



The Lao Cookstove Experience: Redefining Health through Cleaner Energy Solutions

What is the problem?

Although cleaner cookstoves can dramatically improve health in Lao PDR, especially among women and children, the use of solid fuels remains widespread

Worldwide, more than 2.8 billion people continue to use wood, charcoal, and other solid fuels to meet their cooking and heating needs. Household air pollution resulting from the incomplete combustion of those fuels is linked to more than 4 million premature deaths each year (Lim and others 2012). Cleaner-burning nonsolid fuels can save many lives.

In East Asia and the Pacific, the share of the population with access to nonsolid fuel for cooking rose from 33 percent (534 million people) in 1990 to approximately 52 percent (1 billion people) in 2010 (Portale and de Wit 2014). During this period, 477 million people gained access to nonsolid fuel, while the region's population expanded by 350 million.¹

Despite this gain, the challenge of access to nonsolid fuel remains significant in most countries of the region, including the Lao People's Democratic Republic. Across the region, more than 357 million people still live without access to nonsolid fuels, and less than half the population has access to nonsolid fuels in nearly half the countries.

1. Globally, the absolute number of people with access to nonsolid fuels increased by 1.6 billion between 1990 and 2010, but the global population over the period grew by the same amount (World Bank 2014). Hence the global increase in the share of the population with access to nonsolid fuels was only modest.

Although the Lao PDR reported high annual increases in access to nonsolid cooking fuels between 1990 and 2010 (figure 1), almost 96 percent of the Lao population, most of which lives in rural areas, still uses solid biomass such as firewood and charcoal for cooking. This is due to the high costs of both nonsolid fuels and electricity (World Bank 2013). The rate of access to nonsolid fuels in the country remains no more than 4 percent, one of the lowest in the world (figure 2).

Household air pollution from cooking over open fires or on crude wood-burning cookstoves is the top health-risk factor in the country (figure 3). It is estimated by the World Health Organization (Global Burden of Disease Study 2010) to cost 3.5 percent of GDP in lost productivity.

The burden of disease from biomass smoke falls on women and children disproportionately, because in nearly all Lao households women are responsible for daily meal preparation and children join them in the kitchen and often around the fire.

The transition to electricity for household cooking has faltered despite the steady expansion of electricity service in the country. Although more than 90 percent of the Lao population has access to electricity, the great majority (almost 96 percent) continue to use firewood and some charcoal for cooking. Between 1995 and 2005, the use of electricity as the primary cooking fuel actually declined among urban households, from 10.4 percent to just 3.8 percent, as the retail tariff was steadily raised for cost-recovery purposes. Previously, the electricity tariff was significantly lower than the overall

THE BOTTOM LINE

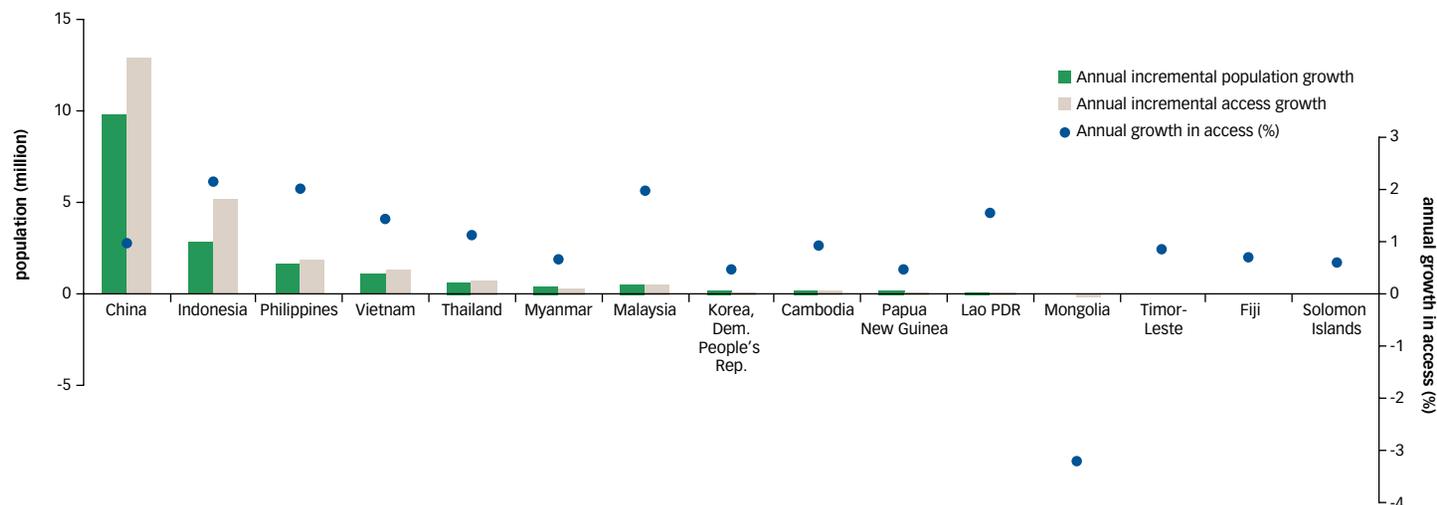
In the Lao People's Democratic Republic household air pollution from the incomplete combustion of solid fuels is the top health risk, costing some 3.5 percent of GDP in lost productivity. To increase access to modern cooking and heating solutions in East Asia, the World Bank introduced a Clean Stove Initiative in 2012. Pilot projects were begun in China, Indonesia, and Mongolia, as well as Lao PDR. One of the first challenges was the need to bring all relevant ministries and stakeholders on board to help recognize the urgency of the problem and the magnitude of suffering that was occurring as a result of household air pollution. The other was to link the health situation with the need for a clean energy solution.



Rutu Dave is an energy specialist and task team leader of the Lao Clean Stove Initiative in the Energy and Extractives Global Practice at the World Bank.



Rema N. Balasundaram is a consultant and writer.

Figure 1. Annual growth in access to nonsolid cooking fuels in East Asia and the Pacific, 1990–2010

“Like electricity, nonsolid fuels such as liquefied petroleum gas (LPG) remain largely unaffordable for the rural poor and thus are not widely used.”

cost of production (i.e., generation, transmission, and distribution) and urban households took advantage of the low tariff rates (World Bank 2013). By 2005, only 8 percent of urban households in Vientiane used electricity as their main cooking fuel, 14 percentage points less than a decade earlier.

Like electricity, nonsolid fuels such as liquefied petroleum gas (LPG) remain largely unaffordable for the rural poor and thus are not widely used. LPG is imported, and the distribution network is expected to remain limited, with access greater in major cities along the border with Thailand and Vietnam.

Firewood, by contrast, is readily available in rural areas of Laos, and its use is culturally ingrained. For example, cooking fires also provide heat for the home and repel insects. They are widely used for drying food.

Given the high prices of LPG and electricity, combined with the abundance of readily available firewood in rural areas, it is likely that fuelwood will continue to be a major household cooking fuel for the foreseeable future unless cleaner alternatives (both stoves and fuels) and solutions can be provided at affordable prices.

What can be done?

Since 2012, the World Bank's Clean Stove Initiative has been introducing cleaner cooking solutions

To increase access to modern cooking and heating solutions, the World Bank introduced the East Asia and Pacific Clean Stove Initiative (CSI) in 2012. Four countries in the region—China, Indonesia, Lao PDR, and Mongolia—embraced the initiative and agreed to conduct pilot studies using the results-based financing model. This model is designed to mobilize and sustain private-sector participation in scaling up access to clean stoves by disbursing public subsidies against demonstrated results.

In response to the WHO finding that household air pollution caused by the burning of biomass was the leading risk factor for premature deaths in Laos, the nation's government resolved to take action. One of the first challenges was the need to have all relevant ministries and stakeholders recognize the urgency of the problem and the magnitude of suffering that was occurring as a result of household air pollution. Another was to link the health situation with the need for a clean energy solution.

Figure 2. Access to nonsolid fuel in countries of East Asia and the Pacific, 2010

“The rate of access to nonsolid fuels in the country remains no more than 4 percent, one of the lowest in the world.”

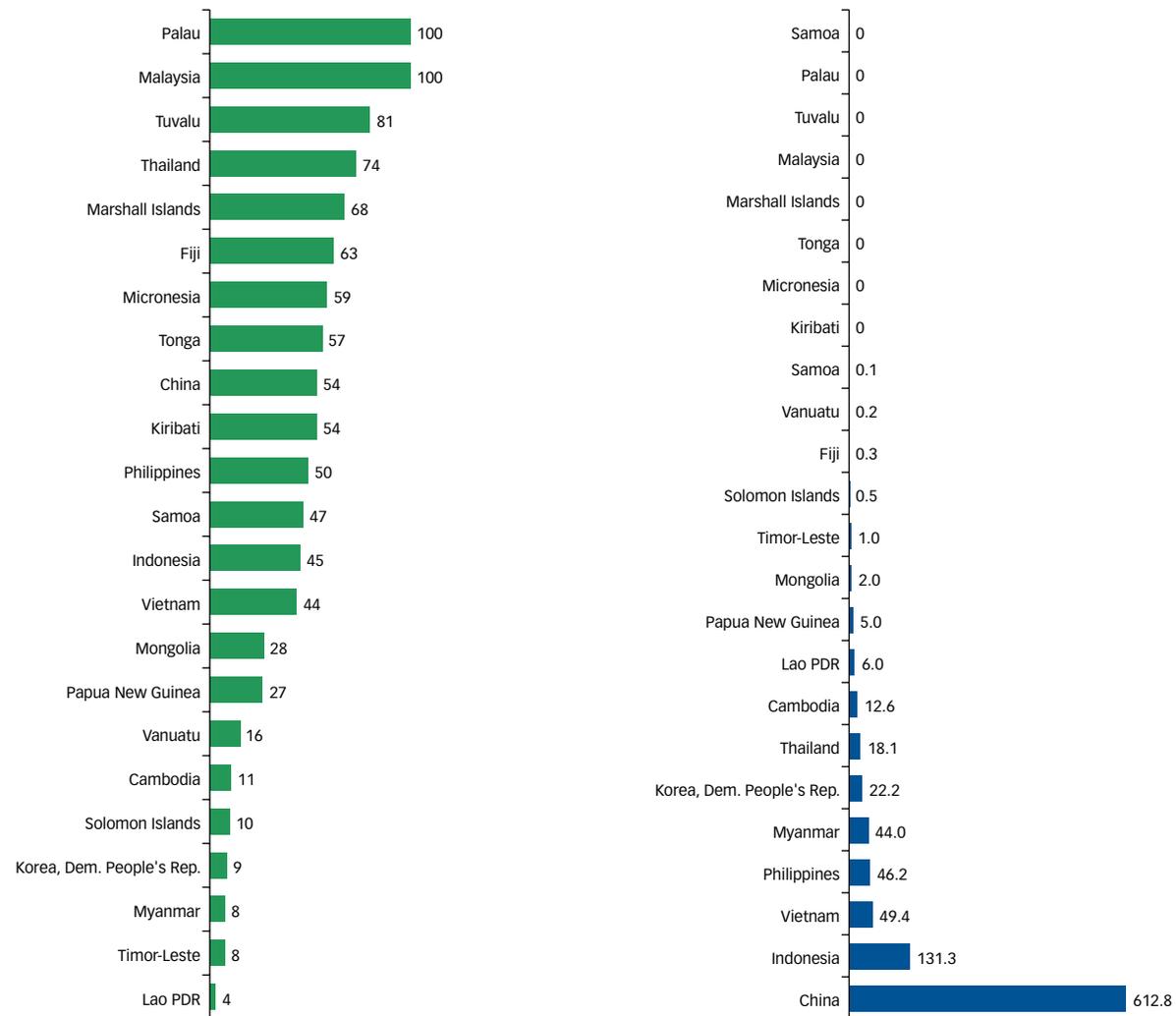
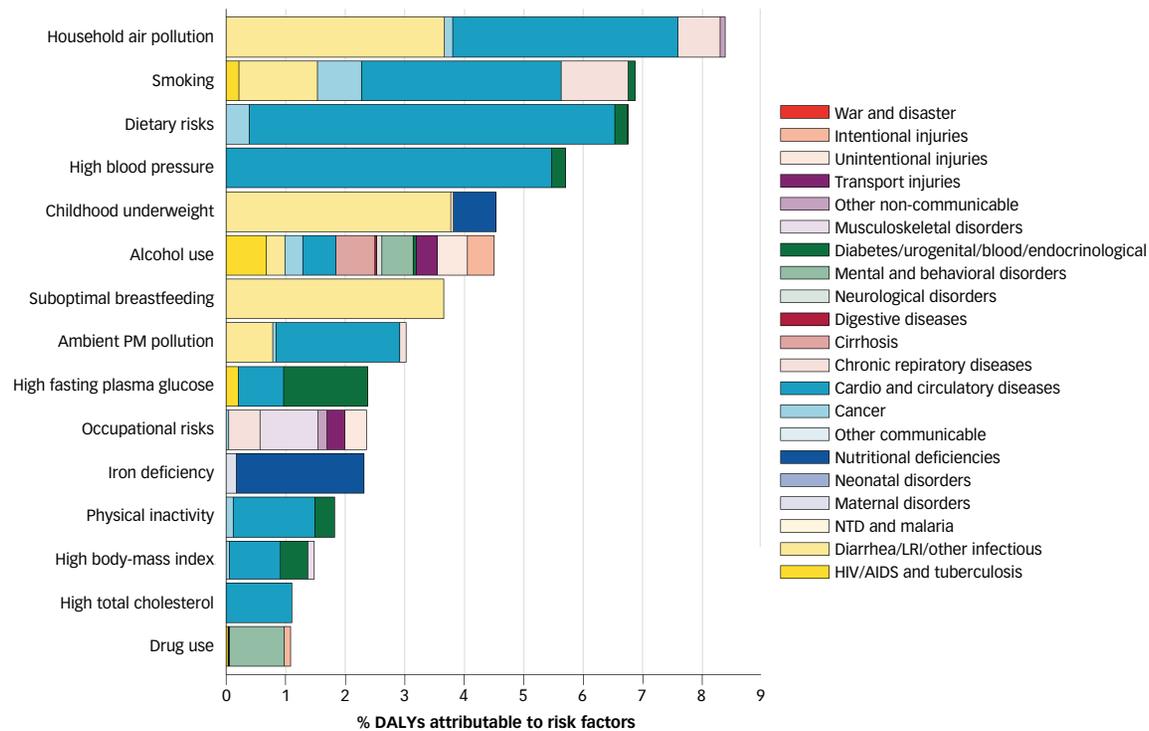


Figure 3. Burden of disease in Lao PDR attributable to 15 leading risk factors, 2010

The colored portion of each bar represents the specific diseases attributable to that risk factor, while bar size represents the percentage of DALYS linked to specific risk factors.

“To coordinate its participation in the CSI, the government of the Lao PDR convened, in 2012, a high-level interministerial taskforce to oversee the nation’s multisectoral Lao Clean Stove Initiative Project, which is based on the premise that technical solutions to address the challenge of indoor air pollution can be delivered to households through a coordinated program of testing, certification, promotion, and results-based financing.”



Source: Institute for Health Metrics and Evaluation (2010).
 Note: DALYS = disability-adjusted life years.

To coordinate its participation in the CSI, the government of the Lao PDR convened, in 2012, a high-level interministerial taskforce to oversee the nation’s multisectoral Lao Clean Stove Initiative Project, which is based on the premise that technical solutions to address the challenge of indoor air pollution already exist and can be delivered to households through a coordinated program of testing, certification, promotion, and results-based financing. The options for clean cooking include electricity, gas, or forced-draft gasifier stoves,

the most advanced type of biomass-burning stoves, which emit little or none of the particulate matter associated with inferior stoves or open fires. Fine particulate matter (PM_{2.5}) is an air pollutant that threatens human health when levels in the air are high. PM_{2.5} are tiny particles that reduce visibility and cause the air to appear hazy when levels are elevated.

The interministerial taskforce was established by the Ministry of Energy and Mines and its Institute of Renewable Energy Promotion

“The Laos Cookstoves and Health Initiative brought the Ministry of Energy and Mines and the Ministry of Health together in a unique collaboration to improve the health and economic well-being of the rural poor.”

(IREP), which served as the CSI focal point and coordinating agency. The role of the task force was to ensure that CSI policy and strategic directives were aligned with the country’s Renewable Energy Development Strategy and other national policies. The taskforce included the Ministry of Health, the Ministry of Science and Technology (with its Renewable Energy and New Materials Institute), and the national university’s faculty of engineering, which helped establish the first national cookstove testing laboratory. The role of the laboratory was to assist the government in establishing cookstove testing protocols to ensure that standards and methods were uniformly applied throughout the country.

The early phases of the Lao CSI also included a high-level policy dialogue and advisory support from the World Bank and the Asia Sustainable and Alternative Energy (ASTAE) program. Initial financing was provided by a World Bank trust fund for infrastructure. ASTAE worked to replicate the cookstove and biodigester programs developed earlier in Cambodia (ASTAE 2013), with specific adaptations to suit Lao traditions.

The project began in 2012 with a stocktaking, field survey, stakeholder consultations, and two consultation workshops. The field survey, conducted in the city of Vientiane and the provinces of Bolikhamsi, Khammouane, and Vientiane, had two parts: (i) a survey of household cooking fuel use conducted in periurban and rural areas, and (ii) a market survey of biomass cookstoves and the supply chain.

A subsequent phase that began in 2013 provided technical assistance in several areas including:

- Capacity building in construction and use of the improved traditional clay-based cookstove
- Establishment of a cookstove testing laboratory at the national university
- Development of the first national cookstove standards (June 2015), and
- An assessment of the program’s impact on health and associated results-based financing.

The Laos Cookstoves and Health Initiative brought the Ministry of Energy and Mines and the Ministry of Health together in a unique

collaboration to improve the health and economic well-being of the rural poor. In January 2014, the interministerial taskforce authorized and sponsored a detailed assessment of the practicability and cost-effectiveness of introducing best-in-class low-emission stoves into households in the poorest rural communities of Lao PDR. The assessment was completed in June 2015. Owing to time constraints, the study was limited in sample size and geographic and seasonal representation and only able to examine short-term pollution and fuel-use effects from the new stove (less than a month after introduction). Most health benefits, however, require long-term reduction in air pollution, which was not directly measured by the study. Findings indicate that:

- When introduced and promoted, the stoves were readily taken up by the villagers and apparently used for nearly all cooking in the first weeks.
- When used exclusively, the cookstove reduced average kitchen pollution levels by a factor of four compared with traditional open biomass stoves.
- When used exclusively, it reduced fuel consumption per person by about 40 percent.
- When used exclusively, it reduced cooks’ exposure to air pollution (the most important metric for health) by about 40 percent.

The study also states that if this performance were maintained for three years with 75 percent long-term adoption and usage, dissemination to 25,000 households in similar Lao villages would reduce premature deaths by about 22 percent and disability-adjusted life years (DALYs) by about 1,200 in this population, with about half of the mortality benefit accruing from decreased child pneumonia and the rest from reduction in adult chronic diseases. (about 70 percent of the reduced DALYs would be in children).² Assuming different lifetimes and/or usage rates would alter these estimates (World Bank 2015a and 2015b).

2. DALYs are used by health and development entities globally to measure the burden of disease from a disease or risk factor and as the metric to evaluate and compare the effectiveness of health-related interventions, for example in terms of dollars per averted DALY.

“Early measures of the project included addressing gender issues in the use of energy-related products and services by integrating a gender-sensitive approach into both the needs identification (demand) and the design-related response (supply) phases. The measures also included identifying gender-sensitive energy-related needs of women in Lao PDR.”

What are the distinguishing features of the Lao Clean Stove Project?

The project is a cross-sectoral, gender-attuned, and innovative effort to improve health through cleaner cooking

Cross-sectoral collaboration. Coordination and cooperation were built into project design at inception, with the decision by the national government to carry out a stakeholder consultation when the Clean Stove Project was initiated. In October 2012 the government agreed that an interministerial CSI task force should be established by the Ministry of Energy and Mines and its Institute of Renewable Energy Promotion (IREP), which would serve as the CSI focal point and coordinating agency. The role of the task force was to ensure that CSI policy and strategic directives were aligned with national policy and the country’s Renewable Energy Development Strategy. The World Bank worked with the government in a unique partnership that recognized the commitment of the line ministries and their individual ministerial missions and mandate, with the overall goal of moving the cookstove story from fuel and charcoal to cleaner and more efficient energy models. Thus the collaborative mode of functioning was set at the government and line ministry level. Another dimension was the recognition and role of the Ministry of Science and Technology and its Renewable Energy and New Materials Institute, along with the Faculty of Engineering at the national university, to help establish the first national cookstove testing laboratory. The role of the laboratory is to assist the government in establishing cookstove testing protocols to ensure that standards and methods are uniformly applied throughout the country. The Ministry of Energy and Mines played the coordinating role. Cooperation was played out with the integration and inclusion of donors both bilateral and multilateral, including the World Bank, nongovernmental organizations, and the private sector.

The gender dimension. Close attention to the gender dimensions of the project were ensured from inception, given the role of the woman in the use of the stove and provision of food for the rural and urban household. The project took into account the fact that more than 70 percent of the 2.3 billion people who still rely

on biomass for cooking live in developing Asia. WHO estimates that 600,000 premature deaths annually are related to cooking using biomass in East Asia alone. The gender dimension of that sobering fact should be noted, given that cooking-related indoor air pollution disproportionately affects women and children. Early measures of the project included addressing gender issues in the use of energy-related products and services by integrating a gender-sensitive approach into both the needs identification (demand) and the design-related response (supply) phases. The measures also included identifying gender-sensitive energy-related needs of women in Lao PDR.

Many households in Lao PDR exhibit concentrations of particulate matter and nitrogen dioxide that are much higher than the guidelines of the World Health Organization (World Bank 2013, citing Mengersen and others 2007; Lao Department of Statistics 2009; and LWU 2001). The World Bank (2013) confirmed a strong link between higher concentrations of indoor air pollution and respiratory illnesses in women and children, with the link particularly strong for women. The incidence of virtually all health outcomes considered in the study was more than triple for women living in dwellings with higher concentrations of nitrogen dioxide. A health survey conducted as part of the project revealed that nearly half of women spent one to three hours each day in the cooking area, while nearly a quarter spent more than six hours there. Nearly three-fourths of children spent more than five hours each day in the cooking area, while 17 percent spent more than five hours close to the fire. Based on the survey results, the study concluded that the more time women and children spend close to the fire, the higher their risk of contracting respiratory illnesses (e.g., cold, fever, runny nose, stinging or watery eyes, coughing, itchy rash or eczema, bronchitis, and pneumonia).

The most recent Lao Expenditure and Consumption Survey (LECS), conducted in 2007–08, confirms that women spend twice as much time as men collecting firewood (an average of 12 minutes versus 6 minutes per day) (Lao Department of Statistics 2009). The study also found that women walk longer distances to collect firewood. A CSI survey found that in 98 percent of the households surveyed, women were responsible for daily meal preparation. In both rural and peri-urban areas, women who cook for family members are typically

about 38 years old and spend about 2.25 hours each day on meal preparation, indicating that this group is especially vulnerable to exposure to indoor air pollution.

Financing. The CSI program's results-based financing (RBF) framework has three building blocks: (i) certification of cookstoves for cleanliness and efficiency, (ii) incentives for the adoption of certified stoves, and (iii) a monitoring and verification system. These building blocks are supported by two pillars: (i) institutional strengthening and capacity building of key market players and (ii) public awareness campaigns to help stimulate household demand (Zhang and Adams 2015; ASTAE 2014; ASTAE and ESMAP 2014).

2014 saw the commencement and financing of a pilot program to see if the Lao PDR's high rate of lost healthy life years—expressed as DALYs—could be reduced through a clean cookstove scheme based on RBF. The basic concept involves verifying and monetizing the health benefits derived by women and children from the use of advanced cookstoves in the household and then compensating the stove provider whose products made the DALY reductions possible.

The first stage of the pilot RBF scheme began with controlled cooking tests and trials using high-efficiency wood-burning cookstoves in Vientiane and Savannakhet. The studies helped assess a households' willingness to pay for improved cookstoves and identified the most common cooking techniques used in Lao PDR. These initial findings are expected to inform the next stage of pilot surveys that will incrementally introduce the concept of improved health outcomes using the "averted DALY" (aDALY) as a tool for the sale and distribution of the Clean Cooking Stove Prototype (Smith and others 2015).

What have we learned?

Valuable lessons emerged from the early phases of the project

The project studied the impact of household air pollution in 72 households from three villages (Houaymouange, Vangkhonkham, and Aho) in the rural Xonboury District of Savannakhet Province. The study found that the use of the cleaner cooking stove failed to contribute in large measure to the improvement in the environment, thereby suggesting that a greater health benefit is likely to accrue if

a larger proportion of households in a village adopt cleaner-burning stoves. Pollution exposures, although substantially improved, did not come down to WHO guidelines or typical national standards for pollution.

The project now faces a set of challenges related to scaling up the RBF model based on aDALYs—that is, in operationalizing the financing elements of the aDALY market, finding buyers, and generating aDALYs in a financially sustainable manner. Another challenge is in working with donors to distribute the clean cookstoves so that the health benefits can trickle down to the community.

These challenges are being addressed through multisectoral engagement and forward-looking strategies. Early on, the team recognized the need to bring in multiple actors at the country level. Coordination and work on the ground involved a number of donors. The cookstove initiative is supported in multiple ways by multilateral and bilateral donor agencies and the national government entities described earlier.

The Pilot Study on Impact of Air Pollution has been completed (World Bank 2015b). As part of Phase II the team is discussing several options with the government of Lao PDR and key stakeholders. Topics include: (i) an in-depth assessment of stove use focusing on clean cookstove performance, quality, and user acceptance; (ii) technical and policy support for the interministerial task force, particularly its committee on clean cookstove standards; and (iii) introducing new clean cookstoves, especially wood-burning stoves, in rural, urban, and peri-urban areas in the north, where firewood remains the cooking fuel used by the vast majority of households. Additionally, efforts are ongoing to build a financing modality that uses the aDALY to support the sale and distribution of the clean cookstove prototype.

The project recognizes the need to use a multi-pronged approach across four key drivers that are precursors to successful cooking stove interventions: awareness raising in the targeted population; studying markets and preferences; reviewing available technologies and standards (Ekouevi 2013) and innovative financing measures. On the consumer side, the key constraints to the adoption of cleaner cooking practices are absence of information, lack of awareness, and the overlap between traditional cooking practices and other household needs and customs (such as heating, drying food, repelling insects, and preserving housing materials). The latter

MAKE FURTHER CONNECTIONS

Live Wire 2014/7. "Understanding the Differences Between Cookstoves," by Koffi Ekouevi, Kate Kennedy, and Ruchi Soni.

Live Wire 2014/8. "Tracking Access to Nonsolid Fuel for Cooking," by Sudeshna Ghosh Banerjee, Elisa Portale, Heather Adair-Rohani, and Sophie Bonjour.

Live Wire 2014/28. "Tracking Progress Toward Providing Sustainable Energy for All in East Asia and the Pacific," by Elisa Portale and Joeri de Wit.

Live Wire 2015/46. "Results-Based Financing to Promote Clean Stoves: Initial Lessons from Pilots in China and Indonesia," by Yabei Zhang and Norma Adams.

Live Wire 2015/62. "Toward Universal Access to Clean Cooking and Heating: Early Lessons from the East Asia and Pacific Clean Stove Initiative," by Yabei Zhang and Norma Adams.

points to the need for research and development on cookstoves that fit local cooking traditions and requirements. The use of promotional campaigns that targeted messages for both the stove users and other household members was also key to ensuring adoption of the methods. Measures for scaling up are being built in a larger and broader context to allow for measurable impact on health of the population as a whole. Plans for these continue to be thought through.

References

- ASTAE (Asia Sustainable and Alternative Energy Program). 2013. "Clean Stove Initiative Forum Proceedings." Phnom Penh, Cambodia, March 18. East Asia and Pacific Clean Stove Initiative Series, World Bank, Washington, DC.
- . 2014. *Annual Status Report FY 2013*. Washington, DC: World Bank.
- ASTAE and ESMAP (Energy Sector Management Assistance Program). *Annual Report 2014*. Washington, DC: World Bank.
- Ekouevi, K. 2013. "Scaling Up Clean Cooking Solutions: The Context, Status, Barriers, and Key Drivers." International Finance Corporation, Washington, DC.
- Institute for Health Metrics and Evaluation. 2010. "Global Burden of Disease Profile for Laos." Seattle, Washington, USA.
- Lao Department of Statistics. 2009. "The Households of Lao PDR, Social and Economic Indicators Survey Results on Expenditure and Consumption of Households 2007/2008 (LECS 4)." Vientiane: Ministry of Planning and Investment, Department of Statistics.
- Lim, S. S., and many others. 2012. "A Comparative Risk Assessment of Burden of Disease and Injury Attributable to 67 Risk Factors and Risk Factor Clusters in 21 Regions, 1990–2010: A Systematic Analysis for the Global Burden of Disease Study 2010." *Lancet* 380 (9859): 2224–60.
- LWU (Lao Women's Union). 2001. "Fuel for Life: Women, Men, and the Fuelwood Cycle in the Lao PDR." Vientiane: Lao Women's Union Gender Resource Information and Development Center (LWU GRID Center).
- Mengersen, K., L. Morawska, H. Wang, F. Tayphasavanh, K. Darasavong, and N. Holmes. 2007. "Investigation of Indoor Air Pollution and Relationship to Housing Characteristics and Health Effects Observed by Occupants in Lao PDR." Executive Summary, Project for World Health Organization, International Laboratory for Air Quality and Health and Queensland University of Technology.
- Portale, E., and J. de Wit. 2014. "Tracking Progress Toward Providing Sustainable Energy for All in East Asia and the Pacific." Live Wire 2014/28, World Bank, Washington, DC. <http://hdl.handle.net/10986/20255>
- Smith, K. R., A. Pillarisetti, L. D. Hill, D. Charron, S. Delapena, C. Garland, and D. Pennise. 2015. "Proposed Methodology: Quantification of a Saleable Health Product (aDALYs) from Household Cooking Interventions." Household Energy, Climate, and Health Research Group, School of Public Health, University of California at Berkeley, and Berkeley Air Monitoring Group. Berkeley, CA, USA. December.
- World Bank. 2013. "Pathways to Cleaner Household Cooking in Lao PDR: An Intervention Strategy." Washington, DC. May.
- . 2014. *Global Tracking Framework. Sustainable Energy for All*. Report 85415. Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/2014/01/19164902/global-tracking-framework>.
- . 2015a. Project Appraisal Document, Lao PDR, Health and Nutrition Program. June.
- . 2015b. "Air Pollution and Impact Analysis of a Pilot Stove Intervention." Final Report to the Ministry of Health and Clean Stove Initiative of the Lao PDR. July.
- World Bank and IEA (International Energy Agency). 2015. *Progress toward Sustainable Energy 2015: Global Tracking Framework Report*. Washington, DC: World Bank.
- Zhang, Y., and N. Adams. 2015. "Results-Based Financing to Promote Clean Stoves: Initial Lessons from Pilots in China and Indonesia." Live Wire 2015/46. World Bank, Washington, DC. <http://hdl.handle.net/10986/22114>.

This note was peer-reviewed by Besnik Hyseni.