



Presentation Hippolis Association

2009-11-04

HARNESSING RESOURCES



- **Something not really possible is now possible!**
- **Harnessing resources**
- **Optimal ecocycling**
- **Security, quality and function**
- **Combined Heat and Power**



FUEL FOR SWEBO BIOTHERM?

SWEBO BioTherm is made for combustion of waste materials like horse / poultry manure, it can easily be adjusted for other fuels like wood chips, peat, briquettes, pellet, grain.



Horsemanure



Woodchips



Peat



Briquettes



Pellets



Grain

...and energywood , slauterywaste

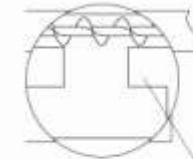




Secondary zone
The optimised mix of gas and air gives highly efficient end combustion.

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

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



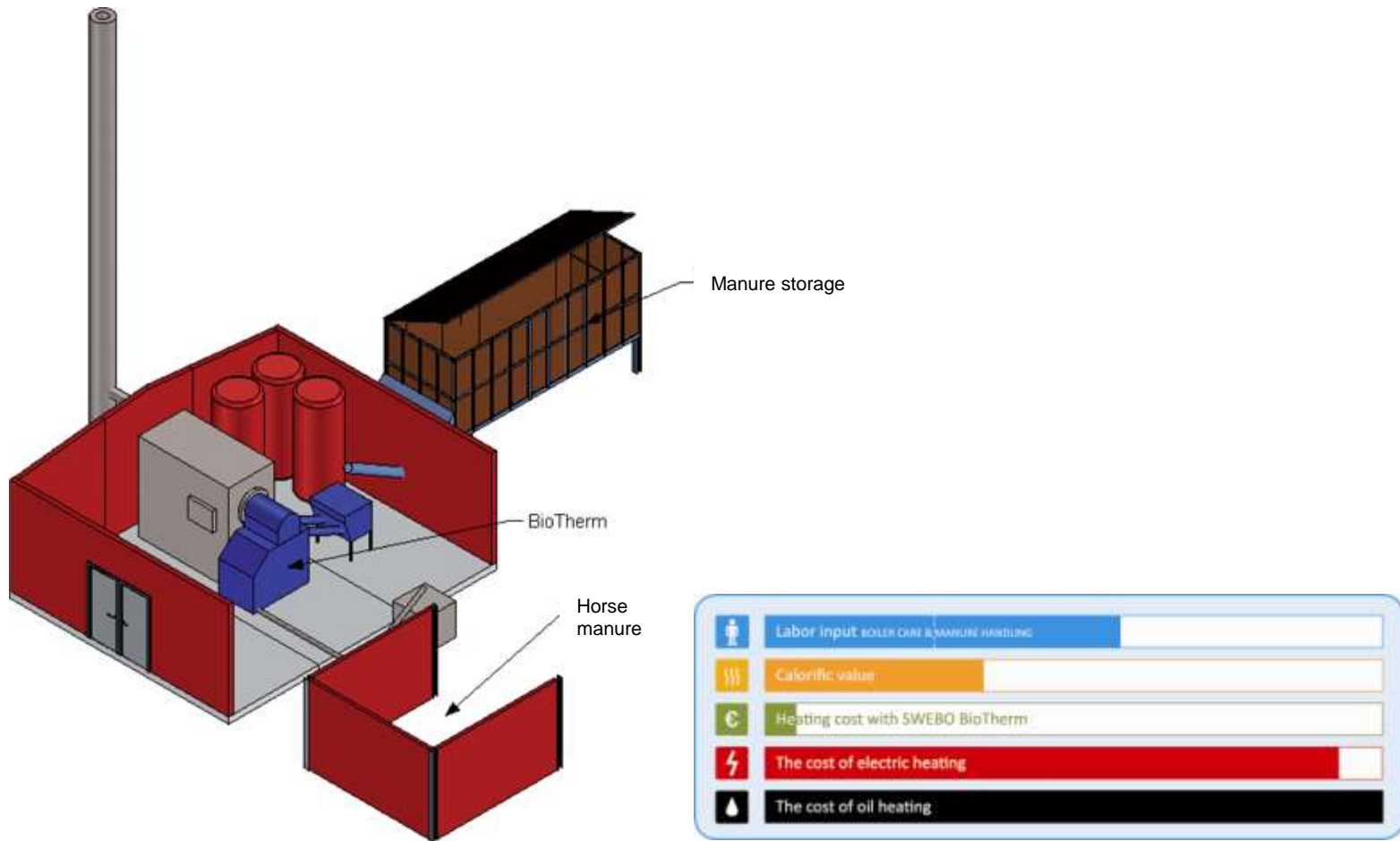
Ash collection
With the help of a feed screw, SWEBO BioTherm transports waste products out from the combustor to a collection box, in many cases located out of doors for easy emptying.

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

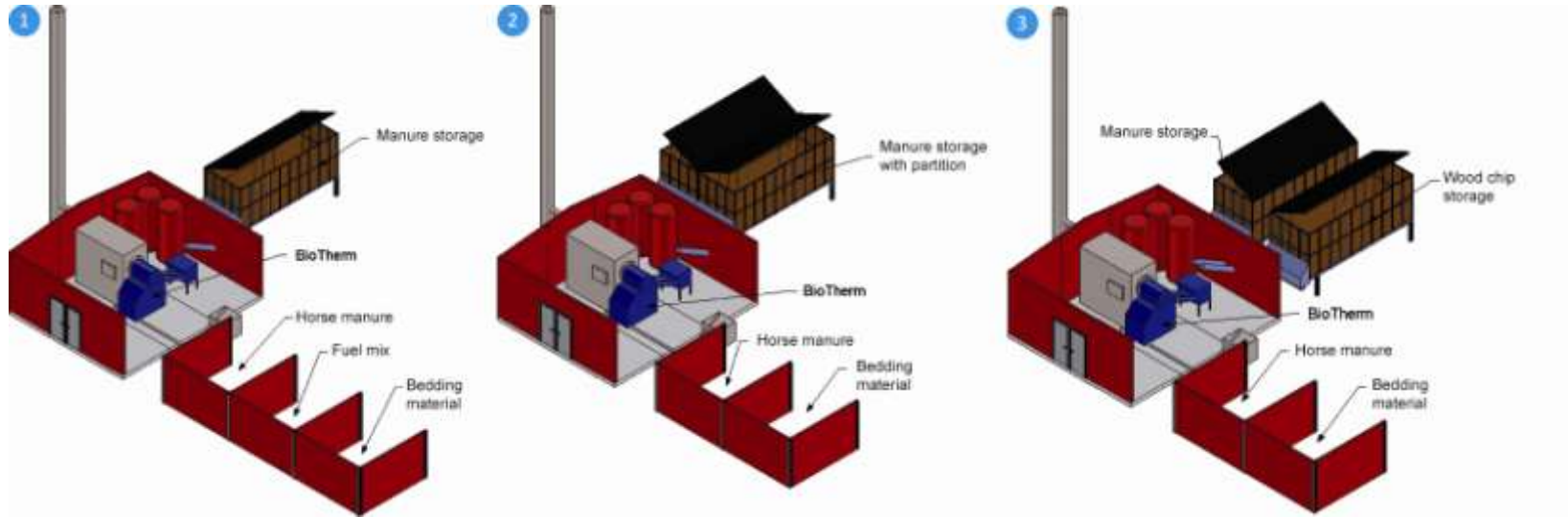
Soot hatch
The soot hatch on the Arimax 500 is located at the bottom of the front side of the mounting, to make maintenance easier.



ALTERNATIVE 1 – Manure, moisture max 50%



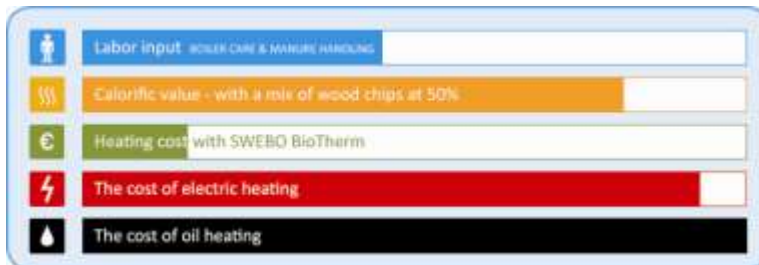
ALTERNATIVE 2 - Mix of manure and example woodchip



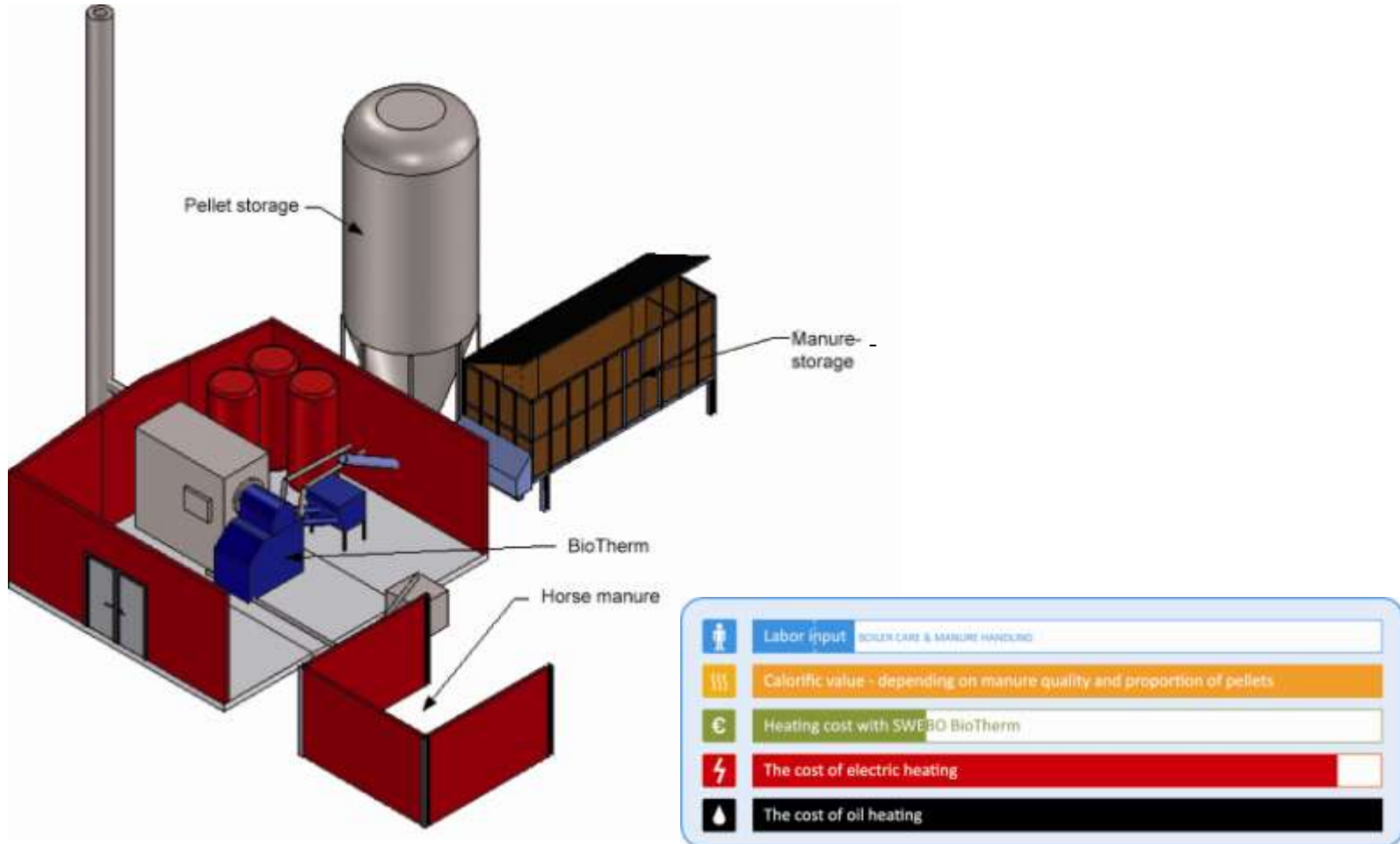
Existing manure platform (under roof) where wood chips and manure mixes manually.

A container with a partition, one side of chips and one for horse manure, mixes before combustion.

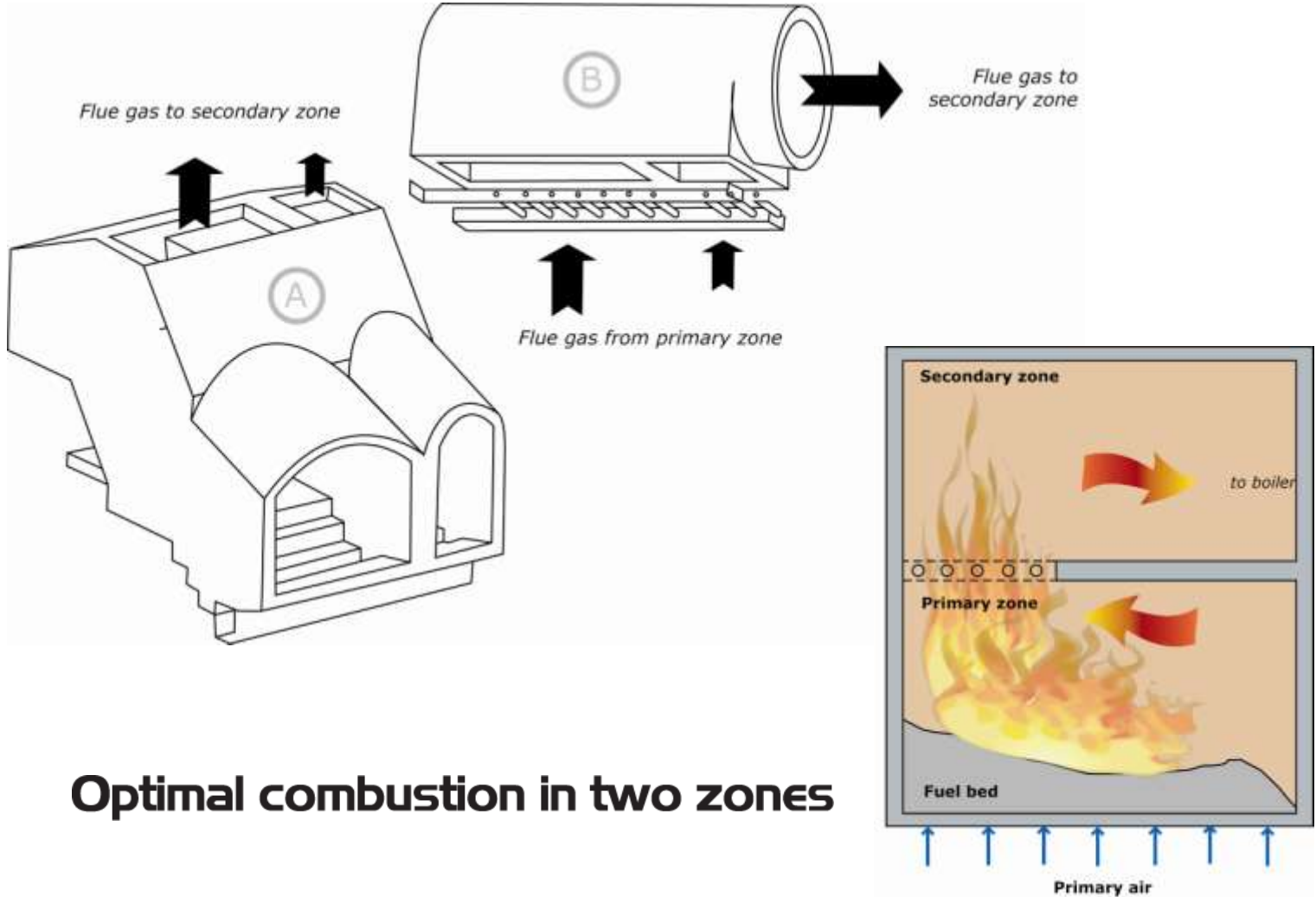
Two containers, one with horse manure and one with chips which are mixed before combustion.



ALTERNATIVE 3 – Biotherm with pellet turbo



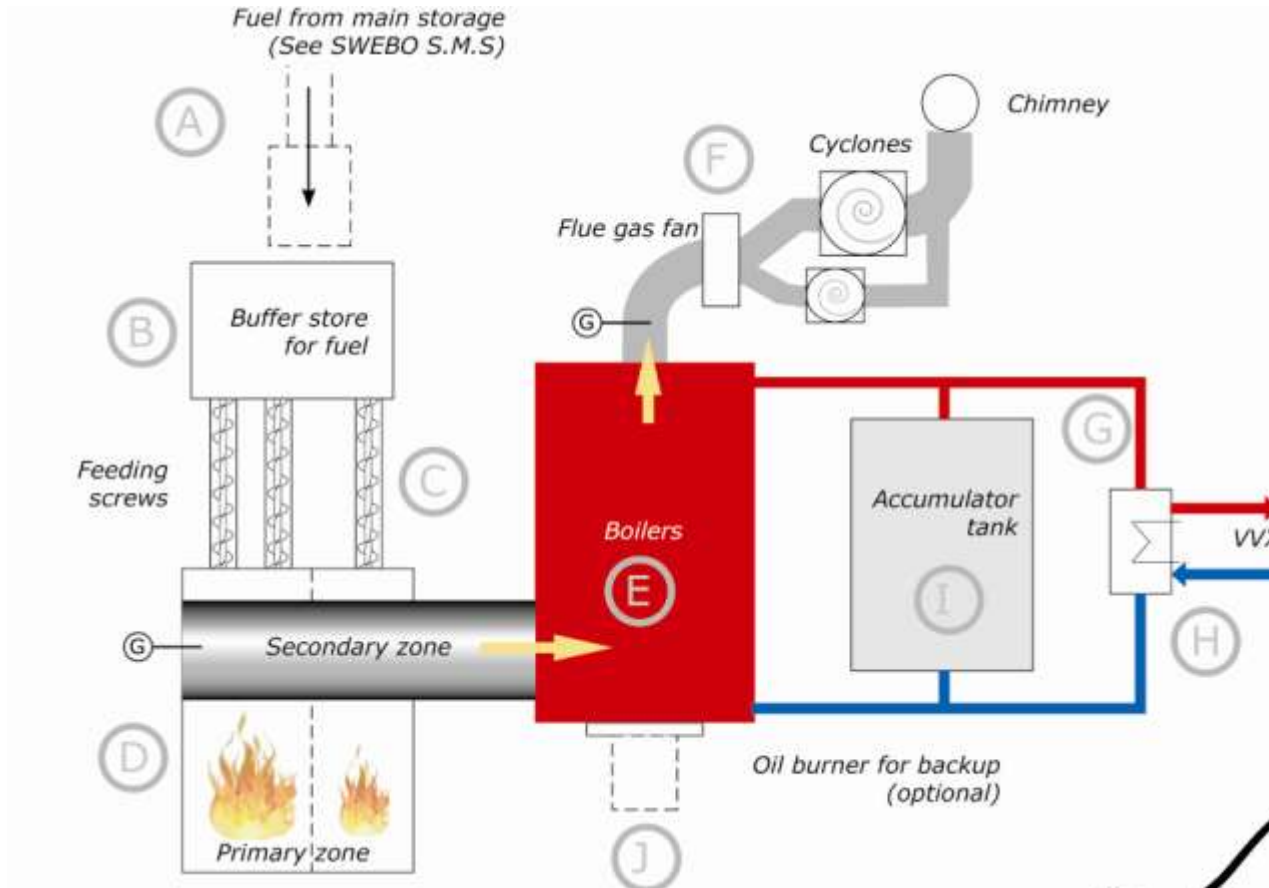
COMBUSTION CHAMBER



Optimal combustion in two zones

OVERVIEW

Control system for maximal effect.



OPTIMIZED CONTROL SYSTEM

IMSSE WebMaster Pro

0 larm

2000-04-15 17:16:40

SWEBO BIOENERGY

Visa

Inställningar

- Givare och ställfön
- Anläggningsinformation
- Larm och händelser
- Aktiva larm
- Externa enheter
- Översikt anläggning
- Skrivar- & Skrapor
- Deltäkningsstationer
- Styrning
- Regulatorinställning
- Anläggning
- Säkerhet
- Mätvärden
- Kortbildsdata
- Längtbildsdata
- Dygnbildsdata

Översikt anläggning

Testlörd 2.8

OT04 Ute temperatur -17.8 °C

Levererad effekt 155.0 kW

Begärd effekt 0.0 %

OT09 Skriv 1 temp: 21.1 °C

OT10 Skriv 2 temp: 21.2 °C

M05 Brännarskriv 1 10 %

M06 Brännarskriv 2 10 %

OT02 Rökgas temperatur 101.2 °C

OT01 Pann temperatur 90.7 °C

M01 Förådskrapa 0

M11 Sekundär 8.0 %

M13 Sekundär 8.0 %

OP04 Undertryck -32.0 Pa

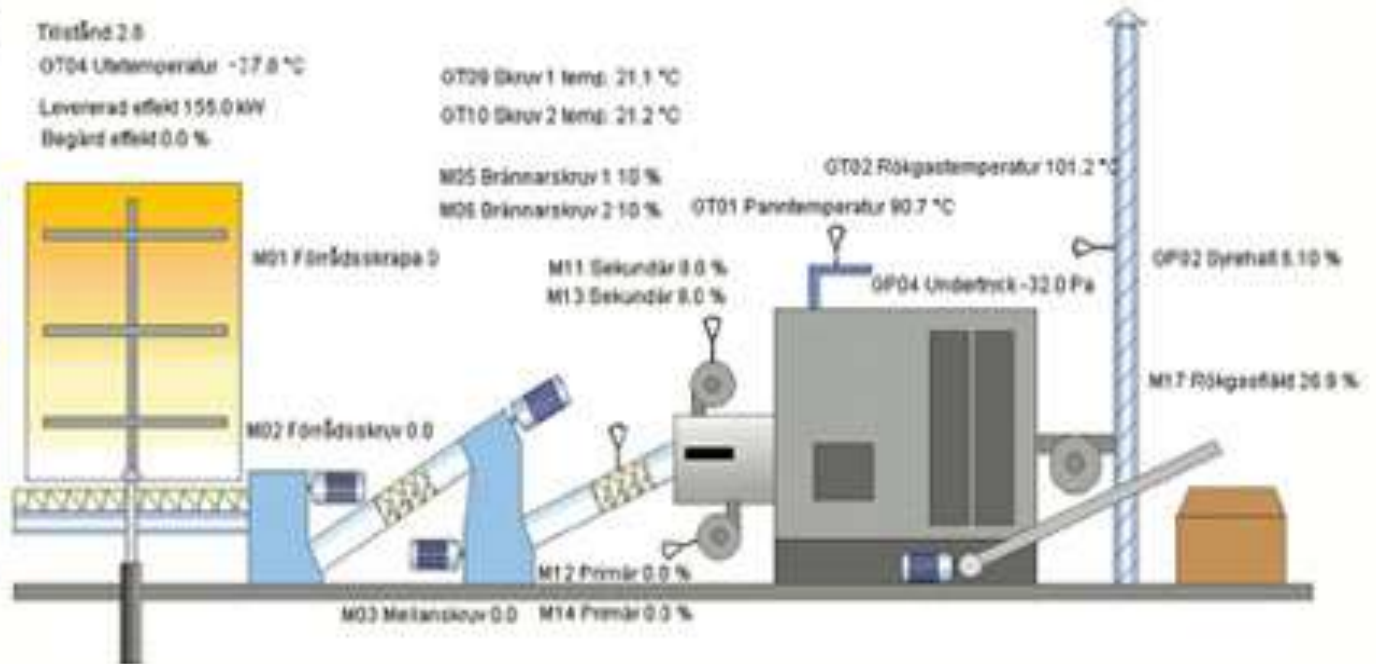
OP02 Dyrhall 5.10 %

M02 Förådskriv 0.0

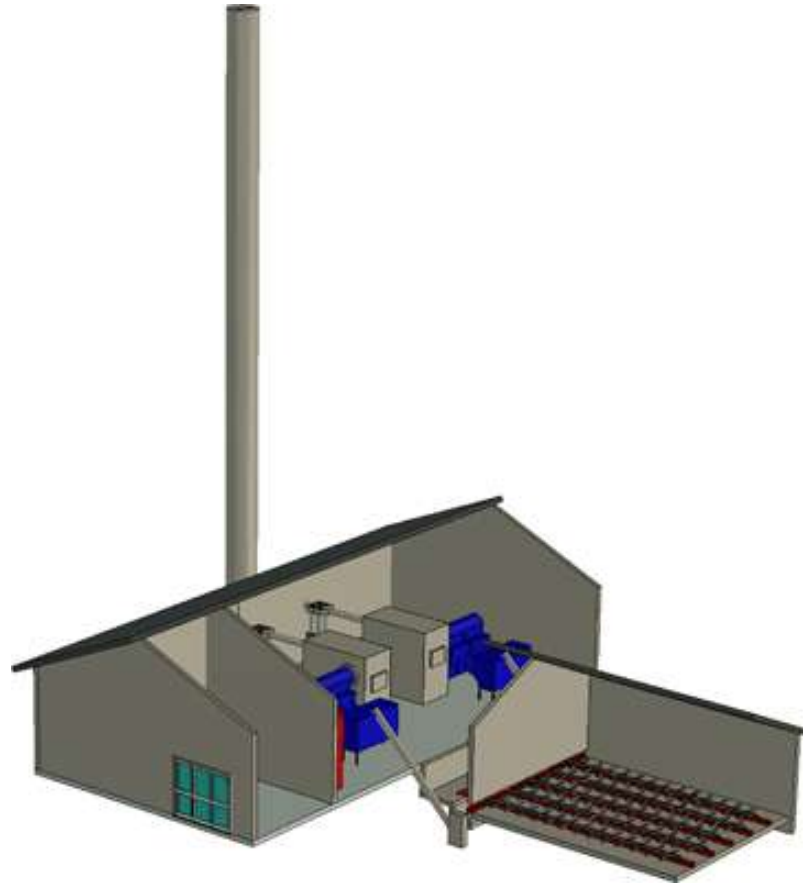
M12 Primär 0.0 %

M17 Rökgasfält 26.9 %

M03 Mellanskriv 0.0 M14 Primär 0.0 %



EXAMPLE OF INDUSTRIAL BIOTHERM INSTALLATION



RESULT OF MANURE COMBUSTION

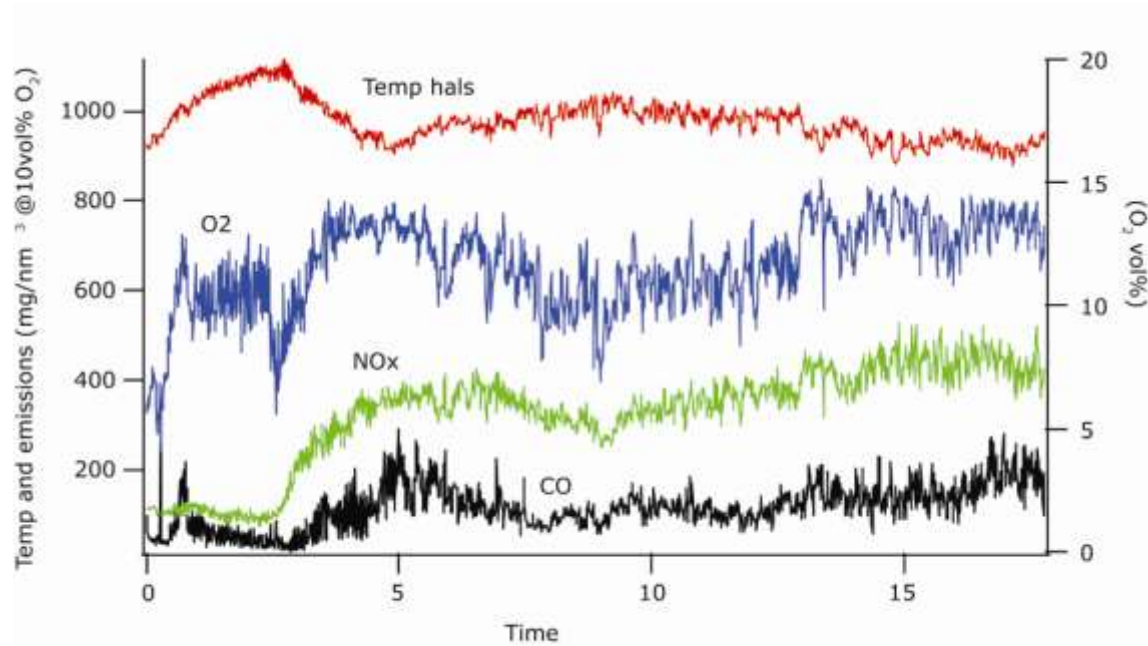


Figure 1: Result of experiment of 28 february.

Emission test made in Boden 2008-12-21

- **Result:**
- The average test result is as follows:
- Flue gas temperature: 344 degrees Celsius (short convection due to future electric power system).
- CO₂: 11,04%
- O₂ 9,6%
- CO 92 ppm
- NO 145,3 ppm
- These results meets the requirement in
- France
- Germany
- Sweden / Norway
- UK



SUMMARY GERMANY EMISSION STANDARDS

Fuel: Chicken manure / horse manure mixed with shavings or straw from the bed with a moisture content of **max 40% / max 50 %**, stored in stack maximum for 5 days to preserve the energy value. Only in cases that moisture content exceeds the critical value, high-value fuel is **automatically added**.

The prevailing regulation when burning manure up to 1 MW is the “TA Luft”.

“TA Luft” **up to 1 MW** requires the compliance of the following limit values (at 11 % Oxygen in exhaust gas):

50 mg/m³ **dust**

250 mg/m³ **CO** (the limit for CO is only relevant **at nominal power**)

500 mg/m³ **NO_x**



- **SUMMARY**

- The Biotherm system meets the requirement in the DIRECTIVE 2000/76/EC OF THE EUROPEAN PARLIAMENT
- CO 2 Neutral
- No disposal cost
- No heating cost
- Combined heat and small scale electricity production (CHP

Emission type	Limit value	Requirement met?
Nitrogen monoxide (NO) and nitrogen dioxide (NO2) expressed as nitrogen dioxide for existing incineration plants with a nominal capacity exceeding 6 tonnes per hour or new incineration plants.	200 mg/m3	YES
Nitrogen monoxide (NO) and nitrogen dioxide (NO2) expressed as nitrogen dioxide for existing incineration plants with a nominal capacity of 6 tonnes per hour or less.	400 mg/m3	YES
CO	250 mg/m3	YES
NO _x	500 mg/m3	YES



Table 1. N losses in composting compared to combustion (Steineck 2001, Pettersson 2002)

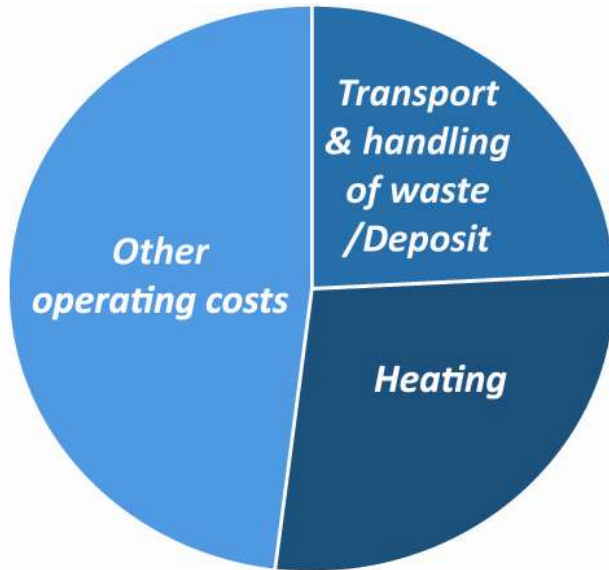
Bedding	N loss in composting %
Peat	4
Chip	8
Straw	41

As mentioned earlier, in combustion all the nitrogen in the fuel is released as nitrogen gas (N₂) or nitrogen oxides (NO_x). On the other hand, all other nutritive substances remain after combustion in the residue ash and flying ash. Phosphorus and potassium are two nutritive substances considered important in horse manure. In combustion tests that have been carried out, c. 60 % of the phosphorus remained in the residue ash, while other experiments have shown that over 80 % of the phosphorus remained in the residue ash (Öhman 2003). However, potassium (K) forms volatile compounds with chlorine (Cl) and sulphur (S), which makes it surprising that 65 % of the potassium remained in the residue ash in the test combustions carried out.

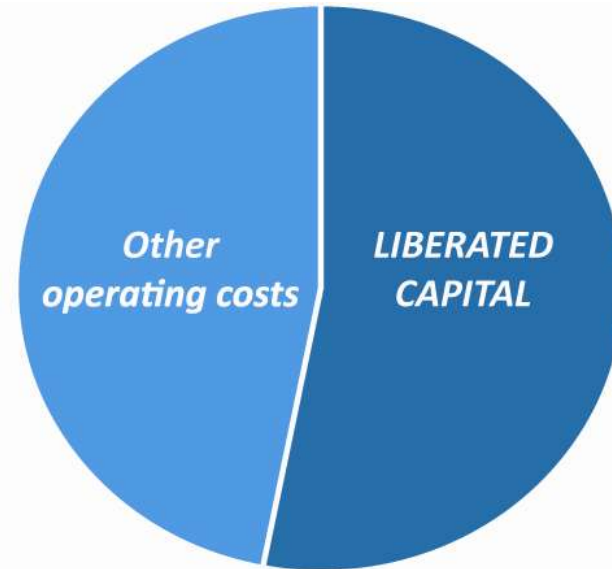
Why do the heating plants not combust the waste product?

As an example, Boden Energi AB does not combust horse manure today, due to the problems with odour and leaching which arise when handling manure at the heating plant using today's methods.

ECONOMY AND ENVIRONMENT

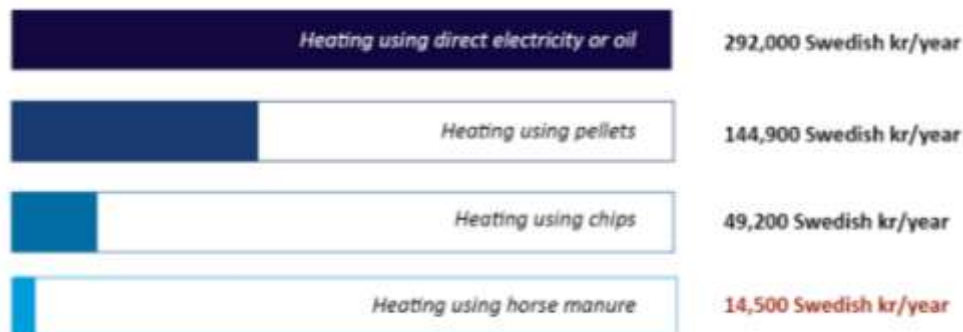


**OPERATING COST WITHOUT
BIOTHERM**
EXPENDITURE: 1 M SWEDISH KR



**OPERATING COST WITH
BIOTHERM**
EXPENDITURE: 1 M SWEDISH KR

Bioenergy & Economy with SWEBO BioTherm



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

+ 561 500 SWEDISH KR/YEAR (*)

The example above is based on the Timrå Riding Arena, which installed a SWEBO BioTherm and saw a drop in its annual consumption from 454,198 kWh to 289,877 kWh over 1 year.

() This figure includes savings on disposal (approx. 300 Swedish kr/tonne) and transport costs.*



TECHNICAL INFORMATION

- The SWEBO Biotherm is available in versions from 85000 Btu to 3,25 MBtu / 30 KW -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 C /1562 F.
- Combustion temperature in the secondary pipes/SSC approx. 1100 C / 2012 F.
- Examples of compatible fuels:
 - Horse manure (moisture content up to 50%)
 - Moist wood chips (moisture content up to 61%)
 - Poultry litter
 - Waste pellets
 - Traditional pellets
 - Harvesting residue
 - Offal, etc.



30 YEARS' EXPERIENCE IN HEATING THE WORLD!

Our expertise is built on over 30 years' experience. Through listening to our customers and tailoring our development and production accordingly, we can remain market leaders by offering new and innovative solutions. We have achieved great success in pushing forward new developments in bioenergy throughout Europe and North America.

Having our development centre in Boden means that we benefit from the arctic climate, which provides the ideal conditions for creating long-term bioenergy solutions, serving either homes and premises or heating plants for industrial applications.

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.