MEMORANDUM

To: Those Working on Sustainable Development Goal 7

From: EarthSpark International + Enèji Pwòp, SA

Date: December 13th, 2021

Re: Electric Cooking Potential, Willingness to Pay, and Costing in Haiti

Electric cooking has the potential to dramatically redefine energy access, multi-solving for health, climate, and energy access economics.

EarthSpark International's 2020 electric cooking pilot in Haiti is part of a growing body of evidence that electric cooking in the energy access context is not only promising from a customer adoption standpoint, but also a significant opportunity to tear down the silos of SDG 7. Indeed, if every new grid or microgrid electricity connection had not only a light bulb and plug but also an electric kitchen, both the clean cooking sector and the electricity access would likely advance more quickly and efficiently with greater benefits to people and planet.

Incentives and subsidies will remain necessary, but less so than if the two silos continue functioning separately. More work is needed on business models and incentive structures, but the path now seems visible for an integrated approach to SDG 7, especially where grid or microgrid electricity services are currently being planned or expanded.

Overview of Recent Literature

Globally efforts towards the expansion of clean cooking alternatives have focused on improved cookstoves, biomass briquettes, and expansion of LPG. However, clean cooking has lagged significantly compared to needed action to meet SDG7. IEA's 2021 update for SDG Outlook[i] estimates that the current pathway for access to clean fuels for cooking will leave over 2.3 billion people without access in 2030 and over 1.8 billion in 2040. A number of recent initiatives have now been focusing on electric cooking as a key competitor and opportunity for clean cooking in developing communities. A key point from the early research on electric cooking is that a utility business model is seen as most attractive for poor households, particularly if combined with consumer financing because it can overcome some of the financial barriers and risks from the new electric cooking technologies.

- **ESMAP Cooking with Electricity**[ii] – The report explored five case studies for a range of electric cooking solutions in different contexts. Overall, the report highlighted that electric cooking on national grids or mini-/micro-hydropower is already cost effective for many people today and that by 2025, the costs of cooking with AC appliances connected to solar hybrid minigrids ($8–$25/month) and with DC appliances powered by solar home systems ($11–$24/month) become fully competitive if they aren't already. Overall, EPCs are expected to be cost competitive currently in areas with low-cost grid connections (electricity tariffs below USD 0.35/kWh) and high charcoal cost (above USD 0.40/kg). Finally, the report found that "the uptake of electric cooking will depend substantially on the willingness of solar companies, mini-grid operators and utilities to adopt cooking as part of the suite of services it offers its customers."

- **Hivos Beyond Fire Report**[iii] – Due to significant decreases in both batteries and PV modules (76% and 82%, respectively since 2010) as well as expanding demonstrations for customer preference and functionality, electric cooking is rapidly becoming a viable solution for clean cooking deployment, particularly in mini-grid systems. The study specifically found that electric slow cookers and pressure cookers can enable household cooking costs between EUR 3.56 – 9.53/month for minigrids (4.19 – 11.21 USD) indicating that electric cooking is well within the range of cost-competitiveness of other alternatives.
- **MECS Solar Microgrid Cooking Assessment**[iv] –The study highlighted cost-competitiveness for electric cooking particularly for community service applications on a fully-renewable solar microgrid. Specifically, the study found a range of Levelised Cost for Cooking a Meal (LCCM) for electric cooking ranging between 0.16 and 0.70 USD/kWh (depending on assumptions for device penetration and fuel stacking) which was comparable to all other cooking options for the area.
- **Efficiency for Access/CLASP EPC Brief**[v] – This brief systematically explored the market, potential, and barriers for expansion of EPC cooking. The brief echoed other studies highlighting the potential for cost-effective electric cooking and further showed that advances in EPC technology and increased availability of these products in key national markets have the potential to accelerate EPC adoption and competitiveness. The brief also highlighted new innovative strategies for supporting long-term adoption of EPCs including KPLC's Pika na Power campaign and EnerGrow's asset-based financing program both of which have been successful in driving uptake (and repayment of over 90%) of EPC devices. Among other recommendations, the brief highlighted the need to integrate cooking into electrification planning and renewable energy investments to accelerate SDG 7 goals for rural communities.
- **MECS EPC Consumer Insight Report**[vi] – Through interviews with 718 EPC customers in Kenya, the report explored a number of elements of consumer acceptance and consumer feedback for EPC models and utilization. Among other findings, the report revealed that 90% of EPC users had no prior exposure to EPCs before making their purchase and that 24% of consumers were also served by solar home systems and mini-grids. The high percentage of first-time consumers demonstrates that EPCs are viable replacements for diverse households and have potential for growth in sales among off- and non-grid connected communities. The report also highlighted the importance of developing consumer-based financing tailored to individual communities and households.

There are numerous other studies highlighting the potential of electric cooking, particularly electric pressure cookers, to drive clean cooking access in developing communities. A major finding across all of the studies is the importance of localized testing and proving of EPC business models for establishing the overall global market for electric cooking specifically through consumer-centered testing, co-development of cooking programs, and innovative research for consumer financing.

Estimate of Costs in Haiti

In 2015, with a traditional stove and traditional wood charcoal, the average urban household in Haiti spent an estimated 58-67 htg/day on fuel (Global Alliance for Clean Cookstoves, 2017) and approximately 10% of their annual income on fuel (Clean Cooking Alliance, 2017). This is compounded by the use of inefficient stoves. Additional evidence from EarthSpark's microgrid planning surveys in 2018 highlights that in more remote rural areas in Southern Haiti nearly 100% of households utilize wood or charcoal for cooking and that some households can spend upwards of 1000 htg every week for cooking fuels. Charcoal prices continue to increase in rural communities, particularly with the national currency fluctuations and national unrest in Haiti. For example, one bucket of charcoal costed 75 htg in February 2020, but it was up to 175 HTG in June 2021 (a 133% price increase in local currency).

In late 2020, EarthSpark partnered with MECS to launch a pilot electric cooking project for EarthSpark's solar microgrid in Les Anglais.[vii] Customer surveys for the report indicated monthly charcoal expenditures for participants before electric cooking ranged from 525 htg ($8.28 USD) – 9,300 htg ($147 USD) with an overall average of 2,538 htg ($40.28 USD) and an average of 2,278 htg ($36.15)[1] leaving out the highest expenditure participant.

In order to fully capture potential demand, the pilot did not charge participants for electricity used for cooking. Even without a price signal, the study provides insight on what effective tariffs might be for electric cooking on EarthSpark's microgrids. Overall average indicative willingness to pay (WTP) from the study was estimated at 30.76 htg/kWh – at the time EarthSpark's tariffs ranged from 25-60 htg/kWh. In total, >50% of the participants reported an indicative willingness to pay at or above existing EarthSpark tariffs and 10% of customers highlighted extraordinarily high economic value for the electric cooking (>100 htg/kWh.) This suggests that electric cooking would have a pathway to commercial viability with specific incentives, results-based financing, and improved service.

In the pilot project, consumer electric cooking – including both electric pressure cookers and induction stoves – consumption per day ranged from 0.86 – 4.91 kWh per day translating to 26 – 150 kWh per month. With just EPCs (which is the focus of the next deployments) the average daily consumption was around 1.1 kwh and 35 kWh a month for high use customers. (As a benchmark, the ESMAP study found that households could meet daily cooking needs with an EPC with consumption between 0.88 and 2.06 kWh/day). At the 1.1 kWh/day level, if EarthSpark were to charge 30 htg/kWh (based on the indicative willingness to pay from the initial study) the estimated monthly cost to a household would be around 1050 htg which was lower than most of the households reported charcoal expenditures (which again have been increasing steadily).

Right now, the EPCs cost 85-150 USD per device which is expensive, but as above a lot of these are not tailored specifically for the Haitian market. In East Africa new manufacturers, like BURN and others, are driving cost reductions as they reach higher scales, but also critically unlocking new financing streams for customers to be able to afford the upfront capital costs. For example, Energrow in Uganda utilized an asset-based financing program and partnership with the national utility UMEME to deploy 150 electric pressure cookers and they saw a 95% repayment rate for the devices and it is now their fastest growing product behind solar water pumps. KPLC also partnered with EPC company Jikoni Magic to implement similar "Pay-as-you-Save" type programs. MECS has published a number of studies (most recent is here) as well on results-based financing to further help customer affordability. MECS has also just recently had their carbon methodology for electric cooking verified by the Gold Standard and **has discussed trialing the methodology with EarthSpark in Haiti**. We see cooking-specific carbon finance as an extremely attractive additional pathway to support customer affordability.

Even though, the Hivos, ESMAP, MECS, and Efficiency for Access work all highlight potential for costs to decline as the markets for electric cooking mature, these price points obviously represent a significant hurdle to overcome for households. Since EarthSpark and Enèji Pwòp function as a utility we are looking to develop specific asset-based financing and results-based financing strategies to help overcome the upfront capital costs for clean cooking as part of the business model development and RBF portions of the project.

In practice, more research will need to be done to explore the impacts of a price signal on overall electric cooking demand as well as what happens to EPC consumption if that is the sole electric cooking device. Again, the initial values highlight that there is an approachable volumetric tariff that could be attractive to customers in microgrid communities especially if targeted to higher volume users and enthusiastic adopters of the technology. The initial

[1] Based on conversion rates of about 63 htg/USD in 2020 which have increased dramatically to about 99 htg/USD in November 2021

study also provided good insight into the characteristics of these customers which can help guide next steps. Further, especially for households with higher volume use, there may well be additional potential margin to support asset-based or utility financing as showcased in other EPC studies. Overall, the appropriate tariff levels and customer uptake, utilization, and willingness to pay will need to be studied as part of the next round of electric cooking trials so that the business model can be clarified including what gaps and opportunities exist for results-based financing, carbon financing, and other strategies to help overcome cost barriers for electric cooking for both microgrid operators and customers.

About EarthSpark International

EarthSpark International is a US-based non-profit building innovations and business models that can solve specific aspects of energy poverty. With a focus on what can work in rural Haiti, EarthSpark pull upon and creates global best practices in the energy access sector. So far, EarthSpark has spun out three companies: SparkMeter, Inc. is a smart meter and grid analytics company which has become the global leader for microgrid grid operations. **SparkMeter** now serves grid operators in 25 countries and was named Most Innovative Energy Company of 2021 by Fast Company. **Enèji Pwòp** is a Haitian energy access company recognized in Haiti as the premier microgrid operator in the country. **Participant Power** is a microgrid development company currently focused on scaling-up EarthSpark's microgrid work in Haiti. The company currently has 20 bids for new microgrids provisionally approved by the Haitian government and $16M of committed blended finance funding, including $9.9M from the Green Climate Fund, for the scale-up.

About Enèji Pwòp, SA

Enèji Pwòp is a Haitian energy access company currently selling efficient lighting and appliances and operating EarthSpark's two solar-hybrid microgrids in southern Haiti. In addition to its current operations, Enèji Pwòp is the designated microgrid operator for 20 future microgrids currently under negotiation with the Haitian government. Before incorporation in 2014, Enèji Pwòp was incubated as a concept and local brand in Haiti by EarthSpark international for 4 years.

Endnotes

[i] IRENA (2021). Tracking SDG 7: The Energy Progress Report (2021); Available at: https://www.irena.org/publications/2021/Jun/Tracking-SDG-7-2021

[ii] ESMAP. (2020). Cooking with Electricity: A Cost Perspective. Washington DC: World Bank. Retrieved from https://openknowledge.worldbank.org/handle/10986/34566

[iii] Couture, T. D., & Jacobs, D. (2019). Beyond Fire: How to Achieve Electric Cooking. Hivos; World Future Council. Retrieved from https://greeninclusiveenergy.org/assets/2019/05/Beyondfire_How-to-achieve-electric-cooking-1.pdf

[iv] MECS. (2020). Accelerating uptake of electric cooking on AC microgrids through business and delivery model innovations. Retrieved from https://mecs.org.uk/wpcontent/uploads/2020/06/MECS-TRIID-PowerGen-Project-Report.pdf

[v] Efficiency for Access / CLASP (2021). Eletric Pressure Cookers Solar Appliance Technology Brief; Available at: https://www.clasp.ngo/wp-content/uploads/2021/05/EforA_Solar_Appliance_Technology_Brief_EPCs_July-2021.pdf

[vi] MECS Electric Pressure Cooker Usability Testing Buyer's Guide; Available at: https://storage.googleapis.com/e4a-website-assets/Electric-Pressure-Cooker-Usability-Testing-Buyers-Guide_final.pdf

[vii] EarthSpark International (2020). Kwison Elektrik: SOLAR POWER FOR ELECTRICITY ACCESS AND ELECTRIC COOKING IN HAITI Available at: http://www.earthsparkinternational.org/uploads/1/3/4/4/13442473/kwison_elektrik_-_solar_power_for_electricity_access_and_electric_cooking_in_haiti.pdf