

## Which business model adaption or innovation in the German biogas sector?

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In Germany, biogas activities started in the early 1990s with around 100 farm and food waste conversion plants. Since 2008, there was a real biogas boom due to financial incentives from the government, planning to move from nuclear to alternative energy. There are currently around 9,500 biogas plants in Germany<sup>1</sup>, mostly owned and managed by either individual farmers or as industrial projects, where the owner is paid for the bio-waste collection. Investments for biogas plants start from 1,5 million euro, depending on the size and technology. With the feed-in tariffs, electricity is subsidised and can currently be sold for 13-15 cent per kwh. However, feed-in tariffs are limited in Germany to 20 years, and then, electricity will be subjected to open market prices which currently are ca. 4 cent per kwh. Electricity can also hardly be sold at a local level, as the big energy suppliers are dominant on the German markets. Therefore, the era of biogas plants in Germany is already entering a final phase, in which the following questions are posed: will the biogas sector remain as it is with electricity-heat-fertilizer outputs or will there be a change of strategy focusing on new products and markets? If so, what are the options (product specialisation, new biorefinery platforms, new markets, distribution channels etc.)? Our specific research aim was to understand how businesses in the German biogas sector can adapt their business models and strategies in response to external changing political and market conditions.

In management research linked to sustainability, resource efficiency and circular economy, the business model has become a popular new unit of analysis (Schaltegger et al., 2016; Nußholz, 2017; Pieroni et al., 2019). Although there is no agreed definition, a business model in general describes how a firm operates and how it creates value for its stakeholders (Casadesus-Masanell & Ricart, 2010). Businesses are obliged to adapt and innovate their models and strategies because of e.g. market liberalisations, new technologies, increased competition, changing socio-economic conditions (Taran et al., 2015). Surprisingly, there is yet little knowledge of how firms adapt their business models in response to external triggers, i.e. to threats and opportunities (Saebi et al., 2017). Business model adaption has been defined as “the process by which management actively *aligns* the firm’s business model to a changing environment” (Saebi et al., 2017: 569), in contrast to an innovation of the core business model itself in order to *disrupt* market conditions. Adaption can be done by changing the element of the business model, i.e. its value proposition (products and services offered to customers), its value creation (activities, resources, partners) and/or its value capture (cost and revenue structure, growth strategy). Earlier studies on business model adaption highlight that facilitating factors in the adaption process are e.g. *a willingness to experiment* (e.g. Andries et al., 2013) or the ability to develop *leadership and organisational capacities* (e.g. Demil & Lecocq, 2010). In contrast, *path dependency* was found to be a barrier, as established structures and relationships may lead to increasing business inertness (Bohnsack et al., 2014).

We have studied more in-depth two business cases from Germany which started early with anaerobic digestion and then developed their activities in response to changing institutional and market conditions. In the first case, the main goal of the company initially was to profitably convert pig slurry from its animal husbandry into biogas via anaerobic digestion. Some years later the manager-owner enlarged his biogas plant in order to create economies of scales for re-investments (from 55 kWe to 300 kWe). After, he started pelletized fertilizer production, marketing and exporting as he noticed that the area to spread digestate and nutrients would become a limiting factor; then he supplied heat to a nearby eco-village via a district heating grid, and finally, electrical energy to an electric car sharing initiative. The second case was founded by several partners with various backgrounds and knowledge, with the objective to build a network and attract investors who would enable the implementation of a circular economy approach around a biogas plant. The initiative regards itself as technology development hub that aims to test and optimise ideas by creating future “modules” like humus, bio-fertiliser, biochar (Palaterra), and Macroalgae production, exploiting heat supply from the biogas plant; the objective is to market these modules via franchising. For the biogas plant, the energy crops were already substituted by horse manure due to the policy change regarding limited use of energy crops in biogas plants. As prices for electricity decrease – because of the new regulation of tendering electricity from renewable energy sources – it is envisaged that the company will be taken over by one of the partners constructing rooftop greenhouses.

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<sup>1</sup> <https://www.euractiv.com/section/energy-environment/opinion/biogas-in-germany-maintaining-momentum/>

Results show that business innovations in the biogas sector are strongly driven by the question of how biogas plants in Germany can survive after 20 years' subventions via feed-in tariffs and the introduction of the new regulation for tendering electricity from renewable sources, which implies competition between the use of different alternative renewable sources. While the first case aligns to the changing institutional and market conditions via an adaption strategy, the second one is also based on an innovation of the business model itself by creating a new firm with a technology development hub. Both cases modify business model elements in terms of new value propositions, resources, partners, and distribution channels. Their strategies are based on technological (developing modules), product (pelletized fertilizers, humus), marketing (electric car-sharing, eco-village) and/or organisational innovation (cooperation between different actors). As our insights are only based on two explorative cases, it would be interesting to perform a large-scale survey among biogas plant owners in Germany to develop real business and policy recommendations.

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