PETRO BIO AB

BLACK VS WHITE PELLETS FOR STEAM PRODUCTION

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Petro Bio AB

FUTURE
ENERGY SOLUTIONS

Vision:
PetroBio contribute globally and locally to a better environment and better climate for future generations

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Business:
PetroBio supply burners and combustion systems, including after sales service

Contract received:	70-250 MSEK annually
Employees:	35
Founded:	1964

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OWNER
THE STENA FAMILY
Stena Drilling
STENA DRILLMAX ICE
ICE
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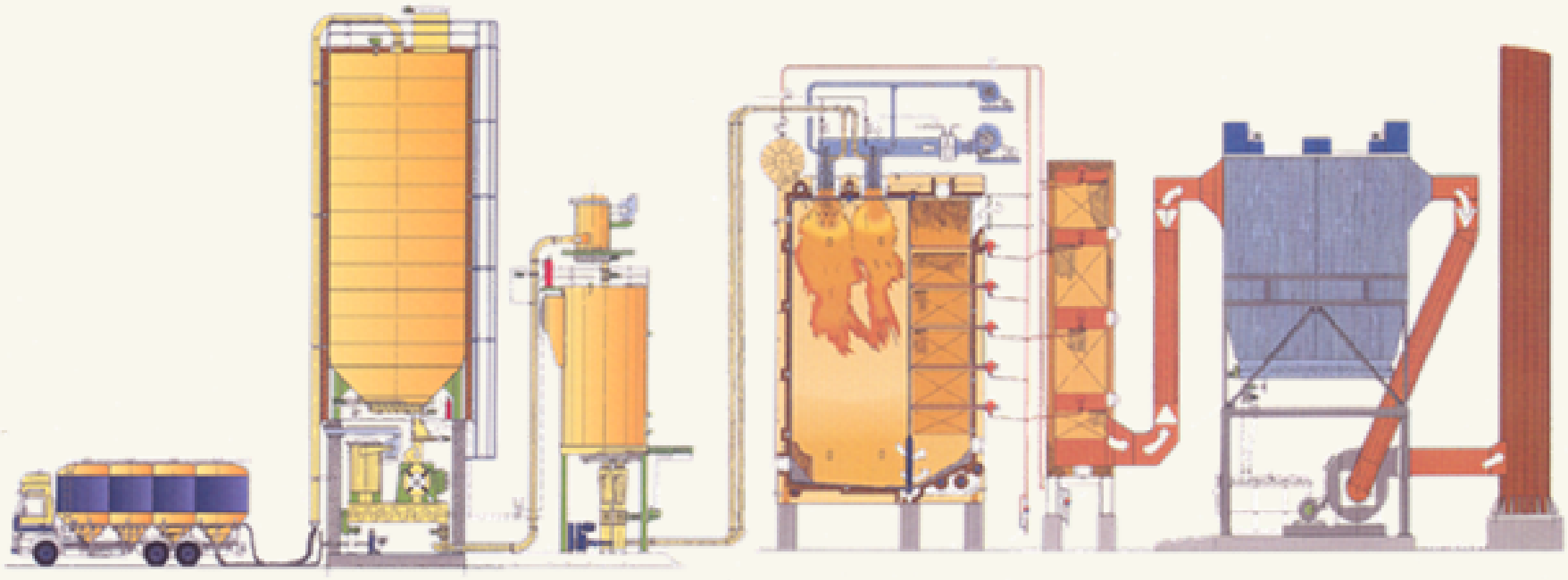
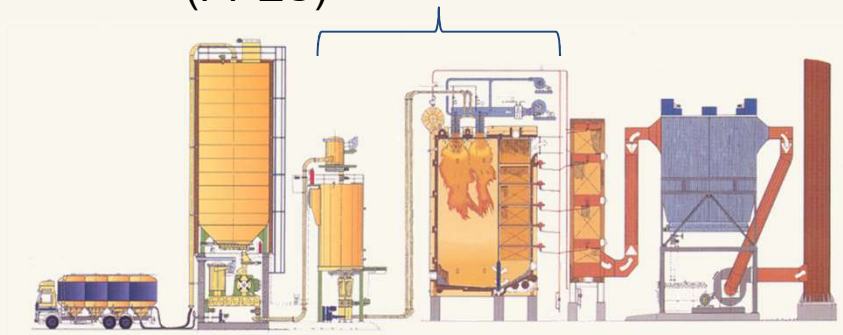
COMBUSTION SOLUTIONS



Bio Energy Powder System

COMBUSTION SOLUTIONS

- **Petro Powder Energy System** (PPES)



- Standardized system
- Large scale combustion (from 6 up to > 100 MW)
- Pulverised biofuels
- Turn-key solution

- **Petro Compact Ecoflame System** (PCES)

- Standardized compact system
- Small scale combustion (2-9 MW)
- Pulverised biofuels
- Turn-key solution

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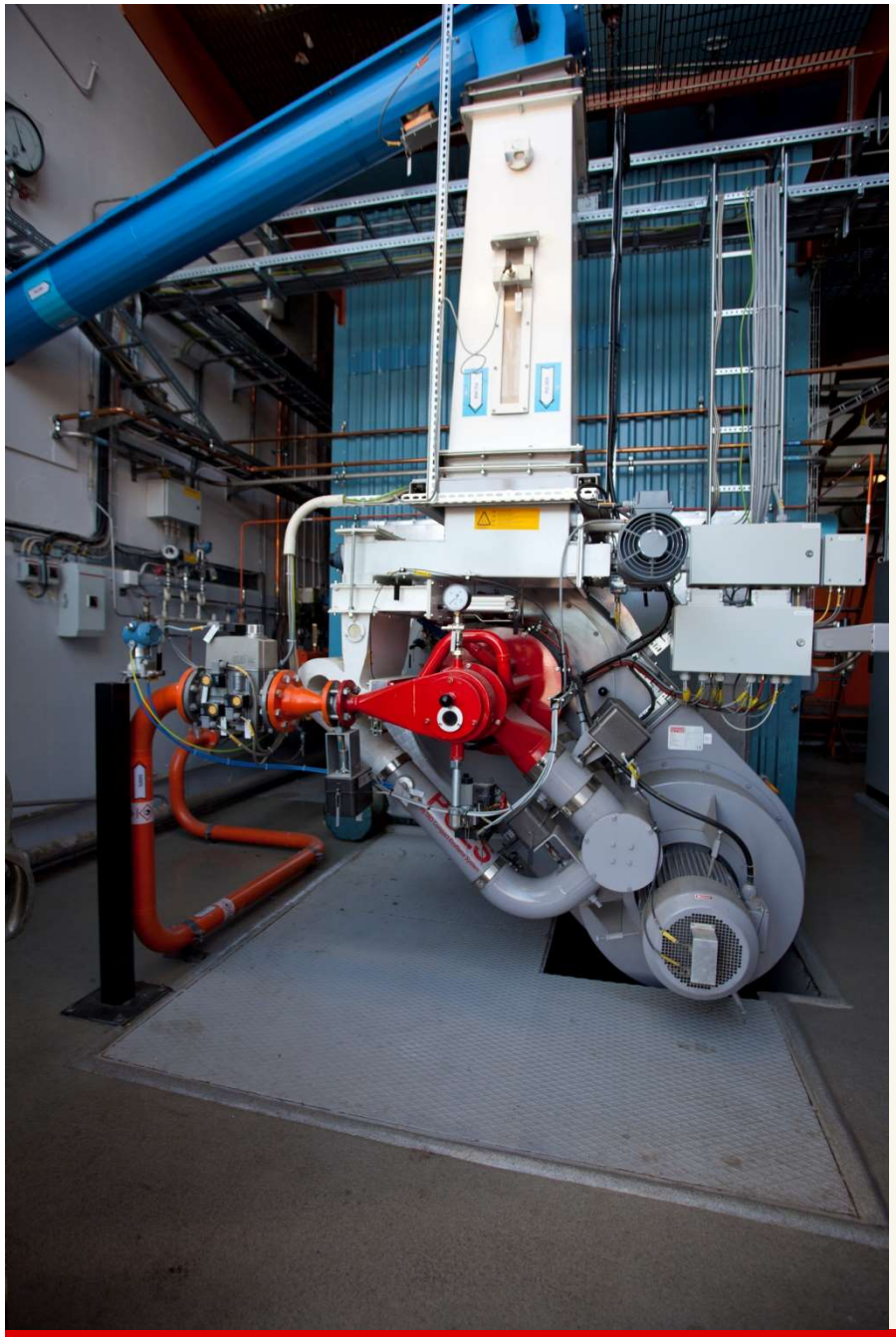

ALINGSÅS LAUNDRY
”The Test Site”

Boiler from Generator AB originally supplied to run on oil, later converted to LPG and now they use white wood powder.

Pellets are milled by a CPM hammer mill.

Fuel handling and burner are controlled by Petro system PMS20.

BIOFUEL
ENERGY SOLUTIONS

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	Steam Exploded	Torrified	White pellets (Derome)
Heat value (MJ/kg)	20,6	21,1	18,9
N (%)	0,1	0,1	0,1
Ash (%)	0,36	0,43	0,3
Density, pellets (kg/m3)	755	685	670
Density, powder (kg/m3)	440-490	--*	244
Powder, <0,5mm (%)	80-90	--*	50-70
Moisture content (%)	3,32	2,71	7-9

** Had no practical opportunity to sample this in the test.*

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Hypotheses before test

1. Black pellets will increase max output
2. Black pellets will increase turn down range
3. Milling of black pellets will require less milling power
4. Black pellets will increase NOx (thermal)

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What happened?

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What happened?

After an initial adjustment of fuel related parameters in the control system according to the new fuel, powder from black pellets was successfully used as fuel.

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What happened? Black pellets are very hard (brittle)

BLACK VS WHITE PELLETS FOR STEAM PRODUCTION

	Steam Exploded	Torrified	White pellets (Derome)
Max output (MW)	7	7,2	5,25
Min output (MW)	1 ,3	1,4	1,2
Turn down	1:5,4	1:5,1	1:4,4
Milling power, max load (A)	68	--*	112
NOx; 3,5MW; 7,0MW (mg/MJ)	67; 105	86; 80	59; n/a
Unburnt in ash (total fuel)	$1{,}26 \times 10^{-4}$	--*	$3{,}0 \times 10^{-6}$

** Had no practical opportunity to sample this in the test.*

BLACK VS WHITE PELLETS FOR STEAM PRODUCTION

Findings

1. Black pellets will increase max output, yes more than 30-40%
2. Black pellets will increase turn down range, yes >20%
3. Milling of black pellets will require less milling power, yes reduction by >70%
4. Black pellets will increase NOx (thermal), No not unambiguously

BLACK VS WHITE PELLETS FOR STEAM PRODUCTION

Take home

1. Petro's systems designed for white pellets will work fine with black pellets.
2. If you need more power, black pellets could be the solution.
3. If you need higher turn down ratio, black pellets can be the solution.
4. Black pellets will reduce the required investment of the biomass energy system

THANKS FOR LISTENING

We have summarized our findings in a white paper. You are welcome to a copy.
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