



NAWARO® – The Process

Utilizing Biogas on an Industrial Scale

NAWARO® BioEnergie AG is the first company in Germany to develop a business concept for generating energy from biogas on an industrial scale. NAWARO®'s innovative approach makes optimal use of the four added value steps of bioenergy production:

- 1. Our farmers raise special energy crops bred to produce optimal energy yield during processing.*
- 2. We provide ongoing, on-site support to farmers during cultivation and harvesting of crops and assist them in transporting their harvest to our BioEnergie Parks.*
- 3. We produce biogas by fermentation of special energy crops, which is then employed to generate electricity and heat in a cogeneration process.*
- 4. We process the byproducts of fermentation to make valuable depot fertilizer.*

A Closed Cycle

We use biomass to make three products: electricity, heat, and depot fertilizer. All that remains when production is completed is pure water. And this is how the NAWARO process works: local farmers supply the NAWARO® BioEnergie Parks with special energy crops. Corn silage mixed with manure is especially suited for producing biogas. This raw material is degraded in special fermenters to produce biogas. Biogas is composed mostly of methane and carbon dioxide. The production of biogas in our BioEnergie Parks is so efficient that maximum yields of combustible gas are ensured.



In the next step, the biogas won through fermentation is combusted to produce electricity and heat, thanks to the cogeneration process used by NAWARO®. Long-term contracts with the relevant power distribution companies according to the provisions of Germany's Renewable Energy Law (EEG) guarantee that the electricity generated in this way can be fed into existing electric power grids.

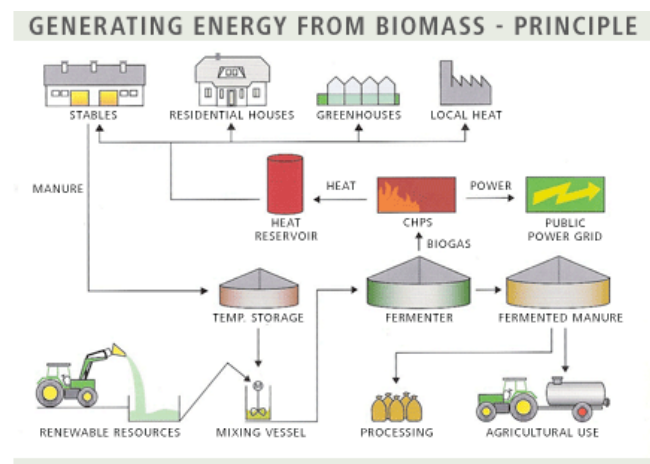
Moreover, because the byproducts of biogas generation are recycled, all material cycles are closed – the byproducts that remain after fermentation are used to produce

fertilizer and thus return to the biosphere. NAWARO® has developed a special technology that yields a high-quality depot fertilizer. Patents for this unique process are pending.

Environmentally Sound and Reliable

Using biomass as a resource for generating energy has numerous advantages. Producing energy for biogas reduces consumption of limited resources and is highly reliable. Energy won from biogas is CO₂-neutral: the amount of CO₂ released during combustion of biogas equals the CO₂-consumption of the energy crops during cultivation.

Bioenergy therefore makes a significant contribution to combating global warming and preventing climate change from greenhouse gases and is an indispensable element – together with water, wind, and solar power – of today’s renewable energy mix. In contrast to photovoltaic and wind energy, biomass from regional resources has a further important advantage: industrial-scale use of biomass guarantees a high level of reliability in electricity feed-in. Whereas wind and sunshine are available only intermittently, biogas can be produced and employed in decentralized, controlled, and continuous production processes.



A key critical argument often heard against renewable energy sources—the supposed unreliability of supply—does not apply to biogas. Electric power generated in NAWARO® BioEnergieparks can be fed into the grid as what is called “baseload” electricity, that is, power that reliably secures the constant, minimum customer demand for electricity.

An Economic Stimulus for the Region

The NAWARO® concept stimulates the economies of underdeveloped rural regions and creates new jobs. Local farmers who sell energy crops to the NAWARO® EnergieParks benefit from long-term supply contracts.

This means that farmers who lack their own small-scale biogas units can nonetheless benefit from the growing bioenergy market. And each new BioEnergie Park brings with it as many as fifty qualified jobs.



Huge Growth Potential

Biomass will play a decisive role in the ongoing development of renewable energy in Germany. The potential for future growth is nothing less than phenomenal. According to studies conducted within the energy sector, some 50 billion € will be invested in renewable energy sources in Germany by 2020. By that year, as much as 75 terawatt hours of electricity might be produced based on biomass, equaling the power generated by 75 000 coal-fueled power plants. This expansion of biomass-generated power would also result in about 85 000 new jobs.

A further consequence of this development is that a large portion of Germany's arable land will in future be used for energy crops. In order to generate 75 terawatt hours, approximately 13 percent of the area currently under cultivation in Germany or a total of about 2.2 million hectares would have to be used to grow energy plants such as corn. According to the Fachverband Biogas [Biogas Association], at least ten percent of Germany's primary energy demand could then be met with energy generated on the basis of biogas.

Power from Biomass

In Germany, electricity from biogas is an integral part of the energy market. In 2005, biogas units produced 2.9 billion kilowatt-hours of electricity, or about three times as much electricity as the amount supplied by photovoltaic solar cells.

To date, the advantages of this decentralized source of energy are utilized mainly by farms and other agricultural facilities in small-scale farm units that turn manure into biogas. Now, however, cutting-edge technologies ensure that biogas-based electricity can be generated on an industrial scale and distributed through the electric power grid as a component of the baseload power supply.

An important prerequisite for expanding the use of biogas as a regenerative energy source is the German Renewable Energy Law (EEG), which regulates the sale of biogas-generated electricity to electric grid operating companies.

