



George Stosur – DLO 15 June 2020 8:30 AM Questions/Answers

The new green deal only punishes the US. China and India won't spend 1.7 Trillion to clean emissions.

Probably so. Compliance would likely be a big problem, especially if there were no penalties for falling short on the pledges (note this inadequacy in the Paris Agreement).

We need to change the focus from the doomsday scenario, to solutions including planting more trees.

Planting trees would help, of course, but the problem is so enormous that such planting is totally insufficient to solve the problem. Planting trees must be combined with industrial-scale projects to, e.g., dispose carbon dioxide in deep saline aquifers and make more serious efforts to cut methane leakages.

Effect of permafrost and wild fires?

I have not found any serious publications or estimates addressing the effect of melting permafrost on global warming. The craters found in Siberia's permafrost areas and the amount of rock thrown out are large, indicating that much gas escaped to the atmosphere. Still, I think the total is probably small compared to leaking methane from pipelines and other industrial facilities. The effect of recent wildfires in the West is too new to be addressed in a quantitative manner but it is thought to be also small compared to the global emissions of CO₂.

We need to promote natural gas. It is unfairly lumped in with the dirtier hydrocarbon fuels.

Yes, there is general agreement that natural gas usage should be emphasized during the "transition" period. Coal is already in serious trouble, especially in Europe where some countries banned it altogether, making way for Siberian gas. The Russian gas creates a security problem in that it makes Europe overly dependent on Russian supplies.

Any thoughts on why cleaner-energy products & services are not able to be price-competitive to conventional ones yet?

The basic problem is economics. The sun does not always shine, and wind does not always blow. However, cleaner-energy products and services are already competitive in some niche markets. The new BP strategy is to prepare to transform into a diversified energy company. And BP and Equinor plan to build large windfarm projects to produce 4.4 GW, enough to power 2 million homes along the US East Coast. The very fact that such large companies are thinking of doing something like that is significant.

What are some of the ways the oil and gas companies can move into renewable energy?

Wind and solar come first to mind, see also answer to the former question. There is also geothermal, ocean waves, turbines installed in fast flowing Gulf Stream, but these are miniscule to what is needed and requires much research and experimentation.

Are we essentially facing the end of the era of O&G as a major source of energy - not If, but how soon?

This question is well considered by Daniel Yergin in "The New Geopolitics of Energy", in The Wall Street Journal of Sept 12, 2020, and elsewhere. While the use of fossil energy will decline in coming years and decades, petroleum will be needed for more than 100 years and longer, to produce thousands of products from fertilizers and chemicals of all sorts, even to beauty products. "If petroleum did not exist, people would invent it". However, some sources speculate that peak oil demand may be this year, 2020.

How does the CO2 generated by California forest fires compare to what humans generate by using petroleum for their transportation and electricity needs?

I never saw any publication or even a serious reference on this issue. I suppose it is too new to be sufficiently researched. I think that, as huge as the fires were, they still contributed a fraction of CO2 compared to what is emitted by the transportation and electricity sectors (on worldwide basis).

Are the impacts of CO2 not logarithmic and not linear? Would the impact of increasing CO2 be less and less?

The impact of CO2 does not seem to be logarithmic or linear, probably because the history of it is too short, but it does seem to be slightly exponential. Based on past major global cooling and warming periods, periods, the effect would eventually be less and less. However, global ice ages and some smaller cooling periods were mostly naturally occurring phenomena. What is happening since the industrial revolution is manmade.

Considering the potential of electric transportation, it seems not considered the environment impact of lithium batteries.

Lithium batteries can be recycled/reprocessed and rare metals used to produce other batteries, albeit at high cost. Some startup companies are already looking into this business.

Should SPE eventually consider changing name to Society of Energy Engineers? Should petroleum engineering curriculums broaden/transition to emphasis on broad energy systems education?

Personally, I see no reason for changing the name of SPE. Not yet anyway -- we can think about it later. Petroleum will be needed and used for 100 years and longer, albeit in declining amounts. For answer to the second question, please see Tom Blasingame's six-page interview published in the Sept. issue of JPT.

Do you think petroleum engineering education to move towards "energy engineering" as some promote or focus on use of our subsurface understanding and leave electrical and chemical engineering to those existing disciplines?

Some tweaking of the petroleum engineering education may indeed be necessary in the near-term future, e.g., greater emphasis on digitization, artificial intelligence, and such. Also, greater focus on understanding of issues related to subsurface fluid injection/CO₂ sequestration. These are very big issues and very important areas for the future.

Net carbon zero by 2050! The world still needs oil and gas as we speak. Do you think this aspiration goal will be met in 30 years time? What is your feeling on this?

Personally, I think that this goal would be extremely difficult to achieve, especially in developing countries. But goals are set and are useful in many human endeavors.

Who and how do you get non-political and non-partisan bodies to research climate science? There is so much data, so many variables and so many unknowns. Or is it impractical to get funding from non-vested interests. Do we just accept that this is a political and public opinion issue now?

As pointed out, there is so much data, so many variables and so many unknowns that people reach different conclusions based on same set of data. I do not know how to answer that question. I'd like to think that university research is least biased. We cannot be cynical though -- there are many very smart and honest people who surely know more than we do.

Why don't you mention nuclear in your presentation? Is it not the only credible source of "green energy"?

I thought I did mention nuclear energy. In the long term, we probably must rely a lot more on nuclear energy. Modern reactors are much safer than in the past, but fear persists to the point of complete ban of this source of energy in some countries. Nuclear fusion-based reactors remain the holy grail. Hundreds of billions of dollars were already spent on research and experimentation, so far to no avail.

How did anyone think that Project Plowshare would do anything but melt and poison the surrounding formation and fluids?

In retrospect, that seems obvious and it had been known then, too. At the time, all kinds of projects were being thought about under the umbrella of as "peaceful applications of nuclear energy", now unthinkable. Nuclear engineers were mostly trying to learn more about the possibility of fracturing ultra-low permeability formations. Better knowledge of fracturing with nuclear devices would aid in understanding other applications and other underground nuclear testing, in general. From the point of stimulating the formation to produce gas, the project was a failure. Fractures did not extend as far as anticipated and were partly sealed without a proppant. The most serious problem was radioactive sludge at the bottom of the chimney and radioactive gas which could not be reduced to safe levels.

On slide 10 you show various cycles of natural warming & cooling. Why do scientists think the current warming trend won't subside into cooling as it has in the past?

Scientists and especially astronomers do think that, the current 20,000 year-long period of global warming will subside, as it happened many times before in the history of the Earth. Some even speculate that we are already overdue for such an event. But this thinking is based on geological scale of time, not human scale. Current spike of rising temperature since the industrial revolution is truly short compared to the 400,000 years shown on that graph; it cannot be explained by astronomical events.

If water vapor is considered the largest component of greenhouse gas, and thus contributor to atmospheric temperature change, what is the estimated relative volume of water vapor from natural sources compared to manmade sources, on an annual basis?

This is a very complicated problem, so it is best that I quote the American Chemical Society article entitled "It's Water Vapor, Not the CO₂"

"It's true that water vapor is the largest contributor to the Earth's greenhouse effect. On average, it probably accounts for about 60% of the warming effect. However, water vapor does not control the Earth's temperature, but is instead controlled by the temperature. This is because the temperature of the surrounding atmosphere limits the maximum amount of water vapor the atmosphere can contain. If a volume of air contains its maximum amount of water vapor and the temperature is decreased, some of the water vapor will condense to form liquid water. This is why clouds form as warm air containing water vapor rises and cools at higher altitudes where the water condenses to the tiny droplets that make up clouds."

More information on this topic can be found by googling "water vapor contribution to climate change".

What is your own position on the climate change?

I started as a sceptic many years ago. I am now a moderate believer. Obviously, I am not a climate science expert (who can claim that anyway?) Ultimately, however, one must trust people that are better equipped to pass judgement in their area of expertise than any one of us, petroleum engineers. One must also assume that most scientists working in their area of expertise are honest, not "crooked".

is stop using oil and gas are the only way to stop climate change?

It is not the only way, but probably the major way. The second major way is "rapid deployment of clean energy" -- the term officials use when they talk about net energy zero.

Will you provide a citation/reference to authors of his report.

I would if I knew which is that report.

What is your recommendation for young petroleum engineers in this transition?

Petroleum will be with us for 100 years, or longer. Even though production may decline in time, the unique skills that petroleum engineers and geologists have will be needed as much in the future as they are today. We are the leading source of expertise for subsurface injection of any fluids. Massive projects will be required to dispose CO₂ at depth. Most of these will fall on the shoulders of petroleum engineers. We have no competition in this area.

Momentum is with the politicians (eg tax raising) and public activists. How do you stop the rampant conflation and lack of context. Small example when they say "climate change" do they mean CC in total caused by nature and humans, CC caused by human activity, CC caused specifically by fossil fuel CO₂ emissions" ?

The politicians and climate change activists are concerned with temperature rise and the associated changes to fauna, flora, melting ice, sea level rise, even the natural phenomena such as hurricanes, tornadoes, forest fires etc. Some of it is the result of misinformation in the media. Nonetheless, when people talk about "climate change", they are concerned about the rise of CO₂ in the air, which is attributed to burning fossil fuels and the temperature rise. Higher taxes presumably lead to more conservation and less fossil fuel consumption.

Why do you think (left- believers) do not consider the tectonic control on climate change in their models? is that a question of negation?

If you mean tectonic movements, then those occur on a scale of thousands and millions of years and would not influence temperature changes on Earth that occurs within decades/centuries. Continents move at the speed of only one or two inches per year.

What about planting trees for every well drilled. Photosynth's removes CO₂ from the air and releases oxygen.

That is helpful, of course, but there are much more efficient ways to remove CO₂ from the air than planting a tree for every well drilled.

I know it's still far down the road but shouldn't we be preparing for the global freezing that will come up?

Global freezing will come eventually, as it did many times in Earth's history and is caused by the so called "Mikhailovich cycles". These are based on varying orbits of the planets in the solar system: eccentricity, obliquity, and precession – all astronomical events. These are well documented. But such changes occur within many thousands of years. By then, humanity might find a more hospitable place somewhere else within the solar system.

Is methane less persistent in the atmosphere than carbon dioxide? Does not stay around as long?

While CO₂ persists in the atmosphere for decades and centuries, methane warms the planet on steroids for a decade or two before decaying to CO₂. In those short decades, methane warms the planet by 86 times as much as CO₂, according to the Intergovernmental Panel on Climate Change. Source: Scientific American, December 22, 2015.

Does nuclear have a future?

I'd think so. If we cannot use coal and must reduce the usage of oil and gas, there is not much left. Sadly, no nuclear power has been built in 30 years in the United States and some that were started were abandoned. Russia continues to build and sell nuclear power plants to other countries. And France produces 70 % of electrical power using nuclear power plants. So could we.

Lockheed Martin had talked about compact fusion. Are they still working on this?

I believe they are still working on this but would need to call them to confirm.

What is status of long term impact recyclable solar panels and electric car batteries?

Recycling of old electric car batteries and solar panels is complicated and expensive but essential in the future. Several small companies in US, Canada and Europe are working on safe and environmentally safe methods of such recycling. The long-term environmental impact should be manageable, they say.

Has anyone estimated the tonnage of CO₂ released by forest fires?

The fires in California have already generated more than 91 million metric tons of CO₂, which is about 25 percent more than the state's annual emissions from fossil fuels (from: Mongabay, Sept 18, 2020 and Washington Post, Sept. 17, 2020).

What is your opinion regarding the residue as an alternative energy source for the electric sector?

Forest/wood residues are a potentially important source of renewable energy, but still very small in the context of what is needed in the future.

How can third world countries join the race of "Net zero emissions" because we need an international coop, and not all countries have the technology or man power to use renewable?

Their efforts would be most likely subsidized, and technology shared by richer countries for the good of humanity.

What does net carbon zero really mean?

In theory, it means greenhouse gas emissions would be dramatically slashed and any remaining emissions offset, thus neutralizing environmental impact and slowing climate change.