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SUMMARY FOR DECISION MAKERS

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Proposals for increasing thermal refurbishment subsidies for households in Chile's XIV region

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We have investigated the technical and economic aspects of household wood fuel use in south-central Chile. A sample analysis of 1,937 households in Valdivia was used as a case study. The area demonstrated a high consumption of firewood, coinciding with low efficiency in building envelopes. Various techniques and materials to retrofit existing homes so that they comply with current regulations and achieve even higher standards were analyzed. The retrofits showed a strong potential to lower fuel consumption and, in turn, to reduce air pollution. Particulate matter (PM) emissions from wood stoves through chimneys are extremely high. Government programs currently subsidize retrofits and stove replacements.

Thus, we studied various stove options, considering emissions in real-life operation, which differs from ideal laboratory measurements. Real-life efficiency values are lower than declared in laboratory measurements, while emissions can be as much as four times higher than declared. Nevertheless, real-life operation still does not include misuse, which is very common in the operation of stoves in Chile, where the wood stoves available on the market can choke the air intake. These types of stoves are often used because the wood can burn for longer; however, PM emissions are increased dramatically due to poor combustion. An economic analysis must consider the cost of retrofits and the savings on firewood in homes retrofitted with new stoves. The percentage of improvement costs covered by subsidies depends on income, as higher income houses are typically larger and require a higher cost retrofit. The savings on firewood is also dependent on income bracket, as the conformation of old stoves and wood cooking stoves differs across incomes. Thus, many of the technical solutions and economic implications found in this study are income sensitive, and care was taken to account for the differences. Energy consumption, emissions and the

economic analysis were performed, using a basic comfort standard of 18ºC. Present average indoor temperatures in winter are lower, and a rebound effect was included (which was also dependent on income, as the present average base temperature ranges from 15ºC for E incomes to 18ºC for C2).

For the economic analysis, we calculated the total cost for both the private and public sector, which included the initial investment and yearly spending on wood fuel and healthcare. For private households, the retrofit options led to a much lower cost, as the savings in wood fuel are larger and subsidies reduce the cost of retrofits. For the public sector, the savings are primarily in healthcare services, with the main investment in subsidies.

For private households, the option of improving efficiency through new stoves, but without a retrofit, led to a decrease in net present value (NPV), meaning greater fuel poverty—thus, unsustainable. All retrofit options increase NPV, and after five years the highest efficiency option becomes more convenient. NPVs calculated with total spending, private plus public, increase with time.

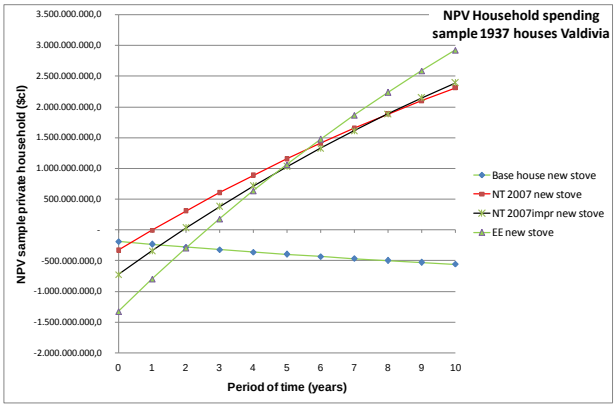

Figure 1. Net present value (NPV) of private household spending to improve the sample of 1,937 houses in Valdivia

A sensitivity analysis was performed using various levels of intake choking that would raise emissions in new stoves. We considered choking to levels that would achieve one-half and one-quarter of the emissions reduction achieved when changing stoves. The effectiveness of the retrofit options shows less variation in terms of rising emissions, while the effectiveness of the option of simply changing stoves easily raises emissions due to choking. The highest efficiency option (EE) does not show a sensitivity to stove replacement in the effectiveness parameter. This reflects the fact that option EE leads to very low wood fuel consumption.

In addition, it was found that 52% of households spend more than 15% of their income on energy consumption, whereby they are in a situation of energy poverty. An additional 27% of the population spends nearly 10% of its income, and just 21% is not at risk of energy poverty, the latter of which is not reduced with stove replacement.

Policy makers should consider the implementation of continuing education and assistance programs. The emphasis should also shift from firewood certification and wood stove quality to thermal refurbishments, which has the largest potential for lowering air pollution by dramatically reducing heating needs. A shift toward the use of higher quality stoves and the implementation of home retrofits cannot be separate initiatives, nor can they be separated from changes in stove use practices. A further step would be to ban devices that allow for complete choking of the air intake. Subsidies and other incentives to self-finance thermal retrofits should include middle-income sectors.

Alejandra Schueftan is an architect. Her research is part of a Ph.D. thesis at Universidad Austral de Chile. As a LACEEP grant holder, Dr. Nancy Olewiler supervised her project.

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