

A Study on Energy from Salinity Gradient in Primorye, Russia

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ABSTRACT

The paper treats a new source of energy – salinity gradient which at equilibrium mixing of solutions this energy can be transformed into useful forms of energy, estimates salinity gradient energy sources by the example of Primorye rivers, and treats several methods of salinity gradient energy transformation, first of all including reverse electro dialysis.

KEY WORDS: Osmosis; solutions; salinity; electro dialysis; energy; membrane.

INTRODUCTION

Oceans contain a huge volume of a natural solution, such as sea water. Solutions of different concentration have different chemical potentials, useful energy can be received at equilibrium mixture of solutions. Fresh water of the rivers running into the seas and artificial brines of high concentration can to be used as second solution. Such energy sources have received the name - salinity gradients energy (SGE) sources.

Salinity gradients have advantages before many other alternative energy sources in size of energy potential and energy density. SGE conversion and usage have minimum environmental influence compared to other energy sources.

SGE resources in Primorye (Russia)

SGE resources of several Primorye, Russia rivers are evaluated in the laboratory of non-conventional energetics (Knyazhev, 2008) (Table 1, Fig.1). Summary power potential is $1.5 \cdot 10^6$ kW in the mouths of rivers of Primorye falling into the Japan sea.

Table 1. Energy potential SGE in the mouths of the rivers of Primorye, Russia

The river	Area of the river basin km ²	Rate of the flow, m ³ /s	Annual volume of the rate, m ³ ·10 ⁶	Average power, MW	Annual development of energy, kW·h·10 ⁶
Samarga	7760	103	3249	229.3	2009.3
Edinka	2120	35.9	1132	79.9	700.1
Kaban'ya	1060	21	662	46.8	409.4
Peya	428	7.28	230	16.2	142.2
Svetlaya	791	13.2	424	29.3	262.2
Kuznetsova	410	4.55	144	10.1	89.1
Maximovka	2240	40.3	1272	31.7	786.7
Kema	2720	45.2	1426	39.9	881.9
Taezhnaya	685	7.28	230	16.2	142.2
Serebryanka	2300	33.4	1053	74.4	651.2
Jigitovka	2210	30.7	968	68.4	598.7
Rudnaya	1140	14.5	457	32.3	282.6
Zerkalnaya	1870	20.2	637	45.0	393.9
Avvakumovka	3170	30.1	949	67.0	586.9
Margaritovka	948	11.2	353	24.9	218.3
Milogradovka	969	11.8	372	26.3	230.1
Kievka	3120	35.7	1126	79.5	696.4
Partizanskaya	4140	38.6	1217	85.9	752.6
Suhodol	617	5.68	179	12.6	110.7
Shkotovka	714	6.88	217	15.3	134.2
Razdolnaya	16800	80.9	2552	180.1	1578.3
Barabash	576	8.95	282	19.9	174.4