Carbon Trading and Energy Economics.

Energy gain theory an introduction

Energy Gain theory, which is based in the physics of the energy system nature uses in biology, alters the use the thermodynamic laws which form part of mainstream economic theory. It is not that the laws of thermodynamics are incorrect it is the naive way in which they have been interpreted and applied for economics, nor is the theory similar to that described by Eric Beinhocker in the “Origins Of Wealth”.

A friend who is a PhD Physicist commented that the use of the theory has an effect similar to when Capernicious stated that the earth revolves around the sun. The current view of Homo sapiens since they discovered fire has been we revolve (or control) energy, but it is really energy revolves us. This is because humans have always been on a positive energy gain curve that has always been forgiving of our monetary economic system. This situation may be coming to an end.

The natural living world has by the laws of physics recognised this. Darwin stated life adapts to the environment and species that adapt best survive best. However, it can be added, that “life both in the micro and macro adapts the environment including other life for it’s own survival” ie. life is actively energy proactive to changing the environment to suit itself.

Fission energy from the sun allowed life on this planet to shift the environment in a way which increased the efficiency of life to proliferate. It was the solar energy gathering life forms which achieved this, despite natural randomly occurring set backs such as large meteorites and volcanic eruptions. The one living organism who has upset this natural pattern is homo sapiens and with much fire and brimstone in the last 300 or so years, a flash time in evolutionary history.

The key to the problem is all life forms “**Gain energy (G)”** and gain is a “**natural function”** and it is within this function the laws of thermodynamics and all laws of physics come true and relate to each other as in other branches of science. When using “Gain Theory” the value of “G”, the Gain factor, is dominant wildcard factor which can, under some conditions can go to the power of y or it can completely cancel out. “G” usually goes to the power of “Y” in a collapsing system situation and causes the rapid collapses. “G” is the product of a function which also varies with different conditions i.e. it is not necessarily linear. It is wild card “G” which is the missing factor in the current economic theories and consequently makes modelling almost impossible. **By default from first principles all mans technological derived energy is also subject gain theory.** I can also be shown that the monetary economy can also be analysed similarly.

The following is a modified version of when “Energy Gain” theory is **applied** to analysing Natural and Technology energy generation systems on a historical basis. This item was first used for submission for the Tasmanian State Government Feed in Tariff proposals.

Energy System Gain Over Time
A different way of looking at the performance and effects of energy systems

Currently the economics of our Technological energy systems have been calculated on data provided by engineers for economists and basically describes the capacity and energy conversion efficiency of the system to meet energy demand. There is nothing incorrect with this data, science and technology have strived to increase the energy efficiency of power producing machines since to first steam engine at 0.01% efficiency. **However, this may not be sufficient to describe the performance of a renewable energy power generation network.**

The scientific concept of **Gain** is not an easy idea for the majority of people to initially understand and is **not quite the same** as the common language usage of the word gain. In this outline paper it is only intended to make awareness of the principle which seems to have been overlooked in current energy thinking, why it has been missed and its importance.

An introduction to the **Gain** Parameter

Basically the **Function** of an active energy device is **TOTAL OUTPUT divided by TOTAL INPUT** in our case units are of energy and is a **number,** as all units cancel out. It is a powerful number with enormous ramifications.

Total energy means just that and differs from the monetary economics version which uses energy conversion efficiency only.

The people who work most with the **Gain** parameter are electronic engineers and although it may seem not related, fundamental and approximate modelling of the worlds living energy system is probably the most easily achieved by using electronic engineering theory.

From the above basic equation if gain is less than one the output will a fraction of the input, if equal to one then output equals input. Gain can be less than one and a chain of gain devices multiply each other. Further, the performance of a chain of energy devices can be considered as a single unit. When a **Gain** number is very high, say in the thousands, which is common in electronic active devices, for many calculation purposes it can be considered infinite in a closed loop circuit where the external feedback components dominate the performance of the circuit. There is another feature of **gain** it is not dependent on the **capacity** of the device it is an inherent function of the device.

It can be also be shown from first principles, that, **all life on this planet** as a single unit or collectively is an **energy Gain device** and obeys the same basic principles as electronic systems or other energy gain systems. Energy generated by mans energy generation technology also obeys the same principles and is also related to life gained energy by these same principles.

Because life uses part of the energy gained as feed back energy to keep the function correct the **Real energy Gain (Gr)** is modified to: **Gr** = **G/ 1-GB** where **B** is the ratio of the energy feedback.

Unseen, this core formula keeps all living things alive. It is the function which energy economics works by and which all the laws of physics balance out. It differs from the unbalanced algorithms of monetary economics.

The human equivalent for **scientific gain** is **Greed, we all want more energy for less work.** Output divided by input each individual is the function by which it is achieved. The financial institutions on Wall Street have been very busy in that direction recently, except they became delusional when they wanted everything for nothing, perpetual motion is not possible.

Greed for energy is the primary motivating endeavor in all life and in mans case it initially was the need to go hunting and gathering in a low gain energy environment. The natural world has a low energy gain number which was a natural constriction to the dominance of man over the environment.

When agriculture and then technology generated energy was invented, it multiplied the natural gain number, creating a much higher gain system. When monetary economics began and technology start providing abundant energy, the vast majority of the population became no longer are involved in gaining energy directly. The horizontal economy exploded, and the primeval motivator for life **Greed** focused on money as the means to obtain their energy.

High gain systems are highly unstable.

High gain systems need utmost control and their collapse is usually catastrophic and very fast. Analysis of energy gain system under certain conditions the gain factor can be cubed. Thus in a low gain system say of ten the driving factor in negative direction could a 1000 but a high gain system say of a 1000 the gain factor would be 1,000,000.000

This type of phenomenon also applies to the monetary economic system, hence when it goes bust it does so very quickly, This is because the monetary system is a GAIN system, a circulatory one, however, it is a man made abstract technology and has serious flaws an other factors built in. The main two being dept and profit, there are no equivalents in the physical world, also savings with a proviso. However, the driving factor is social and human values which create the mechanism for the monetary system to go unstable mainly the transposition of “Greed” into the desire for material wealth often at an obscene level. It is a transposition of Darwin’s survival of the fittest in a materialistic society.

<u>Energy and monetary differential values.</u>

Man made items can be costly in energy and cheap in money or vice versa.

For example: During the last 20 years or so the traditional wealth manufacturing nations have moved their operations to developing countries like China where goods are manufactured at low cost and imported. However, in energy terms the energy to manufacture these goods is about the same wherever the goods are manufactured. Plus the extra energy needed in transporting goods to the export market.

High and lower **Gain** generation technology

The energy density in coal, oil and gas, which can best be described as congealed and compressed energy from the sun, plus nuclear power has enabled engineers to create, in a very short time of 300 years, a high gain electrical power energy system this is primarily based on steam turbine technology. There are many physical factors which control the performance of our energy generation systems but the most important external factor is the man made abstract technology of monetary economics.

For all effective purposes the high intrinsic gain of our electrical power system can be neglected in energy calculations, **capacity** is the major concern. It means as long as we have sufficient capacity, we have energy when we want, in the quantity we want and at the same time build more capacity as we need it quickly. As such engineers do not have to consider the electrical network in terms of gain and understandably would be resistant to do so.

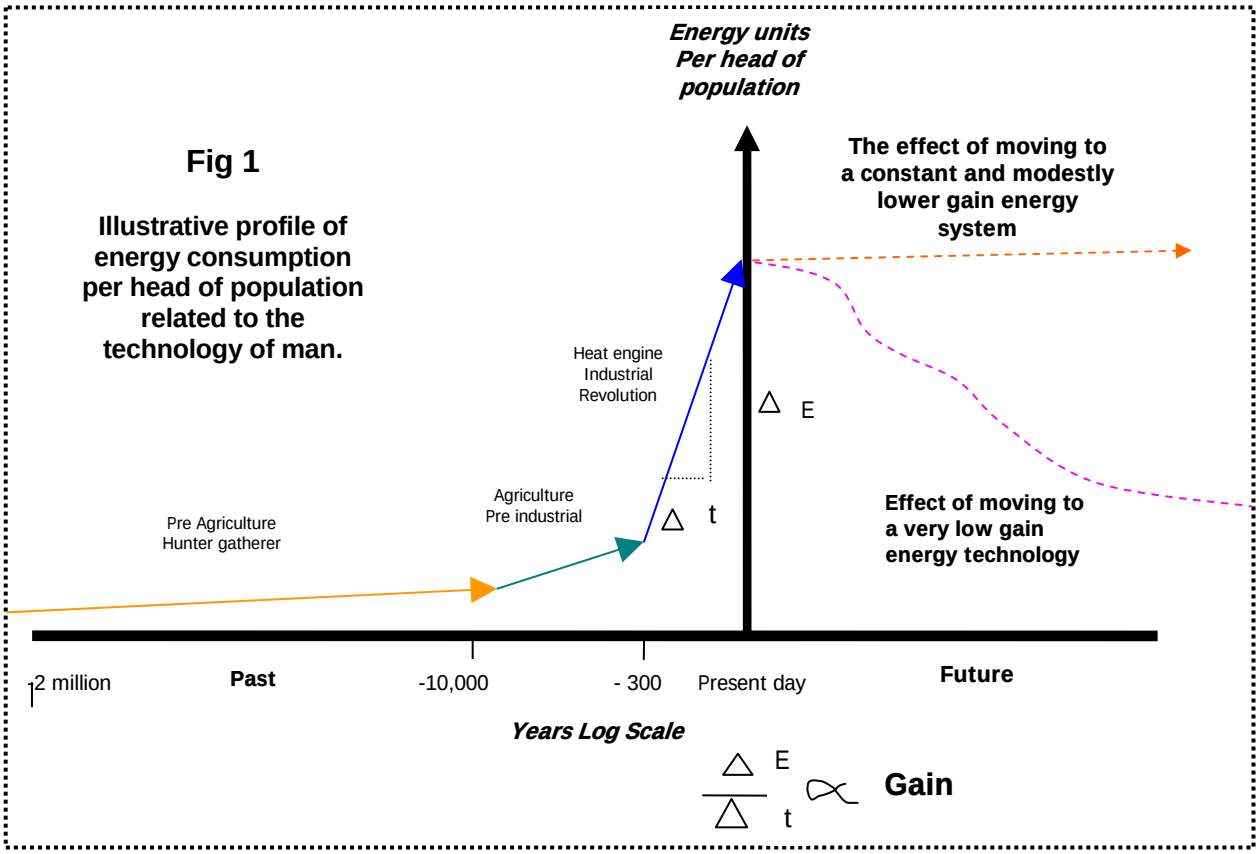
Many Scientists and technologists including some very prominent ones are sceptical about the ability of popular renewable energy systems to be able replace the steam turbine the invention which underpins our energy supply but are unable to define why. If the reasoning above is correct then they have an intuitive insight that technologies such as wind and solar are a lower in **Gain** and the **Gain** factor becomes of increasing importance as the number decreases. We no longer have the luxury of “infinite gain” and a number rules the equation and as the gain number falls the amount of energy available for elevated living stands will fall to new lower level.

Human history of energy consumption

The Fig 1 is an approximation of energy units per head of population verses the text book three phases of man's technological development on a logarithmic horizontal axis for time.

No one, far as I know, no one has ever calculated the energy gain of the natural world or human activity. In Fig 1 the slope of the curve of a graph for **unit energy consumption per head of population verses time**, is proportional to the **gain** values prevailing in any period.

It also shows a likely scenario's for constant and lower energy gain technologies.



Hunter gatherer pre agriculture Period

For almost two million years mans energy *gain* hardly exceeded energy above subsistence. The invention and development of pottery, tools, hunting weapons metal technology increased energy per head leading into agricultural era. Practically all early technological development occurred from -100000 years ago when Homo sapiens first appeared. The gain factor would only have been in the 10 to 20 range, only enough for a replacement population at most times.

Agricultural Period.

The first agriculture showed little improvement but as the technology progressed with the use animal power, the significant increase in available energy per head was the beginnings of the society we have today. We are not in caves today simply because there was enough extra energy to do other work, such as construct buildings for an increasing population, rather than just being able to survive. The gain factor would be much greater, probably above 50 much greater in the later years.

Industrial Period

Essentially the whole of advanced countries development can be based on the development of thermodynamic energy transducers starting with the first steam engine with a conversion efficiency of 0.01% to the modern steam turbine which made the massive electrical generation industry possible, with a current conversion efficiency of 48% almost the theoretical maximum of 49%. It is a pity that the waste heat which makes up 50% of energy lost could not used, as in some industrial and metropolitan installations overseas.

The steam turbine as with the original and much lower efficiency steam piston engine are direct energy transducers and have no energy feed back for there operation. Unlike the internal combustion engine and the gas turbine which waste huge amount of energy in there own internal operation and are only about 16% conversion efficiency. Although co gas systems increase this figure dramatically for gas turbines. These engines do provide useful energy for many applications but the live under the dominant *gain factor* of the steam turbine which is difficult to replace when suppling the needs of a heavy industrial society. Probably the gain factor to an industrialised agricultural society is in the 1000 mark.

The future

Psychologically the human race is mentally locked into a history of an ever increasing energy gain society. Although there are blips in this progression which are not shown in the graph, it has been always a positive rise.

If the gain factor was to remain steady then the energy growth rate would become horizontal or fall to a new slightly lower steady state.

Many Scientists and Technologists, including some who are very prominent, doubt if the most popular renewable energy scenarios namely wind and solar have sufficient ability to replace the fossil and Nuclear powered steam turbines. They are both direct transducers technologies but start with a very low density energy source particularly solar even though delivery is energy free. Both are subject to the discipline of the environmental variations unlike the steam turbine and other thermodynamic engine technologies. Of the renewable energy technologies, hydro, geothermal, tidal and wave all have the potential to provide a high gain systems but are limit in versatility to location and sites available relative to need. Some are in their infancy of development and not reliable.

Note: *The gain factors used above are simply guessed at and meant for relative comparison.*

Energy Gain and Monetary Economics:

A high gain power generation system means: low unit energy cost, high growth and monetary flexibility and control, which is what we now enjoy.

A lower gain power generation system means: Higher unit energy cost, lower growth and physically constricted economic. Rapidly contracting horizontal workforce. Greater employment in primary and fundamental industries and services as human energy replace technological energy.

A very low energy gain scenario means: Subsistence living, collapse of the monetary economics and a fall in population that is hard to imagine.

Note: From a recent lecture at UTAS Peter Newman Professor of Sustainability at Curtain University presented a graph of economic growth from about the start of the industrial revolution to present day. The graph also indicated each of the economic crisis during that period and their duration.

If a high resolution graph is plotted for the same period as in Fig 1 then the changes in the slope of the curve appear. With some slight time shift the economic cycles coincide with energy technology improvements the time shifts caused by the time it takes new technology to be implement.

Summary

From the historical data presented the ability of all life to “Gain” energy is the single most important function that life performs, it is the reference vector for analysis. Where that first injection of energy came from to start the process of life I leave others to determine. However, humans injected their own energy into starting an maintaining the technological energy gain process, with subsequent unintended consequences.

The current dilemma facing society in evaluating energy systems for a carbon reduced future could be simplified by adding the extra factor **“Gain”** into the analysis.

Quantifying the gain potential of each new energy technology will remove much uncertainty in determining the viability of new energy systems.

Carbon Reduction scheme

Science has never recognised “Economic Theory “as valid science but never been able to offer a science based correction. If “Energy Gain Theory” is correct and the projections made and quantified in the ratio previously outlined, then all current thinking both economic and technological for a solution to global climate change, is, from first principles, flawed including “Carbon reduction schemes”.

It becomes a question not of the cost in money but the cost in energy, the primary vector that powers life. The overall energy input multiplied by the overall gain factor determines our standard of living.

We are faced with a catch 22 situation and time is our enemy. The energy requirements for our highly industrialised society currently can only be met by the dominant power generator, the fossil or nuclear powered steam turbine. The two current viable technologies wind and solar although useful are probably not a match for our industrialised society. New carbon sinks are needed for legacy carbon sequestration not future. It is legacy carbon which is currently changing the climate. Energy saving measures to infrastructure on a mass scale are highly carbon producing.

The high gain energy economy has allowed too many people to be employed in the horizontal economy. Energy wise we have an unstable population, a relatively small downward change in the overall energy gain number will cause severe unemployment an social dislocation.

The energy growth which has created the illusion which our current society has grown up on seems to be stalling. There may be some improvements possible but unless fusion technology becomes a practical proposition it is unlikely that the developed countries lifestyle can be maintained.

Our current flawed monetary economic system is not able to cope with a n energy system which is not in continual growth. It was energy growth that hid the massive inherent deficiencies in its formulation.

Carbon Taxing and trading is inherently a flawed system and more for trying to maintain the status quo than reducing greenhouse. A much more radical approach is needed with some extremely hard decisions by all nations on this planet to avert or cope with a future massive change in the environment in which we all live.