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“Waste to Clean Energy” - a private Sector Business?

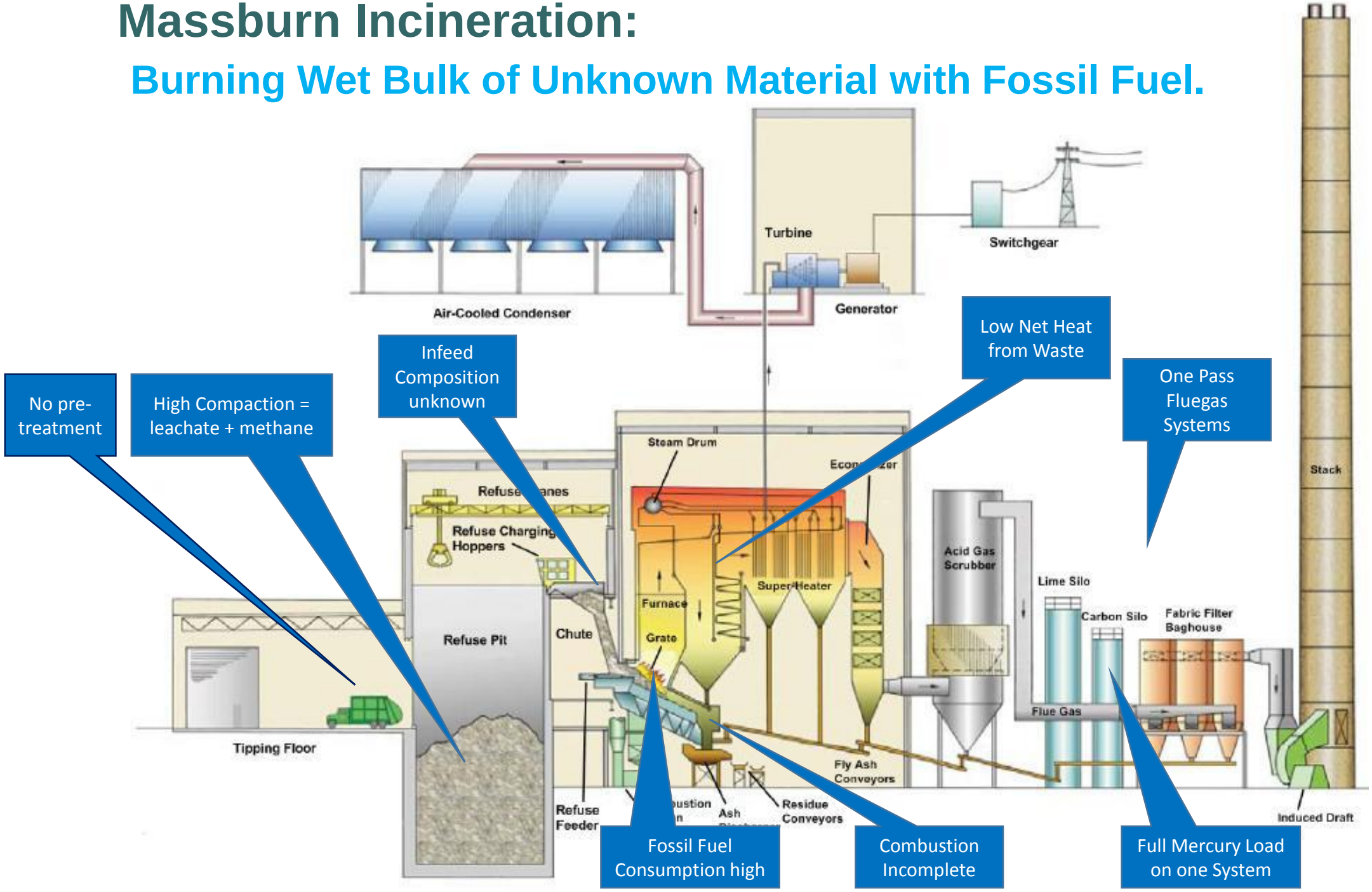
How Energy from Waste can be Profitable and Clean.

Refuse Derived Fuel (RDF):

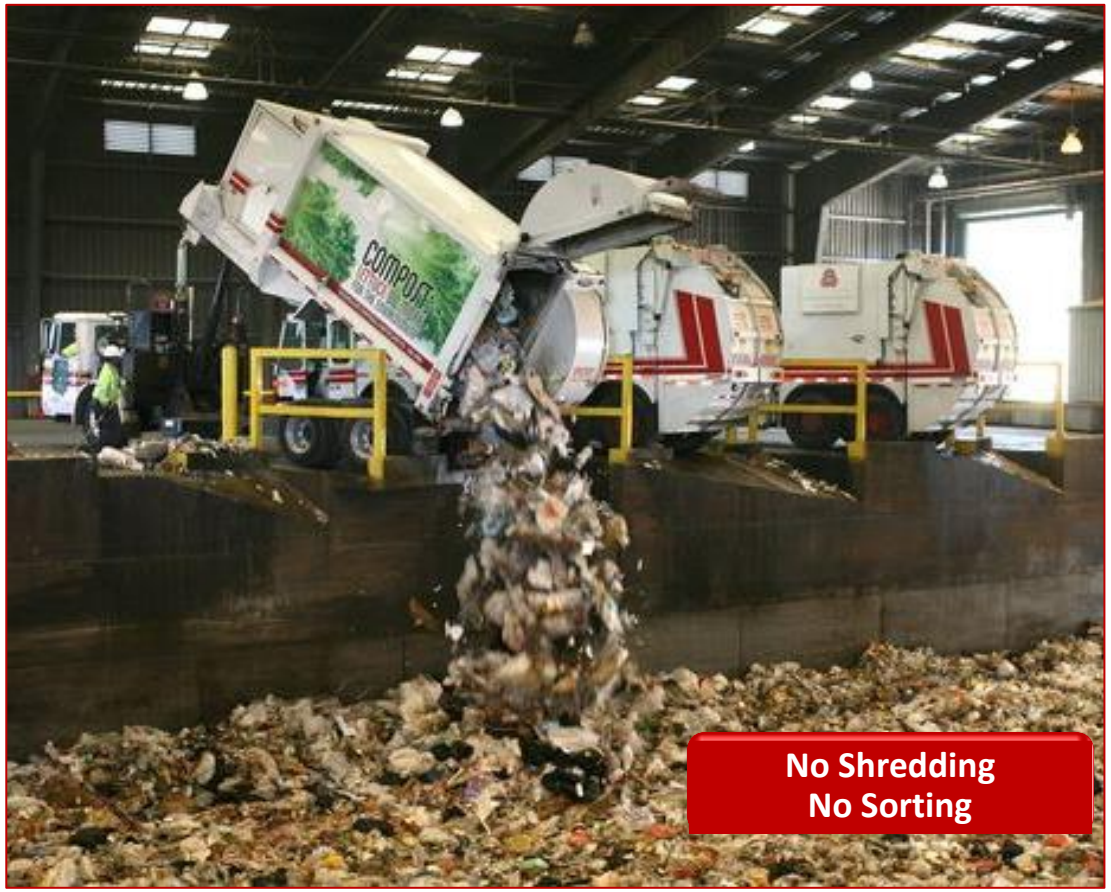
Profitable Cherry Picking – leaving the Problems behind.

Massburn Incineration:

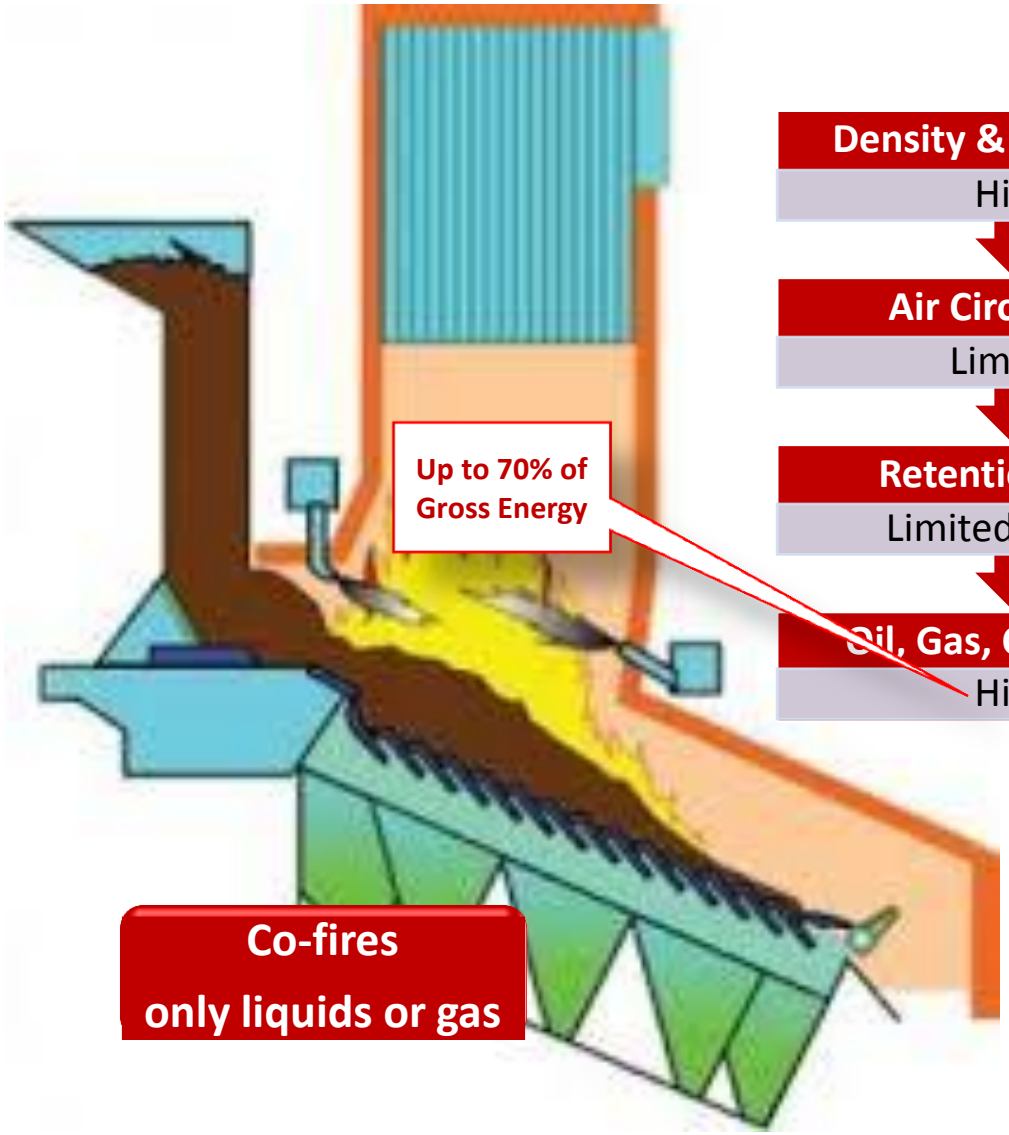
Burning Wet Bulk of Unknown Material with Fossil Fuel.



Once in the Pit – all Treatment Options gone.



One Pass Incomplete Combustion with Fossil Fuel.



Density & Variability
High

Air Circulation
Limited

Retention Time
Limited, 1 pass

Oil, Gas, Coal Input
High

Incinerator Wastewater Causes High Cost.

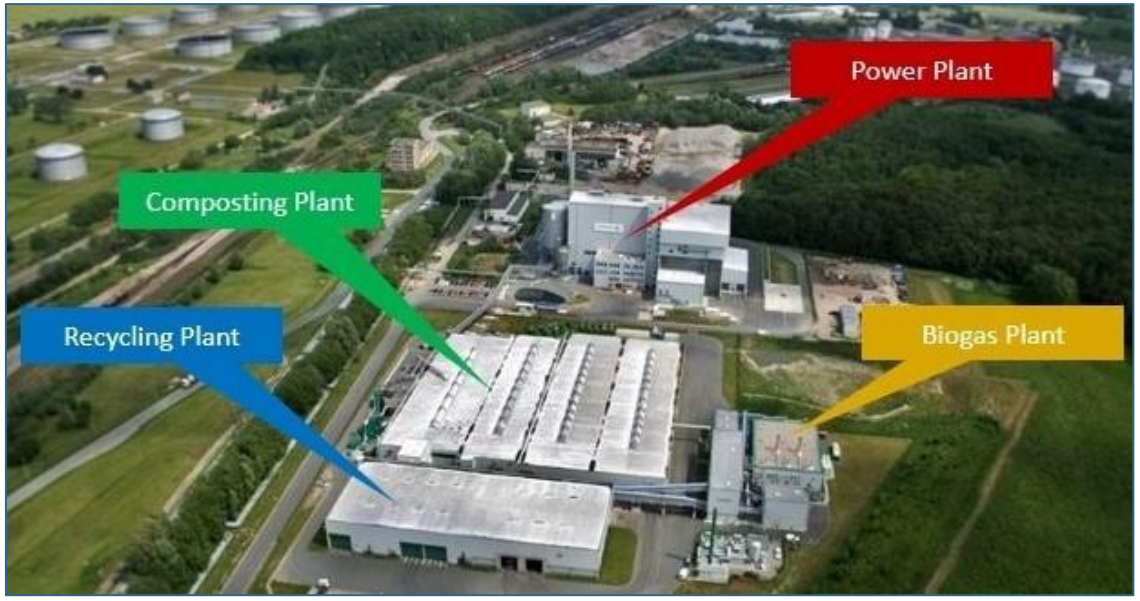
COD / BOD up to 300,000, Sulfur (Odor)

Heavy Metals, Polycyclic Aromatic Hydrocarbons, Bisphenol A

Two Ways to Clean Energy from Waste.

RDF Power Plant + MBT + Biogas
WtE Plant Rostock, Northern Germany
Residual MSW 600 tpd

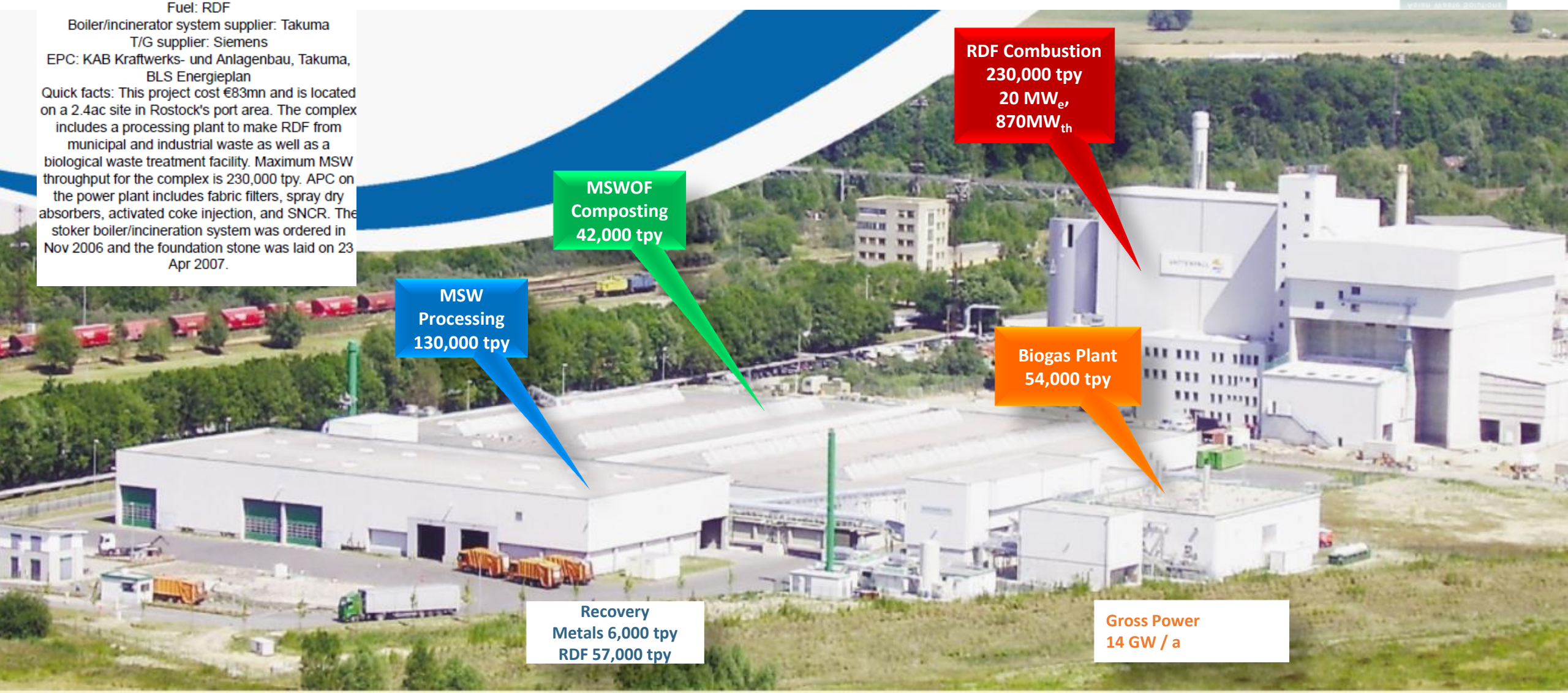
CFB Massburn + Pre-Treatment
WtE Plant Quiaosi, Hangzhou, China
Fresh MSW 800 tpd



Waste to Clean Energy – Rostock, Germany.

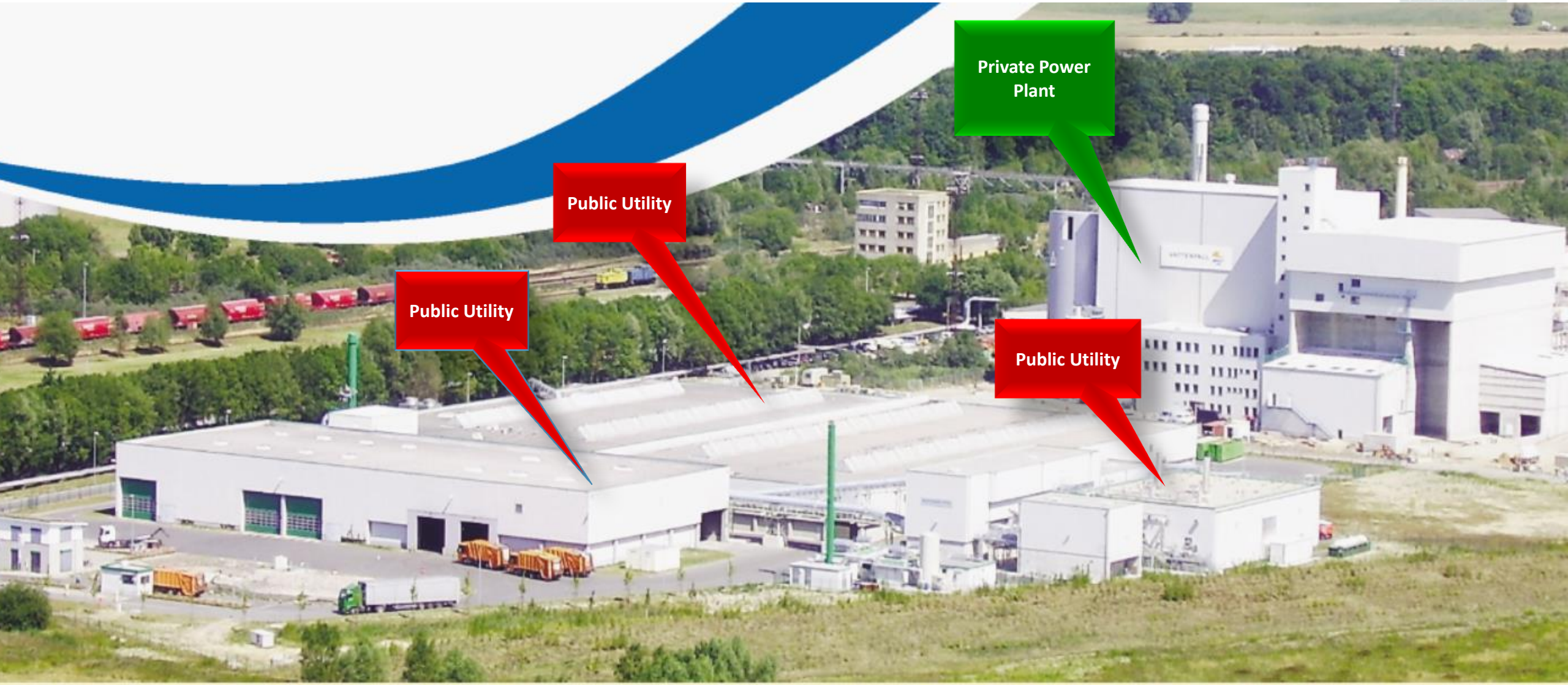
Integrated Plant Burning RDF, Managing Organics.

EBS-HKW Rostock
Location: MV
Operator: Vattenfall Europe New Energy GmbH
Configuration: 1 X 20 MW CHP
Operation: 2010
Fuel: RDF
Boiler/incinerator system supplier: Takuma
T/G supplier: Siemens
EPC: KAB Kraftwerks- und Anlagenbau, Takuma, BLS Energieplan
Quick facts: This project cost €83mn and is located on a 2.4ac site in Rostock's port area. The complex includes a processing plant to make RDF from municipal and industrial waste as well as a biological waste treatment facility. Maximum MSW throughput for the complex is 230,000 tpy. APC on the power plant includes fabric filters, spray dry absorbers, activated coke injection, and SNCR. The stoker boiler/incineration system was ordered in Nov 2006 and the foundation stone was laid on 23 Apr 2007.



Model for Private Sector?

50/50: High CAPEX, Organic residues cause high OPEX.



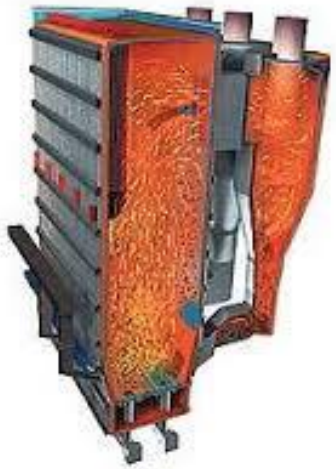
Waste to Clean Energy – Hangzhou China.

CFB Massburn, Pre-Processed, No Fossil Fuel.

MSW Processing 290,000 tpy

MSW Combustion 190,000 tpy MW_e, 870MW_{th}

Circulating Fluidized Bed Combustion



Mass ≠ Bulk

Runs without auxiliary fuel (coal)

- 2 shredders reducing material to 150mm before feed in
- refractory covered waterwalls
- high temperature air preheater before the economizer recirculating solid particles is in ratio of 10 to MSW infeed
- particle settling chamber installed before the heat recovery units

Cixi Operations Parameters and Emissions.

Rapid growth of CFB WTE technology in China

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a) State Key Laboratory of Clean Energy Utilization, Zhejiang University;
b) Earth Engineering Center, Columbia University

item	Design value	Monitored value
Boiler output	33.9t / h	41.525 t / h
Waste incinerated	800t / h	834.20 t / h
Thermal efficiency	75%	77.1%
PM emissions	<80mg/Nm^3	11.56 mg/Nm^3
SO2 emissions	<260mg/Nm^3	52.73 mg/Nm^3
NOX emissions	<400mg/Nm^3	144.32 mg/Nm^3
Dioxin concentration	<1.0 ng TEQ/Nm^3	0.09650 ng TEQ/Nm^3

Model for Private Sector?

Yes: Feedstock flexible, High Stabile Power, Emission Control.

Conclusion.

Private Sector Waste to Clean Energy Plants are feasible.

CHARACTERISTICS	KEY OBSTANCLES
CFB Powerplant with 2step pre-treatment	Concessions too short
No Fossil Fuel Net Power to Grid	Tipping fees too low
Residue Recycling / EU Standard Emissions	PPP too complex
Local employment & service for 30 years	few waste experienced law firms

Country	Thailand	Vietnam
Installed Capacity Wm_e	1 x 9.9	2 x 18
Waste received tpd	400	2000
CAPEX	40 M USD	100 MW USD
IRR	15%	19%
ROC	7	5
Project Lifetime	25 years	25 years