

No. 17 Constructing the Recycling-Based Society – 2

The solar energy operates the biological circulation of a closed system planet – the earth. The solar energy has possibility of the most recyclable energy for the recycling-based society. There are other energies such as wind, waves, and geothermal energy, all of which are generated from rotation and revolution of the earth and moon and the movement of the earth' crust. However, the solar energy will be the principle energy for the recycling-based society.

Therefore, the effective use of the solar energy is very important to construct the recyclable energy system for the recycling-based society. In addition, the compound use of other clean energies will be another scenario to maintain the sustainable society.

The amount of solar energy which pours to the earth is 13×10^{23} cal, but not all of this reaches to the ground. Since short-wavelength ultraviolet rays, harmful to creatures, are partly absorbed to the ozone layer, the amount of energy that reaches to the ground becomes 6.6×10^{23} cal. If we assume the net energy product of photosynthesis as 0.0075×10^{23} cal, approximately 0.1 % of energy that reaches to the ground is used for photosynthesis.

If 100 % of the net energy product is used only for human beings and each person keeps a current American life style, the maximum supportable population in the recycling-based society will be 6,620 millions. So if 1) Americans keep the same living standard and if they realize the 2) sustainable society with 3) impartial to everyone, the earth's capacity is 6,620 millions (Hiroshi Mizutani, 1999). However, this calculation is based on the assumption that 100 % of the net energy product is used only for human beings and no other creatures exist, which never happens in the real world.

So how many percentages of the net energy product can people use for the recycling-based society in the future?

There is a suitable model in Japan to answer this question. The model is the Edo Period when Japan was a closed country.

“The population of Japan from 1721 to 1834 was settled in 26 millions. At the time, Japanese society was a kind of the sustainable society with clean environment and comfortable to live. If it was possible to use the net energy product from temperate forests in Shikoku, Kyushu, and Honshu islands during the Edo Period, the net energy

product that Japanese were able to use would be maximally 1.7×10^{18} cal per year. If we assume that the amount of the annual energy demand per person were 1.0×10^{10} cal in the matured agricultural society, the maximum supportable population in the Edo Period is estimated to 172 millions. The actual population at the time was 26 millions people, the amount of energy used by people in the Edo Period can be calculated by dividing 172 millions, the maximum supportable population, into 26 millions. The result is that 15.2 % of the net energy product was used by people and 84.8 % by other creatures." (Hiroshi Mizutani ed., *Limit of the Earth*, Nikka-giren, 1999)

If men of the present age lived similar to the Edo Period (the recycling-based society) and used no more than 15.2 % of net energy product from the land-ecosystem, the capacity of the earth would be 7.8 billions.

The population is estimated to reach this number before 2030.

The test calculation mentioned above gives us the lessons regarding the construction of the recycling-based society in terms of the energy use.

The first lesson is to improve the solar energy use from 0.1 % (the percentage of the current use). Solar power generation is the energy technology spread out the most for practical use. This energy is characterized by the possibility of a small-scale and dispersed system, compared with a current large-scale and concentrated system. There are less loss from transportation and less risk from disasters. Moreover, this system does not need a vast capital and can be installed in a small scale.

The second lesson is to increase human's share of the net energy product. However, it is difficult to sharply increase it because the eco-circulation system should be well maintained at the same time. Therefore, it will be more important to develop other clean energies with compound use.

The third lesson is to control the mass energy use in advanced countries. During the Edo Period, there was no modern technology to consume resources, such as fossil fuels. On the contrary, human beings in the present age consume resources. The amount of the consumption in 1 day is corresponded to that the global system has accumulated for more than 50,000 years. Therefore, it is extremely difficult to construct the recycling-based society unless they control the mass consumption of resources.

During the Edo Period, there was a custom in the Tohoku region, which was “persimmons in the upper branch are for birds and persimmons in the lower branches for the travelers.” Local people took only the persimmons in the middle branches for themselves.

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