Human Health and Environmental Costs and Benefits of Liquefied Petroleum Gas vs. Firewood for Cooking in the Rohingya Refugee Camp, Bangladesh

Beginning in 2018, LPG for cooking has been freely provided in the Rohingya refugee camp.

This policy brief summarizes a study on the multi-sectoral benefits and costs of free liquefied petroleum gas (LPG) distribution in the Rohingya refugee camp. This study evaluated households newly enrolled in the LPG distribution program and compared them to households that were already receiving LPG to measure the impact of the LPG distribution program. Provision of free LPG was associated with reduced deaths and disease due to indoor air pollution, increased carbon storage, improved food security and mental health, and reduced inter-group and domestic conflict. Long-term provision of LPG to nearly 1 million refugees is a feasible and cost-effective strategy to support the food security, nutrition, health, and safety of refugees while protecting the environment and reducing tension with host communities. These findings support policy and donor decisions on the provision of clean cooking fuel in humanitarian settings.

Key Findings

The LPG distribution program was associated with high exclusive use of LPG and...

- Reduced deforestation
- Averted respiratory illness
- Increased spending on food
- Improved mental health
- Increased time for care and study
- Reduced burning of plastic as cooking fuel
- Reduced inter-group and domestic violence
- Respected refugees' perceptions of dignity
- Effectively spent funds

Prior to LPG distribution, refugees cooked with biomass collected from around the camp and nearby forest.

The Challenge

Unlike lifesaving support such as shelter and food, cooking fuel has historically not been provided by humanitarian organizations. Lacking other options for cooking fuel, refugees turned to the surrounding forest for firewood, just as many local communities do. Burning biomass for cooking is associated with deforestation and respiratory illness. However, limited evidence exits on the human health and environmental impacts of distributing clean cooking fuels in humanitarian settings and thus policymakers and donors may be hesitant to invest.

A Rohingya boy walking home from the forest with firewood.

The Program

To reduce the reliance on firewood for cooking, the government of Bangladesh, together with UN agencies and NGOs, freely provided each of the 195,000 refugee households (and 45,000 host community households) with one LPG stove and cylinder starting in 2018. They also provided hands-on-training and a follow-up visit to the household to assess the safety of installation and use. Households were provided with free LPG refills about once a month, depending on family size. The joint UN program Safe Access to Fuel and Energy (SAFE+) also included livelihood training for refugees and host community members, and forest replanting; these elements were not evaluated.

A sign at a LPG depot for Rohingya refugees, formerly known in Bangladesh as Forcibly Displaced Myanmar Nationals (FDMN).

The Evaluation

A research team from Stanford University and the International Center for Diarrhoeal Disease Research, Bangladesh (icddr,b), evaluated the program. They enrolled 1,200 households: 600 households that had been using LPG for 12 months (comparison group) and 600 households that had not yet started using LPG (intervention group). Households had to have a child between 6-23 months old at enrollment. Stove use and particulate matter were monitored in 202 households both short-term (48 hours) and long-term (3 months). Data were collected at baseline, and 12 and 22 months after baseline.

In addition to conducting quantitative measurements, researchers interviewed Rohingya community members, including married and unmarried men and women and adolescent boys and girls about domestic and inter-group harassment and violence related to cooking fuel collection and use, LPG distribution and training, and program recommendations. They also interviewed LPG distributors, neighborhood leaders and NGO workers about similar topics.

Research Partners

The following organizations were pivotal in the conduct of this research: The Government of Bangladesh, in particular the Rohingya Refugee Repatriation Commissioner's Office and the SAFE+ partners (IOM, FAO, UNHCR, and WFP).

The research team was led by Dr. Laura H Kwong and Christopher LeBoa (University of California, Berkeley, formerly Stanford University), Dr. Stephen P. Luby (Stanford University), and Dr. Mahbubur Rahman, Dr. Ruchira Naved, Dr. Nuhu Amin, Mohammad Saeed Munim, and Nazrin Akter (icddr,b).

Men receiving LPG refills at in the Rohingya refugee camp.

Multi-Sectoral Benefits of LPG

Reduced deforestation

The LPG distribution program allowed households to switch from using 4.3 kg of firewood per day to using 0.34 kg of LPG per day. Households cooked exclusively with LPG more than 80% of the time. This prevented the extraction of 330,600 tons of firewood from around 6,000 hectares of forest per year and avoided the emission of 407,000 tons of carbon dioxide.

Increased spending on food

Households that began to receive LPG reduced monthly spending on firewood by $7.19 and increased monthly spending on food by $8.55. Among intervention households, this savings in firewood represents 24% of the monthly amount spent on food.

Improved mental health

Among households that began to receive LPG, there was a 10.0% reduction in the prevalence of female caregivers at risk for depression (CES-D score ≥16). They reported thinking fewer negative thoughts and a greater enjoyment of life.

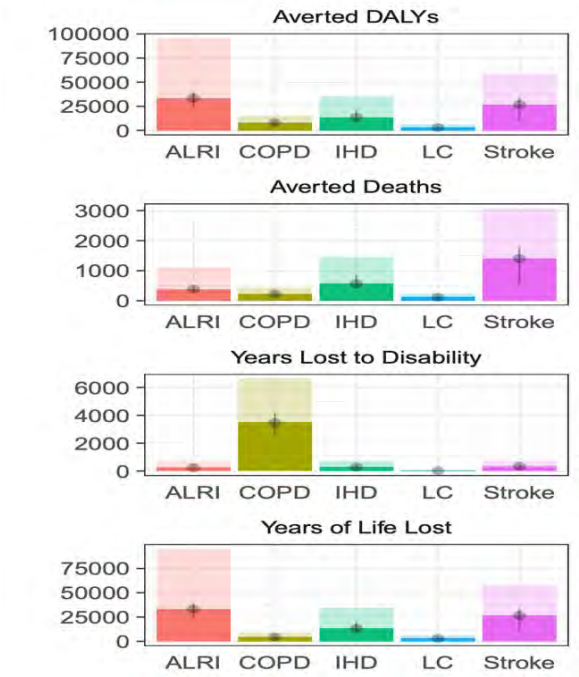
Increased time for care and study

Female caregivers who no longer needed to collect or cook with firewood reported spending less time cooking and cleaning and more time supporting their children, resting, socializing, learning, and volunteering. Children also had more time to study.

LPG distribution reduced burning of plastic for cooking fuel in the camp.

Averted respiratory illness

In almost every month with data from >5 households, households cooked exclusively with LPG on >80% of days. Replacing biomass with LPG as a cooking fuel in intervention households reduced average exposure to $PM_{2.5}$ (weighted by time inside) by 236 ug/m3. These reductions in $PM_{2.5}$ are associated with averted disability-adjusted life years (DALYS) and deaths due to acute lower respiratory infection, chronic obstructive pulmonary disease, ischemic heart disease, lung cancer, and stroke. The intervention averted 2,309 deaths and 51,570 DALYS among adults and 385 deaths and 33,310 DALYS among children.



LPG distribution reduced air pollution and associated respiratory diseases. Dark areas are outcomes that have been averted; light areas those that could be averted. ALRI = acute lower respiratory illness, COPD = chronic obstructive pulmonary disease, IHD = ischemic heart disease, LC = lung cancer

Reduced burning of plastic as cooking fuel

LPG distribution reduced the prevalence of burning plastic when firewood was unavailable. Households would sometime burn discarded plastic bags and other plastic trash to start the cooking fire or for the entire cooking period. At baseline, 40% of intervention households reported burning plastic 5 or more days per week compared to 0% of comparison households. At endline, 0% households burned any trash.

Reduced inter-group and domestic conflict

In in-depth interviews, refugees shared that when they tried to enter the forest, they were sometimes asked to pay money, rice, or lentils and occasionally faced verbal or physical harassment. Men, women, boys, and girls all experienced or felt threatened by this harassment. Provision of LPG reduce conflict with the host community, as well as resolving many factors linking firewood to domestic conflict. LPG provision reduced men's fatigue or frustration related to collecting firewood, reduced women's frustration with men who returned late from the forest or didn't return with any firewood, made it easier to cook food quickly and serve it while still warm, increased the quantity of fully cooked food, and reduced the time required to clean cooking dishes. The ease and speed of cooking with LPG allowed women to watch their children more closely.

Check out the study documentary!

Respected refugees' perceptions of dignity

Among our 1,200 Rohingya households, 920 reported that men collected firewood while 51 reported that women collected firewood. In in-depth interviews, both men and women explained that females were able to protect their dignity by not going to the forest. One adolescent girl explained, "Prior to receiving LPG, women and girls of households that had no men or boys were bound to leave their homes to collect firewood. Women and girls lost their dignity. Now, they can stay home with dignity and safety." LPG provision removed the need for women to make the risky and less socially acceptable trip to the forest.

...all for a low cost!

The total cost to provide LPG to an average (5-person) Rohingya refugee household was $0.34-$0.47 per day. The annual cost to provide one household with an LPG stove and refills was approximately $99 and the distribution costs was an additional $25-$73. Since refugees needed to bring their cylinders to collect the LPG refill, monthly replacement of tanks was <0.2%.

Contacts

To donate or learn more about LPG distribution in the Rohingya refugee camp: Energy & Environment Technical Working Group <eetwg.cxb@gmail.com>. For research questions: Dr. Laura H. Kwong <lakwong@berkeley.edu> or Dr. Mahbubur Rahman <mahbubr@icddrb.org>.

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