Bellwether
Gasification Technologies Ltd.

Gasification *Redefining Clean Energy*

Welcome at Bellwether Gasification Technologies Ltd.

Your Partner for the Development, Design and Construction of Waste Gasification plants

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European waste legislation – New EU- amendment
Framework directive 2006/12/EG

Priority of energy recovery and use of local resources prior to the purely disposal of waste.

Following goals get joined with the energetically recovery of waste:

- Substitution of fossil fuels like fuel oil, fuel gas or coke (preservation/ safeguarding of resources)
- Emission reduction on climatic effected CO_2 (climate protection)
- Decrease in the dependency of global energy markets connected with cost savings
- Increasing in the flexibility of the waste management by reduction of the residual waste

NO energy recovery according to the Frame directive 2006/12/EG: Waste incineration, MBT

Energy recovery at the time solely in co-firing or surrogate fuel power plants.

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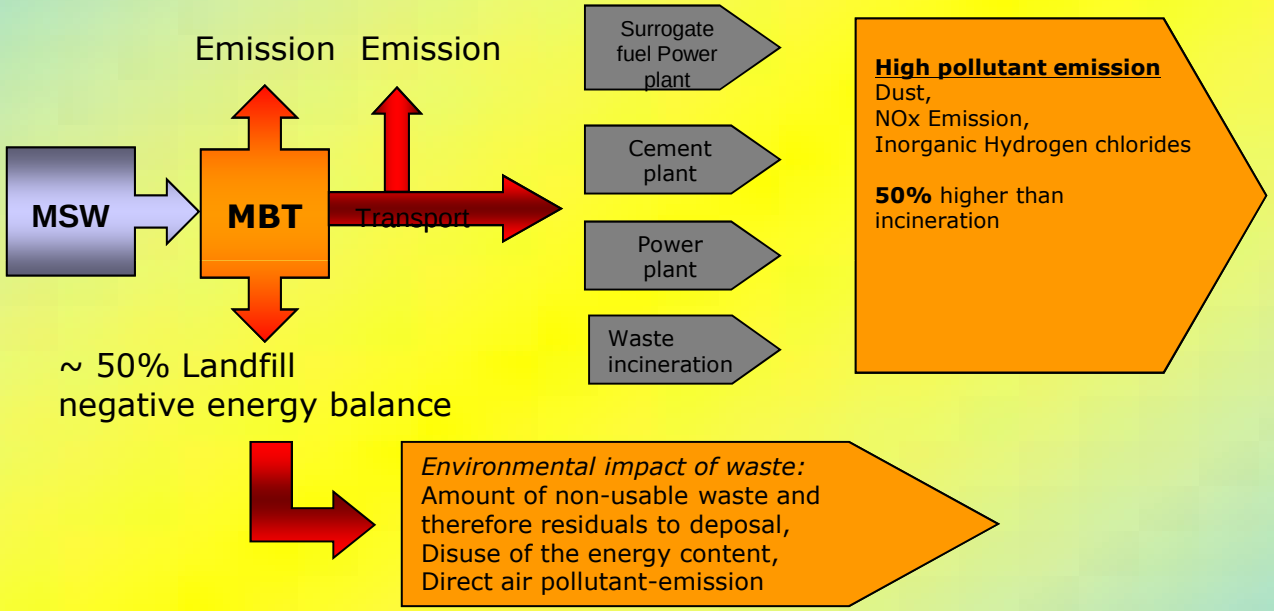
Mechanical Biological Treatment - MBT



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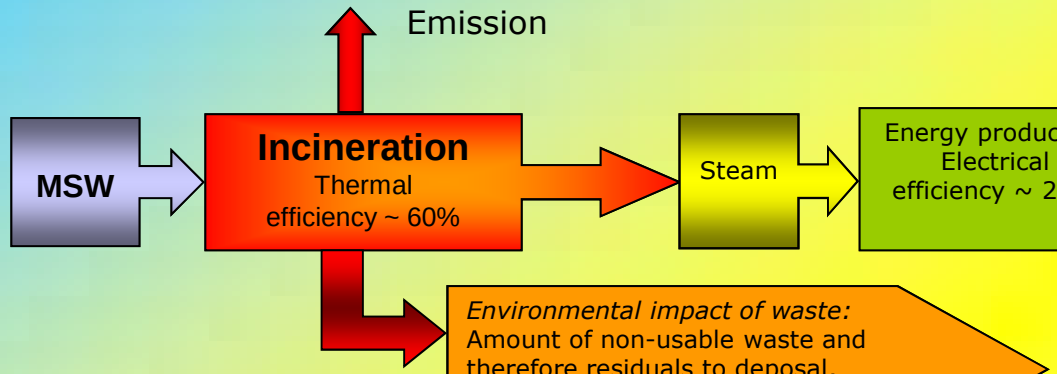
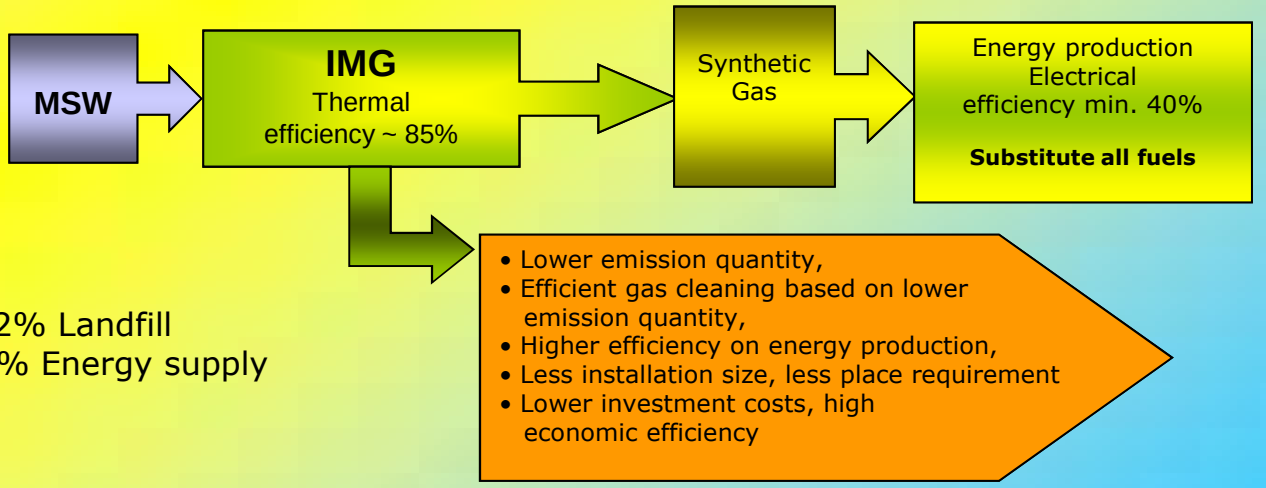
Waste treatment Incineration / IMG



~ 30% Landfill
20% Energy supply



~ 2% Landfill
40% Energy supply

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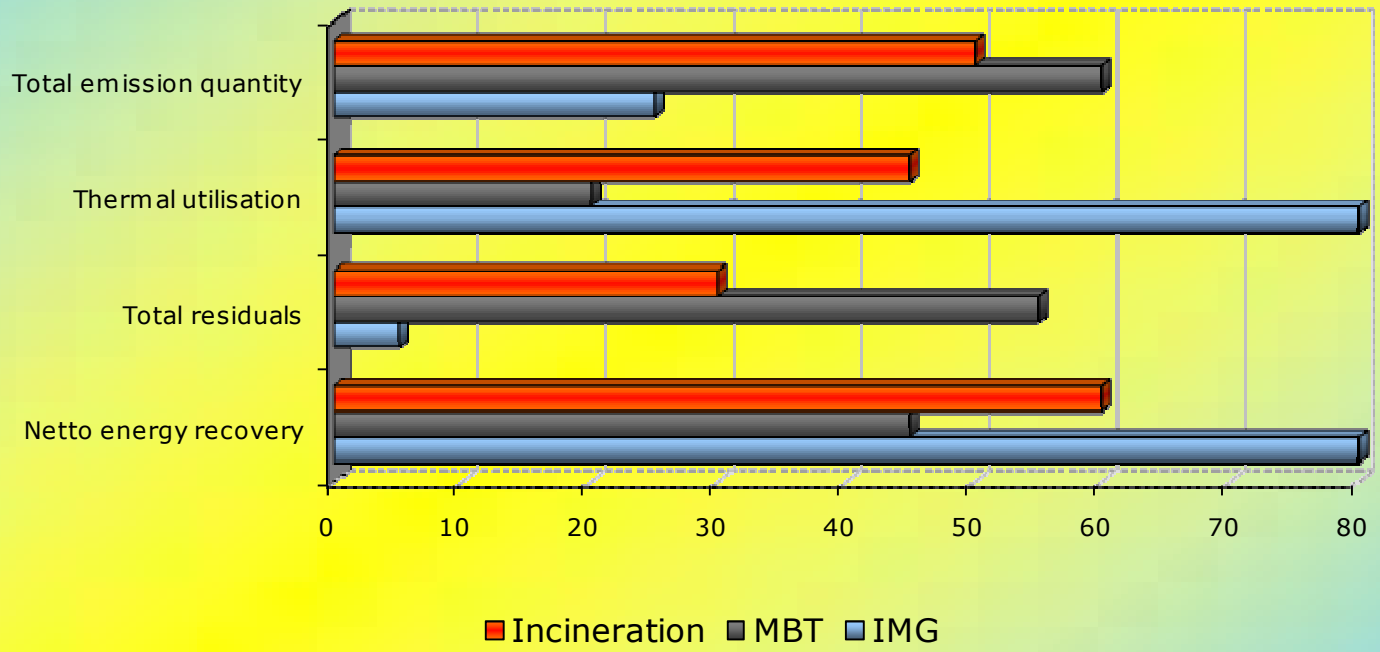
Waste treatment comparison



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Waste as energetically significant resources

As feedstock we can use all caloric resources from all input materials:

- Unsorted municipal waste,
- Industrial waste (e.g. car tires, residuals from recycling and production),
- Agricultural residuals and biomass ,
- Hazardous waste.

Potential in Europe:

300.000.000 tons waste per year in Europe are neither treated nor recycled;

To use these recourses can replace 300.000.000 tons coal and save around 9 million tons CO_2 emission per year.

This resources are not used because of:

- ❖ No capacities for co-firing of the refused derived fuels
- ❖ Incineration is limited on the input quality (Chlorine content, caloric value and energy efficiency)

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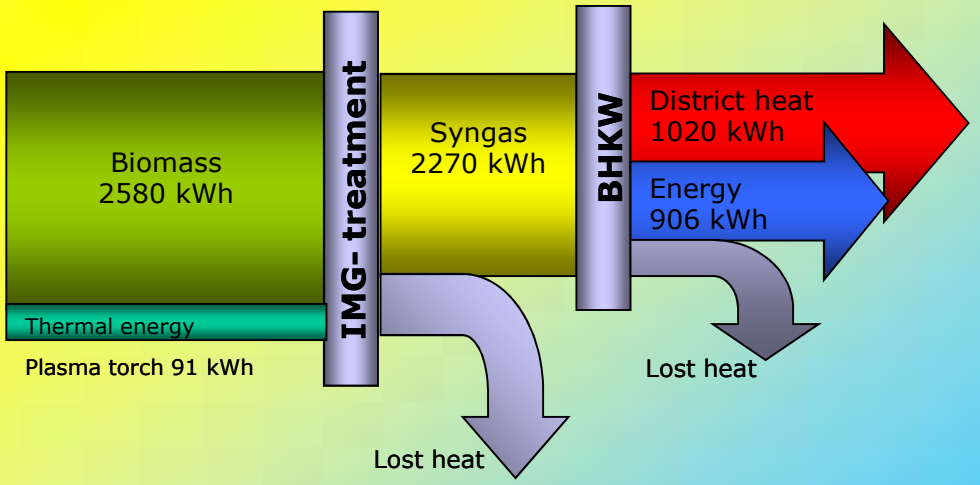
Thermal recycling via IMG and the products

Our technology recover:

- ✓ Organic components → Synthetic gas
- ✓ Inorganic components → Slag
- ✓ Water in the input → Process water
- ✓ Metals → Recycling

Biomass Gasification according to the IMG-treatment
Energy of 1Mg biomass



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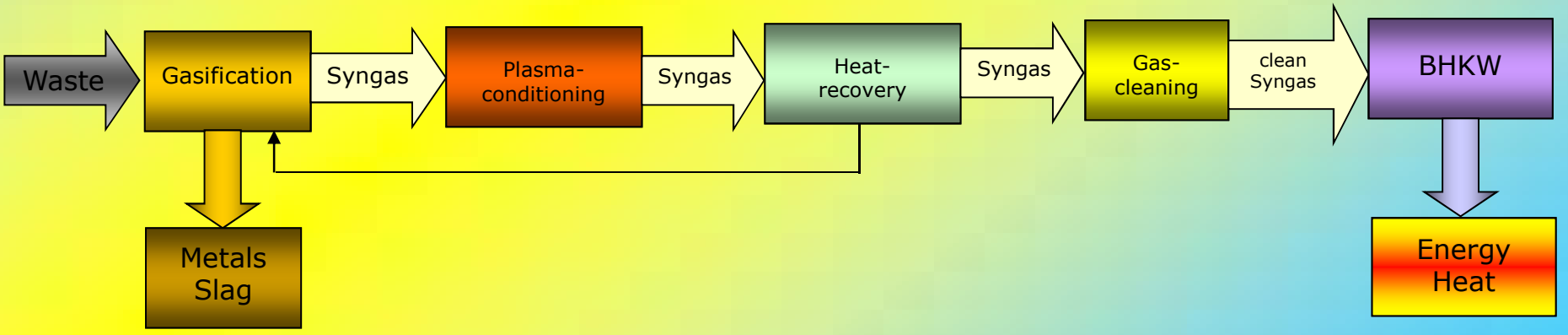
Integrated Multifuel Gasification - IMG

The patented IMG-Technology is an autothermic four-steps gasification followed by a thermal gas-treatment with plasma conditioning.

The resulting heat is re-used in the process to pre-heat the gas-streams that support the gasification process.

The resulting syngas is a clean low caloric fuel gas, that can be directly utilized in gas engines. The slag is inert.



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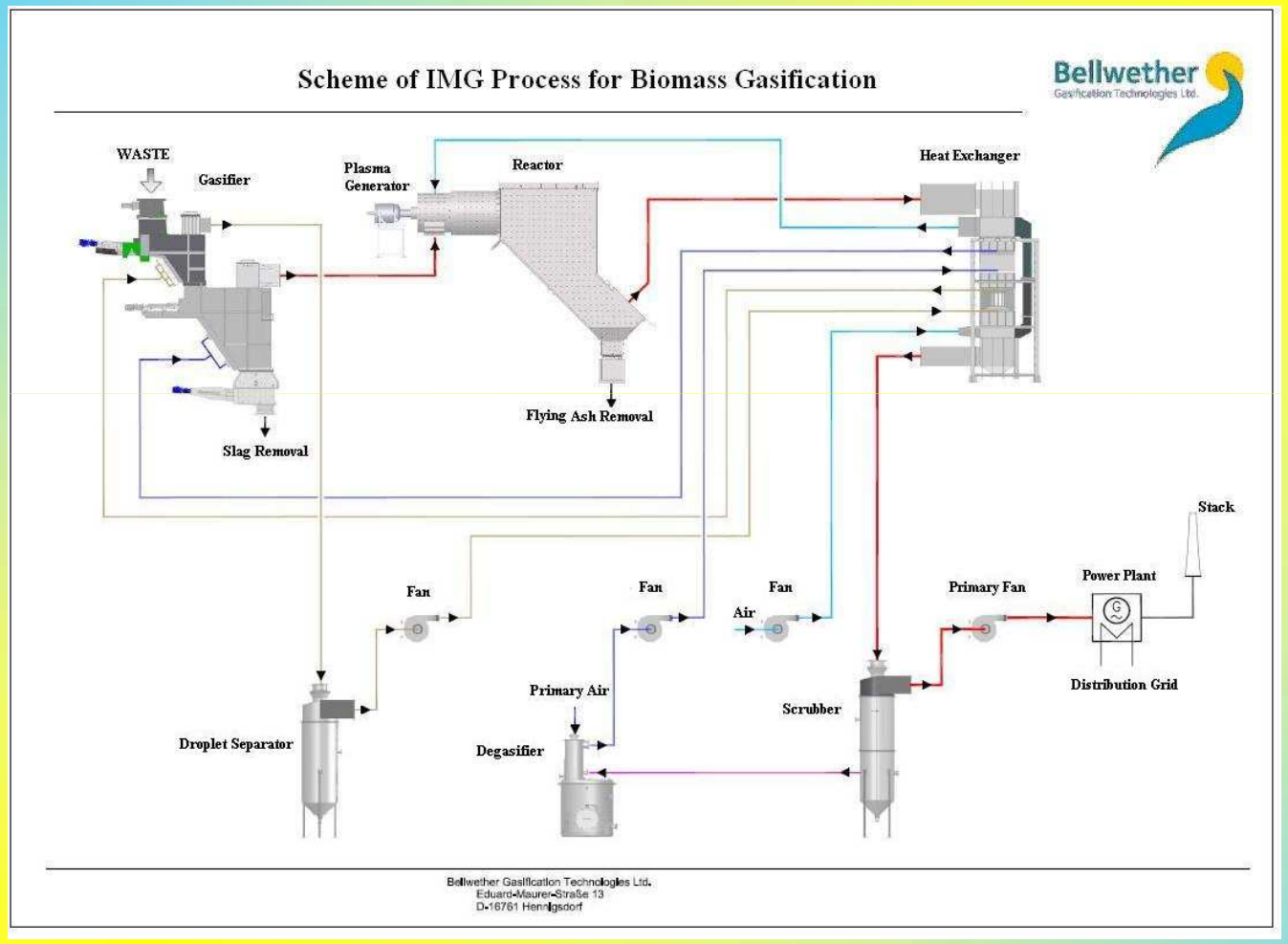
Integrated Multifuel Gasification - IMG



Integrated Multifuel Gasification - IMG

4-step

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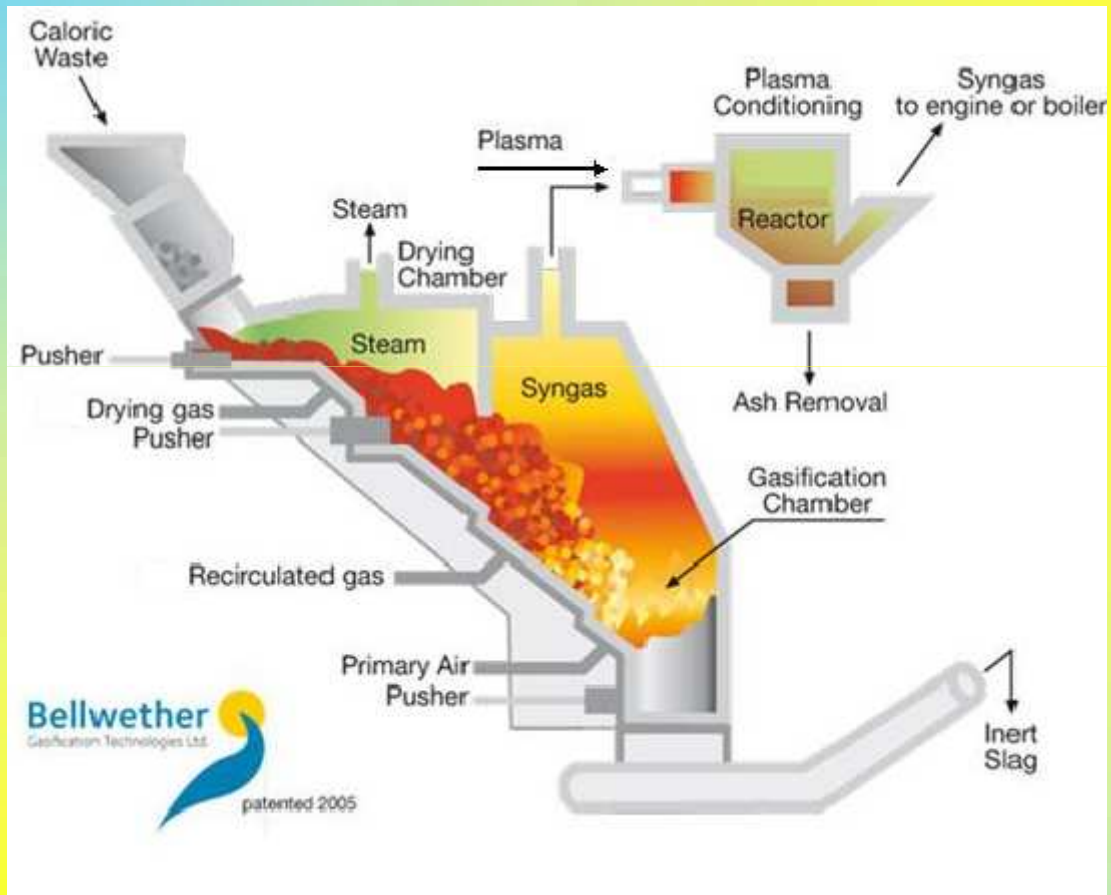

4-step gasification

- Input/feeding
- Drying
- Gasification
- Slag Vitrification

Integrated Multifuel Gasification - IMG

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Plasma Torch

- Thermal gas cleaning with plasma conditioning,
- All tars are decomposed,
- All toxic radicals are destroyed,

- In a reductive atmosphere in the absence of oxygen no NOx is produced,
- No dioxins are generated,
- Clean gas with only simple molecules is the end product.

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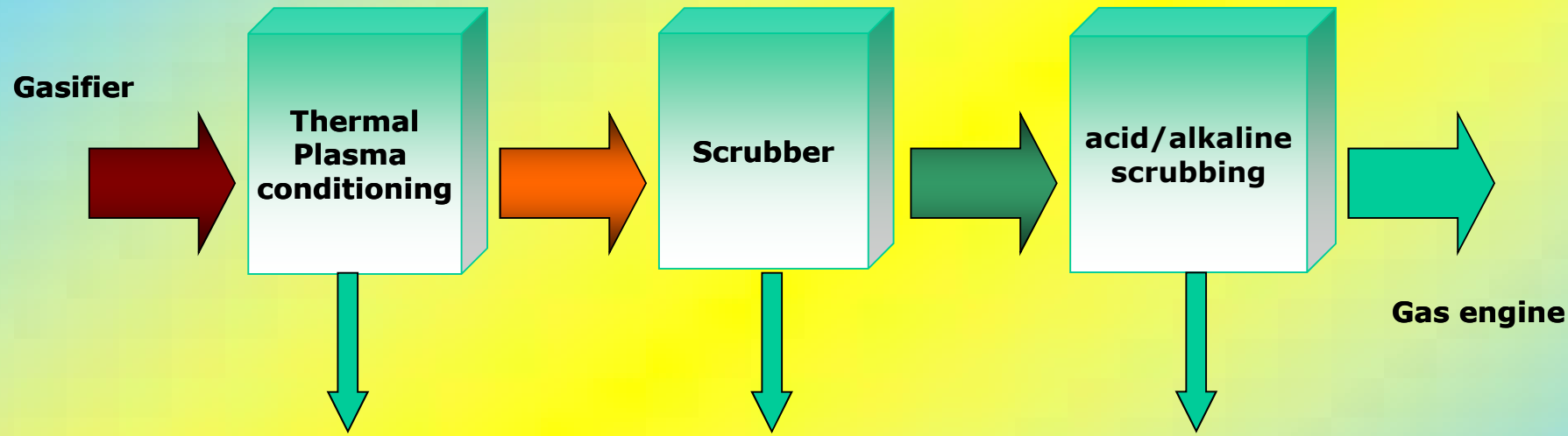
Gas cleaning



The gas volume of the IMG-process corresponds to approx. 25 - 30 % of the gas volume with incineration.

Therefore the emission quantity and cost of the gas cleaning are subsequently lower.

Integrated Multifuel Gasification - IMG

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3 Steps Scrubber

3-Steps scrubber

- ✓ **Dust removal**
- ✓ **Heavy metal removal**
- ✓ **Acid removal**
- ✓ **H_2S removal**
- ✓ **Droplet removal**
- ✓ **Gas cooling**

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Energy production

The components H2 and CO of the Singas substitute natural gas, or other fuels directly in the boiler of power plants or produce energy in gas engines.

The net-efficiency by using of gas engines average 40%.

By additional using of cogeneration the net efficiency average 55%.

By using the heat the net efficiency average is 80%.

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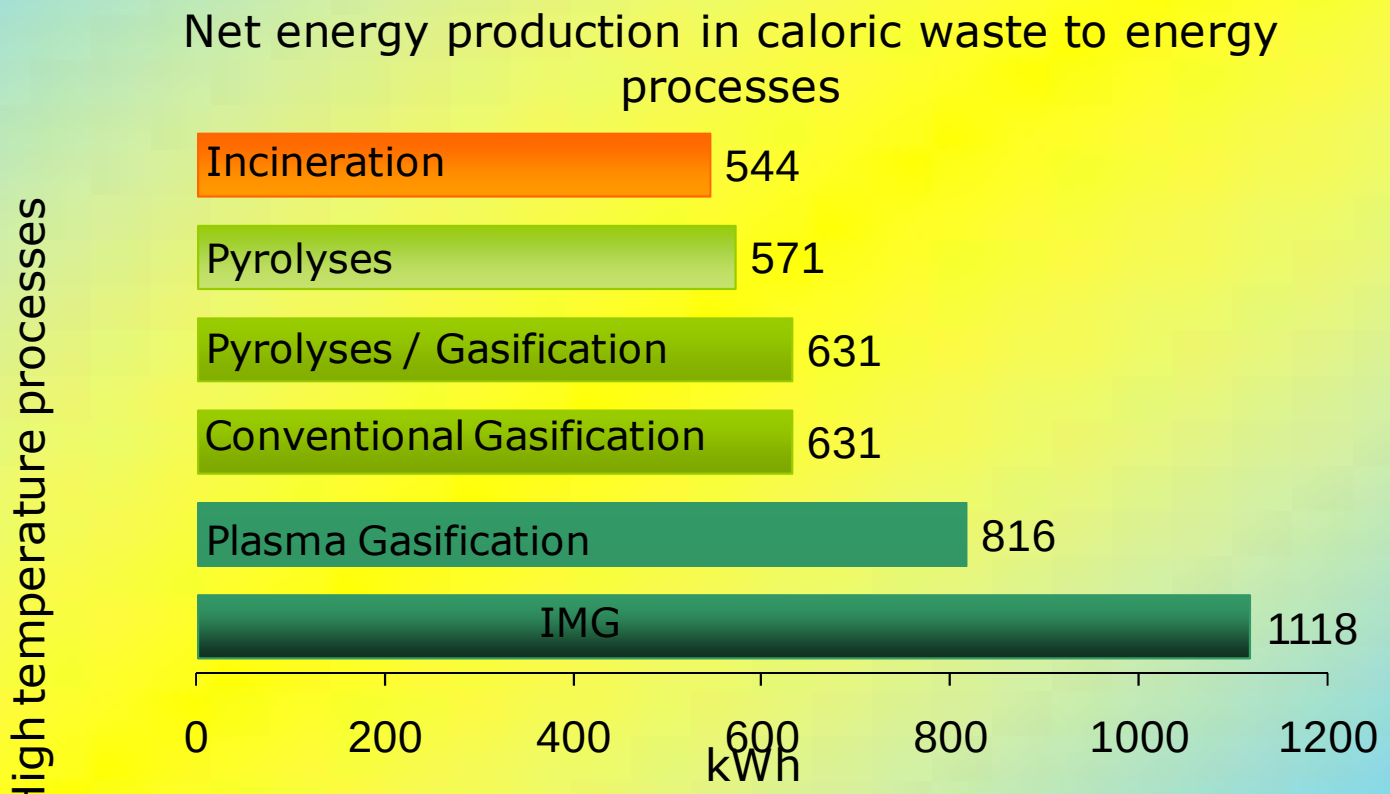
Energy production - Net efficiency



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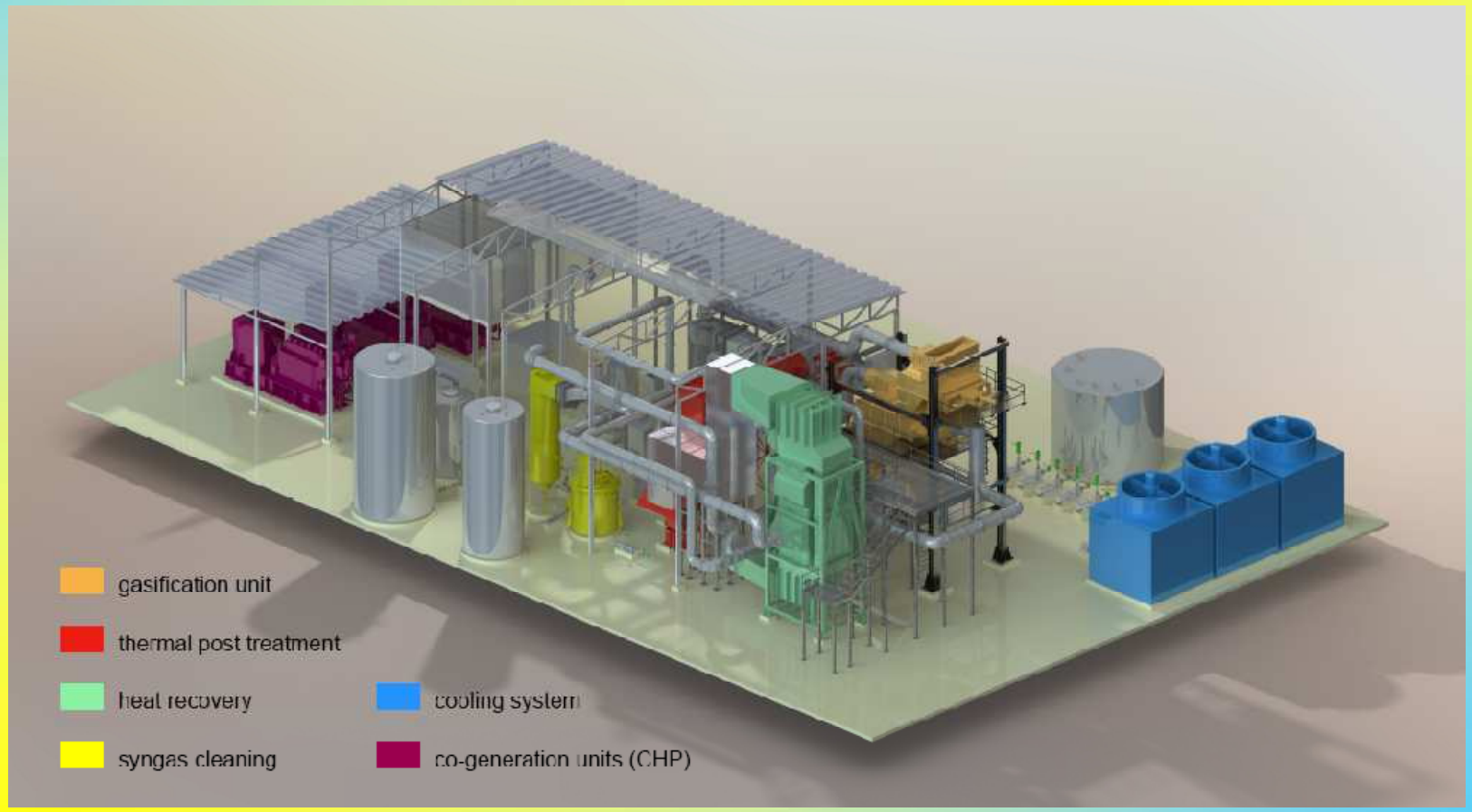
Integrated Multifuel Gasification - IMG



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Waste is our fuel

With competence and Know-how we build turn key power plants.

Our benefits:

- Consulting
- Basic Engineering
- Detail Engineering
- Manufacture and
- erection
- Maintenance

Our technology recovers and recycles:

- Economical
- Environmental friendly
- Sustainable
- Efficient
- Flexible

„We set new standards for economical and environmental friendly recovering of waste“

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1st waste gasification plant with IMG-Technology in Brasov/ Romania

Commissioning: Nov 2008

- Construction time: 14 month
- capacity: waste (MSW) 13Mg/h; LHV=11MJ/kg
- Produced syngas: 188 Mio m³/year; LHV=4,5 MJ/m³
- Thermal energy: 234.000 MWh/year
- Syngas is transported into the local power plant and replaces 28.000 Mg/year of coal

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Clean uniform gas production

Continuous operation with the same gas quality achieved with:

- feeding control
- primary air control
- secondary air control
- gas recirculation

IMG Process - Inert Slag

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Inert Slag

- Municipal waste
- Industrial waste
- Mix waste

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1st waste gasification plant with IMG-Technology in Brasov/ Romania

April – May 2008

- Hall is finished (650m²)
- Erection of the IMG-gasifier and the heat exchanger (Height = 14m)

1st waste gasification plant with IMG-Technology in Brasov/ Romania

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- Cooling water circuit
- Waste water treatment
- Control room

Precipitation
Flocculation
Sedimentation
Capacity: 7m³/h

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1st waste gasification plant with IMG-Technology in Brasov/ Romania

Classifying
Shredder
Feeding
Capatity:13Mg/h

Plasma conditioning

Unionization station

Chemical depose

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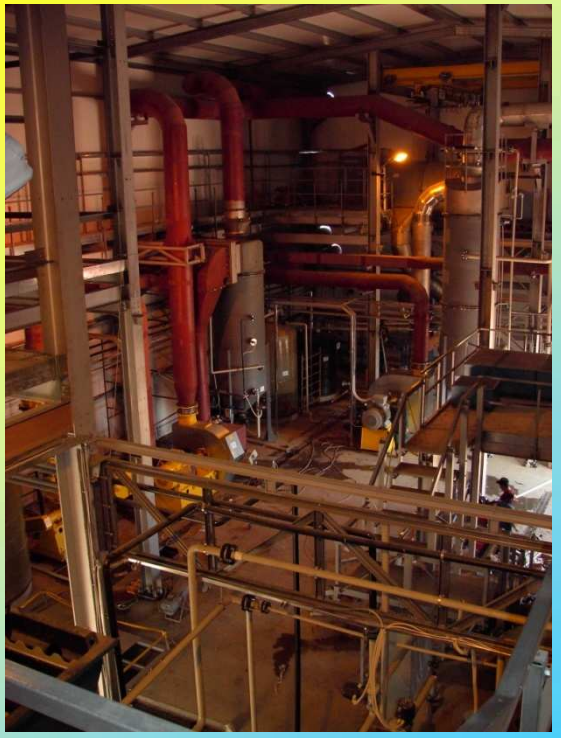
1st waste gasification plant with IMG-Technology in Brasov/ Romania

Main characteristics of the process:

- Compact Design
- Full automatically function
- Low place requirement
- High Quality



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1st waste gasification plant with IMG-Technology in Brasov/ Romania

Results

- Efficiency of the gasifier 80%-85%
- Maximum waste processed 12 t/h
- Quantity of sin gas 14.700 Nm^3/h
- Heating value of the syngas 4,2 MJ/Nm^3
- Energy consumption 1,4 MW
- Power consumption in the Plasma torch 400 KW

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1st waste gasification plant with IMG-Technology in Brasov/ Romania

pollutant concentration, average value of day	Unit	Concentration
Dust	Mg/m³ i.N.tr.	< 3
HCl	Mg/m³ i.N.tr.	< 2
HF	Mg/m³ i.N.tr.	< 0,1
SOx (as SO_2)	Mg/m³ i.N.tr.	< 25
NOx (as NO_2, 95% NO)	Mg/m³ i.N.tr.	< 20
NH_3	Mg/m³ i.N.tr.	< 0,2

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1st waste gasification plant with IMG-Technology in Brasov/ Romania

Fuel Gas Composition	clean
CO %	19-23,1
CO_2 %	7-8,7
H_2	13-17,6
H_2O %	5-8,5
N_2	46-49,6
Other	
Total	100