

Biogas Innovation: Turning Waste into Clean Energy and Green Jobs

For decades, Nigeria has battled with the challenges of waste pollution and energy shortage. Every day, tons of organic waste from households, markets, businesses and farms are left unused and rot. This releases greenhouse gases into the air, which greatly contributes to environmental pollution, health issues and low economic growth. At the same time, millions of Nigerians still lack access to clean cooking fuel and reliable electricity, forcing many to rely on firewood, kerosene, and expensive cooking gas. This heavy dependence on fossil fuels has deeply contributed to deforestation, high cost of living, and climate change. Also, this cycle of energy scarcity and environmental challenges has also made it harder for Nigeria to achieve its climate goals under the Nationally Determined Contributions (NDC), National Adaptation Plan (NAP), and Long-term Low Emission Development Strategy (LT-LEDS). If care is not taken, Nigeria's energy crisis and environmental problems will keep getting worse, but one promising solution to these challenges is Biogas Technology. Inspired by Sweden's success in biogas production, this project introduces a **small-scale bio-digester to convert organic waste into clean energy (biogas) and organic fertilizer (bio-slurry)**, offering an affordable and sustainable solution to both energy and agriculture.

Biogas is a form of renewable energy, produced from the breakdown of organic waste, such as food waste, agricultural residues, and animal manure, in a bio-digester where anaerobic digestion takes place. This process not only produces biogas for cooking and electricity but also generates bio-slurry, which can be used as a natural fertilizer to improve soil health and boost agricultural productivity. The adoption of biogas technology has been widely successful in Sweden, a country strongly known for its global sustainability leadership, with over 83.3% of its energy coming from sustainable sources, has integrated biogas into its transport, industry, homes and farming sectors, proving that waste-to-energy solutions can drive national sustainability. Farmers now rely on bio-slurry instead of chemical fertilizers, improving soil fertility and reducing costs. If Sweden, with a much smaller agricultural sector, can maximize biogas as a clean energy source, then Nigeria with its numerous wastes and rich agriculture has greater opportunity to leverage biogas to gain energy security, environmental protection, and economic growth.

Therefore, a small-scale biodigester, which this project promotes, is a low-cost and adaptable system that converts organic waste into clean energy and organic fertilizer. The process includes: Feeding the waste into an airtight biodigester, allowing micro-organisms to break down waste that will produce methane gas (biogas), testing the produced gas for purification in the lab, before collecting the gas for cooking, heating or generating electricity, as well as extracting the organic fertilizer which is the by-product (bio-slurry) for farming. The best part about this system is that it is simple, affordable, uses local available materials (plastic tanks, pipes), requires minimal maintenance, and provides a continuous source of energy as long as there is a supply of organic waste.

In rural areas, farmers can use animal manure and crop waste to generate biogas for cooking and electricity, and bio-slurry to enrich their farmlands. While in urban areas, restaurants, markets, and food processing industries can adopt biogas to reduce waste pollution and lower fuel costs. Unlike solar or wind energy, biogas works 24/7 because waste is constantly being generated, making it a stable and reliable renewable energy source.

Beyond providing clean energy, biogas presents an opportunity for job creation and economic growth, particularly for young entrepreneurs and women. Nigeria has a high youth unemployment rate, and biogas entrepreneurship can provide sustainable business opportunities in areas such as: Biogas Production, Sales and Distribution, Bio-digester Installation and Maintenance, and Waste Collection for Biogas, so as to activate young entrepreneurs who can set up biogas refill stations for the purchase of clean energy, skilled professionals offering installation, repair, and maintenance services for biogas systems, and businesses that establish waste collection networks where organic waste from markets, farms, and restaurants is gathered and converted into clean energy. Sweden's biogas success story shows that investing in biogas entrepreneurship leads to a self-sustaining green economy, and Nigeria can replicate this model by funding biogas startups, offering training programs, and integrating biogas into national energy policies.

Even though biogas has numerous benefits and potentials in Nigeria, there are still a lot of challenges that will hinder the success and implementation of it, and one of the biggest challenges is the lack of biogas awareness. Many people are unfamiliar with biogas systems and how they work, and that's an issue. Another challenge is the initial set-up cost. Even though it is affordable, it can be expensive for low-income communities. And most importantly, weak government policies and lack of financial incentives will also make it difficult for biogas businesses to scale. So to solve these problems, education and awareness campaigns must be launched to teach communities, farmers, and businesses about the benefits of biogas technology. The government should provide subsidies, grants, and low-interest loans to support startups and small businesses in the biogas sector. And public-private partnerships should also help in expanding biogas adoption, similar to what has been done in Sweden. If these solutions are implemented, biogas can become the major source of energy in Nigeria, reducing fossil fuel dependence while creating sustainable economic opportunities.

Ban Ki Moon once said that "Energy is the golden thread that connects economic growth, social equity, and environmental sustainability." and biogas is a practical, scalable, and economically feasible solution that addresses Nigeria's energy crisis, waste pollution, and youth unemployment. And with the numerous waste produced in our communities each day, Nigeria can leverage biogas technology to provide clean energy, boost agriculture, and create green jobs. With the right policies, funding, and awareness, biogas can empower young entrepreneurs, support food security, and position Nigeria as a leader in clean energy innovation. **Waste is only waste if we waste it**, so the time to act and embrace biogas is now, for it is the future of sustainable clean energy and green entrepreneurship in Nigeria.