PRICES, PEERS, AND PERCEPTIONS (P3): OPPORTUNITIES FOR SCALING UP LIQUEFIED PETROLEUM GAS (LPG) ADOPTION IN NORTHERN GHANA

YEAR 1 REPORT

PROJECT TEAM:

NAVRONGO HEALTH RESEARCH CENTRE

ABRAHAM REXFORD ODURO (PI), MAXWELL DALABA (CO-PI), REX ALIGIRIA, DESMOND AGAO, MANIES ACHAZANGA

ORGANIZATION FOR INDIGENOUS INITIATIVES AND SUSTAINABILITY GHANA (ORGIIS)

JULIUS AWAREGYA, CLIFFORD AMOAH, JOHN BOSCO

UNIVERSITY OF COLORADO

KATHERINE DICKINSON (CO-PI), MICHAEL HANNIGAN, EVAN COFFEY, ELISE MESENBRING

NORTH CAROLINA STATE UNIVERSITY

ZACHARY BROWN

COLUMBIA UNIVERSITY

DARBY JACK

The overarching implementation science objective for this project is to assess how LPG use can be expanded across the urban-rural gradient, focusing on the Kassena-Nankana Districts of Northern Ghana. In the first year of the project, our goals were to characterize current LPG supply and use/demand across these districts, and to design an intervention aimed at expanding use of LPG for cooking. The project is on track to achieve these goals and implement this intervention in Year 2. This report summarizes progress to date and next steps.

I. ENGAGING

Throughout the first year of the project we engaged multiple stakeholders to move the project forward. These included:

- **Collaborating Researchers:**

  Our research team includes individuals from the Navrongo Health Research Centre (Abraham Oduro, Maxwell Dalaba, Rex Alirigia, and others) in Ghana, as well as the University of Colorado-Boulder (Katie Dickinson, Michael Hannigan, Evan Coffey, and Elise Mesenbring), North Carolina State University (Zack Brown), and Columbia University (Darby Jack). Our core team has held weekly Skype meetings throughout the year, and also communicates regularly via WhatsApp. US team members visited the NHRC in November of 2016 and May of 2017. The November visit included a trip to the Kintampo Health Research Centre, where our team met with Dr. Jack's collaborators to share notes from our respective cookstove studies and learn from their LPG-related work. Dr. Jack and Dr. Dickinson also had several opportunities to meet in person and online throughout the year to discuss synergies between our projects.

- **Implementing Partner:**

  Our research team is working with the Organisation for Indigenous Initiatives and Sustainability (ORGIIS), a local environmental NGO working in Northern Ghana, to design and implement the P3 interventions. Julius Awaregya, Clifford Amoah, and John Bosco joined several of our Skype calls and we met in person during the US team's visits to Navrongo.

- **Communities:**

  Our community engagement included community entry activities and the subsequent household survey that was conducted with 600 rural and urban households (covering both ISN-funded LPG project and our NSF-funded biomass stove project). This survey is described in more detail in the next section.

- **Private Sector Entrepreneurs:**

  Through our LPG supply survey and subsequent intervention design activities, we engaged with several private sector actors in the study region. These activities are also described in the next section.

II. EXECUTING

We executed five key tasks over the first year of the project:

1) **LPG Supply Survey:**

   To better understand the supply of LPG fuel and stoves in the study area, we designed and implemented a survey with all refilling stations in the Upper East region (N=7), and all other retail shops selling LPG stoves and cylinders in the Kassena-Nankana Districts (N=9). The survey collected information about the types and quantities of products sold, as well as perceptions of barriers and opportunities for expanding LPG use in the area.

2) **Baseline Household Survey:**

   We also conducted a baseline survey with 600 households in the Kassena-Nankana Districts. Half of these households were selected from the rural areas of the district, and were subsequently involved in

our NSF-funded P3 Bio study (in which biomass stoves are being offered at varying prices to peer and non-peers of households that received free stoves as part of an earlier project). The other 300 households were randomly selected from the central urban area around Navrongo town; these households form the target sample for our LPG intervention. Since the same baseline survey was conducted with both sets of households, the combined dataset includes useful information about fuel use and LPG demand / perceptions across the rural-urban continuum.

Figure 1 maps the locations of the LPG suppliers, color coded by types of products sold, as well as the 600 urban and rural households, color coded by current LPG stove ownership/non-ownership.

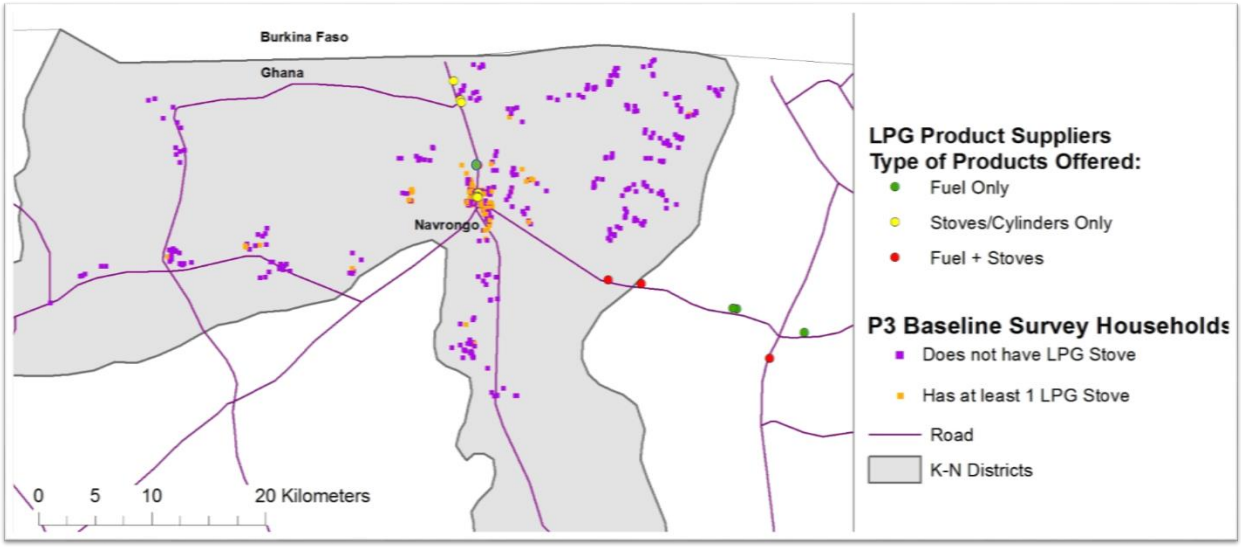


Figure 1: LPG Supply Locations and Household LPG Ownership in the K-N Districts

3) Design of LPG Intervention:

Using information from the LPG supply and household surveys, as well as literature review and engagement with the Kintampo team and the international research community, we designed the LPG intervention that will be implemented in the second year of this project. The resulting set of packages that will be offered to participants in this intervention is described in Figure 2.

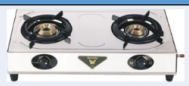
Package Components:		Package Numbers: 1	2	3	4	5	6
	2 Burner Stove	✓	✓				
	1 Burner Local Stove			✓	✓		
	15 kg cylinder + regulator + hose (recirculation)	✓	✓	✓	✓	✓	✓
	4 Fuel Refill Vouchers	✓	✓	✓	✓	✓	✓
	Home Delivery	✓		✓		✓	
	Market value:						
	GHC	550	550	500	500	450	450
	USD	$140	$140	$125	$125	$110	$110

Figure 2: LPG Intervention Packages

4) Training on Becker-Degroot-Marshak Auction:

As we originally proposed, the different LPG packages will be offered to participating households using a mechanism known as the Becker-Degroot-Marshak auction. During our May '17 visit, we developed a detailed protocol and trained the implementing team on how to carry out this auction. Briefly, the procedure that the NGO will follow to implement the intervention is as follows:

A. Hold community meetings with small groups of (6-12) households to explain the LPG package components and deliver promotional messages
B. Visit each household individually to make package offers using the BDM auction
    i. Explain the auction procedure and conduct practice rounds using small items (rice, soap)
    ii. Describe all 6 packages using visuals (printed cards)
    iii. Elicit bids (willingness to pay) from participant for each of the 6 packages
        Participant can decline to bid on any package and remove it from the choice set.
    iv. Participant randomly draws one package (from the ones they bid on)
    v. Participant randomly draws an offer price for the selected package
        → If offer price <= bid price, participant buys selected package at offer price
        → If offer price > bid price, participant does not receive a package
C. Package components are ordered from suppliers, labeled, equipped with SUMs (subset of households), and delivered to households. First payment for package due at time of delivery; remainder of payments due within 6 months.
D. All participating households randomized into different groups for post-purchase interventions designed to encourage LPG use.
E. Follow up data collection: stove and fuel use (surveys and SUMs), personal exposure and household air quality monitoring

5) Emissions Source Sampling

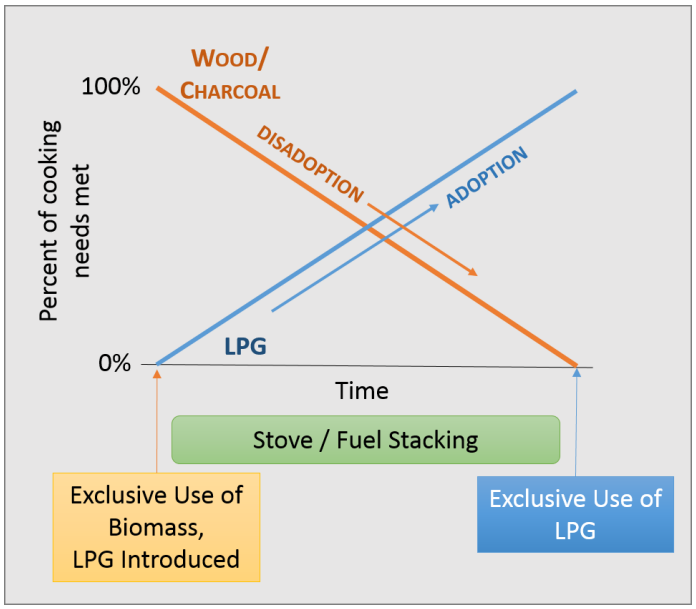
Building on ongoing EPA-funded work, the research team has been collecting a set of emissions samples from multiple different types of sources in the study area. These samples help to characterize emissions from other sources, beyond residential cooking, that contribute to ambient air pollution and personal exposures. Our team has collected a total of 29 such samples so far (see Table 1).

Table 1: Emissions Source Samples by Source Type

Commercial Cooking	Roadway	Kerosene	Trash Burning	Charcoal Making	Bush Burning	Brewing	TOTAL
7	6	5	4	3	2	2	29

Overall, the project has proceeded on schedule and largely in line with what we originally proposed. The design of the LPG intervention has been revised in some minor ways, but this was anticipated: the proposal sketched out some possible intervention components with the plan of revising these based on our formative supply and demand surveys.

The most significant change is that we originally envisioned our intervention targeting only households that did not currently have LPG stoves. However, analysis of our own baseline survey data as well as discussions with the broader cookstove research community highlighted the prevalence of fuel stacking among current LPG users and the need for sustained interventions going beyond the initial adoption (i.e., getting an LPG stove) stage. (For instance: while 51% of households in our urban baseline survey already had an LPG stove, 74% of these



households said they had cooked with charcoal on the day prior to the survey.) The graphic in Figure 3 depicts this adoption-disadoption process that has become a larger focus in our project.

For this reason, we decided to include components of the intervention that will target current LPG users as well as non-users. These include:

- Adding a second type of LPG stove, with a single large burner (see Figure 2), which may be better suited to cooking with large pots. Our work suggests that the need to cook certain dishes in these large pots is one important driver of continued charcoal / wood use. For current non-users and those using standard 2-burner stoves, this locally-made single burner stove may thus lead to greater replacement of traditional biomass stoves.
- Including some packages without any stove, and only fuel (cylinder and refill vouchers) to appeal to households satisfied with their current LPG stoves.
- Focusing a post-purchase intervention component on a pilot of promotion strategies intended to encourage more complete adoption of LPG and disadoption of biomass. We anticipate using both in-person visits and text messages, randomized across participating households.

Figure 3: Adoption of LPG and Disadoption of Biomass as Intersecting Processes

III. Reflecting and Evaluating

At this stage there are no major changes we would make to the design of the project. However, three themes have emerged that were not central to our initial proposal, and which we would like to continue to explore in this project and in future work:

1. **Commercial and institutional cooking.** Related to the source sampling work mentioned above, it is clear that cooking that happens outside the residential setting may significantly impact air quality and exposures in the urban setting. The LPG filling station operator we are working with in Navrongo mentioned that he has approached some commercial cookers, including those brewing pito (a local brew), about supplying them with large LPG cylinders and designing stoves that would serve this purpose. This could be a potential avenue for future community-level interventions.
2. **Disadoption of biomass**. As noted above, the prevalence of fuel stacking has drawn attention to the potential need for strategies that *discourage* use of wood and charcoal, as well as encouraging LPG use. Such strategies have not been discussed widely in previous work; we plan to test some in our intervention and are interested in engaging with others doing similar work.
3. **Expanding the supply chain**. Our supply survey was an important step towards engaging the supply side of the clean fuels market, which has been less studied than the demand side. Our partnership with private sector suppliers in our intervention is testing out some strategies these existing businesses might be able to use to entice more customers into the market, but our intervention does not currently examine ways of enticing more suppliers into the market and into more remote rural areas.

IV. DISSEMINATING

The work from our first year of this project has been disseminated through the following channels:

1) **Academic meetings and workshops.** Dr. Dickinson has presented updates on our project at the Colorado Cookstove Collaborative (CO3) meetings (Dec 2016 and May 2017) and at the ISN annual workshop in June of 2017. Dr. Dalaba gave a project update at the NHRC in Feb of 2017.

2) **Website.** The P3 project website was created to provide a platform for sharing information and updates on the project: http://sciencepolicy.colorado.edu/p3cookstoves/

3) **Blog posts.** The following three blog posts were disseminated through the University of Colorado. Links to these blog posts were posted on the project website and were distributed through social media (Facebook, Twitter).

Want to Buy a New Stove? by Katie Dickinson (March 23, 2017)

What's Cooking in Ghana? CIRES News (December 29, 2016)

Prices, Peers and Perceptions: Studying a Community's Adoption of Cleaner Cookware by Alison Gilchrist (December 6, 2016)

4) **Photographs**. Photojournalist Joanna Pinneo accompanied the P3 team during our May 2017 visit to Navrongo. Ms. Pinneo is a photojournalist who just completed a Scripps Fellowship in Environmental Journalism at CU Boulder. Her current work is focused on household air pollution, its effects on people's lives in different areas around the world, and the research and policies underway to address this problem. The interviews and photographs she took in Navrongo will be used to help communicate the nature and complexity of the household air pollution challenge, specifically related to cooking behaviors and behavior change, and to explain how our team is studying this problem. She is also sharing her images with us for use in our reports, presentations, and publications.

5) **Reports and publications.** A few written dissemination products are in progress and will be disseminated in the near future. One of these is a detailed report from the LPG Supply Survey. A second is a study protocol paper that will use results from the LPG Supply and Baseline Household Surveys, as well as a review of the literature, to document our process for designing the LPG intervention packages and our plans for rolling these out.