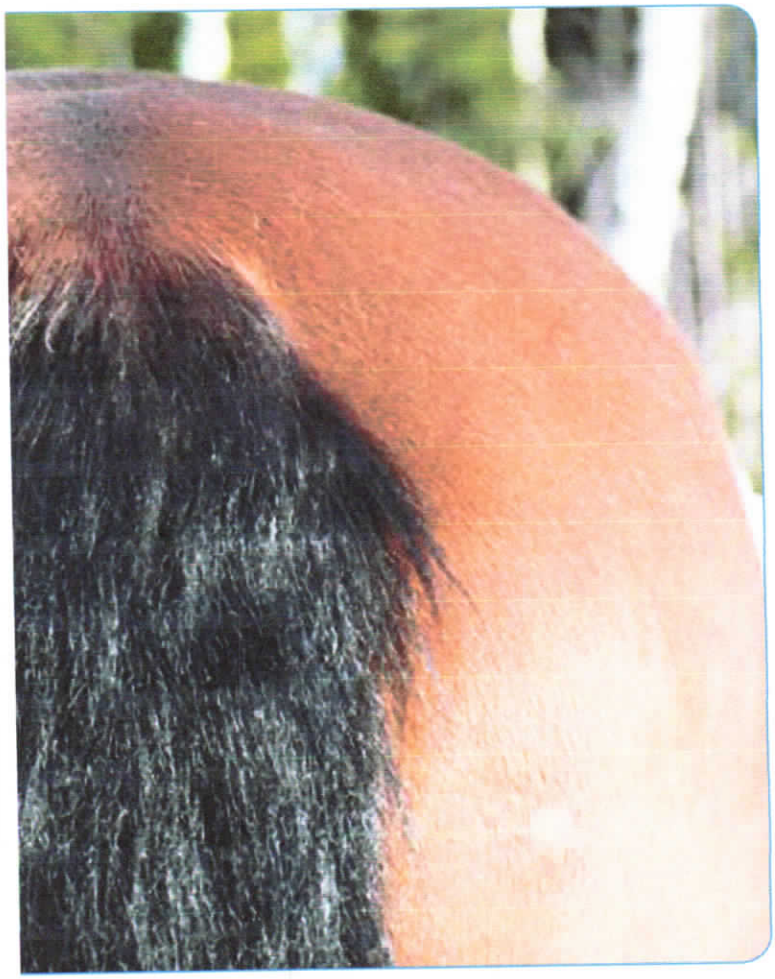
SWEBO BIOENERGY
FUTURE ENERGY SYSTEMS TODAY

SWEBO BIOTHERM

- Yesterdays residues are today's fuel.



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Aerial photo of the plant in Boden.

30 YEARS' EXPERIENCE IN HEATING THE WORLD!

With 30 years' experience and a particular focus on research, we are leading the development of both current and future bioenergy solutions. Through listening to our customers and tailoring our development and production accordingly, we can remain market leaders by offering new and innovative solutions.

Our primary markets are in Europe, with Sweden as our home market. Having our development centre in Boden means that we benefit from the arctic climate, which provides the ideal conditions for creating longterm bioenergy solutions, serving either homes and premises or heating plants for industrial applications.

We offer complete solutions including planning, commissioning and problemfree heat production. Our project control and support network is in place for as long as the system is in operation. This means that the customer benefits from a supplier with responsibility for the whole installation – simply and securely.

Business concept
Our business concept is to fulfil customers' needs by designing, supplying and optimising cost-effective energy solutions with the focus on sound, environmentally conscious values.

SWEBO BIOENERGY
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Complete SWEBO BioTherm-system.

EXTRAORDINARY BIOENERGY

The SWEBO BioTherm: the most extreme bioenergy solution on the market with immediate benefits.

The current global trend is a realisation that we must look after our resources. New, innovative energy solutions must not put pressure on the already highly-stressed environment.

Bioenergy solutions have always been considered one of the most environmentally friendly energy alternatives because they do not increase carbon dioxide emissions. That is a fact.

The SWEBO BioTherm takes bioenergy a step further. All by-products, such as straw bedding and manure, can be burnt to produce clean energy. Emissions are far below the limit values, and the ash left over can be used as an excellent fertiliser for the forestry industry.

With the SWEBO BioTherm, you not only save a lot of money – you also help to save the environment!

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WHAT IS FUEL TO A SWEBO BIOTHERM?

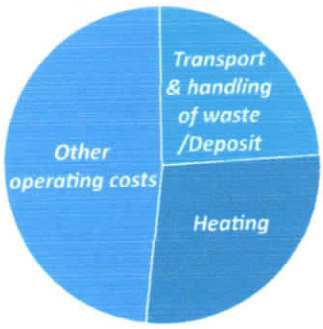
The SWEBO BioTherm is not designed solely for burning horse manure; it can be easily adapted to burn other fuels such as chips, sod peat, briquettes, pellets and grain, among others.

The SWEBO BioTherm is not designed solely for horse owners. What makes the BioTherm even more interesting, is that it can be adapted to burn other biological residues. For that reason it is also ideal for slaughterhouse owners, animal breeders and those working in the forestry industry.

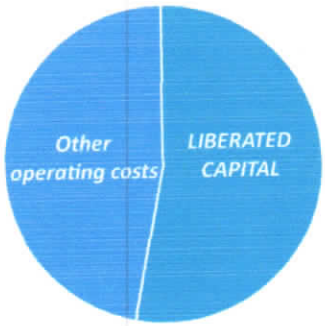
The SWEBO BioTherm's adaptability to a wide variety of extreme fuels makes it easy for users to become energy self-sufficient.

We believe that the SWEBO BioTherm is one of the most versatile and environmentally friendly energy burners on the market.

The SWEBO BioTherm is available in versions from 80 kW to 1000 kW. We can supply them to either fixed boiler rooms or as turnkey prefabricated heating plants.



OPERATING COST WITHOUT BIOTHERM
EXPENDITURE:
1 M SWEDISH KR



OPERATING COST WITH BIOTHERM
EXPENDITURE:
1 M SWEDISH KR


Horse manure


Wood chip


Peat


Wood briquettes


Wood pellet


Grain

...but also reed phalaris, energy forest and by-products from slaughterhouses.

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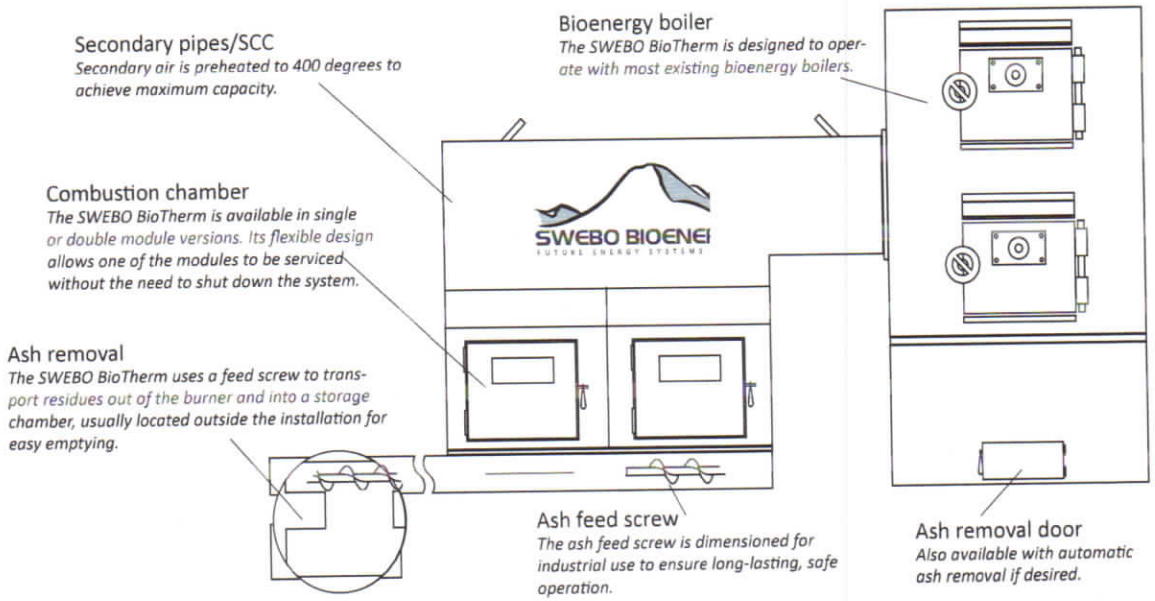

Heating using direct electricity or oil	310,000 Swedish kr/year
Heating using pellets	160,000 Swedish kr/year
Heating using chips	65,000 Swedish kr/year
Heating using horse manure	0 Swedish kr/year

*Manure can also be a benefit if you can charge for received manure from surrounding areas.

Economy based on a comparison between the most and least expensive heating alternatives:

+ 675,000 SWEDISH KR/YEAR (*)

(*) This figure includes savings on disposal (approx. 1,000 Swedish kr/tonne) incl transport costs, calculated on 40 horses.

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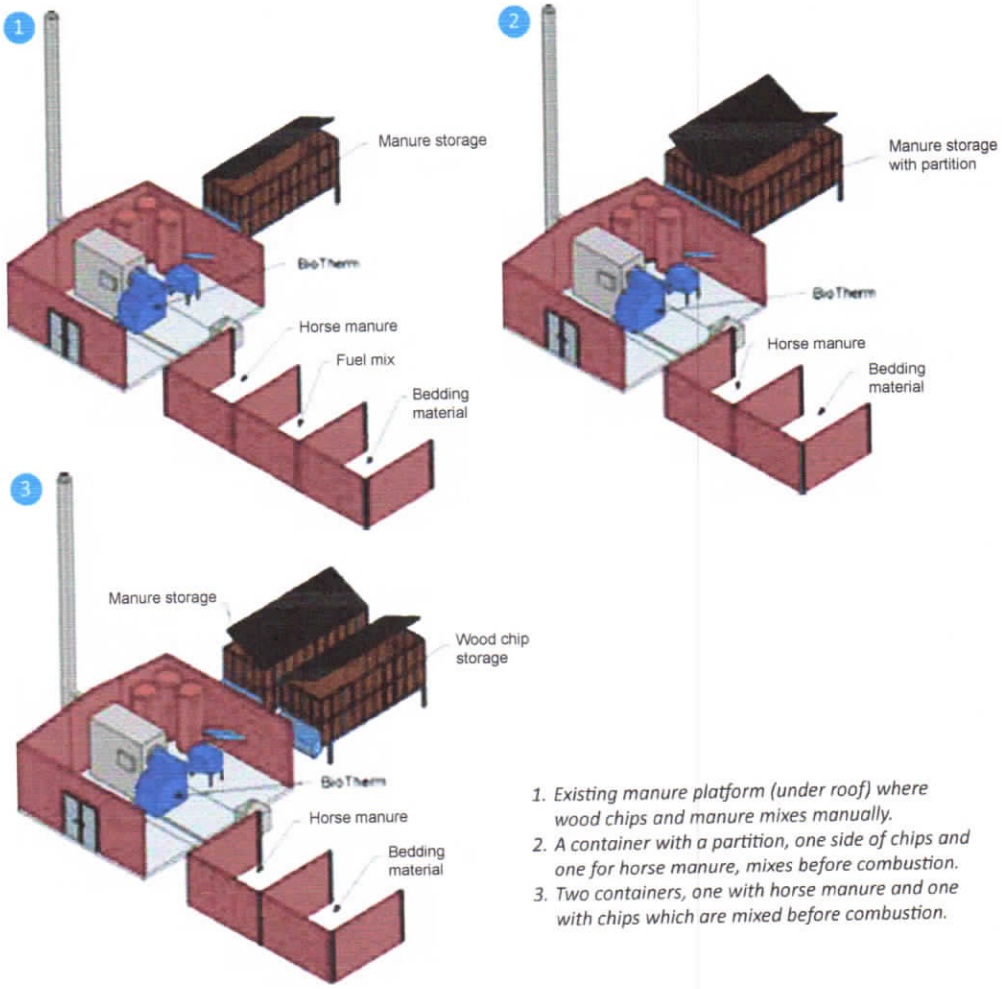
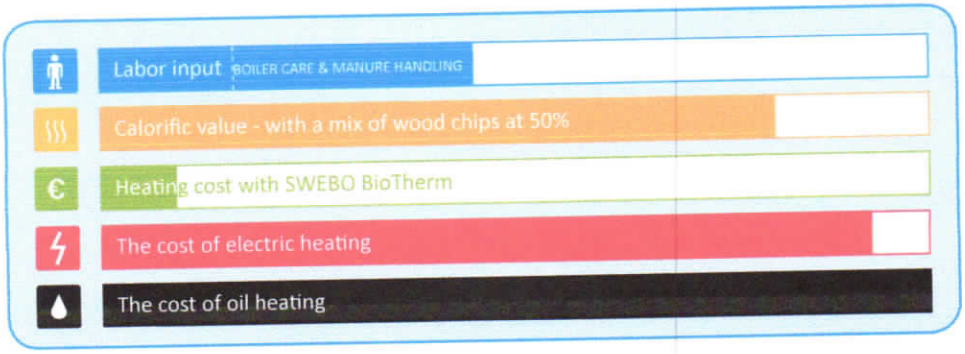
ALTERNATIVE - Mix of horse manure & for example wood chips



1. *Existing manure platform (under roof) where wood chips and manure mixes manually.*
2. *A container with a partition, one side of chips and one for horse manure, mixes before combustion.*
3. *Two containers, one with horse manure and one with chips which are mixed before combustion.*

SUMMARY

- Low cost
- Manual ignition
- Better heating value
- Requires less careful sorting of manure
- Available in three variants - look above



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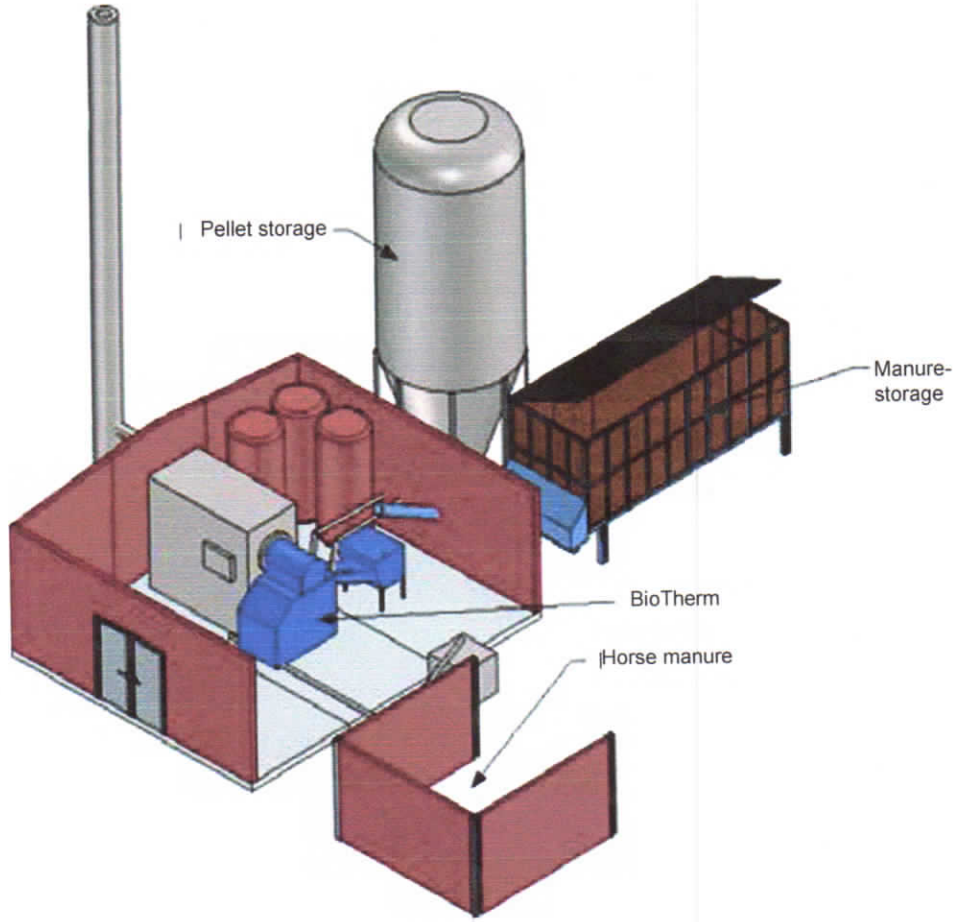
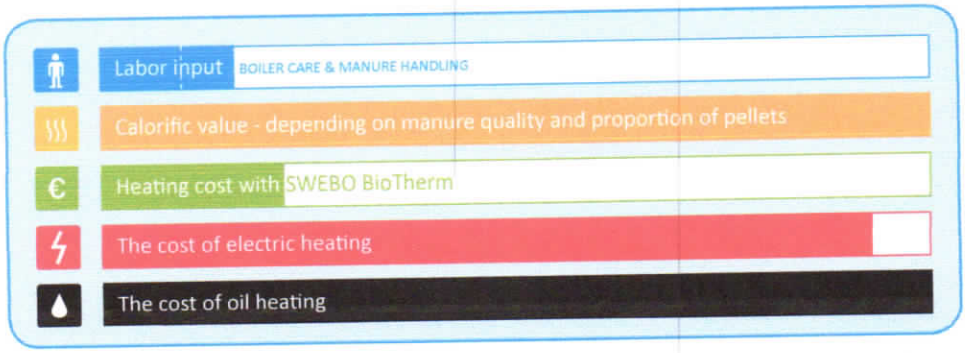
ALTERNATIVE - Horse manure with pellet booster



SUMMARY

- Slightly higher heating costs
- High calorific value - the better manure quality, the less pellets consumed/the worse manure quality, the more pellets consumed
- Automatic electric ignition.
- Automatic pellet backup.

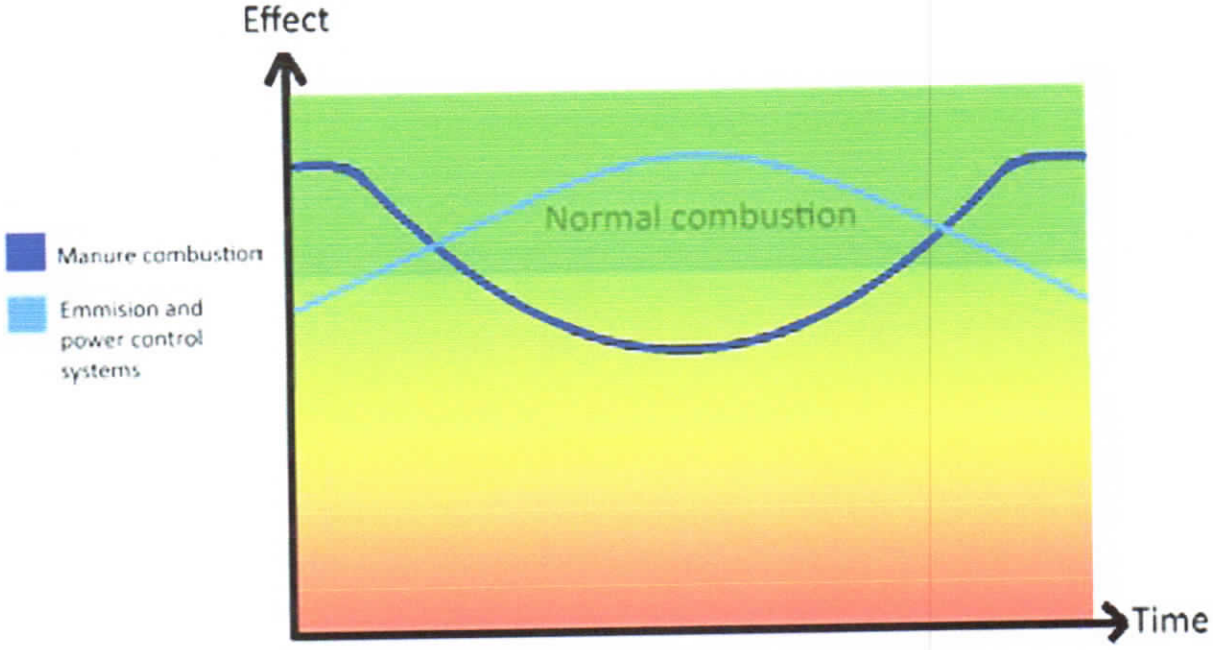


Emmision och power control systems – EKS

SWEBO Power and emission control system (EKS) has two functions. First, to maintain an environmentally friendly combustion but also to maintain a certain effect on the plant based on fuel quality it has.

When burning with horse manure or chicken manure the quality can vary from time to time. A Swebo Biotherm Gen 3 burn horse manure with a moisture content up to 50% and an energy content of about 1700 kWh / ton. But if the manure has been for a long time on stack or has a higher moisture content than prescribed, it means that the power goes down and the emissions goes up. This system detects and activates the EKS program. What happens in practice is that the burner is injected with pellets directly into the fireplace and in a matter of 30-60 seconds the combustion process is regulated to normal. This system is activated when the requirements for combustion is not maintained due to the poor quality of fuel you burn, or if for some reason you want a higher power than the original fuel can offer, than we boosts the burner with the EKS system.

Tests also show that it only requires one very small amount of pellets to compensate a poor source material when it is injected directly into the combustion chamber and not mixed with the original fuel. With this new function, we show further evidence of the cutting-edge technology we hold with Swebo Biotherm Gen 3. The SWEBO Biotherm Gen 3 is not only a burner which burns horse manure, but it can easily be adjusted for other fuels such as wood chips, peat, briquettes, pellets, cereals and more.

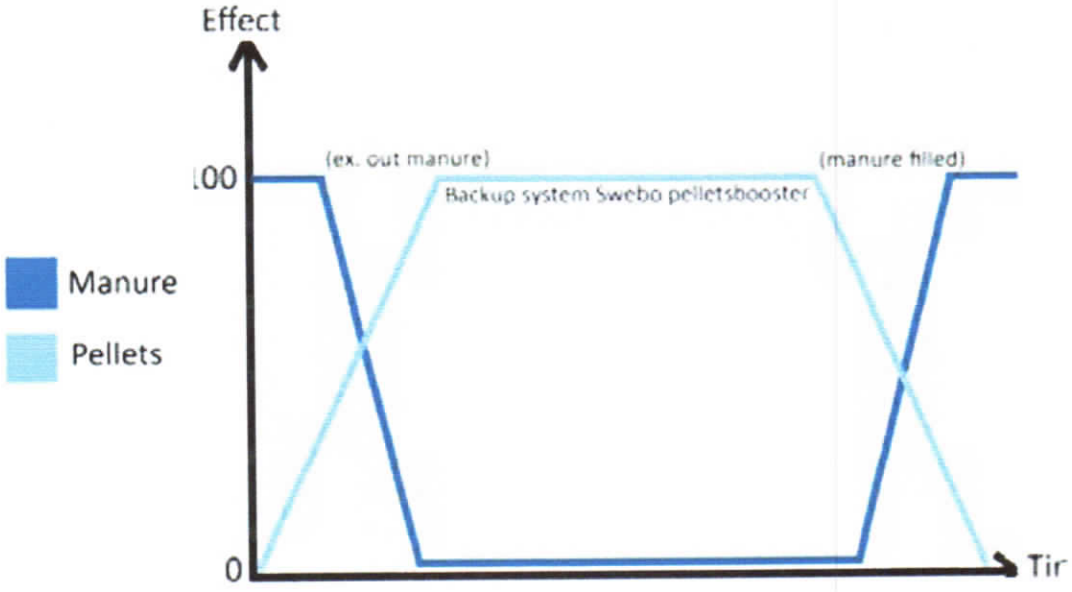


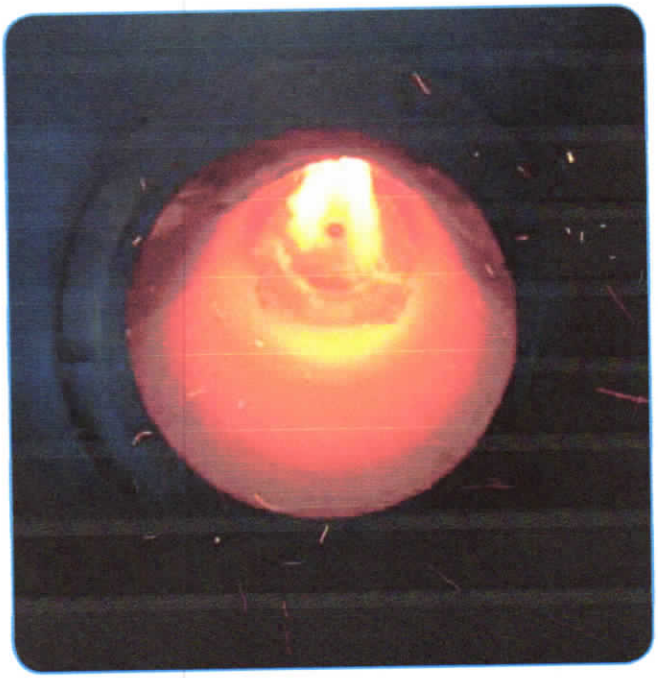
Backup system

Normally, you have oil or gas boilers as backup function when dealing with bioenergy as a basic source. We have also had that kind of std solution when it comes to Swebo Biotherm. But now that we have launched Swebo Bioterm Gen 3, we thought again.

Thanks to our EKS system, we have also integrated a further smart solution. When heating with "Waste fuels", it is unclassified and not quality-controlled fuel involved. This in turn can result in, which we wrote about earlier, that the quality is too poor on fuel so EKS system is activated. But we also utilize this system as a backup if the fuel runs out or if there is someting jaming the feeding screws, for example a horseshoe and for that reason does not add fuel as it should.

In such cases when you can not continue burning regular fuel, the system change to completely burn pellets - instead of oil or gas that is far more expensive, and not being carbon neutral as pellets. The boiler is then simply a pellet boiler at full power!





SWEBO BIOENERGY
FUTURE ENERGY SYSTEMS TODAY

TECHNICAL INFORMATION

- The SWEBO BioTherm is available in versions from 80 kW to 1000 kW.
- The burner is available in both single and double design versions.
- The SWEBO BioTherm double version is adapted for scalable operation.
- Examples of compatible fuels:
  - Horse manure (moisture content up to 50%)
  - Moist wood chips (moisture content up to 61%)
  - Waste pellets
  - Traditional pellets
  - Harvesting residue
  - Offal, etc.
- Extremely low emissions.
- Combustion temperature in the combustion chamber approx. 850 degrees
- Combustion temperature in the secondary pipes/SCC approx. 1,100 degrees
- SWEBO Backup - automatic backup function with pellets that automatically comes into force unless the manure can be fired or if it runs out.

SWEBO BIOENERGY
FUTURE ENERGY SYSTEMS TODAY

BIOTHERM COMBUSTOR

- The optimal heating system, environmental and effective.

Harnessing resources

SWEBO Bioenergy, together with Luleå University of Technology (LTU), have now completed several years' development of a combustor that can burn diffucult fuels as horse manure, chicken manure, extremely moist wood ship, slaughtery waste etc.

Energy from horse manure, wood ship etc.

SWEBO BioTherm is a combustor that extracts energy from horse manure, something that was not previously possible in an environmentally sound way. The horse manure and other material from horse boxes or stalls is mixed and burned in our combustor like any ordinary biofuel – at a moisture content of right up to 61%. It can also burn slaughtery waste. This is, in other words, a multi burner worth mentioning.

With the high operating efficiency of the SWEBO BioTherm, and thanks to the unique combustion construction, it is the most environmentally friendly and effective heating alternative of its type, both operationally and economically. SWEBO BioTherm is the result of a research and development project lasting many years, and like so many other of SWEBO's products has influenced the entire energy market.

Optimal ecocycling

The end product after the combustion of horse manure in SWEBO BioTherm is first rate fertilizer. Leading researchers and engineers from The Energy Technology Centre (ETC) in Piteå, whose expertise covers problems related with ash, combustion and gasification technology, as well as process optimisation, have come to the conclusion that thanks to the hish content of phosphor and potassium, the ash is suitable as fertiliser in forests and on land.

Security, quality and function

The entirety of a complete delivered construction of a SWEBO BioTherm and our large storage facility SWEBO S.M.S (Smart Module System) makes your investment a secure, dependable purchase. It gives you easy and simple fuel handling and an installation that will allow you more spare time. For more information about SWEBO S.M.S, see the separate folder or order a copy via www.swebo.com.

Automatic - comfortable!

Today's modern SWEBO BioTherm system does all the work itself. It is well equipped with electric ignition, which avoids having to light it up manually and it also allows you to light it up and extinguish the facility remotely through the integrated web interface.

The new booster function corrects the manure of poor quality at the right combustion temperature. Just fill in the manure and the rest takes care of itself!

In the modern SWEBO BioTherm we have developed an automatic backup function with pellets which means that you don't need to have fossil fuel as a backup if something happens with the manure system. The system automatically takes over if the manure cannot be fired or if it runs out.

SWEBO BIOENERGY
FUTURE ENERGY SYSTEMS TODAY

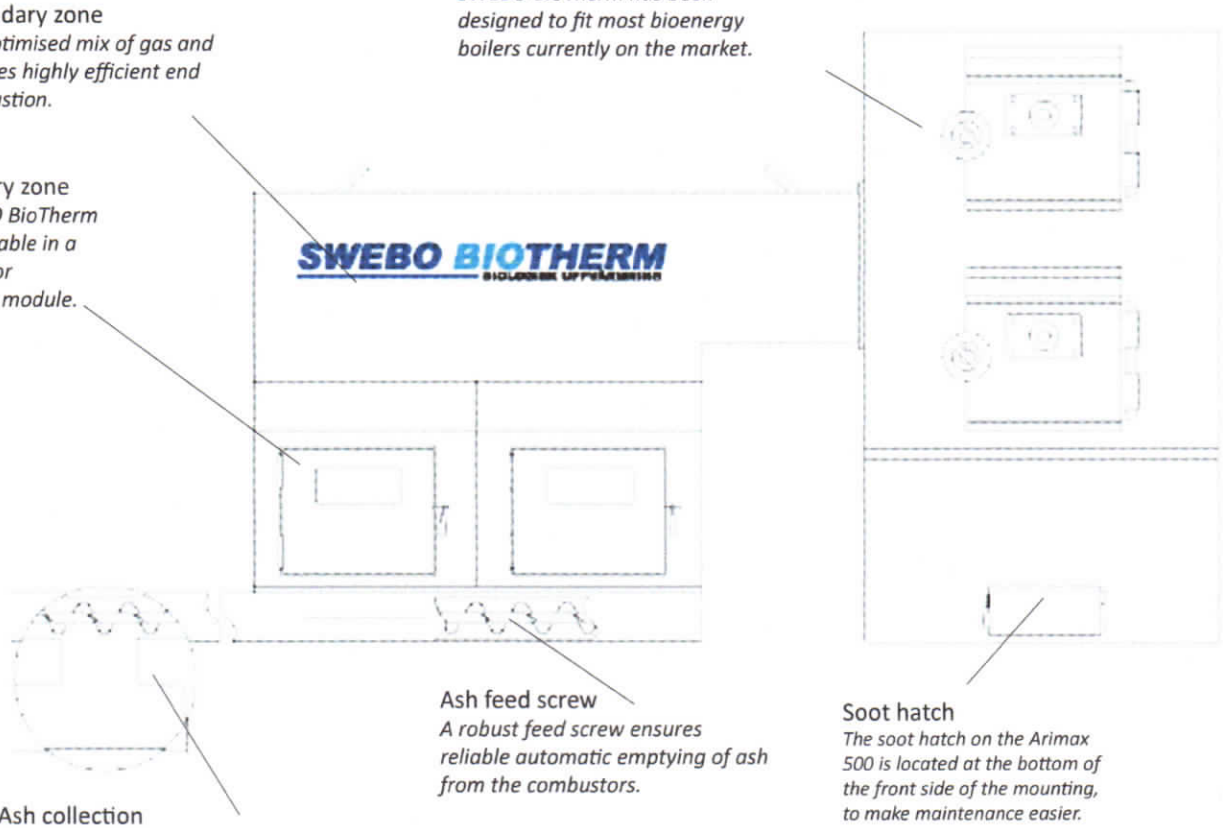
BIOTHERM COMBUSTOR

- The optimal heating system, environmental and effective.

Bioenergy boilers
SWEBO BioTherm has been designed to fit most bioenergy boilers currently on the market.

Secondary zone
The optimised mix of gas and air gives highly efficient end combustion.

Primary zone
SWEBO BioTherm is available in a single or double module.



Ash feed screw
A robust feed screw ensures reliable automatic emptying of ash from the combustors.

Soot hatch
The soot hatch on the Arimax 500 is located at the bottom of the front side of the mounting, to make maintenance easier.

Ash collection
With the help of a feed screw, SWEBO BioTherm transports waste products out from the combustor to a collection box, in many cases located out of doors for easy emptying.

Technical information

- The SWEBO BioTherm is available in versions from 80 kW to 1000 kW.
- The burner is available in both single and double design versions.
- The SWEBO BioTherm double version is adapted for scalable operation.
- Extremely low emissions.
- Combustion temperature in the combustion chamber approx. 850 degrees.
- Combustion temperature in the secondary pipes/SCC approx. 1,100 degrees.
- Automatic electric ignition on all models.
- SWEBO booster function.
- SWEBO pellet backup.
- Examples of compatible fuels:
  - Horse manure (moisture content up to 50%)
  - Moist wood chips (moisture content up to 61%)
  - Waste pellets
  - Traditional pellets
  - Harvesting residue
  - Offal, etc.

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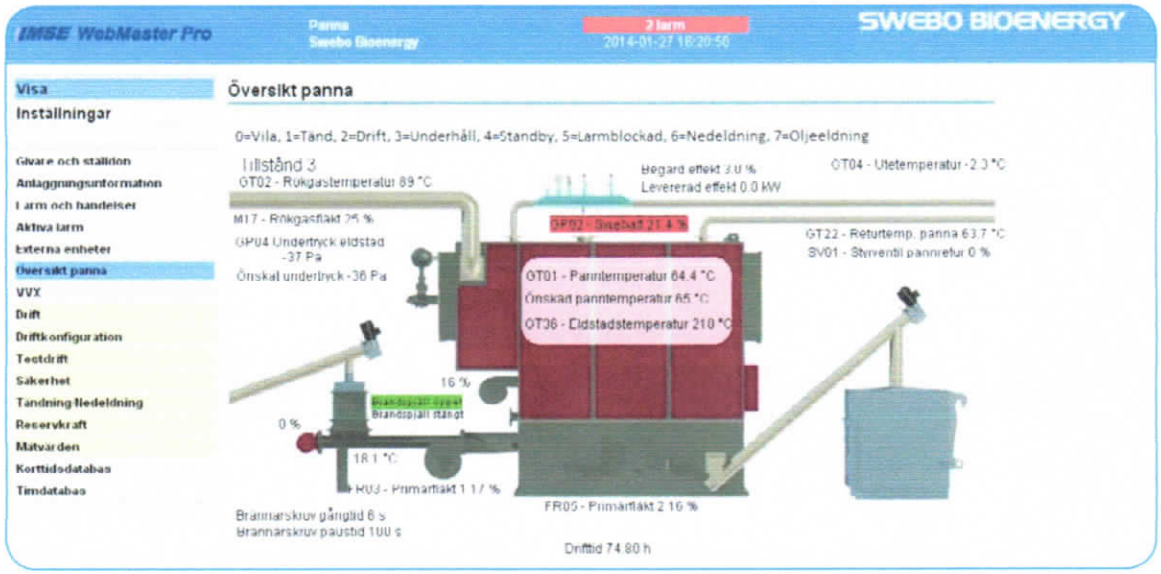
FBS AUTOMATIC COMBUSTION CONTROL SYSTEM

- Monitors, optimises and regulates combustion in biofuel and pellet systems.



Operational reliability – a must!

Operational reliability is essential when major energy consumers switch to alternative energy sources, e.g. bioenergy. Often, a bioenergy installation's service or operational staff are not based on site, which means servicing operations can be lengthy and complex due to journeys to and from the installation. Our FBS automatic combustion control system is designed to provide installation owners with trouble-free, power-optimised combustion.

Control system

The control system is designed for biofuel combustion, and is adapted accordingly. The control system platform is designed for Explorer, and the only requirements for regulating and monitoring the installation are an internet connection and an IP number. It can be managed remotely via the internet using a computer of your choice. No expensive or complicated licences or special programs are required to access the control system.

Security

Unique passwords can be created to ensure that facilities are protected against unauthorised access. There are various access levels which determine the operations a user can perform at an installation, from viewing only to a full user profile, depending on the login.

Available support

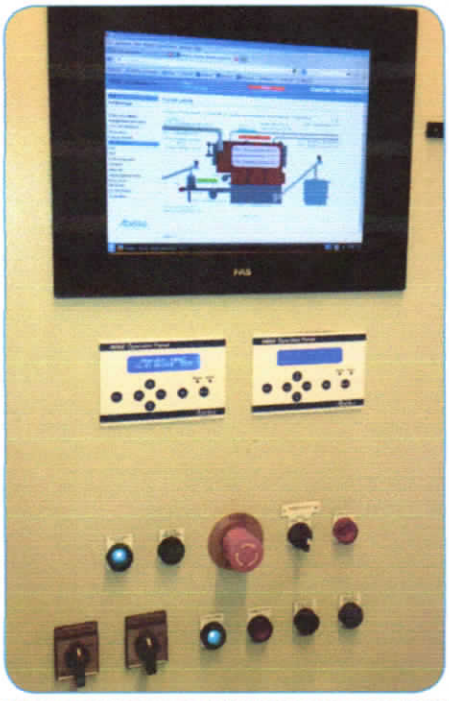
Because our support staff can access each installation supplied, help is always at hand. We can remotely operate the installation with complete control, and fully monitor everything that happens. This is very important, in particular for teaching and training staff operating the installation on a day-to-day basis (basic training for operational staff is provided at startup).

Advanced but user-friendly

SWEBO FBS is one of the most advanced control systems available, but is also simple and intuitive to use. We have designed the control system to be logically adapted to everyday operation, but it is also intended for those who have the desire and capability to use its complex functions to create a cutting-edge tool for supplying safe heating.

Touch screen

The FBS is always supplied with a 15" colour touch screen and a smaller 2-line display with simple button control. The priority is user-friendly operation. *SWEBO FBS can be supplied for installations from 100 kW to 24 mW.*



SWEBO BIOENERGY
FUTURE ENERGY SYSTEMS TODAY

FBS AUTOMATIC COMBUSTION CONTROL SYSTEM

- Monitors, optimises and regulates combustion in biofuel and pellet systems.

Control system interface

Three images of the control system interface are shown on the right. The interface is designed to be as simple and user-friendly as possible.

Details

The control system can regulate using fixed power stages with 0 - 100% power output for maintenance firing and automatic regulation.

Regulates combustion fans, flue gas fan, fuel screws, ash screws. Frequency controlled functions optional.

Co-ordinated database for subsequent evaluation of various scenarios.

Long-term storage of alarms and incidents affecting operation.

Reference value according to external temperature.

Calendar if various temperatures are required depending on the time of day or day of the week.

GSM modem with alarm in plain text, description of the incident, which alarm has been triggered, time and name of installation.

Detailed overview diagram with full information on operating status, temperature, power output, etc.

Easy select functions for simple function connection/disconnection (e.g. electric ignition, automatic regulation).

High level of security and adjustability giving increased availability and operational safety. Inbuilt safety performance for the effect of "human factors" on operation.

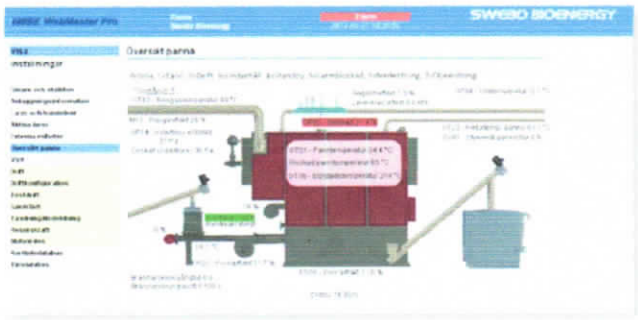
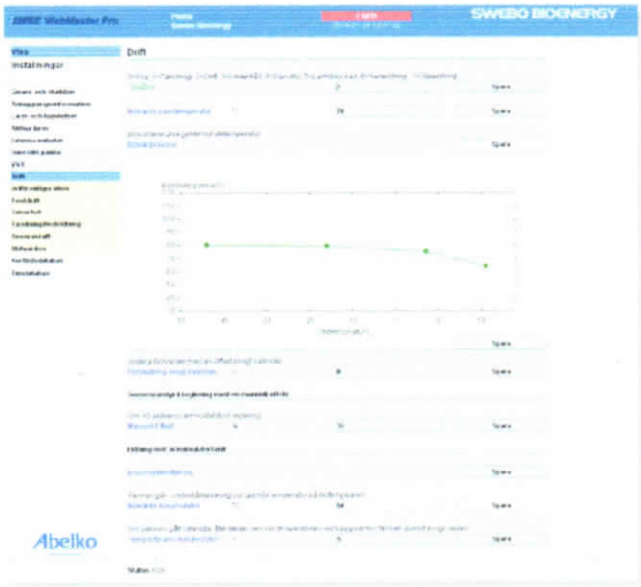


Image 1. Graphical overview of the installation.



Images 2 and 3. Example of interface for controlling the installation.