"Current and Local"
A Test for Energy Sources

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Pharmaceutical adds have gotten really interesting. A significant part of the ad is devoted to a listing of all the possible side effects, per FDA rules, and presented in a tone of voice that makes them sound desirable. We all want rashes in private places, right? I'll take a gross. One of the biggest selling drugs was recently pulled because it does nothing helpful and lots of harm. We hear 5% of a study had improved results and 4% of the placebo group had good results. I'll take a gross! They didn't mention how many studies it took to come up with a study with a slightly positive bent or that perhaps the margin of error was 5 times the difference between the test subjects and the control subjects.

Ads – if we like one part, we swallow the whole pill – and don't even hear the rest. The Percentage with positive results – how many studies – the margin of error – all of that is ignored and we focus on the one implied promise that is most likely not true.

And now with elections approaching and all the Flak that is hitting the media – how do you discern the truth? One subject has a simple test, that of the myriad choices in energy supply. So let's explore that test and how to apply it.

T-Boone Pickens is getting a lot of press lately for an idea intended to be a step in the sustainable direction. I think that is because he is paying for the press, but now he is getting some free via the media. He says he has a new grand idea for solving our energy crisis. It involves using natural gas in vehicles as an "interim" solution and large-scale wind power "plants" for a long term solution. While his heart is probably in the right place, this new idea isn't really breaking new territory. He did make $billions from oil and gas. There were no doubt some good jobs involved in that. I suspect there was also quite a bit of trickle up – our money trickled up into his accounts when we bought gas or paid our utility bills. We have to ask ourselves if this grand new idea will really be a departure that is a greater benefit for "the people" and mitigating climate change, or mostly a financial benefit for another big corporation that may or may not benefit society and the environment. One clue to the answer lies in looking closely at the proposal and who will benefit the most. Bill Gates made a "buck" selling stuff that certainly resulted in huge changes , but also makes many of us want to jump out of windows (pun intended). And now as a philanthropist – giving away money that came from us! It is an interesting philosophical question – are all the progress and additional tasks we can do with the computer really worth all the costs? Remember that data centers are becoming a significant consumer of electricity, and we never did get that 30-hour workweek with an improved lifestyle from machines doing what was humans' work. The stakes with the climate crisis

are far higher than a 30-hour work week. We cannot afford many more mistakes, so how do we evaluate such proposals?

Now T-Boone has a plan to combine wind and gas (and not from eating beans). He too has turned philanthropist. And yet in sticking too close to what he knows (natural gas) is he missing the big picture? There are two simple tests we can apply to possible energy sources that will go a long way toward helping evaluate a proposal. First is to ask if the carbon released into the atmosphere, if any, is current or old (fossil-based). Second is whether the energy production is close to the energy consumption, in other words local. So we ask is it current and local.

How do we discern the truth in the message? Coupling gas with wind implies renewable and sustainable and clean. T-Boone says that gas is clean. But doesn't gas combustion produce many byproducts? In complete combustion, the products are mostly carbon dioxide and water. But combustion is rarely complete, especially if it is burned, which is kinda the whole point of combustion. Other products of combustion include carbon monoxide, soot, and formaldehyde. Natural gas is a gaseous fossil fuel consisting primarily of methane but including significant quantities of ethane, propane, butane, and pentane - heavier hydrocarbons mostly (but not entirely) removed prior to use as a consumer fuel - as well as carbon dioxide, nitrogen, helium and hydrogen sulfide (source: Wikipedia – go ahead, look it up yourself). Methane combustion produces very small amounts of sulfur dioxide and nitrogen oxides, virtually no ash or particulate matter, and lower levels of carbon dioxide, carbon monoxide, and other reactive hydrocarbons. But some. So cleaner than coal or oil, but not clean clean.

The real problem the proposal implies that it addresses is this: too much carbon in the atmosphere and too much CO2 in the oceans (making carbonic acid which in turn threatens most life in the oceans). The result: changing the climate and the chemistry of the oceans, both for the worse as far as humans are concerned.

Lets take a look at some basics. What made gas, oil, and coal? Fossilization. Here is a crude summary:

Fossilization: 50 – 100 million years ago

Plants are made by photosynthesis of energy from the sun
Animals eat some of the plants
Both decompose partially, but are covered before decomposing completely
Coal: plant & animal matter under swamps, mixed with dirt, and then dirt and water pressure.
Oil & Gas: ocean plants & animals, under sand & silt & ocean, then under sand, silt, and rock pressure
Heat & pressure made the gas & oil or coal
The carbon was made by energy from the sun and sequestered for 50 to 100 million years

Imagine – put money under your mattress all your life. Then there is a fire. In a few blinks of an eye, a lifetime of savings is gone. Now think of burning coil, oil, and gas. It took roughly 50 to 100 million years to save and cook, and in 200 years humans have burned about half of it. In the next fifty years, humans will try to burn the other half, in a geologic blink of an eye.

All of it is old, sequestered, "fossilized" carbon.

Wind is coupled to gas in T-Boone's proposal mostly, I think, because wind is renewable and makes the gas sound good. Just like in the pharmaceutical ads. Wind is created directly by heat from the sun. No carbon cycle necessary. It doesn't always blow in a given place, but it is always blowing somewhere. When we use wind power, we are using current, renewable energy.

Biofuels, generally, are made by photosynthesis using energy from the sun. If we use the biofuels reasonably soon after they are grown and processed without sequestering them for millions of years, then we are using current carbon. The carbon is returned to the atmosphere and then goes right back into making plants. This is a closed carbon cycle with nominally a zero net gain, although some carbon is actually sequestered in the soil. Thus biofuels use a current carbon cycle, which does not over time add carbon to the atmosphere or CO2 to the oceans.

Coal, oil, and gas are fossil, or old carbon that releases carbon stored millions of years ago and does increase carbon in the atmosphere and CO2 in the oceans.

Now what about these large, centralized wind power plants?

Remember the last time you drove on a major highway during a massive traffic jam? It took a long time and your mileage was terrible. Think of that as friction between and among many cars on the road. Now drive the same road at 4 AM on a Sunday. Few cars, very little friction, much better mileage. Think of Gas in a pipe line or electrons in a long-distance electrical wire. Same thing. During peak usage, high friction and low efficiency. Wastes fuel. The longer the distance, the more fuel wasted.

Thus the second concept is local vs. long-distance transportation. Old carbon takes sophisticated technology to recover, refine, and use. Large, centralized mines (coal) or refineries (oil) and long pipelines (gas) are needed to get the fuel to the users. That is large and centralized.

Wind blows in many places. You can put a windmill in your backyard and connect by wires to others across the country for those times when backup is needed. That is mostly local with some distance transportation when the wind is not blowing in your area. The overall efficiency is now improved if we can

assume that production efficiency is similar. We can store excess electricity in batteries, or using other storage technologies. Perhaps we could use excess electricity to pump water into a tower, tank, or small reservoir and then use a microturbine to make electricity when the wind is not blowing. Do this on a local community scale, and you have local and high efficiency.

Biofuels are presently a combination. Some can be made locally, some in centralized processing plants. In time, the technologies are expected to be usable in small scale, on a local level. Development is needed for specific bacteria and enzymes. So in time, it can probably be local.

Direct solar is inherently local in many places. The sun shines about everywhere, at varying amounts. Large solar power plants are centralized and require long distance distribution, but we don't always need large and centralized, although sometimes the collection efficiency can be improved. The large corporations need large centralized to be able to sell it to us at a profit and to fit into their, well, large systems. We don't need it to be centralized. Solar is inherently a decentralized energy source just like wind.

An important test for energy policy, therefore, is current and local.

To simplify, ff a technology uses old, fossilized carbon, that is bad.

If a technology uses current carbon, that is good. Nearly as good as using no carbon at all, except for any harmful byproducts of combustion.

If a technology is by nature centralized, then that is a poorer solution.

If a technology is available locally, but someone wants to make it centralized and sell it to you as a convenience, then again, poor solution environmentally.

A technology that both uses current carbon and is local, well, now we're talking!

T-Boones proposal? Mostly old, fossilized carbon, with some current wind energy promised as a teaser, and centralized. The wind energy part of his proposal is current energy, but it is not local. The gas part, well – that is old carbon and centralized. But at least we are now talking about potential solutions and learning to apply a simple test! Look for current and local in **your** energy supplies.

Reference material:

Wikipedia:

Formation

Geologists view crude oil and natural gas as the product of compression and heating of ancient organic materials (i.e. kerogen) over geological time. Formation of petroleum occurs from hydrocarbon pyrolysis, in a variety of mostly endothermic reactions at high temperature and/or pressure.[9] Today's oil formed from the preserved remains of prehistoric zooplankton and algae, which had settled to a sea or lake bottom in large quantities under anoxic conditions (the remains of prehistoric terrestrial plants, on the other hand, tended to form coal). Over geological time the organic matter mixed with mud, and was buried under heavy layers of sediment resulting in high levels of heat and pressure (known as diagenesis). This caused the organic matter to chemically change, first into a waxy material known as kerogen which is found in various oil shales around the world, and then with more heat into liquid and gaseous hydrocarbons in a process known as catagenesis.

Geologists often refer to the temperature range in which oil forms as an "oil window"[10]—below the minimum temperature oil remains trapped in the form of kerogen, and above the maximum temperature the oil is converted to natural gas through the process of thermal cracking. Although this temperature range is found at different depths below the surface throughout the world, a typical depth for the oil window is 4–6 km. Sometimes, oil which is formed at extreme depths may migrate and become trapped at much shallower depths than where it was formed. The Athabasca Oil Sands is one example of this.

Crude oil reservoirs

Three conditions must be present for oil reservoirs to form: a source rock rich in hydrocarbon material buried deep enough for subterranean heat to cook it into oil; a porous and permeable reservoir rock for it to accumulate in; and a cap rock (seal) or other mechanism that prevents it from escaping to the surface. Within these reservoirs, fluids will typically organize themselves like a three-layer cake with a layer of water below the oil layer and a layer of gas above it, although the different layers vary in size between reservoirs.

Because most hydrocarbons are lighter than rock or water, they often migrate upward through adjacent rock layers until either reaching the surface or becoming trapped within porous rocks (known as reservoirs) by impermeable rocks above. However, the process is influenced by underground water flows, causing oil to migrate hundreds of kilometres

horizontally or even short distances downward before becoming trapped in a reservoir. When hydrocarbons are concentrated in a trap, an oil field forms, from which the liquid can be extracted by drilling and pumping.

The reactions that produce oil and natural gas are often modeled as first order breakdown reactions, where hydrocarbons are broken down to oil and natural gas by a set of parallel reactions, and oil eventually breaks down to natural gas by another set of reactions. The latter set is regularly used in petrochemical plants and oil refineries.

Non-conventional oil reservoirs

Oil-eating bacteria biodegrades oil that has escaped to the surface. Oil sands are reservoirs of partially biodegraded oil still in the process of escaping and being biodegraded, but they contain so much migrating oil that, although most of it has escaped, vast amounts are still present—more than can be found in conventional oil reservoirs. The lighter fractions of the crude oil are destroyed first, resulting in reservoirs containing an extremely heavy form of crude oil, called crude bitumen in Canada, or extra-heavy crude oil in Venezuela. These two countries have the world's largest deposits of oil sands.

On the other hand, oil shales are source rocks that have not been exposed to heat or pressure long enough to convert their trapped hydrocarbons into crude oil. Technically speaking, oil shales are not really shales and do not really contain oil, but are usually relatively hard rocks called marls containing a waxy substance called kerogen. The kerogen trapped in the rock can be converted into crude oil using heat and pressure to simulate natural processes. The method has been known for centuries and was patented in 1694 under British Crown Patent No. 330 covering, "A way to extract and make great quantityes of pitch, tarr, and oyle out of a sort of stone." Although oil shales are found in many countries, the United States has the world's largest deposits.[11]

Coal

Coal is a fossil fuel formed in ecosystems where plant remains were preserved by water and mud from oxidization and biodegradation, thus sequestering atmospheric carbon. Coal is a readily combustible black or brownish-black rock. It is a sedimentary rock, but the harder forms, such as anthracite coal, can be regarded as metamorphic rocks because of later exposure to elevated temperature and pressure. It is composed primarily of carbon and hydrogen along with small quantities of other elements, notably sulfur. It is the largest source of fuel for generation of electricity world-wide, as well as the largest world-wide source of carbon

dioxide emissions, which according to the IPCC, contribute to climate change and global warming. In terms of carbon dioxide emissions, coal is slightly ahead of petroleum and about double that of natural gas.[1] Coal is extracted from the ground by coal mining, either underground mining or open pit mining (surface mining).