A2E
ACCESS TO ENERGY INSTITUTE

Making Nigeria generator free: The "Solar Killed the Generator Star" Project by the Access to Energy Institute (A2EI)

With less than 5GW of capacity on the grid, Nigeria is experiencing a substandard delivery of energy which is constraining economic growth and development. In parallel, it is estimated that at least 25 million small fuel powered generators of less than 2 kWp are providing for a back-up energy access infrastructure[1]. This represents the equivalent of at least 25GW of 100% fossil fuel based energy infrastructure, which is mainly powering lights, fans, TVs and productive use appliances in households, small shops and smallholder agricultural settings.

Generators: noise, fumes and carbon emissions

It is estimated that around 100 million liters of fuel are needed daily to run Nigeria's generators[2]. The associated emissions are estimated to be around 85 million tons of CO_2 a year[3]. The massive climate implications are compounded by further negative side effects of generators, as summarized in the graphic below. Generators are not a satisfactory solution to Nigeria's energy crisis. They are, however, currently the only available technology to ensure energy access when the grid is down.

[1] https://nairametrics.com/2018/10/25/generating-set-brands-in-nigeria/ estimates the number to be as high as 60 million. We take a conservative approach with 25 million.

[2] Interviews we conducted with business owners in Abuja and Lagos indicated an average of 4 to 5 liters of fuel was used on a daily basis. 25 million generators hence consume around 100m liters of fuel a day.

[3] The specific emission factor for gasoline was taken from https://www.eia.gov/environment/emissions/co2_vol_mass.php

One possible solution: the solar generator

The devices and appliances typically powered by small generators can of course technically be powered by a solar system. However, and mainly because the solar generator seems more expensive than the fossil fuel generator, no suitable solar substitute has scaled in the Nigerian market yet – despite the obvious demand and the huge potential for noise, fume and CO_2 emissions reduction.

This is why the Access to Energy Institute (A2EI) has decided to dedicate its core resources to work on providing a standalone solar generator to substitute the "betta pass my neighbor[4]" fuel generator within the next two years. We call the project "Solar Killed the Generator Star" and have kickstarted it in Nigeria in April 2019.

We firmly believe the A2EI can develop a solar generator that:

- technically does what a traditional fuel generator does,
- avoids noise, fumes and CO_2 emissions, and
- is affordable.

Initial goals of the "Solar Killed the Generator Star" Project in Nigeria

As a not-for-profit organization, the A2EI strives to share all the information it is gathering with like-minded innovators (be they commercial players or not) in the offgrid solar sector. We explicitly invite partners interested in how to reduce the fossil fuel footprint in the energy access sector in Nigeria to join our efforts.

Initial market research in Nigeria has confirmed that there is a pressing need for generator replacement. Despite cheap subsidized fuel, nobody "wants" a generator. The perspective of a clean and affordable alternative gets a lot of support from literally all the small business owners we have met over the past weeks and months.

Data gathering – research study "The Economics of the Generator"

There is very little reliable data on the exact number of small fuel generators in Nigeria. Depending on the source, the number varies from 18 to 60 million. Also, there is little publicly available open source data on how generators are actually used (how often, how long, to power which appliances, fuel consumption, at what cost etc.)

In a first step, the A2EI has developed special data loggers equipped with a SIM card that can be plugged onto a generator (without impacting its usability) or the grid and that will generate real time 24/7 data series on grid availability, generator usage patterns, consumption, CO_2 emissions and real costs. About 150 of these data loggers have already been installed in Nigeria (Abuja, Lagos and Kano) in April and May 2019. In addition to smart meters, we have also installed air quality monitoring devices that log data on CO, CO_2, NO_2, SO_2, VOC, PM 2.5 etc. Also, noise meters measure the noise pollution emanating from the generators.

To our knowledge, this breadth of data has never been gathered nor made available to interested parties. We believe this is one of the reasons why no suitable solution to generator replacement has been made available to date.

[4] Small generators are popularly known as "I betta pass my neighbor" in Nigeria. https://nigerianprice.com/tiger-generator-price-in-nigeria/

The technical data on what generators do is the prerequisite to calibrate and dimension an adequate solar system. Without exact usage and consumption data, the designing of solar solutions was mostly guesswork. From our observations on the ground, most current solar alternatives are over-dimensioned and too expensive. We hope that the data we will be putting in the public domain will help to unlock the necessary innovation to "invent" and built a solar replacement.

The data will be made available through the website of the Access to Energy Institute (www.a2ei.org/data). In parallel to gathering "technical" data, we are currently interviewing hundreds of households and shop owners that are using a generator regarding their usage patterns and costs etc.

Both data sets we hope will serve as a benchmark to launch a broader and more intensive discussion on how to switch an entire energy access sector from fossil fuels to solar, possibly not only in Nigeria.

At the same time, and based on the data and insights generated, our engineering team is building several prototypes of solar generators (different battery technologies and sizes) that will technically be in a position to substitute for a small generator. These prototypes will be developed and refined in an iterative manner with test customers. A larger pilot project with a few hundred solar generators will help to demonstrate the viability of solar generators substituting and replacing fossil-fuel generators.

If you are interested in getting access to the data gathered on the usage of generators in Nigeria, please register with your email here: www.a2ei.org/data

About the Access to Energy Institute (www.a2ei.org)

The Access to Energy Institute (A2EI) is aiming to be the not for profit, collaborative and innovative research institute for all companies that are active in the solar energy access and Pay-as-you-go (PAYG) market.

Its remit is to pool product innovation and market introduction industry resources. It will efficiently co-develop, test and bring to market the much-needed household appliances and small business/agriculture hardware and services – such as productive use appliances that can be run with solar energy on a PAYG basis. The availability and massive scaling of these appliances will increase the quality of life of families living off the grid and help generate and secure hundreds of thousands of sustainable jobs in infrastructure-poor environments.

The A2EI is ideally the breeding ground for a collaborative PAYG ecosystem. The increasing participation of other PAYG companies, financiers, strategic partners, institutes, academic institutions etc. will be key to give the A2EI the required critical mass.

The fact that the A2EI is shielded from commercial return expectations will hopefully provide the creative and innovative environment needed to swiftly deliver a range of "solar machines" for households, small scale businesses and smallholder farmers.

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