

Bottle
houses: using
waste materials
for sustainable
homes

Using waste materials for sustainable homes



Project

Developing local capacity for building affordable, self-sufficient homes

Awardee

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¹ UN News (2017). Affordable housing key for development and social equality, UN says on World Habitat Day. <https://news.un.org/en/story/2017/10/567552-affordable-housing-key-development-and-social-equality-un-says-world-habitat>

Challenge

Access to safe and affordable housing is a global challenge with more than 1.6 billion people worldwide living in slums, informal settlements or inadequate homes¹. In Nigeria, homes of low-income communities are often low quality and made of mud bricks, which can fall down after several years. Such communities are also plagued by plastic and agricultural waste that is not cleared due to a lack of waste collection services. The waste is often incinerated, leading to a further reduction in living standards. This project offered an opportunity to address both problems at the same time and develop local capacity to construct low-cost, sustainable homes in such communities.

Project solution

A team of engineers and architects from the UK and Nigeria explored the possibility of upcycling materials to use as a low-cost building material in residential construction in the low-income community of Paipe, Nigeria. The team looked at materials such as plastic bottles and agricultural by-products, which are usually thrown away as waste. The engineers tested the structural potential of local waste and investigated the energy and water components required for a self-sufficient building. They also engaged with local members of the community and stakeholders to understand the specific

requirements of housing within the community. Through this engagement the team was able to design and build a prototype self-sufficient home made from locally engineered materials.

Interdisciplinary collaboration

A significant portion of the project was dedicated to collaborating with stakeholders and involving them in the design and construction of homes. The researchers understood that it was paramount that the prototype home was socially accepted by the local community. As such, they conducted interviews and focus groups with 11 households in the community, including residents, local builders and the community chief. Participants were also invited to feedback on prototype designs. By engaging the various expertise of academics, policymakers, community members and construction workers, the researchers were able to co-design a universally beneficial model for a home and raise local awareness of sustainable construction methods.

Sustainable development goals



Impact

The team has built a prototype home using upcycled plastic bottle walls and integrated in-house electricity generation and water purification systems, at 35% of the cost of a conventional building. The researchers also offered training opportunities for young engineers, bringing 20 students and three academics from the UK to Nigeria on a capacity building trip. The team worked with two local academics, eight construction workers and 10 local students during the engineering process to build local knowledge about sustainable construction methods. The design has been widely accepted by the community and the prototype has been visited by over 200 people, including the Housing Committee Chair, Electricity Agency and representatives of the Federal Ministry of Science and Technology. Through this engagement the researchers gave the people of Paipa a solution that can be used time and time again.

Future plans

Following such a positive response from the community the researchers are now seeking funding to enable them to further improve the design of the prototype. As well as making the houses fire retardant and safer, the team is now looking to create eco-bricks made out of plastic bottles that will be shaped like conventional

bricks. This would make the designs more accessible to a larger number of construction workers and enable many more community groups to use such materials for their homes.



“The Frontiers project has been highly instrumental in progressing my research career. It has connected me to people who are also committed to applying their work in developing countries, and I have developed close relationships with many of them.”

Muyiwa Oyinlola, De Montfort University

Funding

The eight-month long project was awarded £20,000 by the Frontiers of Engineering for Development Programme in 2016.



Three academics and 20 students from the UK went to Nigeria on capacity building trip



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For more information, including eligibility, please visit raeng.org.uk/frontiers and follow [@RAEngGlobal](https://twitter.com/RAEngGlobal)

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