

## International Conference on Bioenergy Utilisation and Environment Protection Technology

presented by  
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### **Combustion and gasification of biomass with TPS technology**

#### **History**

TPS Termiska Processer AB originally was a division of the publicly-owned Studsvik group. In 1991, the Swedish State Power Board (Vattenfall) took over the ownership of Studsvik and as a result the Thermal Processes laboratory of Studsvik became a separate company in July 1992. It was named TPS Termiska Processer AB and was originally owned by Swedish producers of district heat and biomass fuel (51%), the employees of the company owning the remaining 49%.

In September 1999 there was a further change in ownership, and now the company is owned mainly by present and ex--employees and members of the board.

The company today offers product and services and performs research and development on gasification and combustion. The research is mainly based on experiments in the laboratories and on computerised flow simulation. The results are used to develop processes that are tested in pilot plant and exploited at commercial scale.

Over the last few years TPS has delivered an increasing number of services and products to district heat producers. Since incorporating CP Energi AB in the TPS group, the delivery of products by TPS has significantly increased.

#### **Strategy**

Studies, design and construction projects shall be based on TPSs knowledge of combustion and gasification processes.

TPS has performed and conducted research projects funded by the European Commission since 1992 and has good contact with research institutes. The knowledge and strategy of TPS are well suited to the aims of the European Commission to sharply increase the use of renewable fuel in the European energy system and to link technical research to large-scale pilot plant and demonstration projects.

TPS expects these aims of the European Commission as well as governmental support by member countries will greatly encourage commercial interest for the gasification technology of TPS. Experiences from the design and operation of the ARBRE plant is critical for the start-up and operation of new large-scale projects. Gasification of bagasse and cane trash could open a new and very large market for TPS technology.

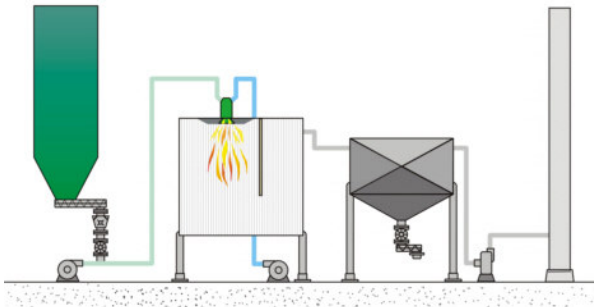
## TPS Engineering

Fuel is converted to power and heat through a large number of fast and interacting reactions. The design of reactors involves an understanding of such complex processes. Our "toolbox" consists of a collection of models for simulating flow, chemical reactions and heat transfer. Guided by our models we test our ideas in our own laboratory and in full scale facilities. In cooperation with universities we constantly aim at improving our models. Together with industry we tailor models to be used as engineering tools.

## Combustion

TPS has considerable theoretical and practical experience from most types of combustors. We offer optimisations, redesigns and retrofits of combustors. We offer a number of solutions to improve the performance of your combustor.

BioSwirl is a wood-fuelled combustor developed by TPS which is at the heart of a complete solution for district heat production. With BioSwirl, the conversion of your oil-fired boiler to pulverised wood combustion will benefit both the environment and the economy of the plant.



principle of BioSwirl

TPS is demonstrating modern combustion technology for refuse derived fuels. Sewage sludge, slaughterhouse waste or sorted industrial waste can be combusted in a 9 MW fluidised bed that will be built in Kil, Sweden.

Methods for ash handling and flue gas cleaning will be demonstrated for heat production plants in the power range 5 to 30 MW.

## Gasification

TPS has many years of experience with gasification of biomass and waste fuels. In the early to mid 1980s, pressurised technology was developed and tested at up to 30 bars in a 2.5 MW pilot plant at TPS.

In the mid 1980s, a 2 MW atmospheric circulating fluidised bed gasification (ACFBG) pilot plant was built at TPS, it being complemented by a patented hot gas conditioning unit (the so-called "tar cracker") in the late 1980s. Extensive fuel testing on biomass and waste fuels took place during the 1990s.

More recently, tests on bagasse and sugar cane trash have been completed. The TPS ACFBG technology can be applied to produce clean gas from biomass and waste. This clean gas can be utilised in a number of ways to produce for example heat, steam and/or power. Typical

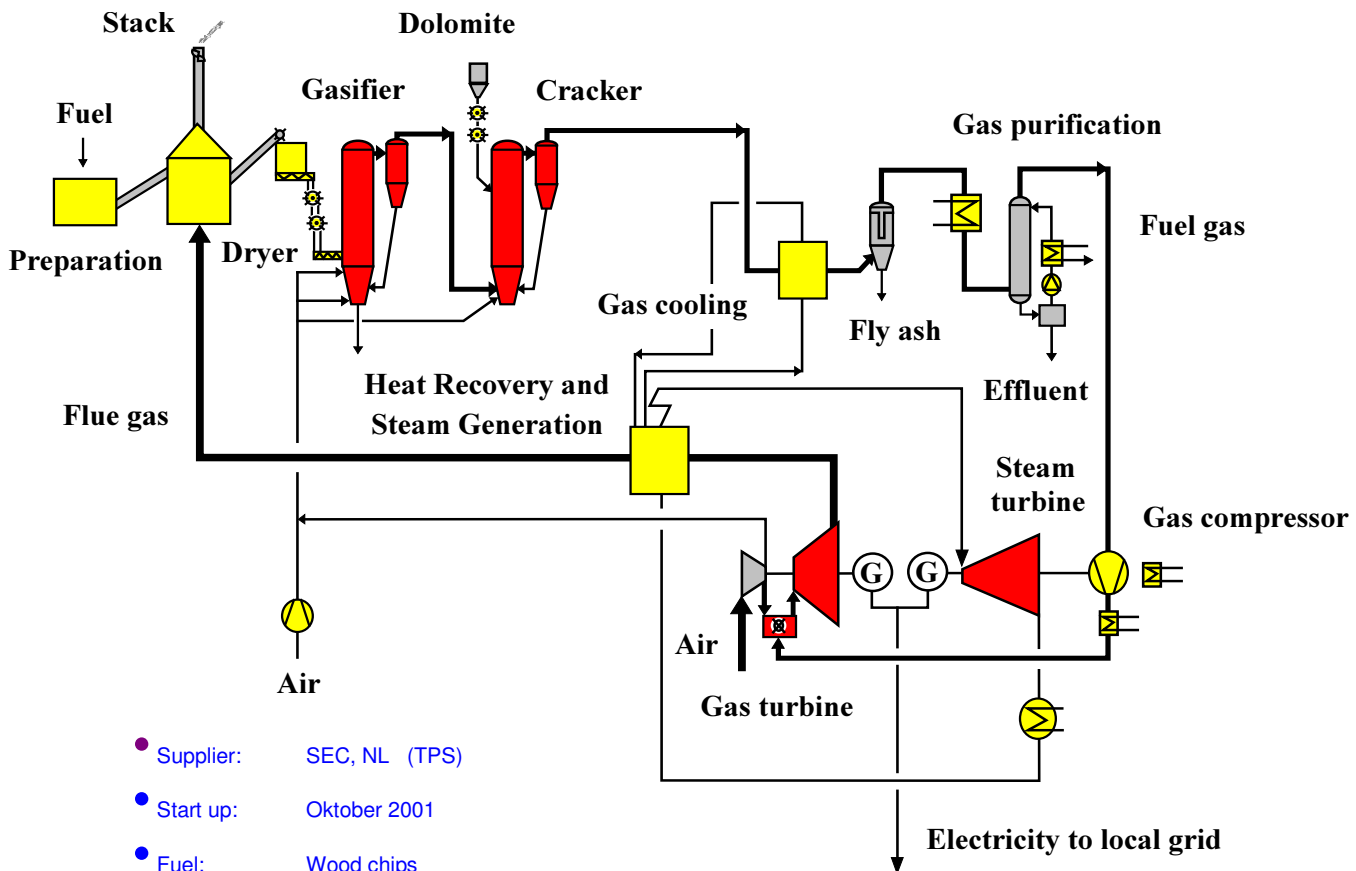
applications are Fuelling lime- or cement kilns, Co-firing new or existing oil- or coal-fired boilers and Gas turbines.

Test results:

The operating temperature of the gasifier was kept below a threshold temperature and no agglomeration occurred. The high chemical reactivity of the organic part of the bagasse and cane trash results in a high carbon conversion to gas, above 95%. the carbon content of the bottom ash was low. The composition and heating value of the gas generated was typical for the pilot plant operating on a dry biomass fuel.

The main objective of the tests, to show that sugar cane bagasse and trash could be used as feedstock to the gasification process, was achieved.

## TPS ATMOSPHERIC GASIFICATION ARBRE COMBINED CYCLE PLANT



- Supplier: SEC, NL (TPS)
- Start up: Oktober 2001
- Fuel: Wood chips
- Fuel 25 MW
- Elect. gen. 8 MW
- Typhoon GT
- TIC: 30 M£
- EC support 35 %
- PPA: 105 £/MWh 2001