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Research paper

Groundwater analysis of Dholera geothermal field, Gujarat, India for suitable applications

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ABSTRACT

The physio-chemical properties of water play an important role on the efficiency of a process, selection of materials and the lifetime of conduits used to carry the fluid used either in industries or for irrigation. A study was undertaken to assess the quality of groundwaters in the Dholera geothermal field. The groundwater samples were collected from shallow geothermal wells, located at different places in Dholera district. Samples were collected from nine geothermal wells and tested for pH, total dissolved salts (TDS), Na^+, K^+, Ca^{2+}, Mg^{2+}, F^-, HCO_3^-, Cl^- and SO_4^{2-} and their distribution was observed using spatial distribution contours. Piper plot, ternary plot and various other diagrams were used to analyse the water for manifold direct and indirect uses. From the results, it was concluded that even though the water cannot be used for irrigation purpose, various utilization strategies focusing on exploitation methods for geothermal energy revolving around industrial applications, agriculture and space heating and cooling and power generation by geothermal resources have been devised for geothermal water of Dholera region in this paper.

1. Introduction

Dholera is situated in the state of Gujarat in India (Fig. 1), which is to be developed as a smart city under the Delhi-Mumbai Industrial Corridor (DMIC) Project. With the aim of developing Dholera as a smart city, the industrial activity is connoted to triple over the next five years spurting the demand for water, one of the most basic necessities for any industry to flourish. Moreover, demand of electric power is implied to skyrocket.

Dholera is one of the most water scarce areas in Gujarat with just 260 m^3 surface water resources per capita (State Environmental Report, 2016). The surface water comes from four west flowing rivers namely Sukhbhadar, Lilka, Bhogavo and Keri which flow into the Gulf of Khambhat and transverse through the DSIR area (Fig. 2). However, neither of the mentioned rivers are perennial i.e. they remain dry for about nine months of the year nor do they provide significant supply and are full of silt. The current water needs of Dholera, like that of most of Gujarat, are satiated by water supply from the Narmada canal.

The water demand for the proposed DSIR will be 947 million litres per day (MLD) out of which residential and industrial water demand will be 298 and 491 MLD respectively. A portion of this industrial grade water is proposed to be procured from treated waste water by Ahmedabad Municipal Corporation (AMC) and water from Narmada Canal is proposed to fulfill the irrigation water demand for the DSIR. Building a canal to Dholera requires a lot of investment – about Rs 4500 crore (694 million dollars). Officials have made it clear that water for industrial and domestic use for Dholera SIR is not available and all of the Narmada water has already been allocated to other areas of Gujarat.

With the problem of scarce surface water resources and limited freshwater supply from the Narmada canal, need arises for exploitation of groundwater found in aquifers lying below the surface in this region. By doing so, salty groundwaters of Dholera region may be used as a proxy for fresh water thus resulting in lower consumption of fresh water for applications where salty water can be used (DSIR, 2013).

Alongside increased water demand, electricity demand will inflate the requirement in residential, industrial, recreational, sports,

Abbreviations: DMIC, Delhi-Mumbai Industrial Corridor; WHO, World Health Organization; TDS, Total Dissolved Solids; ORC, Organic Rankine cycle; EC, Electrical Conductivity; HVAC, Heating, ventilation, and air conditioning; SAR, Sodium Adsorption Ratio

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