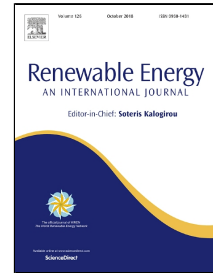


Accepted Manuscript

Sensitivity and Effectiveness Analysis of Incentives for Concentrated Solar Power Projects in Chile

Yeliz Simsek, Carlos Mata-Torres, Amador M. Guzmán, Jose M. Cardemil, Rodrigo Escobar



PII: S0960-1481(18)30642-6
DOI: 10.1016/j.renene.2018.06.012
Reference: RENE 10168
To appear in: *Renewable Energy*
Received Date: 02 March 2017
Accepted Date: 04 June 2018

Please cite this article as: Yeliz Simsek, Carlos Mata-Torres, Amador M. Guzmán, Jose M. Cardemil, Rodrigo Escobar, Sensitivity and Effectiveness Analysis of Incentives for Concentrated Solar Power Projects in Chile, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.06.012

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Sensitivity and Effectiveness Analysis of Incentives for Concentrated Solar Power Projects in Chile

Yeliz Simsek^{a,b*}, Carlos Mata-Torres^{a,b}, Amador M. Guzmán^a, Jose M. Cardemil^c, Rodrigo Escobar^a

^aEscuela de Ingeniería, Pontificia Universidad Católica de Chile, Vicuña Mackenna 4860, Santiago, Chile

^bFraunhofer Chile Research, Center for Solar Energy Technologies, Av. Vicuña Mackenna 4860, Macul, Santiago, Chile

^cIngeniería Mecánica, Facultad de Ciencias Físicas y Matemáticas Universidad de Chile, Castilla 2777, Chile

Abstract

Northern Chile has excellent conditions to develop concentrated solar power projects. Although solar irradiation makes a significant contribution to production in the region, solar thermal projects need some support mechanisms. This study focuses on the best combinations of solar incentives and financial parameters to have lowest government cost and maximum levelized cost of electricity reduction. Key findings of this paper showed that debt fraction and discount rate illustrated meaningful sensitivities on both LCOE and government cost. ITC, PTC, and DM as tax credit and PBI as cash incentives had the best effectiveness, and reduced LCOE better than IBI and STR. The effectiveness of ITC, PTC, PBI, and DM was independent of financial parameters even though STR and IBI showed dependency. Although cash incentives had no limits to reduce LCOE, tax credit incentives reached maximum values, which meant that their impacts were limited. As cash incentives, PBI showed better results when it was compared to IBI. Maximum values of ITC maintained the same for different installed costs, while it changed for PTC. Finally, it was obtained that tax credit incentives were more meaningful at higher PPA price although PBI made more sense in lower PPA prices.

Keywords: CSP, Solar Incentives, LCOE Reduction, Solar Energy Policy, Chile

* Corresponding author. Tel.: +56-9-8193 9222

E-mail address: ysimsek@uc.cl

1. Introduction

The Chilean economy is based on heavily energy consumer mining activities which mostly take place in the north of the country. In order to meet the energy demand of mining industry, it is necessary to develop a sustainable energy policy by using the significant renewable energy potential. In recent years, due to the high solar potential of northern Chile with the approximate annual average of Direct Normal Irradiation (DNI) of 10 kWh/m² per day [1], solar energy projects have gain importance in this region. In spite of high installation cost, the lack of renewable energy incentives and regulation policies (tax incentives, rebate programs, cash-grant programs, loan programs, industry recruitment/support, bond programs, performance-based incentives) [2], high solar irradiation makes a great contribution to develop solar thermal energy projects in the area. Additionally, as reported by *Energy 2050*, Chile has the target of 70% electricity production from NCRE (Non-Conventional Renewable Energy) sources until 2050 [3,4]. It is apparent that concentrated solar power (CSP) plants with thermal storage and photovoltaic (PV) technology could have significant contribution to reach this target and have a continuous, sustainable, and clean energy planning in Chile.

When solar energy plants are compared to the conventional energy production facilities, they may require incentives and financial facilities due to high investment costs. Regulatory instruments and support mechanisms help to increase the number of installed solar power projects. Besides, tax credit and cash incentives are needed to make solar energy projects feasible and these incentives are able to diminish the gap between the levelized cost of electricity (LCOE) and the power purchasing agreements (PPA) in the projects.

According to the report of International Renewable Energy Agency (IRENA) published in 2015, Chile has renewable energy support mechanisms such as regulatory instruments (auctions, quota, certificate system, and net metering) and financial supports (dedicated fund, pre-investment support, and direct funding) [5]. In addition to this, in the past, investors could benefit from tax credit incentives in Arica and Parinacota region in northern Chile. According to the law of Arica in 2001, investment projects were eligible for a tax credit of 30% in Arica and 40% in Parinacota until 2008 [6]. Despite having some regulations and improvements on solar energy support policy in Chile, the mechanisms are not enough to support CSP projects and the auctions result differently each year. As mentioned before, northern Chile is an important region to develop solar energy projects due to the high solar potential. Therefore, in the latest years, CSP companies appeared in the auctions.

Download English Version:

<https://daneshyari.com/en/article/6763929>

Download Persian Version:

<https://daneshyari.com/article/6763929>

[Daneshyari.com](https://daneshyari.com)