# Residential Electricity Demand in Chile

By Claudio A. Agostini, Cecilia Plottier and Eduardo Saavedra*

**Introduction**

Since early 90s the electricity demand in Chile has steadily grown (at an average rate of 8% during the period 1990-2007 and an average of 5.7% during 2008-2012). In the past, the increase in demand was follow by increases in supply, even though there were some shortage periods mostly due to droughts. During these periods of shortage consumers were rationed and there were even some blackouts periods for some type of consumers.

In general, government policy in cases of electricity shortages has been to try to reduce consumption using non-pricing mechanisms. In the case of residential electricity different policies have tried to reduce consumption through incentivizing energy efficiency (use of efficient light bulbs for example) and reducing voltage. The implicit assumption behind these policies (and an explicit assumption in the regulation) is that electricity demand is inelastic to prices. If this assumption is incorrect and the price elasticity is different from zero, then there are pricing policies that can be a better option to deal with supply shortages.

Now Chile faces more complex energy challenges, as the approval of new power generation plants have become increasingly difficult due to environmental restrictions and the supply of energy is not growing at the same pace as demand. Therefore, in a context of growing demand and stochastic energy supply in Chile, it becomes relevant to have a better knowledge of the determinants of the demand of electricity for household use- price elasticity in particular- in order to reduce possible energy deficits through flexible pricing mechanisms. This paper estimates the demand for residential electricity using data from the National Survey of Socioeconomic Characterization (CASEN) 2006, being innovative over previous studies by using disaggregated data per household as previous studies have used aggregated data (Benavente et al. (2005) and Marshall (2010)). The results are consistent with some previous studies, showing a price elasticity between -0.38 and -0.40 for residential consumption, a cross- elasticity between 0.14 and 0.16 with respect to the price of liquefied gas, and an income elasticity of between 0.11 and 0.12, depending on whether it was evaluated on the median or mean of the independent variables. In conclusion, the results show the feasibility of demand management as part of an energy efficiency policy and thus cope with negative shocks of electricity supply in Chile.

**Electricity Demand**

The residential demand for electricity is a derived demand from the use of appliances and illumination. Therefore, the demand for electricity depends on the stock of durable goods (appliances) in the household, their energy requirements, and their intensity o fuse by household members. Based on this, we theoretically derived a demand for electricity from a household maximization problem (Filippini (1999) models energy demand in a similar way). Then, using data from a survey of 34,072 households in Chile in 2006 and data on energy prices for each region of the country, we estimate a residential electricity demand. The data includes information on household consumption of electricity, natural gas, liquefied gas, and wood (mostly for heating purposes and in some rural areas probably for cooking too). Additionally, the survey reports each appliance in the household (washer, dryer, refrigerator, boiler, computer, TV), main housing characteristics (type of roof, type of walls, number of bedrooms, number of bathrooms) and several demographic characteristics (income, education level, number of people in the household, number of children in the household). We also include in the estimation several geographic variables (average temperature, amount of rain). The demand is estimated using Non Linear Least Squares with Heteroskedasticity correction and also considering a potential selection bias because it is non-random the access that different households have to liquefied gas.

One the most relevant results is that demand elasticity is around -0.4, which implies that an automatic price adjustment in case of shortage would allow a reduction in electricity consumption that could prevent blackouts. The magnitude of the elasticity is similar to what other studies have found for other countries (Reiss and White (2005) for California (de –0,39) and Halvorsen and Larsen (2001) for Norway), and shows that assuming a completely inelastic demand might be incorrect and prevent the implementation of better energy policies.

The estimated cross-price elasticity of electricity with respect to liquefied gas is around 0.16, showing some degree of substitution between the two energy sources. This is an additional contribution o this paper as there are few studies

* Claudio A. Agostini is with Universidad Adolfo Ibáñez, Chile; Cecilia Plottier is wth Universidad Católica del Uruguay; and Eduardo Saavedra is with Ilades-Universidad Alberto Hurtado, Chile. Corresponding author, claudio.agostini@uai.cl

in the literature estimating this elasticity (Dubin and McFadden (1984) estimate an elasticity of 0.39 for U.S. households).

Finally, the income elasticity is quite small, with a magnitude around 0.1, which is a relevant parameter for the purpose of estimating demand growth in the future as Chile's income per capita grows.

**Conclusions and Future Research**

In Chile there exists increasing concerns about potential future shortages of energy, as demand have been increasing faster than supply. As a result, several energy policies have been considered and implemented with the goal of reduce electricity consumption. Most of them are related to energy efficiency, but when facing serious risks of blackouts the government has opted for rationing consumers and reducing voltage.

The evidence presented in this paper allows to consider the substitution patterns of households in terms of energy for the purpose of designing and implementing better policies. Particularly, a demand that is not completely inelastic allows the use of a price mechanism to reduce consumption instead of a rationing mechanism.

As future research, the knowledge of price and income elasticities allows a more precise estimation of the potential effects, in terms of revenue and efficiency, of the use of taxes that consider negative externalities of energy consumption on global warming (Azevedo et al. (2011)).

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