BUSINESS PLAN FOR SUSTAINABLE WASTE TO ENERGY: PRODUCTION AND CHARACTERIZATION OF BIOMASS-LDPE WASTE NUGGETS AS AN ALTERNATIVE FUEL

BRIEF OVERVIEW

This business plan presents a sustainable energy project focused on converting agricultural residues (rice husk and straw) reinforced with low-density polyethylene (LDPE) waste into clean-burning solid fuel nuggets through torrefaction technology.

The project addresses two critical environmental issues in Nigeria:

1. Poor waste management of agricultural and LDPE residues.
2. Dependence on expensive, polluting fuels such as firewood and charcoal.

The product, biomass-LDPE fuel nuggets offers a renewable, affordable, and efficient energy source for blacksmiths, bakeries, small foundries, and rural households.

Project Goal:

To establish a pilot-scale torrefaction facility producing 1 ton/day of biomass-LDPE fuel nuggets, with plans for scaling through green-energy partnerships and local government programs.

Funding Requirement: ₦23 million
Expected Annual Revenue: ₦16 million
Net Profit: ₦10 million
Payback Period: 3–4 years

PROBLEM STATEMENT

Nigeria generates over 10 million tonnes of agricultural residues annually and hundreds of thousands of tonnes of LDPE waste.

These wastes are often burned or dumped, causing:

1. Air pollution (CO_2, VOCs, particulates).
2. Soil and water contamination.
3. Public health risks.

At the same time, rural industries and households face fuel shortages and rising energy costs. Transforming these wastes into renewable solid fuel offers a dual solution waste reduction in sustainable energy access.

BUSINESS OPPORTUNITY

Market Demand:

1. Blacksmiths, bakeries, small manufacturing units, and rural households require steady and affordable solid fuel.
2. Nigeria's renewable energy sector is expanding, supported by government incentives and SDG-aligned funding programs.

Competitive Advantage:

1 Uses locally available, low-cost raw materials.
2 Higher calorific value (> 7,000 kcal/kg) than raw biomass.
3 Lower emissions and longer burn duration than charcoal.
4 Eco-friendly and suitable for small-scale industrial use.

Market Reach: Initial operations target Nigerian Market (Enugu and surrounding states) with scalability to other rice-producing African regions.

BUSINESS MODEL

Revenue Source:

Sale of torrefied biomass-LDPE nuggets to:

1. Local forges and foundries (bulk buyers).
2. Bakeries and food processors.
3. Rural and semi-urban households.

Pricing: ₦80,000 per ton.
Production Capacity: 200 tons/year at pilot stage

Distribution:

1. Direct sales to industries and through regional distributors.
2. Partnerships with rural energy cooperatives, and environmental agencies for outreach.

OPERATIONS PLAN

Location: Nigeria.

Facility: 1 ton/day torrefaction plant.

Technology: Torrefaction process at **250–300 °C,** under limited oxygen, producing carbon-rich, dense nuggets.

Equipment Needed:

1. Biomass grinder
2. Torrefaction machine
3. LDPE waste shredder
4. Oven
5. Cooling and packaging units

Personnel:

1 Process Engineer, 2 Technicians, 1 Quality Analyst, 1 Operations Manager, 1 Sales Officer.

Raw Materials:

1. Rice husk and straw from local mills
2. LDPE waste from scavengers and urban recycling centers

FINANCIAL OVERVIEW (₦)

Category	**Estimated Cost (₦)**
Equipment & Installation	13,000,000
Facility Setup & Utilities	5,000,000
Working Capital	5,000,000
Total Capital Requirement	**35,000,000**

Operational Summary:

Item	Value (₦)
Annual Operating Cost	6,000,000
Annual Revenue	16,000,000
Gross Profit	**10,000,000/year**
Net Profit Margin	**≈ 62 %**
Payback Period	**3–4 years**

Funding Sources:

1. Government renewable energy grant programs (RAMP, FMEnv, NESP).
2. Private impact investors and green-energy funds.
3. Partnerships with agricultural cooperatives for supply and distribution.

ENVIRONMENTAL & SOCIAL IMPACT

1. Diverts tons of plastic and agricultural waste from open burning.
2. Reduces CO_2 and methane emissions.
3. Creates local employment in waste collection, processing, and distribution.
4. Promotes rural industrialization and energy access.
5. Aligns with SDGs 7, 12, and 13 (Clean Energy, Responsible Consumption, Climate Action).

IMPLEMENTATION TIMELINE

Phase	Activity	Duration
Phase 1	Feasibility study and design validation	1 month
Phase 2	Equipment procurement and fabrication	2 months
Phase 3	Site setup and installation	1 month
Phase 4	Pilot production and quality testing	2 months

Phase	Activity	Duration
Phase 5	Commercial launch and marketing	2 months

Total Duration: 8 months to full operation.

RISK MANAGEMENT

Risk	Impact	Mitigation
Irregular feedstock supply	Production disruption	Long-term contracts with rice mills and recyclers
Equipment breakdown	Downtime and loss	Preventive maintenance, local fabrication of parts
Market fluctuation	Reduced profitability	Product diversification, forward contracts
Regulatory delay	Implementation delay	Early liaison with NESREA and state environmental agencies

CONCLUSION

The Biomass-LDPE Fuel Nugget Project is financially viable, environmentally sustainable, and socially beneficial. It presents a compelling opportunity for grant funding and green investment, with measurable impact on energy access, waste management, and local economic growth.

Requested Funding: ₦23 million
Anticipated Return: ₦10 million profit annually
Project Duration: 8 months to commissioning