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Skanska AB
www.skanska.com

Contact
Noel Morrin,
Senior Vice President
Sustainability
noel.morrin@skanska.se

Knezice Biogas Power Plant, Czech Republic

Case Study 35

Aspects of Sustainability

This project highlights
the following:

Social Aspects

Human Resources
Corporate Community
Involvement
Business Ethics
Health and Safety

Environmental Aspects

Energy and Climate
Materials
Ecosystems
Local Impacts

Economic Aspects

Project Selection
Supply Chain
Value Added

Knezice biogas power plant in the town of the same name, 70 km east of Prague, produces renewable energy from biodegradable waste, and has solved municipal waste management problems, promoted local energy self-sufficiency, reduced greenhouse gas emissions and provided residents with cheaper energy.



Project Introduction

Knezice biogas power plant has been constructed in Knezice town, 70 km east of Prague in central Bohemia. The plant uses biodegradable waste, such as manure, sewage, straw, woodchips and food waste, from local farms, abattoirs and households to produce biogas. The biogas provides the town with a renewable alternative to gas and coal for heating and electricity generation, and has solved the municipal problems of waste and sewage management. The municipality avoided the traditional solutions of constructing a sewage treatment plant and connecting the town to the national gas network, which are expensive and involve a dependency on imported non-renewable energy.

Skanska CZ constructed the US\$ 7 million biogas power plant between 2005 and 2007 for the local authorities in Knezice, and the European Regional Development Fund that partially financed the project. The plant includes a biogas production plant, a biomass combustion plant and a 6 km district-heating network, which connects approximately 150 households. The biogas production plant contains a 180 m³ homogenisation tank, a waste cleansing line with

a daily capacity of 10 tonnes, a 2,500 m³ heat digester, a Combined Heat and Power (CHP) unit and two 6,500 m³ storage tanks for residual liquid. The biomass combustion plant is equipped with an 800 kW straw furnace and a 400 kW wood chip furnace to generate additional heat in winter. The plant burns the accumulated biogas to generate electricity and heat energy, and the biogas process produces additional heat as a by-product, around 60 percent of which is used by the district heating system. The biogas plant has an electrical output of 330 kW and annually generates 2,600 MWh for the national electricity grid. Heat output of the plant is 405kW and water at about 70 degrees Celsius is distributed to 400 of the town's 480 inhabitants, although the plan is to eventually connect every household in the town. The residue following the biogas production process is a high-quality liquid agricultural organic fertiliser.

The Knezice project is one of the pilot energy projects of the Central Bohemian Region, which generates energy from biodegradable waste and promotes energy self-sufficiency. Knezice won the 2007 European Energy Award for the innovative use of biogas district heating, which has significantly reduced carbon dioxide emissions and promoted economic development in the area.

Contributing Toward Sustainable Development

The Knezice biogas power plant generates renewable heating and electricity from agricultural and municipal waste. The project has reduced greenhouse gas emissions, contributed to the Czech Republic's EU renewable energy targets, and promoted local energy self-sufficiency by reducing dependence on imported non-renewable energy sources. The plant has also solved local waste management problems and has stimulated local economic development by creating jobs, provided residents with cheaper energy and created alternative incomes for local farmers. During the construction, Skanska worked closely with project partners, involved and educated community stakeholders and trained local people to manage and service the plant. Only Czech material suppliers were contracted and high standards of occupational health and safety were realised. Environmental impacts during construction were minimised and waste was effectively managed.

Social Aspects

Stakeholder involvement

Experts from Skanska CZ held community education sessions to inform local people about the biogas project and to raise awareness of renewable energy in general. Residents make their own decision whether to sign up to the project or not. Some were initially sceptical of the project, although the entire town is expected to sign up eventually due to the obvious energy savings.

Project partner collaboration

Skanska worked in close collaboration with the Knezice municipality to develop the project and to provide technical expertise. The plant is equipped with experimental machinery and Skanska found innovative solutions for technical problems that were not anticipated by the design engineers. Skanska continues to cooperate with the municipality and is supporting work to further improve the biogas plant.

Occupational health and safety

No lost time accidents occurred during the construction of the Knezice biogas plant. Standard Skanska CZ procedures were followed and specialised and experienced sub contractors or Skanska teams carried out the work.

Charitable contributions

Skanska landscaped the grounds of the Knezice nursery school as a gesture of good will. Financial

donations were also made to the Partnerství foundation, which planted several hundred trees in the town.

Sustainable urban planning

The Knezice biogas plant was constructed on unused municipal wasteland. The plant is located on the northeast edge of Knezice and is within walking distance of the town.

Raising awareness of renewable energy

As of January 2007 over 50 scientists, journalists, mayors from other towns, students, agricultural specialists, ecologists and energy experts had visited the project. Skanska, the Knezice municipality and plant staff coordinated such visits.

Economic Aspects

Local construction employment and training

Approximately 35 construction workers worked on the site, although only 5 were from the Knezice area due to the specialist skills required for the project. However, three local people were trained during the construction and have been employed to manage the everyday operation of the plant. A qualified chemist from Knezice was also trained to monitor hydrogen sulphide levels in the biogas on a weekly basis and an engineer from the Knezice area was trained by the supplier of the CHP unit to provide technical assistance when required.

Local economic development

The biogas plant supports local farmers by purchasing straw and agricultural waste, and some farmers have diversified their agricultural income by growing biomass crops specifically for the plant. The plant also produces a rich organic fertiliser as a by-product, which is donated to the local farmers and suppliers of waste and biomass. Any remaining fertilizer is used on communal land within the Knezice town. The Skanska team frequently utilised local businesses in the town during the construction, such as a shop and restaurant.

Czech construction material suppliers

No materials were sourced from the Knezice area, although suppliers within the Czech republic provided all construction materials for the project.

Reduced energy costs for Knezice residents

Knezice residents pay an initial fee of US\$ 650 to be connected to the biogas district heating system, but subsequently have access to more affordable and reliable heating. Heat energy from biogas costs about US\$ 17.5 per GJ compared to natural gas,



which cost 22 US\$ per GJ in July 2008. The town is expected to consume around 6,800 GJ of biogas-generated heat in 2008, which amounts to a combined annual resident saving of over US\$ 30,000 compared to natural gas. In July 2008 the biogas plant supplied only a quarter of Knezice's residents with both domestic hot water and central heating. Around three quarters of residents rely on expensive electric boilers for hot water and many are in the process of switching to biogas hot water from the plant, which will further reduce energy costs in the town.

Biogas plant investment return

As a financial investment the Knezice biogas project is as cost-effective as the planned retrofits of Czech coal-fired power plants and only slightly less cost-effective than a state-of-the-art coal power plant. Similarly, the Knezice project is estimated to be approximately twice as cost-effective as a wind power plant. The initial biogas project investment will be paid back in less than 15 years.

Energy self sufficiency

Knezice is one of the first Czech municipalities to become energy self sufficient, and is capable of generating its own heat and more than double its electricity requirements. The Czech Republic is becoming increasingly dependant on imported gas, and the Knezice biogas project constitutes a small step to diversify the country's energy sources and limit the degree of dependency on foreign gas.

EU funding

The European Regional Development Fund financed 75 percent of the project, 10 percent was provided by the Environmental State Fund and the rest from the local authorities.

Environmental Aspects

Minimising environmental impacts during construction

Standard Skanska CZ procedures were followed regarding noise, dust and emissions, and construction activities were only undertaken during the day. The site was landscaped and approximately 50 trees were planted to merge the biogas plant into the rural surroundings.

Construction waste management

Recyclable waste, such as metal, plastic and glass was sorted and recycled off-site. All remaining waste was used to fill excavations and terrain irregularities.

Municipal waste management

The biogas plant treats potentially hazardous waste from farms, abattoirs, septic tanks and cesspits in an environmentally sensitive way through a process of anaerobic digestion. The residue from the biogas process is biologically harmless and can be used as an organic fertilizer. The plant has also reduced the need for sewage treatment facilities and landfill space in the Knezice area.

Contributing toward the Czech Republic's EU renewable energy targets

4 percent of the Czech Republic's energy was sourced from renewable sources in 2007. The Knezice biogas project makes a small contribution toward the EU target of the Czech Republic generating at least 8 percent of its energy from renewable sources by 2010.



Reduced greenhouse gas emissions

Knezice town's electricity and 70 percent of its heating requirements were previously sourced from greenhouse gas emitting coal-fired power stations in the Czech Republic. The biogas production plant captures methane, which causes 20 times the greenhouse effect as carbon dioxide and would otherwise be released into the atmosphere by the decomposing organic matter. Instead, when combusted the methane is converted back to carbon dioxide, which was absorbed during the lifetime of the biomass. The biogas plant has also reduced the number of households using private coal furnaces, and is expected to further reduce coal use in the future as more residents connect to the district heating system.

Learning From Good Practice

This project was unique for Skanska and opens up a potential new market of similar projects, which reduce greenhouse gas emissions, provide reliable relatively cheap energy and promote local energy independence. Biogas is a renewable source of energy with huge potential for other municipalities faced with importing increasingly expensive natural gas.