Saxlund
INTERNATIONAL

Combustion

Welcome

Saxlund has been delivering BioEnergy projects for over 50 successful years with a significant list of reference sites all across Europe. At the forefront of BioEnergy expertise, Saxlund's presence at the forefront of BioEnergy and constant strive for innovation, has resulted in a number of industry leading patents on key technologies which have improved feed and combustion efficiency thereby reducing fuel costs and carbon emissions.

Whether the project requires full EPC contract delivery or the provision of key component technology such as the TubeFeeder®, from our BioEnergy and Materials Handling Centres of Competence, Saxlund has the strength and depth of knowledge to provide solutions to your BioEnergy challenges.

Saxlund is part of the Opcon Group of companies with more than 85 employees based in three locations and a combined turnover of €35 million affording the scale and ability to deliver large projects throughout Europe and beyond.

"Saxlund is a much respected brand in Europe and has established an extremely competent team of engineers and project managers able to tackle complex projects in a variety of fields. The foundations for a successful future have been laid and I'm excited to be able to lead Saxlund International Ltd into the future"

Matt Drew
Managing Director
Saxlund International Limited

Contents

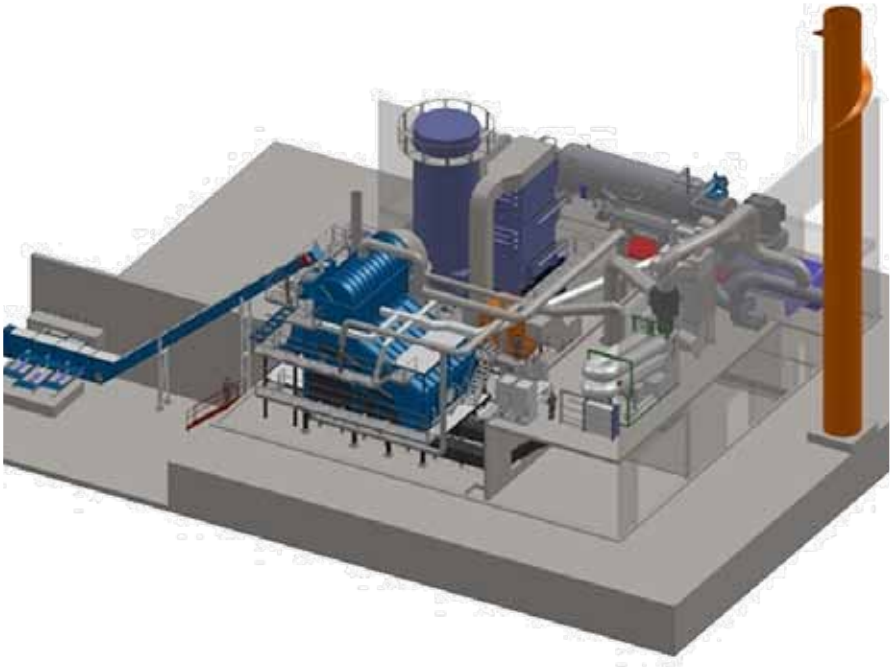
Key Projects

GIRVAN, SCOTLAND

- 2.4MWe Biomass CHP Project
- Fuel Handling, Combustion System
- Thermal Oil Recovery System, Flue Gas Cleaning and Controls
- Operational Summer 2012
- Fuel: Virgin Wood, Bark, Forestry Waste

FALKÖPING, SWEDEN

- Falbygdens Energis -2.4MWe ORC CHP Project
- Complete Turnkey Plant
- Operational Summer 2012
- Fuel: Virgin Wood, Bark, Forestry Waste



IKEA SWEDWOOD

- Ikea Swedwood, 3MW Thermal Oil, 2MW Steam
- Operational 2009
- Fuel: Broken boards, sawdustt and extracted dust.

REXCELL, SWEDEN

- REXCELL 9MW Steam Plant – Co-combusting Wood & Paper Sludge
- Operational 2010
- Fuel: Virgin Wood, Bark, Forestry Waste

Waste Wood Com

Waste Wood is an underutilized resource, especially in the UK where up to 10 million tonnes of waste wood are produced ever year, much of which is currently diverted to landfill or exported overseas. The significant carbon reduction, cost saving and energy benefits of recovering energy from waste wood has been highlighted over recent years in many publications and it should play an important part in the renewable energy strategy.

With much of the generated waste wood being contaminated, the key to recovering energy from waste wood is that the technology needs to be at minimum Waste Incineration Directive (WID) compliant.

Much of the waste wood recovered in the UK is aggregated by the many waste wood processors, where it is split into three primary streams. Where Saxlund is able to help these processors is that the grade B & C waste wood which is currently landfilled or exported can be used as a fuel for a WID compliant BioEnergy plant.

Our BioEnergy technology can be used to build plants converting from 6,000 to 80,000 tonnes per annum of waste wood into renewable electricity and heat.

Key Features of Saxlund BioEnergy Technology include:

- Saxlund Patented Fuel Feeder. The patented design ensures consistent fuel depth across the grate, minimising "burn through" thus minimising NOx emissions from hot spots. The patented feeder can vary the speed of fuel feed across the grate to maintain a consistent flame front.
- Air Cooled Grate. To ensure that the reciprocating grate is kept cool to minimise hot spots and burn through, primary air and/or recirculated flue gas is passed up through the grate. Combustion temperatures are controlled by the introduction of secondary / tertiary air and recirculated flue gas.
- Water Walled Furnace. With the low moisture content of waste wood and to improve combustion efficiencies the air cooled grate is surrounded by a water walled chamber providing an initial radiant pass.
- Urea injection. With waste wood as a fuel the chemical composition is variable and the system needs to be able to deal with increases in nitrogen content in the fuel which can lead to high NOx emissions. Using an injection system to meter urea into the flue gas at the correct temperature will reduce NOx emissions to below that required by WID.

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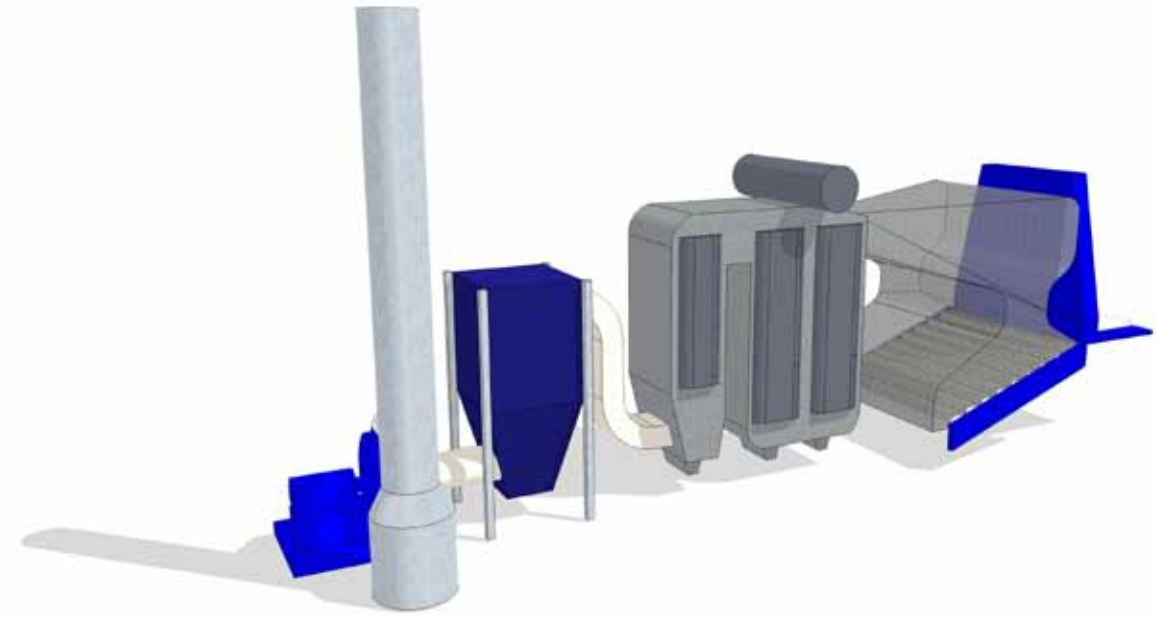
- 2 second residence. For WID compliance the combustion chamber must have a minimum 2 second residence above 850^{0}C after the final injection of combustion air.
- Steam Boiler. Most waste wood systems will be designed with an integrated high pressure steam boiler. Saxlund only works with boiler designers with a proven track record of delivering boilers used in waste applications.
- Flue gas cleaning. On a WID compliant plant it is essential to include a bag filter with sorbent dosing to reduce emissions to below that required by WID. Saxlund only work with proven suppliers of filter systems, which incorporate bicarbonate and carbon black dosing to guarantee emissions.
- Saxlund's unique control system controls fuel feed, grate reciprocation speed, and airflow to achieve optimum performance of the system with widely varying loads. Due to the accuracy of control of the combustion inputs, the Saxlund combustion system can be adjusted quickly to compensate for varying energy load demands. The system is designed for multiple users, such as with a thermal oil heating system and direct fired dryer in combination.



Virgin Wood Com

With the drive to de-carbonise the European economy, BioEnergy is becoming an important part in meeting these objectives. Saxlund have been at the forefront of delivering BioEnergy projects for over 50 years and have continued to develop and innovate their technology to improve combustion efficiency and emissions.

Saxlund's combustion technology enables energy producers to utilise low grade wood products such as waste from forestry production, bark and peelings, enabling economic use of materials that would otherwise be unused.

Able to deal with a wide variation in moisture content and fuel calorific value, a Saxlund BioEnergy system does not mean that you are tied to costly long term fuel supply contracts for high quality wood.

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- Refractory Lined Combustion Chamber. With a wet fuel such as virgin wood the combustion chamber needs to be lined with refractory material to ensure the system has thermal mass. This then allows the wet fuel to be dried as it passes down the grate into the combustion zone.
- Waste Heat Recovery –A Saxlund BioEnergy plant can use a number of methods to recover the heat into energy –
    - High Pressure Steam 40 – 65 bar Water Tube Boiler for electrical production.
    - Low Pressure Steam 5 – 25 bar Fire Tube Steam Boiler for industrial process.
    - High Pressure Steam Boiler for electrical production. 40 – 65 bar water tube boiler.
    - Low Pressure Steam Boiler for industrial process. 5 – 25 bar fire tube steam boiler.
    - Thermal Oil system for electrical production and hot water from an ORC. (Organic Rankin Cycle) turbine.
    - Hot Water Boiler for district heating.
    - Direct heat for drying

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- A combination of above, Saxlund are one of the only suppliers capable of providing multiple heat consumers from a single combustion system.
- Flue gas heat recovery. With a wet fuel a large amount of heat can be wasted up the chimney. By installing one of our Flue gas heat recovery systems you can provide additional hot water for process & heating.
- Flue gas cleaning. With clean wood, fuel emission limits can be achieved using multi-cyclones, WESP or ESP systems depending on the application and site location.
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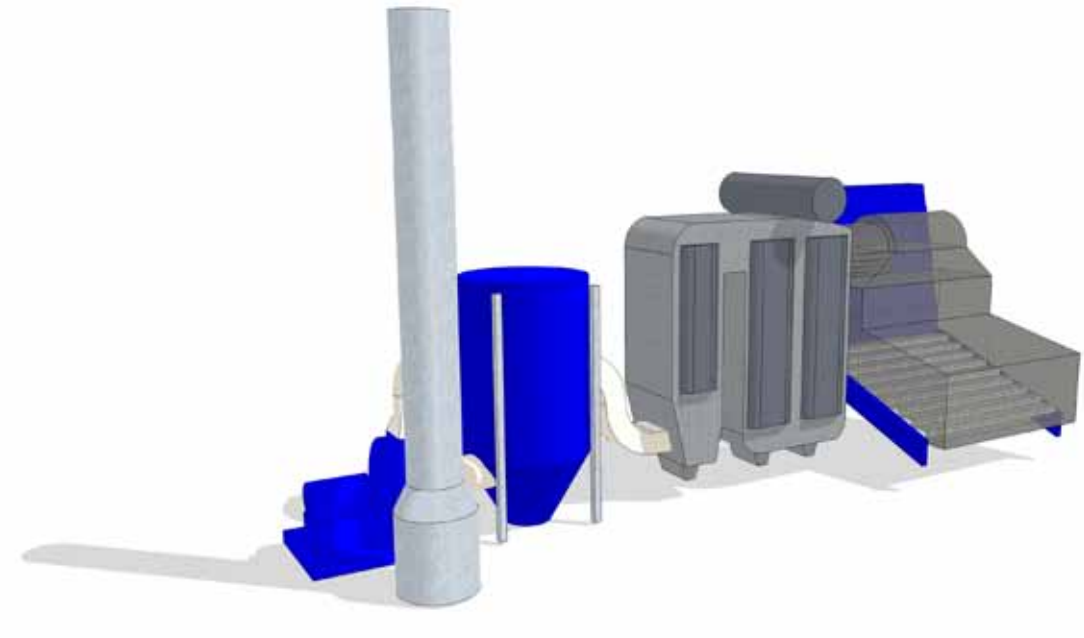


Systems

Steam Systems

Steam systems can be used for providing industrial processes with process steam, and high pressure steam for electrical production. Typically process steam systems require from 7bar to 25bar.Steam turbines tend to require from 40 bar upwards of supersaturated high pressure steam.

Saxlund have a long history of supplying steam for both process and electrical energy production and can deliver BioEnergy systems using waste wood or virgin wood as a fuel stream.

Organic Rankine Cycle - ORC

ORC systems can be used for electricity production from combustion processes by capturing the combustion energy using thermal oil in place of steam, and passing this through an Organic Rankine Cycle turbine. One of the major benefits of an ORC system is that it works under much lower pressures (typically 10 bar) than steam systems which provides lower operational costs. Another benefit of ORC systems is that they are ideal for CHP systems as the output temperature of the ORC processes enables an additional heat consumer such as an industrial process like wood pelleting or district heating.

Saxlund have installed many thermal oil systems around Europe and have thermal ORC systems inoperation, one in the UK and one inSweden delivered as an turkey project.

Combined Heat & Power

To maximise the financial benefits of producing energy from biomass it pays dividends to incorporate a heat consumer into any BioEnergy plant producing electricity. BioEnergy CHP plants can claim additional Renewable Obligation Certificates (ROC's) for electricity produced, along with the sale of the heat to off-site users. As part of the UK governments drive to meets its carbon emissions targets on a cost beneficial way, it has set a criteria to pass for plants claiming these additional ROC's called the CHPQA. This stipulates that a qualified CHPQA plant must produce a certain amount of beneficial heat per MWhr of electricity production.

Saxlund have long delivered plants designed to meet a number of functions, and has delivered a number of plants that combine electrical production with industrial / residential heat consumption such as wood pellet production and district heating.

With our innovative Wet Steam Turbine technology, we can now convert existing district heating plants into CHP sytems, or provide small scale, cost effective CHP plants for industrial heat consumers.

Industrial Process Heat

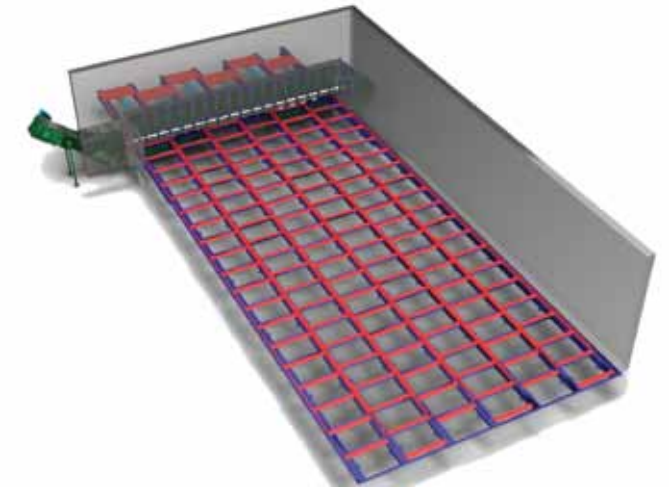
From Sawmills to Pharmaceutical producers, industry uses a huge amount of process heat, whether it be in the form of hot water, hot oil or process steam. Saxlund's robust Bioenergy technology has long been used to provide industrial heat, with the additional benefit that we are able to deliver systems that can have multiple heat consumers on one combustion unit. For example, we have systems in operation that have steam, hot water and hot oil produced from one combustion system.

Fuel Handling

One of the important areas not to be missed is the provision of a proven and robust Fuel Handling System to ensure that the plant availability is maximised.

Saxlund are key suppliers of Fuel Handling Systems, from small BioEnergy plants up to the large dedicated Biomass Power Stations. We understand what is required to ensure the plant is kept running and can supply semi-automated to fully automated systems.

For more information on our Fuel Handling Systems, please see our other brochure.



Delivery

We are flexible in how we deliver our projects. If we are working for a major contractor, Saxlund can supply it's key technology such as the stoker, combustion unit and steam boiler, or combine them with leading third party suppliers to provide a complete heat island, from the fuel in to the chimney.

We can also provide a Bioenergy plant as a complete EPC contract with our partner, who have a track record in delivering many BioEnergy EPC projects around Europe. For many projects this is the preferred solution as this providing a more concrete solution for plant funders and developers.

Service & Maintenance

In today's world of production demands and maintenance budgets, downtime isn't an option. To have the support of an experienced materials handling company, just a phone call away, is invaluable to keep the production process running smoothly. Saxlund's team of engineers have vast knowledge of bulk solid systems, gained from many years in the industry.

Saxlund can ensure downtime losses are minimised and the equipment is returned to service as quickly as possible. Our service team are equipped with the resources and tools to ensure the plant is operational in the shortest time.

Most sites have their own in-house maintenance team, but with the range of equipment to be maintained, sometimes there can be a struggle to fit in the maintenance of complex bulk solids handling systems.

Saxlund can help.

With our engineers knowledge of your processes, we are able to offer a tailored service to suit your requirements and avoid unnecessary downtime.

SERVICES OFFERED

- Replacement Parts
- Preventive Maintenance
- Training
- Troubleshooting
- Commissioning
- Upgrades
- Modifications
- Cleaning
- Shutdown Programmes
- Plant Surveys
- Inspection reporting

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