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Article

Cost Accounting and Product Costing for Farm Biogas: Evidence from a Dairy Farm in Uzbekistan

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Abstract: Biogas plants on livestock farms turn manure into electricity, heat and digestate, yet farm cost accounting in Uzbekistan has no rules for recording such plants or costing their outputs. This study develops a costing methodology for farm biogas production and tests it on a project model built on the manure of a dairy farm in Samarkand region (18,307 t/yr). Following ISO 14051, physical flows are measured first and costs are then assigned to products. The plant is treated as a separate segment for processing secondary resources; manure and digestate are carried at the same nutrient value, so manure valuation passes through and does not affect energy cost; heat is a by-product credited at the replacement cost of natural gas, only for the metered part used on the farm; the cogeneration unit is depreciated by engine hours. The model yields 977,609 kWh of net electricity a year at 827.9 UZS/kWh, 15.7% below the grid tariff. Allocation by energy content would overstate the cost of heat 3.2 times. Unit cost is most sensitive to investment (±19.6% for ±30%). A real internal rate of return of about 4.5% explains why farms do not invest without grants. Journal entries and disclosures are proposed.

Keywords: biogas costing; joint cost allocation; by-product accounting; dairy farm; Uzbekistan.

1. Introduction

Anaerobic digestion of livestock manure is one of the few farm technologies that produce several marketable goods from a material that is otherwise a disposal problem. The biogas produced in a digester is burned in a combined heat and power (CHP) unit, and the digested slurry returns to the fields as an organic fertiliser. Europe has become the world's largest producer of biogas, largely with the help of feed-in tariffs and investment support. Small farm-scale plants remain under-used even there, because their unit costs are high and their economics depend on how the energy is used on the farm (O'Connor et al). A recent techno-economic assessment for small and medium livestock enterprises found that the cost of electricity falls from 0.16 to 0.10 € per kWh as plant capacity rises from 50 to 400 kW, and that a feed-in tariff of 0.21 € per kWh does not cover the costs of plants below 250 kW (Eftaxias et a).[1][2]

Uzbekistan adopted a programme to install biogas plants on 726 large livestock and poultry farms in 2017; at that time about 45 farms operated plants with a total output of 1.1 million m³ of biogas a year (Tashkent Times). A study under the Swiss REPIC programme concluded, however, that farmers were not prepared to invest in biogas without external finance, because natural gas was cheap and no state incentives were in place (Angele et al). The conditions have since changed. From 1 June 2026 the electricity

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tariff for legal entities was raised to 1,100 UZS per kWh and the natural gas tariff to 2,000 UZS per m³, value added tax (VAT) included (Gazeta.uz). For a dairy farm that buys more than a million kilowatt-hours a year, the question of what its own energy would cost has become a practical one.[3][4]

That question cannot be answered from the existing accounting rules. Research on agricultural accounting has concentrated on biological assets and fair value measurement under IAS 41 (Campos-Llerena et al). Recent doctoral studies in Uzbekistan developed the accounting of livestock costs (Menglikulov), of agricultural activity as a whole (Boltayev) and of agro-clusters (Ochilov), but none of them deals with the costing of biogas, energy and digestate. Engineering-economic studies, in turn, estimate levelised costs and payback periods (Gebrezgabher et al., Eftaxias et al.) but do not say where the plant belongs in the farm's chart of accounts, how its joint costs are divided between electricity, heat and digestate, or how internal transfers between the dairy herd, the plant and the fields are kept from inflating farm totals.[5]

A biogas plant raises three accounting problems at once. First, the plant is an item of property, plant and equipment whose components have very different useful lives, and IAS 16 requires significant components to be depreciated separately using a method that reflects the pattern of use (IASB,). Second, a single process yields electricity, heat and digestate, so that joint costs must be allocated (Datar & Rajan,). Third, most of the inputs and outputs circulate inside the farm: manure comes from the dairy herd, and the energy and digestate go back to the dairy unit and to the fields. The material flow cost accounting standard ISO 14051 recommends quantifying physical flows first and only then assigning costs to products and material. This logic suits a biogas plant well, because manure, biogas, energy and digestate are all measurable quantities.[6]

The aim of this study is to develop a methodology of cost accounting and product costing for farm biogas production and to test it on a dairy farm in Uzbekistan. The study contributes in three ways: it defines the accounting object for biogas production and the valuation of its inputs and outputs; it compares joint-cost allocation methods and shows why allocation by energy content is unsuitable; and it proposes journal entries and disclosures consistent with the national chart of accounts and IFRS.[7][8]

2. Materials and Methods

The study uses a case-based project model. No operating biogas plant was found on livestock farms in Samarkand region during the fieldwork, so the model was built on the actual manure resource of the "Siyob-Shavkat-Orzu" dairy farm (Tayloq district, Samarkand region), which agreed to be named. Farm data – herd structure, manure output of 1,525.6 t a month, labour costs and electricity expenses – were collected through a farm survey and interviews with management in 2025–2026. In August 2025 the farm's electricity expense, net of VAT, was 101.89 million UZS at a tariff of 1,000 UZS per kWh including VAT (892.9 UZS excluding VAT), which corresponds to an annual consumption of about 1.37 million kWh. Engineering parameters of the digester and CHP unit are typical design values; they are stated as explicit assumptions and tested in a sensitivity analysis.[9][10]

Physical flows are calculated sequentially from the mass of manure fed to the digester:

$$V_{CH_4} = M \cdot d \cdot o \cdot y \cdot 1000; \quad E_{el} = V_{CH_4} \cdot H \cdot \eta_{el}; \quad E_{th} = V_{CH_4} \cdot H \cdot \eta_{th} \qquad (1)$$

where V_{CH4} is the annual methane volume, m³; M is the mass of manure fed, t; d is the dry matter share; o is the organic matter share of dry matter; y is the methane yield, m³ per kg of organic matter; E_{el} and E_{th} are the electricity and heat produced by the CHP unit, kWh; H is the lower heating value of methane (35.8 MJ/m³, or 9.94 kWh/m³); η_{el} and η_{th} are the electrical and thermal efficiencies of the CHP unit.[11]

The investment is valued at the global weighted-average installed cost of bioenergy plants in 2024, USD 3,242 per kW (IRENA, 2025), translated at the official rate of 11,903.15

UZS per USD on 23 October 2026 (Central Bank of the Republic of Uzbekistan, 2026). It is split into three components with different depreciation methods. The life of a CHP engine is expressed in operating hours rather than years, so it is depreciated in proportion to the hours worked:

$$A_{chp} = C_{chp} \cdot \frac{t_{op}}{T_{ov}} \quad (2)$$

where A_{chp} is the depreciation of the CHP unit for the period, UZS; C_{chp} is its initial cost, UZS; t_{op} is the number of engine hours worked in the period; T_{ov} is the engine life until major overhaul, hours.[12]

Manure enters the plant at the value of its plant nutrients (nitrogen, phosphorus and potassium priced at the cost of the mineral fertilisers they replace, with an efficiency factor of 0.55 for nitrogen), using nutrient contents from Herbert et al. (n.d.). Anaerobic digestion conserves almost all of these nutrients in the digestate (Möller & Müller, 2012), so the digestate leaves the plant at the same value. Heat is treated as a by-product: the metered heat used on the farm is credited at the cost of the natural gas it replaces, while heat used to warm the digester and heat that is not used are not recognised as products. The unit cost of electricity is then:

$$c_{el} = \frac{X_{bg} - V_{dig} - V_{th}}{E_{el,net}} \quad (3)$$

where c_{el} is the cost of 1 kWh of electricity, UZS; X_{bg} is the total cost of the plant for the period (raw material, operating costs and depreciation), UZS; V_{dig} is the nutrient value of the digestate, UZS; V_{th} is the gas-replacement value of the heat used on the farm, UZS; $E_{el,net}$ is the net electricity after the plant's own consumption, kWh.

The proposed treatment is compared with two alternatives: allocation of joint costs by energy content (MJ) and allocation by relative market value (Datar & Rajan, 2021; Lips, 2014). The robustness of the unit cost is tested by changing one assumption at a time. Finally, because the unit cost is an accounting measure, the economic viability of the investment is checked separately with the accounting rate of return, the simple payback period and the internal rate of return (IRR) of cash flows at constant 2026 prices.[13]

3. Results and Discussion

3.1 Physical flows

Table 1 sets out the model parameters and the annual physical flows. The biogas yield of 0.267 m³ per kg of organic matter lies within the range of 0.25–0.28 m³ reported for Uzbek conditions by Angele et al. (2019); one tonne of manure gives 25.6 m³ of biogas. Net electricity of 977,609 kWh would cover 71.4% of the farm's annual consumption.

Table 1. Parameters and physical flows of the biogas plant model (per year)

Indicator	Value	Source or basis
Manure fed to the digester, t	18,307.2	Farm data: 1,525.6 t a month
Dry matter share / organic matter share of dry matter	0.12 / 0.80	Assumption: typical for fresh manure
Organic matter, t	1,757.5	Calculation
Methane yield, m³ per kg of organic matter	0.16	Biogas 0.267 m³/kg (Angele et al., 2019: 0.25–0.28)
Methane / biogas (60% CH_4), m³	281,199 / 468,664	Equation (1); 25.6 m³ of biogas per t of manure
Primary energy, kWh	2,796,364	H = 9.94 kWh/m³
Electricity (η_{el} = 0.38), kWh	1,062,618	Assumption
Own consumption of the plant (8%), kWh	85,009	Assumption
Net electricity, kWh	977,609	71.4% of the farm's consumption
Heat (η_{th} = 0.45), kWh	1,258,364	Assumption
of which: digester heating (40%)	503,345	Internal use, not a product
used on the farm (25%)	314,591	Hot water, milking parlour
not used (35%)	440,427	Loss
Electrical capacity at 8,000 hours, kW	132.8	Calculation
Digestate, t	17,744.8	Manure less biogas mass (562.4 t)

Source: author's calculations based on farm data and the cited sources.

Figure 1 shows the same flows in the form recommended by ISO 14051: every output is either a product, an internal use or a loss. Only 46.2% of the primary energy leaves the plant as products (net electricity and heat used on the farm); the rest is the plant's own consumption, digester heating, unused heat and conversion losses. This split matters for costing, because only products carry costs; the cost of losses is absorbed by the products, and the unused heat is the first place where efficiency can be improved.[14]

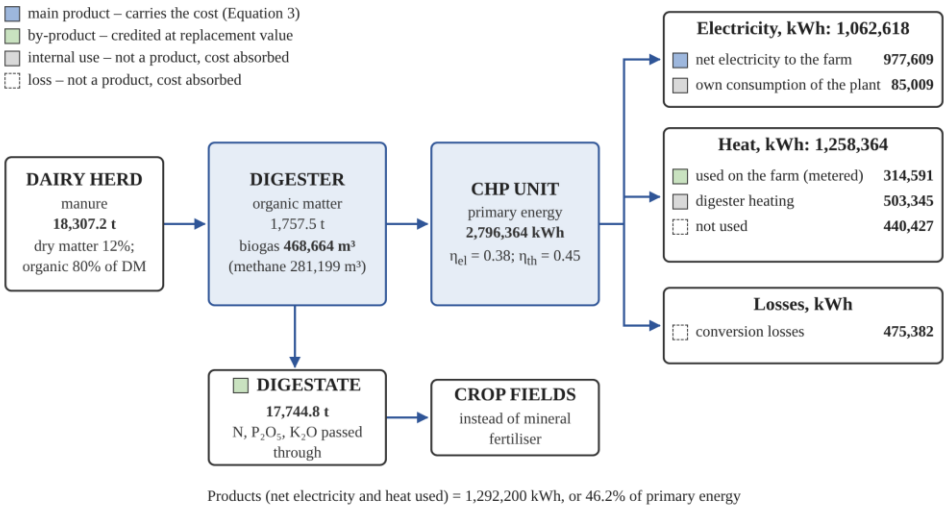


Figure 1. Material and energy flows of the biogas plant model (per year)

Source: author's development based on Table 1.

3.2 Investment and depreciation

The investment of 5,125.8 million UZS (about USD 430,600) is divided into three components (Table 2). The reactor, storage tanks and structures are depreciated on a straight-line basis over 20 years, and pumps, mixers, gas pipes and controls over 10 years. The CHP unit is depreciated by engine hours using Equation (2): with a life of 60,000 hours before overhaul, each hour of operation costs 21,357.5 UZS. When the engine stands idle, no depreciation is charged and the unit cost of electricity reflects actual output.[15]

Table 2. Components of the biogas plant investment and their depreciation

Component	Account	Cost, UZS million	Method and life	Annual depreciation, UZS million
Reactor, manure and digestate tanks, structures	0120	2,562.9	Straight-line, 20 years	128.1
CHP unit (gas engine and generator)	0130	1,281.5	Units of use: 60,000 engine hours (21,357.5 UZS per hour)	170.9
Pumps, mixers, gas pipes, control system	0130	1,281.5	Straight-line, 10 years	128.1
Total	**–**	**5,125.8**	**–**	**427.2**

Source: author's calculations based on IASB (2003b), Ministry of Economy and Finance (2024a), IRENA (2025) and Central Bank of the Republic of Uzbekistan (2026). Investment = 132.8 kW × USD 3,242 × 11,903.15 UZS; the component shares (50:25:25) are a design assumption; 8,000 engine hours a year.

3.3 The accounting object and the valuation of inputs and outputs

Where to place biogas production in the accounts is a matter of principle. It is not a continuation of the dairy enterprise, because manure is a joint result of milk production, not its purpose. Nor is it an auxiliary activity: auxiliary units such as a machinery pool or a repair shop serve the main production, have no products of their own, and their costs are fully charged to the users of their services. A biogas plant processes a secondary resource into three products – electricity, heat and digestate – each of which has a market

value and can be used on the farm or sold. Biogas production is therefore treated as a separate segment, and its costs are collected in account 2010 "Main production" under a separate sub-account, "Processing of secondary resources" (hereafter 2010-SR), of the national chart of accounts (Ministry of Economy and Finance, 2024b). Products used on the farm are recorded as internal transfers between segments, in the same way as home-grown feed passes from crop to livestock production.[16]

The costs of the plant fall into three groups: raw material (manure from the dairy herd), operating costs (labour, repairs and servicing, insurance) and depreciation. Because manure and digestate are carried at the same nutrient value, the raw material cost is passed through: the cost of energy does not depend on how manure is valued, and uncertainty in that valuation does not reach the energy costing. A further consequence is that crops receive the same nutrient value whether manure is spread directly or after digestion. Digestion may increase the ammonium share of nitrogen and thus its availability to plants (Möller & Müller, 2012), but without laboratory data this effect was not valued.[17]

3.4 Unit cost of electricity

Table 3 shows the annual costs of the plant and the costing of electricity by Equation (3). Total costs amount to 1,877.7 million UZS. After the digestate and the heat used on the farm are credited, 809.4 million UZS remain for 977,609 kWh of net electricity, or 827.9 UZS per kWh (about USD 0.070). This is 154.2 UZS, or 15.7%, below the grid tariff of 982.1 UZS per kWh excluding VAT. More than half of this cost is depreciation.

Table 3. Annual costs of the biogas plant and costing of electricity

Item	UZS million	UZS per kWh of net electricity	Note
Raw material: manure (18,307.2 t × 54.7 thousand UZS)	1,001.1	1,024.1	Nutrient value; nitrogen efficiency 0.55
Wages and social tax (2 operators)	157.1	160.7	6.55 million UZS per worker a month (farm average)
CHP servicing	189.7	194.1	USD 0.015 per kWh of gross electricity
Other repairs	76.9	78.6	2% of the cost of structures and auxiliary equipment
Insurance	25.6	26.2	0.5% of the investment
Depreciation	427.2	436.9	Table 2
Total costs (X_{bg})	**1,877.7**	**1,920.7**	–
Less: digestate (17,744.8 t)	−1,001.1	−1,024.1	Nutrients passed through; 56.4 thousand UZS per t
Less: heat used on the farm (314,591 kWh × 213.3 UZS)	−67.1	−68.7	Gas replacement value
Cost of electricity	**809.4**	**827.9**	**977,609 kWh**
For comparison: grid tariff excluding VAT	–	982.1	1,100 UZS including VAT

Source: author's calculations. Heat value: gas price 2,000 UZS/m³ (1,785.7 UZS excluding VAT), lower heating value of gas 9.3 kWh/m³, boiler efficiency 0.9. Wages are based on the farm's monthly labour cost in August 2025 (576.12 million UZS for 88 employees).

3.5 Allocation of joint costs

The choice of allocation method changes the result substantially (Table 4). Allocation by energy content values 1 kWh of heat equal to 1 kWh of electricity and gives heat a cost of 678.3 UZS per kWh – 3.2 times what the same heat costs when produced from gas (213.3 UZS). Equal quantities of energy do not have equal economic value: electricity is a high-quality form of energy that is easily converted to heat, whereas heat cannot be converted back to electricity without large losses. This is why energy-based allocation is

regarded as inferior for cogeneration systems (Rosen, 2008). Crediting heat as a by-product at its replacement value ties it directly to a market price and gives a result close to the relative market value method, while recognising heat only where it is metered and actually used.[18]

Table 4. Results of joint-cost allocation methods for the biogas plant

Method	Electricity, UZS per kWh	Heat, UZS per kWh	Assessment
Energy content (MJ)	678.3	678.3	Heat appears 3.2 times dearer than from gas; energy quality ignored
Relative market value	838.0	182.0	Applicable when both products have market prices
Heat as by-product at replacement value (proposed)	827.9	213.3	Heat recognised only for the metered part used

Source: author's calculations. In all methods the digestate is first deducted at its nutrient value.

3.6 Sensitivity of the unit cost

Table 5 shows how the cost of electricity responds to changes in the main assumptions. The investment cost has the largest effect: if it is 30% higher, the unit cost exceeds the grid tariff. Methane yield and the share of heat used on the farm also matter; if no heat is used, the cost rises to 896.6 UZS per kWh. The composition and price of manure have no effect at all, which confirms the pass-through property of the valuation rule.[19]

Table 5. Sensitivity of the unit cost of electricity to the main assumptions

Assumption	Change	UZS per kWh	Difference from base, %
Base case	–	827.9	–
Investment per kW	+30% / −30%	990.5 / 665.4	+19.6 / −19.6
Methane yield (capacity scaled)	+20% / −20%	801.2 / 868.1	−3.2 / +4.9
Share of heat used on the farm	40% / 0%	786.7 / 896.6	−5.0 / +8.3
Nutrient value of manure	54.7 → 92.1 thousand UZS per t	827.9	0

Source: author's calculations.

3.7 Economic viability and government grants

A unit cost below the tariff does not make the investment attractive. The plant saves the farm 150.7 million UZS a year in accounting terms (avoided grid electricity and gas, less all plant costs including depreciation), an accounting rate of return of only 2.9% (Table 6). In cash terms the plant saves 960.1 million UZS of grid electricity and 67.1 million UZS of gas while incurring 449.3 million UZS of cash operating costs; the net cash benefit of 577.9 million UZS a year repays the investment in 8.9 years – longer than the 7.5 years after which the CHP engine needs an overhaul. Over a 20-year horizon at constant 2026 prices, with the engine replaced in years 8 and 15 and the pumps and controls in year 10, the real IRR is about 4.5%. These results support the conclusion of Angele et al. (2019) that farm biogas in Uzbekistan is not attractive without external finance.[20]

A grant covering 30% of the investment (1,537.7 million UZS) raises the real IRR to 9.7% and shortens the payback to 6.2 years. Its effect on the unit cost depends on the presentation chosen under IAS 20 and the national standard NAS 10 (IASB, 1983; Ministry of Economy and Finance, n.d.). If the grant is presented as deferred income and released to other operating income in proportion to depreciation (128.1 million UZS a year), the

production cost of electricity remains 827.9 UZS per kWh; if it is deducted from the carrying amount of the asset, depreciation falls and the unit cost becomes 696.9 UZS. Repairs and insurance are not affected, because they depend on the physical asset, not on who financed it. The accounting policy must therefore state the method, otherwise unit costs of subsidised and unsubsidised plants are not comparable. Following Ochilov's (2024) proposal of separate working sub-accounts for subsidies in agro-clusters, the biogas grant is recorded in a separate sub-account of account 8820 "Subsidies".[21]

Table 6. Economic indicators of the biogas plant with and without a 30% investment grant

Indicator	Without grant	With 30% grant
Investment borne by the farm, UZS million	5,125.8	3,588.1
Unit cost of electricity, UZS per kWh: grant as deferred income	827.9	827.9
Unit cost of electricity, UZS per kWh: grant deducted from the asset	827.9	696.9
Annual accounting saving, UZS million	150.7	278.8
Accounting rate of return on the farm's investment, %	2.9	7.8
Annual net cash benefit, UZS million	577.9	577.9
Simple payback period, years	8.9	6.2
Real internal rate of return over 20 years, %	4.5	9.7

Source: author's calculations. Cash flows at constant 2026 prices; CHP engine replaced in years 8 and 15, pumps and controls in year 10; no residual value; taxes and financing costs are not included. With the grant, the accounting saving includes the grant income of 128.1 million UZS a year.

3.8 Recording and disclosure

Figure 2 and Table 7 set out how the plant's transactions are recorded. At the centre of the scheme is the "Biogas plant" cost object in sub-account 2010-SR: raw material, operating costs and depreciation are collected on its debit side, and products are transferred from its credit side to the receiving segments.[22]

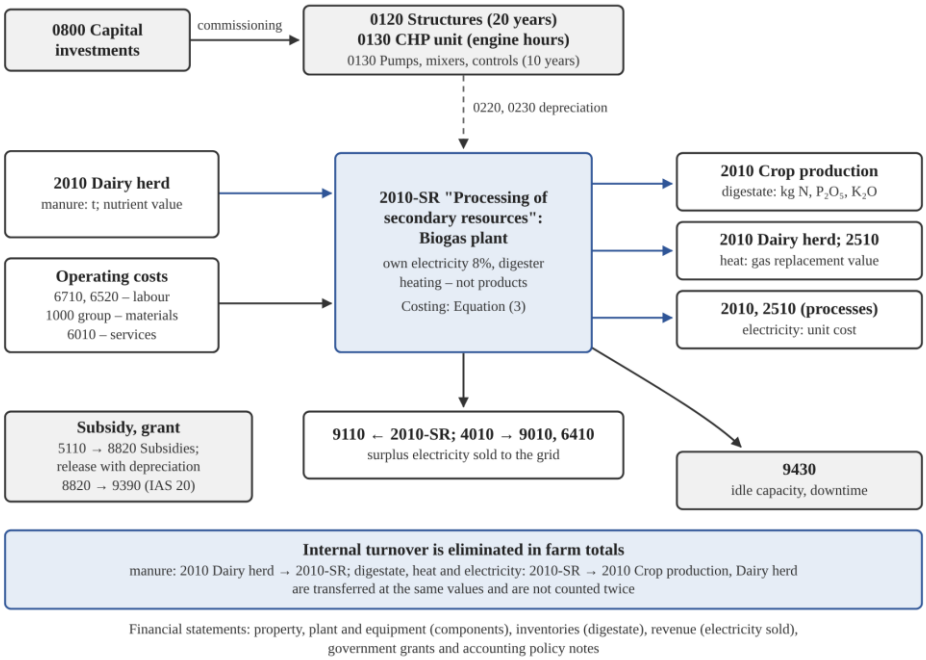


Figure 2. Accounting scheme for biogas production on a farm

Source: author's development based on the national chart of accounts (Ministry of Economy and Finance, 2024b) and IAS 2, 16 and 20.

Table 7. Journal entries for biogas production

No	Transaction	Debit	Credit	Measurement
	Construction and commissioning			
1	Construction and equipment costs	0800 Capital investments	6010, 6710, 6520, 1000 group	Actual cost
2	Recoverable VAT	4410	6010	Per invoice
3	Commissioning by component	0120; 0130	0800	Initial cost
4	Government subsidy received (8810 for an international grant)	5110	8820 Subsidies	Amount received
	Current operations			
5	Manure fed to the plant	2010-SR Biogas plant	2010 Dairy herd or 2810	Nutrient value
6	Operators' wages and social tax	2010-SR	6710; 6520	Amount accrued
7	Materials, spare parts, services	2010-SR	1000 group; 6010	Actual cost
8	Depreciation of structures and equipment	2010-SR	0220; 0230	Straight-line
9	Depreciation of the CHP unit	2010-SR	0230	Engine hours, Eq. (2)
10	Grant released in proportion to depreciation	8820	9390 Other operating income	IAS 20; NAS 10
	Output and use of products			
11	Digestate applied to fields	2010 Crop production	2010-SR	Nutrient value
12	Digestate stored for sale	2810 Digestate	2010-SR	Lower of nutrient value and NRV
13	Heat used on the farm	2010 Dairy herd; 2510	2010-SR	Gas replacement value
14	Electricity used on the farm	2010 (by process); 2510	2010-SR	Unit cost, Eq. (3)
15	Surplus electricity sold to the grid	4010; 9110	9010, 6410; 2010-SR	Sales price; cost
16	Idle capacity and abnormal downtime	9430	2010-SR	Deviation from normal load

Source: author's development based on IASB (1983, 2003a, 2003b) and Ministry of Economy and Finance (2024a, 2024b). 2010-SR is the "Processing of secondary resources" sub-account of account 2010 "Main production"; NRV – net realisable value. Entries 5, 11, 13 and 14 are eliminated as internal turnover when farm totals are compiled.

The system of entries has three features. First, manure and digestate move at the same nutrient value, so the value that reaches the crops is the same whether manure passes through the plant or not. Second, the depreciation of the CHP unit is tied to engine hours,

so a month in which the engine stands idle carries no CHP depreciation. Third, the cost of unused capacity resulting from operation below normal load is charged to period expenses rather than to product cost, as IAS 2 requires for unallocated fixed overheads (IASB, 2003a). In the model, internal turnover amounts to 2,878.8 million UZS a year (manure 1,001.1, digestate 1,001.1, heat 67.1 and electricity 809.4 million UZS). If these amounts were not eliminated, the farm's total costs and gross output would both be overstated by that amount – 1.5 times the plant's own total costs.[23]

In the financial statements, the plant is disclosed as property, plant and equipment by component, with the depreciation methods, useful lives and engine-hour life; digestate held for sale is disclosed in inventories with its measurement basis; the unrecognised balance of the grant is shown in account 8820; and the accounting policy note explains the valuation of manure and digestate, the by-product treatment of heat and the elimination of internal turnover. The same disclosures will be needed under the IFRS for SMEs Accounting Standard (IASB, 2025), towards which national reporting for small and medium-sized entities is moving.[24]

3.9 Discussion and limitations

The unit cost of about USD 0.070 per kWh is lower than the 0.10–0.16 € per kWh reported for plants of 50–400 kW in Greece (Eftaxias et al., 2024). The comparison should be made with care: here the manure cost is passed through to the digestate, wages are lower, and the accounting cost excludes interest and the opportunity cost of capital, which levelised-cost studies include.[25] The more robust finding is the structural one, which agrees with O'Connor et al. (2021) and Gebrezgabher et al. (2010): depreciation dominates the cost of small plants, and the economics depend on whether the farm uses the heat. In the model, 35% of the heat is wasted; each additional 10 percentage points of heat used would reduce the unit cost by about 27 UZS per kWh.[26]

The results are based on design parameters rather than on data from an operating plant. CHP efficiencies, servicing costs and component shares are typical values, and the investment cost is a global average, whereas locally manufactured equipment may be cheaper.[27] Once a plant is in operation, the assumptions are replaced by metered values – manure mass, biogas volume, electricity and heat meter readings – and the costing is prepared monthly from actual data.[28]

4. Conclusion

Farm biogas production requires its own cost accounting rules, which cannot be borrowed from either livestock or auxiliary production. The study proposes to treat the plant as a separate segment for processing secondary resources, with costs collected in a dedicated sub-account of account 2010; to carry manure and digestate at the same nutrient value, so that the cost of energy does not depend on manure valuation; to credit heat as a by-product at the replacement cost of natural gas, and only for the metered quantity used on the farm; to depreciate the plant by components, with the CHP unit depreciated by engine hours; to charge idle capacity to period expenses; and to eliminate internal turnover when farm totals are compiled.

Applied to a dairy farm in Samarkand region, the methodology gives a cost of 827.9 UZS per kWh of electricity, 15.7% below the grid tariff, and shows that allocation by energy content would overstate the cost of heat 3.2 times. At the same time, the real IRR of about 4.5% shows that tariff increases alone do not make farm biogas attractive; a grant of 30% of the investment raises the return to 9.7%. The costing therefore also serves as an information base for designing state support. Future research should test the methodology on operating plants and value the change in nitrogen availability in the digestate.

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