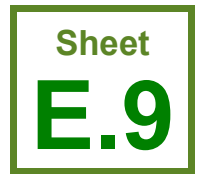


Energy Delusions

The Trade in Pseudo-Solutions



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(where sold)

Members of the *Energy Beyond Oil Project* have been talking with different community groups for over 5 years. Over this time we've heard many "solutions" to the problems raised, and to be fair, we've looked into most of them to try and work them into the narrative of the Project. Most of these solutions, for want of a better term, are *complete rubbish!* Here's why.

EROEI – It's all physics!

We use machines to produce energy, but more importantly, a fuel source to power it. It takes energy to make the machine, and energy to make the resources that are used in its construction. Using tools such as life-cycle analysis we can add up the value of the energy consumed by an energy "solution". Comparing this value to the energy produced we get a ratio for the *energy return on the energy invested* – usually abbreviated to the rather ugly acronym *EROEI*.

In terms of human civilisations, the human system EROEI has been falling since we ceased being hunter-gathering tribes. It dropped during the industrial revolution, and today, as we run out of dense energy sources the EROEI is falling further because the more marginal sources of oil and gas take more energy to produce each unit of fuel.

When looking at energy "solutions" the issue is not whether it produces usable energy or not, it's whether the solution has a better EROEI than our existing energy and economic infrastructure. Unless we start getting a better return on the energy and resources invested in our infrastructure systems, we're simply going to over-consume ourselves out of existence. Put very simply, any animal or plant that uses more energy to get the energy it needs to live is doomed, at some point, to extinction.

Second Law efficiency

Our use of energy is governed by the *Laws of Thermodynamics*. When we measure efficiency, we look at the energy going into a system, in terms of fuel or power, versus the energy generated by the system. For example, in an electric motor we measure the electric current going into the system and the force (or torque) that the motor produces to get a value for the energy efficiency of the motor. This is called *First Law Efficiency* because we're just looking at the energy flowing through one small system (*First Law*, because you are looking at the energy in terms of an isolated system under the *First Law of Thermodynamics*).

The problem is that a measure of First Law Efficiency doesn't give you a picture of the whole system. For example, your electric motor might be 85% efficient, but if your electricity is generated from coal at 30% efficiency then the total efficiency from fuel source to motor energy is 26%. For this reason

those studying energy now use a measure based on the whole system energy use to produce a measure of the total, or *Second Law Efficiency* (*Second Law* because you're looking at the total consumption of energy and resources, from beginning to end, according to the *Second Law of Thermodynamics*).

Energy Delusions

We know that The Laws of Thermodynamics "work" because, when we look at the natural world, the Laws correctly map the movement of energy in the environment at the scale of galaxies, planets or cellular organisms. If there were problems, for example types of energy we didn't know existed, there would be 'gaps' – things would happen that we couldn't predict.

Likewise, if the natural world didn't work according to these Laws then our everyday experience of the world would be subject to totally random variations in our experience – for example, imagine if one day the Sun didn't rise. We don't see these random variations, so the Laws work. Any energy system that defies these Laws must therefore be an aberration:

- ◆ It might be working to the Laws, but the operators don't understand how; or
- ◆ It just doesn't work, and the operators are misunderstanding, or falsifying, their measurements.

This is what we find when we look at what we call, *Energy Delusions* – systems that, even if they produce some energy, don't really work because: to do so would defy the Laws of Thermodynamics; or they use more energy to operate than they produce; or they have no future because of a lack of resources to fuel them in the future. Here are some of the energy delusions that we most commonly come across:

Fast fission/fusion nuclear power

There are, according to official estimates, only 60 or so years of uranium left. This is because only 1 in 140 atoms of uranium are directly usable by nuclear reactors. We have the theoretical capability to use the rest of the uranium resource, which might deliver another few hundred years of power – the problem is that we can't produce the specialised materials required to build a fast fission reactor!

Fusion power has the same problem – we can fuse nuclei of hydrogen but, like fast fission, we can't yet create a material that can withstand the bombardment with fast neutrons that the process gener-

ates. There is no certainty that we will be able to engineer a containment that can withstand neutron bombardment, and even if we can, those involved put the time scale to a commercial fusion reactor at 50 years – well beyond *Peak Energy*.

Hydrogen

Hydrogen is not a source of energy, it is a carrier of energy (like electricity). Consequently you can never get as much energy out of the hydrogen than was invested in its creation. In any case, there are serious concerns that the resources of essential rare earth metals required for the production of hydrogen fuel cells would not permit a large-scale development of a hydrogen-based energy system.

Non-conventional oil

As “conventional” oil depletes many groups advocate the use of “unconventional” oil – such as oil shale or heavy oil. The problem is that they require a large energy input to produce the oil, so the EROEI is much lower, and the carbon emissions are much higher, than for conventional oil sources.

Studies of non-conventional oil show that production levels are unlikely to exceed more than 5% to 10% of current oil production levels. Not only that, but the most significant restriction on production is the availability of natural gas, or fresh water, to allow the non-conventional oil to be extracted. But, as the best sources of unconventional oil are used the EROEI will progressively fall, reducing the energy yield as time passes, reducing its viability.

Perpetual energy devices

Perpetual energy devices claim to be able to produce energy without a fuel input, or produce more energy than was supplied to it. They clearly offend the Laws of Thermodynamics, and in fact most of the “greater than unity” (which is their other name) energy devices are either hoaxes or fantasies. E.g., one of the latest examples, the 'Steorn' device, conveniently fails to work when demonstrated in front of a suitably qualified audience!

Planetary evacuation

If life on Earth is so problematic, the obvious answer to some is to emigrate to another planet. This ignores the obvious energy and resource restriction: To live in a biosphere requires energy – a lot more energy than living in a natural environment because all natural processes that are carried out with high efficiency by organisms – such as nutrient cycling in waste, cleaning the air and water, or enabling plants to access nutrients in the soil – would have to be carried out artificially. So it's far better to clean up this imperfect world than struggling to find a new one to mess up all over again.

Technological Improvements to Efficiency

Currently we are told by environment groups and politicians that energy efficiency can deliver savings in carbon dioxide. On an isolated analysis this might be true, but in terms of the whole energy economy it is not. The idea that we can grow and become more

efficient is an elaborate fallacy.

From William Jeavon's studies of steam engines in the 1830s, there is a wealth of evidence that the effect of greater technological efficiency has been to increase, not decrease, consumption. The resources saved through greater efficiency are simply re-deployed to drive consumption elsewhere in the economy. The only circumstance in which energy efficiency would truly deliver energy savings is when the levels of economic growth is less than the level of improvements in efficiency, or when increasing fuel prices wipe out the economic savings from efficiency improvements – but, if prolonged, either of these would cause the collapse of the economy.

Tesla coils

Tesla coils are claimed to produce energy from the air. This is not impossible – this is what your radio and TV do all the time (albeit they're using thousands of times more energy to amplify that signal to a usable level compared to the energy actually received). However the only reasonable source of energy for the coil would be the Earth's magnetic field – if it were to oscillate then it could induce an electrical current in a coil, but making it oscillate could cause all sorts of unexpected effects!

Waste incineration and recycling

Burning waste only recovers a small fraction of the energy invested in the manufacture of the materials. Likewise, due to the Second Law, recycling can never approach 100% levels of recovery without investing large amounts of energy in the collection and processing of waste – more than it would take to manufacture extra material. Ultimately we have to understand that the physical restrictions on our use of resources mean that we must minimise our total use rather than investing energy in waste collection and recycling.

Zero point energy

Zero point energy stems from a paper co-written by Albert Einstein in the early 20th Century. This postulated that all matter contains free energy even when the temperature is reduced to absolute zero. Zero point energy devices claim to be able to liberate this energy. However, the original theory, and more recent interpretations of it, prohibit the removal of the energy from the matter. Quite simply, zero point energy devices, like other perpetual energy devices, are a complete delusion.

So what can we do instead?

Stop using so much energy and resources by contracting the economy and undertaking a transition to a lower energy pattern of living.

Why do so many people put so much effort into promoting energy delusions? To date, we've found only one clear explanation: Technology reinforces a deep seated desire to reject anything that looks like an unwelcome reality, and to allow the continuation of the business as usual scenario by perpetuating the myth that “in the end it will be all right”.