



MORE THAN ONE LEVEL OF ENERGY SAVINGS AT NOVOZYMES

Novozymes provides enzymes to the world market, where the enzymes contribute to reduce energy consumption at the costumers. Producing enzymes is an energy-intensive process and Novozymes has, among others an agreement with the Danish Energy Agency to implement energy efficient measures in order to reduce energy costs. The energy efficient measures have mainly been implemented as product and process optimizations.

SYSTEMATIC FOCUS ON ENERGY EFFICIENCY

As a part of the agreement with the Danish Energy Agency to implement energy efficient measures, Novozymes has worked systematically with among other energy management after the ISO 50001 standard, energy-conscious planning and energy optimization at the production facility in Kalundborg. Many solutions have afterwards been used at other production sites in Denmark and the rest of the world. These are now leading identification of new energy efficient measures locally at sites outside Denmark.

The agreement with the Danish Energy Agency has contributed to generate a substantial focus on the company's energy consumption. For example the agreement implies that the company must define a comprehensive energy strategy and objective and also appoint an energy responsible employee. The company has appointed energy responsible employees for every area of expertise, so that every process – fermentation, cleaning, granulation and environmental technology – has an energy responsible

FACTS ABOUT NOVOZYMES

- The company's energy consumption globally was in 2014; 4188000 GJ = 1,163,000 MWh.
- The company has increased its energy efficiency with 43% from 2005-2014.
- Energy efficiency was improved with 3 percentage points from 2013-2014.
- The company has reduced its carbon emission by approximately 56% from 2005-2014.
- The company is focusing on reducing transportation e.g. by transporting more products at the time. Thereby energy consumption and carbon emission is kept at a minimum and at the same time lead to cost savings for the company.

employee attached. This makes specialization possible and thus generates a larger outcome of the work with energy savings.

Novozymes set a new operational energy and CO₂ target in 2014. Novozymes aims at reducing CO₂ intensity (measured as metric tonnes of CO₂ emissions per gross profit) of their operations by 25% by 2020, compared with a 2014 baseline. This new target was framed in this manner to be consistent with climate science and the Sectoral Decarbonization Approach.

Expressing Novozymes' performance in terms of CO₂ intensity (where gross profits indicates the company's added value to the economy) will make their performance easy to communicate, understand and compare with sectoral peers. This science-based approach will enable Novozymes to understand their efficiency at reducing CO₂ emissions across business segments in a homogeneous, consistent and transparent manner.

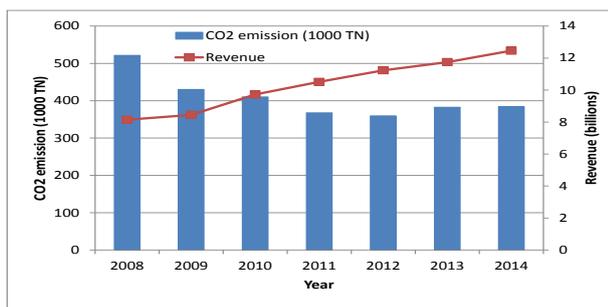


Figure 1: The turnover rises while the carbon emission decreases.



THE PRODUCTION IS AN IMPORTANT PRIORITY
Working with energy savings for example means using LEAN that focusses on reduced energy consumption and minimized waste. Practically this for example means a focus on combining the right mixture of raw materials and enzyme producing microorganisms in smaller test facilities in order to determine the optimal recipe for how, the enzymes can gradually be produced large-scale at the same time ensuring most possible product per energy unit.

WASTE WATER IS USED FOR ENERGY GENERATION
As a part of the agreement with the Danish Energy Agency and included in the effort to minimize waste from the enzyme production, Novozymes in 2010 committed to study whether the waste water from the enzyme production at the Kalundborg facility could be used for energy purposes.

Earlier the wastewater had been treated aerobically. However, this method meant that approximately 50% of the organic content in the waste water was converted into sludge. Through the study it was documented that the waste water from the enzyme production could be treated in an anaerobic treatment facility. The method causes only 10% of organic material in the waste water to be converted into sludge, while the remaining 90% is transformed into methane; a gas that can be used to generate energy in the form of electricity and heat.

In 2013, Novozymes completed the implementation of the anaerobic wastewater treatment plant at their site in Kalundborg, Denmark. The biogas reactor utilizes wastewater to generate energy. When operating at full capacity, the reactor will cut costs and reduce CO₂ emissions by approximately 20,000 tons annually.

ENERGY SAVINGS IN PRODUCTION METHODS
The actual production of enzymes takes place in large tank installations, which ensures the best capacity utilization and energy efficiency. The company works widely to obtain energy saving in both the actual production methods and in the energy supplies. By using energy management and through the energy responsible employees the following steps have been

implemented:

ACTIONS THAT SAVED ENERGY

- Excess heat from gas turbine has been reused to heat water for cleaning
- Replacement of process equipment using significant amount of energy with new and more energy efficient process equipment
- Temperature of liquid used for the cleaning of process equipment has been optimized
- Heat recovery from condensate had led to significant CO₂ and energy savings
- Cooling systems, compressed air system and machinery are optimized and attuned to the demands of the production
- Operators and technical staff are educated in energy-efficient operation of the facilities
- The energy consumption of each batch is monitored, so key figures can be developed at an ongoing basis.

EVEN MORE ENERGY SAVINGS USING ENZYMES
In industrial processes even small amounts of enzymes can replace large amounts of chemicals, energy and water. Product analyses show that 1 kg of Novozymes enzyme on average results in 100 kg carbon reduction at the costumers, while it only costs less than 10 kg carbon to produce.

Novozymes estimates that customers avoided 60m tons of CO₂ emissions in 2014 by applying the products, the equivalent of taking approximately 25m cars off the road. This is an increase of 8m tons compared with 2013 and was driven primarily by increased sales and performance of solutions for biofuels, household care and textiles.

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