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EFFICIENCY FOR ACCESS RESEARCH AND DEVELOPMENT FUND: INNOVATOR SERIES

AFFORDABLE, SOLAR-POWERED IRONS FOR SUB-SAHARAN AFRICA

Irons are highly important for many people living in off- and weak-grid locations in Sub-Saharan Africa. Neat, ironed clothes enable people to work in professional environments. Further, ironing clothes helps to avoid potential health conditions. The adult mango fly, found in Sub-Saharan Africa, finds damp cloth an ideal place for laying its eggs. It often infests clothes that have been washed and then hung out to dry. This phenomenon is the most common cause of human myiasis (infection of fly larva in human tissue). An effective prevention strategy is to kill the eggs by ironing clothes.

In Sub-Saharan Africa, charcoal irons are the most commonly used irons. These irons use heated charcoal inside them, which becomes extremely hot and can burn people and clothes. They are expensive to run and pollute the environment. In addition, they are inefficient, making ironing time-intensive, and this burden usually falls on women and children.

To help create an alternative to the charcoal iron, Efficiency for Access Research and Development Fund supported Bboxx to develop a direct current (DC) iron that would be compatible with solar home systems. Bboxx's iron aimed to be efficient, durable, safe, and affordable, as well as reduce ironing time.

DID YOU KNOW?

Bboxx has helped over two million people gain access to clean and sustainable energy.

BBOXX'S LOW-COST, DC-POWERED IRON

Bboxx is a next generation utility company based in the UK and operates in 11 countries in Africa and Asia. The company aims to end energy poverty by designing, distributing, and financing different products that are off- and weak-grid-appropriate. Bboxx's core products are solar home systems, clean cooking solutions, financial services, and mobile phone connectivity.

BBOXX :

"The Efficiency for Access Research and Development Fund was key to the design and development of a low-cost and power-efficient iron for use with solar home systems. The Fund was essential for us throughout the research and development cycle."

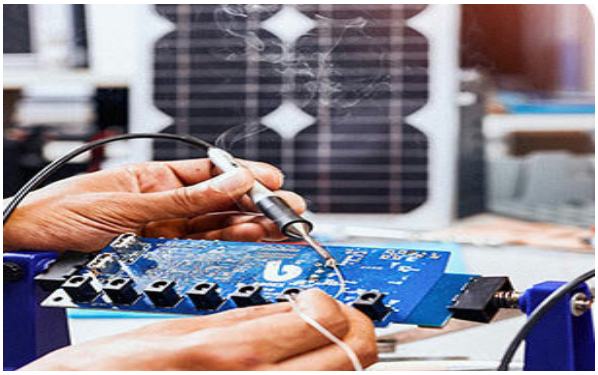
– Ulrich Reinecker, Director, Product Innovation

Bboxx aimed to develop a low-power, direct current (DC) iron, to replace traditional charcoal irons in Sub-Saharan Africa, which would be powered by its largest solar home system, the bPower300. Bboxx designed the iron with the following specifications:

- It would need to cost less than USD 30 for target customers.
- A need for multiple heat settings to choose based on fabric type, which would also help to manage the power consumption.
- The iron should automatically switch off to avoid causing an accident or fire.
- The power should be under 150W, to ensure compatibility with a solar home system and guarantee customers a reliable user experience.
- The iron should be durable and have a lifetime of at least two years to ensure customers do not have to keep buying a new one.
- The iron should be at least eight inches in length to ensure effective ironing.
- The iron should have a cord more than 1.5m for a good user experience when ironing.
- The iron must reach a temperature of at least 150°C so that clothes are ironed properly.

DESIGN AND DEVELOPMENT PROCESS

Before the initial design of the iron, Bboxx conducted human-centred design research in Goma, Democratic Republic of Congo (DRC), to target customers' needs and inform the design process. Engineers visited customers and asked questions about their ironing habits, as well as watching them iron with their own charcoal irons and use an electric sample provided by Bboxx.



Bboxx then worked with a supplier to design and 3D-print prototypes that could be integrated with the bPower300 solar home system, for user feedback and testing. Based on the feedback from the samples and technical testing in the lab, Bboxx created several iterations of the iron before finalising the design. This design met the user, technical and certification requirements.

The supplier produced several samples through 3D printing that were used for quality testing, customer feedback and pre-certification testing. Some of the samples were sent to DRC to collect initial customer feedback. This feedback led to a significant redesign of the iron to make the base larger, ensure it heated up quickly enough, and make the user interface (dials) easier to understand.

Through continuous improvement, the final iron sample met key user requirements. These were:

- Power – a consumption of 140W at 200°C
- Usability– 3 energy settings with easy-to-understand dials
- Efficiency – 8 inches and auto switch off
- Affordability – Final sample was quoted at USD 20.1 per piece.

WHAT DID WE LEARN?

The need for reliable suppliers with a desire to create DC irons

Issues with suppliers and quality testing significantly delayed the project timeline. During the project, Bboxx also looked to change suppliers but found that the nascency and complexity of the market resulted in reluctance to enter it. Bboxx are in the process of engaging new suppliers in order to move forward with finalising its product and scaling it as a commercial appliance. This project highlighted the importance of having a fully-committed supplier onboard as key to commercialisation.

Quality testing is essential to ensuring the viability of the iron and the safety of customers

After the initial designs were tested, Bboxx produced revised designs and performed quality testing on the irons, with the plan to produce irons after these tests had been carried out. However, during the testing, Bboxx encountered two quality issues: enclosure safety failure and power cable supply failure.

It found that the enclosure material could not withstand heat at the maximum operating temperature of ~200°C, which presented a safety hazard for end users. The issue was not identified during the design stage because Bboxx had used 3D printed samples. It also found that the power cable heated up, which was unsafe for end users to touch.

Even after going through four sample revisions, Bboxx still encountered these quality issues. Interactions with the supplier, coupled with the recurring quality issues, hindered Bboxx from advancing to production of the iron units. Bboxx is working independently on incorporating new materials into its irons following the results of the quality testing.

There is significant demand for an off-grid, electric iron

In Bboxx's human-centred design research in DRC, it found that there was a significant interest in DC off-grid irons. 30% of customers surveyed displayed interest, not only in the iron itself, but also the pricing and PAYGo options. The fact that customers were interested in the business model, as well as the innovation, means that these customers could be engaged and used as sales agents in the future.

STEPS TO CREATING A MARKET-READY DC IRON.

Integrating new materials

In future iterations of this iron, Bboxx intends to replace existing materials that did not meet the safety requirement for different ones. The enclosure material will be changed to polycarbonate, which is Underwriter Laboratories-certified for high heat ratings. The power cable will also be covered with a polyvinyl chloride heat shrink to stop it from heating up. These new materials should produce an iron that is safer and passes quality testing.

Re-developing the bPower300

The bPower300 – Bboxx's largest solar home system that aimed to be used with the iron – is currently being redesigned to meet the power consumption requirements of the iron product. Bboxx is conducting market testing in Kenya for the bPower300, as well as mini-grid pilots in Togo and DRC. This will enable the bPower300 to meet all user requirements. Bboxx is also currently looking to identify two alternative suppliers, which could make production significantly faster.

GET IN TOUCH:

EforAgrants@est.org.uk