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Estimation of salinity gradient power generation in sea-river systems in Japan

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ABSTRACT

Salinity gradient energy (SGE), also known as blue energy or osmotic energy, is the energy obtained by mixing two solutions of different salinity (usually seawater and river water). SGE is expected to be a new form of renewable energy because it has little temporal variation in power generation and can be installed near large cities, eliminating the need for power transmission equipment. In fact, the power generated by mixing river water around the world with seawater has been estimated to be 1 TW, which is equivalent to approximately one thousand nuclear power plants.

Japan has abundant sea-river systems potentially suitable for SGE extraction. Nevertheless, to the author's knowledge, there are not many academic attempts that have theoretically evaluated the potential of this energy resource in Japan. These facts motivated us to estimate the potential of SGE using natural environmental data in Japan.

According to Forgacs' formula, the theoretical potential energy produced by a salinity gradient, denoted by P_{SG}, in a river-sea system depends on the following four environmental factors [1]: the water temperature, the river discharge, the salt concentration of sea water, and that of river water. By extracting these values from a database managed by Japanese public institutions, followed by substituting them into the formula for P_{SG}, we have estimated the amount of power generation expected in various locations along the coast of Japan. Comparing the results with power generation estimation in various countries around the world (in Sweden [2], for example), we have confirmed that Japan is a suitable region for SGE development.

REFERENCES

[1] Cipollina, A. and Micale, G. (2016), "Sustainable Energy from Salinity Gradients", (*Woodhead Publishing, 362 pages)*.
[2] Essalhi, M. et al. (2023), "The potential of salinity gradient energy based on natural and anthropogenic resources in Sweden", *Renew. Energy,* **215**, 118984.

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