The Oil Drum: Australia & New Zealand
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

The Trouble With Energy - Part 1.

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This series of posts will be co-authored by phoenix, who is an Engineer heavily involved in the energy sector. It will be based on a submission we made recently to the Australian Government.

INTRODUCTION

Energy is a gateway resource.

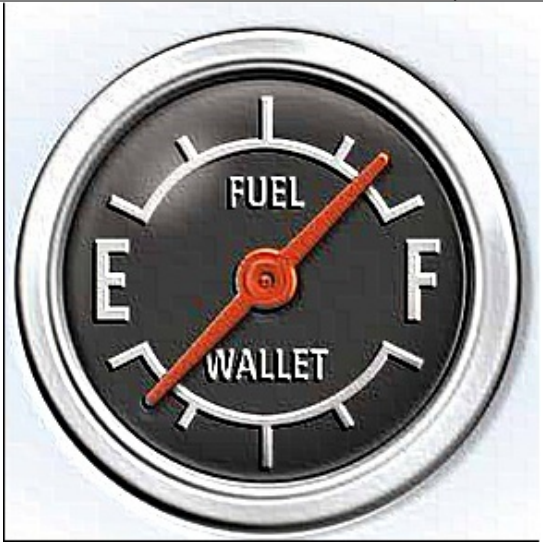
Given abundant energy, minerals can be refined from seawater if necessary. But in the absence of energy even the richest mineral deposits are inaccessible.

Similarly, given sufficient energy, a valuable energy resource such as oil can be made synthetically from virtually any organic input. In theory (given the right infrastructure and energy production) the production rate of synthetic oil would be limited only by the availability of sufficient energy.

In this series of posts we will attempt to do 7 things:

1. Discuss Energy Return on Energy Invested (EROEI). Show that a net-zero EROEI for a resource does not necessarily mean that the energy resource has no utility - it simply means that the energy resource has become an energy carrier, not an energy source. The burden of energy production must be moved to a different energy source. If reduced energy returns exist in our future (as they clearly do – this is happening already) then an infrastructure for this alternate energy source (or sources) must logically be built before the energy available from fossil fuels approaches zero.
2. Discuss the lifespan of Australia's endowment of fossil fuel (FF).
3. Present an order-of magnitude estimate for the amount of time necessary to build an alternate energy infrastructure.
4. Show that the lifespan of Australia's current FF energy endowment is likely to be less than the time required to design and build an alternate energy infrastructure.
5. Show that the energy required to build the infrastructure is likely to be a substantial fraction of all the energy that we have available, leading to an inevitable impact on GDP and living standards.
6. Examine the same issues from a US/International perspective.
7. Discuss solutions.

We do not intend to discuss the Hubbert Peak, declining supplies, or declining exports, since all of these matters are very familiar to TOD readers. However we will discuss Energy Return on Energy Invested (EROEI) because this is a prerequisite for the discussion that follows.



EROEI

People visualize an oil well as being a hole in the ground with oil shooting out in a profligate geyser of energy-rich hydrocarbons. In fact, this has not been the case for decades. Modern oil wells rarely consist of a light drill rig making a hole out of which pressurised oil erupts. More commonly the oil is a tar-like substance which requires a complex technology to bring to the surface. Even more complex technologies are required to convert this viscous substance into what we would recognise as oil.

Refining Tar Sands. Not only does this process require immense energy inputs, it is also CO2 intensive.

The substance we describe as "oil" today is not what was described as "oil" in previous decades. The diminishing supply of "sweet light" crude oil simply does not meet today's demand, forcing us to use toxic "heavy sour" oils, tar sands, and other sources of petro-chemicals that are only distantly related to conventional oil.

Similarly, acceptable grades of coal have broadened. Anthracite is being increasingly replaced by

brown coals, which may be 60% or more water. Obviously, drying this coal before use consumes considerable energy and leads to decreasing energy returns from the coal.

In almost every form of mining similar stories are found. The easily accessed, highly concentrated ores have been mined, forcing us to consume more energy in extracting and refining the less-accessible, less-concentrated ore. The energy required to extract mineral resources is increasing for almost every mineral resource we mine.

When dealing with energy resources we see this problem in its purest form. We are looking at the energy required to produce energy. The concept of Energy Returned On Energy Invested (EROEI) is gaining increasing currency in thinking about this problem.

In the case of shale oil we are approaching the point at which, for some shales, the energy required to extract and refine the oil may exceed the amount of energy the oil will provide. This oil no longer provides our society with energy; it simply converts energy from cheap sources (such as nuclear power or natural gas) into a higher-value, convenient liquid fuel for powering our vehicles.

The utility of an energy-dense liquid fuel is immense, so this conversion has great value. However we must not lose sight of the fact that the energy must come from somewhere. If it is no longer coming from the oil, then it must be coming from renewable and alternate energy sources (in "alternate" I include nuclear and all other non-fossil energy sources).

Stephen Leeb in his book "Game Over" defines "Absolute Peak Oil" as that point where we invest more than a barrel's worth of energy to pump, refine, and truck a barrel of oil to its point-of use. He discusses the plunging decline in energy return that has occurred recently and shows that the point in time at which oil's energy return reaches zero is approaching.

In the next few decades we will need to expend a significant quantity of energy to simply extract and refine our fossil fuel. This will lead to an increased requirement for energy at a time when fossil fuels are yielding a decreased return.

THE CONSEQUENCES OF A PEAK IN ENERGY

Resource companies have consistently claimed that we have no shortage of resources. All that is required is a higher price. This is particularly true where fossil fuels are concerned. Companies have asserted that for the right price, reserves can be found.

This is undoubtedly true since, as observed above, products such as oil can be manufactured from almost any organic source, as long as energy is available. HOWEVER, the unspoken assumptions are:

- That alternate energy sources will be made available.
- This alternate energy can be produced in the quantities required.

Upon examination, these unspoken assumptions imply that we will need a steadily increasing alternate energy infrastructure as a prerequisite for the continued supply of our resources.

In general, the consequences of these assumptions have not been explored in depth by the responsible authorities.

This appears to be because the resource companies that make these unspoken assumptions are not responsible for planning and delivering an alternate energy infrastructure. The authorities that are responsible for planning and providing this infrastructure have not been fully briefed on the implications of the unspoken assumptions.

The next post attempts to address this issue. We will explore the time and energy required to build an alternate and renewable energy infrastructure in Australia. The estimated duration of Australia's reserves of fossil fuel will then be compared to the time and energy required for this transition. The economic consequences will be explored.

The decline in quality and quantity of Fossil Fuels would not be an issue if adequate alternate energy sources can be made available.

The clear conclusion is that renewable and alternate energy sources are no longer a "nice to have" or a "green solution" they are an absolutely critical requirement of any future resource calculus.

Unfortunately, providing these facilities is not without issues. In subsequent posts we intend to explore the technical issues associated with the viability of this course of action.

Part 2 is here.