Submission No: 74

SUBMISSION TO THE HOUSE OF REPRESENTATIVES INQUIRY INTO THE DEVELOPMENT OF THE NON-FOSSIL FUEL INDUSTRY IN AUSTRALIA

From:
Don Hampshire,

Summary:

1. Need for definitions to avoid confusion or misrepresentation of the purpose of products or processes.
2. Question regarding ethanol.
3. Question regarding Biodiesel.
4. Need to develop an energy store.
5. Two matters not relevant to this Inquiry.

Need for Definitions

Renewable energy sources have one or more purposes, but they can be confused or unwittingly or intentionally misrepresented.

One of the most blatant misrepresentations was published in Royalauto, March 2007, obviously based on a press release. It concerned the SAAB "Bio-power car" which can use ULP/ethanol blends up to 85% ethanol (E85).

> "..**can cut their fossil fuel carbon dioxide emissions by up to 80%".**

This would be fine if the carbon atoms in sugar wore green tee shirts with "Good girl" logos and fossil carbons wore black "Bad boy" garments. Trees could eagerly gobble up the good ones and spit the bad ones back in our faces; but it does not work that way.

So things should be distinguished as:

- Renewable sources that replace non-renewable sources which will become in short supply in the foreseeable future.
- Sources with low CO2 emission to replace sources with high CO2 discharge.
- Ozone friendly or ozone unfriendly. Not directly relevant to this Inquiry but sometimes confused and of secondary concern.
- Appear or are tarted up to appear good, but are not.

The first two are important to identify because some sources cover both but others cover only one and can be negative to the other.

Ethanol

There are concerns about the agricultural factors: land use, agricultural practices and the effect on food prices and availability. I am sure these will be raised by people expert in those matters.

I wish to highlight the CO2 unfriendliness of ethanol fuel.

Ethanol is made by fermentation of glucose. The simple equation is:

$$C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$$

To put two carbon atoms into your fuel tank as ethanol costs one other carbon atom already in the atmosphere as CO2.

Ethanol is slightly less efficient a fuel than hydrocarbons because it is already slightly oxidised, so Ex fuel slightly increases consumption*. At the exhaust pipe, CO2 emission from Ex fuel is slightly more than from ULP.

Add the half as much again from the fermentation and it is a greenhouse disaster.

(* If all fuel was a particular Ex blend, future engines could have a higher compression ratio thanks to the higher octane rating, giving superior fuel economy. This is impractical because of Australia's dependence on imported vehicles.)

Biodiesel

[Disclosure of interest. I own 5000 shares in Symex Holdings Ltd]

I believe that Biodiesel is made from vegetable oils or waste animal oils by saponification to fatty acid then esterification to simple mono-ester. (fats and oils are tri-esters of glycerol.) The lengthy process is necessary to produce a fuel that will not harm engines even after extensive use.

The purpose of Biodiesel is to replace fossil fuel and at the exhaust pipe there is no significant difference in CO2 emission between bio- and fossil fuel.

The environmental impact of the manufacturing process should be studied. I have no knowledge of it.

As a shareholder of Symex, I became aware of two matters.

- Symex are a long established manufacturer of fatty acids which are used for making soaps, cosmetics and other purposes. The by-product is glycerol (also known incorrectly as glycerine.) There is a limited market for this, meaning that glycerol was a profitable, saleable product. The advent of Biodiesel has produced an excess of glycerol, crashing the price to the point that it is almost a waste product.
- Unmodified canola oil will perform as a 100% alternative diesel fuel satisfactorily in the short term, but damages the engine after a few tens of thousands of kilometres. However, blends of up to 30% canola oil with diesel fuel perform satisfactorily without harm indefinitely.

My source of this information Symex Holdings Lt. If this company has not made a submission to the Inquiry or similar information been supplied, I suggest they be invited to.

Assume that the information is correct. Consider Biodiesel as a renewable replacement to a diminishing resource. There is no hope of producing enough vegetable oil to fully replace fossil diesel, so it can only be a partial replacement. There are two options for partially replacement: two products or a blend. That is: 100% Biodiesel sold as x% of the market or x% unmodified vegetable oil in 100% of the fuel sold.

Surely a blend would be a better proposition. It would be cheaper with no processing cost, no environmental aspects of the processing to be considered and there would be a fraction more.

Need to develop an energy store.

There are several means of generating electricity by renewable means, some in use, and some being developed. Except geothermal, they all derive from today's, last week's or last year's sunlight, which is an extremely reliable source in the long term picture.

It is recognised that all are erratic in the short term of minutes and hours and that is where we need reliability. Partial smoothing could result from having several different methods, spread widely in location. If a practical energy store was possibly, the last of the problem would be solved.

Governments are throwing buckets of money into subsidies for renewables and research and "research". (See next section.)

I suggest a comparative thimbleful be allocated for collecting experts for brainstorming of the ridiculous to the credible, to possibly produce some ideas worth considering. (Brainstorming encourages the outrageous and fanciful, so that the shy genius can say "Here's one for laughs ..")

Here are my brainstorms regarding an energy store:

- Trying to smooth erratic power flow from renewables at source is probably not worth the bother unless it is very cheap and simple.
- Aim at the opposite, the whole grid, which could mean smoothing multi-thousand volt DC as in main transmission lines. That could be seen as a problem or an advantage.
- Look at smoothing in the seconds to an hour period, using normal adjustment of base load to cover predictable changes.
- Chemistry and the physical aspects of chemical change probably eliminate batteries from consideration. This leaves kinetic energy, potential energy and heat.
- Surplus electrical energy is already stored as potential energy on a small scale in the Snowy Mountains scheme. Water drops from a high dam to a low dam through a hydro power station supplying peak power, then the system is reversed to pump water back up using off-peak power. The problem preventing it acting as a short time smoother is inertia. It takes time for the generator to slow either way. Would a separate variable-power pump be the answer? Baseload power could be set so that there would be a little surplus power for this pump at all times. More water would be returned to the top to generate more peak power, reducing the need for fossil fuel peak generation.
- What about a massive flywheel with a motor/generator? It would have to be massive. So is the Opera House, the Synchrotron and every power station. Big is not impossible.

A matter not relevant to this Inquiry: thermal efficiency.

Most electricity is generated via heating of water into steam. Both coal and nuclear have thermal to electrical conversion efficiencies of around 30%, indicating that the high inefficiency is not in the heat source.

A major source of the inefficiency is the Specific Heat of Evaporation of water (SHEw). (Known to older people as Latent Heat of Evaporation.)

Heating water from 20C to 100C requires 335 J/g.

Converting the water into steam still at 100C at atmospheric pressure requires 2259 J/g.

None of this is recoverable as electricity. All of the energy that converts the fuel's heat into electricity is that which is then imparted into the steam as elevated temperature and pressure.

Water has a very high Specific Heat of Evaporation. In the past water was cheap and plentiful and so was fuel.

My field of textile chemistry has achieved major reductions in water and energy use since price increases forced review of processes. One place, restricted to those large enough to carry the capital cost is in cleaning of fabric, switching from scouring and rinsing to dry cleaning with perchlorethylene solvent. For economy and the environment, the system is closed with very high solvent recovery for recycling.

This is not to suggest perchlorethylene as an alternative to water in power stations. It is making the point that there are many liquids with much lower SHE. Among them there may be a practical alternative that would improve efficiency.

In fact the answer could be away from a simple single material replacement. Dying out in the 1950s was an alternative to compressor refrigerators. It involved a gas highly soluble in a high boiling point liquid. The gas was driven from the liquid by heating then, after other steps, redissolved in it. The heat transfer involved is irrelevant to this matter, it simply illustrates that there are various ways of going from liquid to gas to liquid.

Like load smoothing, it is a subject that could suit brainstorming. To throw in a brainstorm: xenon.

Another matter not relevant to the Inquiry: Clean coal

Of the several proposals, the only one that seems to have any prospect to my admittedly inexpert view is geosequestration via coal/oxygen combustion.

Geosequestration seems practical, even if the CO2 starts leaking out in 50 or 100 years time. It gives us time to cut emissions and plant enough trees to cope. It requires damn-all research. We do not need to learn how to liquefy CO2, drill deep holes or pump liquid CO2 down them. So why are we wasting money there?

Coal/oxygen combustion will produce near pure CO2, with small amounts of water vapour, SO2 etc. These can be easily removed, if they need to be. There is no 80% nitrogen to be separated.

Coal/oxygen combustion would produce a much hotter flame than coal/air. This could be seen as a problem: existing furnace/boiler combinations would burn out or burst.

But in an appropriately designed power station, the higher the temperature and pressure, the greater the efficiency. Less coal per watt, less CO2 to dispose of. It might even improve combustion of brown coal.

The other proposals in clean coal technology involve cost and inefficiencies with no compensation. Only the coal/oxygen path offers geosequestration plus bonus and the only research needed is to design a power station that maximises the benefits. Don Hampshire

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