

Briquetting of agricultural biomass – challenges in industrial production

Agenda:

- The briquetting process - why
- Different uses
- Different raw materials
- Examples of straw lines
- Key figures – cost comparisons to normal bales
- Questions



Briquetting of agricultural biomass – challenges in industrial production



Density
150 kg/m³

Baling

The straw is baled in the field for easier handling and storage. This means a dramatic volume reduction through the process.



LogistEC test results

Species	Die temp	Die size	Capacity set point	Capacity measured	Power consumption, main motor	Briquette density (kg/m ³)
Triticale	95°C	Main 50 B	150kg/h	120kg/h	26A = 15kW	1,085
	105°C	Ext 50B400		120kg/h	23A = 13kW	1,018
Sorghum	100°C	Main 50 A Ext 50A400	200kg/h	120kg/h	38A = 21kW	1,097
Miscanthus	80°C	Main 50 B	150kg/h	102kg/h	23A = 13kW	0,969
	100°C	Ext 50B250		102kg/h	21A = 12kW	0,931
Willow	80°C	Main 50 B	150kg/h	126kg/h	35A = 19kW	1,152
	100°C	Ext 50B250		126kg/h	31A = 17kW	1,133



Advantages in briquetting

- **Logistics – bulk density rises from 150 kg/m³ in bales to 450-550 kg/m³ in briquettes**
- **Transport cost decrease**
- **Storage cost decrease**
- **Fuel becomes homogenous – i.e. moisture between 10-12%, customer specific briquette size and particle size**
- **Additional advantages for bedding and biogas**



Different end uses for briquettes from agricultural biomass

- For fuel in boilers and power plants
- Consumer briquettes – only for select markets
- Animal feed
- Bedding – increases water absorption up to 4 times, removes dust and bacteria
- Use in biogas reactors – increases gas production 150-200%



Different raw materials

- Rice husk
- Peanut shells
- Wine stalks
- Miscanthus
- Straw
- Etc.





Typical straw line for briquetting

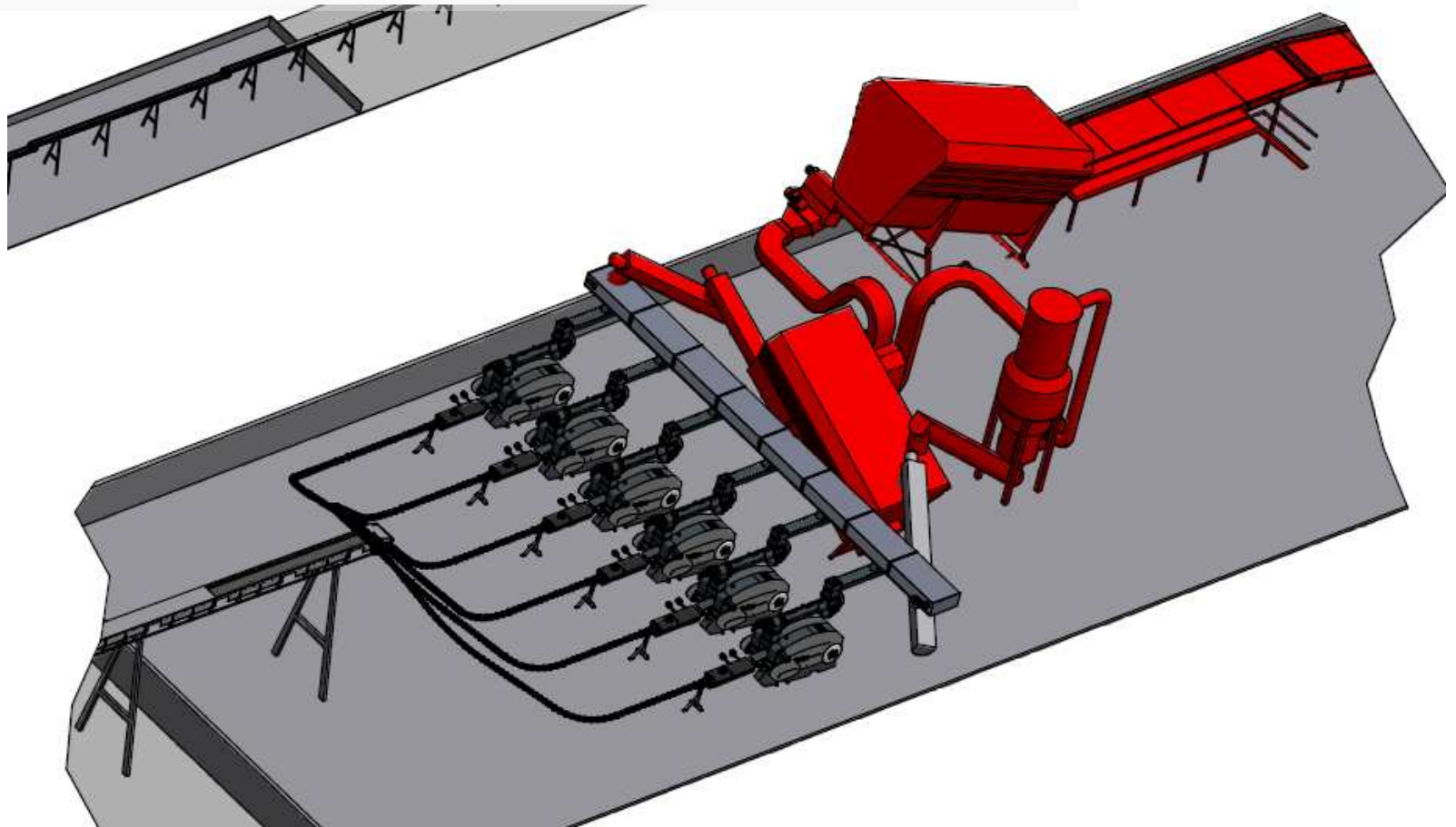
Briquetting Solutions – Agricultural waste...

Complete briquetting solution for production of agro briquettes.

Unique straw handling and preparation system

Low investments as normally no need for drying

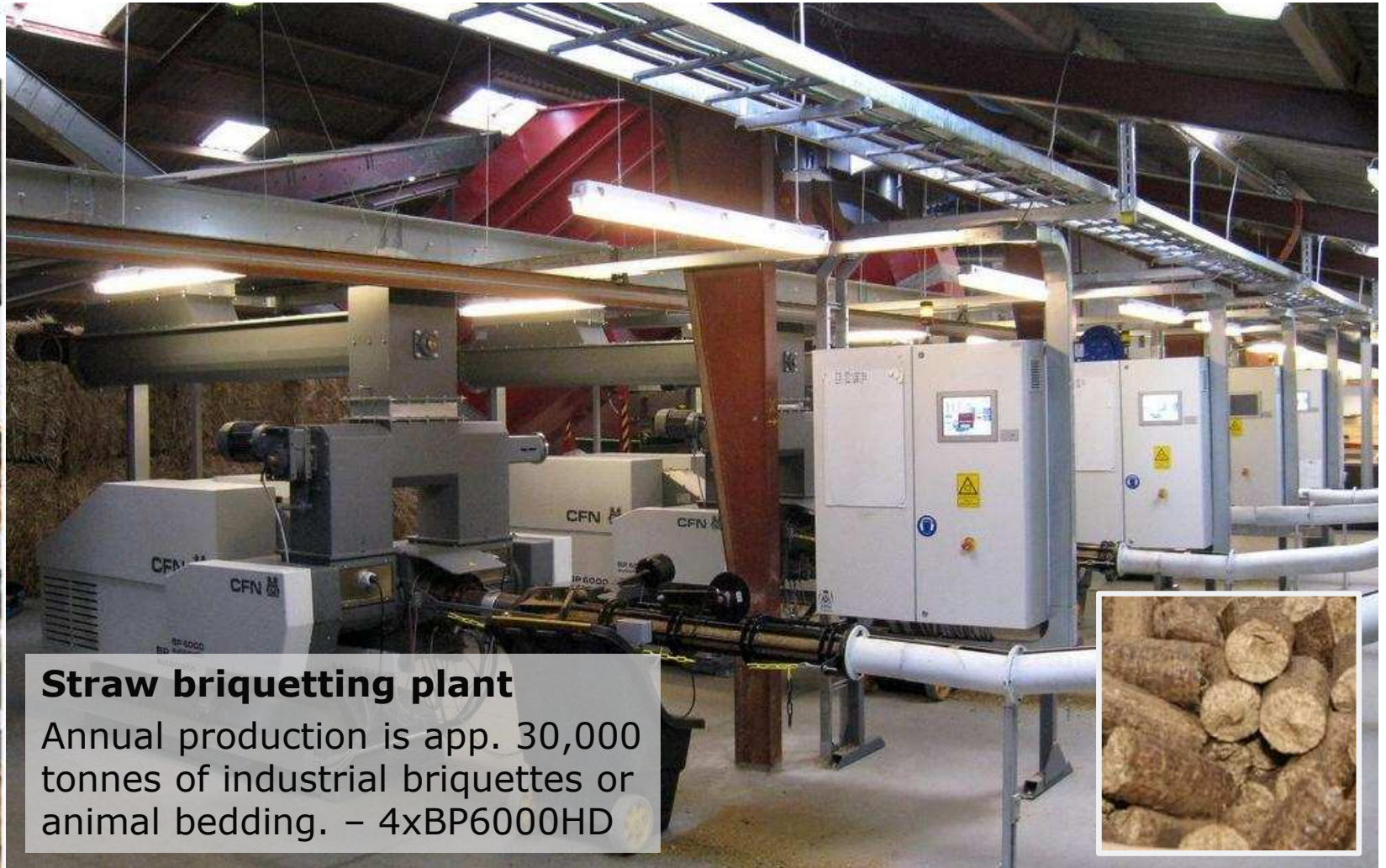
Plant capacity 10 ton per hour





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Straw Briquetting Plant – DDS Case



Straw briquetting plant

Annual production is app. 30,000 tonnes of industrial briquettes or animal bedding. – 4xBP6000HD





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Straw Briquetting Plant – DDS Case



This case is from DDS in Denmark.

They are running 4 BP6000HD CF Nielsen presses for briquetting of straw.



Wheat straw bales are placed on the inlet conveyor and automatically fed into the MTX straw shredder and mixer before entering the hammermill.

It is very important to remove stone and sand particles to reduce the wear on vital parts of briquetting press.





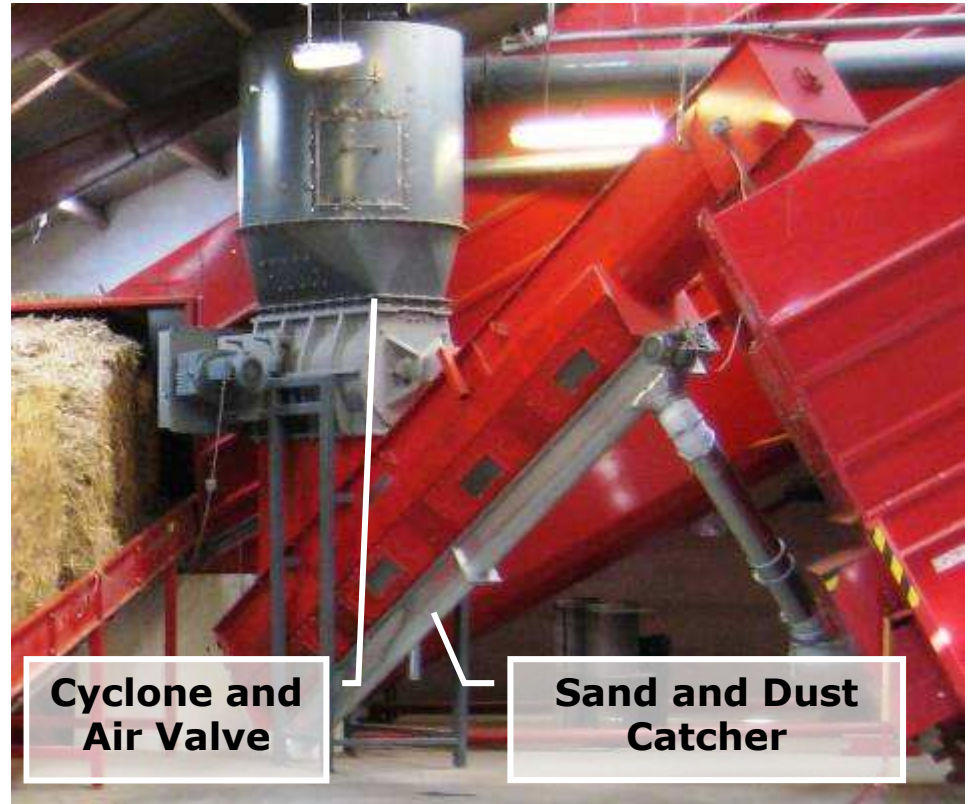
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Details for Stone Trap + Sand- & Dust Separation

Stone, sand particles, metal parts etc. has to be separated from the straw in order to reduce wear on all the vital parts of the briquette presses and other equipment.



Stone Trap



Cyclone and Air Valve

Sand and Dust Catcher

4 x BP 6000 HD Presses in action

Chain conveyor with by-pass system for feeding of the presses instead of classical dosing silos.



Briquettes made from Wheat Straw

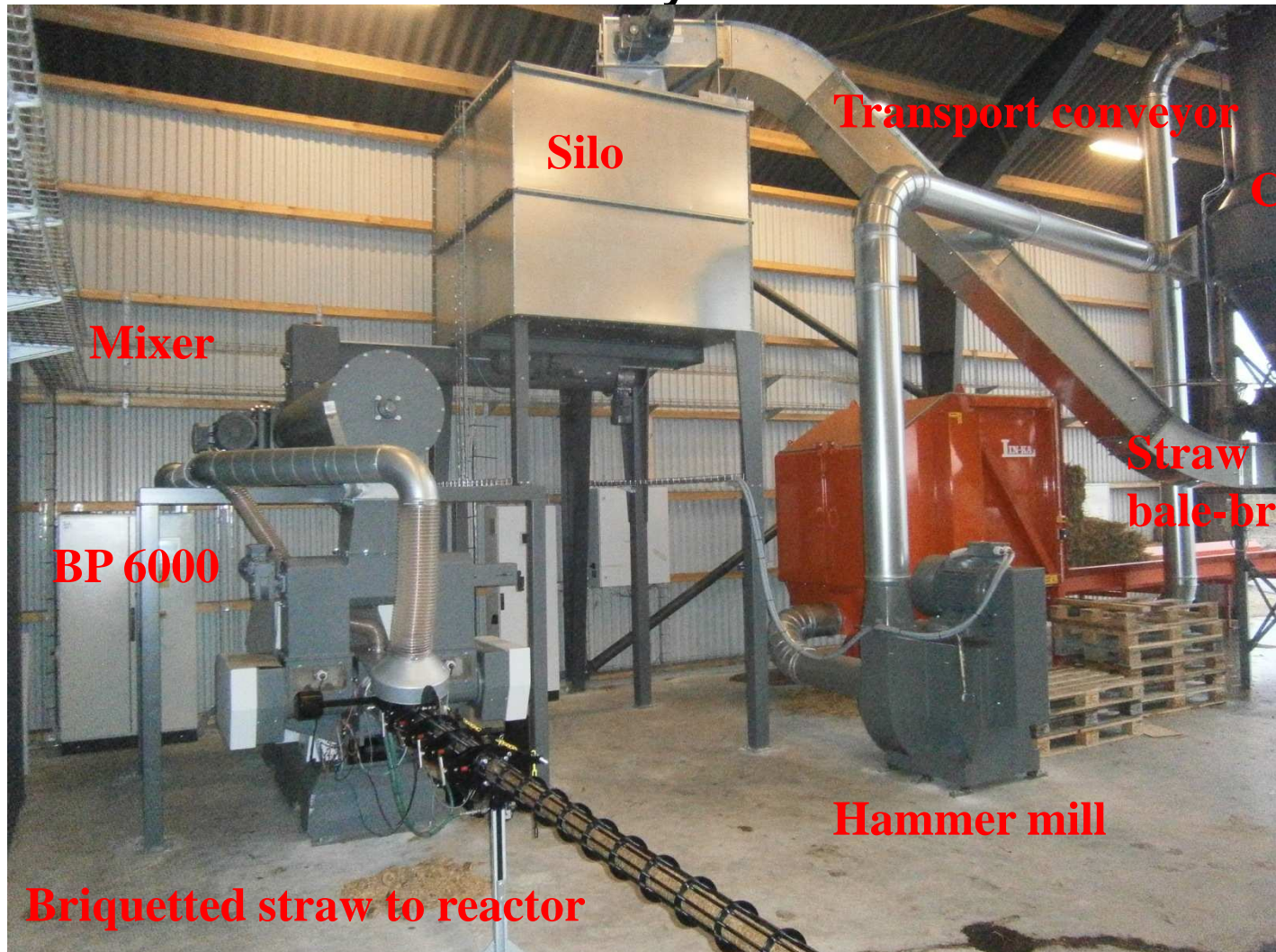


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Aarhus Universitet Biogas line in Foulum, DK



Worlds first Straw-to-biomethane plant - on Aarhus university testsite in Foulum



Silo

Transport conveyor

Cyklon

Mixer

Straw
bale-breaker

BP 6000

Hammer mill

Briquetted straw to reactor

Key Figures

Case: 6-7 ton/hour briquetting lines for straw, placed decentrally, supplying a centrally placed biomass power plant.

	MEUR
• Briquette presses	1.0-1.1
• Straw pretreatment	0.45-0.5
• Misc.	0.15-0.2
• Total	1.6-1.8

Investment only covers machines and installation, not buildings, etc.



Key figures

- **Production: 7.000 hour per year**
- **Salarys – 1-2 operators + 1 maintenance person per shift**
- **Other direct production costs:**
 - **Installed power: 900-1000 kW**
 - **Energy consumption: 75-100 kWh per ton briquettes**
 - **Spare parts, 3 EUR per ton**
 - **Other costs: Service, etc. 1-2 EUR per ton**



Cost comparisons – briquettes vs. bales

- Decentralized briquetting stations
- Regional central biomass power plant



Cost price straw bales	EUR/ton
Total costs of bales from field	42
Storage in open barn with dirt floor	13
Total	55

Cost price briquetting	EUR/ton
Total costs of bales from field	42
Transport to briquetting station	4
Briquette production	19
Storage in barn with concrete floor	8
Total	73

Difference	18
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Cost comparisons – briquettes vs. bales



Transport costs	EUR/ton	EUR/ton
Raw material	Bales	Briquettes
50 km	10	5
100 km	16	7
200 km	29	14
500 km	67	34

Total raw materials and transport	Bales	Briquettes	Difference
50 km	64	77	--13
100 km	70	80	-10
200 km	83	86	-3
500 km	121	106	15

Cost comparisons – briquettes vs. bales



Additional costs by using bales at the power plant	EUR/ton
Ekstra storage costs at the power plant	5
Ekstra investments for shredding and handling of bales - estimate	8
Bale price increase due to localized sourcing 10% - estimate	4
Salarys estimate	5
Total	22

Total raw materials and transport full scenario	Bales	Briquettes	Difference
50 km	86	77	9
100 km	92	80	12
200 km	105	86	19
500 km	143	106	37



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Conclusions

- **When solely considering transport costs, distance from production location to consuming location must be above 250 km, before briquetting is relevant.**
- **Since briquettes entail a more simple installation at the consuming location, significant savings on investments and running costs mean that briquetting is also feasible for short distances.**
- **Calculations/considerations are similar for a biogas plant, but a significant argument is added for briquetting, since straw that has been through the briquetting process yields 150-200% more gas than untreated straw. Furthermore, using untreated straw in a large scale biogas process holds very big challenges.**

