BUSINESS PLAN FOR A BIOGAS UNIT (BGU) IN GREENHOUSE FARMING

1. PROJECT SUMMARY

INTRODUCTION

This system, equipped with an integrated heat cogeneration unit from a gas generator, is capable of fully meeting the energy demands of a greenhouse complex. A 1000 m² greenhouse, fitted with an autonomous biogas unit (BGU) featuring an integrated gas and heat cogeneration system (GHCS) and covered with multi-chamber polycarbonate (8–10 mm thick, with a thermal conductivity of approximately 0.25 W/(m²·K)), ensures minimal heat loss and high energy efficiency. However, to guarantee reliability and stability during temporary disruptions (e.g., fluctuations in raw material supply, maintenance, or unforeseen circumstances), backup energy sources must be considered.

Project Budget: Implementation of a BGU in the greenhouse farm: **~20,000 USD (≈260,000,000 UZS)**

Objective: To establish an autonomous biogas unit (BGU with an integrated GHCS) for a 1000 m² greenhouse that will provide the facility with its own gas, heat, and electricity by processing local raw materials (manure, poultry droppings, plant, and food waste).

Additionally, the production of digestate as a by-product, which is converted into biohumus, will be included. The current market price for biohumus is **35 USD per ton** (net price after tax is ~31.5 USD/ton, or approximately **455,000 UZS/ton**).

Key Advantages:

- Autonomous energy supply, reducing purchased energy costs by **50–70%**.
- Additional revenue from biohumus sales.
- **24/7 year-round operation.**
- **Payback period: 3–5 years** (faster with preferential financing).

Strategic Benefits: The project is a strategic step toward establishing an **energy-autonomous, environmentally friendly, low-carbon, profitable, and investment-attractive business.**

---

2. PROJECT DESCRIPTION

The project includes the following key elements:

- **A micro-biogas plant (BGU)** with an integrated **cogeneration system** (GHCS) to supply a **1000 m² greenhouse** with its own energy resources.
- **Utilization of local raw materials** (manure, poultry droppings, plant, and food waste), ensuring stable operation.
- **Production of digestate**, which is converted into biohumus and sold at market rates.
- **Technical specifications:** Generation capacity **15–30 kW**, reactor volume **50–100 m³**.
- **Operation:** Autonomous energy supply supporting greenhouse **lighting, air conditioning, and heating**.
- **Budget: 20,000 USD (≈260,000,000 UZS)**.
- **Economic benefits:** Significant savings on energy costs, additional revenue from biohumus sales, reduced costs for chemical fertilizers.

---

3. REGIONAL CHARACTERISTICS

- **Climate (Uzbekistan):**
    - Winter temperatures can drop below **0°C**, requiring efficient heating.
    - Summer daytime temperatures reach **+35…+40°C**, nighttime temperatures around **+20°C**, necessitating a cooling system.
- **Raw Material Base:**
    - **Abundant organic waste** due to developed livestock farming (cattle, poultry, swine), crop farming, and food processing industries.
- **Tariffs (2024):**
    - Electricity: **~1000 UZS/kWh (≈0.08 USD/kWh)**

- Natural gas: **~1800 UZS/m³ (≈0.14 USD/m³)**
- Exchange rate: **1 USD = 13,000 UZS**

---

4. ENERGY DEMAND ANALYSIS FOR THE GREENHOUSE COMPLEX

- **Heating (Winter Needs):**
  - To maintain an internal temperature of **+15…+20°C**, approximately **100 W/m²** is required, resulting in a peak load of **100 kW** for a **1000 m²** greenhouse.
- **Cooling (Summer Needs):**
  - Cooling requirements amount to **~40 W/m²**, or a total demand of **40 kW**.
- **Electricity Generation:**
  - A **gas-piston unit** with a capacity of **~0.4 MW**, operating at **40% efficiency**, produces approximately **160 kW of net electricity**, fully covering greenhouse needs and providing reserve capacity.

---

5. RAW MATERIALS FOR BGU

Types of Raw Materials and Biogas Yield

Raw Material	**Biogas Yield (m³/ton)**
Cattle Manure	20–25
Poultry Droppings	60–70
Swine Manure	20–25
Plant Waste	30–60
Food Waste	50–100

Estimated Feedstock Composition (5 tons/day)

Raw Material	% of Mass	Mass (tons/day)	Estimated Biogas Yield (m³/day)
Cattle Manure	40–50%	2.0 – 2.5	40–62.5
Poultry Droppings	10–20%	0.5 – 1.0	30–70
Plant Waste	20–30%	1.0 – 1.5	30–60
Food Waste	10–20%	0.5 – 1.0	25–100

---

6. CASH FLOW ANALYSIS (5-YEAR PROJECTION)

Indicator	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
CAPEX	-20,000 USD	0	0	0	0	0
Annual Revenue & Savings	0	20,000 USD	20,000 USD	20,000 USD	20,000 USD	22,000 USD (including residual value)
Operating Expenses (OPEX)	0	-12,000 USD	-12,000 USD	-12,000 USD	-12,000 USD	-12,000 USD
Net Cash Flow	-20,000 USD	+8,000 USD	+8,000 USD	+8,000 USD	+8,000 USD	+10,000 USD

---

7. CONCLUSION

This business plan demonstrates that **a 20,000 USD investment in a compact biogas unit with a cogeneration system can provide a 1000 m² greenhouse with self-sufficient energy**, significantly reducing operational costs and generating additional revenue from biohumus sales. The project represents a **strategic step toward creating an energy-autonomous, eco-friendly, and profitable agribusiness.**