Completion Report

Piloting Africa's first affordable PAYGO, real-time data-enabled clean cookstove, Zambia

NCF-8

C8-0428

Grantee: Emerging Cooking Solutions Sweden AB

Local Partner(s): Emerging Cooking Solutions (Zambia) Limited

Project start date: 01*/07/2019*

Project end date*: 30/06/2022*

28/04/2025

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MATTIAS OHLON
Exec Chairman

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ANNEXES

1. EXECUTIVE SUMMARY

The purpose of the project was to develop an IoT platform, where advanced biomass pellet stoves would record how they were used, and transmit the data to a cloud-based, custom-made application. The usage data, could then be used to better understand customers and respond to them, both if a stove had a fault, user needed help or user did not use the stove. The usage data will also be an invaluable tool in carbon credit tracking.

All this has been accomplished, despite all the macro-level challenges over the past years. The project is in our eyes a resounding success. The technical solution works well on the Mimi Moto stove (and soon on our own SupaMoto stove as well). We have at time of writing over 15 million cooking sample records and hundreds of thousands of cooking sessions recorded from the 2504 connected stoves sold. The stoves can be turned off remotely if not used. The data is real time and a data portal and various administrative interfaced have been developed.

The implications on our business model have been profound. Since our driver is average pellet sales per stove, the usage data is invaluable. Our conclusion is that the extra cost of connecting the stove to internet is smaller than the value of being able to respond to lower performing customers with precision and speed, and the extra revenue that higher-quality carbon credits will give. Given that the value of carbon credits has increased steadily during the project period, which is great news for project developers' ability to make solutions affordable, we believe that with a higher price will also come a higher demand for quality – something we can back up with almost unprecedented quality of data, which therefore makes our solution less vulnerable.

2. ACHIEVEMENT OF RESULTS

2.1 Achievement of outcomes and outputs

Expected outcomes and output	Indicator(s):	Achievement of outcomes and outputs:
Outcome 1: Improved access to one of Africa's most advanced and affordable, improved cookstove and fuel-supply solution to peri- urban and rural households in Lusaka Province, Zambia	1.1: GHG emissions: 20,100 1.2: PAR-60 < 10% 1.3: Number of people reached = 15,000	1.1: Achieved: The estimated actual GHG emission savings over the project time was 20,100. 1.2: Achieved: PAR-60 has fallen to 9%. 1.3: Achieved: 15,020 people have been reached through 500 baseline and 2504 connected households if

		we estimate that there are 5 people per household on average.
Output 1.1: Complete first iterations of PAYGo firmware and systems integration	1.1.1 Sandbox and in-field test report	Achieved: The electronics and firmware were developed and are working well.
Activity 1.1.1: Design and test firmware integration and systems development of the connected cookstove	PCB and firmware working	Achieved: with 15 million+ records transmitted to the database, they are working well although there are some ongoing issues with fixing minor bugs
Activity 1.1.2: Design and test systems development including cooking event, fault event algorithm and if-this- then-that (IFTT) design	Systems development working	Achieved: Various tests have been achieved and the systems and integrations have been live for about two years.
Output 1.2: 500 base model stoves sold	Indicator 1.2.1: 500 base models sold	Achieved: 500 un-connected stoves were sold and a reference survey was made.
Activity 1.2.1: Deliver 500 of the base model with subscriptions to the customers	As above	As above
Output 1.3: 2500 connected stoves sold	Indicator 1.3.1 Reach 2500 households with the connected stove.	Achieved: 2504 internet-connected stoves were sold.
Outcome 1.2: Enhanced affordability and scalability: Improved operational efficiencies to further increase cookstove penetration/ scalability and sustainability	Indicator 1.2.1: Amount of funds leveraged: 1M EUR Indicator 1.2.2: Number of green business concepts tested: 2 Indicator 1.2.3: Number of new decent jobs created: 45	1.2.1: In progress: A Letter of Intent from a carbon broker, worth substantially more than 1M EUR is currently being discussed. 1.2.2: Partially achieved: One new green business concept was tested (the so-called “utility model”) and is currently being rolled out. 1.2.3: Partially achieved: 42 new, decent jobs were created.
Output 2.1: Improved competitive intelligence and understanding of factors hindering or assisting scalability of clean cookstove business model	Indicator 2.1.1: Comparative market study	2.1.1 Achieved: a comparative market study was completed, which formed the basis for change of distribution model in 2.2.1
Activity 2.1.1: Planning of comparative study and sampling of targeted and		Achieved: the baseline study was completed

onboarded users (baseline study)		
Activity 2.1.2: Quantitative and qualitative data collection and analysis (in-field, USSD and remote monitoring)		Achieved: both user surveys completed and 15+ million data records collected
Activity 2.1.3: Evaluate relevant real-time data and qualitative information generated on clean cookstove usage as well as associated transaction costs in Zambia		Achieved: real-time data was evaluated
Activity 2.1.4: Complete comparative market study to increase, sustain and verify use by capturing, comparing user/system data and transaction costs associated with two cookstove and subscription models		Achieved: the insights from the data collected lead to a new distribution model
Output 2.2: Finalise business model for a cost-effective clean cookstove solution and subscription service involving the most advanced clean cookstove for customers in Zambia, including an improved customer service and sales agent distribution model and potential for neighbouring markets		Achieved: The project has resulted in a "utility model" where ECS retains ownership of stove and customer must buy at least 1kg pellets per day, see flyer under "images". This is synonymous with a "cooking as a service" model.
Activity 2.1.1: Design and development of revised business/customer service model and design of target cookstove interventions	Indicator 2.2.1: Revised business plan and marketing strategy for ECS	2.2.1: Achieved: Thanks to insights from the data, we have changed our distribution to a "cooking as a service" model.
Activity 2.1.2: Updated internal management systems for the new business model	Indicator 2.2.2 Uploaded CRM/ERP	2.2.2: Achieved: CRM and ERP completed
Output 2.3: Develop, publish and adhere to a comprehensive data management plan		
Activity 2.3.1: Data policy research, implementation, certification and auditing	Indicator 2.3.1: Documented and published data management plan	Achieved: The data policy has been developed and is currently being implemented.
Output 2.4: Key staff and sales agents at ECS trained on new		

customer service model and delivery of new clean cookstove business model is operationalised at ECS		
Activity 2.4.1: Training of staff, including call centre, customer service operatives and sales agents on new business processes and model	Indicator 2.4.1: Customer service and operational staff trained	Achieved: ECS has become a data-driven company, based on actual and real-time performance data. All relevant staff have been trained.

2.2 Deviations from the planned outputs and activities

No major deviations to output, only extension of timeline by a year.

2.3 Achievement of NCF indicators

NCF core indicator	Results (quantitative)			Clarifications/Means of verification
Number of beneficiaries reached	women		2109	Between the 500 baseline stoves sold and 2504 connected stoves (assuming 1 beneficiary per stove), 3004 beneficiaries were reached in total, of which 2109 (70.2%) women and 895 (29.8%) men. If using average family size of 5 as # of beneficiaries per stove instead, the value would be 15,020.
	men		895	
	total		3004	
Number of people with increased resilience to climate change	women		2109	Before onboarding, everyone is screened to ensure prior charcoal usage. We argue that switching from unsustainable charcoal (which will likely be harder and more expensive to get in the future) to a sustainable fuel such as pellets therefore has a positive impact on their climate change resilience.
	men		895	
	total		3004	
Number of people with improved livelihoods	women		2109	Switching from charcoal to pellets saves people about 50% of their cooking fuel expenditure (about €10 per month) on average.
	men		895	
	total		3004	
New decent jobs created	full-time	women	3	42 new jobs were created during the project: contracted staff, commission based agents, seasonal biomass collectors. If counting part-time and seasonal jobs as ½ full-time equivalent (FTE) each, the sum of 5 FTE and 37 ½ FTE is 23.5 FTE jobs created.
		men	2	
		total	5	
	part-time	women	14	
		men	8	
		total	22	
		women	0	

	seaso-nal	men	15	
		Total	15	

3. CLIMATE CHANGE

ECS as a company was founded with the idea of reducing climate change. The core idea is to replace charcoal (made from unsustainably harvested, virgin wood) by waste biomass pellets.

ECS is currently in the final stages of registering a carbon offset program under Gold Standard, using the new methodology "for metered devices". After that, more exact offset claims can be made. However, tentatively, we estimate that 20,100 tCO2-eq will be the direct result of the project. This is based on a combination of stove life-time and average mitigation per stove per year. In total, every stove, over its lifetime is estimated to generate just under 7 tCO2-eq savings, which might be a too conservative estimate.

4. DEVELOPMENT IMPACTS AND CROSS-CUTTING ISSUES

Directly, the project has had substantial positive impact, considering the results of "3004 people with increased resilience to climate change", 3004 people with improved livelihoods and 42 new decent jobs created.

These numbers are not negligible but not huge either, and further impact that can elaborated on further. However, the purpose of the project was not to reach high numbers but to develop and pilot new technology and to see if it could be scaled up. We have indeed developed this technology and we believe we have proven it to be superior, but time will tell.

Indirectly, we truly hope that we have contributed to catalyse a mass adoption of *modern* cooking solutions (not just improved cooking solution), something which in our view, will require leveraging appropriate and new technologies such as the type of IoT platform which this project has helped fund..

5. ASSESSMENT OF THE RESULTS AND IMPACTS OF THE PROJECT

5.1 Relevance

Finding better alternatives to charcoal for cooking, and making these solutions available and affordable, is a priority for many Sub-Saharan African countries, Zambia included. In this respect, our project has been highly relevant, particularly considering that our fuel is made domestically at our pellet factory in Ndola, rather than imported.

5.2 Effectiveness

The project has achieved all objectives, and the outcomes are highly positive. It has been effective in redefining ECS as a company, and hopefully in catalysing positive improvements in the sector as a whole.

5.3 Efficiency

The project would have been relatively efficient had it not been for all the various disruptions encountered due to the COVID-19 pandemic, including supply chain disruptions and lack of physical access.

5.4 Impact

We believe that what has proven on this project level, has importance on a much larger scale, and will be adopted by others as well. If that will be the case, the project has been catalytic for the sector. To be more specific: the key reason why clean cooking (defined as "modern cooking" rather than "transitionary" based on the World Bank Multi-tier framework) has not yet grown substantially despite various development efforts, is in our view related to two key factors:

1. To move people away from the baseline (firewood and charcoal), the new technology has to be aspirational - much higher performance

2. For mass adoption, solutions have to be affordable (in most urban/peri-urban contexts in Sub-Saharan Africa, fuel cost has to be around or less than 10 USD per day)

#1 almost inevitably implies switch to a new fuel and #2 has cost contraints attached to it. By connecting stoves to internet, and developing systems for tracking individual fuel purchases, we have established highly reliable, accurate and powerful management systems, where we know exactly when the stoves are used and how much fuel is being bought. We are then able to pin-point our responses to where they are most needed, for example stoves not working or not being used.

Once we have reached a much larger scale, for which this project has laid the ground work, we believe our technologies and systems will be adopted by others as well.

5.5 Sustainability

It is not an overstatement to say that ECS has reinvented itself by successfully executed this complex, challenging and high innovation level project. Our new distribution model ("utility model"), where we have good margins on the fuel (50% GP), where users only pay a small onboarding fee (less than 10 USD) and thereafter pay around 10 USD per month in fuel (and saves about 50% compared with their previous expenditure on charcoal), has been proven internally. We are scaling this up this very model, together with the connected stoves, and sustainability to us looks likely. From ECS's perspective the results will therefore be sustainable in our own operations. From ECS's perspective the results will therefore be sustainable in our own operations.

5.6 Coherence

A few other companies in the clean cooking sector are working with similar ideas and IoT solutions. We try to be in touch with them as much as possible (and would like to be in touch with others that we have missed).

A few other companies in the clean cooking sector are working with similar ideas and IoT solutions. We try to be in touch with them as much as possible (and would like to be in touch with others that we have missed). Overall, the project is compatible with the general need for:

- Knowing about stove stacking. If stoves are not used, there is no impact.
- Switching from unclean to modern cooking (fuel-switch)
- High quality data (for high quality carbon credits)

6. INNOVATION

1. Technical innovation: develop new PCB electronics and firmware, develop server application to connect to, develop various admin and business tools using the data.

2. Business model: pioneering cooking as a service. Proven track record with strong unit economics.

7. POTENTIAL FOR SCALING UP AND FOLLOW-UP INVESTMENTS

Project is already replicated in our operations in Malawi and Mozambique and there is interest from others too.

8. RISKS

Of the risks identified before the project start:

- The technological risks did not materialise, although we had to overcome several significant challenges.
- Risks of running out of biomass for making pellets did not materialise either, but we have to work on supply for future growth.
- Increased competition has not materialised either - our main competition remains the ubiquitousness of charcoal itself.

- Political unrest, a real risk at the time of writing the project proposal, did not materilise either, thanks to a peaceful transition of power and a new government ambitous to fight corruption.

We were however confronted with all the various challenges by the COVID-19 pandemic, including eroded purchasing power among customers, lack of access to customers, various staff issues and supply chain disruptions.

9. MONITORING AND EVALUATION

This project has been very much about creating a digial monitoring and evaluation platform. What we have achieved is:

- Customer details are recorded in a smart-phone app by sales agents, including personal details, socio-economic details and GPS location
- After purchasing fuel, always by mobile money, their purchase is associated with their account, showing how much they buy
- When using the stove, the GSM-chip in the stove, thanks to the technology developed in this project, sends usage data (fan speed, battery voltage, time, duration, location) back to our servers
- Call centre, in their interactions with the customer, records and associates the data with the customer

All in all, the project has developed an accurate and high-level monitoring system. It has generated over 15 million records of data sent by the stoves. This data has been analysed extensively internally and channelled to internal management tools for daily use (see Annex 4 for examples). It has also been analysed by external parties:

- A data analytics company using predictive analysis and AI for estimated likelihood of reaching a desired impact return for a specific stove/user evaluated, within 30 days of first (see Annex 4)
- statistics and analytics organisation taking all our data sets and looking for various patterns (also Annex 4)

These are just scratching the surface of what we can do.

We also had organisation 60Decibels do an impact survey, but that was across all our customers, not just customers within this program. The findings were generally very positive, although several customers complained about slow service for repair jobs during the COVID-19 pandemic years.

10. LESSONS LEARNT

Being first of its kind project for us there are many lessons learnt – some more internal and some more of general interest:

- Firstly, a project involving so many different development teams (especially electronics, firmware, server-side development, and user-experience) will need to be agile and ready to respond to what is most pressing at the moment. It is hard to follow a set and linear plan without any adjustments.

- The value of data. By having usage data at our fingertips, we have become a data-driven company, able to see which customers are not using the stoves and respond proactively. We did not however analyse this data until late into the project and in hindsight we would have benefitted to do so earlier.

11. OUTREACH

CEO Mattias Ohlson is sharing his experiences in a seminar at the Clean Cooking Forum in Accra in October 2022.

An article is being prepared with the organisation that did some of the data analysis. The ambition is to publish it before the Clean Cooking Forum.

ECS has a rather open policy of sharing and is actively engaged with many actors interested in a similar approach. We are also considering making all data (depersonalized) available to the public for research purposes.

12. FINANCIAL SUMMARY

Table 1. Project financing per partner

	ECS Sweden	ECS Zambia	Total
NCF contribution	150,191.10	244,002.51	394,193.62
Co-financing	103,777.98	137,824.70	241,602.67
Total	253,969.08	381,827.21	635,796.29

13. CONCLUSIONS AND RECOMMENDATIONS

As project developers, as far as we are concerned, the project has been a resounding success – technically and commercially. It has helped reinvent our business and thrust us into becoming a data-driven company.

We believe our solution has a substantial commercial value, in the future for real-time carbon credits, for example, and for B2B applications.

Annex 1 Project completion fact sheet

Project Name:	Piloting Africa's first affordable PAYGO, real-time data-enabled clean cookstove		
Project no.	C8-0428		
Country:	Zambia	Financing:	
		EUR	%
Nordic Partner:	Emerging Cooking Solutions Sweden AB	103,777.91	16%
Local Partner:	Emerging Cooking Solutions (Zambia) Limited	137,824.70	22%
	NCF grant disbursed	394,193.69	62%
	Total		100%
Classification:	Combination		
Project cycle:	Project start date: 01 July 2019 Original closing date: 30 June 2021 Actual closing date: 30 June 2022		
Short project description:	The project will improve access to Africa's most advanced and affordable data-enabled cookstove and PAYGO fuel-supply solution to 2500 peri-urban and rural households in Lusaka Province, Zambia, while increasing, sustaining, and verifying use, reducing systems downtime and unlocking operational efficiencies to further increase penetration and climate change mitigation.		
Project performance:	Expected Outcomes and Outputs	Achieved	End-of-project status
	Outcome 1: Improved access to one of Africa's most advanced and affordable, improved cookstove and fuel-supply solution to peri- urban and rural households in Lusaka Province, Zambia	YES	Achieved
	Output 1.1: Complete first iterations of PAYGO firmware and systems integration Output 1.2: 500 base model stoves sold Output 1.3: 2500 connected stoves sold	YES	All outputs achieved
	Outcome 2: Enhanced affordability and scalability: Improved operational efficiencies to further increase cookstove penetration/ scalability and sustainability	YES	Achieved
	Output 2.1: Improved competitive intelligence and understanding of factors hindering or assisting scalability of clean cookstove business model Output 2.2: Finalise business model for a cost-effective clean cookstove solution and subscription service involving the most advanced clean cookstove for customers in Zambia, including an improved customer service and sales agent distribution model and potential for neighbouring markets Output 2.3: Develop, publish and adhere to a comprehensive data management plan Output 2.4: Key staff and sales agents at ECS trained on new customer service model and delivery of new clean cookstove business model is operationalised at ECS	YES	All outputs achieved
Climate change outcomes and impacts:	Estimated tCO2-eq that will be mitigated as a direct result of the project: 20,100		
Development outcomes and impacts:	3004 people with increased resilience to climate change, 3004 people with improved livelihoods and 42 new decent jobs created		

NCF core indicators	NCF core indicator	Results (quantitative)			Clarifications/Means of verification	
	Number of beneficiaries reached	women		2109	Sales database	
		men		895		
		total		3004		
	Number of people with increased resilience to climate change	women		2109	Based on above	
		men		895		
		total		3004		
	Number of people with improved livelihoods	women		2109	Based on above	
		men		895		
		total		3004		
	New decent jobs created	full-time	women	3	HR records (staff, agents, seasonal)	
			men	2		
			total	5		
		part-time	women	14		
			men	8		
			total	22		
		seasonal	women	0		
			men	15		
			total	15		

Annex 2 Results Framework

An updated results framework presenting the achieved results in the project needs to be attached. Please insert a copy of the table from Section 2.1 here.

Expected outcomes and output	Indicator(s):	Achievement of outcomes and outputs:
Outcome 1: Improved access to one of Africa's most advanced and affordable, improved cookstove and fuel-supply solution to peri- urban and rural households in Lusaka Province, Zambia	1.1: GHG emissions: 20,100 1.2: PAR-60 < 10% 1.3: Number of people reached = 15,000	1.1: Achieved: The estimated actual GHG emission savings over the project time was 20,100. 1.2: Achieved: PAR-60 has fallen to 9%. 1.3: Achieved: 15,020 people have been reached through 500 baseline and 2504 connected households if we estimate that there are 5 people per household on average.
Output 1.1: Complete first iterations of PAYGo firmware and systems integration	1.1.1 Sandbox and in-field test report	Achieved: The electronics and firmware were developed and are working well.
Activity 1.1.1: Design and test firmware integration and systems development of the connected cookstove	PCB and firmware working	Achieved: with 15 million+ records transmitted to the database, they are working well although there are some ongoing issues with fixing minor bugs
Activity 1.1.2: Design and test systems development including cooking event, fault event algorithm and if-this- then-that (IFTT) design	Systems development working	Achieved: Various tests have been achieved and the systems and integrations have been live for about two years.
Output 1.2: 500 base model stoves sold	Indicator 1.2.1: 500 base models sold	Achieved: 500 un-connected stoves were sold and a reference survey was made.
Activity 1.2.1: Deliver 500 of the base model with subscriptions to the customers	As above	As above
Output 1.3: 2500 connected stoves sold	Indicator 1.3.1 Reach 2500 households with the connected stove.	Achieved: 2504 internet-connected stoves were sold.
Outcome 1.2: Enhanced affordability and scalability: Improved operational	Indicator 1.2.1: Amount of funds leveraged: 1M EUR	1.2.1: In progress: A Letter of Intent from a carbon broker, worth

efficiencies to further increase cookstove penetration/ scalability and sustainability	Indicator 1.2.2: Number of green business concepts tested: 2 Indicator 1.2.3: Number of new decent jobs created: 45	substantially more than 1M EUR is currently being discussed. 1.2.2: Partially achieved: One new green business concept was tested (the so-called "utility model") and is currently being rolled out. 1.2.3: Partially achieved: 42 new, decent jobs were created.
Output 2.1: Improved competitive intelligence and understanding of factors hindering or assisting scalability of clean cookstove business model	Indicator 2.1.1: Comparative market study	2.1.1 Achieved: a comparative market study was completed, which formed the basis for change of distribution model in 2.2.1
Activity 2.1.1: Planning of comparative study and sampling of targeted and onboarded users (baseline study)		Achieved: the baseline study was completed
Activity 2.1.2: Quantitative and qualitative data collection and analysis (in-field, USSD and remote monitoring)		Achieved: both user surveys completed and 15+ million data records collected
Activity 2.1.3: Evaluate relevant real-time data and qualitative information generated on clean cookstove usage as well as associated transaction costs in Zambia		Achieved: real-time data was evaluated
Activity 2.1.4: Complete comparative market study to increase, sustain and verify use by capturing, comparing user/system data and transaction costs associated with two cookstove and subscription models		Achieved: the insights from the data collected lead to a new distribution model
Output 2.2: Finalise business model for a cost-effective clean cookstove solution and subscription service involving the most advanced clean cookstove for customers in Zambia, including an improved customer service and sales agent distribution model and		Achieved: The project has resulted in a "utility model" where ECS retains ownership of stove and customer must buy at least 1kg pellets per day, see flyer under "images". This is synonymous with a "cooking as a service" model.

potential for neighbouring markets		
Activity 2.1.1: Design and development of revised business/customer service model and design of target cookstove interventions	Indicator 2.2.1: Revised business plan and marketing strategy for ECS	2.2.1: Achieved: Thanks to insights from the data, we have changed our distribution to a "cooking as a service" model.
Activity 2.1.2: Updated internal management systems for the new business model	Indicator 2.2.2 Uploaded CRM/ERP	2.2.2: Achieved: CRM and ERP completed
Output 2.3: Develop, publish and adhere to a comprehensive data management plan		
Activity 2.3.1: Data policy research, implementation, certification and auditing	Indicator 2.3.1: Documented and published data management plan	Achieved: The data policy has been developed and is currently being implemented.
Output 2.4: Key staff and sales agents at ECS trained on new customer service model and delivery of new clean cookstove business model is operationalised at ECS		
Activity 2.4.1: Training of staff, including call centre, customer service operatives and sales agents on new business processes and model	Indicator 2.4.1: Customer service and operational staff trained	Achieved: ECS has become a data-driven company, based on actual and real-time performance data. All relevant staff have been trained.

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Activity 2.4.1: Training of staff, including call centre, customer service operatives and sales agents on new business processes and model	Indicator 2.4.1: Customer service and operational staff trained	Achieved: ECS has become a data-driven company, based on actual and real-time performance data. All relevant staff have been trained.
Expected outcomes and output	Indicator(s):	Achievement of outcomes and outputs:
Outcome 1: Improved access to one of Africa's most advanced and affordable, improved cookstove and fuel-supply solution to peri- urban and rural households in Lusaka Province, Zambia	1.1: GHG emissions: 20,100 1.2: PAR-60 < 10% 1.3: Number of people reached = 15,000	1.1: Achieved: The estimated actual GHG emission savings over the project time was 20,100. 1.2: Achieved: PAR-60 has fallen to 9%. 1.3: Achieved: 15,020 people have been reached through 500 baseline and 2504 connected households if we estimate that there are 5 people per household on average.
Output 1.1: Complete first iterations of PAYGo firmware and systems integration	1.1.1 Sandbox and in-field test report	Achieved: The electronics and firmware were developed and are working well.
Activity 1.1.1: Design and test firmware integration and systems development of the connected cookstove	PCB and firmware working	Achieved: with 15 million+ records transmitted to the database, they are working well although there are some ongoing issues with fixing minor bugs
Activity 1.1.2: Design and test systems development including cooking event, fault event algorithm and if-this- then-that (IFTT) design	Systems development working	Achieved: Various tests have been achieved and the systems and integrations have been live for about two years.
Output 1.2: 500 base model stoves sold	Indicator 1.2.1: 500 base models sold	Achieved: 500 un-connected stoves were sold and a reference survey was made.
Activity 1.2.1: Deliver 500 of the base model with subscriptions to the customers	As above	As above
Output 1.3: 2500 connected stoves sold	Indicator 1.3.1 Reach 2500 households with the connected stove.	Achieved: 2504 internet-connected stoves were sold.

Outcome 1.2: Enhanced affordability and scalability: Improved operational efficiencies to further increase cookstove penetration/ scalability and sustainability	Indicator 1.2.1: Amount of funds leveraged: 1M EUR Indicator 1.2.2: Number of green business concepts tested: 2 Indicator 1.2.3: Number of new decent jobs created: 45	1.2.1: In progress: A Letter of Intent from a carbon broker, worth substantially more than 1M EUR is currently being discussed. 1.2.2: Partially achieved: One new green business concept was tested (the so-called "utility model") and is currently being rolled out. 1.2.3: Partially achieved: 42 new, decent jobs were created.
Output 2.1: Improved competitive intelligence and understanding of factors hindering or assisting scalability of clean cookstove business model	Indicator 2.1.1: Comparative market study	2.1.1 Achieved: a comparative market study was completed, which formed the basis for change of distribution model in 2.2.1
Activity 2.1.1: Planning of comparative study and sampling of targeted and onboarded users (baseline study)		Achieved: the baseline study was completed
Activity 2.1.2: Quantitative and qualitative data collection and analysis (in-field, USSD and remote monitoring)		Achieved: both user surveys completed and 15+ million data records collected
Activity 2.1.3: Evaluate relevant real-time data and qualitative information generated on clean cookstove usage as well as associated transaction costs in Zambia		Achieved: real-time data was evaluated
Activity 2.1.4: Complete comparative market study to increase, sustain and verify use by capturing, comparing user/system data and transaction costs associated with two cookstove and subscription models		Achieved: the insights from the data collected lead to a new distribution model
Output 2.2: Finalise business model for a cost-effective clean cookstove solution and subscription service involving the most advanced clean cookstove for customers in Zambia, including an improved customer service and sales		Achieved: The project has resulted in a "utility model" where ECS retains ownership of stove and customer must buy at least 1kg pellets per day, see flyer under "images". This is synonymous with a "cooking as a service" model.

agent distribution model and potential for neighbouring markets		
Activity 2.1.1: Design and development of revised business/customer service model and design of target cookstove interventions	Indicator 2.2.1: Revised business plan and marketing strategy for ECS	2.2.1: Achieved: Thanks to insights from the data, we have changed our distribution to a "cooking as a service" model.
Activity 2.1.2: Updated internal management systems for the new business model	Indicator 2.2.2 Uploaded CRM/ERP	2.2.2: Achieved: CRM and ERP completed
Output 2.3: Develop, publish and adhere to a comprehensive data management plan		
Activity 2.3.1: Data policy research, implementation, certification and auditing	Indicator 2.3.1: Documented and published data management plan	Achieved: The data policy has been developed and is currently being implemented.
Output 2.4: Key staff and sales agents at ECS trained on new customer service model and delivery of new clean cookstove business model is operationalised at ECS		
Activity 2.4.1: Training of staff, including call centre, customer service operatives and sales agents on new business processes and model	Indicator 2.4.1: Customer service and operational staff trained	Achieved: ECS has become a data-driven company, based on actual and real-time performance data. All relevant staff have been trained.

Annex 3 Pictures

The pictures are available at higher resolution at:

https://www.dropbox.com/s/9wgkv4qux3mypoj/NCF_C8_0428_Pictures.zip?dl=0

	
Reseller	*SupaMoto 5kg*
	
Supamoto 20kg	*Sales staff*
	
Customer	*Customer with family*

	
Reseller	*SupaMoto shop*

"Utility model" flyer:

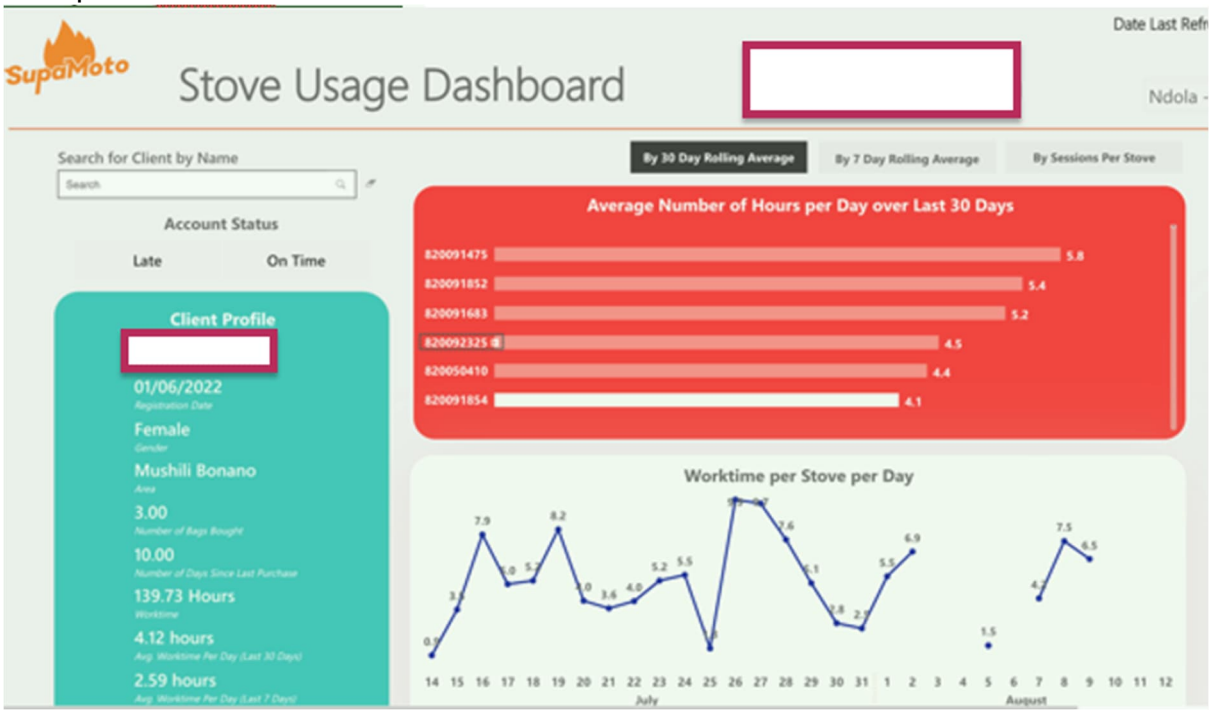
Annex 4 Other supplementary deliverables/documentation/links

Documents supplied separately (confidential)

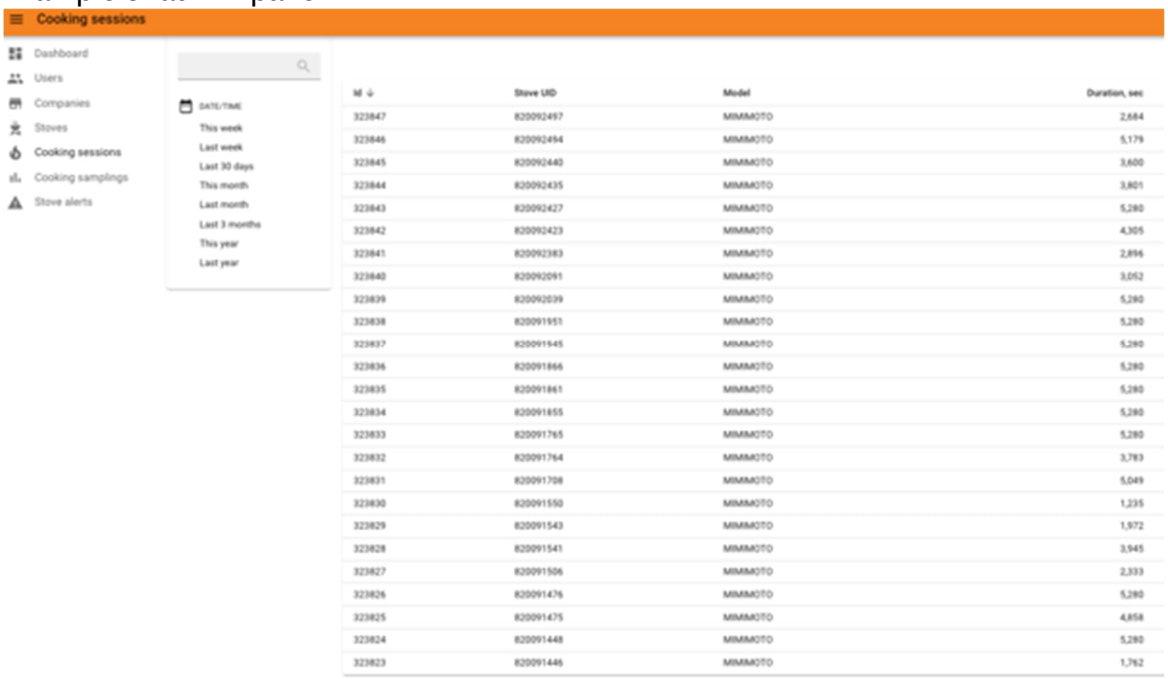
- Data Architecture diagram
- Letter of Intent with carbon buyer
- 60Decibel Impact Survey

For public version:

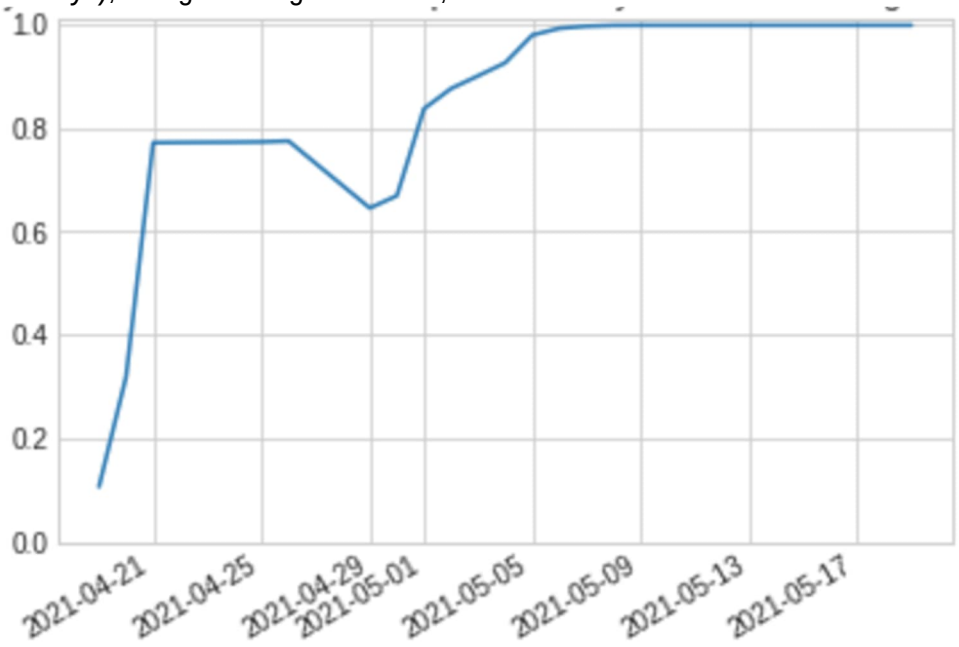
Example of PowerBI interface



Example of admin panel

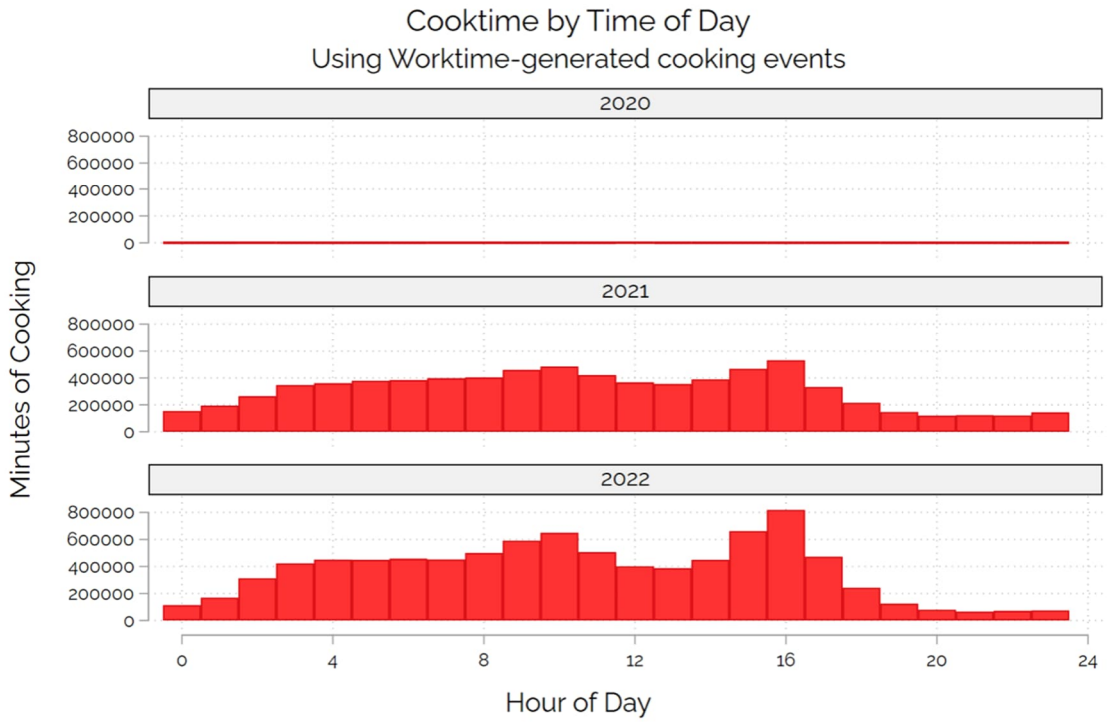


Example of predictive analysis (reach desired impact return for a specific stove ID within 30 days), using cooking time data, where 1 is close to certain.



Example of analysing cooking by time of day.
Note that times are in UTC so Zambia is +2: peaks predictably occur at noon and 6pm.

1. **Time of Day Cooking Patterns**
   a.



Annex 5 Impact story

Joseph

Joseph lives in Lusaka along with his children. He used to rely on charcoal and electric cookers to prepare meals for his household. However, the electricity crisis in Zambia was causing an inflation in the prices of charcoal and the costs of buying additional power, owing to shortages, were increasing. These factors pushed Joseph to seek an alternative method for cooking, preferably one that will not peak his electricity bills. That is why he decided to invest in a SupaMoto stove, and he has been using it for over 4 months now.

The stove allowed Joseph and his family to dramatically decrease their expenses as the country's struggle with the power cuts continued. To his delight, Joseph also realized that in the winter, the heated pellets from the SupaMoto stove can be used to heat the room. He started removing them from their chambers after cooking and placing them on the ground to cool off, heating the room in the process. He is also finding the cleaning process to be much more practical for SupaMoto than for the cooking equipment he was using previously. In addition to that, he is saving so much time as the cooking with SupaMoto does not need a long time to start, allowing him to do other things like reading, for example. As for the taste, Joseph reassured us that it did not change in the slightest.

Joseph is also very pleased with the increased safety, especially since he has children at home.

"It's safer. It's very, very safe because the way they are made, they don't emit heat through the sides of the stove, the heat only comes at the top where there's whatever you're cooking. So in terms of safety, yes it's much safer because, for braziers, you find that once you just get close to it, you may easily get burned, like the kids can easily get burnt but with SUPAMOTO, it's much safer."

The Covid-19 pandemic was hard on Joseph's household as his kids are young and needed to be looked after as they went into lockdown together. The global crisis made the availability of SUPAMOTO pellets scarce and the family could not change them as often as they needed.

Queen

Queen lives with her family in Lusaka, Zambia. She had bought the SupaMoto stove during the global Covid-19 pandemic that has greatly restricted the movement of people in Zambia. Queen has invested in the stove for the rainy season as she normally relies on charcoal to cook, which gets messy on rainy days.

Although she currently relies on both methods, charcoal and SupaMoto, she finds SupaMoto to be much faster as it does not take a long time to start, unlike charcoal. *"We really like it because it cooks really fast, and even if you're in a hurry to go somewhere, you quickly boil water to bath and you're good to go."*

Queen also finds SupaMoto to be much cheaper than charcoal. She mainly uses it to prepare tea, rice and nshima while relish she prepares using charcoal. Queen finds that preparing food is more practical using SupaMoto and cleaning it is easier too. Another aspect she likes about the SupaMoto stove is that it does not emit any fumes.