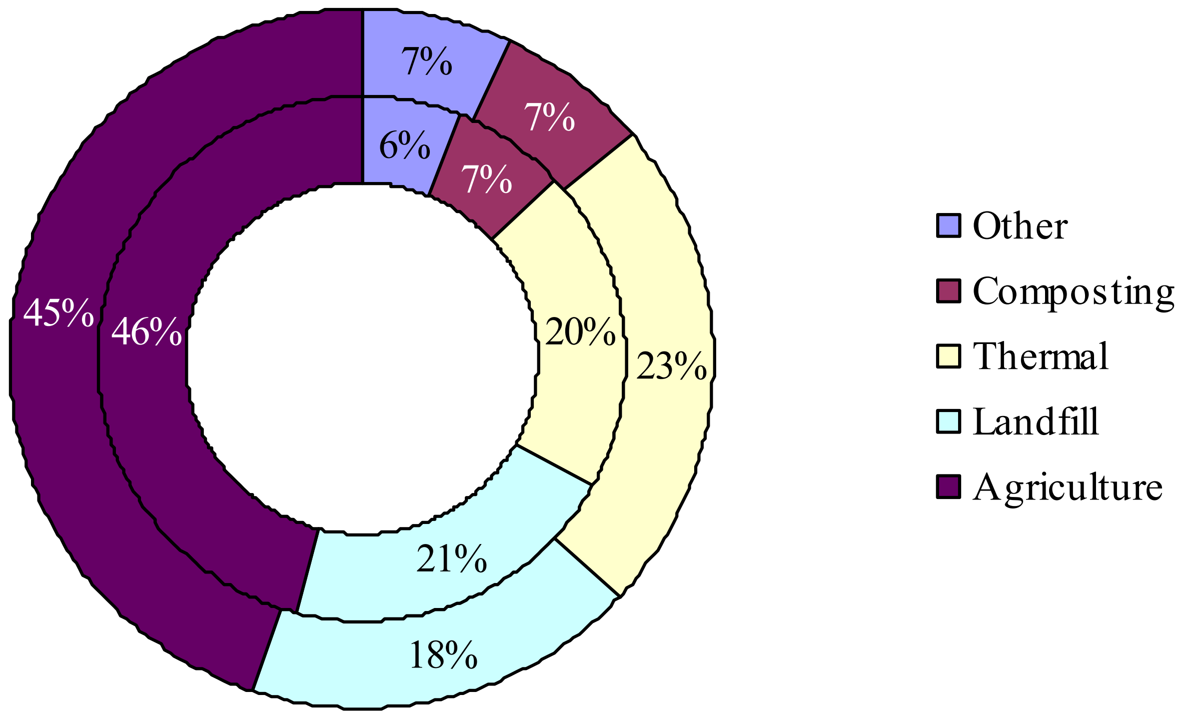
European Workshop

Thermal Treatment of Sewage Sludge for CHP Applications

Brussels, 15. – 16. September 2003

Environment and Process Technologies / S. Solmaz

Percentage of Sludge Volumes by Disposal Channels in EC, 2002 and 2009

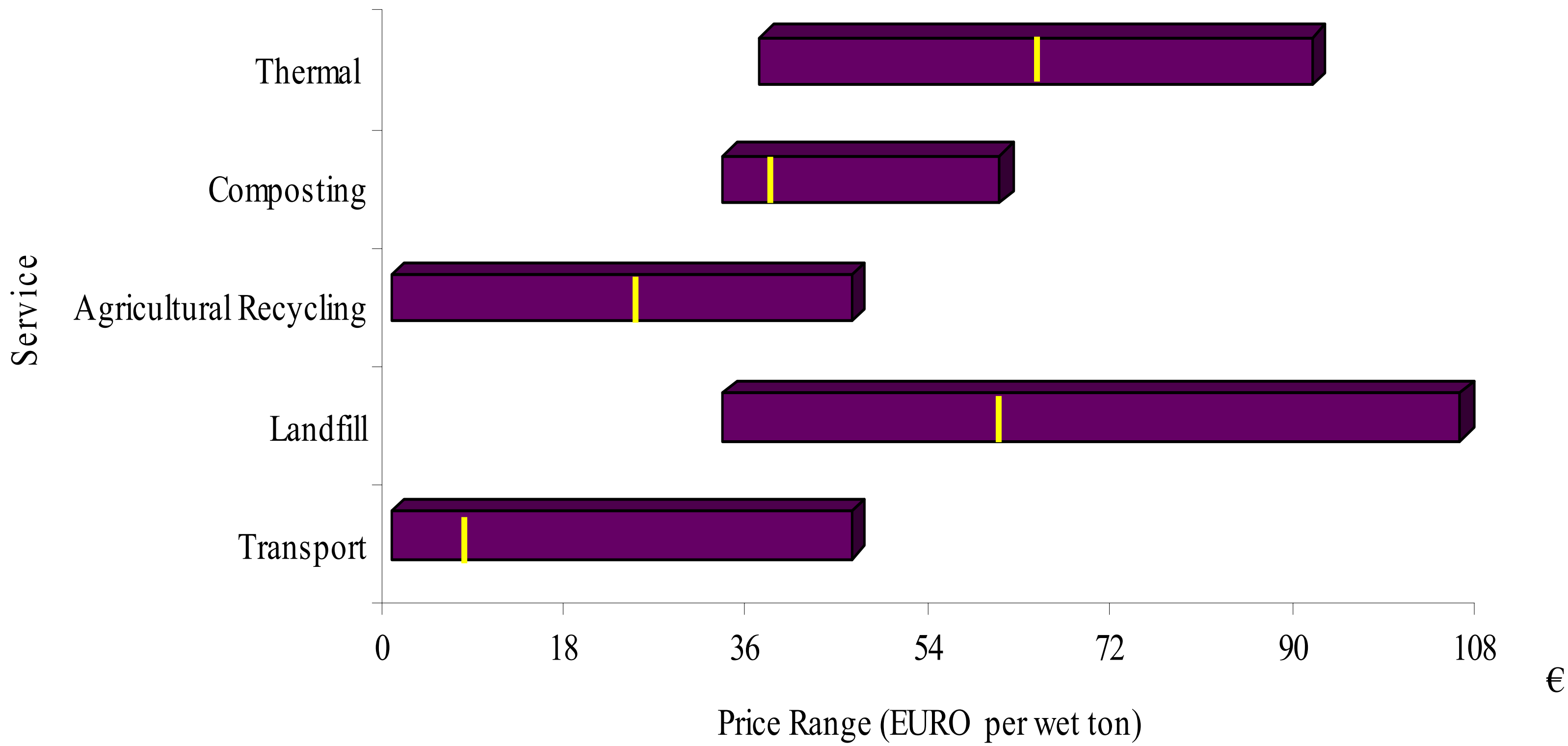


Key:

Inner Circle = Year 2002

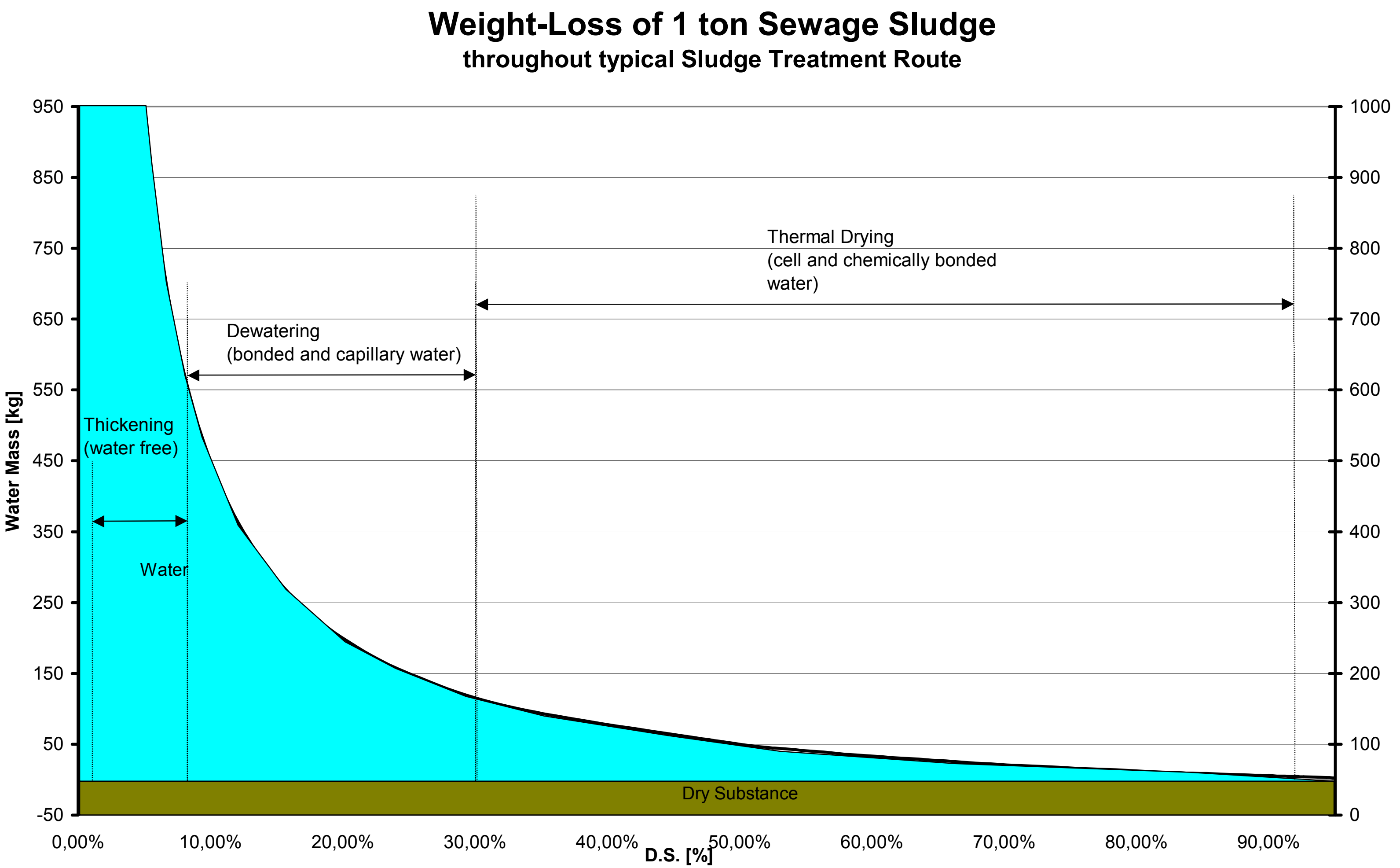
Outer Circle = Year 2009

Price Trends by Services in EC, 2002



| = Average Price

Water Content



Bio Solids Use and Disposal

Waste to energy by incineration of sludge cake at 20 – 40 DS with power production	**Waste to energy by incineration of dried sludge at 90 % DS**	**The agricultural use of the dried sewage sludge as fertilizer and for the soil improvement**
Incineration and energy recovery of sewage sludge at an average DS content of 25% results in a power production of 250 – 300 kW/TDS. The incineration plant itself has a typical parasitic power load of 250 – 300 kW/TDS. The final product from the plant is an ash that can be used as a raw material for manufacture of civil engineering products.	Energy recovery from a plant processing dried sewage sludge at 95% DS results in a power production of 700 – 1000 kW/TDS. The plant itself has a typical parasitic power load of 300 – 330 kW/TDS. The final product from the plant is an ash that can be used as a raw material for manufacture of civil engineering products.	Total Dry Substance on oats / container Fertilizing without sewage sludge 17.6 with sewage sludge 1000 kg N / ha 37.6 with sewage sludge 2000 kg N / ha 45.9 with sewage sludge 4000 kg N / ha 49.6 with sewage sludge 8000 kg N / ha 48.9 with artificial fertilizer 1000 kg N / ha 42.9

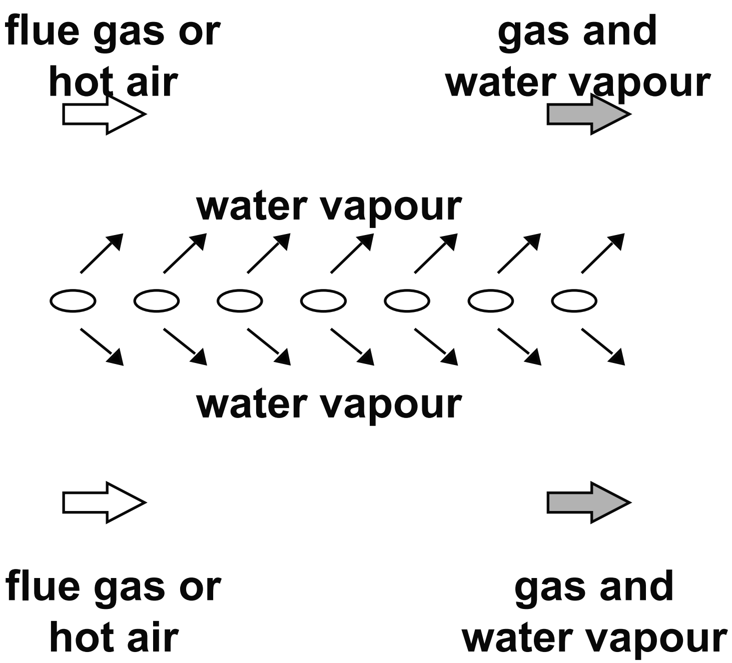
- Sewage sludge has a positive effect on plants and enables high yield
- Even overdosed the fertilizing effects remain due to high buffer capacity of sludge
- The organic compound of the sludge increase the humus content of the soil.

Conclusion:
Sewage sludge is a high efficiency Nitrogen fertilizer with additional ability to improve the soil due to the organic matters contained in the sludge. It also serves as a fuel resource for energy production. In both cases drying is the most beneficial way for its preparation.

Thermal Drying of Sewage Sludge

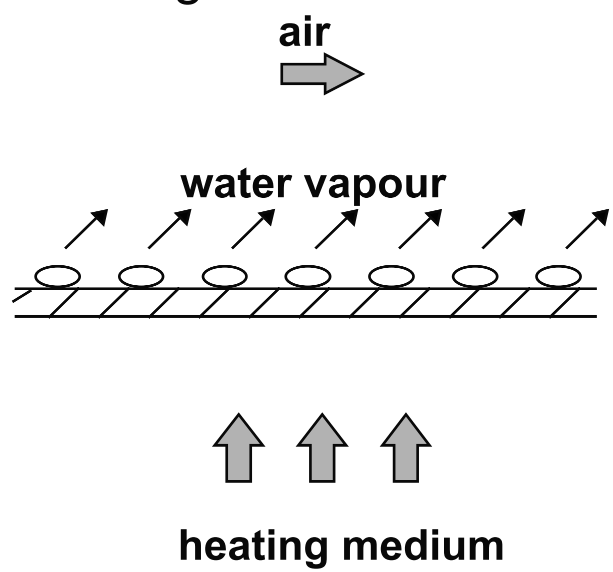
Convective Drying

The sludge is directly dried by the flue gas or hot air and the humidity is discharged.

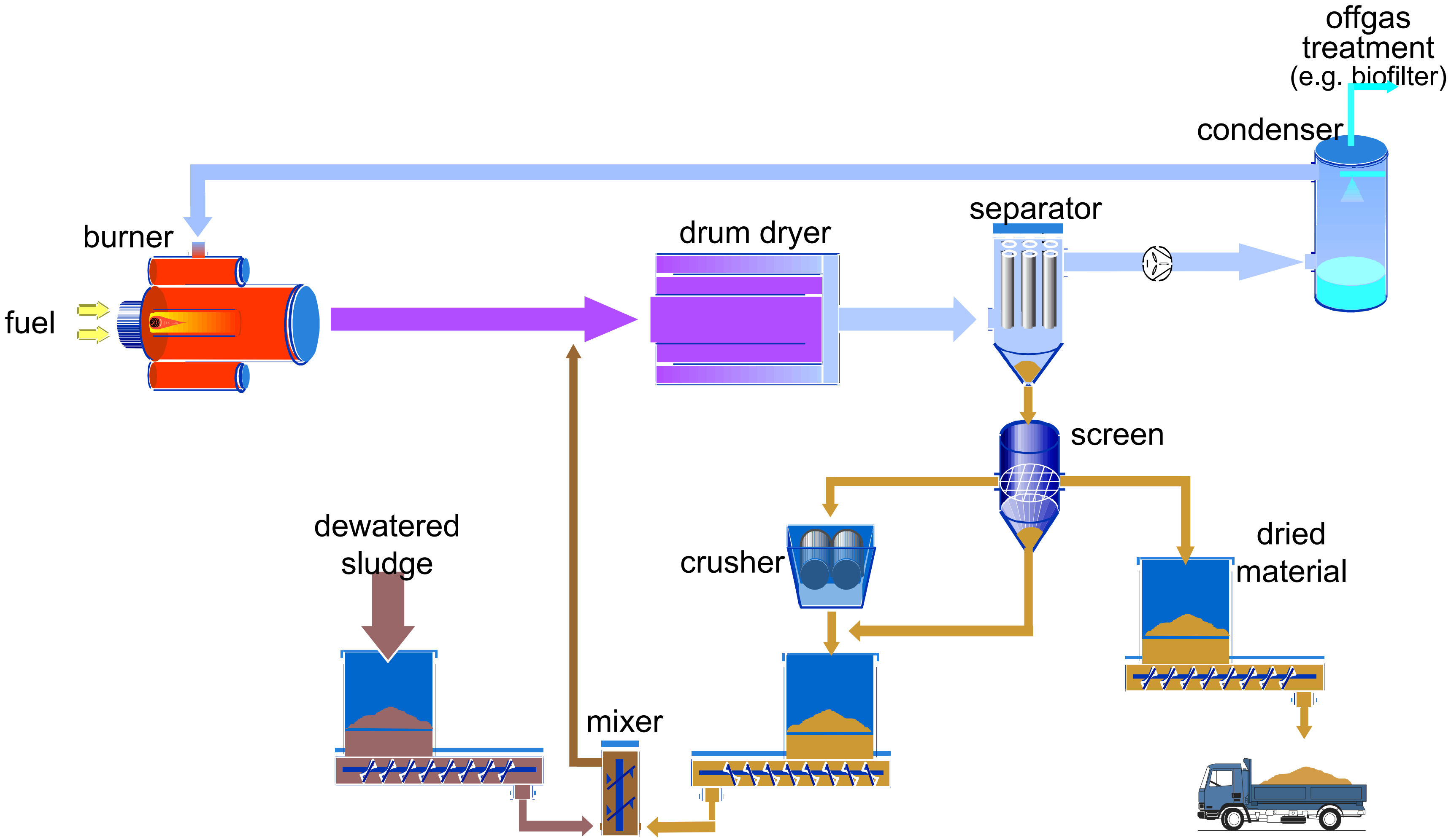


Contact Drying

Heat is transported via a lateral surface to the sludge. The humidity evaporates and is discharged.



Drum Drying System - Direct heated system



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Daldowie (Glasgow)

- **Plant Type:** 12 Centrifuges D7LL, 6 Drum Drying Lines DDS 40
- **Input:** Industrial and municipal sludge
- **Dewatering:** from 2 to 28 % TS
- **Drying:** from 28 to 92 % TS
- **Final Product:** 1 – 6 mm granulate
- **Evaporation rate:** 22.000 l H_2O / h
- **Start up:** 2002

Louisville and Jefferson country (USA)

- Equipment Type: 4 x DDS 90
- Inlet: Biosolids, at 22% TS
- Product: 92 % TS; 1 – 4 mm Granulate
- Evaporation: 36.000 kg H_2O / hr
- Start up: 2002

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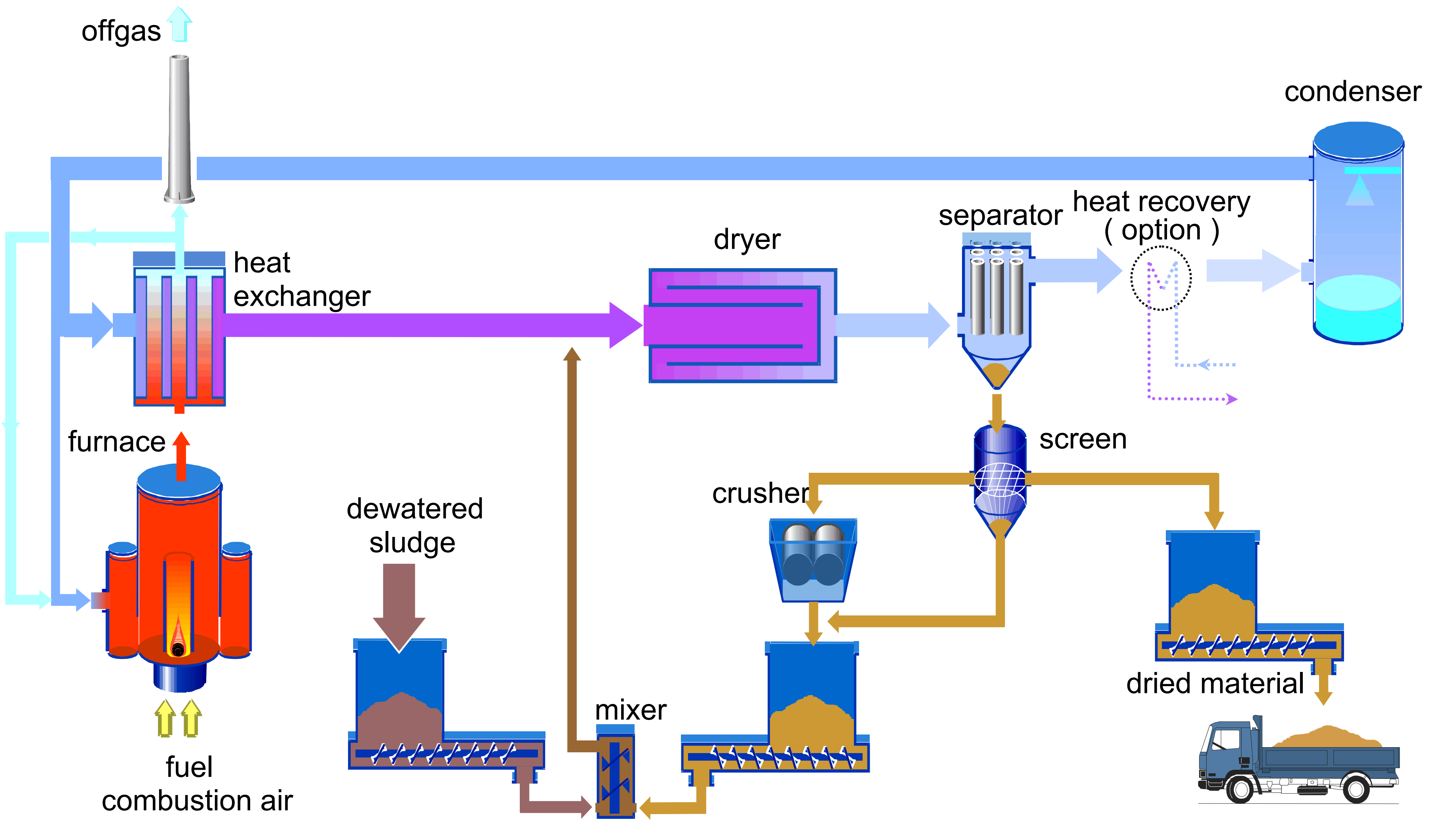
Drum Drying System – Indirect heated system



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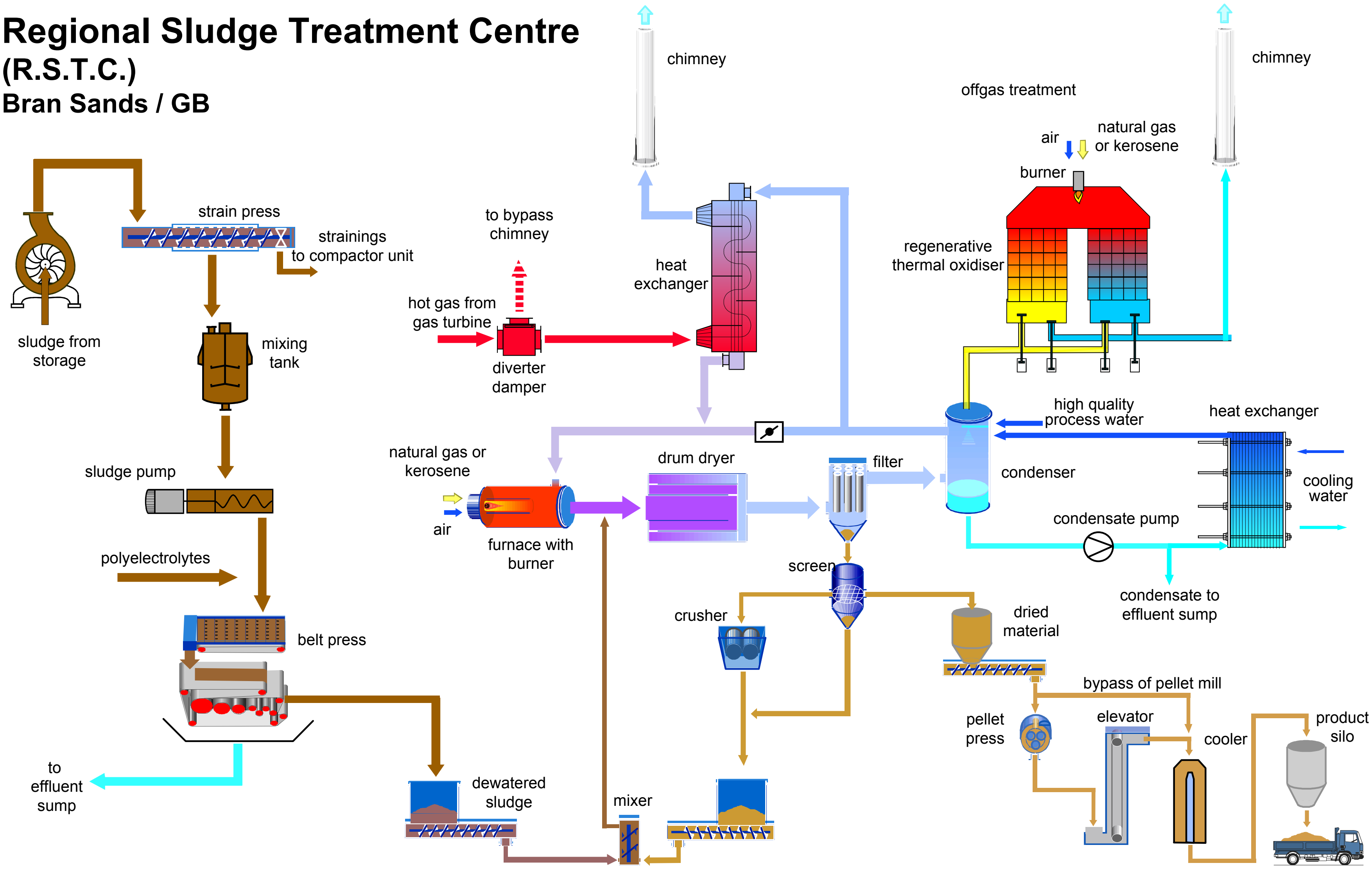
DDS – Bran Sands
Simplified Process Flow Diagram

Regional Sludge Treatment Centre
(R.S.T.C.)
Bran Sands / GB



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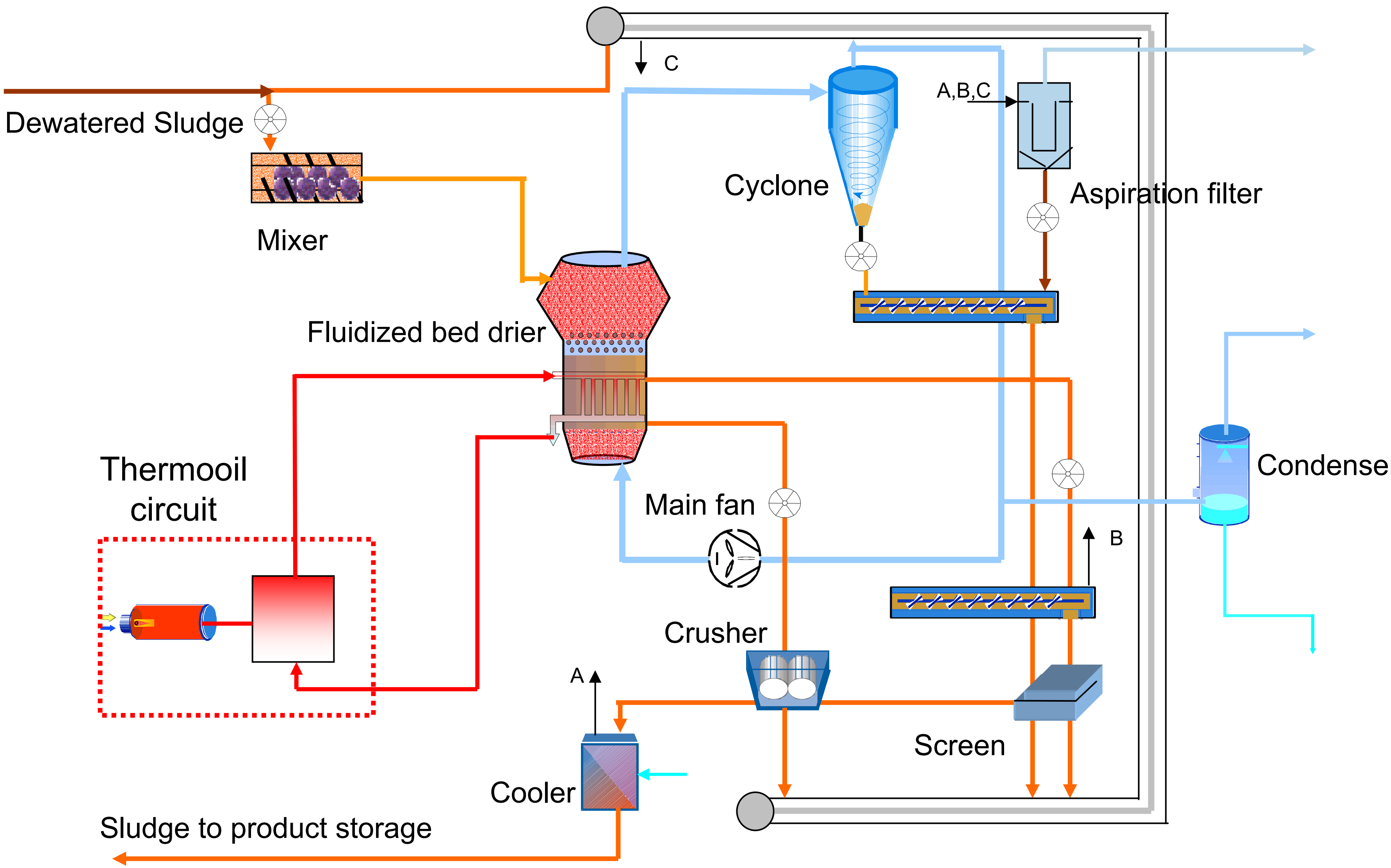
Bran Sands

The peripheral equipment comprises:

- 3 parallel gas turbines (fired by natural gas, 5 MW each), supplying hot exhaust air (approx. 430 °C) as heating energy to the dryers and, more importantly, producing electric current supplied to the national grid.

- a complete sewage treatment plant for the filtrates produced in the sludge dewatering stage, for treatment up to receiving water grade.

Fluidised Bed Sludge Drying Plant



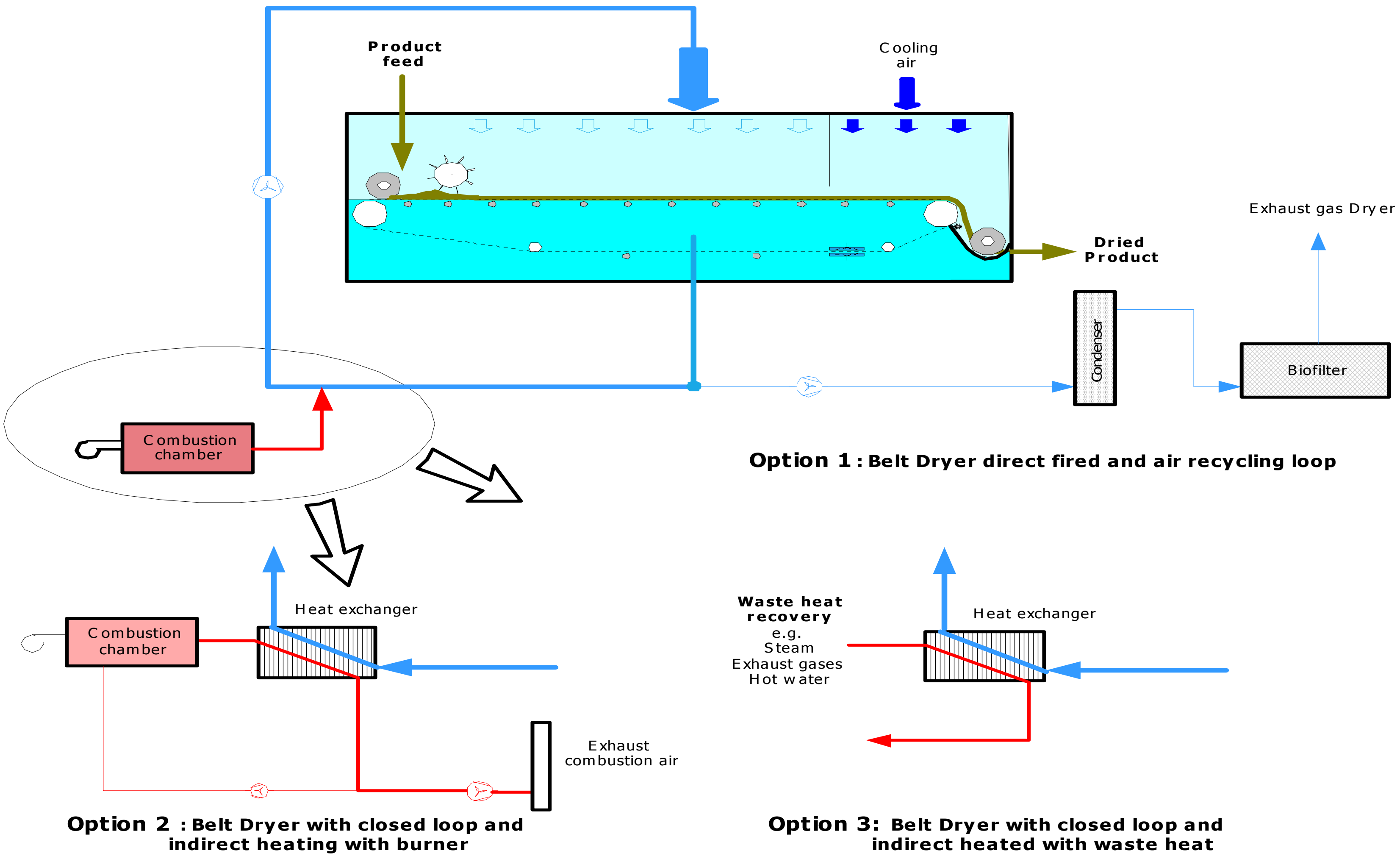
Palm 1

- **Plant Type:** **CDS 60**
  fluidized bed dryer
- **Feed:** **bio and DAF sludge,**
  Dewatered to 35 % DS
- **Product:** **95 % DS;**
  1 – 4 mm Granulate
- **Evaporation:** **6.000 l/h H_2O - design**
- **Start up:** **1999**

Palm 2

- **Plant Type:** CDS 20
  fluidized bed dryer
- **Feed:** bio sludge,
  Dewatered to 16 % DS
- **Product:** 95 % DS;
  1 – 4 mm Granulate
- **Evaporation:** 2.000 l/h H_2O - design
- **Start up:** 2002

Belt Drying System



Altenrhein (Germany)

- **Equipment Type: Belt dryer (BDS)**
- **Inlet: Biosolids, Inlet Consistency at 28-30 % TS**
- **Product: 92 % TS; Granulate**
- **Evaporation: 400 kg/hr H_2O**
- **Start up: 2002**

Comparison of the different dryer types

	DDS	CDS	BDS
Granulate	Dimensionally stable, round granules of 2 to 4 mm; Virtually dust free	Dimensionally stable, round granules of 2 to 4 mm Virtually dust free	Dimensionally stable, round granules of 1 to 8 mm
Energy sources for drying	Natural gas Bio-Gas Exhaust gases from gas turbine Exhaust gases from gas engine Wood-gasification process gas Thermal Oil	Steam @ 10 bar saturated Thermal oil Exhaust gases from coal fired power plants	Natural gas Bio-Gas Steam @ 4 bar saturated Thermal Oil Hot water Exhaust gases from processes at low temperature (~ 140°C)

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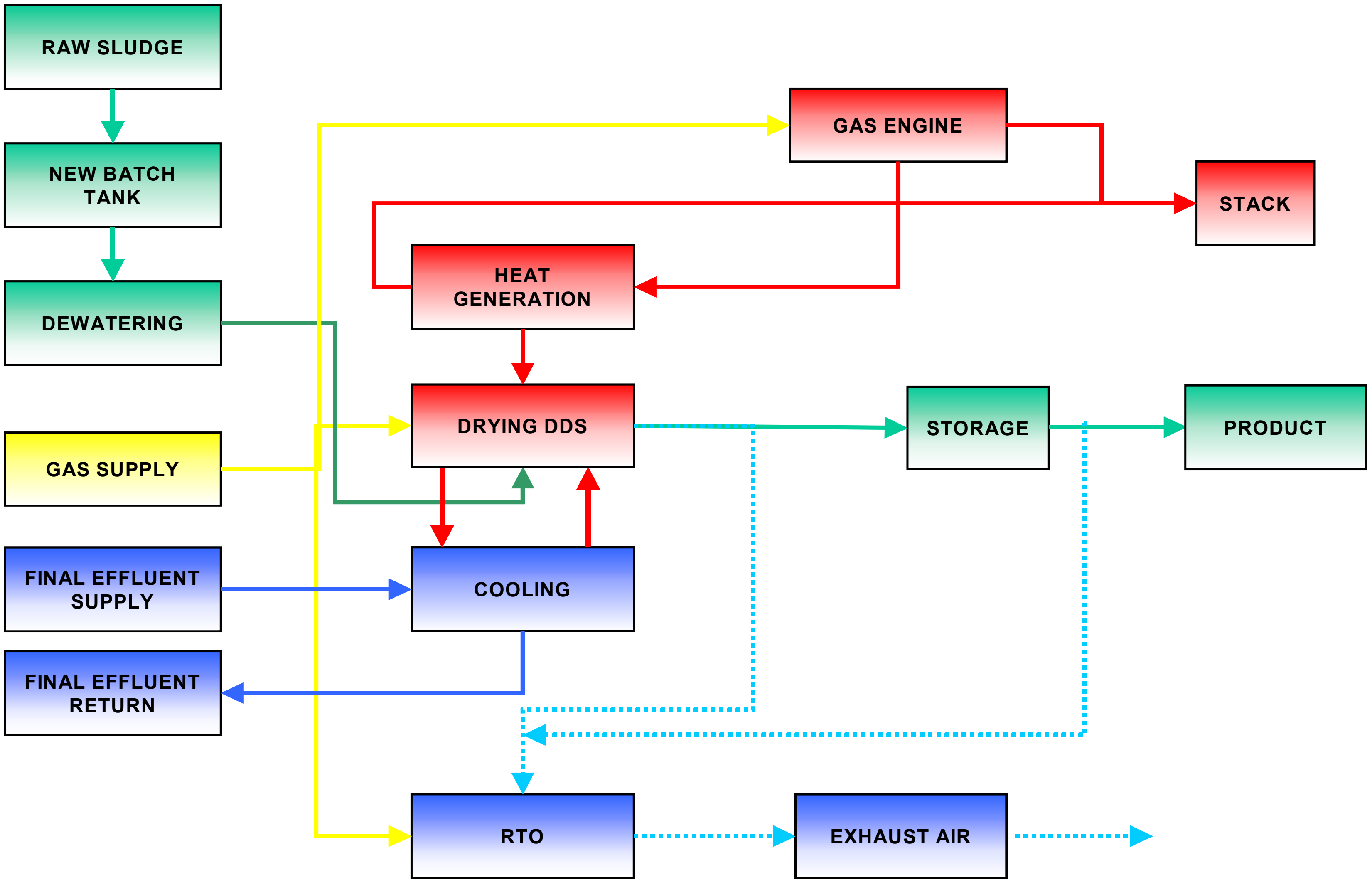
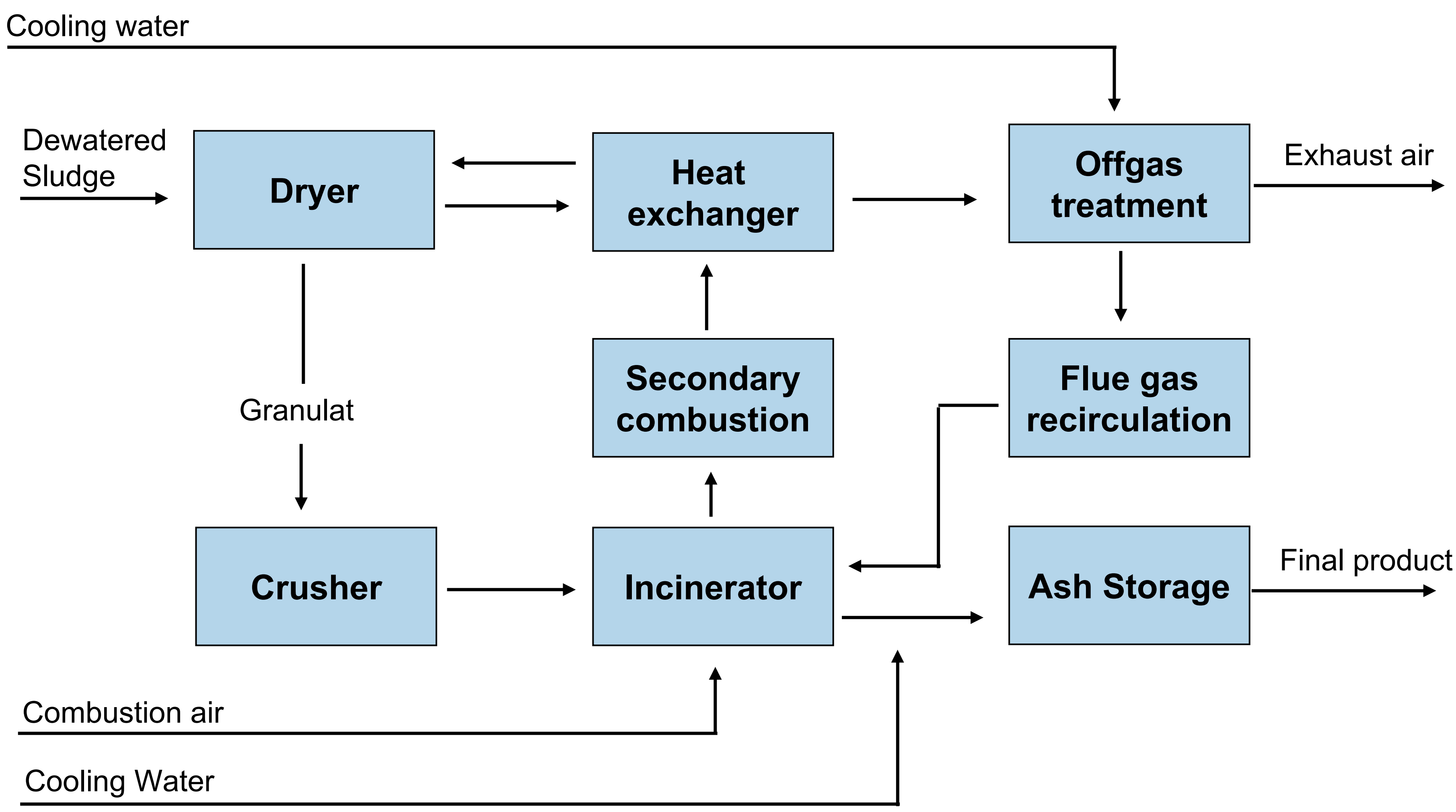
Combination of dryers with CHP processes
Block Flow Diagram



Eco-Dry Principle Block Diagram



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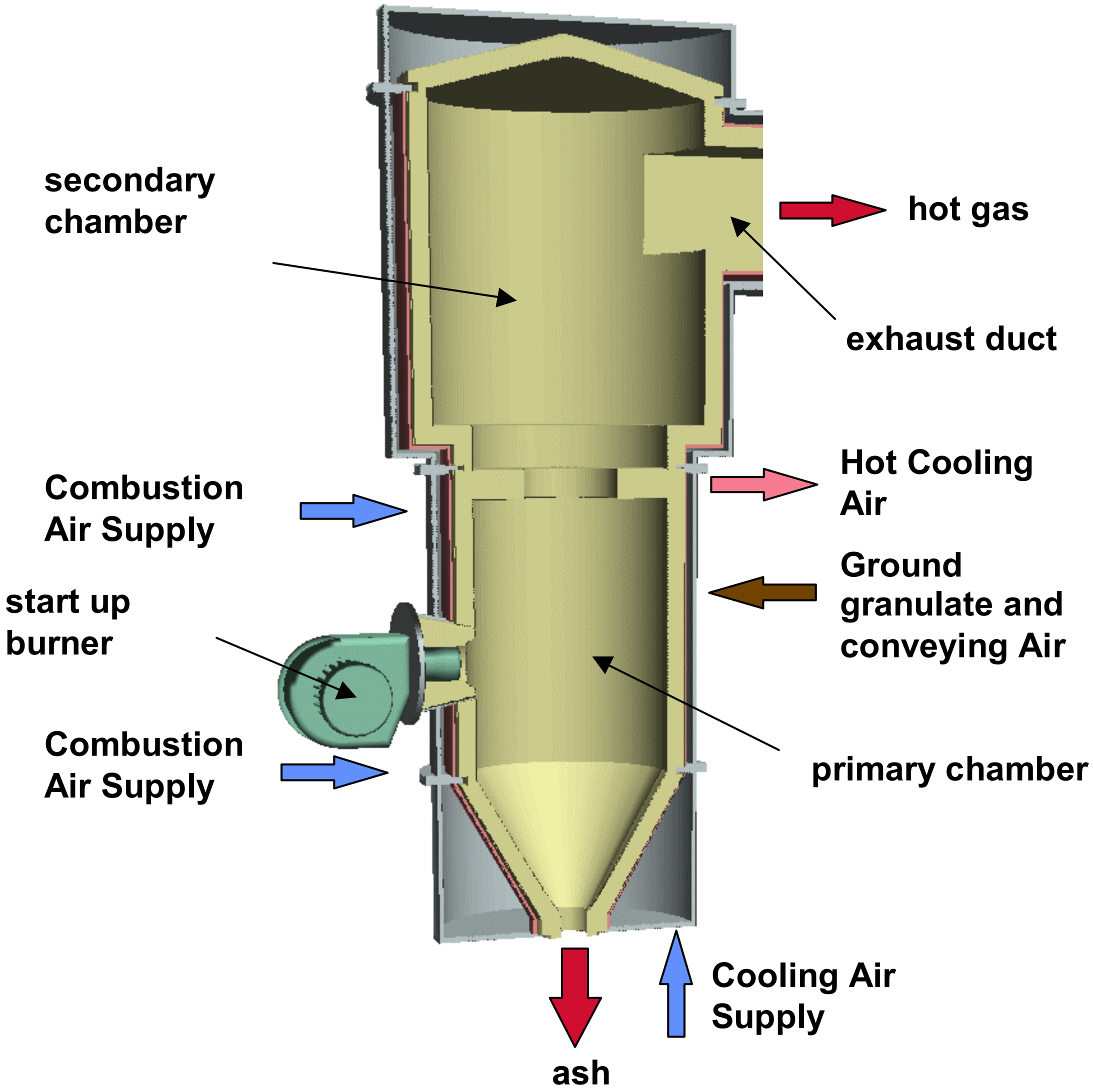
Cyclone furnace



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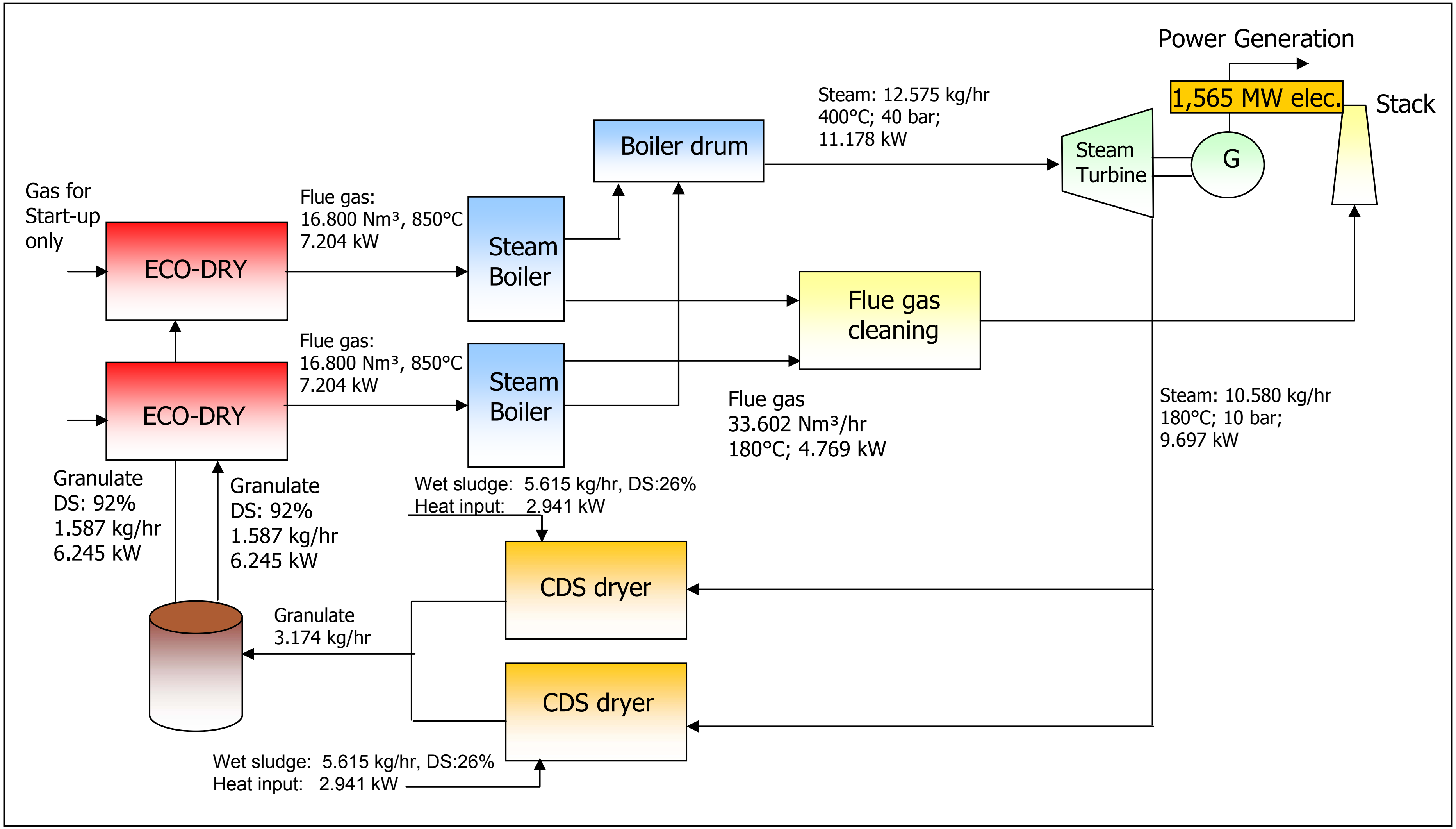
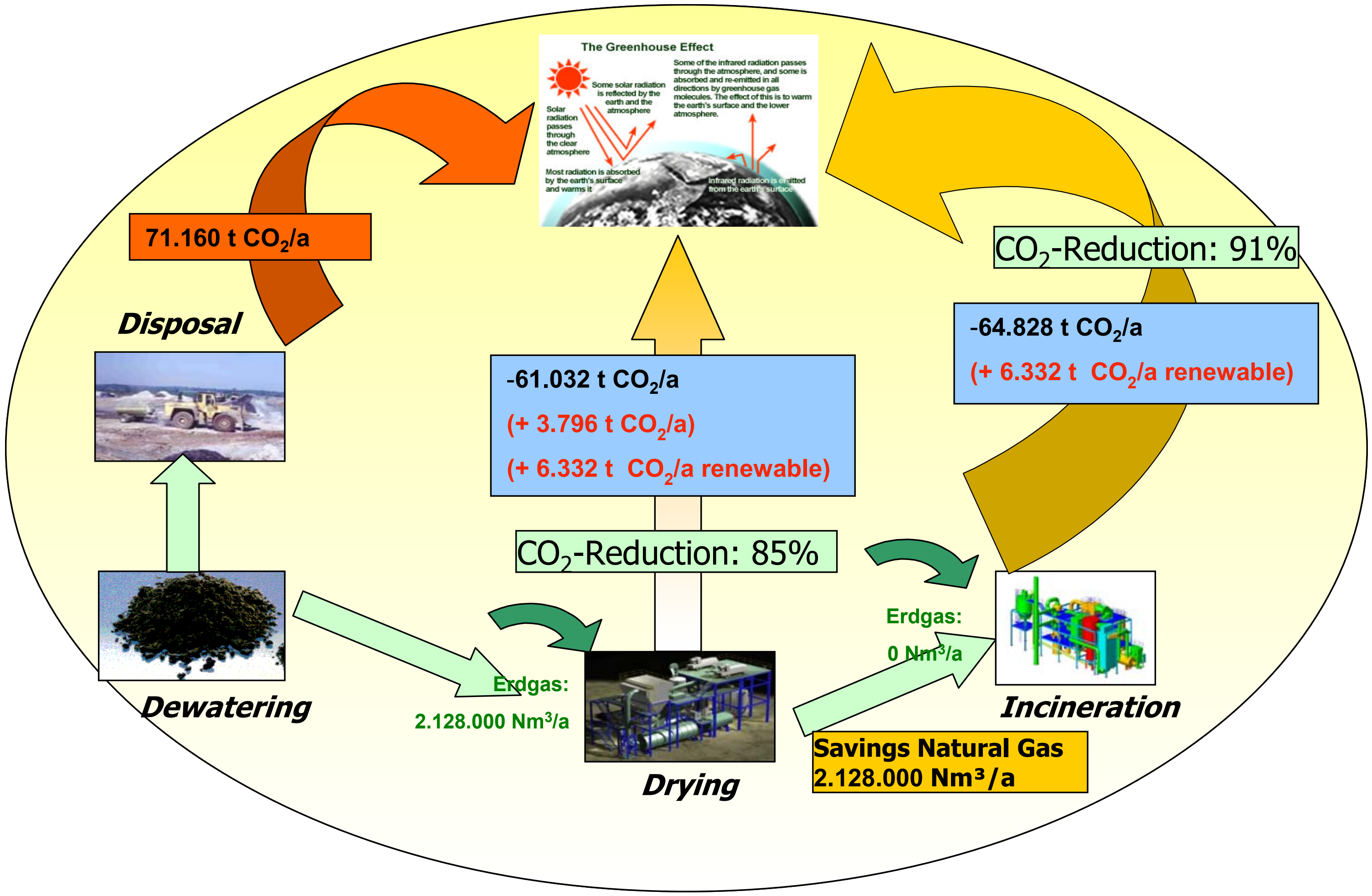
Drying and Incineration with combined Heat and Power



CO_2 Balance



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