

SUSTAINABLE BIOENERGY IN TÜRKIYE

CASE STUDY

INDUSTRIAL
DECARBONIZATION
ACCELERATOR



Bolu Güç Birliği (BGB) Bolu, Türkiye

Sector

Poultry livestock waste management

Intervention

Thermal energy generation from sustainable biomass to replace fossil fuels

Date of implementation **Duration**

2021 - 2022

12 months

Company profile

Bolu, in north-western Türkiye, has a thriving poultry industry. Around one-quarter of all national broiler chicken production (chicken bred and raised for meat) comes from the area. As broiler farms are abundant here, the sheer scale of production makes poultry waste a significant environmental problem and a public health risk. To address this issue, farm owners and local businesses have come together to form Bolu Güç Birliği (BGB), a bioenergy company that turns broiler litter (a mix of chicken bedding, chicken droppings, spilled feed and feathers) into renewable energy.

Project summary

The project will generate green energy by turning broiler litter into electricity, heat (thermal energy) and biochar (a carbon-rich by-product that can be used to increase soil fertility). It does this through a process of pyrolysis (heating organic matter without using oxygen). The electricity generated will be sold to the national grid, and the thermal energy will be used in both BGB's biowaste pellet production facility and to heat neighbouring broiler farms. The biochar will be sold to farmers as an organic, high-quality fertilizer.

This technology intervention has potential to be replicated and scaled up, both across Türkiye and Europe. The project showcases the many environmental, economic and social benefits thermal energy generation from poultry waste has to offer.

Plant profile

BGB's bioenergy plant is a gasification power plant with a total installed power of 2.6 MWe/10.8 MWth. The plant will operate for 7,000 hours per year and will generate 18,200,000 kWh electrical energy. Around 18,900 tons of litter pellet, which is produced from rice husk containing broiler litter, will be used as feedstock in the gasification plant, and 2,700 tons/year biochar will be produced.

UNIDO, in partnership with Türkiye's Ministry of Agriculture and Forestry and Tagem, supported BGB's investment by providing technical assistance and investment support. As a result, the plant is utilizing the full potential of biomass by installing integrated waste heat recovery and creating a sustainable feedstock supply chain. All the waste that comes to the plant comes from farms in Bolu, most of which are located within 5 km of the bioenergy plant.

The feedstock preparation takes place in the plant. Wastes are dried and pulverized, pellets are then produced and fed into the gasifier. This produces a syngas, which is combusted in a syngas boiler to generate thermal energy. This thermal energy is used to heat conductive oil, and this generates electricity through a process called the organic rankine cycle (ORC), which can produce power from low to medium



heat sources. Hot water is generated, and in typical processes this is then cooled down. But UNIDO has supported BGB to utilize this hot water to produce more thermal energy. The plant has installed an economizer and heat transfer network that moves this thermal energy back to the pellet production system to power the drying process and to broiler farms for heating.

UNIDO has also supported the plant to create a sustainable and more efficient biomass supply chain by helping BGB produce higher quality fuel pellets from poultry litter, which upgrades the energy value of the feedstock. As a result, BGB has signed feedstock supply agreements with 57 broilers in the region.

Impact

The project will utilize approximately 20,000 tonnes per year of poultry litter, preventing environmentally damaging disposal of this waste.

The clean electricity that is generated will prevent 8,750 tonnes of CO₂ emissions each year. The co-generation of thermal energy replaces the use of 2,530 tonnes of coal per year for the plant's heat requirements, saving around 3,000 tonnes of CO₂ emissions.

The 2,700 tonnes/year of biochar produced will bring an economic revenue to BGB. The use of biochar will also improve the soil quality of farmlands by protecting nutrient cycles (such as the nitrogen and phosphorus cycle), which are vital for ecological balance.

The plant is having a positive impact on the region for other reasons too. By addressing the broiler waste problem it is also enabling broiler chicken farms to increase their capacities. New jobs have been created in the process, not only on farms but in the biomass plant itself.

Environmental and social benefits

Waste elimination greatly benefits local people, increasing the welfare of the community and creating a cleaner environment.

Rapid elimination of poultry litter (at a rate of 55 tonnes a day) will greatly improve soil quality and mitigate public health and environmental risks. The risk of groundwater pollution from the poultry waste will also be prevented, as will the risk of manure-borne pathogens that threaten human health. The foul smell emitted by poultry waste is also being eradicated, making the air more pleasant to breathe.

The ORC system does not require water to operate. This means the entire process uses relatively small amounts of water, so it does not put a strain on this natural resource.

The project promotes economic development in rural areas by providing an environmentally-friendly waste management service to broiler farms in Bolu. This

is likely to attract more broiler farms to the area, as one of the main challenges of building a new broiler farm is getting a waste management permit. Rural development also helps to reduce migration by creating jobs and new lines of work, meaning people do not have to move elsewhere to make a living.

Strengthening relationships between the waste management, poultry and renewable energy sectors helps to make each sector more resilient. It also brings Turkiye closer to achieving the Sustainable Development Goals and climate change targets.

Challenges and lessons

Biomass-to-energy plants are more profitable as the size goes up due to the economies of scale. But small, regional plants have several advantages, such as easier access to biomass feedstock, lower initial investment costs and simple operating logistics. Many of these advantages are increasing in importance, given the energy and food crises affecting the post-pandemic, conflict-affected world.

Often, thermal energy utilization through waste heat recovery is overlooked in developing countries due to a lack of capacity and awareness – generating income by selling electricity to the grid is often the main focus. As the special feed-in tariff (FIT) for renewable energy plants is now finished in Turkiye, waste heat recovery carries greater promise.

Co-generating electricity and thermal energy and ensuring a sustainable supply chain unlocks the full potential of bioenergy in industrial processes, bringing expanded environmental and economic benefits.



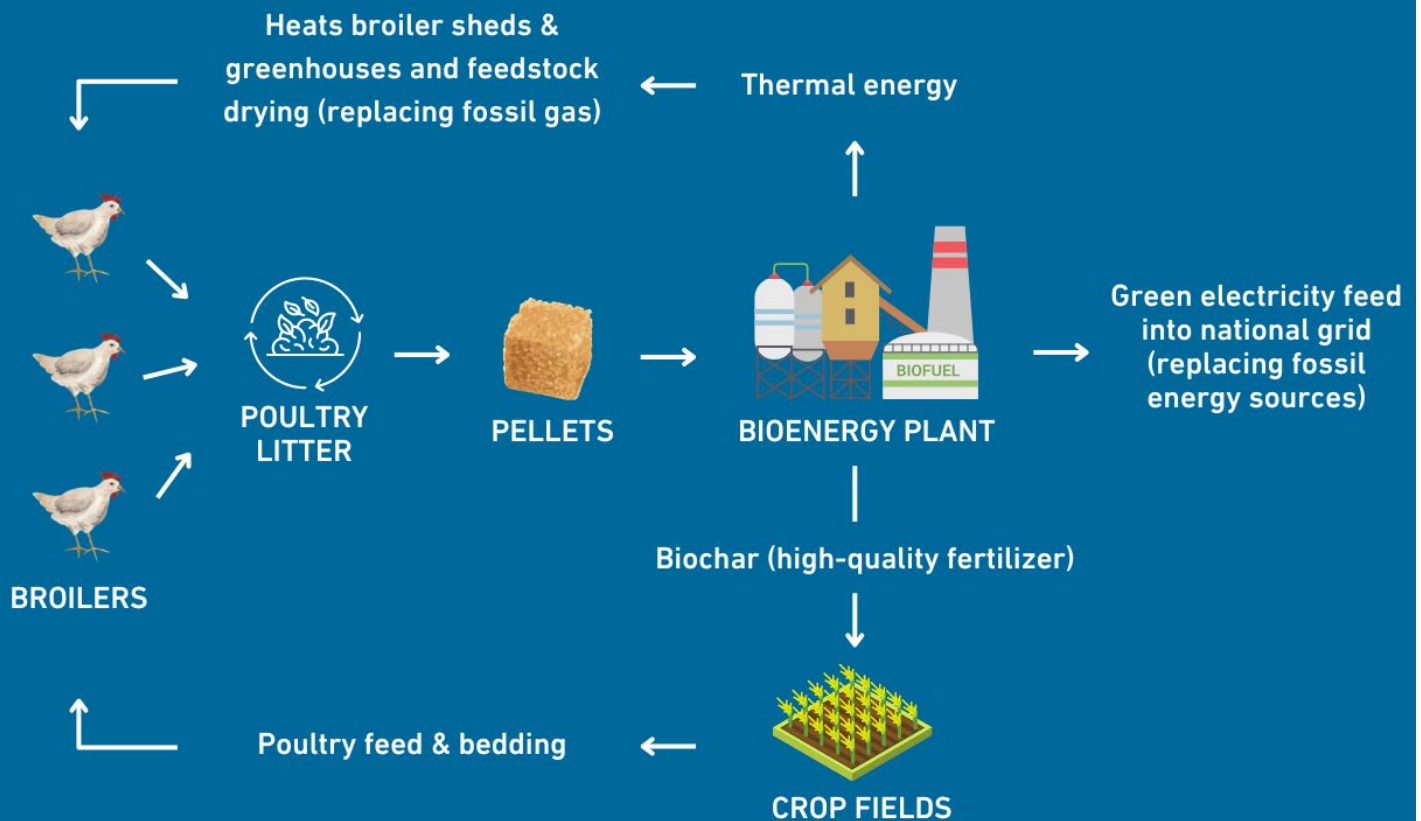
Benefits

- GHG emissions reduction
- Local employment creation
- Reduced public health risks a bullet itself
- Nutrient cycle preserved
- Increased economic competitiveness of agro-industry
- Enhanced energy independence

In numbers

Capacity	2.600 kWe/10.800 kWth
Yearly CO ₂ emissions reduction (direct)	11,750 tons CO ₂ eq (equivalent to 1000 houses' energy use/year)
Total investment	USD \$7.5m
<ul style="list-style-type: none"> • BGB's financing 	USD \$6.75m
<ul style="list-style-type: none"> • UNIDO's contribution 	USD \$0.75m + technical assistance (thermal energy project and biomass supply chain)
Payback period (thermal energy initiative)	44 months

Process flowchart



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