The Fuel-less future:

Abstract:

Anthropological philosophers now believe that man was domesticated by various plants and animals. This tragic path, the path of agriculture, has left humanity dedicated to the growth and health of these “lower species”. We protect them, we feed them, we spend countless hours bringing them water and energy. In effect humanity has been enslaved by wheat and chickens, whose populations are many times greater than the populations of their human slaves. This article questions another tragic mistake that has allowed not only plants but also minerals to enslave us. That mistake was to follow and worship the flickering flames of fuel. We have been convinced by these flames that they are the Gods of warmth and safety. Yet nature uses fuels sparingly and in very controlled ways. While we are destroying our world by consuming fuels on a vast and increasing scale. We spend more human lives on finding, delivering and consuming fuel than in conflicts or disease. This manuscript examines the history and future of human fuel use, and presents provocative ideas about where we might go next.

A new direction in energy:

The history [1]of mankind has been defined by fuel, fuel sources, and fuel to fire conversion methods. The earliest form of fuel was for incidental warmth, when prehistoric humans found some relief from the cold, competitors and predators near a naturally occurring flame. Due to the rarity of the occurrence of natural fires, these people, once they overcame their fears, and understood its power, may have deified these flames, making fire one of our first Gods.
[2]

Unlike dogs, who are theorized to have domesticated mankind, by providing various services such as early warning, protection, and perhaps even as being occasional snack food. Man domesticated fire, by cherishing it, protecting it. and enslaving it to their needs.

The collection of fuel, in the form of branches and logs, most likely took hundreds if not thousands of human generations to master.

One of my favorite movies since the 80's is, "Quest for fire[3]". The story informs my ideas of the domestication of fire by human societies. In this excellent film, the main group of, cavemen, is continuously attacked by other groups who want to steal their fire. As the movie progresses, the hero of the story learns how to make fire, which in his time was as amazing as human flight would have been to the Romans. I'll never forget the look on his face when a man, from a more advanced tribe, makes fire by rapid rotation of sticks.

It is axiomatic that fuel has been extremely important in the development of human society. Yet, I contend that it represents a path that was both unfortunate and will prove to be increasingly pyrrhic.

The conversion of plant mass into heat is the natural progression for an intelligent species. I would expect other primates to follow this path, if they are unimpeded, over the next thousand or so generations. Yet was this the only path, that we could have followed?

During that same period, when fire was domesticated, other less obvious, forms of energy conversion were also apparent. For example the throwing of projectiles, or the rolling of large rocks down hillsides to kill predators or prey, and the construction of solid structures to protect from natural forces, were also being adopted by early man.

These forms of fuel-less energy conversion, without the direct conversion of fuel, are a path that was perhaps too difficult to explore for the pre, or early, cortex human. Yet, over the ensuing centuries many forms of fuel-less energy were discovered.

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[1] <http://science.jrank.org/kids/article_images/earth_p15.jpg>
[2] <http://scienceblogs.com/startswithabang/files/2010/03/gravity_zoomed_mass.gif>
[3] "Quest for Fire (1981) - Trailer - YouTube." 2013. 29 Feb. 2016 <https://www.youtube.com/watch?v=2pcGGKtPpSE>

Elaborate buildings, based upon dynamic bases which ameliorate earthquake damage, the solar drying of crops and skins and water power from streams and rivers. As well as a wide variety of non-combustion chemical reactions, solar heating, chemical conversion and the cleansing power and energy of rain, were all being actively harvested by humans. Often to achieve the same ends as fire, warmth, hygiene and security.

These fuel-less forms of energy conversion also represent a path to warmth and mastery of nature. A fuel-less path, potentially as powerful as plant mass oxidation. A path which was stunted by the wonders, and perhaps the deification, of fire.

Imagine if the big thwack, the currently accepted theory of how the moon formed, had left us with an abundance of fluorine as opposed to oxygen. Fluorine is very similar to oxygen, with a slightly large nucleus, yet it is not subject to easy combustion. Life may still have flourished but combustion would have forced intelligent creatures to seek fuel-less energy exclusively.

This fuel-less path is provided by naturally occurring energy from living creatures, chemical reactions, sunlight, rain, wind and gravity. This is the fuel-less path of static energy conversion.

Gravity is by far nature's favorite form of energy. Energy from gravity is so ubiquitous that we don't even realize it's there, until something heavy drops on your foot. Yet, weight is conservative force that is as active as other forms of energy, which is a as much a result of energy conversion as burning gasoline.

Gravity is nature's favorite form of energy:

Think of the immediate impacts if gravity were to suddenly disappear. Everything that we hold dear would slowly float away into space. I saw an interesting treatment of this idea in an indie film. In this film, a woman, who happened to be a wife and mother, suddenly became immune to gravity. She gradually began to float higher and higher, until her family had to supply her with an oxygen supply, because she had drifted up into the stratosphere. I won't spoil the movie for you, but let's just say that it did not end well for the unfortunate woman.

Gravity unlike sunlight, is a constant source, yet gravity is even more active than sunlight. Like sunlight, gravity has its energetic by-products. The by-products of sunlight are heat, growth, decomposition, chemical reactions, evaporation and numerous other critical processes. Gravity's by-products are wind, waves, rain, compression, chemical reactions and, perhaps most importantly, weight.

Science at the quantum, and even Newtonian, levels considers gravitational energy as weak, passive background energy, which is taken for granted in most analysis of physical, molecular and atomic phenomena. Yet, gravity is not weak, it is diffuse and very active.

Science and physics are primarily concerned with overcoming the effects of gravity. Yet, engineers, like myself, have long been forced to embrace gravity, especially in the design, construction, and maintenance of large structures such as bridges, dams and tall buildings.

Many of the early notable scientific triumphs were in understanding and quantifying the effects of gravity, especially for military purposes. The path of cannon shells and bullets and the construction of protective walls are some of the early problems that were solved through the improved understanding of gravitational phenomena.

It is my contention, and my objective in this manuscript, to describe the fuel-less path. The fuel-less path, that mankind could have taken, and that I believe will eventually be forced upon us by the destructive nature of our current fuel based path.

I believe, and will try to prove, that their is sufficient energy that can be harvested at any point on the planet's surface, to provide sufficient energy for human society, without the use of fuel.

Nature eschews fuel combustion:

Plants, insects and animals have survived and prospered for a billion generations without the usage of fuel as we know it. Trees and other huge lifeforms live tremendous long lives without fuel.

These iconic lifeforms use gravity as foundational structure, to sustain flows of fluid, sunlight as heat and ionic sources, and wind to live and propagate.

Your first reaction to the idea of a fuel-less world, is most likely that we need the density of fuels for warmth, transport, and the domination of nature. Yet, the arc of the energy required for all these needs tends toward greater and greater conservation. Not conservation in the sense of reducing the amount actually used, but instead, the reduction in the amount needed to achieve a particular goal. Home and building construction are prime examples of the illusory nature of fuel requirements.

A well insulated home or building, perhaps constructed at least partially below ground, can virtually eliminate the need for fuel. The combination of geothermal energy for heating and cooling, and solar and wind energy for electricity and water heating, can make even a large house or building completely independent of fuel or grid based energy sources.

Transportation is perhaps the next challenge for a fuel-less future. To this I would ask is transport in the manner that we have become accustomed to actually practical? Is it really necessary that we travel at hundreds of miles per hour? Or is it necessary that we employ thousands of pounds of equipment to transport a 150 pound human? Perhaps things are just too far away!

Yet, given that these fundamental philosophical questions, may have already been rendered moot by our recent progress, which informs our expectations, we can still harvest sufficient energy from non-fuel sources to meet our fundamental transport needs.

Electric cars are becoming increasingly efficient and practical. Energy derived from solar energy concentration, combined with new gravity harvesting methods, that I will discuss, and vehicles constructed of lightweight composites, will soon make the internal combustion engine powered vehicle, an artistic remnant rather than an engineering phenomena.

The problems with fuel:

Typical fuel sources include plant mass (wood, peat, oil, coal, etc.) and fissile metals (uranium, plutonium, etc.), yet many materials can be used in a fuel relationship. The fuel relationship necessarily includes a conversion in form to a more or less fundamental form.

The most extreme example of this is the splitting of atomic nuclei during the fissile process, which is a form of nuclear transmutation. The resulting products of these reactions are fundamentally different from the original materials.

Transmutation is a natural process which regularly occurs in the atmosphere due to the influence of cosmic rays on materials such as argon.

In more quotidian processes such as combustion, a fuel source is converted from its original molecular structure, as opposed to its original atomic structure, into by-products such as carbon dioxide and carbon particles, ranging in size from the microscopic to the macroscopic.

Fuel is often non-renewable:

The problem with fuel, is that the resulting products of combustion or fission are less valuable, from a human perspective, than was the original material. The gains from the process are the release, or conversion, of energy usually as a form of heat. Since heat is essentially a form of free energy, a change agent, it can be converted into kinetic energy, such as movement or pressure, or through some other conversion into easily distributable electrical energy.

For early humans the valuable by-products of combustion were heat and light, and at some later stage in development into chemical and mechanical processes such as the drying of skins.

Consequently fuel, in most cases has two fundamental problems. The first is in the rapid conversion of resources which took years to assemble, thereby converting non-renewable resources into energy.

Fuel is degrading:

The second problem is that since the process of conversion creates by-products of less or even negative value, to mankind and the ecosystem, the use of fuel creates pollutants. The pollutants that we are currently aware of, which are by no means all of the pollutants created by these processes, include air pollution, water pollution and nuclear waste.

It's possible that some of these low value by-products will eventually be realized as having some other use which renders than to be of higher value to mankind. This has been the theme of many new innovations which for example use excess carbon dioxide in greenhouses[4][5] and other valuable processes.

Yet, nature has not proven to be as facile or flexible as mankind. The result is that the by-products of fuel use are stressing evolved ecosystems resulting in contemporary problems such as global warming and the reduction of the world's supply of potable water.

Many argue that non-renewable resources are far from critical stress points, and that we don't need to incur the tremendous costs of either conservation or outright bans on their usage. They make the point that although we have already used vast quantities of these natural nonrenewable resources, new resources are being discovered at an increasing rate.

[4] "Turning Excess Carbon Dioxide Into Fuel - Astrobiology ..." 2014. 29 Feb. 2016 <http://www.astrobio.net/topic/solar-system/earth/climate/turning-excess-carbon-dioxide-into-fuel/>
[5] "UGA discovery may allow scientists to make fuel from CO2 ..." 2013. 29 Feb. 2016 <http://news.uga.edu/releases/article/uga-discovery-may-allow-scientists-to-make-fuel-from-co2-in-the-atmosp/>

Fuel is subject to markets:

However, at the time of this writing, (early 2016), the drastic and sustained fall of energy prices is causing great stress to producing nations and organizations, as the cost of production are more than the market value of the resource.

However, for all of us who are old enough to remember the oil shortages of the 1970's, caused by the OPEC pricing cartel, low energy prices and high fuel availability seem like a true blessing. Yet, this dichotomy between boom and bust times, informs us of the potentials for a more stable fuel-less economy.

Indeed it was the oil shortage that prompted western nations to seek new sources of energy, which has led to the rapid expansion of both regional exploration and the drive toward fuel-less energy. The result of these efforts are the low prices that we see today, as vehicles and buildings become more fuel efficient, and entrepreneurs have pushed global exploration, which has led to both dramatic supply increases and greater competition among suppliers.

The current low petroleum prices are largely the result of the competitive strategies[6] of dominant low production cost suppliers to bankrupt high cost providers. Yet, as alternative fuel-less sources become increasingly economically viable, due to long-sighted views of enlightened world leaders, who continue to invest in renewable, (i.e. fuel-less), sources. the value of fuel will continue to wane.

This long term shift will force, which is great for the populace, those countries which have economies almost entirely based upon selling oil, to begin to seriously diversify and become competitive in the non-oil world economy.

[6] "Oil Prices: What's Behind the Drop? Simple Economics ..." 2016. 29 Feb. 2016 <http://www.nytimes.com/interactive/2016/business/energy-environment/oil-prices.html>

Alternatives to fuel:

It's hard, for the student of international development, not to see the rise of fuel-less energy sources around the world. The world press is filled with pictures of huts with solar panels on the roof and solar stoves. Yet the most positive trends toward fuel-less energy is actually coming from methane capture[7][8], especially on small farms around the world.

The viability of fuel-less energy sources, especially combined with non-combustible biomass sources such as methane capture, is increasing at a rapid rate. This rise is doing much more than reducing energy costs and increasing energy availability. Rural and spontaneous communities[9][10], such as the vast slums and refugee camps, are finding that they can have indoor illumination, hot water, and even refrigeration due to advances in fuel-less energy sources.

These fuel-less sources will include; solar, wind, bio-conversion, rainwater collection, and gravity powered devices. I contend that although our sun only provides about 120 watts per square meter, with the usage of solar concentration, (which includes bio-conversion), geothermal energy and gravity there is a enough natural energy to provide 300-400 watts per habitated square meter.

This level of fuel-less energy density is sufficient to provide a 50 square meter home with sufficient Kw hours to provide lighting, communication, refrigeration and heating without the burning a drop of, post manufacturer, fuel.

This same 6-12 Kw per hour, per square meter, is also sufficient for transit. It's axiomatic that transport will continue to become more efficient. The idea that you need thousands of pounds of equipment and fuel to rapidly move a 150 pound person around is dis-proven everyday in my area, where teens on 50 pound hoverboards zip about the streets with abandon.

I foresee family sized driverless platforms, which weight less than 100 pounds, kinda like golf carts, filling the roadways of cities around the world. You will sit or stand on these platforms and like magic carpets you will tell it where you want to go. If it's cold or raining the platform will project a beam which acts as a wall, either blocking, diverting, or absorbing excess weather.

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[7] "Fiscalini Farms Methane Capture Project | CarbonNeutral ..." 2013. 29 Feb. 2016 <http://www.carbonneutral.com/carbon-offsets/fiscalini-farms-methane-capture-project>
[8] "Trash to Cash - Methane Capture Generates $3-4 ... - C40." 2014. 29 Feb. 2016 <http://www.c40.org/case_studies/trash-to-cash-methane-capture-generates-3-4-million-annually>
[9] "NATIONS: Renewable energy, once a dream, lights up ..." 2013. 29 Feb. 2016 <http://www.eenews.net/stories/1059992166>
[10] "Renewable energy in slums - OpenIDEO." 2015. 29 Feb. 2016 <https://challenges.openideo.com/challenge/urban-resilience/ideas/renewable-energy-in-slums>

I've already seen a version of this in Taiwan, a couple of years ago. They had a wall in my hotel room that you could switch on or off, making it clear or cloudy. It's not too far a stretch to see a similar technology that with low energy usage can block not only light but kinetics as well.

A bit closer to our time the lack of exploitation of fuel-less energy is have tremendous consequences today. Due to the interminable wars in the middle east, the international news is filled with tragic refugee stories. Perhaps the most tragic is that millions of families are shivering in cold tents, despite the fact that the ground underneath the tents is a comfortable 60 degrees. If geothermal pumps were distributed to these people they could be safer and much more comfortable. Such devices can be constructed from excess construction materials, or manufactured for reasonable costs.

Geothermal is also dramatically under utilized[1112] even in more developed areas. Many small farm houses and barns spend thousands of dollars per year on heating when a simple geothermal system could provide them with years of free heat.

[11] "Geothermal Basics Current Use - Geothermal Energy ..." 2009. 29 Feb. 2016 <http://geo-energy.org/currentUse.aspx>
[12] "The Uses of Geothermal Energy - Green Living Ideas." 2010. 29 Feb. 2016 <http://greenlivingideas.com/2007/10/22/the-uses-of-geothermal-energy/>

Fuel is killing people everyday:

Another excellent example of under utilized fuel-less energy is literally killing people everyday all across the world. Street appliances[13][14] like lighting, stop signs, informational signs and emergency vehicle control systems are essential for today's high volume and high speed traffic flows.
These devices are often the first casualties of systemic and regional grid failures. In the DC area every time we have a major weather event traffic lights go into emergency mode if they stay on at all.

These little inconveniences are indeed quite deadly. Hundreds of T-bones, sideswipes, and head on collisions are caused by traffic appliance failures. This problem is relatively minor in the US and other developed economies, yet in less developed areas this is a bloodbath, especially for pedestrians. I have seen both the volume and operational incompetence of vehicles in cities like Cairo and New Delhi, where even working lights and signs are often ignored.

These problems could be ameliorated if traffic generated electricity. The gravity powered generators that were much heralded in the national and international press in the early 2000's. right before the 9/11 catastrophe.

[13] "Five reasons buildings fail in an earthquake - Christner Inc." 2014. 29 Feb. 2016 <http://christnerinc.com/uploads/wysiwyg/hcd-five-reasons-buildings-fail-during-earthquakes-jeff-white.pdf>
[14] "Earthquakes - City of Redwood City." 2015. 29 Feb. 2016 <http://www.redwoodcity.org/home/showdocument?id=5441>

Technological alternatives for fuel:

These technologies have remained unexplored and un-implemented, largely due to suppression from the scientific community due to linger irrational views on perpetual motion. My colleague Dr.Gare Henderson, is the inventor of the original device known as the Traffic Tap. This simple mechanical device can provide all of the power needed to operate traffic appliances around the world. The systems are largely immune to weather or earthquake, and are more efficient when traffic flows are highest.

The fuel-less sources are defined as DSE sources (Dynamic State Energy). as opposed to forms of fuel conversion, such as fire or nuclear fission.

These DSE sources are all based upon some dynamic changes, natural or contrived, to some static energy source or static mass. Static energy sources such as gravity, the atmosphere and sunlight can be harvested by some recognized or induced change. Gravity can be captured from falling or floating masses.

Atmospheric mass energy can be harvested from natural changes such as wind (kinetic energy of moving molecules) or changes in density. Gravity induced water pressure, as in the deep ocean, can be harvested by systematic changes in the resistance of a body to the pressure.

Sunlight, while varied by the rotation, solar orbit, and seasonal tilt of the planet, can be harvested from induced changes in some static mass, as heat or atomic or molecular conversions. Electrical generation can be readily harvested by induced changes or disruptions in a static magnetic field.

Issues:

Sustainability:

In this document I will include methane capture, especially local capture, as a form of fuel-less energy, even though methane is a type of fuel that is often used as a combustion source. I include these sources because they represent many of the fundamental virtues of fuel-less energy.

One of the main aspects of local methane capture, which dovetails well with energy sources such as solar, is sustainability. That is the ability of energy users to operate independently of centrally provided energy resources such as grid electricity and converted petroleum.

Sustainability[15][16] will become the clarion call of the next couple of decades. Central resource failures are already endemic, yet as concepts like the internet of things, and cyber-warfare continue to develop, sustainability of energy and water will become increasingly paramount in the concerns of both the populace and legislative bodies.

The most well known fuel-less energy sources are solar photovoltaic, wind and hydro. Other less known sources include geothermal, bio-conversion (methane capture), solar heating, and gravity capture. Gravity capture is my area of expertise, and I will discuss many methods of gravity capture that are all but unknown even among renewable energy experts.

All of these sources have many shared characteristics which provide advantages to the users and the environment. The primary difference between these fuel-less sources is that their is no, or minor, conversion of form. Of course when solar rays are converted into an electrical charge, some conversion is involved. Yet the by-products of energy generation are very limited, which are the bane of fuel use. This is not to say that their are no impacts from the usage of fuel-less energy sources.

[15] Bradley, Thomas H, and Andrew A Frank. "Design, demonstrations and sustainability impact assessments for plug-in hybrid electric vehicles." *Renewable and Sustainable Energy Reviews* 13.1 (2009): 115-128.
[16] "Future Grid to Enable Sustainable Energy Systems." 2015. 29 Feb. 2016 <http://pserc.wisc.edu/research/futuregrid.aspx>

The impacts of hydropower:

Capturing hydro power removes energy from the flow of its source[17][18]. This can have immediate impacts on local animal and plant viability, as the strength of the flows of water are often important in the distribution of nutrients and procreation. The decrease of water flows can also have serious impacts for downstream users, who often depend on flow strength for downstream hydroelectric generation and flow powered irrigation schemes. This problem has been most publicized in the conflict between Egypt and upstream Nile users such as Sudan and Ethiopia.

The secondary impacts of hydropower, are generally due to the design of dams, which prevent fish from intuitive spawning behavior, and the construction of reservoirs which displace human and animal populations and trap large amounts of carbon underwater.

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[17] Williams, Garnett P, and Markley Gordon Wolman. "Downstream effects of dams on alluvial rivers." 1286 (1984).

[18] Chaves-Ulloa, R. "Downstream effects of hydropower production on aquatic ..." 2014. <http://www.ncbi.nlm.nih.gov/pubmed/25189078>