

## **Some thoughts related to renewable energy (and other?) systems**

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### **ABSTRACT**

As fossil fuel prices rise and the consequences of excessive use of these fuels become more obvious interest in renewable energy technologies is increasing. Because of our tendency to think that “I am right and you are wrong”, “big is beautiful”, “technology is king” and “get more for less” as well as “tunnel vision” that sees only the immediate problem public acceptance of many schemes is poor while some proposals gain huge support simply because their publicity campaign is effective. By challenging the accepted assumptions listed above it may be possible to greatly improve the acceptance of many forms of renewable energy, for the benefit of society.

### **INTRODUCTION**

While renewable energies like hydroelectricity, solar electricity and wind generators have increased in popularity and there seems to be a lot of excitement about the “hydrogen economy” technologies like biogas and gasification have been largely ignored in “western” countries, although there are millions of small systems in “developing” countries. There may be a number of reasons for the lower acceptance but ones that I have come across repeatedly are “anaerobic digestion is complicated”, along with “we must have a centralized system” which is often tied in with the perceived complication.

Our current society “throw away” society with its tendency to live in large cities with centralized water, power, communication and waste systems has developed from a time when technology was very limited, with no mass communication, limited travel and labor intensive methods of production. Most of these limitations have now been removed, but we still live with the consequences of earlier decisions, entrenched by the huge investments largely made 30-40 years or more ago, and reaching the end of their useful life.

One of my favorite quotes is “Things should be as simple as possible, but no simpler.” from Albert Einstein, who also said “You can’t solve a problem using the thinking that created the problem.” and I think these statements provide us with a way forward.

### **DISCUSSION**

We live in a very competitive society and the proponents of a “hydrogen economy”, who rightly point out that hydrogen is very clean, are busy trying to attract investment to support the huge infrastructure that is needed to support our current systems. I think one of the problems with this solution is that with their “I’m right” attitude at least some R&D money is being diverted from other legitimate technologies. Another problem arises from the fact that I don’t think very many hydrogen supporters have looked at a whole system approach and realized that making hydrogen on a large scale may be difficult and that the energy involved in infrastructure and processing may be greater than the useful energy output. I doubt if many

have also considered if transport is the best use of hydrogen, or if we really need the transport we enjoy today.

Most anaerobic digestion proponents are focusing on high rate systems because of pressures to use technology, dispose of waste quickly and to make money (or at least attract funding). This has led to the misconception that anaerobic digestion must be complicated and expensive. A corollary of this misconception is that centralized systems are essential, as that is the only way such a “complicated” technology can possibly be properly managed, but the energy cost of collecting all the waste and then redistributing the byproducts of treatment are subsidized by taxes and “cheap” fossil fuels.

Let’s dispel some of these myths.

There are often many possible ways to get from point A to point B, whatever the points may be. Similarly there are many ways to make (or conserve) renewable energy and we need ALL of them. Some may be more appropriate than others to particular situations, but in different situations the most appropriate options may be quite different. For example anaerobic digestion is not appropriate for wood waste and gasification may not really be that suitable for liquid waste.

Anaerobic digestion is simple and robust – it occurs in the Arctic Tundra and marshes, ruminants and ants. If waste is generated in a factory with limited available area and good technical support a high rate digester is quite justified, but in rural applications there is usually plenty of land and support is limited, so a much simpler, more robust system is much more desirable.

Oysters make a material more durable than concrete, but only require temperatures of 10 C or so rather than the furnaces and grinding mills that we use. Why not use natural processes, that don’t consume high grade energy, as much as possible? Natural systems may be slower but humans are really the only things in a real hurry, but what are we hurrying to?

Forests consist of thousands of trees, not a single huge specimen, for redundancy as well as reducing nutrient transport difficulties. Is it really sensible to use energy collecting waste to a central unit, that may fail or be easily attacked, and then spend more energy carting byproducts away to be disposed of because possible uses are “too far away”? If something stops the central unit (or the transport to or fro!) **everyone** has a problem but if one part of a distributed system fails it may not be too difficult for neighbouring units to temporarily take up the load.

Reductionist thinking may be a good way to break down a complex problem into manageable bits but the whole complexity needs to be kept in mind so the final solution will work in practice. I also think there is also a need to make sure we put our efforts into areas that will make a reasonable difference with a reasonable effort rather than into areas that really don’t matter or that are really hard work. Of course this is not always obvious from the beginning but there are times when the right decision may well be “leave it, at least for now, as we can’t do that with the knowledge we have at the moment”. Please don’t take this as a demand that only applied research be undertaken, as a lot of what we have today has come from basic research, but with limited resources I think we need to be as practical as possible.

From this different point of view we should be working together to develop small, simple units for gasification, pyrolysis, hydrogen, photovoltaic, solar thermal, anaerobic digestion, wind, hydro and any other energy related technology we can conceive, as each will have a part to play in meeting our energy needs. We also have to reduce our energy wants, as it will be impossible to meet the current growing demand. A “systems” approach to this will assist, as we need to start regarding all our “wastes” as resources in the wrong place – perhaps the term “etsaw” should be adopted to symbolise this turn around in thinking.

By adopting simpler approaches to tasks “distributed“ systems become more possible. We can use technology to monitor and control such systems if necessary, but by having multiple small units the collection/distribution costs/energy are reduced. This should balance the higher cost and lower efficiency that we may get from the smaller individual units, again we need to look at the total system rather than performance of an individual unit in a complex system.

## **CONCLUSIONS**

I hope this encourages you to step back and ask “Why is this so?”. Quite often I think you will find that the original reasons no longer exist, so why stick with the original solutions?

Another saying I like is “Minds are like parachutes, they only function when open!” (anon?), but unfortunately both minds and parachutes are often only used in emergencies – there are of course some enthusiasts who use them at every opportunity.

Simple, distributed, renewable energy systems are possible, look at China, India and more recently Vietnam (among others).

## **REFERENCES**

Many Sources of information have contributed to this paper, but I have not knowingly drawn on any major published references directly. Even my quotes are from desk pads or other general sources, rather than a web site.