

# *The Impact of Income Tax Incentives on the Adoption of Solar Thermal Water-Heating Systems in Chile*

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Historically, many governments have invested large funds to stimulate consumer interests in the development of solar energy technologies. More specifically, several governments have implemented subsidies to help households and businesses to overcome the barrier of high initial equipment costs for buying and using these technologies. The most common policy used for this purpose takes the form of personal and corporate income tax credit incentives. Income-tax credits consider a direct reduction in a personal and corporate tax liabilities for some fixed amount of the system costs, thereby increasing after-tax cash flows and promoting investment in solar equipment. The cost of these programs, as they imply loss of income tax revenue, are usually considered tax expenditures for budgeting purposes.

Authors such as Jaffe, Newell, Stavins, 2004, recognized that the first adopters of new technologies such as SWH face a higher cost, justifying an intervention of the government until that additional cost levels out. In order to justify the use of public resources, authors such as Li, Rubin, Onyina, 2012 identify the decrease of dependency on fossil fuels, as a primary objective and increase the percentage of renewable energy, reduction of emissions, employment related to the installation and maintenance of the systems.

For the first time, in 2009, the Chilean government approved an incentive mechanism (Law 20.365) in the form of income tax credits to promote the installation of solar water heating systems. The tax credit was in effect between 2009 and 2013. The main objective of the legislation was to establish a local solar thermal water-heating (solar thermal energy) market by stimulating demand. This regulatory mechanism offered tax benefits to construction developers that were willing to install solar water heating systems in new housing developments. To do it allowed them to receive a share of the installation costs of solar thermal system and also the maintenance costs as a tax credit for their corporate income taxes. The legislation also had a consumer protection provision offering a 5-year guarantee against failures in the solar thermal system and a free inspection within the first year of home ownership. The law was modified by another Law 20.897 in 2016 extending the benefits for a second period between 2016 and 2020. The new law, besides the tax incentive, created a new incentive mechanism - a direct state subsidy- to finance the installation of solar thermal water-heating in new housing.

A growing body of research shows that a government-sponsored incentives may generate different consumer responses in terms of solar technology adoption (Gallagher and Muehlegger, 2011; Sarzynski et al., 2012; ). Therefore, there is a long debate over the effectiveness of different public policies on the adoption of the solar technologies. To address the question of whether state income tax credits effectively encourage solar installation in Chile during the first period. For this purpose, this research analyzes data on solar installers to evaluate the importance of state tax credits in the construction firm's solar installation decisions and other economic and socio-demographic variables in housing purchasing decision by final consumers. Particularly, the paper focus on two main questions: Do government incentives in Chile actually encouraged the installation of solar thermal

water-heating in new housing meeting? and how important are different socioeconomic and demographic factors in terms of affecting the installation of solar equipment?

## **Methods**

The methodology for the study consists of three different but complementary parts. The first and second part include a questionnaire survey design and data collection. The questionnaire survey contains a closed end and multiple answer questions. The survey consists of a stratified representative sample of 1,113 head of households equipped with solar thermal panels located in the Metropolitan (389 respondents), Valparaíso (325 respondents) and Coquimbo (399 respondents) regions of Chile. This survey was conducted between January and May 2016. Finally, the third part of the methodology includes different analyses of the most relevant factors of interest for the public policy based on regression models and simulations.

## **Results:**

The empirical results indicate that the magnitude of the government tax credit, the educational level of the head of household, being middle or middle-high income households and the number of household residents are all positive and significantly related to adoption of solar water heating devices. The results also show no impacts on system installations for lower and upper class housing. The former because builders do not seem to see value in adding SWH systems. The latter because the incentive had a limit to the price of the recipient house (Muñoz, 2015).

The results show a much higher than expected number of systems installed in Santiago, the Capital City, which is not the best area of the country in terms of high irradiation levels. However, Santiago has the largest portion of industry, providing support to the new installers, and a third of the country population, with plenty of housing projects.

The beneficiaries have shown a high satisfaction with respect to the quality of the installations and functioning of the solar thermal panels. This implies that policy makers can have an important impact on solar energy adoption in Chile. However, it became evident that that the impact was reduced as the incentive scheme targeted to benefit to low and middle income families only.

## **References**

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