IEA Bioenergy
Technology Collaboration Programme

BECC – from base-load biomass CHP to a flexible energy hub

Land van Cuijk, the Netherlands

Best Practices on flexible bioenergy

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Author: Daniel Goedhuis

Project description

BECC, Bio-Energy Centrale Cuijk, is transforming from a base-load project based on a solid biomass power plant to a flexible renewable energy hub, which is steered on optimizing operational margin instead of maximizing MWh output.

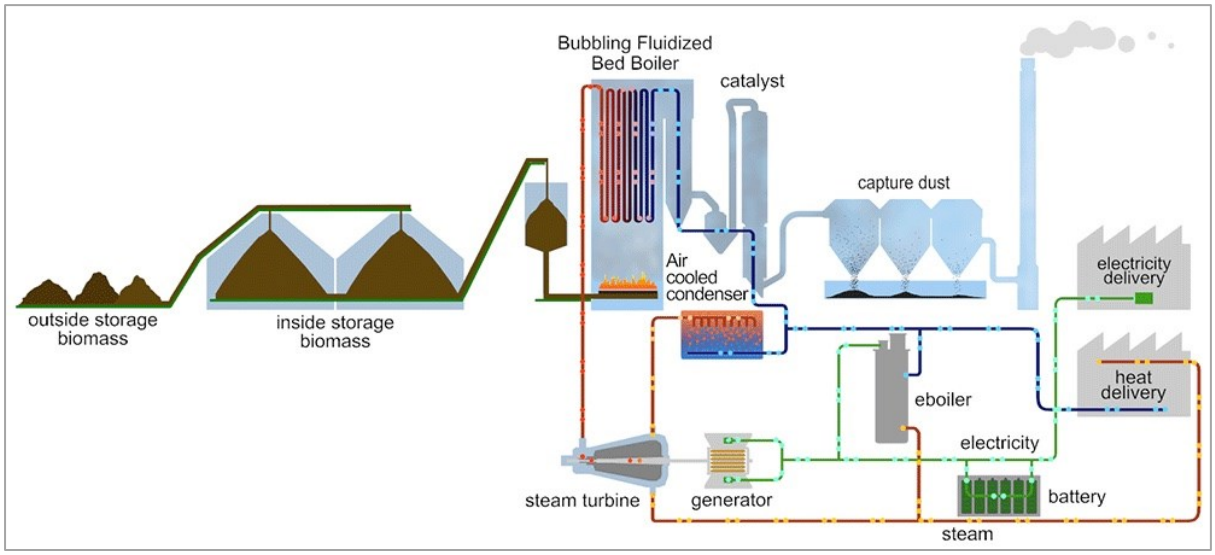

Figure 1: Simplified process flow diagram of the existing situation at BECC.

Built in 1999 as a 25 MW_e power plant burning pruning wood, the plant was operated until 2010 based on an operational MEP subsidy[1]. When this subsidy ended the plant was mothballed. In 2015 it was acquired by a consortium of 4 entrepreneurs and Pontex Investments Partners (before NIBC). With a vision to prepare the plant for the future, the total project is transformed into a flexible energy hub. The first step (in 2016) was to introduce other biomass streams such as waste wood and paper sludge, to diversify the feedstock. The second step (in 2018) was to invest in a steam grid to supply local industries with steam (35 bar, 270 ^{0}C), which was further expanded in 2019. This was followed by the investment in a 10 MW/20 MWh energy storage system in 2022 and an electric boiler in 2023. These assets now form the basis for flexible operations on all power markets while maintaining the supply of steam towards the clients.

Next steps will be investments in a carbon capture project to move towards negative emissions. Also, battery charging infrastructure is being developed, supplying battery

[1] MEP: Environmental Quality of Electricity Production (Milieukwaliteit van de Elektriciteitsproductie)= is a kWh subsidy paid to domestic producers of electricity from renewable sources and CHP who feed-in to the national grid.

charging facilities for zero emission construction projects in the area and electric truck loading facilities. Furthermore, a molten salt heat storage system is in preparation to further flexibilization of the energy production patterns and to provide additional flexibility for the energy markets.

BECC works closely together with Greenchoice and Spectral on the optimization software development of all assets on site. This is a complex puzzle that needs to be automized in order to realize the revenues on the different markets BECC is active in and truly operates as a fully automated energy hub.

Base information	
Link for more information	www.beccuijk.nl
Contact person, email	Daniel Goedhuis – daniel@beccuijk.nl
Location (city, country)	Cuijk, The Netherlands
Owner/Operator	BECC
Technology supplier	Kvaerner (biomass boiler), Siemens (turbine/generator), Valmet (DCS), Alfen (battery), Parat (e-boiler)
Construction year	1999/2015
Status	Operational and partly under construction
Feedstock	Pruning wood chips, waste wood, paper sludge
Products	Power, steam, CO_2, flex services
Avoided emissions per year	60,000 tonnes of CO_2 per year as CHP, growing to 180,000 tonnes/year when CCU/CCS project is realized
Type of flexibility provided	Feedstock flexibility with multiple feedstocks, co-generation with flexible output, flexibility through storage (both power and heat)
Investment cost of the plant (€/USD)	Original investment EUR 70 M€, expansion projects in total over EUR 60 M€

Technical and Commercial Details

The plant runs commercially under an SDE subsidy since 2015. Annual consumption of biomass is approx. 160-200,000 ton, producing approx. 110,000 MWh power and 80,000 MWh heat in 7,000 -7,500 operating hours per year.

The plant has a reasonable efficiency of approx. 30%, partly due to the relatively low amount of steam that is supplied. In recent years, the biomass plant has been running more and more as a flex unit, ramping up and down during the day, following the hourly power prices.

While this has a negative effect on average fuel efficiency, the overall operational margin is improving, given the high prices at high load, and avoiding low power prices through low production. This fits very well in national policy statements that biomass should play a complementary role for sun and wind produced power, in combination with supplying industrial heat for which there are no good renewable alternatives.

The combination with a battery and e-boiler provides opportunities to benefit from imbalance markets and ancillary services markets, optimizing the use of the existing grid connection.

Market Opportunities

With the carbon capture (CCU/CCS) expansion project currently under development, BECC will have yet another optimization play. The CO_2 capture facility can be ramped up and down in light of the fluctuating energy prices, reaping even more margin from these fluctuations, while creating margin from the CCU/CCS market and subsidies on an average price level basis.

The battery charging facility (see above) should also be seen in this light. The intent is to be able to load these batteries during low priced hours, and not so much as fast as possible. As these batteries will be exchanged on site, this should be very well possible, giving BECC yet another flexibility option.

The heat storage development project adds further to the flexibility play. In fact, this is an indirect storage facility on the power market, as it is loaded with power and the supply of heat from the storage has the effect that the biomass plant can produce more power. Compared to the existing energy storage (power only), this storage has the benefit that no additional grid capacity is used, and furthermore it has a scalable storage size.

Lessons learned

So far, the lessons learned are that steering the total project on optimizing operational margin instead of MWh output using the different flexibility options is complex. Both in the development phase as in the operational phase, it involves a lot of deep energy market insights, in combination with understanding the technical limitations of the assets to reap the maximum benefits. And with every new asset, the playground is changing again, leading to other dispatch and optimization patterns.

Figure 2: BECC, Bio-Energy Centrale Cuijk 2024