world is expected to peak at year ~2035, really BAD NEWS!** (See graphs at the end of this document.) We need to greatly accelerate replacing energy from fossil fuels with renewable energy, such as wind, solar and biodiesel made from algae and transform our means of transportation to electric trains, electric cars and biodiesel trucks and airplanes. (Oil and natural gas are too valuable for making useful items to burn! I drive a 2012 Nissan LEAF electric car.) At the current exponentially-increasing rate of producing electricity from renewable sources in the US, renewable electricity will be about twice as large as electricity produced by nuclear reactors, burning coal and burning natural gas at year 2025. (See graph at the end of this document.) If the US were an intelligent society it would increase this exponential rate. You can help by joining Solarize Blacksburg; see <http://www.solarizeblacksburg.org> , which will be online soon.
14. The problems of fossil fuels and global warming are highly mathematical. Policy makers and citizens need to understand the mathematics if they are going to make intelligent decisions. I urge readers to carefully study the graphs in this document to get a better understanding of the two problems. I am available to give talks to organizations about fossil-fuels depletion, renewable energy, global warming and/or electric vehicles to help advance citizens' knowledge about the facts and mathematics of these subjects.
15. The underlying problem is too many people using too much energy. An intelligent global society would provide free birth control to all humans.

$$\Delta T = \frac{S}{\ln(2)} \ln\left(\frac{C_f}{C_i}\right) \text{ where}$$

ΔT = average Earth temperature change due to spewing CO₂ into the atmosphere

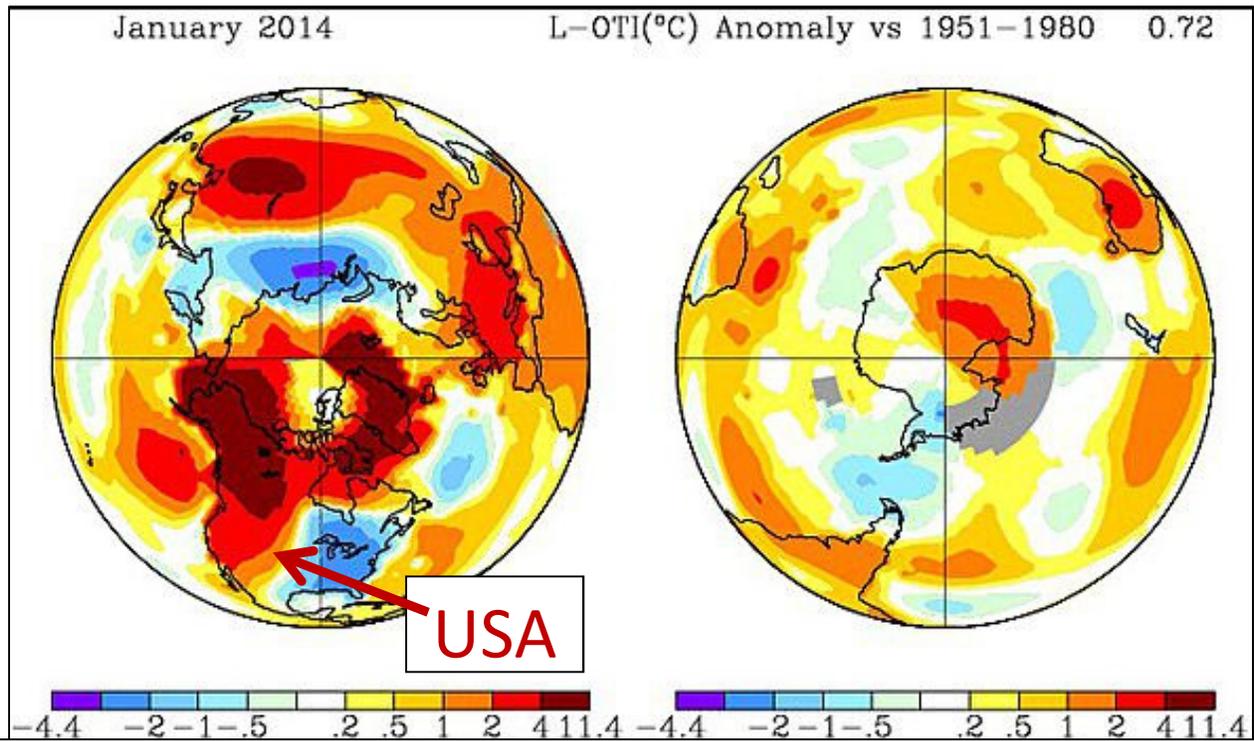
S = climate sensitivity

C_f = final CO₂ concentration

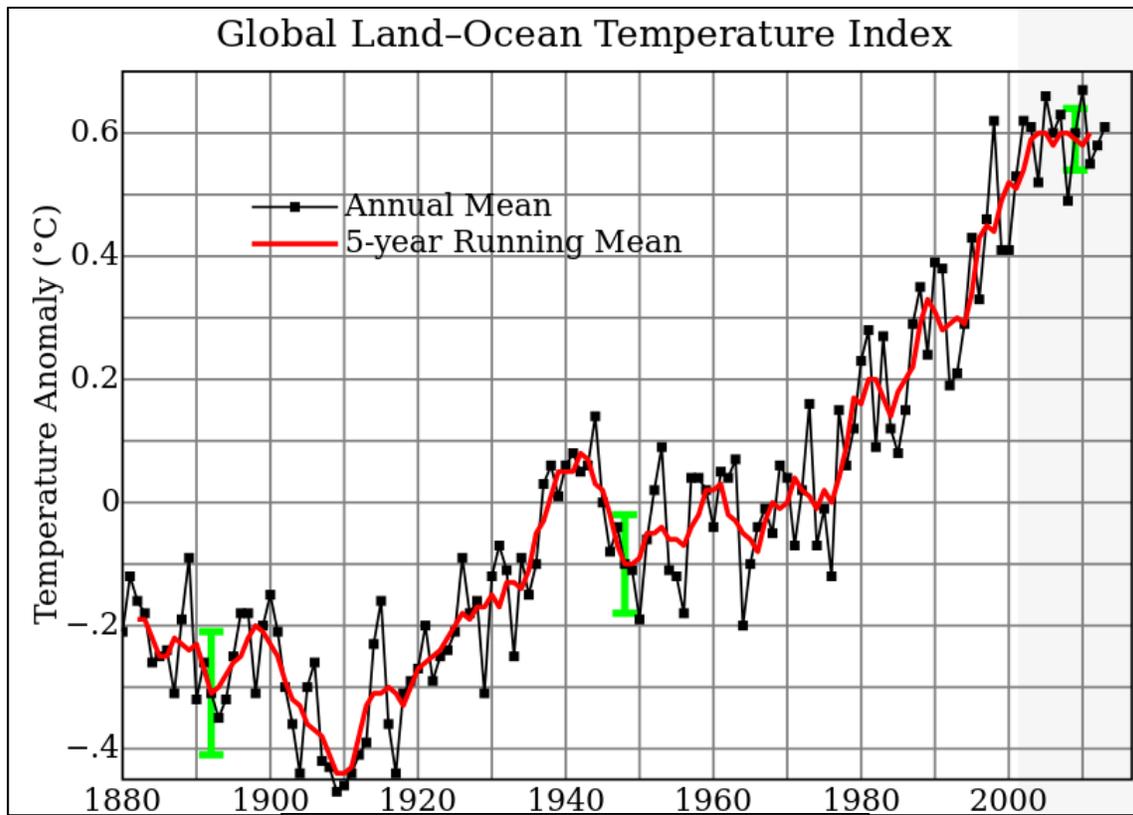
C_i = initial CO₂ concentration

$S \cong 3^\circ\text{C}$ for short-term positive feedbacks, determined by studying recent global warming

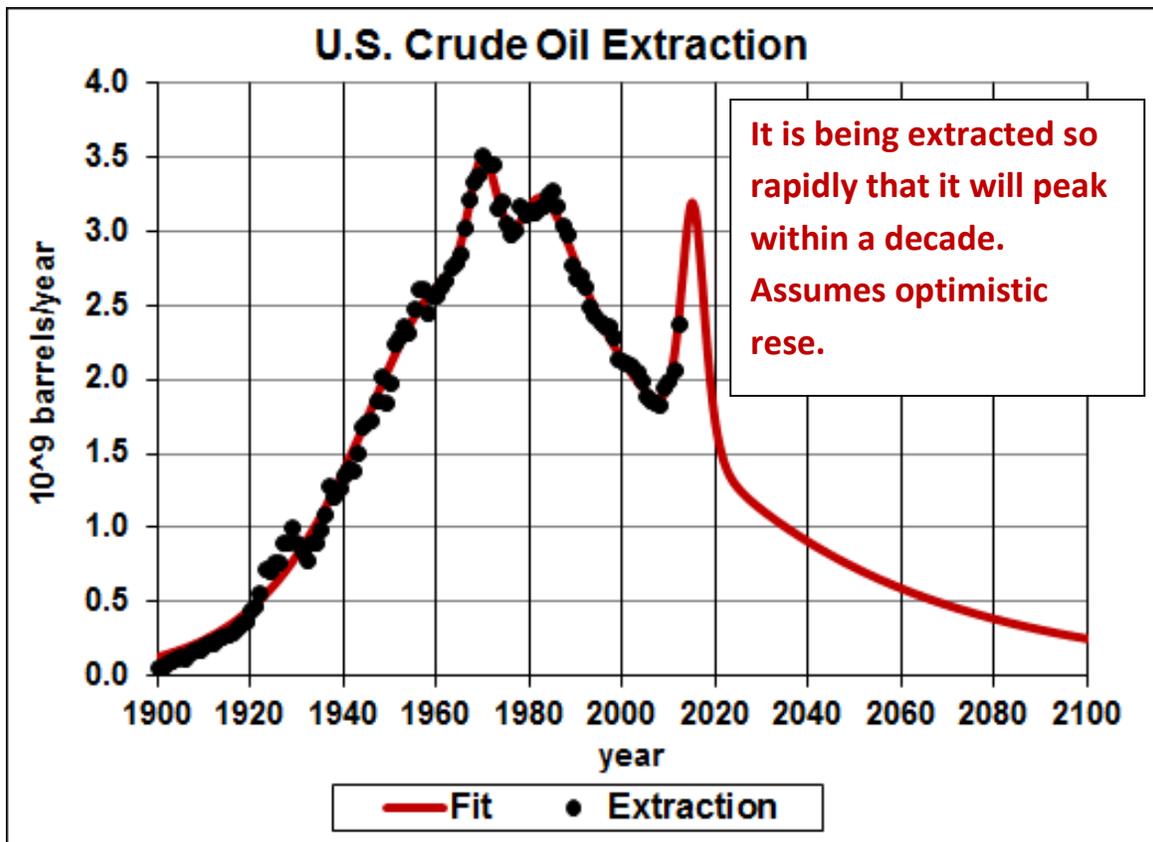
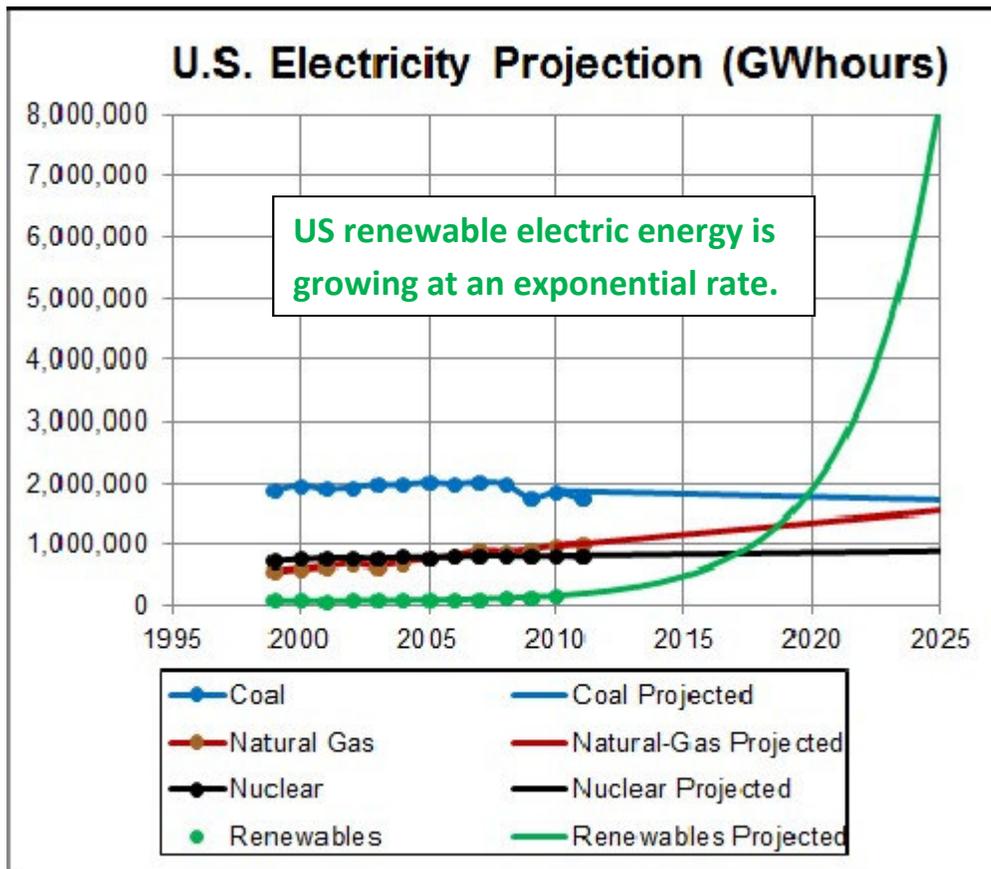
$S \cong 6^\circ\text{C}$ for long-term positive feedbacks, determined by studying ice cores back ~500,000 years

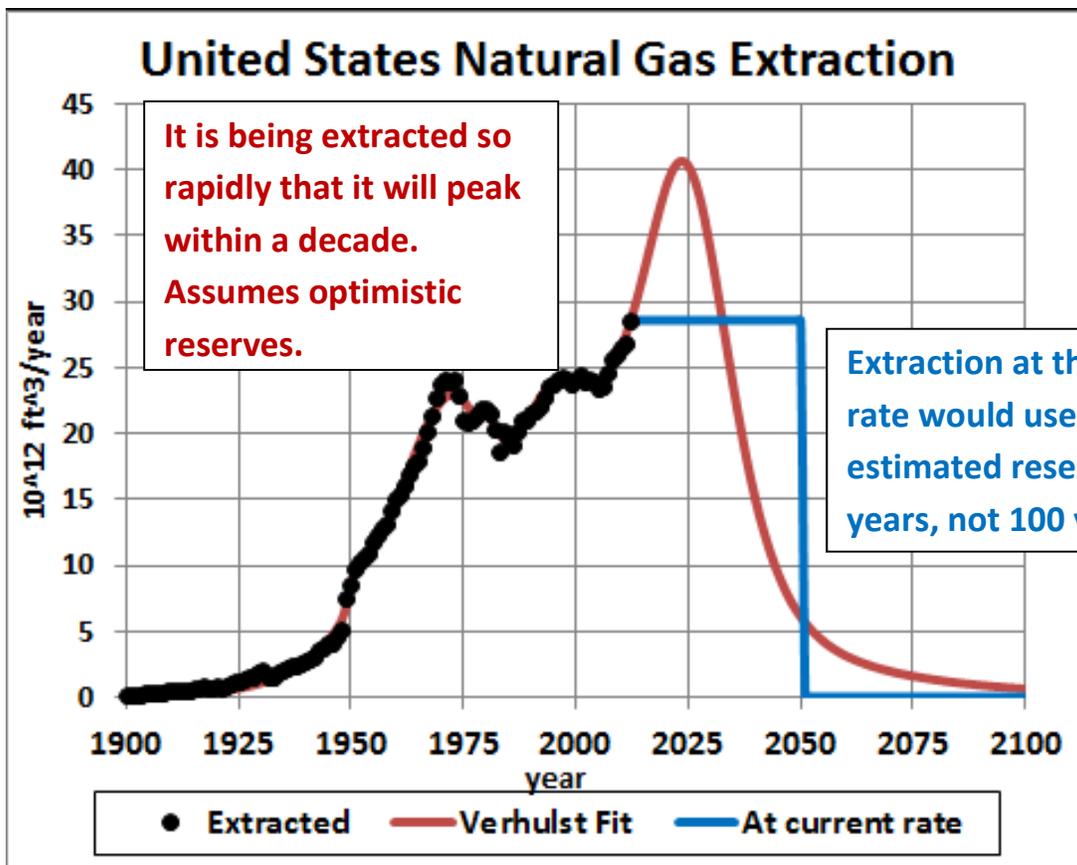
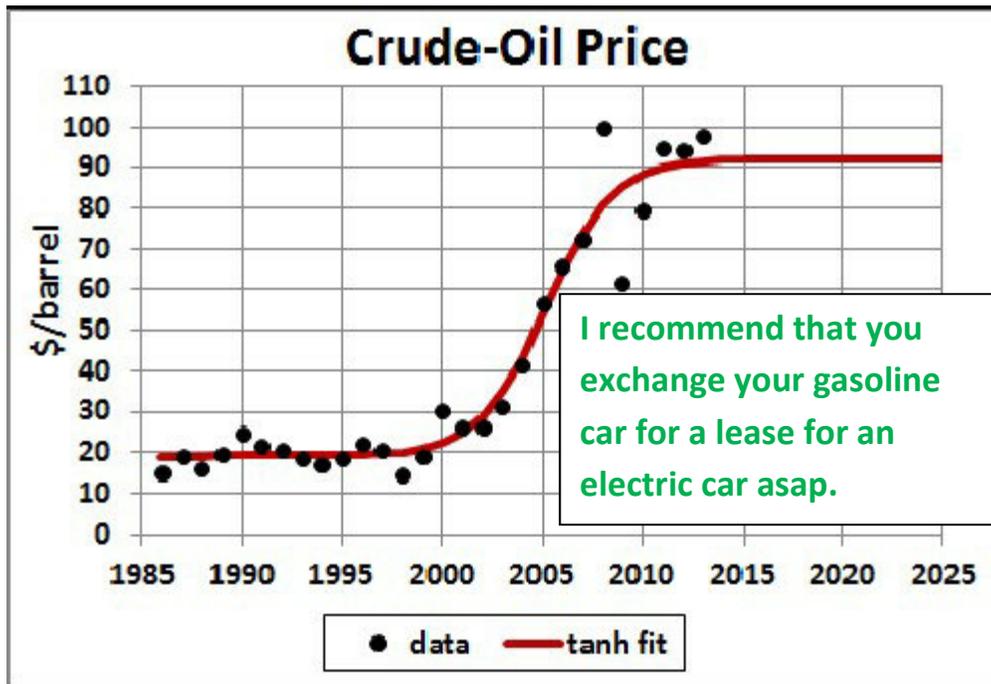


<http://www.accuweather.com/en/weather-blogs/climatechange/how-did-surface-temperatures-r/23474915>

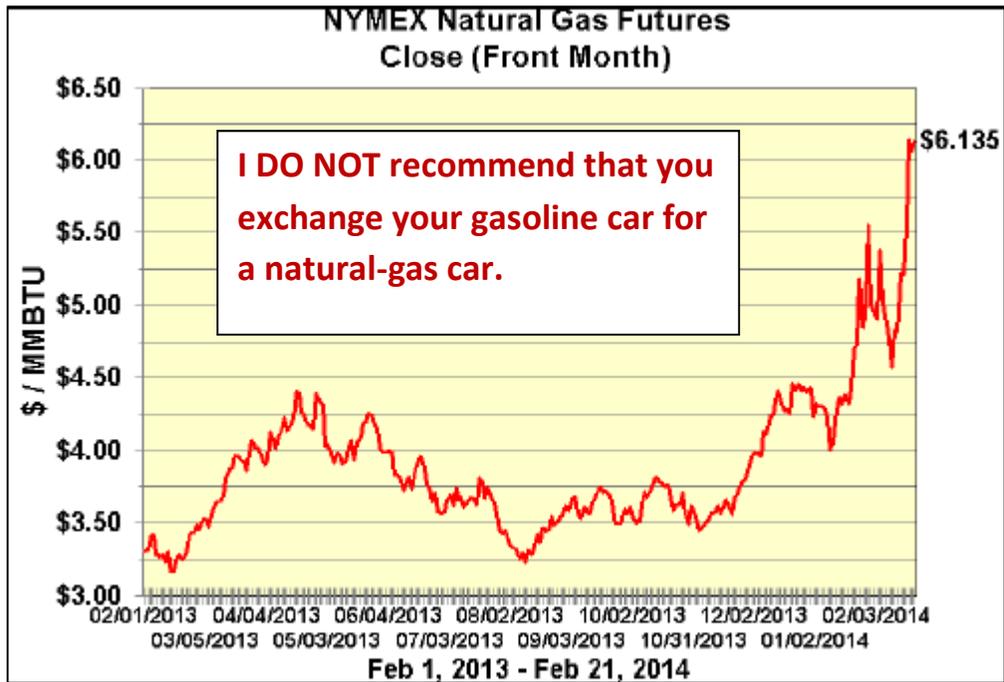


http://en.wikipedia.org/wiki/Global_warming

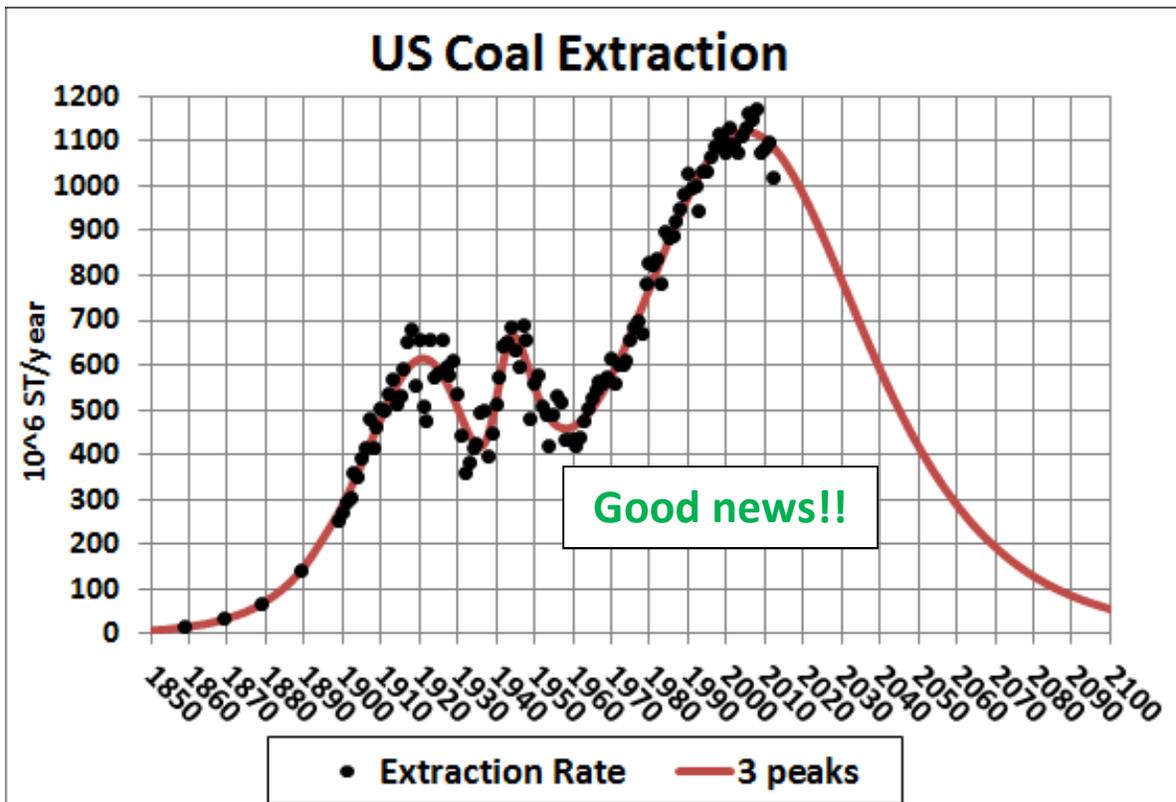




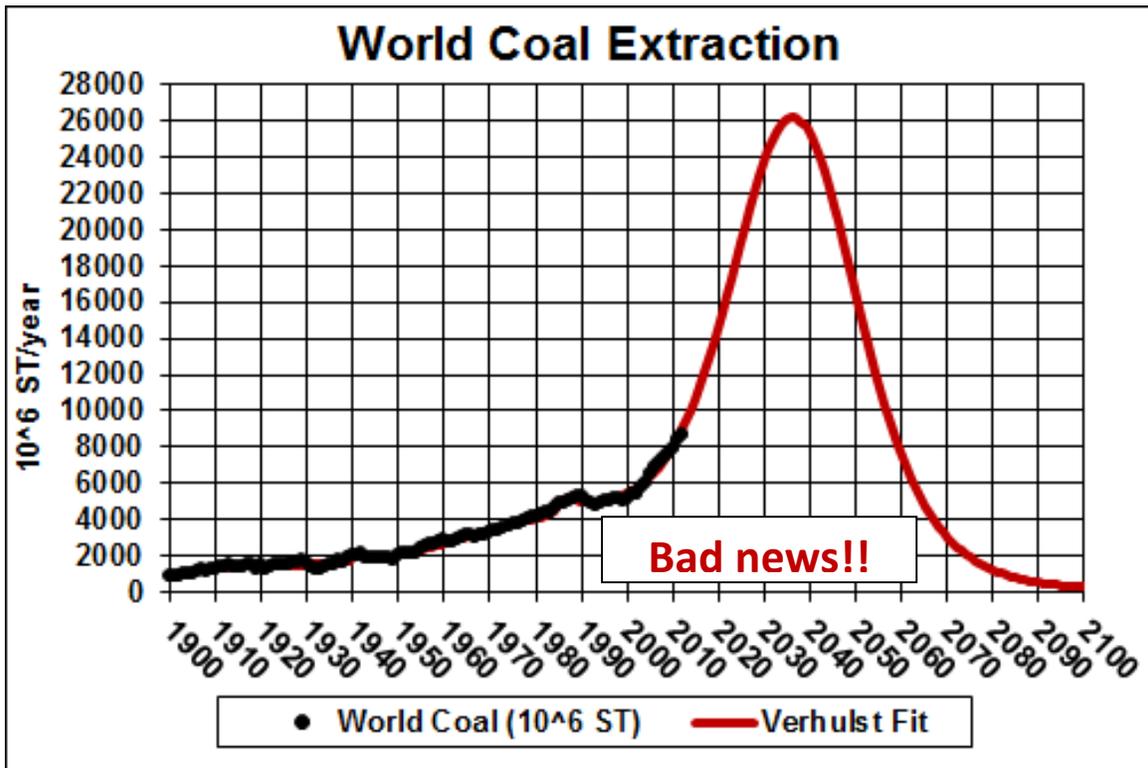
http://www.roberld.com/science/minerals/USGasBoom_Bust.htm



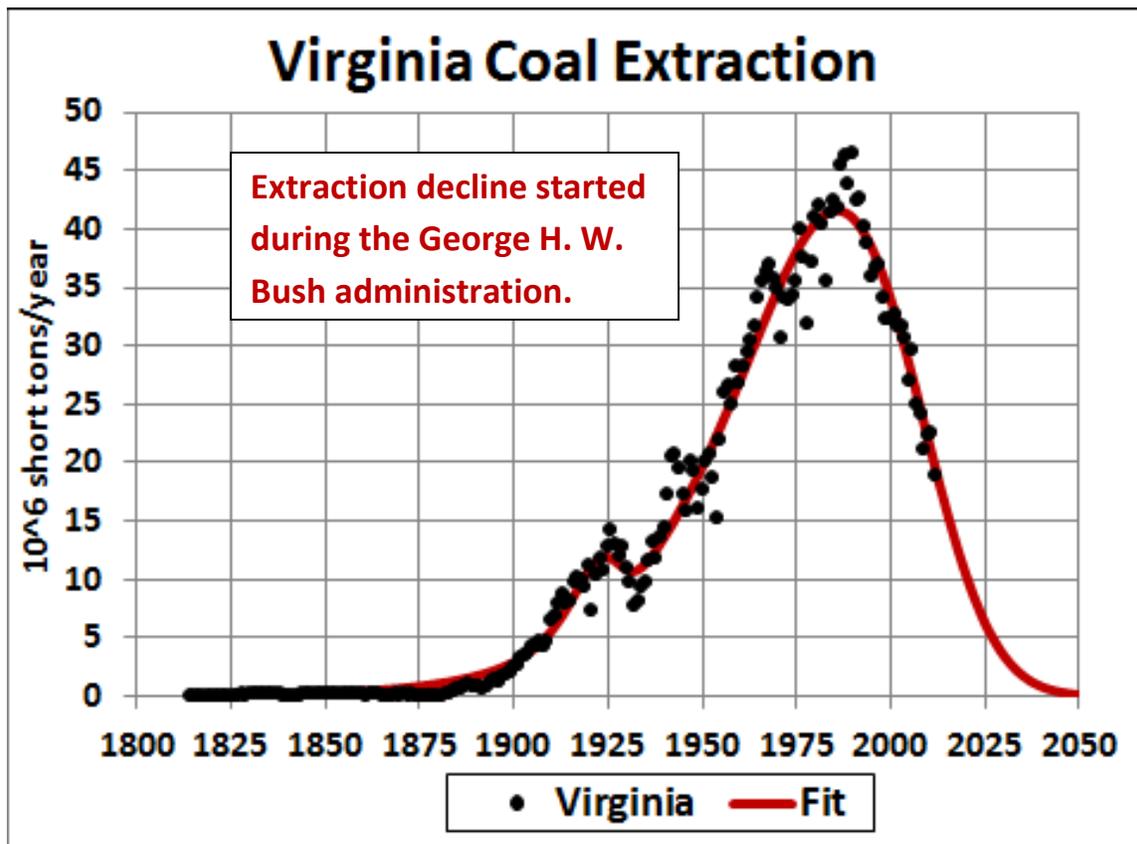
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<http://www.roperId.com/science/minerals/CoalExtractionUS.pdf>



<http://www.roperld.com/science/minerals/WorldCoalFuture.pdf>



<http://www.roperld.com/science/minerals/VACoalDecline.pdf>

The author of these comments was not a participant in previous Critical-Decisions sessions. After creating these comments he watched the “Energy Independence” and “Food and Climate” videos of Critical Decisions and has the following comments about them.

The selection of the single interviewees for the two videos was highly biased toward the fossil-fuels industry (T. Boone Pickens [http://en.wikipedia.org/wiki/T. Boone Pickens](http://en.wikipedia.org/wiki/T._Boone_Pickens)) and conservative political science professor (Bjorn Lomborg [http://en.wikipedia.org/wiki/Bjorn Lomborg](http://en.wikipedia.org/wiki/Bjorn_Lomberg)). There should have been at least two interviewees for each subject. For example, Joseph Romm ([http://en.wikipedia.org/wiki/Joseph Romm](http://en.wikipedia.org/wiki/Joseph_Romm)) would have been excellent for both videos. James Hanson ([http://en.wikipedia.org/wiki/James Hansen](http://en.wikipedia.org/wiki/James_Hansen)), Lester Brown ([http://en.wikipedia.org/wiki/Lester Brown](http://en.wikipedia.org/wiki/Lester_Brown)) or Michael Mann ([http://en.wikipedia.org/wiki/Michael E. Mann](http://en.wikipedia.org/wiki/Michael_E._Mann)) would have been excellent for the Food-and-Climate video.

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<http://www.roperld.com/science/minerals/minerals.htm>