Desalination and Water Treatment
www.deswater.com
32 (2011) 373–380
August
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doi: 10.5004/dwt.2011.2724

Calculation of storage capacity of geothermal resources by weighted element weight method — A case study of Zhangjiapo Formation in Xi'an Depression*

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Received 1 September 2010; Accepted in revised form 10 January 2011

ABSTRACT

Weighted element method is proposed in this paper to improve the accuracy of calculating storage capacity of geothermal reservoirs. This method makes full use of all geothermal wells in the calculation region, which is defined by every three neighboring geothermal wells. The calculation region is divided into many calculation elements. As a result, the entire calculation region of the distribution parameters is discretized into independent in each element with lumped parameters. The arithmetic mean of three-node parameters in each element is used as the lumped parameter, and the block with the same set of parameters is divided into calculation regions as small as possible. The effect of one element as well as its parameters in the entire calculation region depends on the weight of the area of this element in the whole calculation area. The weighted element method can be used to calculate the volumetric water storage capacity of geothermal fluids, elastic release storage capacity, geothermal storage capacity of volume water, geothermal energy storage capacity of elastic releasing water, geothermal storage capacity of geothermal reservoir rocks for each element, respectively. The storage capacities of various elements and the entire calculation regions can be calculated with superposition. The proposed approach was used to calculate the storage capacity of geothermal resources in Zhangjiapo Formation of Xi'an Depression, in which data of 28 existing geothermal wells were available. If the geothermal energy recovery is set at 10% and theexploitation remains stable, the geothermal energy contained in the geothermal reservoir can be extracted for more than 7,000 years. Under the current conditions of exploitation technology, the actual geothermal energy that can be effectively exploited and used is 3301.419×10^8 kcal, which is equivalent to standard coal of 47.1631×10^4 t.

Keywords: Weighted element method; Geothermal resources; Storage capacity; Zhangjiapo Formation; Xi'an Depression

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