Coastal water resources and watershed management

The Use Of Cold Sea Waters To Produce Fresh Water

Victor Tchmyr [1]

(1) Institute of Biology of Southern Seas, 90000 Sevawstopol, Ukraine
Telephone: 0676924358 Email: vikchm@mail.ru

There is enormous atmospheric moisture content in air masses over the Black Sea in summer. And sea waters are characterized by large temperature gradients. In summer the atmos-pheric moisture off the Crimean coast is 10 – 15 g/m3 at air temperature over 20 – 25 oC . Mean-while water temperature of cold intermediate layer is about 8 oC. The nucleus of cold interme-diate layer off the Crimean coast is at a depth of 90 – 100 m, its upper bound is at a depth of 55 – 70 m and its lower bound at a depth of 125 – 135 m. In the Caspian Sea in summer cold waters with the temperature 6 – 7 oC are at a depth of 50 – 100 m. It is a unique opportunity to get fresh water on the arid shores of these inside seas by the condensation of atmospheric moisture on the outer surface of the tube condensers that are cooled by deep sea water. Air cooling on the condenser surface to 10 °C will cause condensation of about half air moisture or 5 g of 1 m3 of air when air temperature above the sea is 20 °C and atmospheric mois-ture content is 10 g per 1 m3. Thereby to get 1 kg of fresh water is necessary to cool 200 m3 of air to 10 °C. The condensation of 1 kg of moisture will emit 2258*103 joule of heat, cooling of 200 m3 of air to 10 °C 2676*103 joule more. To produce 1 kg of fresh water the condenser must absorb about 5000*103 joule of heat energy. To withdraw such quantity of heat is necessary to heat 240 kg of deep water (T 8 °C) to 13°C. These theoretical estimates were confirmed experimentally off the Black Sea coast in Se-vastopol by exposition of a cold water vessel at fixed test duration, obtained condensate mass and water temperature changes in the vessel. According to the experiment, as 24-hour period equivalent about 11 kg of fresh water was obtained from 1 m2 of vessel surface or 35 kg of 1 m2 of condenser cross-section. This quantity at wind speed about 3 m per second is hardly 3,5 % of atmospheric moisture general content in air composition that cross 1 m2 of wind current cross-section during 24-hour period. Using a complex tube condenser this index can be increased by an order, placing the tubes at a distance equal to the diameter of each other in a checkerboard pattern. So, it’s very possible to obtain up to 350 kg of fresh water per 24-hour period on 1 m2 of condenser cross-section. Cold water feed to the coastal slope can be carried out by electric pumps through plastic pipes of large diameter having thermal insulating properties, to a height suitable for the condenser location. The condensers can be assembled of individual sections, consisting of thin polyethylene tubes. Passing through the condensers sea water can accumulate in pool and then reset to the turbines, returning the spent energy on lifting, during its deficit in electrical supply. Operating in hydro-accumulator power plant regime the complex of

condensers can fully supply with drinking water a town with a population of 500 thousand in the summer time, occupying only a few kilo-meters of sea coast. To get a commensurate amount of fresh water by the thermal desalination, it would require energy of a nuclear power station. Moreover, these condensers and storage pool can be located close to the coast outside the actual beach area, without infracting its economic and recreational use. At the same time rich of mineral substances surfaced deep waters can be used in developing the aquaculture.