

NATIONAL POLICY PAPER

From Installation to Sustained Value

A National Policy Framework for Biogas, Bio-CNG and Circular Agriculture in Bangladesh

THE POLICY SHIFT

Public and concessional finance should purchase sustained energy service, verified methane avoidance and marketable agricultural value, not equipment alone.

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Prepared as a strategic brief for government, financial institutions, development partners and private-sector implementers

Purpose and Evidence Status

This paper converts a project-level biogas case study into a national policy framework. It combines three supplied evidence streams: Project Green Flame Phase I, the Farming Smart Model Village (FSMV) example from Dhontola, Rangpur, and a pre-feasibility investment note for an integrated Bio-CNG and granulated organic fertilizer platform. It also mines Bangladesh Bureau of Statistics (BBS) Economic Census 2024 data and selected official public sources.

Read the evidence labels carefully

Green Flame and FSMV figures are drawn from project material supplied for this assignment unless otherwise stated. They are useful for design analysis, but installation, income and sales claims should be independently verified before public attribution. Industrial Bio-CNG figures are pre-feasibility assumptions, not operating results.

The paper is not a feasibility study for a specific site. It sets the national rules, data requirements and institutional architecture needed before household, cluster or industrial models are scaled.

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Executive Summary

Bangladesh has accumulated substantial experience with household biogas, but the policy frame remains too close to hardware delivery. A digester is not a durable energy outcome merely because it has been installed. It must continue to receive suitable feedstock, produce usable gas, receive maintenance, and generate enough household or commercial value to justify the work of operating it.

The national opportunity is larger than clean cooking. Biogas can link rural energy, livestock and crop waste management, organic soil inputs, women-led enterprise, industrial fuel reliability and methane mitigation. But those benefits arise only when the whole operating system works. Household digesters, cluster-level fertilizer hubs and industrial Bio-CNG plants are connected parts of this system, yet they have different logistics, products, risks and financing needs.

Central recommendation

Adopt a national circular bioenergy framework with three separate investment windows: household and community energy service; cluster-based digestate and organic fertilizer markets; and phase-gated industrial Bio-CNG platforms. Apply a common evidence standard across all three.

The evidence in brief

Indicator	Policy meaning
11.70 million	Economic units counted by BBS in 2024; 63.11% were rural.
95.41%	Share of economic units classified as cottage or micro, pointing to a highly distributed service and enterprise base.
81.51%	Units relying on own funds; only 2.75% reported bank finance as a capital source.
16.69%	Establishments reporting waste-disposal facilities; the rural share was 10.59%.
0.12%	Applicable manufacturing respondents reporting biogas as a fuel source.
56,500+	Biogas plants financed by IDCOL through 38 partner organizations by December 2020, according to IDCOL.

Sources: BBS Economic Census 2024 National Report; IDCOL Biogas and Bio-fertilizer Program. Percentages reflect the definitions and respondent bases used in the original tables.

Ten decisions for national policy

- 1. Reclassify the asset.** Treat biogas as circular infrastructure, not a cooking appliance.
- 2. Pay for outcomes.** Tie subsidy, CSR and concessional tranches to commissioning, continued operation and verified value.
- 3. Build a registry.** Create one GPS-tagged national asset and service registry for household, community and industrial systems.
- 4. Deploy in clusters.** Verify feedstock and service density before financing dispersed household units.
- 5. Finance the missing middle.** Fund technicians, collection, dewatering, drying, testing, storage, working capital and buyer linkage.
- 6. Separate product pathways.** Regulate and commercialize wet slurry, compost, vermicompost and granulated digestate as different products.

7. **7. Create fertilizer gates.** Require laboratory testing, field validation, registration strategy and buyer evidence before scale.
8. **8. Position Bio-CNG selectively.** Target industrial reliability and costly backup-fuel displacement, not blanket price competition with grid gas.
9. **9. Protect inclusion.** Measure women's control of income, labour burdens, safety and access to service, not participation counts alone.
10. **10. Publish retention.** Report functioning assets and user retention at 6, 12 and 24 months.

1. The National Policy Problem

Installation is an input, not an outcome

Biogas programmes are easy to administer through procurement targets and installation counts. Those measures answer whether public or CSR money bought equipment. They do not answer whether the equipment still produces gas, whether a household continues to use it, whether repair is available, or whether digestate creates value rather than a disposal burden.

Every biogas system has an operating burden: feedstock must be collected and mixed, water must be available, inlets and outlets must be cleaned, faults must be repaired, and digestate must be used or moved. If those costs sit with a household while the benefits are uncertain, adoption can weaken after the project team exits. Regional evidence underscores the risk: a 2025 peer-reviewed study of 2,559 households in Nepal found that 54% of surveyed household plants had been abandoned, with malfunction, small herds, weak cleaning and inadequate repair services among the associated factors. [S7]

The policy problem has four layers

Layer	Question national policy must answer
Asset integrity	Was the unit correctly installed, commissioned, safe and still functional?
Operating viability	Is suitable feedstock available every day, and can users manage the labour, water and maintenance?
Value-chain viability	Can gas savings and digestate value cover operating friction and service costs?
Institutional viability	Who owns the registry, enforces quality, pays for results, handles complaints and closes failed assets?

Three scales, three business models

Household biogas, cluster-level circular agriculture and industrial Bio-CNG should sit under one national framework, but not one undifferentiated subsidy. Wet slurry from a household digester is not commercially equivalent to vermicompost or a registered granulated fertilizer. Likewise, a household cooking system cannot be assessed through the debt-service logic of an industrial plant. Policy must preserve those distinctions.

Scale	Primary value	Binding risk	Appropriate instrument
Household/ community	Clean cooking, local nutrient use, reduced biomass dependence	Daily feedstock, user effort, repair access, retention	Results-based support and service contracts

2. What the National Evidence Shows

A large rural enterprise base exists, but formal systems are thin

The Economic Census 2024 counted 11,702,792 economic units, of which 7,385,828 were rural. Economic households accounted for 4,859,366 units, and 75.85% of them were rural. Cottage and micro units together made up 95.41% of all economic units. This is the market structure in which a national biogas service network would operate: highly distributed, mostly small, and heavily dependent on local enterprise. [S1]

The same census shows why hardware-only delivery is unlikely to mature into a market by itself. Own funds were reported as a capital source by 81.51% of units, compared with 7.13% for NGOs and 2.75% for banks. Among responding units, 85.89% cited insufficient capital and 34.42% cited lack of easy access to loans as difficulties. Aggregators, service firms and women-led producer groups will need instruments suited to small balance sheets, uncertain collateral and seasonal cash flow. [S1]

Evidence	Census signal	Policy implication
Rural market base	7.39 million rural economic units	Create district service and aggregation markets, not only national procurement contracts.
Enterprise scale	95.41% cottage or micro	Standardize small-ticket finance, training and service-franchise models.
Finance	81.51% own funds; 2.75% bank finance	Use guarantees, working-capital facilities and verified receivables.
Waste systems	16.69% report disposal facilities; 10.59% rural	Bundle waste management infrastructure with energy investment.
Formalization	28.06% registered; 64.59% unregistered	Use proportionate onboarding and staged compliance for local suppliers.
Women's economic control	6.5% female-headed units; 16.71% of persons engaged are women	Track ownership, decision-making and receipt of payments.
Manufacturing fuel	Biogas reported by 0.12% of applicable respondents	Treat industrial Bio-CNG as a market-formation challenge.

Source: BBS Economic Census 2024 National Report. Fuel use is a multiple-response table with a restricted applicable respondent base. The Census category "Liquid Gas (LNG)" should not be interpreted as industrial LNG consumption without clarification from BBS.

Existing biogas experience is an asset, but current operating status is not visible

IDCOL reports financing more than 56,500 biogas plants through 38 partner organizations by December 2020. This establishes a substantial implementation base and partner network. It does not, by itself, reveal the number of plants still operating, their service history, gas output, household retention or realized fertilizer value. A national policy should therefore begin with an asset-and-functionality audit rather than assume either success or failure from cumulative installation totals. [S2]

Climate policy strengthens the case for methane-focused measurement

Bangladesh's NDC 3.0 is active for the 2035 horizon and includes mitigation across energy, agriculture and waste. Biogas can contribute through methane avoidance,

renewable gas and reduced use of higher-emission fuels, but only when projects establish credible baselines, control methane leakage and prevent double counting. Climate claims should follow the same measured-data discipline as financial claims. [S3]

3. Lessons from Three Operating Scales

3.1 Green Flame: the evidence design gap

Project Green Flame Phase I was structured as a CSR-backed household biogas rollout. The supplied project material records BDT 11,999,200 in committed financing from City Bank, a target of 400 units and a beneficiary contribution of BDT 10,500 toward a BDT 35,000 hardware package. Approximately 300 installations were self-reported in the material reviewed.

The design also projected BDT 36 million in household slurry income and 180,000 tonnes of organic fertilizer across a 25-year asset life. Spread evenly across the targeted 400 households, this implies BDT 3,600 per household per year. The available file set, however, did not establish the operating chain behind that projection: no complete GPS-tagged commissioned asset list, functionality series, slurry collection ledger, household payment record or off-take invoice was available for review.

National lesson from Green Flame

Do not treat a projected byproduct value as a household benefit until the project can show a buyer, an agreed product specification, transaction records and payment to the household. Administrative completion should require post-installation evidence.

3.2 FSMV Dhontola: aggregation as a design principle

The FSMV example in Dhontola, Rangpur is based on vermicomposting, not wet biogas digestate. Its economics should therefore not be transferred directly to household slurry. Its relevance lies in the operating architecture: 11 women producers were linked to a named local entrepreneur who aggregated, packaged and marketed the product. Project material reports producer income of BDT 8,000-9,000 per month and an increase in the entrepreneur's monthly sales from BDT 96,000 to BDT 360,000.

The project made training, aggregation, quality support and buyer linkage visible through Centers of Excellence and Farmers' Hubs. That is the missing middle in many household biogas programmes. Producers should not be expected to create product standards, find buyers, finance stock and arrange transport independently.

3.3 Industrial Bio-CNG: a dual-market platform

The supplied pre-feasibility note models a full module processing 373 tonnes per day of wet mixed feedstock to produce about 9.58 tonnes per day of Bio-CNG and 104.6 tonnes per day of granulated fertilizer over 330 operating days. The model assumes biomethane upgrading to at least 95% methane purity, compression to 250 bar and cascade delivery to buyers.

Its most important policy insight is that this is not only a gas project. In the base-case table, fertilizer contributes approximately 50.5% of gross revenue. Elsewhere the narrative describes fertilizer as roughly 59% of steady-state gross income. That internal difference should be reconciled before investment use, but both figures point to the same conclusion: fertilizer registration, quality and market absorption may determine bankability as much as gas production.

Stage	Feedstock	Bio-CNG	Fertilizer	Indicative CAPEX	Purpose
Phase 1	75 TPD	2.0 TPD	21.0 TPD	BDT 85m	Validate feedstock, biology, fertilizer and buyers
Phase 2	186 TPD	5.0 TPD	52.3 TPD	BDT 180m	Expand only after performance and demand gates
Phase 3	373 TPD	9.58 TPD	104.6 TPD	BDT 345m	Full module after bankability is demonstrated

Source: supplied Pre-Feasibility Investment Note_BIO Gas.docx. All figures are model assumptions and require site-specific validation, binding quotes and regulatory review.

Comparative policy reading

Dimension	Green Flame	FSMV Dhontola	Industrial Bio-CNG
Model	Hardware subsidy	Producer-to-aggregator value chain	Gas plus fertilizer platform
Evidence status	Installations and benefits not fully verified in supplied files	Project-reported income and sales	Pre-feasibility assumptions
Market anchor	Not visible in reviewed evidence	Named local aggregator	Requires gas buyers and fertilizer distributors
Central constraint	Retention and slurry monetization	Aggregation, quality and route to market	Feedstock, technology, off-take and fertilizer absorption
National lesson	Make continued operation auditable	Fund the market-making layer	Use phase gates before debt-funded scale

4. National Policy Architecture

Bangladesh should establish a Circular Bioenergy and Organic Nutrient Framework jointly owned by energy, agriculture, environment and finance institutions. The framework should define three investment windows, one evidence standard and a common digital registry.

Window 1: Household and community energy service

- Finance units only after household or cluster feedstock, water, labour and land conditions are verified.
- Contract local after-sales service for at least 24 months, with repair response and spare-parts standards.
- Release final subsidy tranches against verified functionality at 6 and 12 months, not installation alone.
- Track fuel stacking, biomass and LPG substitution, time use, safety and user retention.
- Treat local slurry use as a valid benefit when it is measured; do not force commercialization where logistics do not support it.

Window 2: Cluster circular-agriculture hubs

- Locate hubs where digester density, farm demand and road access can support collection economics.
- Offer capital and working-capital finance for collection, dewatering, drying, composting, storage, testing and packaging.
- Appoint or competitively select a market anchor with transparent producer pricing and payment records.
- Use product-specific standards. Wet slurry, dried digestate, compost, vermicompost and granules should not share one generic claim set.
- Support women-led producer groups while measuring who controls payment and who carries the additional labour.

Window 3: Industrial Bio-CNG and fertilizer

- Require a defined feedstock radius supported by supplier mapping, seasonal availability and delivered-cost evidence.
- Require gas buyer letters of intent, site-interface design and credible willingness to pay before major capital release.
- Start with a pilot module and scale only after biological stability, gas quality, methane slip, power demand and uptime are demonstrated.
- Begin fertilizer laboratory testing, field trials, registration strategy and distributor validation during the pilot.
- Use Bio-CNG first where reliability and displacement of costly backup fuels create value; do not assume it will undercut subsidized grid gas.

A common evidence standard

Evidence domain	Minimum record
Asset	GPS, owner, installer, technology, capacity, subsidy history, commissioning and safety certificate
Operation	Feedstock, gas output or use proxy, downtime, maintenance, repair response and retention
Economics	Fuel savings, product quantity, buyer, invoice, producer payment, collection cost and working capital
Environment	Baseline, methane capture, methane slip, digestate handling, avoided fuel and monitoring method
Inclusion	Women's ownership, control of payment, labour and time effects, safety, accessibility and grievance handling

5. Financing and Market Instruments

Instrument	Best use	Control
Capital grant or CSR	Affordability, pilots, inclusion, training, registry and early service infrastructure	Do not fund equipment without post-installation obligations
Results-based payment	Functioning assets, retention, verified fuel substitution, methane avoidance and producer payments	Use independently auditable indicators
Concessional debt	Mature cluster hubs and industrial platforms with feedstock and buyer evidence	Release by technical and commercial gates
Credit guarantee	Local aggregators, service firms, women-led enterprises and fertilizer distributors	Pair with cash-flow records and buyer contracts

Instrument	Best use	Control
Working-capital line	Feedstock purchase, collection, inventory, packaging and receivables	Match tenor to seasonal sales cycles
Equity or strategic capital	Industrial platforms and scalable service networks	Require governance rights and downside stress tests
Carbon finance	Measured methane avoidance and fuel substitution	Treat as upside until methodology and monitoring are secured

Outcome-linked disbursement

Indicative share	Milestone	Evidence
20%	Design and mobilization	Site and user baseline; feedstock verification; permits pathway; service contract
35%	Installation and commissioning	GPS asset record; quality inspection; commissioning; user training
25%	Early operation	Functionality and service record at 3-6 months; safe digestate handling
20%	Sustained value	Retention at 12 months; verified savings or sales; payments and grievance closure

Illustrative structure. Shares should be calibrated by scale and risk; industrial projects require additional technology, buyer, lender and regulatory gates.

Fertilizer market formation

Bangladesh's Fertilizer (Management) Act, 2006 requires registration to produce, preserve, distribute, market, transport or sell fertilizer. Digestate-derived products therefore need an explicit route through testing, registration, labelling and quality control. [S4]

- Publish a product classification note for wet slurry, stabilized digestate, compost and granulated digestate.
- Create a DAE/SRDI-led testing protocol covering nutrient profile, organic matter, moisture, carbon-to-nitrogen ratio, pathogens, heavy metals and storage stability.
- Use controlled field trials to validate crop and soil claims; prohibit unverified yield or income claims in public programmes.
- Develop distributor and anchor-buyer agreements before industrial scale-up, including seasonal demand and credit terms.
- Publish market prices and quality test results through the national registry to reduce information asymmetry.

6. Governance, Standards and Accountability

Institution	Proposed role
Power Division / SREDA	National targets, technical framework, renewable-gas recognition, registry coordination
Department of Environment	Environmental clearance, waste and effluent controls, monitoring and enforcement
DAE and SRDI	Product classification, fertilizer testing, field validation and farmer advisory
BSTI / relevant standards bodies	Gas quality, measurement, product standards, labelling and consumer protection
Department of Explosives and Fire Service	Compressed-gas storage, cascades, transport, site safety and emergency response

Institution	Proposed role
IDCOL and participating financiers	Phase-gated finance, due diligence, partner accreditation and results verification
Bangladesh Bank	Sustainable finance taxonomy, refinancing, guarantees and prudential guidance where applicable
Local government	Land-use support, local feedstock and waste mapping, community oversight and grievance referral
Private operators and aggregators	Performance, service, transparent buying, product quality and data submission

The national asset registry

The registry should be a public-interest operating system, not a one-time project database. Each asset should have a persistent ID linking its location, financing, ownership, installer, service provider, commissioning, safety status, operating checks and closure. Sensitive household information should be protected, while aggregate performance and supplier scorecards should be publishable.

Access layer	Content
Public layer	District totals, functional share, service coverage, programme finance, verified outputs and supplier performance
Regulator layer	Asset-level inspection, permits, incidents, test results, subsidy and carbon claims
Operator layer	Service tickets, parts, production, transactions, buyer and feedstock records
User layer	Consent, service request, payment history, grievance status and safety information

National results framework

Domain	Core indicator	Evidence	Frequency
Reach	Commissioned assets by scale, district and finance source	Registry and commissioning certificate	Monthly
Retention	Share functional and in use at 6, 12 and 24 months	Inspection plus user confirmation	Six-monthly
Service	Median repair response, downtime and repeat fault rate	Digital service logs	Quarterly
Energy	Gas produced or credible use proxy; fuel displaced	Meters, logs and sample surveys	Monthly/annual
Circular value	Digestate safely used or sold; producer payments	Weight, invoices and payment ledger	Monthly
Market	Gas and fertilizer sales, active buyers, receivable days	Audited commercial records	Quarterly
Climate	Methane captured, leakage, avoided emissions	Approved monitoring protocol	Annual
Inclusion	Women controlling assets/payments; labour and time change	Disaggregated survey and ledger	Annual
Safety	Incidents, near misses, inspections and closure time	Incident register	Immediate/quarterly

7. A 36-Month Implementation Roadmap

Period	Objective	Priority actions
0-6 months	Policy and evidence baseline	Create inter-agency taskforce; publish evidence standard; audit a sample of legacy assets; design registry; issue fertilizer classification and testing roadmap; identify priority districts.
6-12 months	Cluster preparation	Accredit installers and service providers; map feedstock and buyers; select household clusters and hub operators; launch functionality audit; secure industrial pilot LOIs and supplier quotes.
12-24 months	Demonstration and verification	Deploy results-based household clusters; commission service hubs; run fertilizer tests and field trials; operate Phase 1 industrial pilots; publish quarterly performance dashboards.

Period	Objective	Priority actions
24-30 months	Independent evaluation	Evaluate retention, unit economics, service quality, fertilizer absorption, inclusion, methane performance and safety; revise standards and finance terms.
30-36 months	Controlled scale-up	Expand only models that clear evidence thresholds; establish financing windows; publish standard contracts; integrate verified projects with climate-finance pipelines.

Go / no-go thresholds

Decision point	Minimum threshold
Household cluster	Verified feedstock and service coverage; $\geq 80\%$ of commissioned units functioning and used at 12 months; safety and grievance systems operating
Circular hub	Traceable input/output; tested product; positive contribution margin after collection; recurring buyers; timely producer payments
Industrial Phase 1	Stable digestion; contracted feedstock; compliant gas quality; acceptable methane slip; fertilizer testing path; credible buyers and lender review
Industrial scale-up	Binding off-take supporting debt service; fertilizer absorption evidenced; supplier guarantees; permits; downside case within agreed risk limits

The 80% household retention threshold is a proposed policy standard for programme design, not a measured national benchmark.

8. Risks and Safeguards

Risk	Safeguard
Installed-but-idle assets	Delayed outcome payments; retention audits; supplier scorecards and remediation
Insufficient or seasonal feedstock	Baseline herd and waste assessment; competing-use analysis; conservative collection radius
Household labour burden	Time-use baseline; design support; transparent task allocation; optional cluster feeding models
Wet slurry transport destroys value	Prioritize local use or dewatering; test delivered cost before commercial claims
Fertilizer quality or market failure	Product testing, registration, field trials, buyer contracts and phased capacity
Technology underperformance	Guaranteed performance, tropical references, acceptance testing and independent engineer
Methane leakage erodes climate benefit	Leak detection and repair, methane-slip guarantees and measured monitoring
Overstated income or carbon claims	Separate projections from realized results; audited ledgers; approved baselines
Exclusion or elite capture	Published eligibility, women's control indicators, grievance channels and payment traceability
Regulatory fragmentation	Single coordinated approval map with named lead agency and time-bound decisions

9. Conclusion

Bangladesh does not need a larger installation campaign. It needs a better operating system for circular bioenergy. The Green Flame material shows the weakness of closing a project before continued operation and slurry value are evidenced. FSMV shows why aggregation, enterprise and buyer linkage matter. The industrial pre-feasibility note shows that fertilizer can carry around half or more of projected platform revenue and must therefore be treated as a core business, not a disposal solution.

The national policy test is simple: can Bangladesh prove that an asset remains in use, that feedstock and service are available, that digestate is safe and valuable, that buyers will pay, and that the climate benefit is real? Projects that can answer those questions should be supported to scale. Projects that cannot should remain pilots until they do.

Appendix A. Available Evidence and Datasets

Dataset / source	What it provides	Coverage	Key limitation
BBS Economic Census 2024	Economic units, scale, finance, fuel, waste facilities, registration, sex-disaggregated participation and detailed industry classes	National, rural/urban and selected administrative/industry tables	Does not count ordinary agricultural producing households; cannot estimate total manure or biogas functionality
IDCOL Biogas and Bio-fertilizer Program	Cumulative financed plants, partner organizations and programme-level benefit estimates	Programme, through Dec 2020 on public page	Public page does not provide current plant-level functionality or transactions
Agriculture Census 2019	Holdings, livestock and poultry structures	Household/holding microdata and reports	Needs updating and spatial linkage for current recoverable manure
DLS Livestock Economy at a Glance	Livestock and poultry population and sector trends	National and selected administrative detail	Animal counts do not equal collectable manure or contracted feedstock
BDHS 2022	Household cooking fuel and related characteristics	National survey microdata	Not designed to measure biogas plant condition, output or service
World Bank Multi-Tier Framework survey	Energy access, cooking technology, fuel stacking and service attributes	National household survey	Earlier survey round; requires update for current adoption
HCU / Petrobangla gas reports	Production, distribution and consumption	National/sectoral reporting	Limited facility-level outage and willingness-to-pay evidence
Bangladesh NDC 3.0 and BTR	National mitigation targets, sectors and inventory context	National climate reporting	Project baselines and leakage still require site measurement
Supplied project files	Green Flame design and projections; FSMV reported outcomes; industrial Bio-CNG assumptions	Project or pre-feasibility	Not a substitute for independent verification or operating data

How to use the Economic Census microdata

The published report establishes the size and structure of the opportunity. The next analytical step is to obtain district- and upazila-level cross-tabs linking industry class, fuel use, waste facilities, finance source, registration status and enterprise size. That would identify clusters where feedstock suppliers, service enterprises, industrial off-takers and fertilizer channels overlap. It remains a targeting tool, not a substitute for site-level feedstock and buyer diligence.

Appendix B. Priority Datapoints Not Yet Available

The following datapoints were not available in the reviewed files or public datasets at the level needed for national investment decisions. “Unavailable” does not mean the data do not exist anywhere; it means they were not accessible in a sufficiently current, granular and verifiable form for this paper.

Missing datapoint	Why it matters	Proposed collection route	Decision unlocked
Asset Complete installed-asset register	Establishes denominator, location, ownership, installer, technology, commissioning and subsidy history	Reconcile funder, IDCOL, implementer and local records; GPS audit	National asset baseline and sampling frame
Asset Functionality at 3, 6, 12 and 24 months	Separates installation from sustained use	Independent inspections plus user confirmation	Retention-linked payment and supplier rating
Asset Daily gas output and actual use	Quantifies energy service and detects underfeeding	Meters on samples; standardized operating logs and sensors where justified	Sizing, savings and climate claims
Adoption Fuel stacking and dis-adoption reasons	Shows whether biogas replaces biomass/LPG and why users stop	Panel household survey and qualitative follow-up	User design, targeting and remediation
Service Downtime, fault type, response and repair cost	Tests the viability of after-sales models	Digital ticketing linked to asset ID	Service contracts and technician density
Household Fuel expenditure and time before/after	Measures realized household value	Baseline/endline expenditure and time-use survey, disaggregated by sex	Benefit-cost and inclusion case
Feedstock Animals actually accessible to each site	Herd ownership alone may overstate collectable manure	Household/farm verification and seasonal observation	Eligibility and digester sizing
Feedstock Recoverable manure and crop residue by district	National animal counts do not equal usable feedstock	Ag Census/DLS integration plus recovery factors and field validation	Priority-district map
Feedstock Competing uses and seasonal availability	Avoids diversion assumptions and supply shortfalls	Supplier interviews, seasonal logs and market study	Conservative contracted volume
Feedstock Delivered cost within actual collection radius	Transport can erase project margin	Route trials, weighbridge records and binding supplier quotes	Hub siting and gate price
Feedstock Moisture, contamination, VS and methane potential	Determines biological yield and process design	Representative laboratory sampling and BMP tests	Technology and revenue assumptions
Digestate Quantity, moisture and seasonality by system	Defines handling and sales burden	Mass-balance measurement at representative plants	Collection and processing design
Digestate Nutrient, pathogen and heavy-metal profile	Required for safety, claims and registration	SRDI/approved laboratory protocol across feedstocks and technologies	Product classification and market access
Digestate Actual household use, sale and payment	Tests whether projected income reaches producers	Weight tickets, invoices and digital payment ledger	Results payment and income claims
Logistics Collection, dewatering, drying and storage cost	Determines whether wet or processed products are viable	Pilot cost accounting by tonne and kilometre	Product-pathway choice
Fertilizer Registered digestate-based products and sales	Reveals current market depth and comparators	DAE registration data plus producer/distributor survey	Competitive and regulatory strategy
Fertilizer Buyer demand, price, seasonality and credit terms	Industrial output can exceed local absorption	Distributor and anchor-buyer survey; purchase trials	Capacity cap and working capital
Fertilizer Multi-season field performance	Supports agronomic claims and farmer adoption	Controlled trials across crops, soils and agro-ecological zones	Labelling, pricing and extension advice
Industrial gas Hourly demand, pressure shortfall and outage cost	Identifies where reliability has real value	Buyer energy audit and metered baseline	Priority off-takers and willingness to pay
Industrial gas Binding off-take and take-or-pay terms	LOIs alone may not support debt service	Negotiated term sheets and credit review	Financing and scale-up

Missing datapoint	Why it matters	Proposed collection route	Decision unlocked
Technology Supplier guarantees and tropical references	Controls yield, purity, uptime, power use and methane slip	Binding EPC/vendor bids and reference checks	CAPEX choice and performance security
Regulation Consolidated Bio-CNG quality and cascade pathway	Multiple permits create schedule and safety risk	Joint agency legal/technical review and published approval map	Bankable timeline and compliance
Finance Binding CAPEX, FX, debt pricing and DSCR terms	Pre-feasibility outputs are sensitive to financing and imported equipment	Vendor quotes, LC assumptions and lender term sheet	Investment decision and downside case
Climate Project baseline, leakage, additionality and method	Prevents overstated or double-counted mitigation	Approved monitoring plan, leak detection and carbon-method review	NDC attribution and carbon finance
Market map Upazila cross-tab of industry, fuel, waste and finance	Locates viable overlaps between supply, buyers and service firms	BBS Economic Census 2024 microdata/custom tabulation	Cluster selection
Municipal waste Organic volume, composition and recoverable share	Municipal feedstock claims are often gross rather than usable	Seasonal waste characterization and route data	Urban/community plant feasibility
Inclusion Ownership, payment control, labour and grievance outcomes	Participation counts can conceal unequal burdens or capture	Sex-disaggregated panel data and grievance audit	Safeguards and equitable programme rules
Safety Incident, near-miss and closure records	National standards need an empirical risk base	Mandatory incident reporting linked to asset registry	Inspection frequency and design rules

Minimum national baseline study

Before a new national investment window opens, commission a stratified functionality and value-chain study covering legacy household plants, active clusters and candidate industrial locations. It should combine asset inspection, household panels, feedstock sampling, service records, buyer research and fertilizer testing. The first objective is not to produce a single national abandonment rate; it is to identify which combinations of technology, feedstock, service and market design remain functional over time.

Appendix C. Source Notes

- [S1]** Bangladesh Bureau of Statistics. Economic Census 2024: National Report (Volume 1), final report released 7 April 2026. Supplied PDF and official landing page: <https://bbs.gov.bd/pages/static-pages/695b99a3c4774958d7b705e2>
- [S2]** IDCOL. Biogas and Bio-fertilizer Program. Public programme page: <https://idcol.org/home/dbiogas>
- [S3]** Government of Bangladesh. Third Nationally Determined Contribution (NDC 3.0), submitted September 2025. UNFCCC registry: <https://unfccc.int/node/650128>
- [S4]** Government of Bangladesh. Fertilizer (Management) Act, 2006: <https://bdlaws.minlaw.gov.bd/upload/act/2023-08-02-15-05-14-110.The-Fertilizer-%28Management%29-Act%2C-2006.pdf>
- [S5]** FAO Microdata Catalogue. Bangladesh Agriculture Census 2019: <https://microdata.fao.org/index.php/catalog/2821>
- [S6]** World Bank Microdata Library. Bangladesh Multi-Tier Framework Survey: <https://microdata.worldbank.org/index.php/catalog/3871>
- [S7]** Scientific Reports (2025). “Dis-adoption of household biogas plants in Nepal: a large-scale survey.” <https://www.nature.com/articles/s41598-025-24615-2>
- [S8]** World Bank Microdata Library. Bangladesh Demographic and Health Survey 2022: <https://microdata.worldbank.org/index.php/catalog/6290>
- [S9]** Supplied file. Pre-Feasibility Investment Note_BIO Gas.docx. Financial and technical figures are assumptions requiring site-specific diligence.
- [S10]** Supplied project materials. Project Green Flame Phase I and FSMV Dhontola data as summarized in the case-study brief. Treat reported outcomes as project claims until independently verified.

Interpretation rules

- Projected values are labelled as projections or assumptions; they should not be presented as realized income or output.
- Project-reported results are not described as independently verified.
- Economic Census percentages retain the respondent base and definitions used by BBS; denominators differ across tables.
- Vermicompost evidence is used to illustrate aggregation and market anchoring, not to price wet digestate.
- Industrial Bio-CNG model values are a pre-feasibility reference and should not be used for credit approval without site, vendor, market and regulatory diligence.