

# Värnamo Pilot Plant

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The IGCC concept has been developed and demonstrated for power generation using fossil fuels as feedstock. The main features are the possibility of cleaning the gas from impurities under pressure before the gas enters the combustion section of the gas turbine, and also the relatively high electrical efficiency. Higher efficiencies also mean relatively lower emissions. On the basis of these considerations, Sydkraft AB took a decision in 1991 to build a wood fuelled co generation demonstration plant at Värnamo, Sweden (see Figure below) to demonstrate the technology. The Värnamo plant was the first of its kind in the World. The plant is designed to generate 6 MW of electricity and 9 MW of heat for district heating.

## Värnamo biomass-fuelled pressurised IGCC plant

The process scheme of the Värnamo plant is shown in the diagram below. The wood fuel is dried using a flue gas dryer to moisture content of 5-20% in a separate fuel preparation plant. The dried and crushed wood fuel is pressurised in a lock hopper system and is fed by screw feeders into the circulating fluidised bed (CFB) gasifier. The fluidisation medium of the gasifier is air, the operating temperature is 950-1 000°C and the pressure is approximately 18 bar.g. About 10% of the air is extracted from the gas turbine compressor, compressed further in a booster compressor, and then injected into the bottom of the gasifier.

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the gasifier, the gas produced flows to a gas cooler and a hot gas filter. The gas cooler cools the gas to a temperature of 350-400°C.

After cooling, the gas enters the candle filter vessel where particulate clean up occurs. The gas generated is burned in the combustion chambers and expands through the gas turbine, generating 4.2 MW of electricity.

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hot flue gas from the gas turbine is ducted to the heat recovery steam generator, where the steam generated, along with steam from the gas cooler, is superheated and then supplied to a steam turbine (40 bar, 455°C), generating 1.8 MWe.

An

extensive demonstration/development programme was carried out during 1996-2000. The work was partly financed by the Commission and STEM (Swedish Energy Authority). The overall aim of the demonstration programme was to verify the status and future potential of the biomass IGCC concept from a technical and economical point of view. Of particular interest to the success of the gasification technology was to verify the quality of the gas produced in the gasifier as well as the operation of the gas turbine. The demonstration/development programme has now been completed and is deemed to be very successful in proving that the pressurised biomass IGCC technology works. The results achieved can be summarised as follows:

- High pressure gasification technology works.
- Gas produced can be burnt in a gas turbine under stable conditions.
- Hot gas filtration is efficient and reliable.
- Technology is capable of gasifying "difficult fuels".
- No harmful effects identified on gas turbine or other components.
- NOx emission slightly high at present for some fuels, but solutions available.
- Emissions of HC very low and emissions of dioxins below detection level even for chlorine rich fuels.
- IGCC is competitive with conventional biomass technology for condensing applications at today's fuel cost.
- Biomass gasification technology is highly suitable for retrofit to existing IGCC.

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plant was shut down in 2000 after the test programme had been completed as revenues from the sales of power and heat did not cover the operating costs.

## Formation of Växjö Värnamo Biomass Gasification Centre (VVBGC)

Since

2000 several ideas have been proposed as to how to make the best use of this unique facility including: using the plant for further IGCC developments or to rebuild it to produce synthesis gas; sell, dismantle and reassemble the plant elsewhere, inside and outside Europe: and even scrapping the plant completely.

An analysis by the Swedish government identified the development of synthesis gas generation from biomass as key technology for large scale, cost efficient production of liquid biofuels. In 2001, several industrial companies put together a proposal to use the plant to produce bio DME at a scale of approx. 10 000 tonnes/year. However, it was concluded that the technical/scientific risks involved (in economic terms) were too large to be borne by themselves.

Therefore in order to decrease the economic risk of private industry, the availability of the plant must be guaranteed by public funding. In order to do this, the model proposed was to establish a non profit organisation under the control of an educational institution. VXU expressed interest in this proposal and was selected for this purpose, with the assignment to establish a European Biomass Gasification Centre at Värnamo, later to become known as the Växjö Värnamo Biomass Gasification Centre (VVBGC). This arrangement would safeguard the access and availability of the plant, including the use of qualified staff for projects interested in using the Värnamo plant.

The founding owner of the Värnamo plant, Sydkraft AB and the owner of the technology for the air blown, pressurised IGCC technology, Bioflow, have transferred ownership of the facility to VVBGC on negotiated terms, and agreed arrangements regarding IPR with VVBGC, respectively. The formation of VVBGC will contribute to the aims of the EC Specific Programme "Integrating and Strengthening the European Research Area".

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url = url.substring( ind + 1, url.length );
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