

New Concept for the Overall use of Renewable Energy

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Abstract—The development and application of wind power for renewable energy has attracted growing interest in recent years. Renewable energy sources are attracting much attention as they can reduce both environmental damage and dependence on fossil fuels. With the growing need for sustainable energy supplies, a case is made for decentralized, stand-alone power supplies (SAPS) as an alternative to power grids. In the era which traditional petroleum energy resource decreasing and the green house affect significant increasing, the development and usage of regenerative resources is inevitable. Due to the contribution of the pioneers, the development of regenerative resources already has a remarkable achievement; however, in the view of economy and quantity, it is still a long road for regenerative energy to replace traditional petroleum energy. In our prospective, in stead of investigate larger regenerative energy equipment, it is much wiser to think about the blind side and breakthrough of the current technique.

Keywords—regenerative resources, hybrid system, transfer, storage, phase change

I. INTRODUCTION

OWING to the sustainability and cleanness for environment, the renewable energy is thought by people to be the most effect remedy to solve the global warming and shortage of fossil fuel. However, their low energy density and intermittent hinders them to directly couple with the traditional power machine [1-4]. The only solution is like the plant in the earth—storage the energy in some forms and utilizes it later. The stages to use renewable energy can generally classify to five steps: capture; conversion; storage; reconversion and applications [5]. For example, we capture solar energy by photo-voltaic panels, converts to electricity, storage in battery, reconverts to mechanical energy, and finally to drive the vehicle. Namely, the plant-microbial fuel cell capture the solar energy; convert to electricity; use it to split water into hydrogen and oxygen; mean while, it also capture the carbon dioxide, let hydrogen and carbon dioxide react to become carbohydrate; storage the carbohydrate and retransform to some kind to protein; finally to repair its cells. Figure 1, five major energy styles and their conversion relations are shown. Besides, the different kinds of renewable energy that can be captured are also shown. It is clear that although electricity is the most useful energy in modern time, the large-scale and efficient methods to store it is not mature yet. In this situation, just to capture the renewable energy and directly convert to electricity is not very practical, such as the problems we face now by solar photo-voltaic panels and wind power systems.

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Therefore, if we want to use renewable energy efficiently, integrate consideration from capture to transform then to storage of energy with proper forms is necessary.

II. THE NEW METHODS TO CAPTURE RENEW-ABLE ENERGIES

This paper carried out some suggestions to about utilize the renewable energy, hoping it can stir the imagination of the experts and try to make the renewable energy more practically replace the conventional fossil energy.

A. Solar energy collection devices

Since the solar radiation come from the sun and the radiation temperature is near 5700 Celsius degree, theoretically, we also can obtain the solar energy at the same temperature. According to the 2nd law of thermodynamics, the higher temperature we used, the higher efficient of work we can get. For this reason, we must keep the capture temperature as high as possible, instead to maximum its quantity such as heating the water for the bath! Currently, if we want to obtain the solar energy both with quantity and quality, the facilities is so huge (ex: solar tower) that obscure its use for small scale [6, 7]. In here, we present new solar thermal collection devices as shown in figure 2.

There are suit for different scale, but more emphasize in get higher temperature solar energy than large amount of lower temperature one. It is shown that the heat transfer medium is circulated until it reaches the design high temperature then output to produce power. One device is fixed, it let the solar ray refract from mirrors and focus on targets, so that it need not trace the solar path, but it will occupies more space, the other one, just can focus the light that parallel the solar beam, need to trace the sun, however, it only need little space so that suit for portable situation.

B. Wind power system

Traditional, there are two types of wind turbine: vertical and horizontal axis one. For vertical axis type wind turbine, due to the effective attack angle varies too much within one cycle; it is very hard to design its blade shape for optimum operation and starter with low wind speed [8-10]. For horizontal axis one, its efficiency already near the Belz's criterion and the technique are very mature. However, its tower must very strong to stand for the hung anti-torque in operation. The aerodynamic noise from blades is also a problem [11, 12]. That effect restricts its location. Here, we propose another solution: tubal type wind turbine as shown in figure 3. In the inlet part, the bend tube is used to change the wind direction from horizontal to vertical; in the outlet portion, part cutting edge of the tube generates vortex streets and local low pressure region induces the massive flow rate at outlet plane. Therefore, the head loss while change the wind direction can be makes by the outlet suction. Moreover, we can design multi-layer tube and rotation guiding blades and even multi-stage nozzles to fully utilize the wind power that capture by the tubal type device, that make the wind power conversion efficiency of this device exceed the Belz's criterion and without huge anti-torque.

More, by our numerical simulations, the distance between adjacent tubal type wind turbines is much smaller than the horizontal axis one, so that it can accumulate more wind power without the terrain restriction in a proper farm. That means it can be located in the upper layer of a building or a mobile vehicle or ship.

III. THE BOTTLENECK OF STORAGE RENEWABLE ENERGY

A. Renewable energy storage vs. retrieval

Once the renewable energy is captured, the more difficulty thing is reliable and massive storage it for further applications. Currently, we use battery and super-capacity to store electricity; we use fly-wheel or spring to store mechanical energy; we use thermal storage material to store thermal energy [1, 5]. Unfortunately, neither one can meet the requirement of the applications. The most stable and mature way to store energy is by chemistry material, except hydrogen [13]. However, synthesis gases such as methanol or DME which can replace gasoline and diesel are very promising. On the other hand, little attention is paid to fluid energy. Traditional, hydraulic power is the major source, but it cannot shrink down to small scale and strong depend on location so that limit its use [14]. High pressure gases owing to its easy to store and less occupied volume can be another choice. But, currently, it takes too much work to compress gases and low efficient in utilization make it is not so popular. Actually, we proposed a method which cans efficient transform thermal energy to high pressure and using shock wave to drive the power, that make high pressure gases a very good solution for storage regenerative energy. You may also notice that the transformation from electricity or magnetism to fluid energy, either by high frequency wave m, plasma, laser cooling or plastic crystal is not mature yet, however, we pretty sure this research will open a big window for renewable energy utilization.

In this paper, it also shows some mechanism for the energy transformation. According to the 1st law of thermodynamics: the internal energy is point function, it doesn't depend on the path, but heat and work change is depending on path; and by 2nd law: heat can't transfer to work totally. Therefore, choosing most economic ratio of heat and work use and utilize catalyst as most possible are a good strategy in energy transformation. Here are some examples: first, we all known using heat pump can obtain more thermal energy than just using electric heater—that just work transfer to heat. Second, while decomposing water to hydrogen and oxygen, you can use 100 percent electricity, or using 50 percent electricity and 40 percent heat plus 10 percent work. Namely, we can compress the gases by 100 percent of work or 10 percent of work plus 90 percent of heat. Those will make the cost down significantly.

Now, we would like to introduce some mechanism to transfer thermal energy to electricity.

Usually, heat engine based on Rankine cycle or Brayton cycle is used in transportation vehicles. But those heat engines are not easy to scale down so they will strong depend on storage tool if we want to use renewable energy. However, there still are some

ways we can transfer electricity from thermal energy. For instance, some metal (such as tungsten) can emitted thermionic at high temperature; and heating alkaline(lithium, sodium) metal to plasma then let it pass through the electrolyte can also induce electric current, of course magneto hydrodynamic flow power generator and thermal-electric power generator are another options.

B. New transformation devices

In figure 4, a combined thermal-electric system is shown, which use high temperature thermal source to induce current by thermionic power generator, then the waste heat is used to heat the alkali metal for another electric generator, next, the waste heat from the alkali metal system is used to be the source of magneto hydrodynamic flow, at last, that waste heat from MHD is used by thermal-electric power generator. Thus, this combined system will has very high efficiency and very easy to adjust its scale to meet the quantity that available. Actually, if the thermal source is coming from nuclear power, the whole system can be fitted to an ordinary compact car.

Next, let we mention the chemical-electricity transformation. Custom, combustion generates heat drive heat engine then impetus the electric power generator is the standard procedure to produce electricity [2, 3]. However, we also can use hydrogen and air directly to generate electricity such as fuel cells. Besides, active metal (such as zinc) can react with air to produce electricity too. In figure 5, a high temperature and high pressure hydrogen and oxygen come from thermal-electric decomposing water are used to a series of fuel cell—from solid oxide to phosphoric acid to alkaline to PEMFC, so that to get the maximum efficiency.

Now, let us switch to another subject—fluid work. Most people are familiar with hydraulic system, but high pressure gases are also very useful. Since high pressure gases is much easier to store than high temperature ones, and if we can use high pressure gases to produce shock wave, by using the character of shock wave—interaction, reflection and focus, then it will have a lot of applications. Such as to drive a mixer, dryer, filter, sputter, combustor, launcher, engine, and even to be the igniter for nuclear fusion. A high temperature combustor which uses shock wave as drive force is shown in figure 6. The shock wave can be oscillatory amplified to reach high temperature that meets requirement.

IV. SOME HYBRID SYSTEMS TO UTILIZE RENEW-ABLE ENERGY

The first one is a solar thermal and wind capture system; the captured work from the wind turbine is used to drive a heat pump to generate thermal energy. Both thermal energies from solar radiation and heat pump are stored in a aerial balloon which contain a helium tank.

The helium is used not only for store thermal energy but also to keep the buoyancy of this balloon as shown in figure 7(a) and 7(b). This balloon can be designed like an airplane so that it is very easy to change the head direction toward the wind. You may notice that the tubal type wind turbines are coupled with the delta wings (canard) so that the vortex induced by the canard

can flow into the wind turbine to increase the mass flow rate and wind energy. In additions, the shape of the inlet can raise the local pressure and outlet can reduce the local pressure, thus, a larger pressure difference is created to drive the wind turbine. The thermal energy generated by solar and wind can be transformed to electricity by the combined thermal-electric devices just mention before.

Figure 7(c) shows a system that collects solar thermal and wind energy from the roof of buildings, and then stores it by using the thermal-pressure transformation mechanism to transfer the thermal energy to high pressure fluid energy. The stored high pressure gases can be released and switched to shock wave to drive the heat pump and electric generator, which can be used as the power of air-conditioner or indoor heater or illumination lights.

After that is a system used high pressure gases to drive the vehicle as shown in figure 7(d), and the fuel (chemical energy) is used to generate thermal energy then transfer to high pressure fluid energy to maintain the strength of the high pressure tank, so that this vehicle can drive a much longer distance or output much larger horsepower.

Next, a solar-wind-wave energy combination system which can be mounted in a ship or an oil drilling platform as shown in figure 8 is used to generate synthesis gases such as methanol or DME. The idea is used wave energy as power to capture the carbon-dioxide from the atmosphere and desalinate the ocean water to fresh water, using solar and wind energy to decomposed fresh water into hydrogen and reacts with carbon dioxide to be the DME. Just like previous examples, in this system a high pressure gases tank is used as the energy storage. Besides hydrogen can also used to deoxygenize zinc oxide to zinc, and zinc can be the fuel of zinc-air battery to drive the ship.

In figure 9, image that a ship just used renewable energy can navigate to southern hemisphere (to use its large wind and wave energy). And reform the renewable energy into synthesis gases. That will be a wonderful thing for the whole world.

The last case is about desalination. Since the deep ocean water is cooler than the surface one. The idea of this system is used the relative cool deep sea water to be the freeze fluid to condense the flash water vapor generate from the warm sea water, and the surface sea water is used as heat source. In additions, the sanity between surface sea water and dense salt water that come out from distilled sea water is large enough to create gravity potential energy which can used to pump deep sea water. Therefore, in this system, take the advantage of temperature and sanity gradient can reduce the power to desalinate the sea water.

V. CONCLUSIONS

1. Integrate consideration of capture; transformation and storage is essential to efficient utilize renewable energy.
2. The transformation path should consider the local cost of work and heat.
3. Fluid work is much easy to store, but its effective transfer mechanism to other forms of energy still need to explore. Fourth, the energy transfer between electron and nucleus in microscopic of view deserve expectation.

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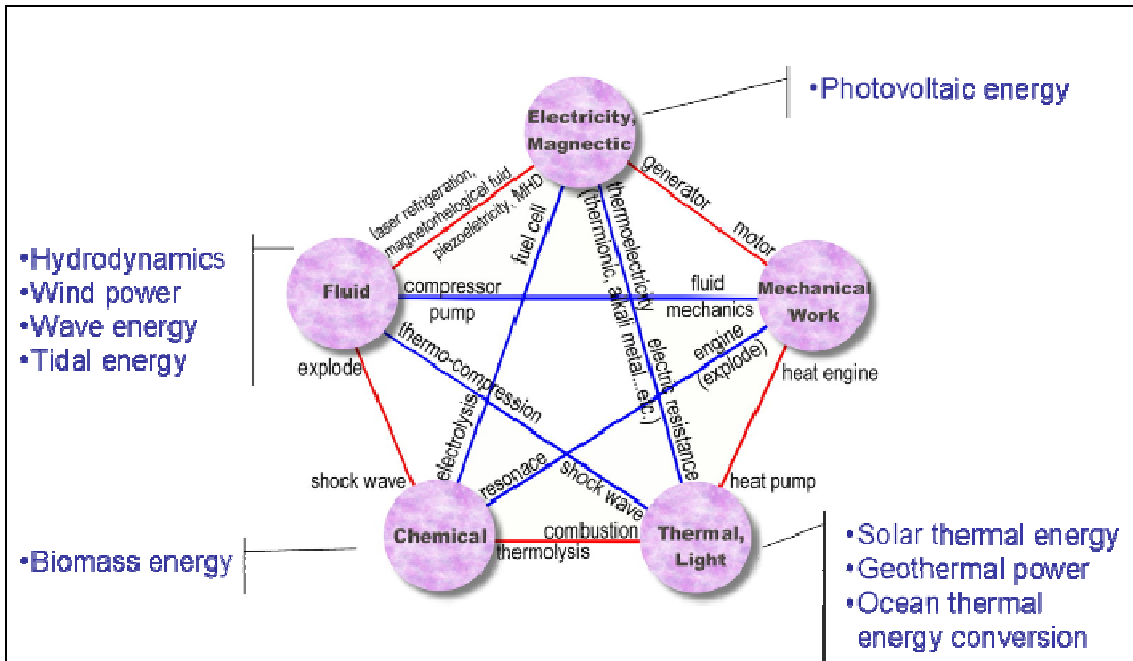


Fig. 1 The transformation between of 5 major energies

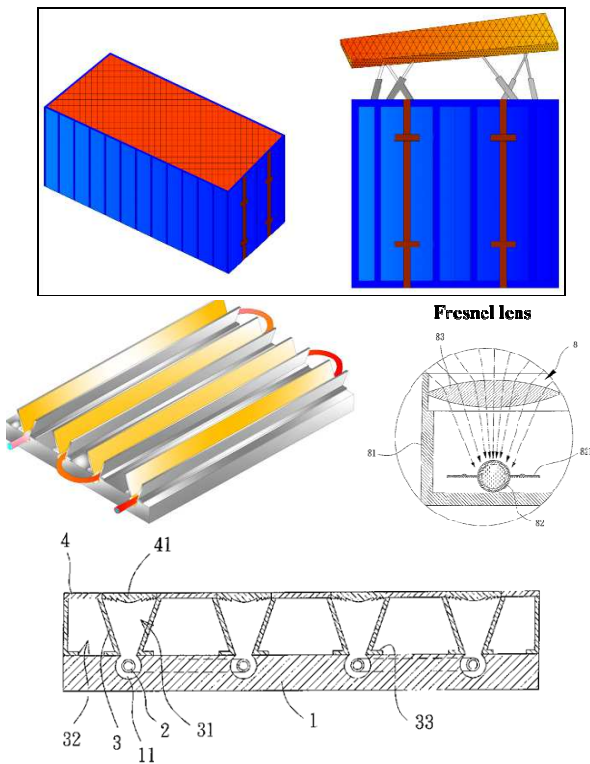


Fig. 2 A solar thermal energy collector

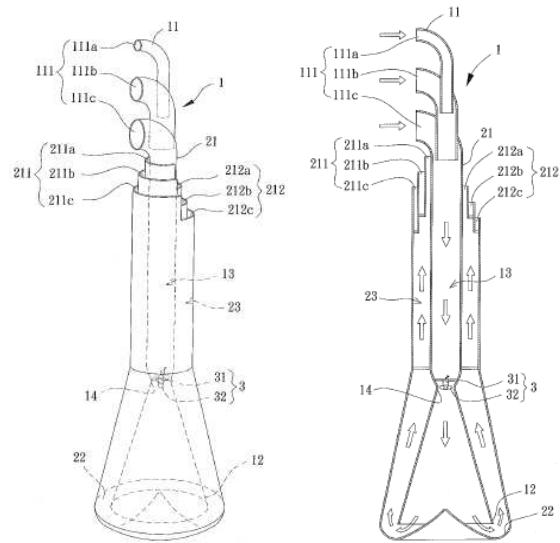


Fig. 3 A tubal type wind turbine

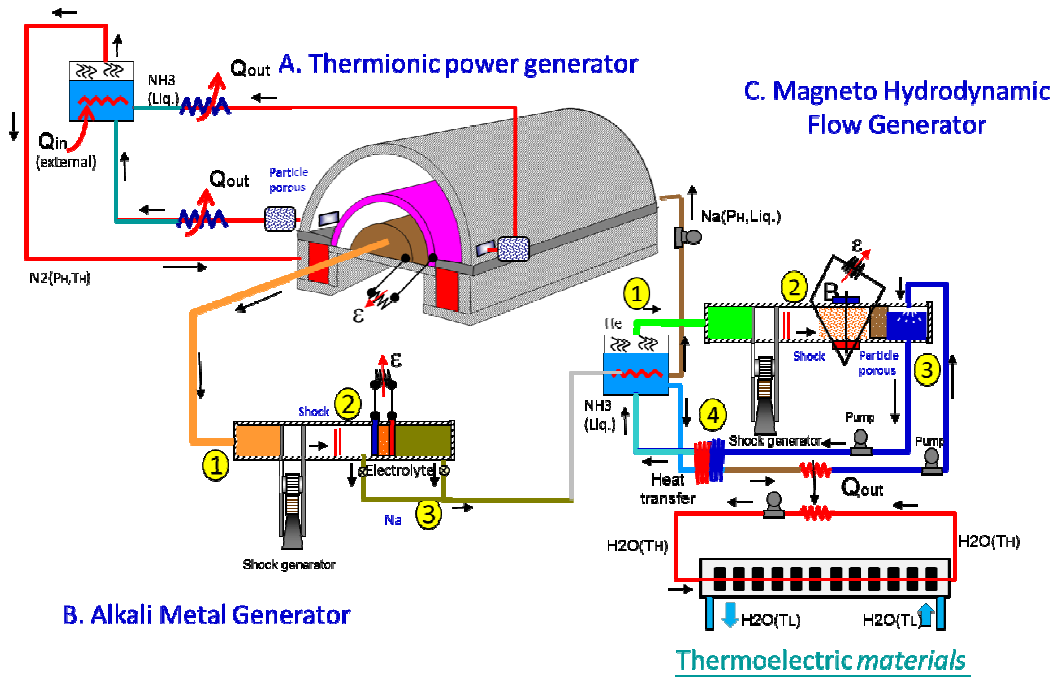


Fig. 4 A hybrid thermal-electrical generator system

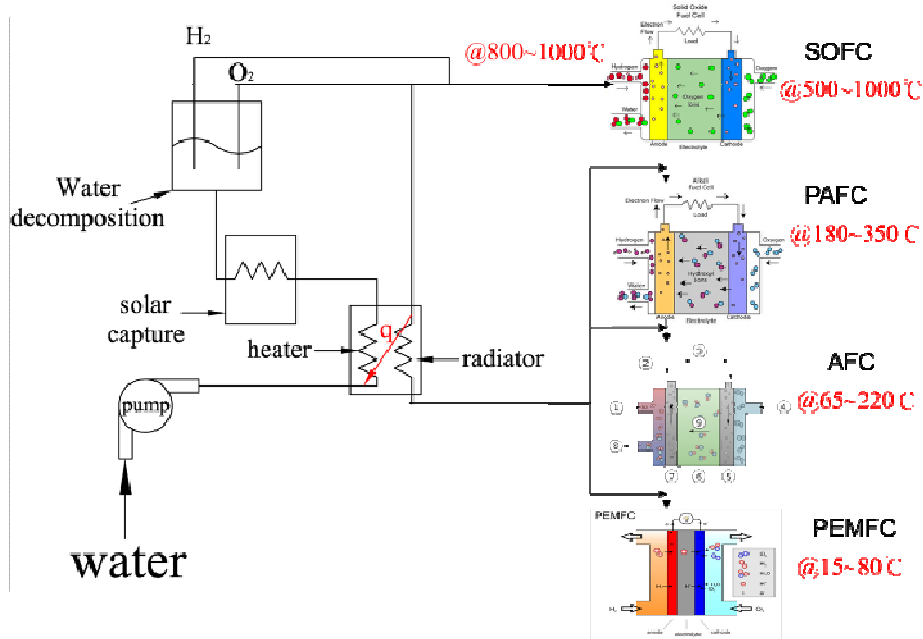


Fig. 5 Fuel cell generators in series

Open Science Index, Environmental and Ecological Engineering Vol:6, No:5, 2012 publications.waset.org/8272.pdf

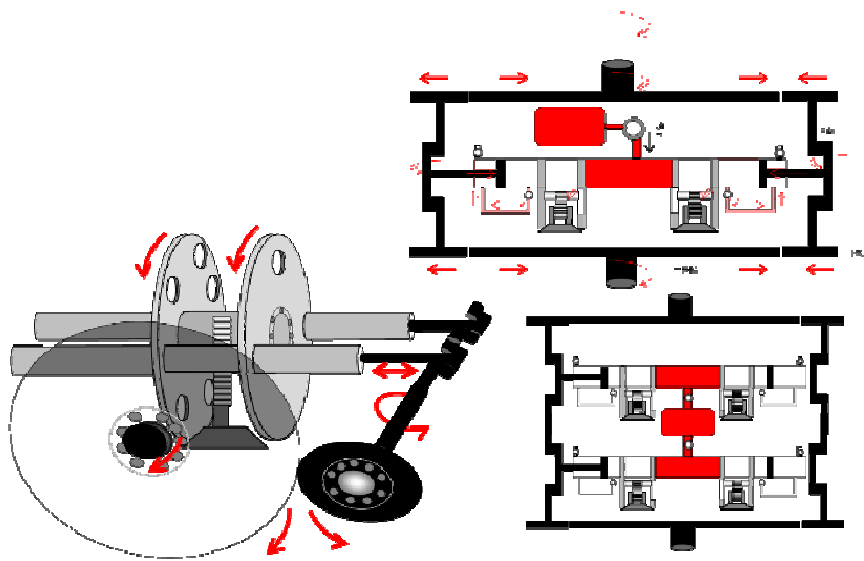
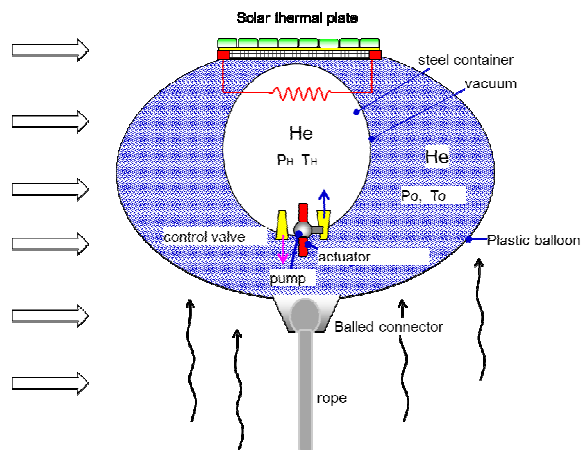
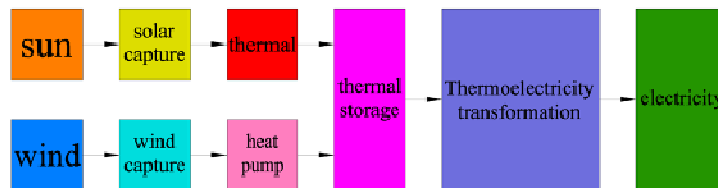
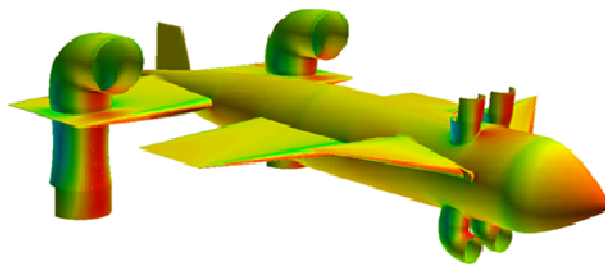


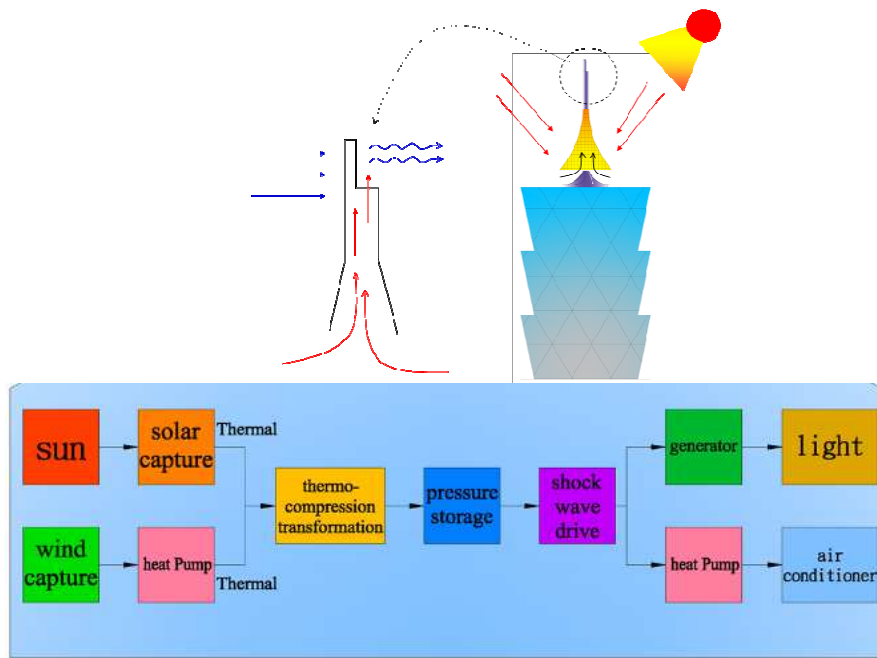
Fig. 6 Resonance shock wave drive engine



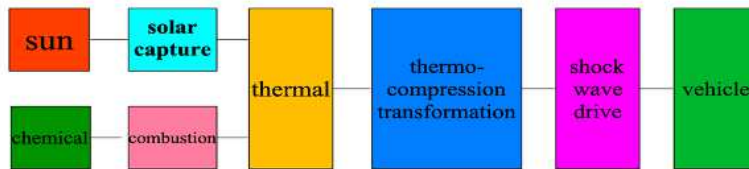
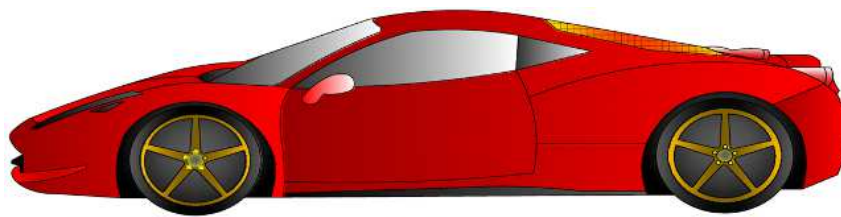
(a) solar thermal and wind capturer system aerial balloon



(b) aerial solar and wind power capturer system



(c) solar and wind energy utilization for building



(d) hybrid thermal-air compression engine

Fig. 7 Novel hybrid systems

Utilization of high pressure gas as intermediate storage medium

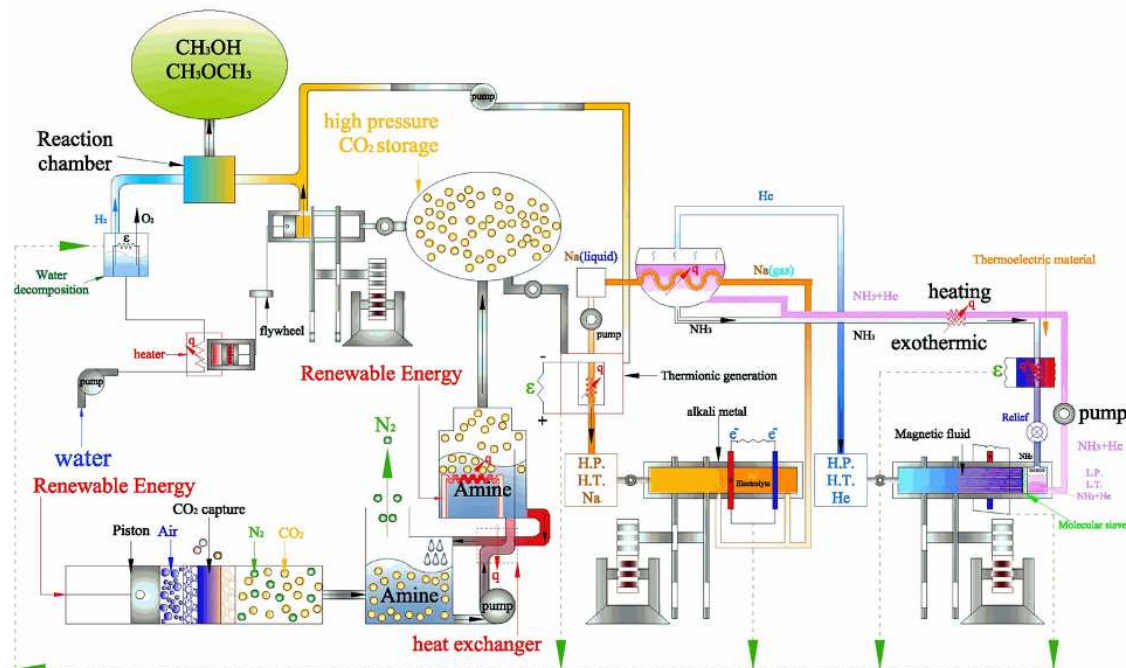
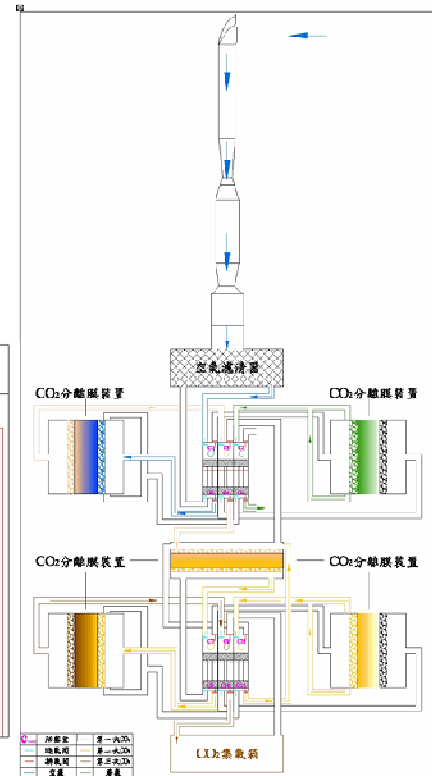
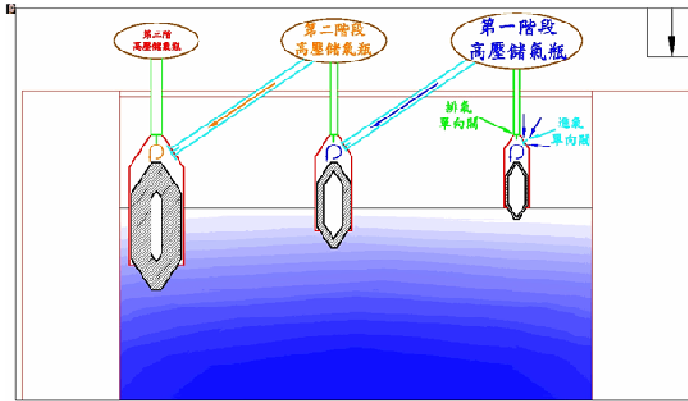


Fig. 8 Solar-wind-wave hybrid energy system for abandoned oil drilling platform

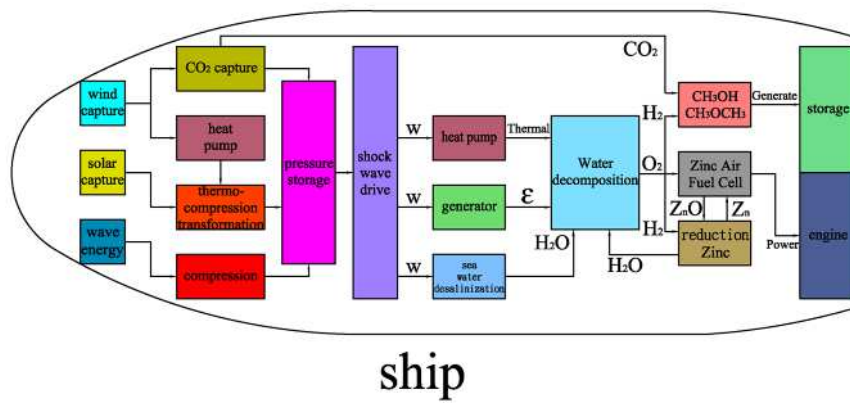
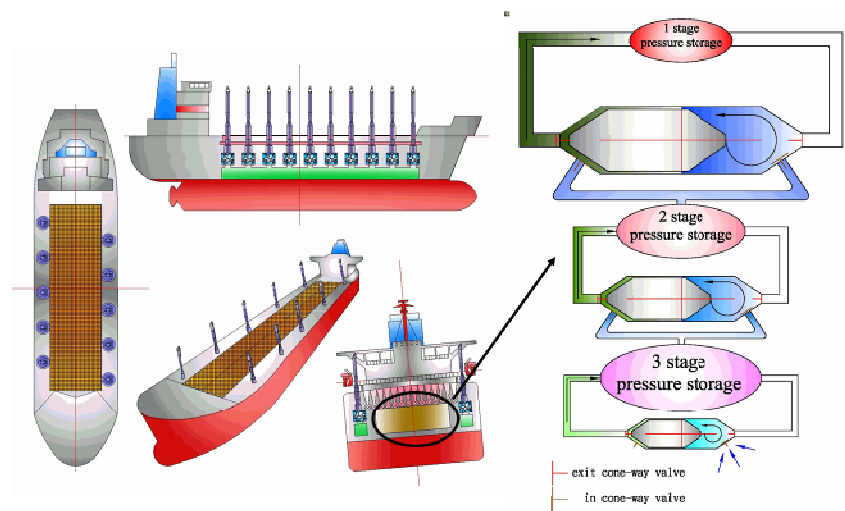


Fig. 9 Schematic of a Renewable Energy Capturer Vessel

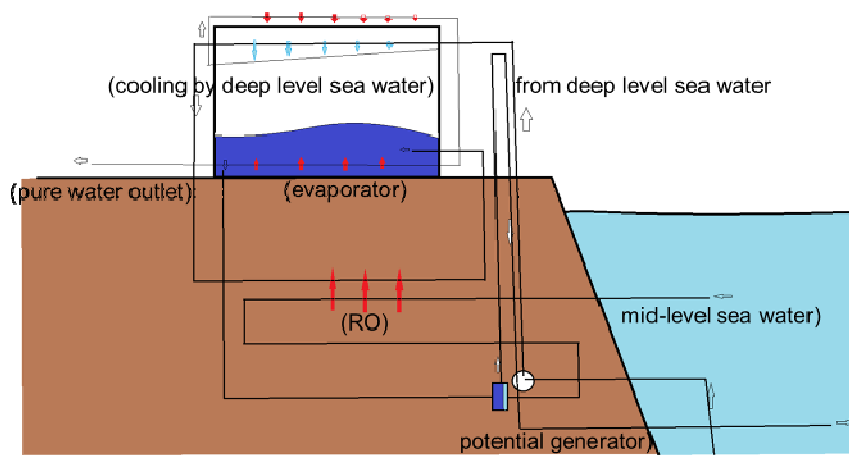


Fig. 10 Using ocean temperature and concentration gradient for desalination