



**RAMBOLL**

## BIOMASS CONVERSION - FROM FOSSIL TO RENEWABLE ENERGY

**The trend in power generation is to convert coal-fired plants to co-firing and to construct new units fuelled with biomass and thereby reduce the emission of greenhouse gasses.**

Ramboll's expertise encompasses the full range of knowledge needed to successfully convert or new build a plant - from fuel receipt and logistics to supply of power and heat.

### **Optimisation of combustion**

Biomass combustion is not a straight forward process, it can lead to fouling and corrosion of boiler heating surfaces as well as placing new demands on the ESP and fly ash removal systems and the disposal of the ash. In addition changes to the fuel system have to be considered in relation to the ATEX directive as well as other health and safety issues.

We are able to advise counter-measures and solutions for all major challenges arising from biomass conversion, co-firing or designated biomass fuelling

Ramboll offers all engineering services in respect to the planning, design, tendering etc. of new build

power or CHP plants, fuelled by biomass, including wood chips, straw, wood pellets, forestry residue woods or reclaimed wood types.

We also advise about the special demands arising from the conversion to or co-firing of biomass to the milling process, This includes the behavior of pulverised wood pellets and the demands made to the PF piping as well as to the burners. These all have a decisive influence on the combustion process, the heat balance and emission control.

### **Storage facilities and fire safety**

The main challenges in storage facilities are the early detection and suppression of fires. Smouldering fires pose the greatest challenge as they are very difficult to detect and can also be very complicated and hazardous to extinguish. Ramboll's long experience in biomass handling has led to the invention of a novel fire safety solution whereby liquid nitrogen

injection is utilised for fire suppression for which we have a patent pending.

### **Designing innovative solutions**

Ramboll has designed highly automated bio fuelled power stations comprising automated straw reception and transport systems that only require manpower during receipt of straw. This concept has been used at several power plants.

For further information please visit our website [www.ramboll.com/power](http://www.ramboll.com/power) or contact our Service Line Manager directly.

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## CHALLENGES

Every type of biomass fuel comes with its own characteristics and challenges.

Ramboll has designed reception, transportation, storage and handling systems for all kind of biomass fuels, such as straw, wood pellets, wood chips and olive residues.

### Reception



### Storage



### Transportation

Ramboll offers innovative solutions that integrate the necessary mitigating measures regarding boiler design, dust handling, incineration residues, ATEX, fire suppression and fire fighting, health issues etc.

### Handling



### Combustion

### Residual products



## EXPERIENCES



### AVEDØRE POWER STATION, COPENHAGEN, DENMARK

#### Multi-fuel CHP station with high electrical efficiency

The Unit 2 has for more than 10 years been in successful operation combusting wood pellets. The plant has the highest electrical efficiency within coal and multi-fuel fired plants in the world: 48%. The wood pellet storage facility at the Avedøre Power Station is the biggest fully automatic wood pellet storage facility in the world, containing 100,000 m<sup>3</sup>.

Ramboll was consultant for DONG Energy for the conversion from coal to combustion of wood pellets including the design of the storage facilities.



### HERNING CHP, HERNING, DENMARK

#### Conversion from fossil fuelled to multi-fuel plant

Herning CHP Station has been converted over three stages. 1<sup>st</sup> stage from coal to coal/natural gas, 2<sup>nd</sup> stage from coal/natural gas to wood chips/natural gas and, latest two-thirds of the gas burners were rebuilt to take pulverised wood pellets making a truly multi-fuel plant in full operation based on 90 % biomass (chips and wood pellets).

As a part of the third conversion Ramboll established a fire safety strategy to prevent and mitigate the fire and explosion hazards for this particular wood pellet transportation and storage system.



### SANDVIK POWER STATION, SWEDEN

#### Use of local fuel

Ramboll has as owner's engineer for VEAB the project management and the technical responsibility for a new 100 MW<sub>th</sub> biomass boiler including Balance of Plant (BOP) and flue gas treatment. The CHP plant will use local fuels as wood chips, bark, saw dust and branches and roots.

The plant is planned to be commissioned in the end of 2014.