Electric Cooking After the Trial:
Three-Year Impacts, Perceptions, and Preferences

Pre-analysis plan

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1. Abstract

This pre-analysis plan covers a +3-year follow-up of an RCT in Goma (Democratic Republic of Congo) that randomized offers of free Electric Pressure Cookers (EPCs). We assess whether 12-month impacts on EPC use and fuel substitution persist. The study adds two modules, administered separately to the main cook and their spouse: first, a conjoint experiment to identify preferences and willingness to pay for stove attributes and to test whether EPC exposure shifts these preferences; second, a perceptions module, to benchmark beliefs about EPC use, time and money savings against objective study averages, and analyse whether these beliefs are affected by EPC exposure, and by intra-household financial roles—who pays for charcoal and electricity. Additionally, in a subsample, Stove Use Monitors (SUMs) measure on/off-peak EPC use and characterize stacking (using EPC and charcoal in the same meal) versus substitution (replacing charcoal with electricity).

2. Motivation

Billions still cook with polluting biomass, with the burden growing in Sub-Saharan Africa (IEA, 2025). This imposes large private costs (time, expenditure, health) and social costs (deforestation, CO_2 from wood harvest, carbonization, and combustion). At the same time, electrification has expanded rapidly: a large share of biomass-reliant households now has grid access (Min et al., 2024), and modern electric cooking—especially EPCs—can be faster, cheaper, and cleaner when reliable power is available. Yet adoption and full switching remain limited due to high upfront costs and learning frictions.

Our first RCT in Goma addressed these barriers by randomizing the offer of a free EPC[6], distributed during a hands-on demonstration session (Desbureaux et al., 2025). The experiment showed high take-up (92% of treated households collected an EPC), frequent use (≈11 dishes/week), time savings of 35 minutes per day, and a 35% reduction in charcoal consumption, yielding a $5.76 drop in total monthly energy spending. After one year, estimated welfare gains, including lower CO_2 emissions and improved protection for mountain gorillas, were roughly twice the subsidy cost ($94[7]), and the rise in electricity purchases enabled the private electricity provider to recover one fourth of the subsidy[8]; simple projections at the time suggested full recoupment over a five-year EPC lifespan.

These results speak to the promise of utility-backed distribution models that recoup costs through increased electricity sales, and to the household and environmental gains from shifting (part of) cooking fuel demand toward electricity. They also raise key questions: **Do impacts persist beyond the first year? Which stove attributes do households value and find worth paying for, and how is this affected by EPC exposure? How are beliefs formed and updated within the household regarding the impact of cooking with electricity?** The +3-year follow-up addresses these questions.

[6] The EPCs were purchased from SESCOM, a Tanzanian company recognized for its award-winning model (SESCOM MY-CJ6001W, 6-liter capacity).
[7] The $94 subsidy includes purchase, import, and distribution costs.
[8] An 11 kWh/month increase yields $2.35/user/month at a $0.214/kWh retail rate (≈$28.20/year). If surplus power exists, this is pure profit; otherwise we must deduct the $0.17/kWh production cost. Our survey data indicates that only 23% of all EPC-cooked meals occurred during peak (outside 7–9 p.m.). Hence, the distributor's additional annual revenue per EPC is ≈$23.11 after one year.

Continuous administrative data allow us to trace intent-to-treat (ITT) effects on electricity purchases through October 2025. An event-study plot (Figure 1) shows the ≈11 kWh/month increase at 12 months tapering thereafter, especially after month ~30. This attenuation could relate to EPC malfunction, linkage noise if households moved and their electricity meters changed, and/or the changing context in the city (cf. below). The +3-year follow-up is designed to diagnose these mechanisms: by assessing EPC functionality and re-verifying meter numbers we will separate true impact decay from measurement issues. Doing so, the +3-year follow-up will deliver rare medium-term evidence[9] on sustained clean cooking adoption—before control-group contamination expected at longer horizons. Additionally, in a subsample, we equip EPC and charcoal stoves with SUMs[10] to capture high-frequency on/off-peak use and stacking. If stacking is widespread, it points to a flexibility constraint: households may need multi-hub devices or an extra pot/complementary appliance to shift more fully to electric cooking. If on-peak use is concentrated, providers can consider load-management tools (time-of-use pricing, off-peak credits, or SMS nudges) to shift cooking off-peak.

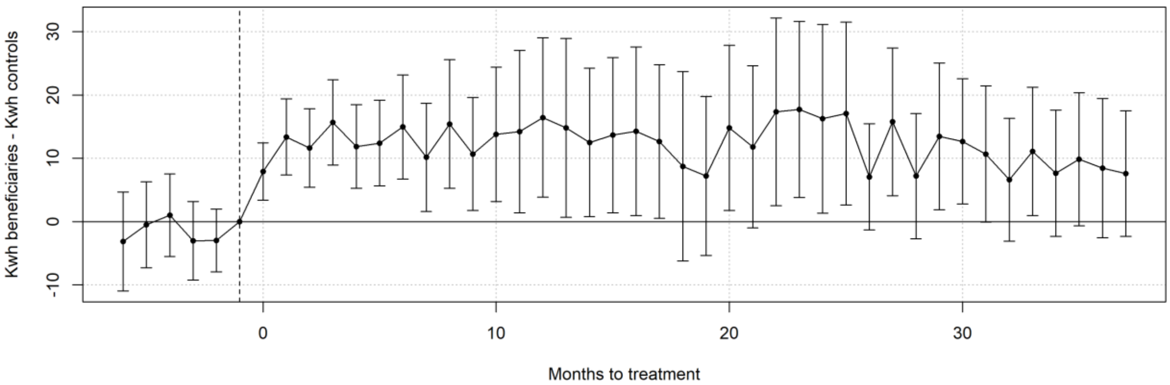

Figure 1. The ITT effect of having been assigned to receive an EPC on monthly electricity purchases from six months before to the distribution (Aug-2022) till 38 months after (Oct-2025). Standard errors are clustered at the neighbourhood level. Dots indicate estimated coefficients and bars indicate 95% confidence intervals.

Second, a conjoint experiment elicits preferences and willingness to pay (WTP) for key stove attributes—operating cost, impact on deforestation, smoke reduction, time savings, and cooking flexibility—and tests whether randomized exposure to EPCs shifts these preferences relative to control households. While several studies have used conjoint experiments to examine cooking device preferences (e.g., Das et al. 2021; Jeuland et al. 2015; Takama et al. 2012; van der Kroon et al., 2014), to our knowledge, none leverage exogenous, randomized variation in prior technology exposure, making this contribution novel. Unlike standard survey questions, that often mask trade-offs and are prone to social desirability bias, conjoint analysis elicits marginal rates of substitution between attributes and has been shown to mitigate social desirability concerns (Horiuchi et al., 2022), yielding policy-relevant guidance for utilities, manufacturers, and donors deciding which attributes to prioritize. Since preferences and WTP may vary within the household depending on the division of cooking and financial

[9] Examples of longer-term impact evaluations of clean cooking interventions are Bensch and Peters (2020), Berkouwer and Dean (2025), and Mekonnen et al. (2025).
[10] Stove Use Monitors: we used the ‘EXACT Pro Stove Use Monitor’ from Climate Solutions Consulting. https://www.climate-solutions.net/products/exact-stove-use-monitor

responsibilities, we administer the conjoint module separately to the main cook (typically female), the charcoal buyer (often the same person) and the electricity buyer (typically the male partner).

Third, we study how beliefs about electric cooking are formed and how accurate they are. A perceptions module—also administered separately to the main cook, the charcoal buyer and the electricity buyer—elicits perceived EPC use, time savings, changes in charcoal and electricity spending, technical reliability of the EPC, and its environmental impact, and benchmarks these against objective study results. This speaks to the literature showing that misperceptions can impede adoption of cost-effective technologies (e.g., in health and energy technologies; Cohen & Dupas 2010; Hanna, Duflo & Greenstone 2016) and to the distinction between experience attributes and credence attributes (e.g., Dulleck and Kerschbamer, 2006; Giraudet et al., 2020). In particular, we seek to establish whether misperceptions persist after random exposure to the EPC, as well as for which attributes of an electric cooker: which specific EPC benefits can be learned (experience), and which benefits may remain hard to verify even after use (credence). Additionally, we also ask for whom misperceptions persist? The latter connects our study to the literature on intra-household decision-making, where separate financial spheres can lead to suboptimal choices (Buchmann et al. 2025; Udry 1996). In our setting, charcoal is often financed from the wife's dotation while electricity is usually paid by the husband. By comparing beliefs of the main cook, the charcoal buyer, and the electricity buyer within the same household, we test whether belief gaps align with these financial spheres.

Taken together, these contributions extend the initial RCT's insights from short-term adoption to medium-term persistence, pinpoint which stove attributes (and WTP) matter for scaling clean cooking, and link objective impacts to subjective beliefs, and learning, within households.

3. Context

Our experiment takes place in Goma, the provincial capital of North-Kivu. Goma's population is estimated at ~2 million residents, corresponding to ~250 thousand households (World Bank, 2020).[11] We implement the study in collaboration with Virunga Energies (VE), a Congolese for-profit subsidiary of the Virunga Foundation (which manages the Virunga National Park). VE generates, transports, distributes, and commercializes renewable energy in North Kivu; its primary market is Goma, where it provides over 80% of the electricity supply and connected almost 40,000 households to its grid since 2019 (Lunanga et al., 2025).

The 2022 baseline survey from our first experiment showed that about 80% of VE-connected households still cooked primarily with charcoal, spending about $30 on average on charcoal per month (Desbureaux et al., 2025). Roughly two-thirds of this charcoal is illegally produced in national parks, with deforestation encroaching dangerously on mountain-gorilla habitat and threatening decades of conservation efforts (Morisho et al., 2022). Beyond private gains in fuel expenditure, time saved, and

[11] Estimates vary widely and are prone to error due to conflict-driven inflows—and outflows, following the takeover by the Rwandan-backed rebel group M23 in January 2025.

reduced indoor air pollution, EPC adoption—especially at scale—could thus also yield environmental benefits, including biodiversity conservation and reduced CO_2 emissions.

Since the time of first experiment, two major contextual shifts took place in Goma. First, VE's customer base in Goma continued to grow, while rainfall was erratic with longer dry seasons; together these factors contributed to more frequent electricity outages. Second, the resurgence of the M23 rebellion (from 2022 onward) generated substantial internal displacement into Goma, delayed construction of a new power plant, and disrupted charcoal markets. Armed clashes reached Goma in January 2025; after several weeks, the city came under new authorities linked to M23. The new power plant subsequently became operational in spring 2025.

4. Research design

4.1 Original RCT

In the original RCT, Virunga Energies distributed EPCs to a random sample of 1,034 residential clients in two waves (Wave 1: August 2022; Wave 2: August 2023). Figure 2 shows the timeline for both waves.

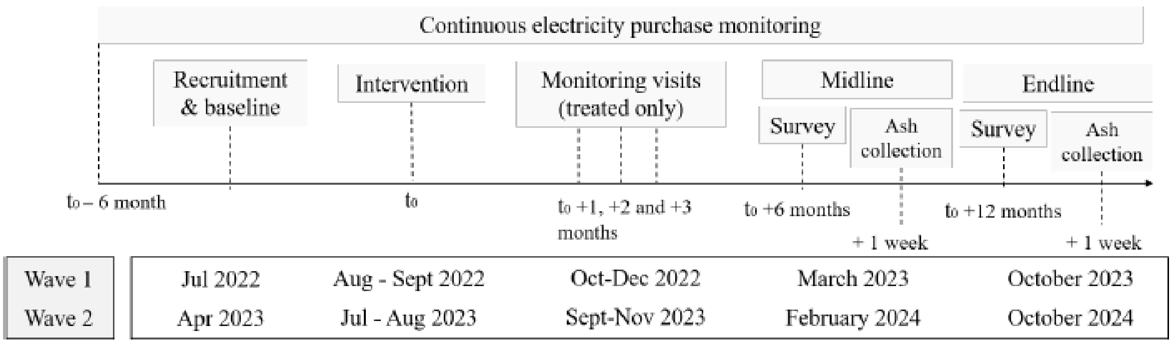

Figure 2. Timeline of the original RCT study. For each wave, we recruited participants as part of a baseline study and randomized them in the different treatment arms. Those assigned to the EPC group received three monitoring visits as part of the intervention. We organized two post-intervention surveys after six and 12 months. Each of these surveys was composed of a main questionnaire and a follow-up visit after seven days to weigh post-combustion ashes. Throughout the study, we continuously tracked electricity purchases.

Treatments. The core treatment consisted of a free EPC, a demonstration session, house visits, and a tailor-made cookbook. We designed two sub interventions to explore adoption mechanisms: a 20 kWh (~ $5) electricity transfer credited directly to the household electricity meter (the equivalent of about 80 EPC-cooked dishes, or 32 full meals) to test the hypothesis that a financial nudge overcomes (uncertainty about) the EPCs variable usage costs; and an environmental education session (presented by Virunga Park rangers) to test whether awareness about the peace and environmental effects of charcoal production may boost EPC use. To remind beneficiaries about this education session, they received a sticker on their EPC carrying the same message.

Sample and recruitment. We drew the study sample from VE's client database in Goma. Starting with 15,511 connections, we excluded (i) 50 pilot beneficiaries, (ii) 3,442 clients on shared/collective meters, and (iii) households with very low (< $3) or high (> $30) average monthly electricity purchases in the six months pre-baseline, yielding 9,658 eligible households. We randomly contacted 2,875 clients by phone to verify that the user was a household (not a business), identify the current user of the meter, confirm charcoal/wood as the primary cooking fuel, and obtain consent for an in-person survey—without mentioning the experiment. Enumerators reached 1,857 clients; these did not differ in prior kWh from those not reached. Of those reached, 1,594 (86%) primarily used wood/charcoal and were eligible.

Randomization. We randomly assigned 1,594 participants to (sub)treatment (N=1,034) or control (N=560). To reduce contamination, households within 150 m were grouped into "neighborhoods" and all households in a neighborhood received the same assignment; this produced 387 neighborhoods. Randomization was clustered at the neighborhood level and stratified by the neighborhood's median baseline monthly kWh (six months pre-baseline) and baseline charcoal spending. Balance checks showed few imbalances across arms.

4.2 Follow-up

The present +3-year follow-up focuses only on Wave 1 (N = 762; 462 treatment, 300 control); the decision on a +3-year follow-up for Wave 2 (N=832; 572 treatment, 260 control) is pending.[12]

Survey. In December 2025-January 2026, we conduct an in-person interview with the main adult household member responsible for cooking (domestic workers excluded). For the Conjoint and Perceptions modules, we also interview the household's primary charcoal buyer and primary electricity buyer (these roles may coincide with the main cook). In the Perceptions module, respondents first state their own estimates of EPC impacts for an average household in Goma; after which we then share the original RCT's average impacts orally and via a brief information leaflet.

SUMs subsample. After the survey, we will draw a SUMs subsample[13] from households that have an operational EPC. Selected households are re-contacted by phone to obtain verbal consent and schedule installation. At the visit, trained staff attach a SUM to the EPC and to up to two main charcoal stoves. These SUMs will allow us to confirm EPC usage estimates, characterize timing of use, and explore how households stack different fuels.

Attrition. We can track households based on GPS coordinates and three phone numbers (both for respondents and their relatives). During the endline survey at +12 months, enumerators were able to track and survey 98% of the study participants, with no differential attrition between treated and control households.

Power calculation. For EPC usage, proxied through monthly electricity consumption, we will have data for 46 time periods (6 months before and 40 months after the distribution), including 28 months since the end of the original RCT. Focussing on the 12 months preceding the new survey, Monte Carlo simulations that account for cluster-level dependence and within-household serial correlation show that

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[12] The decision will be based on (i) available budget; (ii) local security conditions; (iii) in-country presence of a PI or qualified supervisor; and (iv) whether a public scale-up is announced before fieldwork begins.

[13] The size and stratification of the SUMs subsample cannot be defined at this point; it depends on SUM data accuracy (which will be tested internally) and device inventory (collected during the survey). We will publicize the SUM sample size in a dated PAP addendum (leaving this PAP unchanged).

the study is fully powered to detect an ITT effect of the same magnitude as that estimated in the original RCT, and has a power of approximately 95% to detect an effect equal to half of the original effect size. For charcoal spending, Monte Carlo simulations calibrated to the original panel data and cluster structure similarly indicate that the study is fully powered to detect an ITT effect of the same magnitude as that estimated in the original RCT, and has approximately 95% power to detect an effect equal to one-third of the original effect size.

5. Hypotheses

5.1 EPC usage and charcoal spending

We will test whether the initial gains in terms of kWh purchased and charcoal spending persist:

H1. ITT effects on electricity purchases (our proxy for EPC usage) persist in the 12 months prior to the +3-year follow-up survey.

H2. ITT effects on monthly charcoal spending persist in +3-year follow-up survey.

Further data analysis will explore which policies to prioritize (repairs, off-peak incentives, added flexibility) to make the shift to electric cooking stick at scale. In particular:

- We will explore whether the persistence of effects depends on device functionality: if effects are maintained only when EPCs remain operational, this points to repair/maintenance and spare-part access as high-return complements to subsidies.
- Relying on data from the SUMs subsample, we will quantify when households cook. A high off-peak share lowers the risk of grid stress, while any on-peak concentration can be targeted with time-of-use pricing, off-peak credits, or SMS nudges.
- Combining SUMs data of the EPC and charcoal stoves, we will measure the prevalence of within-meal stacking; if common, it indicates a flexibility constraint, suggesting complements like multi-hub devices, an extra pot, or pairing with another appliance.

5.2 Preferences and Perceptions

We will test whether experience with an EPC increases stated preferences for EPC-relevant attributes in a conjoint experiment.

H3. Compared to her counterpart in the control households, the main cook within the treated households has a higher preference for cookers that have the EPC-like attributes: lower operating cost, forest protection, smoke reduction, and time saving.

As secondary hypotheses:

- We expect that, in the conjoint choices, both treated and control households will positively value forest protection, smoke reduction, time saving, and cooking flexibility; while purchase price and operating cost negatively impact choice for the cooking device.

- We expect that treated households have a higher WTP for the EPC-like attributes: lower operating cost, forest protection, smoke reduction, and time saving. While treated households may place greater disutility on lower cooking flexibility (another EPC-like attribute), we nonetheless expect them to have a higher overall valuation of EPC-like profiles.
- Relying on the responses of the different individuals within a household (main cook, main charcoal buyer, main electricity buyer) we further explore whether WTP and preferences for attributes vary by cooking responsibility and financial roles in the household.
- We will also explore whether preferences for forest protection are larger for households that received the environmental message in the original RCT.

In a final formal hypothesis, we seek to establish whether experience with the EPC helps to update beliefs about its benefits:

H4. Perception bias (for the number of meals cooked with the EPC, charcoal savings, increased electricity spending, time savings) is lower for the main cook within the treated households compared to her counterpart in control households.

- We will further unpack this hypothesis and explore which attribute is driving the hypothesized gap between treated and control households. If treated households still misperceive key benefits after three years, these attributes act as credence goods and call for active information provision; if beliefs do improve, they act like experience goods and need exposure.
- Regarding the intra-household roles, we will further explore whether perceptions (bias) differ across roles—main cook vs. charcoal payer vs. electricity payer. Within-household gaps (cook vs. charcoal buyer vs. electricity buyer) motivate role-specific messaging and incentives, so the relevant decision-maker gets the right nudge.

6. Outcomes

6.1 Primary outcomes

	Outcome	Variable	Measurement
1	EPC usage (H1)	Average monthly electricity consumption in the 12 months prior to the survey.	Monthly electricity consumption proxied by monthly electricity purchases (in USD)[14]: the outcome will be computed using the universe of electricity transactions from all VE clients. Transactions will be summed for every month to obtain monthly consumption.
2	Charcoal reliance (H2)	A continuous variable indicating monthly charcoal expenditure in USD.	A recall question will be asked during the survey: "How much did your household spend on charcoal last month?". Values reported in Congolese Francs will be converted to values in USD.

[14] Electricity is pre-paid, meaning that a kWh needs to be purchased before it can be used by households. As households do not have an incentive to save on their meter, purchases are a good proxy for electricity consumption.

3	Preference for EPC-like attributes (H3)	Treatment heterogeneity in AMCEs for EPC-like attributes.	We expect the main cook in treated households to have higher estimated Average Marginal Component Effects (AMCEs) for lower operating cost, forest protection, smoke reduction, and time saving. We will conduct a joint test of treatment heterogeneity across these attributes.
4	Perception accuracy (H4)	Perception Bias Index = mean(|N−N*|/σ, |C−C*|/σ, |E−E*|/σ, |T−T*|/σ).	From the main cook's survey responses, elicit perceived weekly EPC uses (N), monthly charcoal saving (C), monthly electricity expenditure increase (E), and daily time saved (T). For each metric, we will compute standardized absolute deviations from the measured study average(*). The index is the mean of the four standardized deviations. Lower = more accurate.

6.2 Secondary outcomes

1	EPC functionality status	A dummy variable taking 1 if EPC is functional at the time of the survey, and zero otherwise.	Derived from a survey question on EPC functionality: "What is the current status of your cooker (EPC)?"
2	Off-peak EPC use	Off-peak-share = (# EPC heat events outside peak time) / (total EPC events)	For SUM subsample; constructed based on timestamped SUM logs. The peak window is defined using VE's hour-of-day load profiles as the 2–3 consecutive hours with the highest average system load. Off-peak measures use all SUM activity outside this window.
3	Within-meal stacking	Share of meals with overlapping EPC–charcoal heat events.	For SUM subsample; constructed based on timestamped SUM logs.
4	WTP for EPC-like attributes	Treatment heterogeneity in WTP for EPC-like attributes.	We will translate estimated attribute effects into implied WTP for EPC-like attributes: lower operating cost, forest protection, smoke reduction, time saving, and lower cooking flexibility. We report WTP using (i) a common price slope pooled across treatment arms, and (ii) treatment-specific price slopes that allow price sensitivity to differ between treated and control households.
5	Within-household heterogeneity in attribute preferences	Within-household heterogeneity in AMCEs and WTP	We will explore whether AMCEs and WTP for attributes vary by cooking responsibility and financial roles in the household.

6	Overall attribute preferences	Estimated AMCEs	We expect that households will positively value forest protection, smoke reduction, time saving, and cooking flexibility; while purchase price and operating cost negatively impact choice for the cooking device.
7	Preference for forest protection	Estimated AMCEs and WTP	We will explore whether preferences for forest protection are larger for households that received the environmental message in the original RCT
8	Perception bias for each metric separately	Perception Bias = $\lvert X - X^* \rvert / \sigma$	For each metric (N, C, E, T), compute the standardized bias. Lower = more accurate.
9	Within-Household Perception Gap	Within-household perception gap, by metric (pairwise).	For each metric (N, C, E, T), and pair of roles (e.g., cook vs electricity payer), compute the difference in standardized biases. Lower = more aligned perceptions within the household.

7. Set-up of the conjoint and perception modules

The main survey is administered to the household's main cook. For the conjoint and perception modules, the enumerator additionally identifies the household's primary charcoal buyer and primary electricity buyer. These roles may coincide with the main cook. As a result, each household will have a minimum of one and a maximum of three participants in these modules. Importantly, for both the conjoint and perception modules, participants receive separate answer sheets and are instructed not to discuss their responses with others, but to record their own opinions independently.

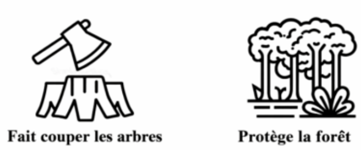
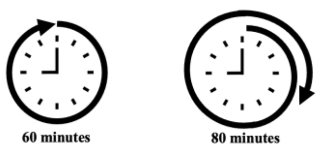
In the conjoint experiment, respondents each time compare two profiles of cookstoves. These profiles randomly vary along six dimensions: purchase price, operating cost, forest protection, smoke emission, cooking time, cooking flexibility. The Table below presents these attributes, their levels[15], and the icons used to present them to respondents. The order of attributes is randomized across households and held fixed across repetitions within the same household. Each household completes five repetitions of the conjoint experiment.

Respondents are instructed to consider each profile as representing a generic cookstove – whether electric, charcoal, or another technology – and to base their choices solely on the features presented. In each task, respondents compare two different stove profiles and indicate which they would prefer for

[15] The attribute levels were chosen to reflect characteristics of electric pressure cookers (EPCs) and traditional charcoal stoves. An EPC profile combines a relatively high purchase price with lower operating costs, no smoke emissions, shorter cooking times, and lower cooking flexibility. The $60 purchase price corresponds approximately to the market price of an EPC, while the monthly operating cost of $15 and a cooking time of 60 minutes per meal are based on estimates from the original RCT. In contrast, a traditional charcoal stove is characterized by a lower purchase price, higher operating costs, substantial smoke emissions, longer cooking times, and greater cooking flexibility; the operating cost and cooking time levels are likewise grounded in estimates from the original randomized controlled trial.

their household. Participants are reminded that there are no right or wrong answers and are asked to respond based on their household's actual needs and preferences, imagining that they could purchase each stove at the listed price. In addition to the forced-choice task, respondents indicate for each cookstove profile how likely they would be to purchase it at the displayed price, using a five-point Likert scale.

After the fifth repetition, respondents are asked – separately for each profile – to indicate what type of cooker[16] they had in mind when evaluating the presented attributes. In addition, respondents report their level of agreement, using a five-point Likert scale, with the following statements: the cooker would help the household save money; the cooker would be good for the household's health; the cooker would be easy to use; the cooker would help the household save time; and the cooker would protect the environment. Responses to these questions are used to assess how different stove attributes and levels are associated with perceived stove types and benefits, and to explore whether these associations differ by treatment status or by cooking-related roles within the household.

Attribute	Levels	Icons
Purchase price	$0 ; $20; $40 ; $60	
Monthly operating cost	$15; $25	
Forest impact	Causes deforestation; Protects the forest	
Smoke emission	A lot of smoke; no smoke	
Cooking time per meal	60 minutes; 80 minutes	
Cooking flexibility	One pot at a time; two pots at a time	

In the perceptions module, participants are first reminded of the randomized controlled trial conducted three years earlier. They are then informed that the results of that study will be shared in the form of a brief game. Participants are asked to estimate the study's impacts on a set of outcomes and are told that, after all households have participated, the five participants whose estimates are closest to the true values will receive a prize of $10. Participants are again reminded not to discuss their responses with others and to record their own opinions independently on their answer sheets.

[16] Wood stove, charcoal stove, simple electric hotplate, gas stove, induction stove, or EPC.

Participants are first asked to estimate, on average, how many times per week a household that received an EPC used it during the first 12 months after receiving the stove. After all participants have recorded their responses, they are informed that, on average, households used the EPC 11 times per week (or 44 times per month). Participants are then told that this usage reduced charcoal expenditures and are asked to estimate by how much the average household could reduce its monthly charcoal spending. Next, participants are informed that electricity purchases increased and are asked to estimate the average monthly increase in electricity expenditures. They are then told that cooking time decreased and are asked to estimate the average reduction in daily cooking time (in minutes), again over the first 12 months. Participants are subsequently asked to estimate how many of the original EPCs would still be functioning at the present time. Finally, they are asked to estimate how many EPCs are required to protect one hectare of forest (approximately the size of a football field). For all of these questions, we also ask respondents to indicate their level of confidence in their answers on a 1 – 5 scale.

The results of the original study are then shared with participants in the form of a one-page leaflet that summarizes the findings and provides the correct answers to the preceding questions. Households that were part of the original treatment group are subsequently asked whether their own experience differed from the study averages – specifically, whether their EPC usage was higher, their charcoal expenditure savings were greater, and their electricity expenditure increases were larger than the reported averages. Responses are recorded using "yes," "no," or "don't know" options.

8. Empirical strategy

8.1 Empirical specification

We rely on the random distribution of the EPC offer in the original RCT to estimate intention-to-treat (ITT) effects. For primary outcomes 1,2, and 4, the empirical specification takes the following form:

$$Y_i = \beta_0 + \beta_1 \cdot T1_i + \delta \cdot X_{i,0} + \varepsilon_i$$

Where Y_i is the outcome of interest for individual i. T_i is a dummy variable indicating whether an individual was offered the subsidized cooker.[17] $X_{i,0}$ is a vector of baseline controls and strata variables used in randomization. ε_i is a mean zero error term.

All regressions include the baseline stratification variables—baseline electricity consumption and baseline charcoal spending—as controls, and an indicator for whether the charcoal-spending recall window overlaps Christmas and/or New Year. We use a doubly-robust lasso procedure to select additional covariates (Belloni et al., 2014). Standard errors are clustered at the randomization (neighborhood) level.

We assume a Poisson distribution when estimating the effect on charcoal spending because switching to the EPC is expected to reduce charcoal spending proportionally. For all other outcomes, we use OLS.

8.2 Multiple hypothesis testing

[17] In this primary regression, we do not distinguish between the sub interventions mentioned in Section 4.1.

Following Benjamini, Krieger and Yekutieli (2006), we will use false discovery rate corrections to account for multiple hypothesis testing across our primary outcome variables. Therefore, for each hypothesis test, we will report two values:

1. The usual p-value from a Wald test; and
2. False discovery Rate q-values, taken across primary outcomes.

8.3 Empirical specification for the conjoint experiment

We estimate Average Marginal Component Effects (AMCEs) following Hainmueller, Hopkins, and Yamamoto (2014) using a regression of the form:

$$Choice_{irc} = \gamma_0 + \gamma_1 Price_{irc} + \gamma_2 Operating\ cost_{irc} + \gamma_3 Forest\ impact_{irc} + \gamma_4 Smoke\ emission_{irc} + \gamma_5 Cooking\ time_{irc} + \gamma_5 Cooking\ flexibility_{irc} + \varepsilon_i$$

where i indicates participants, r indicates choice-task repetitions, and c indicates cooker profiles. In our setting, each participant completes five choice tasks ($r \epsilon \{1, \dots, 5\}$), and each task consists of two cooker profiles ($c \epsilon \{1, 2\}$). The unit of analysis is the cooker profile.

The main outcome is a binary indicator equal to one if the respondent selected the cooker profile in a given choice task. We additionally analyse a continuous outcome capturing participant's stated likelihood of purchasing each cooker profile, measured on a five-point Likert scale.

Explanatory variables correspond to the randomly assigned cooker attributes. Standard errors are clustered at the respondent level. When examining subgroup differences in preferences, we estimate differences in AMCEs across groups and additionally report differences in marginal means, following Leeper, Hobolot, and Tilleay, (2020). We additionally compute implied willingness-to-pay (WTP) for attributes by scaling estimated AMCEs by the marginal disutility of price, using both pooled and treatment-specific price coefficients.

9. References

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