ETHOS 2019

Green fuel comes to the big city:

can ethanol displace kerosene and charcoal in urban homes?

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Evaluation of CleanCook pilot

- **Project Gaia planned a commercial pilot** with support from Shell Nigeria Exploration and Production Company (SNEPCo) and through partnerships with Unikem and Forte Oil.
- **Gas stations to sell 2,500 CleanCook stoves** to households in **Lagos** and provide system for refilling fuel canisters
- Berkeley Air provided study design and analysis; Project Gaia - University of Chicago field team collected data

Study Aims

Demonstrate **consumer uptake, financial feasibility and safe supply chain** for an ethanol/methanol fuel.

Influence energy policy to support ethanol/methanol as cooking fuel.

The CleanCook Stove

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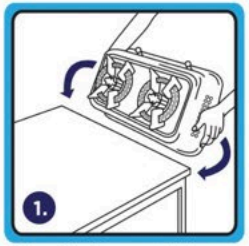
Safety Manual for the Double Burner Canister Distribution Model



1. Turn the stove upside down. Make sure the stove is cool before placing it on the table top.

2. Remove peel-off seal from the canister. Attach seal to bottom of canister for reuse.

3. Place canister in stove. Be sure it fits properly and is not loose. Always keep canister and stove clean from spilled fuel, grease, or oil.

4. Place stove on a flat, stable surface away from all flammable material such as curtains. Make sure stove is in a well-ventilated area away from drafts.

5. Light burner by holding a lit match, burning stick, or long lighter in the burner opening on the stove top. Burner lights easier by placing the flame down the burner tube at fuel canister opening.

6. Use only approved (name of local producer/distributor) fuel canister containing certified CleanCook fuel. Do not use any other fuel, as this may harm stove and create safety hazard.

7. The fuel canister burns for about 4 hours on highest heat setting. To conserve fuel, use regulator to adjust heat down during cooking. Store canister in stove with regulator in off position (closed) to prevent loss of fuel.

8. When canister is empty, replace with full canister and return empty canister to vendor.

9. Never pour any liquid fuel into the stove or the canister.

10. Never try to open the canister to get fuel out. If canister is damaged, return to the vendor for replacement.

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ATTENTION! Be very careful when operating this stove. Follow instructions carefully in order to avoid burns or fire hazard. Water will extinguish this flame. When switching off stove, close and open the regulator three or four times rapidly to ensure that the flame is extinguished.

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PEDUCCT study groups

Experimental Sample:
30 households randomly selected from the catchment areas of the three Forte Oil gas stations (10 households from each). Given stove for duration of study with option to buy. Pay for own fuel

Early purchasers:
Up to 35 early CleanCook purchasers to be recruited at purchase point for in-home evaluations

Market Survey
The impact of stove promotion activities will be measured in 200 randomly selected participants.

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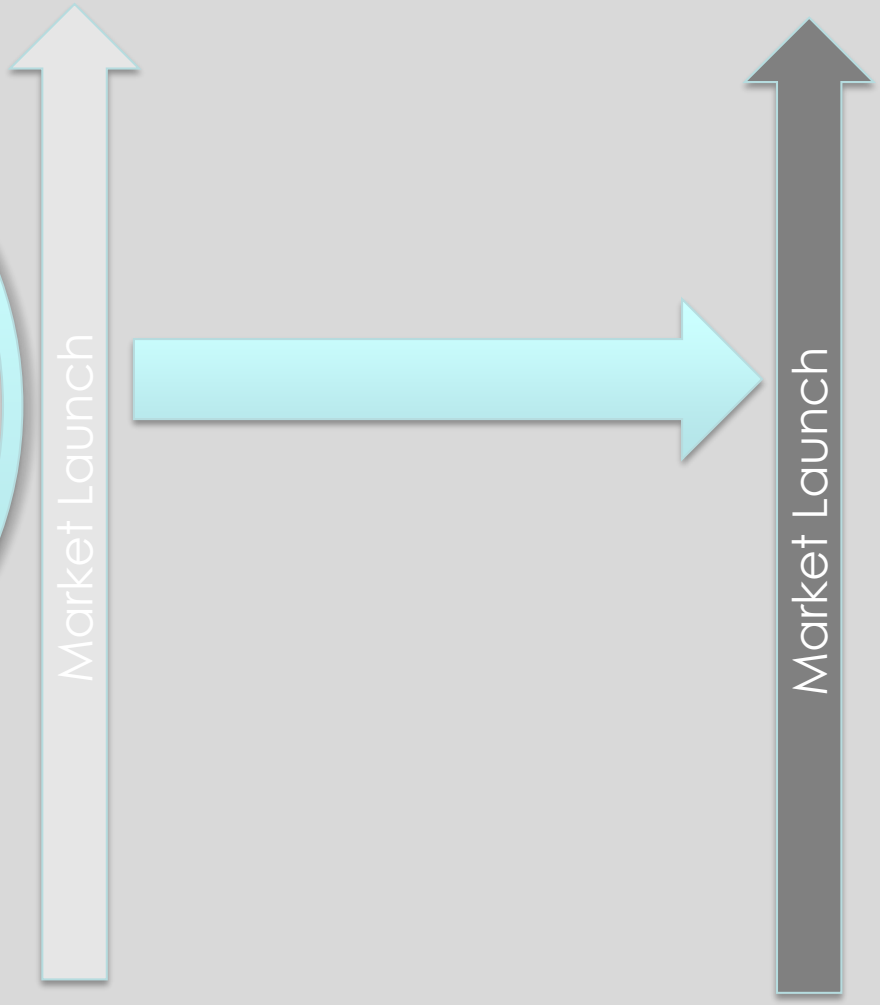

Now planned for Q2 2019

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Commercial pilot evaluation (PEDUCCT)

Collaborative assessment led by Berkeley Air with funding from African Development Bank

Methods and indicators

- Assess consumer preferences & satisfaction with CleanCook through household interviews
- Investigate usage patterns, evaluate correct operation using sensors (SUMS) and surveys
- Test customer willingness to pay
- Measure baseline and intervention stove performance in the laboratory using local fuels
- Model potential regional impacts on climate

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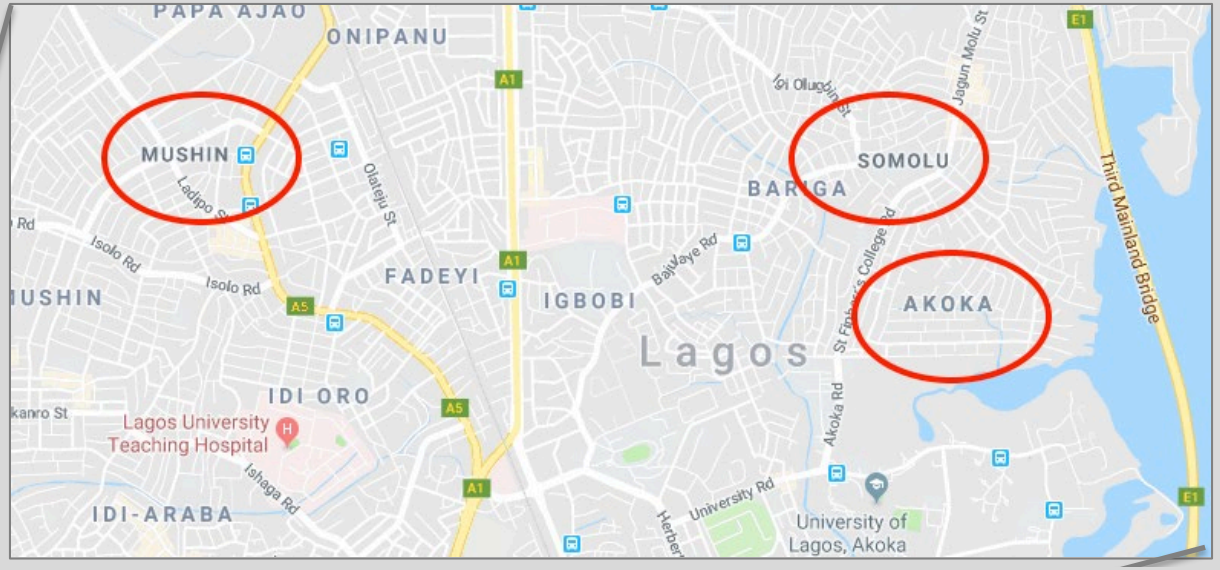
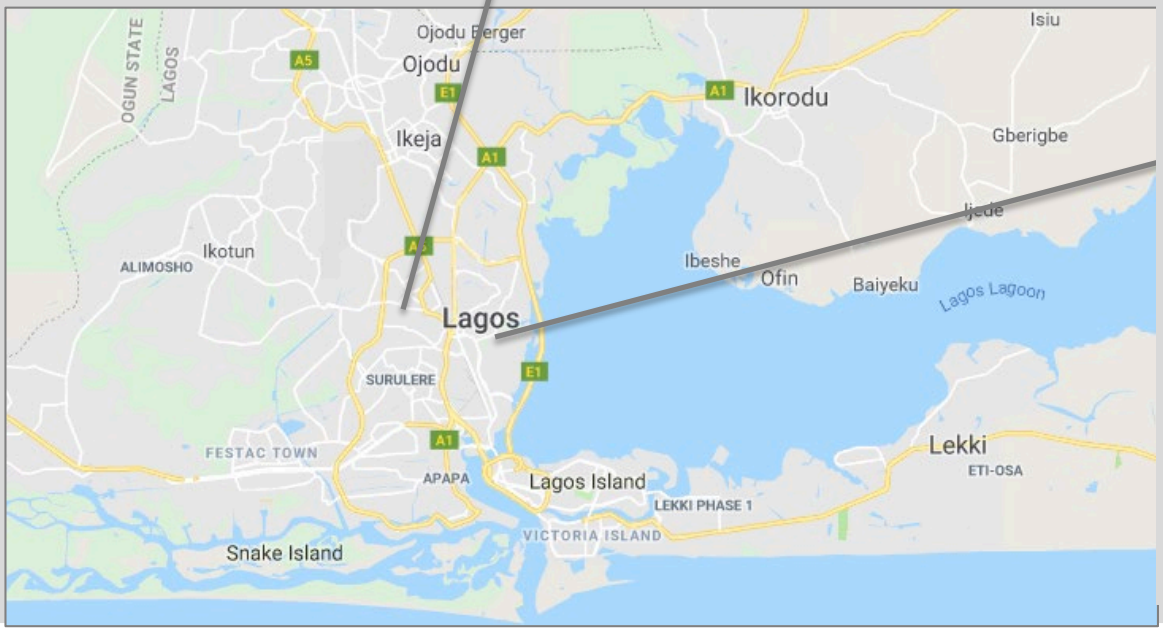
Study locations





Within 2 km radius of three Forte Oil gas stations located within neighborhoods of Lagos with distinct socioeconomic characteristics: Mushin, Shomolu, and Akoka-Yaba

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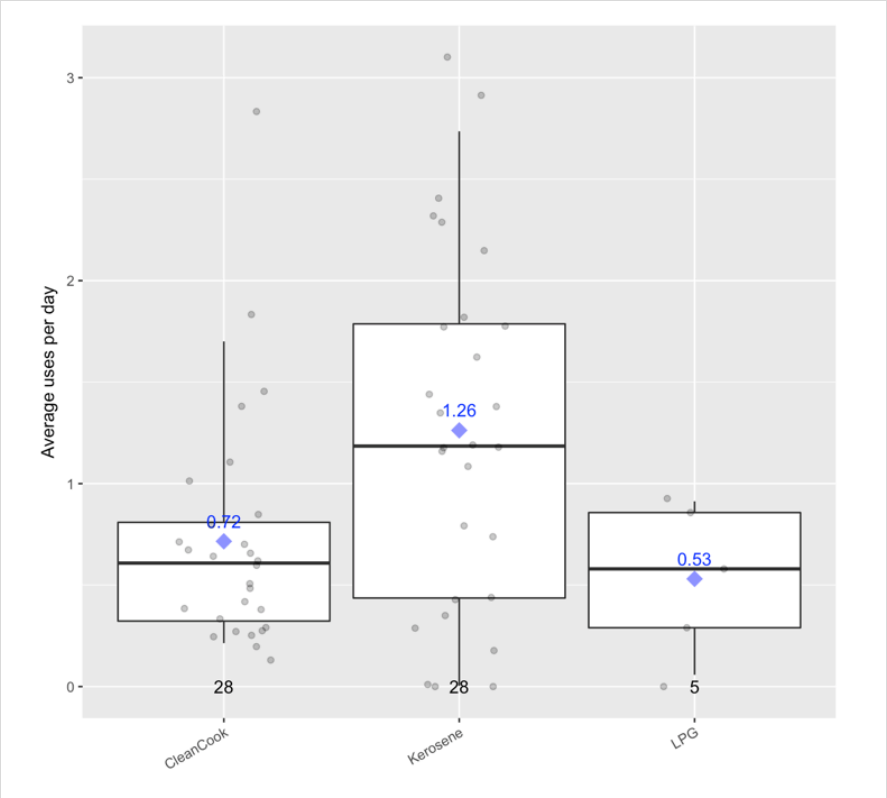
Usage results 1

Stove use monitor (SUM) and self-reported data show usage patterns that suggest consistent but incomplete adoption of the CleanCook stove

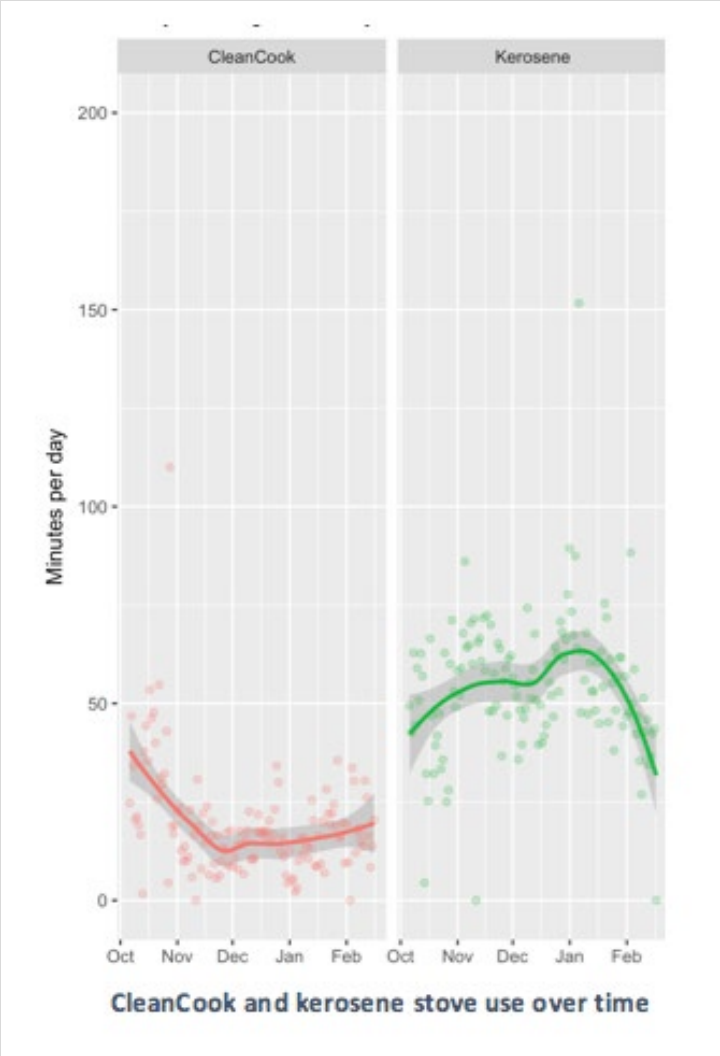
- 4-5 months after receiving the stove, **65% (n=17) of participants reported that the CleanCook was the stove they 'used most of the time.**
- 38%, (n=10) of participants reported to use their CleanCook **7 days per week**, with almost all of these (using it for **2 or more meals**.
- Self-reported data appears to overreport CleanCook stove usage.



Average cooking events per day, by stove.

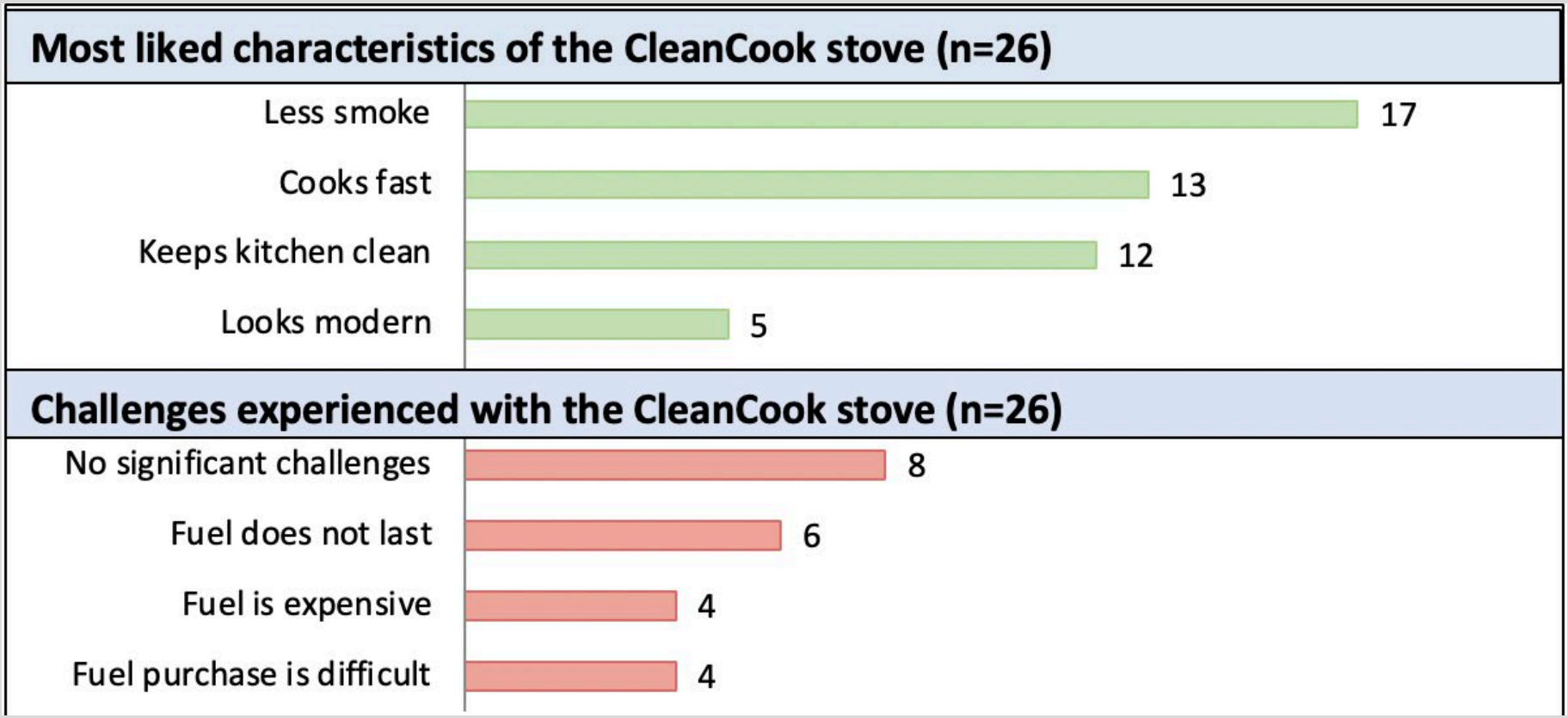
Usage results 2

- SUMs data shows that Cleancook **usage was relatively consistent** after the initial 'honeymoon' period.
- **10 participants purchased** the stove after the experimental study.
- Homes that purchased the CleanCook showed a more intensive pre-purchase CleanCook usage pattern than those that decided not to buy.
- Stove use data showed no change in the use of the CleanCook stove before and after purchase (p=0.76)



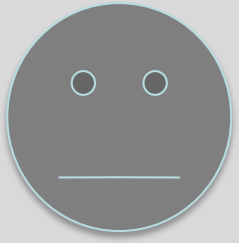
Perceptions of the CleanCook

4-5 months after receiving the CleanCook, **all participants (n=26) stated that they would recommend** the stove to friends and family.



Fuel access & availability

Percent of participants agreeing or disagreeing with statements related ton the perceived usability of the CleanCook fuel.


I can afford to cook with CleanCook fuel (n=25)		
36% (9)	64% (16)	0% (0)
CleanCook fuel is a safe fuel to cook with (n=26)		
58% (15)	39% (10)	4% (1)
CleanCook fuel is a clean fuel to cook with (n=26)		
61% (16)	39% (10)	0% (0)

Fuel affordability and access (2)

- **Fuel canisters were sold at an average rate of 2.3 canisters per household/month.**
- Provides **~1/3 of the estimated daily fuel budget** for a typical Lagos household to meet all cooking needs.
- **58% (n=15) reported that fuel canisters were not always available when needed.** When canisters were unavailable, participants cooked with a different stove.

Emissions and Climate Impacts

- Usage data (SUMS) and emissions factors were used to model climate impacts.
- Estimates suggest **participants reduced their long- and short-term climate emissions by approximately 15-20%**, as measured by carbon dioxide-equivalent and black carbon-equivalent, respectively.
- Bulk of **climate-forcing emissions came from the production and use of kerosene**, as this was the primary fuel used even after the CleanCook was introduced into the households.
- **Potential for larger reductions** of 70% in their carbon dioxide-equivalent and 80% in black carbon-equivalent emissions **if full adoption**

Willingness to pay for CleanCook

- A willingness-to-pay exercise was conducted with 37 households. **94.6% (n=35) were interested in purchasing the stove**.
- Participants were told that the stove was 'worth' N24,000, but they could purchase it for a discounted N19,000.
- If they declined this offer, participants were invited to make up to 3 bids for the stove, with any bid over N15,000 being accepted.
- **30% (n=11) purchased the CleanCook stove at an average price of N15,909 (SD 1300).**
- Participants with higher levels of education were more likely to purchase the CleanCook stove (p=0.02). There was no relationship seen with other possible predictors

Study Limitations

Findings are limited to the experimental study that could be done during the research contract timeframe

- Market launch delayed
- Could not assess authentic customer experience
- Challenging to assess customer satisfaction with the fuel procurement before the actual supply chain has been established

- Difficult for Project Gaia to both build the program and conduct assessment simultaneously

Key conclusions

Canister refill data may be a cost-effective way to measure adoption when the study stoves use a fuel that can only be purchased from limited sources.

- No recall or over-reporting biases (unlike self-reported data)
- Much less invasive and labor-intensive than stove use monitoring

Overall, data generates an encouraging picture of ethanol/methanol blend as a likeable and affordable urban household fuel.

- Participants were willing to procure the fuel even though the purchase experience was sometimes inconsistent and challenging.

Even with incomplete adoption, an ethanol-methanol initiative could deliver significant regional reductions in climate-damaging pollutants.

- Monetizing the climate benefits to subsidize the CleanCook capital cost would help it better compete with LPG and kerosene.

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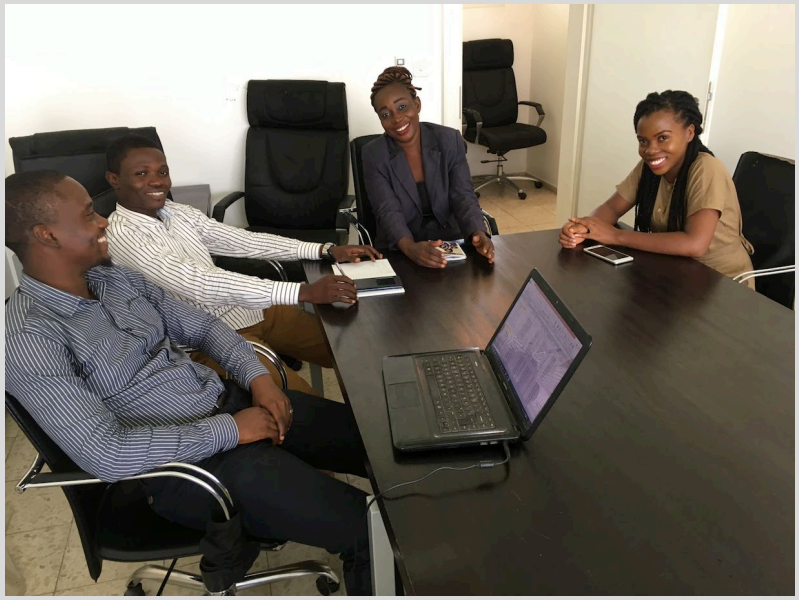

Thank you

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Foundational research in Nigeria

- CleanCook first disseminated in Nigeria as part of studies led by the Univeristy of Chicago.
- Clinical trial (2013) showed that **using bioethanol for cooking has the potential to reduce health risks** for pregnant women and their developing foetuses as compared to households using biomass or kerosene fuels.
- Follow-on acceptability study (2015) reported **significant decline of traditional kerosene stove usage**, with 84% of women in the bioethanol arm giving away their kerosene stove before the conclusion of the study.
- Participants cited ease of use, durability, efficiency, cleanliness, comfort and safety among the advantages of bioethanol cooking.