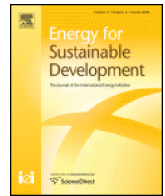




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## Energy for Sustainable Development



## An evaluation of the Fondo de Inclusión Social Energético program to promote access to liquefied petroleum gas in Peru

Suzanne L. Pollard<sup>a,b,\*</sup>, Kendra N. Williams<sup>b,c</sup>, Carolyn J. O'Brien<sup>b,c</sup>, Abigail Winiker<sup>b,c</sup>, Elisa Puzzolo<sup>d,e</sup>, Josiah L. Kephart<sup>b,f</sup>, Magdalena Fandiño-Del-Río<sup>b,f</sup>, Carla Tarazona-Meza<sup>g</sup>, Matthew R. Grigsby<sup>a,b</sup>, Marilú Chiang<sup>g</sup>, William Checkley<sup>a,b,c</sup>

<sup>a</sup> Division of Pulmonary and Critical Care, School of Medicine, Johns Hopkins University, Baltimore, USA

<sup>b</sup> Center for Global Non-Communicable Disease Research and Training, Johns Hopkins University, Baltimore, USA

<sup>c</sup> Department of International Health, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, USA

<sup>d</sup> Department of Public Health and Policy, The University of Liverpool, United Kingdom

<sup>e</sup> The Global LPG Partnership, New York, USA

<sup>f</sup> Department of Environmental Health and Engineering, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, USA

<sup>g</sup> Biomedical Research Unit, A.B. PRISMA, Lima, Peru

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## ABSTRACT

**Introduction:** Over 80% of rural households in Peru use solid fuels as their primary source of domestic energy, which contributes to several health problems. In 2016, 6.7 million Peruvians were living in rural areas. The Fondo de Inclusión Social Energético (FISE) LPG Promotion Program, which began in 2012 and is housed under the Ministry of Energy and Mining, is a government-sponsored initiative aimed at reducing use of solid fuels by increasing access to clean fuel for cooking to poor Peruvian households.

**Methods:** We conducted a mixed methods study incorporating data from publicly available records and reports, a community survey of 375 households in Puno (the province with the largest number of FISE beneficiary households), and in-depth interviews with community members and key stakeholders. We used the Reach, Effectiveness – Adoption, Implementation, Maintenance (RE-AIM) framework to guide our data collection and analysis efforts. In a sample of 95 households, we also measured 48-hour area concentrations and personal exposures to fine particulate matter (PM<sub>2.5</sub>).

**Results:** The FISE LPG promotion program has achieved high geographical reach; the program is currently serving households in 100% of districts in Peru. Households with access to electricity may be participating at a higher level than households without electricity because the program is implemented primarily by electricity distributors. In a sample of 95 households, FISE beneficiaries experienced a reduction in kitchen concentrations of PM<sub>2.5</sub>; however, there were no differences in personal exposures, and both kitchen and personal exposures were above the WHO intermediate target for indoor air quality. Among the 375 households surveyed, stove stacking with biomass fuels was reported in >95% of both beneficiary and non-beneficiary households, with fewer than 5% reporting exclusive use. In-depth interviews suggest that the complexity of the enrollment process and access to LPG distribution points may be key barriers to participating in FISE.

**Conclusion:** The FISE LPG Program has achieved high reach and its targeted subsidy and surcharge-based financing structure represent a potentially feasible and sustainable model for other government programs. However, the prevalence of stove stacking among FISE beneficiaries remains high. There is a need for improved communication channels between program implementers and beneficiaries. FISE should also consider expanding the mobile LPG network and community delivery service to reduce physical barriers and indirect costs of LPG acquisition. Finally, increasing the value of LPG vouchers to completely cover one or two tanks a month, or alternatively, introducing behavior change strategies to reduce monthly LPG usage, may facilitate the transition to exclusive LPG use.

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## Background

Peru is an upper middle-income country with a population of approximately 31.5 million (2016) (World Bank, 2016a). In 2016, 6.7 million (21.1%) of Peruvians were living in rural areas (World

\* Corresponding author at: Division of Pulmonary and Critical Care, School of Medicine, Johns Hopkins University, 1830 E. Monument St., Room 555, Baltimore, MD 21287, USA.  
E-mail address: [spollard@jhu.edu](mailto:spollard@jhu.edu) (S.L. Pollard).

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Bank, 2016b). Peru has experienced rapid economic growth (6% annual increase in GDP) in recent decades (World Bank, 2016c). This coincided with a dramatic reduction in the population living below the national poverty line (176 soles or 54 USD per month), which fell from 49.2% to 20.7% between 2006 and 2016 (World Bank, 2016d). However, inequalities remain between urban and rural areas. In 2014, 46% of the population in rural Peru lived below the national poverty line, compared to just 15.3% of the urban population (World Bank, 2016e and 2016f). Similar differences exist when examining access to electricity and clean fuels for cooking; while 98.9% of the urban population had access to electricity in 2014, only 74.5% of the rural population had access (World Bank, 2016g and 2016h). Similarly, 81.8% of rural households in Peru primarily use solid fuels for cooking (typically wood, dung, and agricultural crop waste), compared to 9.8% of urban households, who typically cook with liquefied petroleum gas (LPG) or, to a lesser extent, natural gas (DHS, 2012). Solid fuel use leads to high exposure to household air pollution (HAP), which in turn increases the risk of morbidity and mortality due to various HAP-related health problems (GBD, 2017). In 2016, an estimated 5421 deaths nationwide were attributable to HAP (GBD, 2017). Thus, given the much higher reliance on solid fuels, rural populations may face a much greater burden of health problems caused by HAP exposure than urban populations.

Puno, Peru is a region in the Andes mountains located in the south-east of the country with 65% of the population living in rural areas (DHS, 2014). In addition, 70.5% of the population falls in the lowest two wealth quintiles, making the distribution of rural residents and individuals living in poverty comparable to those of mountainous regions of Peru (DHS, 2014). In 2016, 32.8% of the population of Puno used LPG for cooking (INEI, 2007). A 2015 study showed that in Puno, daily biomass use was associated with a 2.2-fold increase in odds of COPD among adult women (Jaganath et al., 2015). Furthermore, the population attributable risk for daily biomass use for COPD in adult women in Puno was 55% (Jaganath et al., 2015). Daily biomass use was also associated with increased risk of hypertension (RR 3.5, 95% CI 1.7 to 7.0) (Burroughs Peña et al., 2015).

Prior research shows that urban households in Puno that use LPG as their primary cooking fuel experience PM<sub>2.5</sub> concentrations below World Health Organization (WHO) safe levels (22 µg/m<sup>3</sup>), whereas rural homes that use biomass (median of 24-hour averages 130 µg/m<sup>3</sup>,  $p < 0.001$ ) do not (Pollard et al., 2014; WHO, 2014). Modeling based on laboratory emission data suggests that exclusive LPG use would allow 94% of homes to meet the WHO air quality guidelines for PM<sub>2.5</sub> (WHO, 2014). However, using a traditional stove for an average of just 10 min per day was found to raise PM<sub>2.5</sub> concentrations above WHO annual guidelines; thus, even a small amount of stove stacking can decrease the potential benefits of clean fuels (Johnson & Chiang, 2015).

Many clean fuel options exist (e.g. electricity, natural gas, LPG, ethanol, and biogas); however, LPG is likely the most feasible clean fuel for widespread implementation in Peru in the short- to medium term. LPG is already commonly used in Peru, with a supply that is almost entirely produced nationally, and 85% of it is produced from gas processing. Peru is the fifth largest consumer of LPG as a cooking fuel in Latin America, behind Mexico, Brazil, Argentina, and Venezuela (WLPGA & Argus, 2017). Peru operates with an LPG cylinder recirculation model, in which consumers exchange empty cylinders for different full ones from LPG retail locations (instead of refilling cylinders that they own). The standard size of LPG tanks in Peru is 10 kg, costing on average 34 soles (approximately 10 USD).

The Ministry of Energy and Mining (MINEM) is the main branch of the Peruvian government focused on achieving universal access to electricity and clean fuel for domestic use. MINEM created a Plan for Universal Access to Energy 2013–2022 (FISE, n.d.a) based on the acknowledgement that access to energy is an essential pillar for addressing poverty and improving education, health, security, and productivity. The four major components of this plan include: expansion of natural gas (domestic and vehicular); expansion of renewable electricity; compensation for

residential electrical costs; and, promotion of LPG for domestic use. This plan also leverages resources allocated to Peru's National Plan for Rural Electrification 2013–2022 (FISE, n.d.a).

#### *The Fondo de Inclusión Social Energético*

The Fondo de Inclusión Social Energético (FISE), or the Fund for Social Inclusion for Energy in English, is one of the mechanisms by which MINEM is currently carrying out its plan for universal energy access. FISE is an ongoing subsidy-based program implemented by the Peruvian government in collaboration with private energy distributors at the national level and was established in 2012 as a public policy for social inclusion. The primary objective of the program is to provide the most vulnerable populations with access to cleaner energy, targeting households living in poverty or extreme poverty (FISE, n.d.b). Although improving health was not the primary stated objective of the program, according to key stakeholders, health benefits are recognized as important program outcomes.

FISE is a multi-component initiative that includes several programs to increase access to clean energy, including the LPG Fuel Access Promotion Program. The FISE LPG program centers around the monthly provision of a voucher worth 16 soles (approximately 5 USD) to eligible families. An act of Congress is required to change the value of the voucher. The voucher is used to exchange an empty 10 kg LPG cylinder, costing 32 soles (approximately 10 USD) for a full one.

The FISE LPG program is targeted toward households living in poverty or extreme poverty. Beneficiary households must meet the following eligibility criteria (FISE, n.d.c):

- Household income less than S/. 18,000 (USD 5500) per year
- Household does not have electricity, or is connected to electricity with an average monthly consumption <30 kWh
- Precarious housing (i.e. no running water, unreinforced adobe or thatch material, etc.)
- Household is classified as extreme or non-extreme poverty by the Sistema de Focalización de Hogares (SISFOH) (<http://www.sisfoh.gob.pe>)
- Household has an LPG stove

MINEM previously supported a program separate from FISE (“Cocina Peru”) that provided an LPG stove kit to poor families; however, this program is currently inactive. Currently, LPG stoves are not subsidized and must be purchased by beneficiaries; LPG stoves cost approximately S/0.50 (USD 15) soles to purchase independently. To receive vouchers, households with electricity must register with their electricity provider; those without electricity must register with their local MINEM office. Once eligibility is confirmed, vouchers are provided via electronic code on the monthly electricity bill for households with electricity, or via paper vouchers for households without electricity. FISE beneficiary households must use at least one LPG voucher within a four-month period or their beneficiary status is temporarily suspended. Beneficiary status is inactivated after one year of non-use, in which case households must re-enroll.

The FISE LPG program is a collaborative effort involving public and private actors. The Supervisory Organism of Investment in Energy and Mining (OSINERGMIN), housed within MINEM, is currently the primary body responsible for administration of the program. Electricity distribution companies (Empresas de Distribución Eléctrica, or EDEs) act in a supervisory, administrative, and operational capacity at the regional level. EDEs are responsible for maintaining the census of beneficiaries, distributing LPG vouchers to FISE households with and without electricity, and enrolling and overseeing local private LPG retailers. EDEs also carry out much of the marketing and promotion efforts of the program, which include radio spots, online promotional videos, banners, flyers and pamphlets, presentations at community meetings, and school-based outreach.

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