



ECREEE

TOWARDS SUSTAINABLE ENERGY

DOCUMENTATION OF RENEWABLE ENERGY PROJECTS IN THE ECOWAS REGION

KEYS FACTS, LESSONS LEARNED AND CHALLENGES

FASO BIOGAZ BURKINA FASO



BACKGROUND

FasoBiogaz SARL is an enterprise founded in 2012 by the two Dutch entrepreneurs. The enterprise is located in the industrial zone of Kossodo in Ouagadougou, Burkina Faso, and operates the first industrial biogas plant connected to the SONABEL power grid. The plant, with an installed electrical capacity of 275 kW, is transforming slaughterhouse waste and other available organic substrate into biogas and digestat. While biogas is transformed into electricity and injected into the national power grid, the digestat is commercialized as biofertilizer under the brand "Nourrisol".

KEY INFORMATIONS

Site	Ouagadougou, Burkina Faso
Technology	Grid-connected biogas plant
Installed Electrical Capacity	275 kW (550 kW)
Developer	FasoGaz
Operator	FasoBiogaz SARL (private enterprise)
Commissioning	October 2015
Investment Costs	1,500,000 EUR (for 550 kW)
Financing	50% subvention from Dutch government, 50% private sector investment



PROJECT DEVELOPMENT

Many large-scale factories are located in the industrial zone of Kossodo in Ouagadougou, including the main slaughterhouse of the city (Abattoir Frigorifique de Ouagadougou AFO). Its wastewater was forwarded directly to a wastewater treatment plant which is under the responsibility of the National Office for Water and Sanitation (ONEA). To meet the requirements set by ONEA, an adequate pretreatment of the effluents was necessary, giving AFO the motivation to find an appropriate treatment solution.

Through the application of biogas technology, the wastewater receives the necessary pretreatment to meet the existing requirements set by the ONEA. At the same time, a valorization of wastewater, dung and stomach contents to biogas and valuable digestat takes place.

With the agreement from AFO to forward all their waste to the biogas project which is located on the unused terrain next to the slaughterhouse, the Burkinabe group FasoGaz applied for a subsidy from the Private Sector Investment (PSI) program. This program funded by the Dutch Ministry of Foreign Affairs aimed at supporting innovative investment projects in developing countries initiated by Dutch enterprises with a

long-term cooperation with a local partner in the country of the project's implementation.

FasoBiogaz was created in 2012, after the receipt of the first part of the PSI subsidy. The Burkinabe enterprise, which is part of the FasoGaz group, is exclusively responsible for operation and maintenance of the biogas plant as well as the marketing of its by-products. A feasibility study was elaborated in 2014 by Access Services Énergétiques (ASE) on behalf of FasoBiogaz and the Société de Gestion de l'Abattoir Frigorifique de Ouagadougou (SOGEAO) on the integration of the project with the operations of the existing slaughterhouse, and on technical and economic aspects concerning the connection to the power grid.

The Construction followed the approval of the project by SOGEO and the first phase with a digester and an installed electrical power of 275 kW was completed in October 2015.

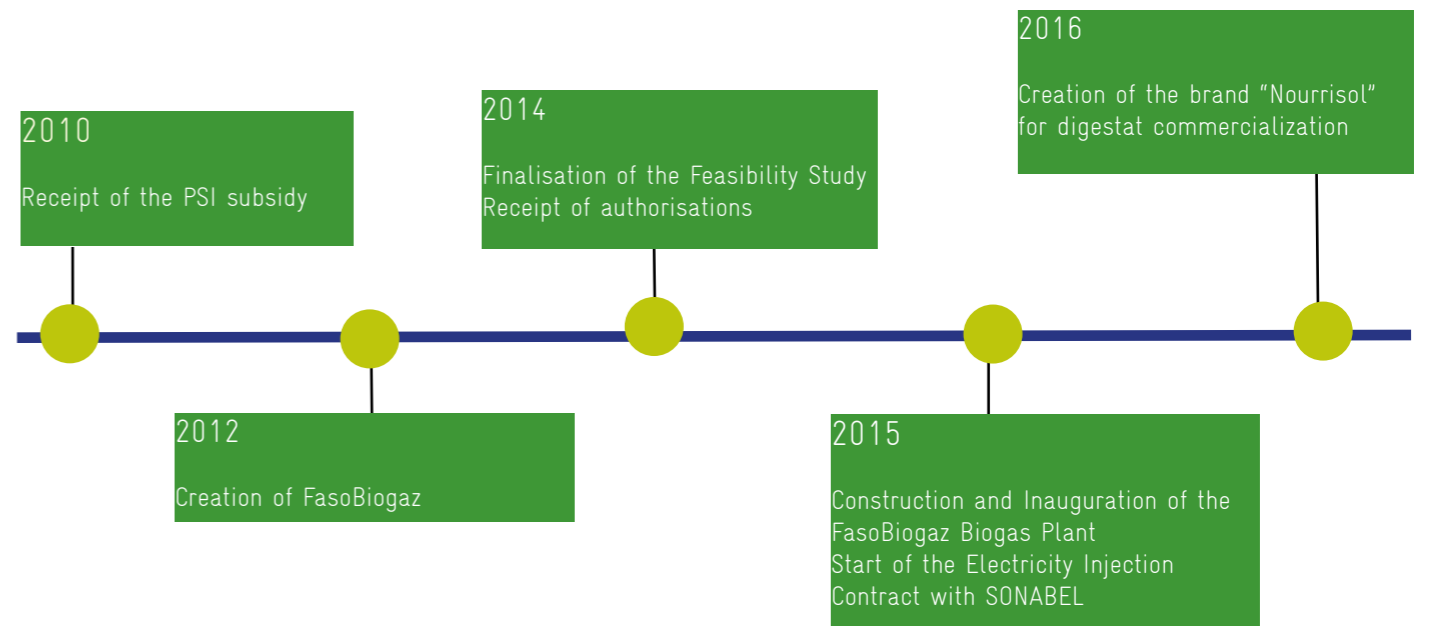
FasoBiogaz started injecting electricity into the national power grid from November 2015, on the basis of a Power Purchase Agreement with the national power grid company SONABEL.

Regarding the digestate, FasoBiogaz created the brand "Nourrisol" and began its commercialization in 2016.

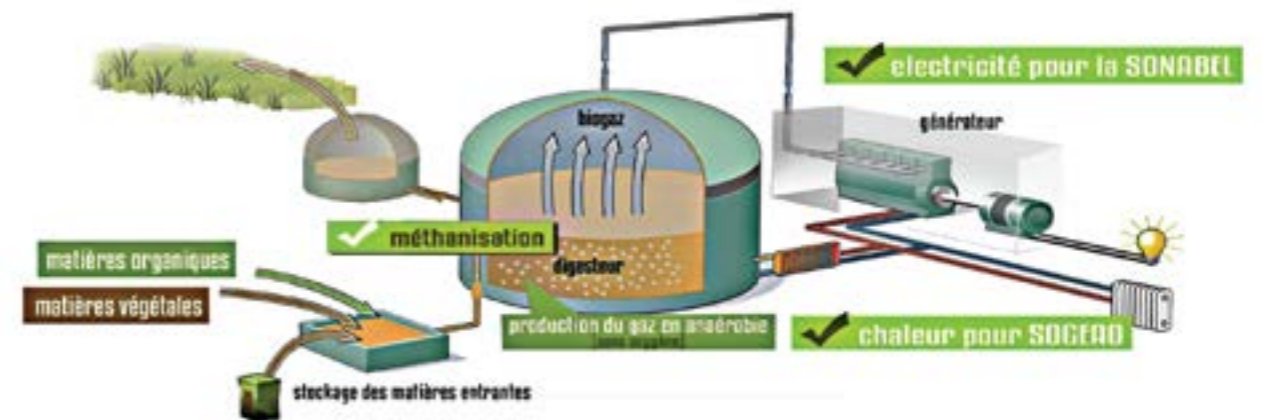
PROJET MILESTONES

FasoBiogaz is a flagship and pioneering project for Burkina Faso which provides an innovative recovery solution for slaughterhouse waste using methanization technology allowing the production of electricity and biofertilizer. This solution is particularly relevant in a context where, on the one hand, the production of electricity is not always sufficient, and, on the other hand, agricultural soils are depleted.

The project is the result of a cooperation between Burkina Faso and the Netherlands and a cooperation between the public and private sectors. Initiated by the Burkinabe group FasoGaz, the project now belongs to Catalyse Energy Burkina Faso (CEBF), a company founded in the Netherlands.



FasoBiogaz



Processus de production d'électricité et de biofertilisant

TECHNOLOGY

The site of the FasoBiogaz biogas plant is ideally located next to the slaughterhouse on an area of about 8,400 m². The construction was realized by Access Services Énergétiques (ASE) and the Dutch enterprise Nijhuis Water Technology.

The receiving pond is an underground concrete structure, leveled at the bottom and with an open top. The structure is equipped with four stainless steel heating coils and a sieve on top for the separation of impurities. Inside the pond, a mixing pump is installed and is also used to convey the substrate into the digester. The lagoon digester has a concrete enclosure and a double membrane roof. The 2,500 m³ square-shaped structure is equipped with two inclined submersible mixers, an underfloor heating system as

well as an over and under pressure device. The double membrane is further stabilized by a compressor/fan. Biogas is transformed into electricity and heat by a cogeneration unit (Waukesha) with an installed electrical power of 275 kW.

After fermentation in the lagoon digester, the digestate is sent to the mechanical screw solid-liquid separator. As storage of liquid digestate is more complex, a storage tank is placed next to the separator.

The electricity produced is injected into the electricity grid through a 15 kV substation located on the site. In the event of an increase in installed capacity (above 550 kW), and according to existing rules, the electricity would have to be first routed to the nearest SONABEL power station, which will have an impact on costs.



Lagoon digester with double-membrane

OPERATIONS

The biogas plant operates without interruption. The combined heat and power unit operates 16 hours a day, from 6 a.m. until 10 p.m. The digester is fed in the morning or depending on the availability of the substrate. According to the technological concept, it is planned to pump 40 to 60 m³ per day into the digester, in order to achieve a hydraulic retention time (HRT) from 40 to 60 days. The lagoon digester operates under mesophilic temperature conditions (around 38 °C). To keep the substrate homogenized and avoid the formation of crusts, the substrate is mixed in total 6 hours a day at regular intervals.

Depending on the feeding, the gas mixture has a methane content between 60 and 70%, and around 630 to 740 m³ of biogas are produced each day. Part of the electricity produced is used for plant equipment. In total, 4,200 to 4,300 kWh of remaining electricity is sent to the transformer and injected into the electricity network. At the end of each month, SONABEL and FasoBiogaz observe together the electricity meter located at the plant and invoice the amounts injected.

As for the digestate, three different products – liquid fertilizer, solid biofertilizer and organic soil amendment – are advertised on the FasoBiogaz website. The sale of an organic fertilizer is also advertised on a poster outside the plant. Farmers and others can bring their own container to collect the digestate on site.

ECONOMIC AND FINANCIAL ANALYSIS

The project is financed by the Dutch private investor company Van Kersbergen Invest B.V. In the framework of the Private Investor Program (PSI), the Netherlands Enterprise Agency has agreed to reimbursement up to 750,000 EUR based on a results-based milestones agreement. The initial investment amounts to 1,500,000 EUR for the implementation of a plant with an installed capacity of 500 kW. Operating revenues are generated through the sale of electricity and digestate as biofertilizer.

In 2015, FasoBiogaz was able to negotiate a Power Purchase Agreement (PPA) with SONABEL with a desirable tariff for 3 years. With a currently installed power of 275 kW, the plant can daily inject between 4,200 and 4,300 kWh into the grid. With the planned extension, the income generated by electricity production could be doubled.

Strong demand can be observed for solid fertilizers, higher than the current supply. In order to guarantee a higher production of organic fertilizer, and an increase in revenues, the biogas plant must ensure a constant supply, in quality and quantity, of the input substrate.



RESALE OF ELECTRICITY

If a similar project is implemented in 2020, the price for reselling electricity to SONABEL should be between 0.08 and 0.11 EUR per kWh. This result is due to the strong negotiating position of SONABEL.

Although the framework conditions have changed with the implementation of a new law in 2017 which allows independent producers to sell electricity directly to consumers, most producers are still supplying the existing network, and therefore SONABEL.



DID YOU KNOW?

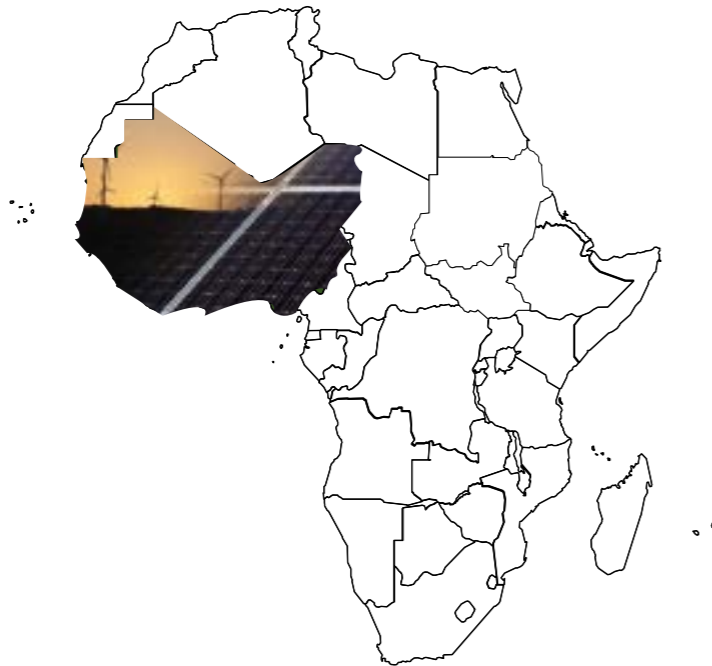
Decomposition of organic waste and wastewater contributes to the creation and release into the air of methane emissions (CH₄).

According to the Intergovernmental Panel on Climate Change (IPCC), methane, if it is not captured, has an impact on global warming over a period of 100 years 34 times higher than CO₂.

ENVIRONMENTAL BENEFITS

The environmental benefits of the project are mainly linked to the recovery of slaughterhouse waste for the production of energy and fertilizer. They fall under the following categories:

- Reduction of Greenhouse Gas (GHG) emissions (including methane, CH₄) thanks to the substitution of electricity produced from fossil resources (hence reduction of CO₂ emissions by clean energy from organic waste), and the controlled use of methane, because without capture and treatment the waste would produce uncontrolled (open air) GHG emissions. Reducing these emissions helps to mitigate climate change.
- Reduction of various pollutions, such as air/atmospheric pollution due to odorous substances or exhaust gases if the waste is not treated; pollution of soil or groundwater due to emissions from untreated slaughterhouse wastewater or the use of imported chemical fertilizers for farming instead of biofertilizers produced by the project.
- Production of renewable energy and contributing to the reduction of national petroleum consumption as a primary source of electricity production. Possibility to sell electricity directly to consumers.
- With large-scale cogeneration, the heat produced and not valorized in the process could be used for the refrigeration of the slaughterhouse, thereby reducing its energy consumption.



Supply of wastewater

CONCLUSION

FasoBiogaz is a flagship project for Burkina Faso with regards to using waste to produce biogas and electricity on a large scale. The large amount of organic waste available in Ouagadougou would allow this project to be extended or repeated. The enterprise benefits from ideal framework conditions with its location in the industrial area of the city and an agreement with the slaughterhouse. This location allows low collection and transportation costs and offers a variety of options for alternative substrates due to the presence of many businesses in the area. Large-scale biogas technology remains unique for the region with only one other large-scale biogas plant in Ouagadougou. Due to the limited existence of sites, local expertise also remains limited. To strengthen the sector and also to avoid dependence on international experts, and thus reduce operating costs, in-depth professional training should take place.

Electrical autonomy of farms is also an important development axis for the future. Initiatives such as FasoBiogaz should form a national association for renewable energies in order to promote them more actively and allow more exchanges of experiences between stakeholders in the sector.

The investment costs for large biogas plants are relatively high and require subsidies. Ideally, projects should be implemented in partnership with the state or communities to obtain free land and thereby reduce CAPEX.

CRITICAL SUCCESS FACTORS

Financing	Facilitated access to capital for private entrepreneurs and/or possibility of receiving government grants to finance high initial investment costs
Adapted and easily accessible site	Biogas plants must be located near the main source of substrate and require good access (roads) for supply.
Consistent and predictable supply	Biogas plants depend on the raw material and the logistics arrangements must be made with a partner who can ensure a constant and long-term supply of substrate.
Revenue diversification	The biogas plant does not only depend on biogas for income generation, but also generates value from its other products such as digestate or electricity if it is produced via a cogeneration unit. It is also possible to recover the waste heat in order to improve the economic profitability of the project.
System adaptability	The technology must be selected according to the local context. In addition, it is important to have a modular, flexible and adaptable system which can be enlarged if necessary or which can receive other substrates in case the supply of the main substrate is not possible.

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