



Mass Energy Supply Evolution

By CK Wong 2006.0906

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Introduction

In the modern world, we could not live without a single joule to drive the gizmo around us. The most common source of energy is electricity. We have a fairly large number of energy options: electricity, fossil combustion and raw source such as wood. Although we use a smorgasbord of energy, their modes of consumption are specific. The fundamental energy source is electricity. The society is built on the assumption that we have an unlimited supply of electricity. In this short article we should examine how an evolution is undergoing to take on the challenge of the oil shock. There are many aspects we could review. In this article we only focus on the mass energy supply which I refer to the source like hydro, gasoline as oppose to battery or solar panel. One could ask why don't I discuss the power generation? I would like to differentiate the power generation from mass energy supply industry because I would like to examine the possibility of alternative mass energy generation method.

Mother of Source

While we can use gasoline or wood to satisfy our energy requirement, on the top of the energy demand, it is always electricity we called for in our daily life. The reason is simple: electricity employs a simple delivery system that does not require continuous physical movement. To use gasoline, you have to go the gas station. To burn wood, it has to be delivered to your house. Natural gas has the infrastructure that provides the continuous supply.

If you live in a cabin, you most probably have electricity other than natural gas or oil. But why? Comparing the delivery vehicle of natural gas and electricity, you can immediately identify that the natural gas pipe is hard and larger than electric cable. You cannot have the gas pipe hung in the middle of the air. To share the electricity is just clamp another cable to the live one. You would need much more work to split the natural gas supply.

Electricity is so convenience that we always take it for granted. At the beginning of the energy industry is was not electricity.

Coal had been the major source of energy in the Nineteenth Century. It generates heat to warm household and drives the major transportations: train and ship. During the Charles Dickens' time of London, you could see the coal wagon serving the community in many passages in Dickens' novel.

As the demand of energy (not coal) increase, the delivery system of coal could not handle the demand. Another alternative delivery method has to be invented. The delivery method governs the form of energy delivered. It was the coal gas. In the Sherlock Holmes stories, gas lamp played some parts in the story lines. To some extend, the gas still plays the role

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of energy source to power the fridge, stove and even lamp. One of the short coming of natural gas is the emission. Yes, it is not just the car has the emission problem. Using natural gas as an energy source demands additional design to solve the oxygen supply and carbon dioxide disposal. Electricity has it advantage because you do not have such accompanied issues.

The convenience offered to user also provides a compact equipment design. The convenience of supply infrastructure and the compact size reduce the cost of the major appliance. Or in fashionable saying, we call it optimized solution. On top of these, the secondary energy usage is also designed on electricity due to all these electronic gizmos. Your TV's tube, the plasma screen, and my lap top are all run on other electricity. If the source of energy is not electricity, every piece of gizmo much have an energy transformer to convert whatever it is to electricity to power the electronics.

The current model of mass energy supply is actually a transformer that converts energy stored material to electricity. To satisfy the high demand, the energy stored material has to be cheap in multiple ways: extraction, delivery and dispose.

Mobility is the wild card

Although electricity is the convenient it requires a tether to its source. For mobility, it is not acceptable. From this aspect, fossil liquid or gas fuel such as gasoline still play a major role. In fact, if we have to switch the primary energy source of mobile equipment to be electricity, we can borrow many lessons from the gas station industry.

Store and use energy source

I don't like fabricated terms. But in this case I have to make up a name to identify a concept. So I would like to ask you to bear with me for a few more paragraphs.

What could be the store and use energy sources? They are solar, fossil fuel, air, water, geothermal and nuclear fuel. The entity that contains the energy but we cannot access the energy in it directly. In some case, it is stored in a container and then you go through a process to consume. The store and use concept is parallel to the water reservoir concept. To make the consuming process efficiently, you have to store before you use.

Solar energy has advanced so much that every one could buy a solar panel to do some useful thing rather than a show and tell science project. The earth satellites including the International Space Station also rely on the solar power. Its energy density is low. You need large enough physical space to capture the light to power your house. Other than very low energy demand application, you cannot connect the solar panel to the application because the sun is not available all the time. To make it a primary source of energy, the electricity generated from the solar panel has to be stored in battery or other form to be consumed when sun is not available or rectified. In high population density environment such as city the real-estate cost would be prohibition factors. In the farm and remote area, this is the only viable solution.

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Natural Gas is similar to electricity. Once you have the delivery system set up. It is very reliable. However, it still has to use a transformer to convert it to electricity for many other gizmos in your house. The major drawback as mentioned earlier is the additional oxygen and carbon dioxide management to use the gas. So it is a good potential source to be the generator fuel.

Hydro energy is one of the cleanest sources. Whether it is the environmental friendly is debatable. The Three Gorges Dam in China has been proved to be destructive to the ecology system because it floods vast land mass that distinguishes many species of plant and animal; not to mention the heritages. Other than this there are only a limited number of hydro generators you could create.

There is an alternative hydro energy we can tap into: **oceanic**. The tidal wave could be used to drive turbine that generate electricity. Again it is locale depending. In Siberia the solution is not applicable.

Geothermal has been deployed in many centuries. The houses of Adobe Indian use thick terra construction to capture the heat during the day and warm the house at night. Some upscale houses in Canada and Scandinavia peninsula have using the geothermal for house warming. The high upfront investment makes it unpopular. In Iceland, a volcanic based geothermal generator is experimenting. However it is just like solar energy, it either required a lot real-estate or like hydro it can only be used in specific locations only. In addition, heating is one of the energy need but it does not fulfill the energy consumption model in contemporary society.

Coal will dominate the mass energy supply industry when the natural gas climbs to a point that we could not afford it any more. The supply of coal is not exhausted yet. It is forecasted another 100 years of supply. But let's not be too happy. The forecast is based on some historical consumption. The projected demand is always proved to be too low.

Nuclear is the last but not least is the most resisted stored energy material. There are two type of nuclear reactor: fission and fusion. Fission generator uses the physical change of atom splitting to generate energy. Fusion is to generate energy by combining atoms. To be very precise we are talking about the nucleus in the atom not the whole atom.

In theory, you can build nuclear generator anywhere even in your car. The fuel is high density. The consumption is slow. However, there is intrinsic fear stemmed from the radioactive leak and the melt down. It is nothing different from the coal fired generator. At the beginning of its appearance society has exactly the same fear. I was brought up in Hong Kong. My home was next to three most dangerous places in the whole Colony: the Shell Oil Storage Depot, the Government's explosive warehouse and the coal gas plant. All situated at the middle of the city for easy of access. I do not defense the potential danger. My point is that we should be engineering to make it safe rather than rejecting it. It is just like American Space Shuttle. You do not give up the program because it has

flaw. You correct it to make it safe. We fail one, try the second. We fail the second we try the third.

Now there is the problem if radioactive by products from the nuclear generator. Again this is really due to the supply and demand issue. All the nuclear generators still use the 50 year old design which uses only 7% of the U_{235} . The unused 93% could be recycled rather than stowed away in the heart of some cavern that continues its radioactive life for century. The reason to not recycle is just a convenience factor not economic. In fact, we have the technology to continuously using the same nucleus reaction pile to generate energy for a long while. The nucleus waste generate from U_{235} can also continues the fission process. It is just harder to continue the process.

Next Step

There are a number of mass energy supply we may want or not want. The adaptation of these supply key on how it is being used: domestic or mobile. The method of consumption will guide us to which one to be adopted. The principle is whether an intermediate conversion mechanism is required and whether this mechanism is economic viable.

Very specific application can use microwave as the source of energy but it is not currently a mass supply until we could use the microwave deliver the solar energy from outer space. These specific solutions could one day be viable when we have the infrastructure.