IEA Bioenergy
Technology Collaboration Programme

80 Farmers - one biogas system

A cooperative biogas plant in St. Lorenzen

Case Story

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Background in forming a biogas cooperative

The biogas plant operated by the Cooperative Bioenergie St. Lorenzen (Italy) is located in St. Lorenzen in the Pustertal Valley, a region extending from Brixen to Lienz. The region is situated at 800–1'000 meters above sea level and has a diversified agricultural structure. Animal husbandry is dominated by dairy farming. Crop production includes permanent grassland and maize cultivation, as well as potato farming and forage crop production.

The biogas plant is supplied by 80 farms located within a radius of approximately 10 km, managing a combined agricultural area of 1,300 ha, with most of the participating farmers operating their farms on a part-time basis. The close proximity is a key factor in the plant's operational success, as it minimizes transport distances, reduces logistical costs, and supports

efficient biomass supply management.

The cooperative was formally established in 2005, although initial interest in biogas technology among local farmers emerged in the early 2000's. This interest was strongly influenced by developments in Germany, where the successful deployment of biogas plants raised awareness and encouraged farmers in the region to explore similar solutions. Early considerations focused on small-scale installations using manure from 30–100 livestock units, but these were ultimately deemed economically unviable. As a result, a cooperative approach was pursued, favoring a larger plant size, as the Italian biogas subsidy scheme at the time provided a profitable framework.

The region in the valley is located within a monitoring zone where nitrate levels are being observed. In addition, the farms are already operating at full labor capacity. These conditions were key drivers for the development of the biogas plant. The main motivation for farmers to join the cooperation was to use highly innovative technology for the field application of digestate. The plant is the only installation in South Tyrol that applies digestate using injection technology. It services about 1,000 hectares managed directly through the application system. This approach eliminates the need for farmers to invest in additional field spreading or application equipment and saves time. This system enabled further farm growth without the need to expand manure storage infrastructure.

Cooperative model

The cooperative model in agriculture is well established in South Tyrol, with long-standing traditions in both production and marketing cooperatives, providing a solid institutional foundation for collective investment and operation. Higher feed-in tariffs for electricity generated from biogas in Italy compared to Germany provided a strong economic incentive and motivated participation. The avoidance of manure application by individual farmers was a key operational advantage and became a decisive factor for other farmers.

The initiative for constructing the biogas plant was launched by several farms interested in biogas technology, supported by manufacturers' sales networks providing technical and market expertise. The project was subsequently formalized through the establishment of a 80 farmer cooperative, with organizational and advisory support from the Raiffeisen Association. An administrative board comprising seven members has been in place since the foundation of the organization and has remained unchanged ever since. The board members are active farmers, ensuring direct information flow to the cooperative members. A general assembly is held once per year, while members have no additional operational responsibilities. Regulatory rules were defined to limit excessively high livestock densities and excessively distant fields. As an example, in the initial phase it was necessary for farmers to stop the use of sawdust in animal husbandry, as it is not degradable in the biogas process and forms sediments in the digesters. A formal statute and internal regulations were established, and the board set additional operational criteria, such as the enlargement of field access roads to accommodate larger machinery use.

The farmers became pioneers in manure and digestate logistics and self-propelled manure application, contributing to reduced odor emissions in the region, which is dependent on tourism. This led to strong acceptance among the local population and political stakeholders. Implementation was supported by numerous information events, study trips by bus to Bavaria (Germany) to visit existing plants, and active involvement of the local farmers' association.

Emissions are reduced both on farms and during field application, supported by improved

nutrient management and a corresponding decrease in the use of mineral fertilisers. The project contributes to local employment. In particular, the transport of substrates by truck is perceived less negatively by the public than the use of agricultural transport machinery. Unlike other agricultural activities, no complaints regarding transport operations have been reported to date. Revenues generated from energy production help support small-scale agricultural structures, especially in the areas of manure management and emission reduction. The stability and long-term viability of the cooperative are reflected in the fact that all founding members remain part of the organization until today, with withdrawals occurring only when members have converted to organic farming. This sustained commitment is further evidenced by a waiting list of approximately 30–40 farmers seeking membership.

Value creation and revenue streams

During the initial operational phase starting in 2005, the biogas plant was supported by a feed-in tariff scheme in Italy, providing 0.28 € per kWh over a period of 10 years which made a profitable operation of a CHP-Capacity of 1 MW_{el} possible. No utilisation of external waste heat was implemented, as the planned integration with the wastewater treatment plant, which is located in the neighborhood, was not realised. Additional financial support was provided by the provincial government in the form of investment grants for plant construction. The installation of the facility on a sloped site presented specific engineering challenges and higher investment costs.

From the beginning of 2026 onwards, the plant switched to biomethane injection into the gas grid under a support scheme for renewable gas, with a feed-in tariff of €124 per MWh. This framework ensures the continued economic viability of the plant. The transition to biomethane injection required an investment of approximately €7.7 million for a membrane upgrading unit. It also enables the virtual sale of energy to hard-to-abate industrial consumers. An amount of approximately 2.5 MW in form of biomethane (250 Nm^3 methane/h) is supplied to an industrial user for milk powder production, allowing for an additional premium on the tariff. Under this scheme, annual revenues are expected to reach around €3 million, compared to approximately €2.3 million under the previous electricity-based system.

Within this support mechanism, participation in CO_2 certificate trading is not possible, as the Italian state guarantees the energy price and retains control over the associated certificates. A CHP unit with a capacity of 250 kW_{el} continues to be operated for on-site electricity and heat supply. Additional on-site energy systems include a wood chip boiler for heat generation and a photovoltaic installation with a capacity of 210 kW_p.

In addition, each cooperative member contributes an annual fee of €50 per hectare. The system is based on a regulatory livestock density threshold of 2.5 livestock units (GVE) per hectare. This corresponds to application costs for the farmers of €1.2 per m^3 of manure, which is significantly lower than the costs typically incurred when farmers carry out manure spreading individually. This provides a strong incentive for farmers to participate. However, these membership contributions alone are insufficient to finance the plant's operation and account for only about 2% of the cooperative's total revenue. The facility is therefore dependent on regulated feed-in tariffs and must be operated on a fully commercial, economically viable basis. Business plans were essential for securing financing, which in turn enabled the issuance of the necessary construction permits, representing a fundamental prerequisite for regulatory approval.

Plant operation and logistics required a staffing level equivalent to seven full-time positions, with employment demand subject to seasonal fluctuations. The use of own digestate led to a

noticeable reduction in mineral fertilizer requirements on the farms. The total cost for logistics related to solid and liquid manure and the application of digestate amounts to €10 per cubic meter. There is no revenue stream from the fertiliser.

Replicability of the model

From the cooperative's perspective, implementation is understood as a long-term process ("a marathon") that requires sustained effort rather than rapid execution. For replicability of the model, it is essential to gradually build political understanding and actively secure political support. At the same time, the cooperative recognizes that uncertainties and perceived risks can delay or prevent project realization. Effective replication depends on robust and reliable management structures within the cooperative and a framework that minimizes risk for participating farmers. The model is only transferable if a suitable funding scheme, appropriate regulatory frameworks, and optimal local conditions are in place.

Feedstock, technology and plant concept

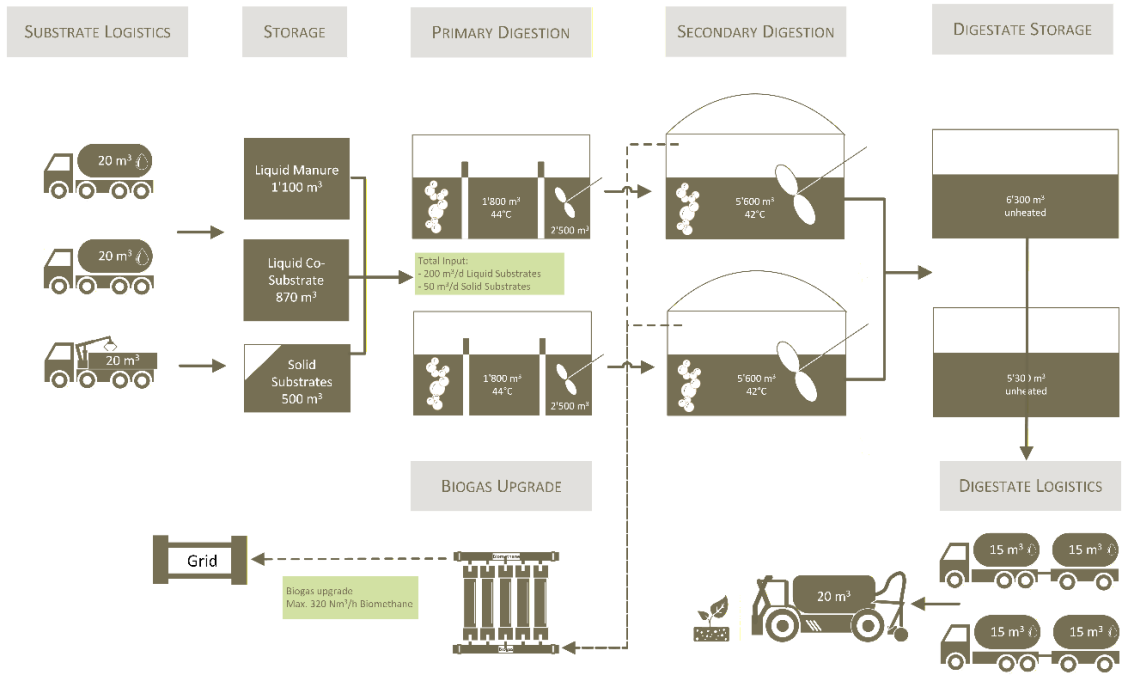

Figure 1. Flow scheme and storage capacities of the biogas plant St. Lorenzen

Most substrates are supplied by local farmers, predominantly high-performance dairy farms generating nutrient-rich manure. In addition, residues from cooperative potato cultivation are utilized as feedstock for the biogas plant. Further input materials include by-products from agricultural production, such as pomace, as well as residues from apple juice processing and sugar- and alcohol-containing wastes from the food industry. Approximately 90% of the total input consists of liquid and solid manure. The deliberate decision was made not to use dedicated energy crops, reflecting a clear strategy to avoid the use of cultivated energy crops in favour of residual and waste-based substrates.

In total, around 100 farms with 2'500-3'000 Livestock Units (LSU) supply feedstock to the plant, of which 80 are cooperative members. Additionally, 20 farms participate as non-members, acting both as suppliers and users of digestate. Some participating farms do not keep livestock

and are instead engaged in forage crop or vegetable production. These are actively integrated as they represent important consumers of digestate. Farm sizes of members vary considerably, ranging from of up to 100 LSU to small farms of around 10 LSU, with an average size between 20–40 LSU. Approximately 70–80% of the supplying farms deliver manure, while the share of solid manure is declining, as new livestock facilities increasingly shift towards liquid manure based systems. The plant processes a total annual input of 70'000 tonnes, with a potential capacity of up to 90'000 tonnes. The potential for increasing feedstock husbandry is primarily limited by winter storage capacity requirements, which oblige farms to maintain on-farm storage facilities sufficient for five months of manure production. Around 90% of the feedstock consists of liquid and solid manure, while the remaining fraction originates from industrial residues. Co-substrates represent a core input component, contributing around 30–40% of total biogas yield. Their selection is optimized to minimize residual digestate volume.

Substrates are collected from the supplying farms via the biogas plant's dedicated logistics system at intervals of approximately 2–3 months, using truck-based transport. The logistics system includes two four-axle trucks equipped with 20 m^3 pump tanker units for manure collection, as well as one truck (20 m^3) fitted with a loading crane for the transport of solid manure. At the plant site, liquid input streams are stored in two separate receiving tanks, one designated for agricultural slurries (1'100 m^3) and the other for energy-rich liquid substrates (870 m^3). Solid feedstock is discharged into a storage bunker (500 m^3) and subsequently handled by an overhead bridge crane, which feeds the material into a 60 m^3 solid-substrate dosing unit.



Figure 2. Field transfer of digestate from trucks to the self propelled injection vehicle

During the fertilization period, digestate is transported to the fields using two trucks equipped with 15 m^3 tanks and 15 m^3 trailers, as well as the two manure collection trucks, which are directly integrated into field logistics. The digestate is then applied using a self-propelled slurry injector (Vredo, VT4556, 20m^3 Volume, Netherlands). The application of digestate is coordinated by the driver of the injection machine, who manages logistics and scheduling in real time using SMS, phone calls, and massenger services. Operational information, such as mowing activities, is communicated to support planning. The driver determines the optimal application timing and prepares the logistics plan accordingly. In approximately 70% of cases, no further communication is required, as the system has become well established through routine operation. With injection technology, application is ideally carried out approximately one week after mowing. Furthermore, nitrification inhibitors are applied in maize fertilization, enhancing nitrogen use efficiency by delaying nitrogen transformation processes, thereby

improving the temporal match between nitrogen availability and crop uptake during the summer growth period. While intermediate storage of digestate at farm level could contribute to optimised logistics, its implementation requires separate storage facilities for raw manure and digestate. As a result, this option was not pursued by the cooperative. Future plans include the acquisition of a semi-trailer truck with a capacity of approximately 30 m^3 to further optimize transport efficiency.

Lessons learned and future perspectives

The following key factors were identified as critical success conditions for the development and implementation of the cooperative biogas project:

- The initiative must originate from farmers themselves and be organized by the agricultural community.
- Strong pioneering farmers ("key persons") are required to mobilize and involve other participants.
- A suitable and strategically located site is essential.
- A solid business case is required.
- A robust technical implementation is necessary, and the plant must operate at its designed full capacity.
- Joint manure management has proven to be a key success factor for project realization.
- Support from local political authorities and administrative bodies is necessary for successful implementation.

Contact of case story

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