

# Renewable Energy Makes Life Style Change: An Example of Yakushima Island's Zero Emissions

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## Abstract

Tohoku Earthquake, which occurred on March 11, 2011, was a cause of great shock, not only to Japan but to the rest of the world as well. The quake has led to a paradigm shift in terms of the use of electricity power. We must now review our nuclear power policy and change our lifestyles by imposing limitations on the use of electrical power. In the past, we have thought of nuclear power as being low cost, which is important in terms of business activities. Subsequently, we have found nuclear power to be high risk, as evident in this accident. We have to find alternatives. Nuclear power is the most effective way of generating large amounts of electricity, and it is difficult to achieve these large volumes except other energy sources.

Yakushima Island, a World Natural Heritage Site located in Kagoshima Prefecture, Japan, is almost completely powered by hydroelectricity. Focusing on this unique island, Kagoshima Prefecture is promoting the “Zero Carbon Emissions Island” initiative, which aims to create a developed area where carbon dioxide (CO<sub>2</sub>) emissions are effectively reduced. I thus propose alternatives to nuclear power as well as a new lifestyle, using Yakushima Island as an example.

**Keywords:** electric vehicles, new lifestyle, World Natural Heritage Site, Zero Carbon Emissions Island

## Use of Renewable Energy

Renewable energy has been used in the world. It depends on country terrain, wind power and solar power are developing in Spain and United States. In Japan, hydro water power is the most popular, but wind power is not widely open because of the terrain and operation. On the other hand, Japan is surrounded by the sea; it is supposed the use of offshore wind.

According to the investigation of the International Energy Agency (IEA), the amount of electricity generated by renewable energy in the world in 2008 account for only 18%. IIDA Tetsuya said that diffusion of renewable energy power generation in Japan is about 10% and it has not been changed for past 10 years (THE NIKKEI NEWSPAPER 2012). Compared with the same period in Germany and Spain, it increased by 18% and by 20% in Germany and in Spain, respectively. About the reason for the delay in promoting renewable energy in Japan, IIDA

says that there are four problems: (1) no support system, (2) monopoly of the transmission line by the power company, (3) excess of the amount due to local government regulations and the country and (4) absence of agreement with the local community (THE NIKKEI NEWSPAPER 2012). For (1), feed-in tariff of renewable energy was adopted late in Japan. In Spain and Germany, it is already adopted. Solar cell manufacturers, such as Q-Cells, have increased its share. In this early century, Japanese companies, such as Kyocera and Sharp, had the majority of the share of solar power, which were reversed in Western companies because these were effectively utilized the feed-in tariff. Now, here is momentum in Chinese companies such as Suntech Power and JA Solar with low cost that will dominate the market. For (2), power industry intends to try to promote nuclear power than renewable energy because each power company has a monopoly on the wall next to the power transmission network. For (3), this is the adverse effects of traditional Japanese legacy system. When you are trying to take advantage of renewable energy, its application is impeded by a number of regulations. For example, trying to take advantage of geothermal energy has been placed under the control of the National Park, you will not be able to use actively. If you want to use it, you have to submit many applications to more than one municipality, prefecture, city, Government and so on. For (4), this is the problem of water rights, which is a major concern in the region. When you are trying to set up the hydropower, you must get permission to the water rights of downstream to do it. This task is very difficult. To make this easier, it will be necessary to penetrate the recognition of renewable energy. The biggest advantage of renewable energy is the eco-friendly and cleanly. But, it is difficult to understand it. The biggest concern for a water right is that their rights are infringed.

There are many problems which renewable energy does not penetrate in Japan. The lack of understanding of renewable energy is also one of the biggest problems. The merit of using renewable energy is that energy is never dirty after use, and we are able to reuse many times. By recognizing the benefits, we have to use renewable energy as energy that can be used semi-permanently.

### **Lifestyle Change from Large-Scale Power Generation-Dependent**

Each household made a self-generation to correspond to the power demand in the late 19th century (CARR 2008). Then, the customers have come to rely on large-scale power generation facilities. Because of the economies of scale, electricity price is reduced, many appliances are developed. Moreover, an electrical-dependent lifestyle has evolved in a way to maximize the benefits of low-cost power. It means that you can use the required amount of power, you don't worry about the lack of power in order to enrich the lives of your own. As far as economic development continues, you were able to increase in ever-increasing amount

of power you need. Thus, further economies of scale in power will advance, which is promoting the construction of large power plants such as nuclear power that can generate electricity efficiently.

At this time, if this flow is reversed, you do not depend on the power company; each household produces the power required. It is renewable energy which makes it come true.

### **Hydro Power in Yakushima Island**

Yakushima Island is the fifth largest island in Japan, 132 km perimeter, 503 m<sup>2</sup> area. In "Drifting Clouds" book, HAYASHI Fumiko wrote "in Yakushima it rains 35 days in one month" (HAYASHI 1953). It is an area very much rain which caused by mountain conditions. Yakushima Island is blessed with the natural environment. Hydroelectric power using the abundant water takes up a lot of power in Yakushima.

According to "The History of the Power in Kagoshima" (KYUSHU ELECTRIC POWER CO., INC. KAGOSHIMA BRANCH 1998), the hydropower has been planned early by geographical inconvenience of outlying and abundant rainfall. In 1916, Kagoshima Electricity got the water rights of Anbou River and tried to build a fertilizer plant but not achieved. In 1924, Yakushima Hydroelectricity Company was established. Takeno River Plant was completed two years later and general electric light was supplied to Isso, Yoshida and Nagata area. In 1949, hydroelectric power was 385 kW power generation in just four areas; there were 1,530 light lamp. Yakushima Denko Co., Ltd., in 1953 completed Senpiro Fall Plant, and in 1960 Anbou River Plant was completed. So there are four hydropower plant and one thermal plant in Yakushima. Miyanoura thermal power plant is not running basically. It operates just when the hydropower is insufficient. Instead of Kyushu Electric Power, Yakushima Denko has been responsible for it in Yakushima. The amount of hydroelectric power generation have more than enough, the power supply is not considered stagnation. Yakushima power has been met by hydroelectric power, which will serve as a model for Japan that is to increase the percentage of renewable energy. So we have to think of the effective use of available capacity hydroelectric and need to promote the benefits that will change as the disadvantages of the island.

### **The Use of Electric Vehicles**

It is possible that hydropower generated from abundant water in Yakushima covers the most of the island's power. The geographical disadvantage of islands, for the supply of gasoline, is about 20% higher than the price of gasoline in mainland. If many use the electric

vehicles, we will save about 50%. If gasoline can be replaced by electric, economic burden of the people in Yakushima can be reduced and it is expected that the realization of zero emissions and CO<sub>2</sub>-free will come true.

Many people in Yakushima can finish the requirements in less than 30 minutes. Range of activities is within 20 km. Disadvantages of electric vehicles are the time for a single charge. As described, this condition is sufficient. In other words, the electric vehicle is very economical and reasonable in Yakushima.

### **New Lifestyle**

With the spread of electric vehicles, a new lifestyle is proposed in Yakushima. What electric car brings is not only zero-emissions, CO<sub>2</sub>-free, but also low cost convenient life. But, the electric car is not yet sufficiently diffused in Yakushima. The environment which electric vehicles spread is not enough in Yakushima. So, we have discussed the environment surrounding the electric vehicles; “What elements are missing?”, “What should be improved?”, “If these problems are eliminated, are electric vehicles prevalent in Yakushima?”, “Will we achieve zero emissions and CO<sub>2</sub>-free?” I mentioned about the problems to be solved and the potential for electric vehicles.

- (1) High selling price compared to equivalent gasoline vehicles
- (2) Infrastructure on the island, namely lack of charging facilities
- (3) Lack of understanding to the electric car
- (4) Impact on existing industries, the creation of new industries

For (1), not only national and local government subsidies, but the innovation to reduce the selling price by automobile company is necessary. It is important to be able to sell to consumers without burden.

For (2), not only subsidies for charging equipment, but the small and lightweight battery, such as a 100 V household power supply, which we can be replaced when needed is expected to be developed. And we would require an extension of the cruising range due to improved battery technology.

For (3), rate of more than 65 years of age accounted for 28.7% in Yakushima Island. Car is also the necessities of life, the driving is essential for their life. Many elderly drive often, a simple way of charging and anxiolytic to out of batteries in the middle of operation will be necessary. Only the benefits of electric vehicles would not be an appeal to purchase. We would need to make surely awareness for electric vehicles to islanders. As described in this paper, automotive operating environment at Yakushima is very limited, it is expected that the

possibilities of out of batteries is as same as the shortage of gasoline when you drive the internal combustion engine. As long as the battery is not in trouble, we make it sure that out of batteries never happen in the use of electric vehicles during the day if we have each night charge.

For (4), with the spread of electric vehicles may have a major impact on the conventional industry and business. For example, gas station would go no longer required due to the spread of electric vehicles. The conventional garages must be corresponding to the electric vehicles, mechanic technology is not intended for combustion; it may be required to that of electrical systems.

Resume operations of nuclear power plants is a difficult situation, it may be required to increase the power rates and rolling blackouts. So hydropower potential in Yakushima will become the coveted for many companies. Disadvantage of solitary island has come to hamper the development of new industries, young people has gone out to the city to get the job. Based on the abundant hydro and power crisis, you should actively attract new companies. Compared to the demerit to be away from the city and the merit to the stability of the power supply, there is a benefit to the company to advance to Yakushima. Hydroelectric power provided by abundant water in Yakushima, which is the renewable energy and does not give a load to the nature, will bring a new life style.

## **Conclusion**

By using renewable energy, in this paper I have proposed the creation of a new lifestyle to take advantage of electric vehicles. In Japan, most of the nuclear power plant is shut down currently, alternative method that is the thermal power mostly. But, thermal power generation has environmental impact of carbon dioxide emissions, as became apparent this accident, nuclear power also has a large risk to the environment. The only way to remove the environment risk would be use of renewable energy. Power generation per one facility is very small. In Japan, mountainous areas account for approximately 65%, as hydropower have been utilized since ancient times, we have very big potential for renewable energy.

Benefits of hydroelectric power are not polluting the water after use. Although there are problems such as water rights, rediscovering the validity of hydropower, I wonder if it might become an opportunity to review the hydro power as an alternative to conventional power generation.

I have an example of Yakushima because of special situations, abundant annual rainfall and hydroelectric power. So it is possible to use the hydroelectric power effectively to drive electric vehicles. Also be registered on the World Natural Heritage Site, Yakushima appeals to nature conservation and the maintenance. Most of the island is occupied by forest and if we

can achieve CO<sub>2</sub>-free, zero emissions, we can enhance the value of its presence more. If alternative to gasoline-powered vehicles are electric vehicles, they will not emit CO<sub>2</sub>, it will be a big help to protect the natural environment. Gasoline prices in Yakushima are about 20% higher than those in mainland Japan, it would be a great benefit if you change from gasoline to electrical energy for vehicle. To use the renewable energy is a competitive advantage to another area. In Yakushima, small hydroelectric power has begun to be implemented, which is the amount of close to zero. There are many rivers, waterfalls everywhere, it is expected that there are so many places that we can take advantage of hydroelectric power. Taking advantage of them, you will be able to interchange the power unit residents. It will serve as a model of power generation and supply system of a recycling-oriented not only Japan but also world should aim to. We have been building a power plant in the form of destroying nature so far, but with an awareness of the use of more natural, we should think we will live together in the form of power generation facilities.

It is expected that renewable energy will be utilized in many places in the future and energy recycling system will be constructed more efficiently. Yakushima is a cutting-edge area of the model, we will be sure to create a form that does not leave a load on the future to generate the power.

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