Portable Energy

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Introduction

To support all the modern need such as temperature control, radio, and driving, the energy provide to these gadgets must be portable. We already have a very good strategy for small energy requirement using battery. For larger energy requirement, it is more complicated. The current view is using fuel cell and petrol fuel. How can we evolve the portable energy supply when we have not a clear winner of fuel cell and there are tremendous concern about petrol fuel. Could we really scale up battery approach?

First Law of Thermal Dynamic

This article is the place to give a lecture. But I would like to state the first law of thermal dynamic that points out when energy is converted from one form to another, the output will always be less than the input. This is the rule that governing all engineers to avoid the design of gadgets that converts energy from one form to another form before we could use. However, some time, we change the state or the characteristic (such as converting crude oil to gasoline) to allow us to use less expensive equipments.

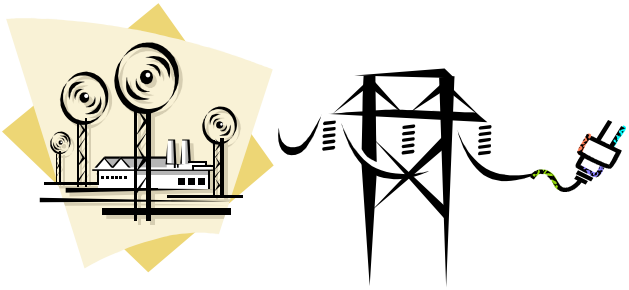
Methods to deliver energy

There are two methods of delivering our daily used energy: steady-supplied and portable. Steady-supplied energies are those sent out from the energy factory to end equipment. We flip the switch, the energy supply flow and equipment could consume the energy.

The other type is the portable energy which stores the energy in a container. These two categories of energies are not mutually exclusive. Rather they are inter-depended in a very intricate web of relationship.

Steady-supplied Energy

Natural gas and electricity are the two common forms of energies that delivered continuously. They are manufactured or stored at the energy factory. When we turn on the natural gas stove, the gas comes out. The fuel is burnt and the heat is used for cooking or other function. The generation of these energies is efficient because it is mass production. There is a tether between the energy factory and the end-user. This tether could not be severed. At this point, there is no need to differentiate how the energy is generated at the energy factory (EF). In case of electricity, it is consuming some fuel to generate or generate by converting energy (e.g. wind) to electricity. In some other case, it is stored and delivered to the end user. If we ignore the mean of generation, both are very similar.



However, there is a concept we have to explore which will be vital for us to consider the choice of energy. It is the last step to consume to energy or put energy to work. If the energy is natural gas, naturally it is not convenient to power a television set or your laptop because it requires electricity. Why do we not design such device that uses natural gas? There are two major factors. The first one is that the technology we employ requires electricity. It is simple to use electricity rather than have another intermediate step to use natural gas to generate the electricity. The second is the characteristics of consuming natural gas: it requires oxygen and generates CO_2 or CO and other undesirable by-products.

As the result, some appliance such as dryer, refrigerator and stove could use natural gas but some are just more efficient to use electricity. This simple analysis brings us to the conclusion that electricity is the preferred choice of energy because of the technology limitation. In the situation the generated by-product could be managed, we could use alternative solution such as burning the fuel, i.e. using combustion engine.

Portable Energy

As oppose to steady-supplied energy, portable energy does not have the tether. The energy is stored in a container. Of course, the container is filled up using the steady-supplied energy. Therefore, there is a tight relationship between the steady-supplied energy and portable energy. If there is no steady-supplied energy then there will be no portable energy.

One could argue that battery does not require steady-supplied energy because it is a single use container. If you go to the second level which is what generates the electrolyte in the battery, the steady-supplied energy are the chemicals and the electrodes that there is a steady supply. The definition of steady supply could be relaxed to the unconventional sense.

The battery example brings out a very important issue we have to consider for the portable energy: should it be a single use or rechargeable. As always, there are scenarios we have to employ single use portable energy; if possible, we prefer to use the rechargeable portable energy. The recharge concept should also be scrutinized. When we accept any concept in its token value, it can easily overlook the whole picture. The rechargeable cost should be considered in several levels: cost of material, cost of disposal and cost of charge. Again, we should liberate ourselves to what are the costs. We have to include the environmental, social and monetary. Something could be very cheap to

dispose however, it may pollute the environment so much that the cleanup of the pollution could be high.

A Few Examples of Portable Energy

At the beginning, wood was the only portable energy. If you want to carry a fire from one place to another, you have to carry the wood. Since wood is abundant in the old time, it is not a problem during the dry season. In the wet season, dry wood has to be stocked. Wood has demonstrated a very important concept here. When we use wood to transfer energy we are also consuming the medium. The process does not have any productivity. To avoid the consumption of wood, we have to wait until the invention of flint or fire starting technologies. Until then wood is not a good portable energy source because its value diminishes with time. Energy may be portable in a container, i.e. wood, but to release the energy, we have to ignite the energy. Hydrogen or gasoline does not have such a problem. Nucleus fuel generator will not be easily started. So good portable energy should have the following characteristics:

- There is a steady-supplied source to fill the container.
- Ideal portable energy does not leak or consume when it is stored in a container.
- The energy could be re-ignited easily on demand.
- The container is safe to carry and low cost to environment, user and may be low cost to recharge.

First Conclusion

The topic is large. I cannot give a conclusion but try to write a series of it. The first conclusion I would like to draw is that if we rely on the steady-supplied energy we have to consider the on demand nature to recharge the portable energy container. For example, if we talk about the electric car which uses battery to power the car, the design to recharge the battery may not be a desirable solution because the current electricity generation could not increase or decrease the supply instantly. When higher demand is required, more generators will be fired. There is a preload phase that brings the generator to its operating level. This phase is not productive. Similarly, when you unplug the charger, the generator could not shut off immediately, the winding down phase is also non-productive. This non-productive cycles are directly proportion to the size of the generator. Unless these non-productive cycles could be minimized, rechargeable battery for car is not a good solution but a bridging solution until we solve the charging problem.