

## **End of project popular science description: Governing solar electronic waste in Kenya**

### **Introduction**

Since 2010, the market for off-grid solar photovoltaic (PV) systems has grown steadily, reaching cumulative sales of around 130 million solar devices in 2017. Recent reports estimate that the total number of customers having purchased an off-grid solar PV system in 2022 amounted to a total of 493 million, a number that is expected to continue to grow in the coming years. The sale of off-grid solar systems is concentrated geographically in Sub-Saharan Africa, especially in East Africa, where Kenya is the leading country in terms of the number of units sold. The growth of the off-grid solar PV market plays an important role in providing Africa's rural population with access to sustainable and affordable sources of energy.

However, given the increasing number of units sold, the amount of solar electronic waste (e-waste) being generated and disposed of is increasing at a similar pace. In Kenya, around 700 tonnes of solar e-waste were discarded in 2016, a figure that was expected to reach 3,800 tonnes in 2020. A similar picture is evident across Africa: the total estimated amount of solar e-waste generated in Sub-Saharan Africa was 12,000 tonnes in 2020, a 545% increase from 2016. These estimates have raised concerns about the overall environmental sustainability of the off-grid solar industry, since the systems contain various hazardous materials, such as lead, cadmium, mercury and sulfuric acid, which may cause serious adverse effects on both humans and the environment.

Given the limited research on solar e-waste in Sub-Saharan Africa, the project aimed at improving the understanding of current e-waste management practices along the value chain for solar PV systems, including the role of companies selling the products, investors, households and local repair shops. The knowledge generated in the project was designed to inform regulation and private sector initiatives aimed at improving the collection and recycling of solar e-waste, which was ensured through close interaction with key public and private stakeholders throughout the project.

The project was carried out through close cooperation between the Technical University of Denmark, University of Nairobi and Kenyatta University. A number of private partners were also involved in the project, including Stena Recycling, Recykla International, Kenya Private Sector Alliance (KEPSA) and H-D Global Development Advisors.

### **Results**

The research undertaken in the project shows that e-waste management is not a main priority for the companies selling the solar PV systems. Since the companies are start-ups, their main focus is on creating commercially viable businesses. Their main approach to waste management mainly involves repairs and replacement of defective components within the warranty period, which is typically of one to two years. The company managers consider efforts aimed at improving waste management beyond the warranty period to be an added cost, which could jeopardize the development of their businesses.

Furthermore, the research shows that when off-grid solar PV systems break down at home, they take on different trajectories. Specifically, a survey conducted in the project with 525 households with broken systems shows that 25% of the latter have actually been repaired and are functional, and that a high share (60%) of those that are taken in for repair end up being repaired and remain functional. However, of the non-functioning off-grid solar PV systems, about 72% are stored at home, also referred to as 'hibernation', and only 8% are deposited in landfills by consumers. The remaining 20% of broken systems are handled by the formal and informal repair shops, partly as waste and partly being used as spare parts for repairs. The

research highlights that hibernation of broken solar PV systems in the households of the customers is occasioned by a number of economic, cultural and symbolic meanings.

## **Conclusions**

In order to avoid the potential risks to their reputations, investors are increasingly encouraging the companies selling the solar PV systems to strengthen their efforts to improve e-waste management. Nevertheless, these efforts have not resulted in changing companies' business practices. Furthermore, the companies are not subjected to pressure to comply with national e-waste regulations, which could potentially contribute to changing the status quo. In the meantime, the hibernation of broken solar PV systems in the households of the customers has become an unintended and temporary 'solution' for waste management, in addition to the local repairing or recycling of the systems.

## **Recommendations**

The government of Kenya has recently introduced regulation adopting the principle of extended producer responsibility (EPR), which could potentially contribute to improve solar e-waste management. For the EPR regulation to be effective, we recommend clarifying what the consequences will be in case the suppliers fail, individually and collectively, to collect and process as much e-waste as they bring to the market. Moreover, we suggest that incentives for repair are strengthened by including repair in the EPR compliance rates and that economic support is provided for increasing the capacity of local repair shops through training and certification schemes. We also recommend that the overall cost of implementing the EPR regulation is reduced by integrating the informal sector via lenient, non-bureaucratic means of gradually formalizing and legalizing formerly informal activities.

We recommend that investors in the off-grid solar market should allocate resources specifically dedicated to e-waste management that goes beyond the warranty periods and establish stricter monitoring and compliance mechanisms for end-of-life e-waste management. In turn, we suggest that companies selling off-grid solar PV systems should extend warranty periods to ensure a greater degree of e-waste collection and repairs while providing finance to repair devices under the same conditions as finance for new devices in order to encourage repairs rather than selling new devices. Furthermore, the companies should develop products that can easily be reassembled and repaired and make spare parts available for informal technicians to carry out repairs of branded devices out of warranty.

Lastly, we recommend that donors and international organizations should provide additional funding aimed at training technicians in the informal repair sector and develop a proper infrastructure for the handling and recycling of solar e-waste.