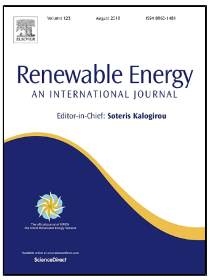
Accepted Manuscript



CO_2 –Water Mixture Reinjection into Two-Phase Liquid Dominated Geothermal Reservoirs

Eylem Kaya, Victor Callos, Warren Mannington

PII:	S0960-1481(18)30378-1
DOI:	10.1016/j.renene.2018.03.067
Reference:	RENE 9936
To appear in:	*Renewable Energy*
Received Date:	13 July 2017
Revised Date:	02 February 2018
Accepted Date:	25 March 2018

Please cite this article as: Eylem Kaya, Victor Callos, Warren Mannington, CO_2 –Water Mixture Reinjection into Two-Phase Liquid Dominated Geothermal Reservoirs, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.03.067

CO_2 –WATER MIXTURE REINJECTION INTO TWO-PHASE LIQUID DOMINATED GEOTHERMAL RESERVOIRS

Eylem Kaya [1]*, Victor Callos [2], and Warren Mannington [3]

[1] Department of Engineering Science, University of Auckland, Private Bag 92019, Auckland, New Zealand
[2]Energy Development Corporation, Pasig 1605, Philippines
[3] Wairakei Power Station, Contact Energy, State Highway 1, Private Bag 2001, Taupo 3352, New Zealand
*e.kaya@auckland.ac.nz

ABSTRACT

Geothermal energy resources are considered to be one of the main contributors to clean, renewable and low-risk energy production. However geothermal power production may result in some greenhouse gas (GHG) emissions. Injection of GHGs into geothermal reservoirs can be used to reduce these emissions, providing reservoir pressure support and possibly improve reservoir permeability.

To understand the migration and behavior of injected gases in the reservoir and to forecast gas breakthrough, simulation studies are required. This work investigates the possible impacts of infield reinjection of CO_2 in two-phase liquid-dominated geothermal reservoirs using an earlier 3D numerical model of the Wairakei-Tauhara system as a representative case study. Wairakei-Tauhara is an interesting case study as it has been operated with no reinjection for most of its lifetime. The work investigated the impact of various scenarios of separated geothermal water and CO_2 reinjection on reservoir sustainability. The breakthrough of CO_2 was also monitored since it can result in higher gas production and lower power generation. The modelling results showed that the injection of CO_2-water mixture helps to maintain the reservoir's pressure, but, at the same time, it may suppress natural recharge and boiling, which results in reduction of the enthalpy of the produced fluid.

Keywords: N*on-condensable gases, Geothermal, Reinjection, Carbon dioxide, Mixed CO_2-Water injection, Reservoir simulation*

1. INTRODUCTION

Geothermal energy is an environmentally friendly, renewable, and sustainable source of electricity. It is well positioned to play an important role in mitigating global climate change as the overall CO_2 saving from geothermal electricity production worldwide can be around a billion tons per year (Bertani, 2016). However, as the geothermal sector has expanded, a wider range of geothermal resources have been brought into exploitation, including geothermal systems with high greenhouse gas concentrations. Hence, sustainable development of these resources requires methods and tools to control their environmental impacts.