

Utilisation of agricultural residues in biomass boilers

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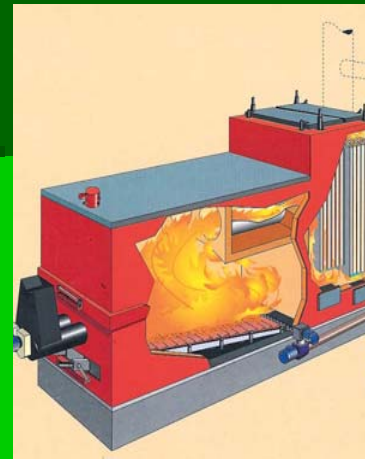
Production chain

Residues

Upgraded
fuel

Boilers
Stoves

Electricity
Heating



Agricultural residues

- Dedicated energy crops (Salix, Reed canary grass)
- By-products of biomass-related industry (husks)
- Straws
- Cereal grains

Problems in using crop residues as biofuels

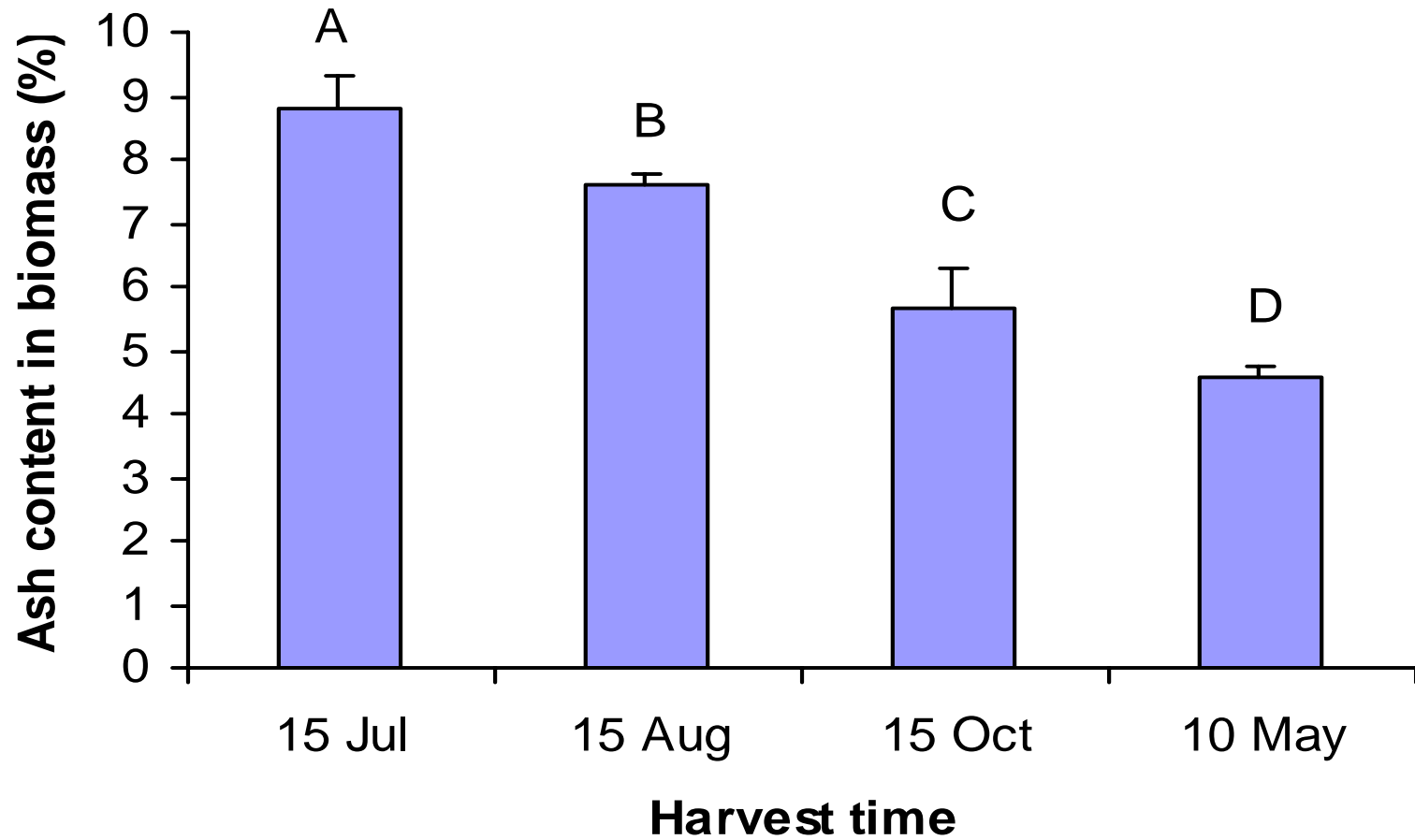


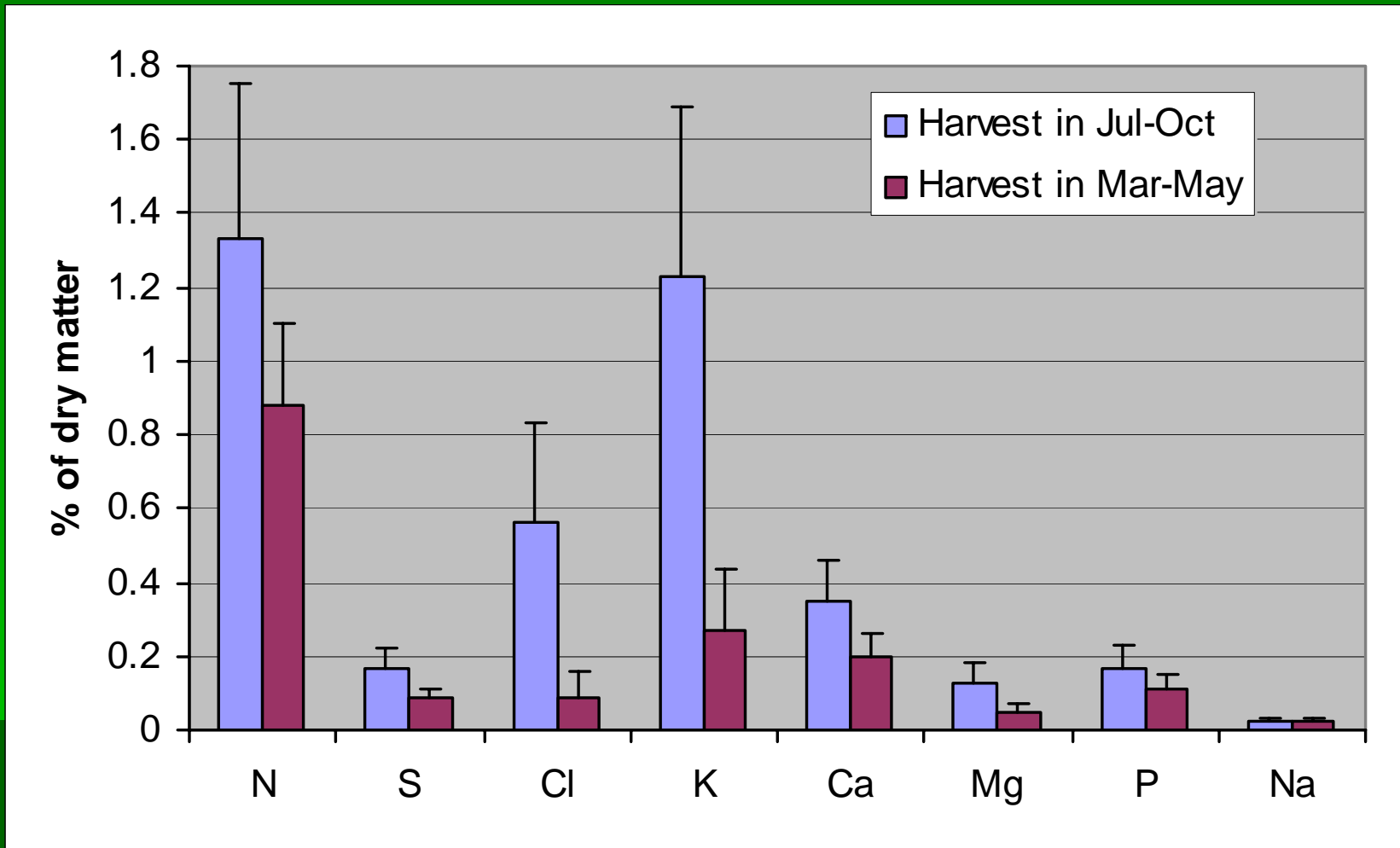
- High ash content: 6-13%
- Undesirable elements:
 - N → HNO_3 , NO_x
 - Cl → HCl, Dioxine,
KCl
 - K, Ca, Mg, Si →
sinters
 - Other pollutants

Delayed harvest: an effective way to improve bio fuel quality



A spring harvest can reduce ash content!!





Source: Burvall 1997

Only the seeds of hemp were harvested in autumn





Harvested in autumn



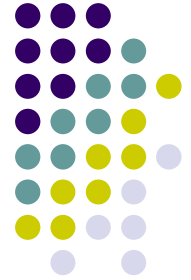
Remained in field







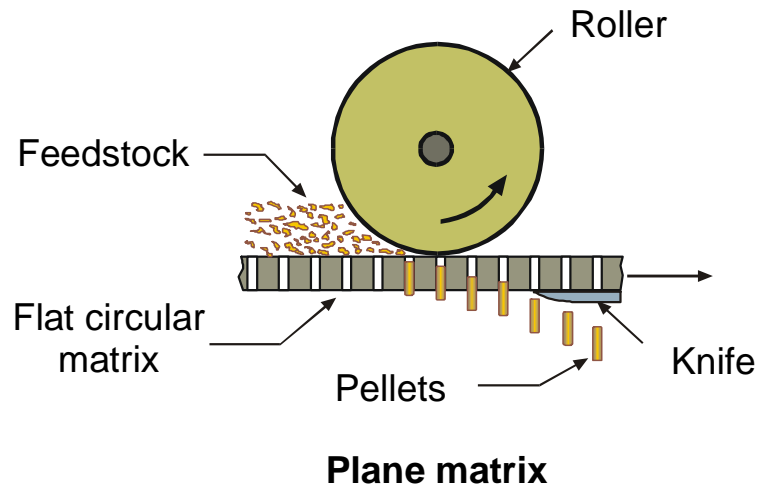
UPGRADED FUELS



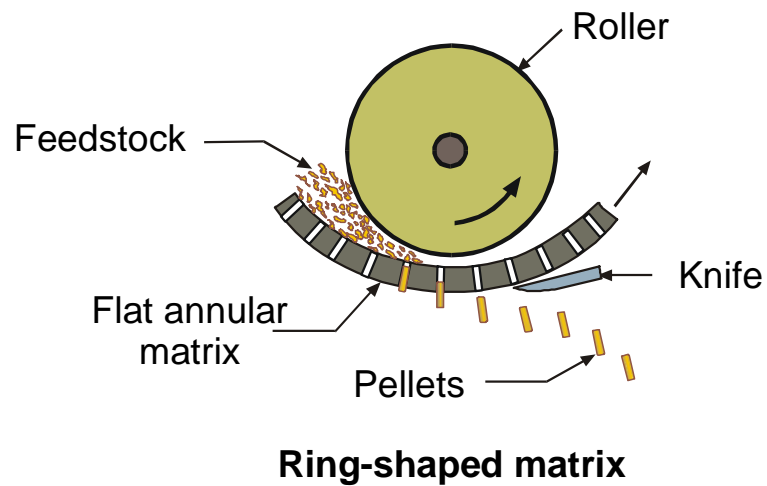
Production technology of pellets

- 1. Storing and pre-treatment of the raw material**
- 2. Drying the raw material**
- 3. The actual pellet production process**

UPGRADED FUELS

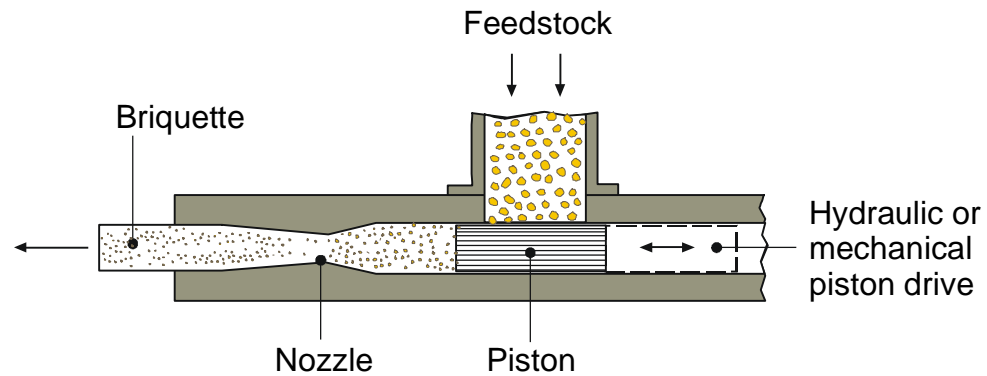


- Pellet press



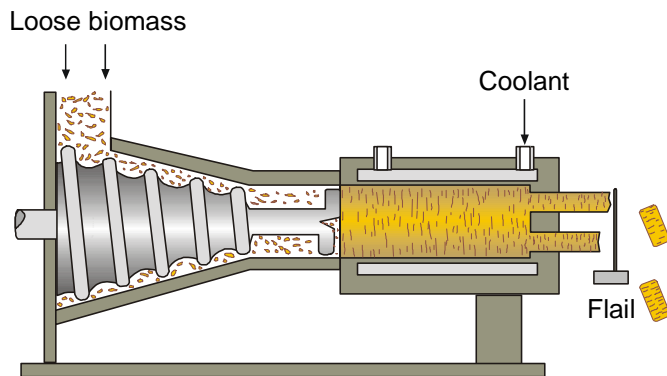
Source: Vinterbäck 1995

UPGRADED FUELS



- Briquette press

- Piston drive



- Cone-shaped screw

UPGRADED FUELS



Average characters of pellets

Character	Unit or measure
Heat value (energy density)	4.6-4.8 kWh/ kg (ca. 2.1 tons of pellets = 1 m ³ light oil)
Density	650-700 kg/ m ³
Diameter	6-14 mm
Length	20-30 mm (typically 4x diameter)
Ash contents	3 – 6 %
Moisture	7-12%



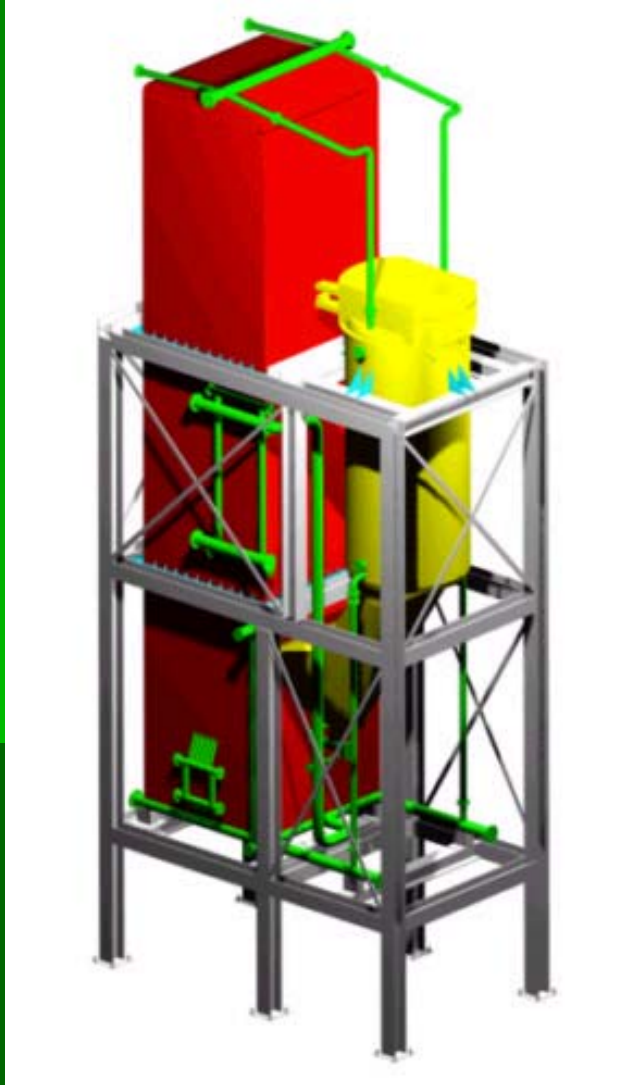
LARGE SCALE UNITS

- Heat and electricity
- Fluidised bed
- Exhaust gas
condensing for district
heating
- Bio ash recycling



Cogeneration plant, Nässjö, Sweden. Source: www.vattenfall.se

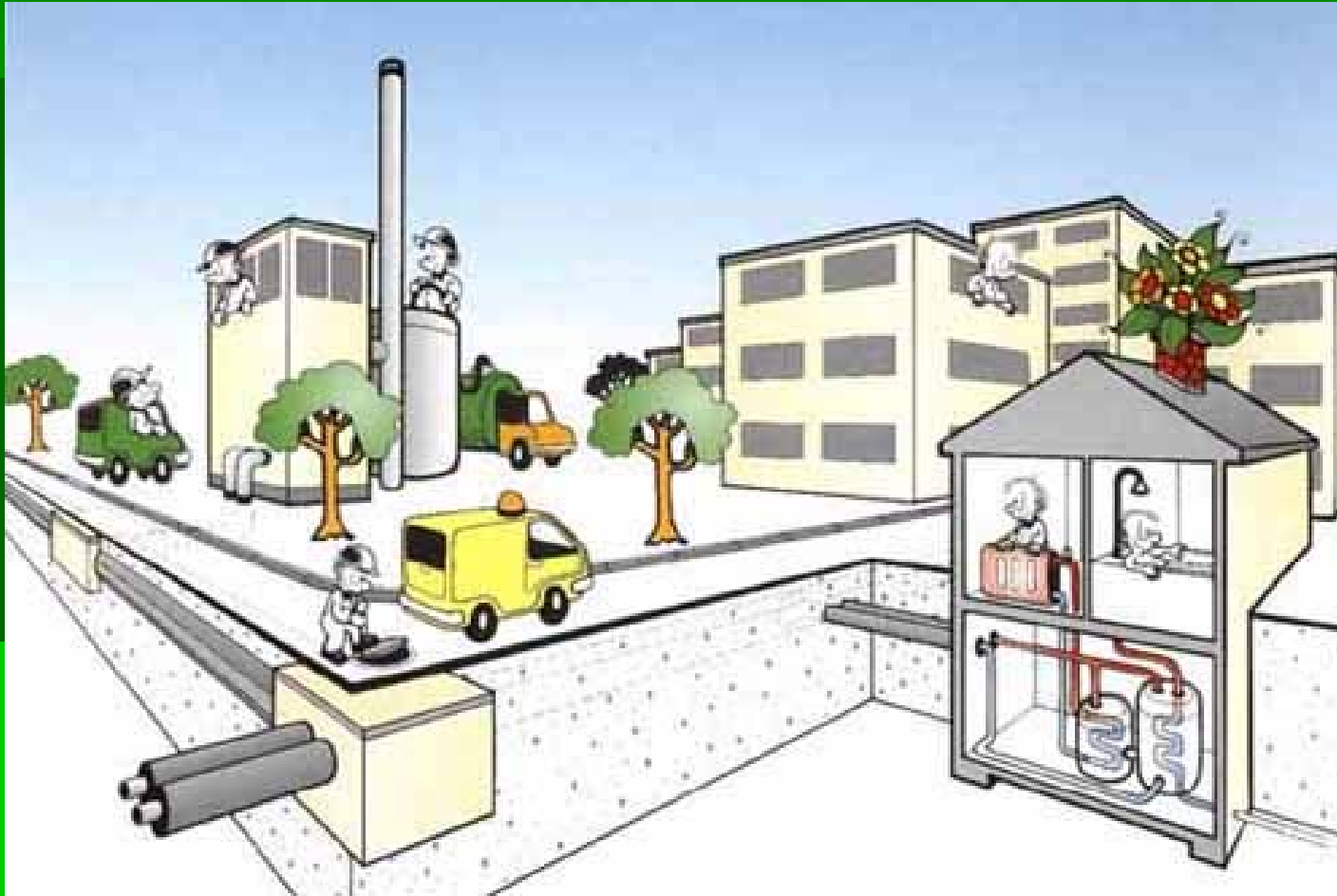
A fluidised bed at Kil



TPS is demonstrating modern combustion technology for refuse derived fuels. Sewage sludge, slaughterhouse waste or sorted industrial waste can be combusted in a 9 MW fluidised bed that will be built in Kil, Sweden.

Methods for ash handling and flue gas cleaning will be demonstrated for heat production plants in the power range 5 to 30 MW.

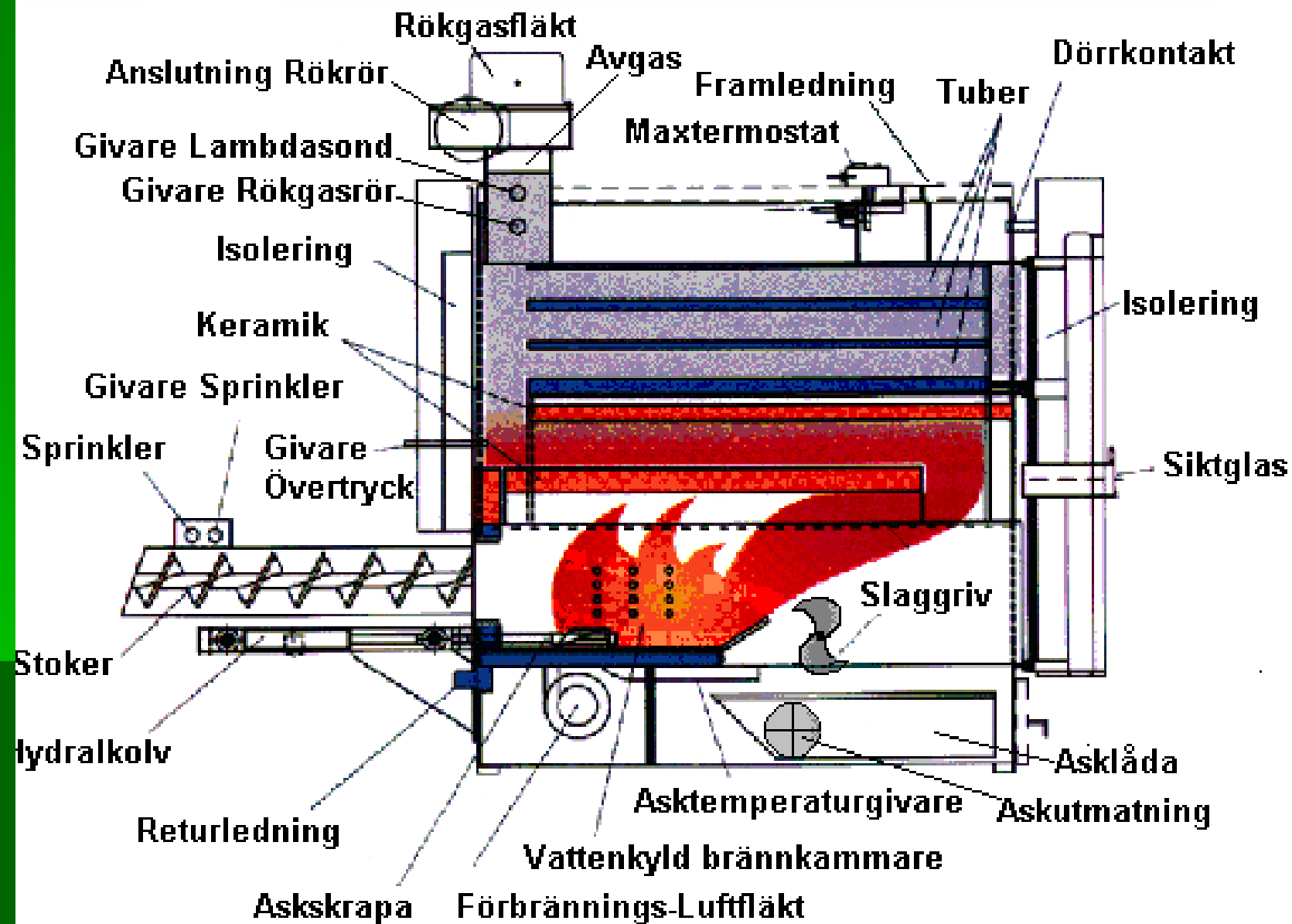
DISTRICT HEATING



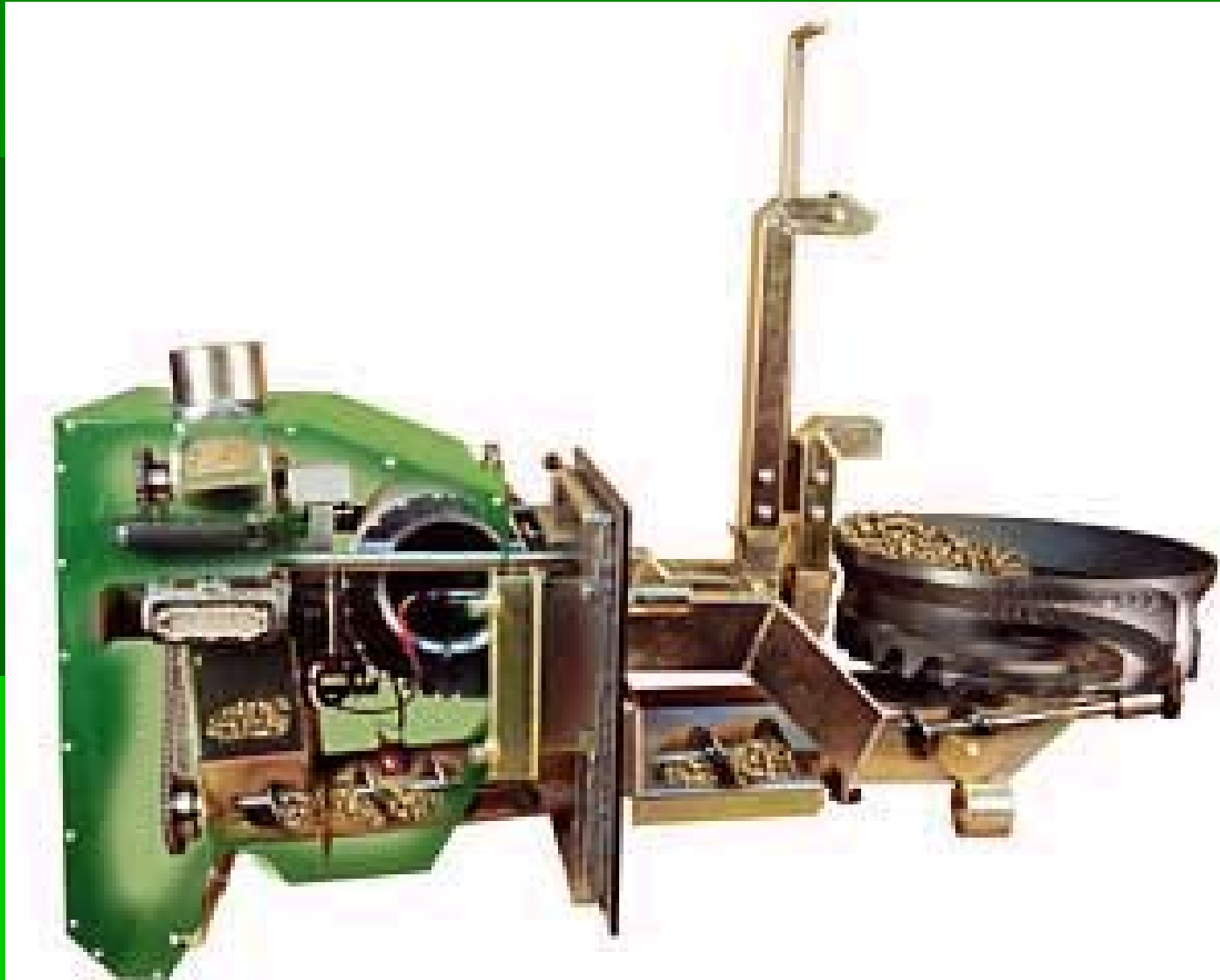
Source: Finnish District Heating Association / <http://www.energia.fi>

Medium scale pellet boilers





Small scale pellet burner



Small scale pellet burner

Fuels:

- Wood pellets
- Straw pellets
- Cereal grains

