The Egg

The Birds

Tom Ransom 2011...

Which came first? Insofar as humankind is concerned, no question about it—the egg came first. In fact, our 'yolk' was here long before we were, reservoirs of oil so abundant they were under pressure. Tap in and out gassed petroleum, barrels full for the filling, so much fuel that it provided for the cityscaping of Earth and the globalization of commerce. Yet many now believe the petroleum age is fouling our planet, presenting humanity with a potential crisis that places our future in jeopardy. Really? Consuming our yolk is the *end* of it all! Rather, step back for a moment, zoom out, and look how remarkably Earth resembles an *incubator:* Fertile lands awash with water, slowly rotating in the warmth of its parent star, generating a magnetic shield deflecting the Sun's most damaging radiation. Would it be any more remarkable, to now suppose that perhaps life on Earth—humankind, necessarily consuming its yolk, might be right on time?

Indeed, our incubating "biosphere" proved so favorably fertile that the earliest plant forms, over millions of solar orbits, were able to photosynthesize a global cache of energy rich "carbohydrates". Oxygen was a byproduct. When metabolic oxidation was found to reverse this process, the solar energy was reused, fueling the coevolution of ever more advanced life forms. And with each generation's passing, under the compounding pressure of all this biomass, and then geologic churning, life's layers were slowly processed into "hydrocarbons"—coal, oil, and natural gas. Such "fossil fuels" ignite because at their combustion temperature their hydro-carbon bonds burst, and as oxygen rushes in to capture the carbon, and the hydrogen returns to water, the energy from all those original photo-bonds is released. That's the heat of the Sun we feel whenever something organic burns; stored sunlight from millions of years ago when we're burning fossil fuels.

It now seems a gathering majority believes that critical consequences require us to restrict our consumption of these fossil fuel reserves. Clearly, it's not like letting sunlight out of a jar; when light and heat are released from combusting hydrocarbons so is carbon, and carbon compounds pollute Earth's atmosphere with particulates and gases, altering its composition and density. Those who warn of an impending climate crisis recognize that the prevailing ecological equilibrium is a tentative adaptation tuned to the mean of its habitable range. Rapid change can undermine the balance of nature and overwhelm its adaptive capacity. They know the fossil record provides substantial evidence that the evolutionary edifice of life on Earth has collapsed many times in the past due to cataclysmic volcanic and meteoric events.[1]

As climate change alarmists input field data into computer models portending an environmental crisis if fossil fuel consumption continues unabated, informed skeptics caution that our biosphere may be too dynamically complex to successfully compress into algorithms predicting long term outcomes. They know that the water vapor cycle, one of the most influential model components, and likely the most thermal mitigating, is also the least predictable.(2) And they question the purported "anthropogenic" climate-change evidence. There are, after all, causations far greater than human activity influencing the global climate, such as stochastic variations in solar radiance, and periodic perturbations in Earth's orbit and rotation, like those causing glacial periods, and perhaps the current desertification of northern Africa.(2a) And unlike sudden geo-cataclysmic events, burning our hydrocarbon reserves would likely evidence the thermal effects of a slow extended impact trending on a century scale, not decades.

While such skepticism may be justified, a countervailing fact remains. Over a few hundred years humankind will be reintroducing many *millions* of years(3) of hydrocarbon-sequestered solar energy onto the surface of our planet. Because every fossil fueled activity ends up as heat, and compensatory radiative forcing(4) is impeded by the "greenhouse effect", the certain consequence of consuming our petroleum yolk will—without a doubt, be a warmer world. Take a look at an overview of our electrical resistance "grid" and consider that within the comparative space of an apple skin, this round-the-clock, mega-terawatt, 'electric heater' represents just half the heat we're actually producing.

Though this anthropogenic heat is a relatively small contributor in Earth's global thermal exchange, our terrestrial environment is very complex and feedback intensive, small influences can have significant effects, and the thermal input of human civilization is both non-trivial and unprecedented. While we may be unable to predict to what degree, perhaps in principle we can agree, that *all* heat released from the consumption of latent, interred, energy resources makes a positive thermal contribution to current global conditions. That said, why must our presumptive demise necessarily follow? We might be right on time. Here's what the great visionary Buckminster Fuller had to say a half century ago:

> "Humanity's survival and growth up to now was apparently provided just as a bird inside of the egg is provided with liquid nutriment to develop it to a certain point. But then by design the nutriment is exhausted at just the time when the chick is large enough to be able to locomote... stepping forth from its shell the young bird must now forage on its own legs and wings to discover the next phase of its active regenerative sustenance. My own picture of humanity today finds us just about to step out from the pieces of our broken eggshell... we are faced with an entirely new relationship to the universe. We are going to have to spread our wings of intellect and fly or perish."[7a]

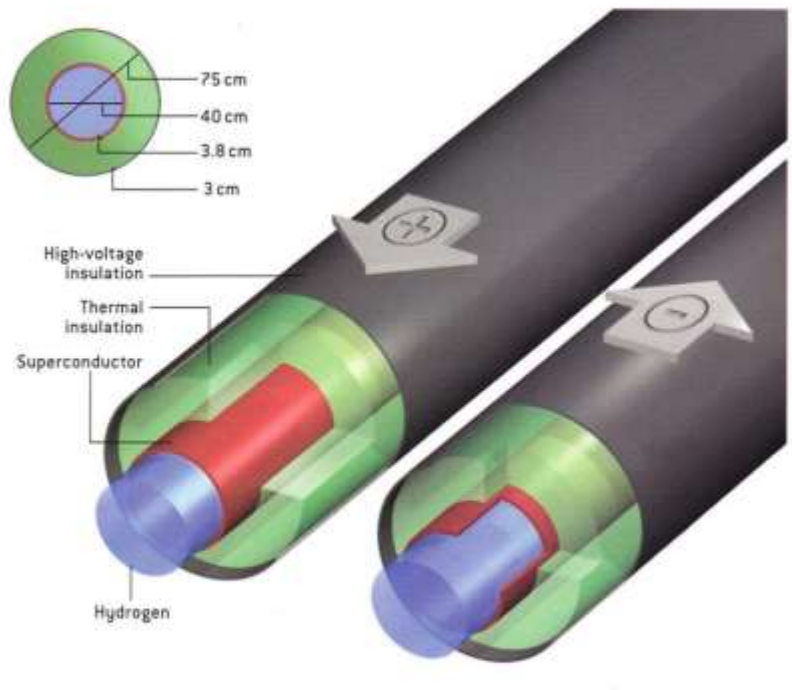
> "The fossil fuel deposits of our Spaceship Earth correspond to an automobile's storage battery which must be conserved to turn over our main engine's self-starter. Thereafter, our 'main engine', the life regenerating processes, must operate exclusively on our vast daily energy income from the powers of wind, tide, water, and the direct sun radiation energy."[7b]

The extent to which Earth's ecosystem may be influenced by our energy contribution will be proportional to what we *introduce* into the environment, not by what we necessarily consume. The way to relieve a pending energy crises is to unburden ourselves from having to find, extract, refine, carry, burn and clean up, heavy, contaminating, hydrocarbon and radioactive mineral fuels. A clean, weightless, inexhaustible, solar and geothermal energy supply is ours to use freely, and it's *plenty*. The direct annual solar potential alone is greater than that obtainable from the *total* of Earth’s combined fossil fuel and uranium reserves.[8] Add to this the geothermal potential available to varying degree nearly everywhere under ground, and with ever greater efficiency gains, these ample energy allowances will only appear to grow. Already the technologies to utilize them are readily advancing. At any rate, it's just a matter of time before the scarcity and externalities of fossil and fissionable fuel acquisition and consumption drive up their total "true costs"[9], to where renewing alternate energy sources favorably compete, and human civilization, as a matter of course, steps out from its petroleum yolk dependency on the past, into a real-time regenerative energy future.

We could prepare for and even expedite this eventuality by anticipating the energy endgame—hydrogen and electricity. These two 'fuels' aren't energy resources themselves because it takes energy to produce them, rather, they are readily transportable fluid carriers. Free electrons and atomic hydrogen are the ultimate energy currencies because not only is each immutably basic, nearly weightless, and universally abundant, they are complementary, each able to regenerate the other to become one electro-chemical utility. Hydrogen can be burned—oxidized, exhausting only water, to drive the generators that power the grid. Hydrogen can produce electricity directly if processed in a fuel cell. And an electrical differential is an excellent way to separate a water molecule into its constituent gases—hydrogen and oxygen. Hydrogen can then be pumped into reserve storage and called upon to produce heat and electricity whenever solar, wind, and water resources directly provide less than demand requires. And lastly, most auspiciously, the carrying capacity of these energy carriers is complementary as well. At the temperature of liquid hydrogen electrical conductors become "superconducting" meaning charge conveyance via hydrogen cooled conduits is as efficient as it gets. All told, the integration of these two carrier coefficients is so enabling, that without the hydrogen factor, real-time electrical resources may never satisfactorily solve the sustainable energy equation.[a]

Government and corporate leadership could promote the transition from the hydrocarbon to the hydrogen age by committing to the construction of a "SuperGrid". Following the existing power-tower corridors, a "SuperCable"[10] would pipe both hydrogen and electricity ("hydricity") between cities.[b] A "smart"[11] decentralized SuperGrid would feature "network redundancy", energized locally from any source that produces hydrogen or a positive voltage potential. Small scale energy producers would proliferate, innovation directly rewarded. True-cost corrected hydrocarbon and nuclear fuel contributions could compete as any other.[c] A strategic plan to develop a distributed-supply, interstate SuperGrid, would stimulate capital investment, create new employment sectors, and trend the economy away from its dependency on fossil and fissile fuels *as* they become evermore costly to consume. Anyway, it's likely these non-renewable buried resources will be even more valuable to future generations for purposes other than terminal ignition.

SuperCables could transport energy in both electrical and chemical form. Electricity would travel nearly resistance-free through pipes (*red*) made of a superconducting material. Chilled hydrogen flowing as a liquid (*blue*) inside the conductors would keep their temperature near absolute zero. A SuperCable with two conduits, each about a meter in diameter, could simultaneously transmit five gigawatts of electricity and 10 gigawatts of thermal power (*table*).



	Voltage/Temperature	Flow rate	Power delivered
DC circuit	+50,000 volts and −50,000 volts	50,000 amperes	5,000 megawatts electric
Liquid hydrogen	20 kelvins	0.6 cubic meter/ second in each pipe	10,000 megawatts thermal

An advancing marketplace of products and technologies is primed and ready to begin moving us toward a sustainable, non-polluting, net thermal-neutral, hydrogen-solar economy. Geothermal and hydrogen conversion facilities, hydrogen powered engines, hydrogen fuel cells, photo-voltaics, solar-thermal arrays, hydroelectric, oceanic, and wind driven turbines are all producing energy today.[d] It's time we invest our fossil fuel endowment in the development of a smart, secure, hydricity SuperGrid energized in real-time by the internal heat of planet

Earth and that of the Sun—its parent star, that life-sustaining, exemplary fusion, of hydrogen and electromagnetic transmission. It's time we gratefully turn away from our petroleum yolk, set our sights on the solar wind, and "spread our wings of intellect and fly". And yes, it appears we might be right on time.

a) And those who believe thermonuclear hydrogen fusion could one day be the ultimate sustainable energy solution should reconsider the effect a multitude of terrestrial 'mini-stars' would have on Earth's thermal equilibrium.

b) With a few modifications, hydrogen could initially be blended along with natural gas and distributed through a city's existing gaspipe infrastructure.(12)

c) The recent abundance of recoverable natural gas is a most favorable finding, for not only is this the hydrocarbon fuel with the least negative externalities, it is currently the preferable source of hydrogen. Fractured shale technologies may also provide access to geothermal potential.

d) Biofuels are not included. Excepting local energy-from-waste incineration, carbon fuels will prove to be, for the most part, burdensome, inefficient, and unnecessary. Loose the carbon—it's hydrogen we're after.

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