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**Experience and lessons learned during construction
and trial period of the MBT in Sofia, Bulgaria
and it's potential to contribute to renewable energy**

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Education:

**Diploma as Civil Engineer at Stuttgart
University (1991)**

Profession:

**Head of Department -
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Experience:

**Working in the fields „waste management“
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Today's presentation

2 parts:

1. **MBT Sofia – Basis information and lessons learned**
2. **Potential of waste to contribute to renewable energy – a comparison of existing WtE (waste to energy) options**

Part 1: MBT Sofia



NATIONAL CONTEST
BUILDING OF THE YEAR
BULGARIA
2015



Part 1:
MBT Sofia –
Basis information and
lessons learned

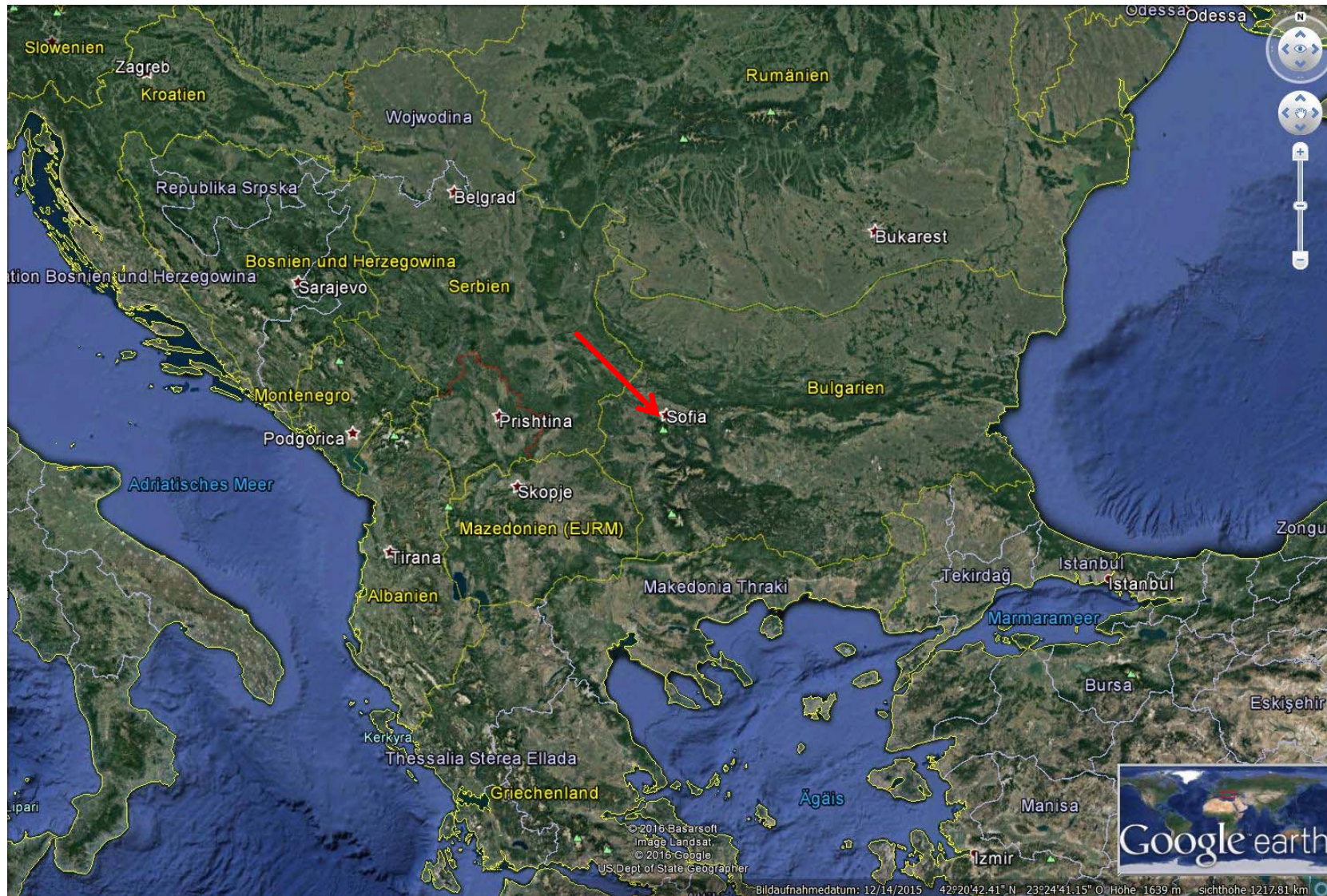
1. Sanitary landfill for MSW (10 ha)
2. Composting Plant for Green Waste (20.000 t/a)
3. Biogas Plant for Biowaste (24.000 t/a)
4. MBT for mixed MSW (410.000 t/a)
 - Secondary fuel (RDF)
 - Recyclables
 - Kompost

- | | |
|---------------------|------------------------------|
| 1. Landfill | Unieco (It) / Geotechmin(Bg) |
| 2. Composting Plant | Eggersmann (D) |
| 3. Biogas Plant | Eggersmann (D) |
| 4. MBT | Actor-Helektor (Gr) |

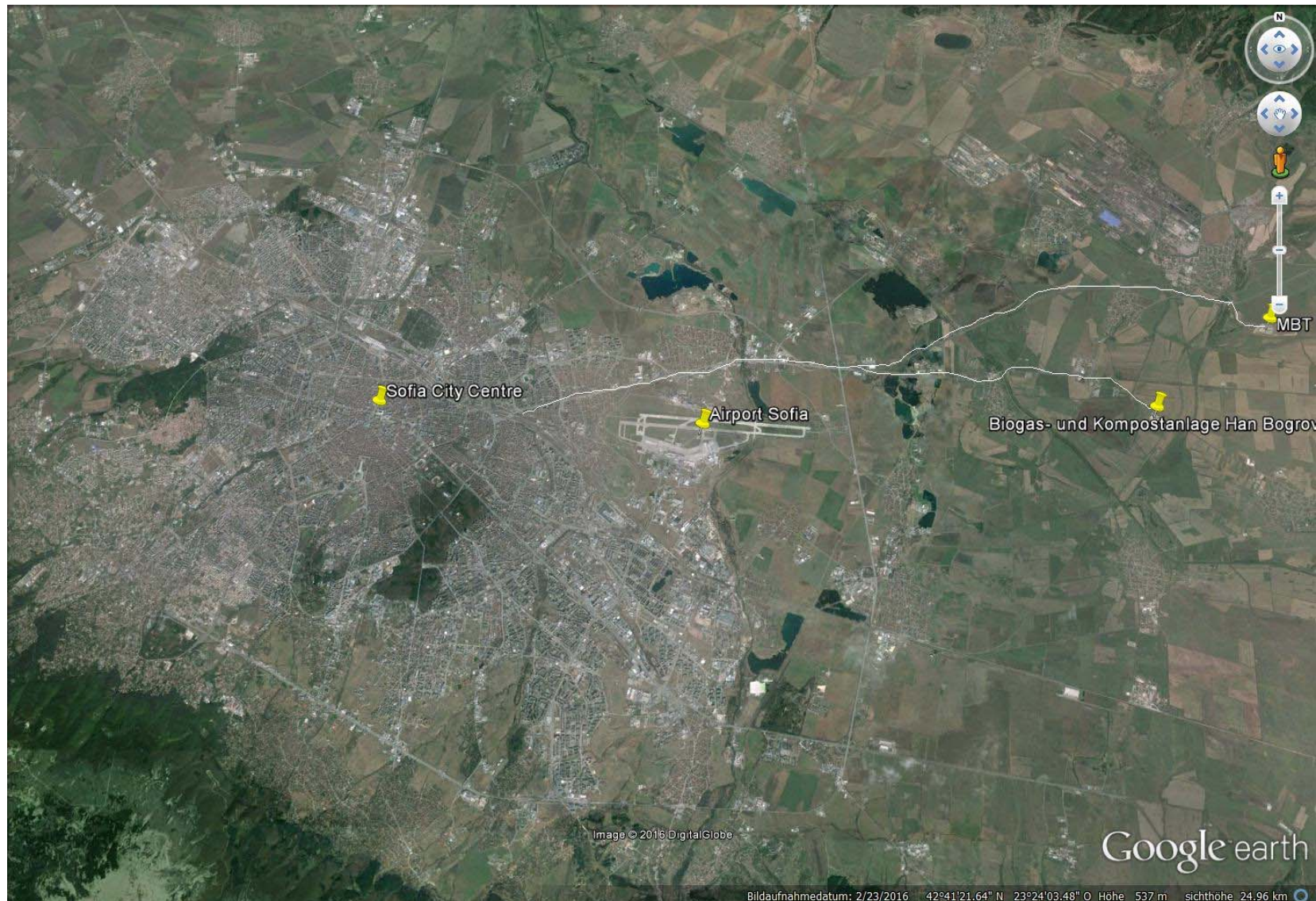
SUPERVISION

1. Planning & Design
2. Construction
3. Startup
4. One year trial operation

Location of Plants



Location of Plants



MBT Sofia- Basis information

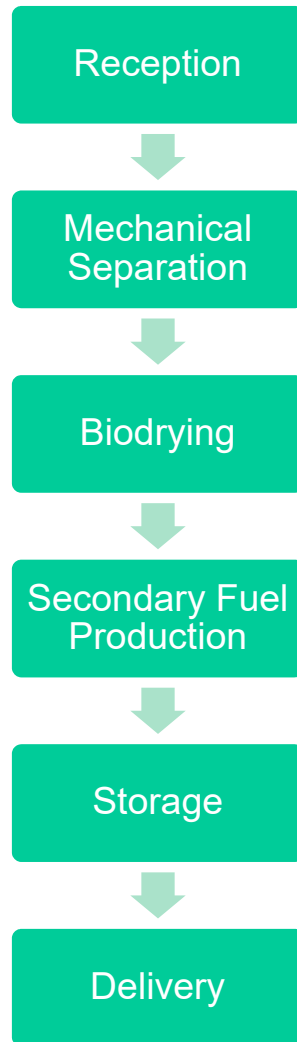
- Location Sadinata, about 22 km east from Sofia
- Surface Area 10,7 ha
- Construction time 19 month – completion 09/15
- One year trial period till 09/16
- Investment about 110 Mio. Euro
- Capacity 410.000 t/a (up to 1.300 t/d)

MBT Sofia- Input/Output



Input	410.000 t/y
RDF	43,5%
Recyclables	9,5%
CLO	0,1%
Losses	28,5%
Residues	18,4%

Mechanical-Biological Treatment (MBT) / Example Sofia, Bulgaria



MBT Sofia, Waste reception

Reception



Mechanical Separation



Biodrying



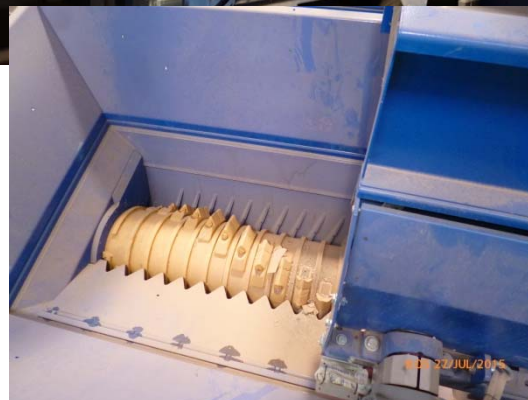
Secondary Fuel Production



Storage



Delivery



- Delivery to deep bunker
- Crane
- Movingfloor
- Shredder
- Manuel Presorting

MBT Sofia, Mechanical Separation

Reception



Mechanical Separation



Biodrying



Secondary Fuel Production



Storage



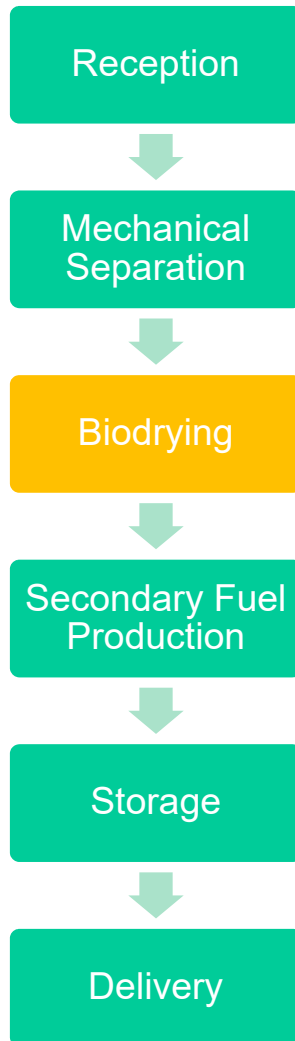
Delivery



- Drumsieve 200 mm
- > 200 mm – Manual sorting → Recycling
- > 200 mm – Waste shredder → Biodrying
- < 200 mm → Biodrying



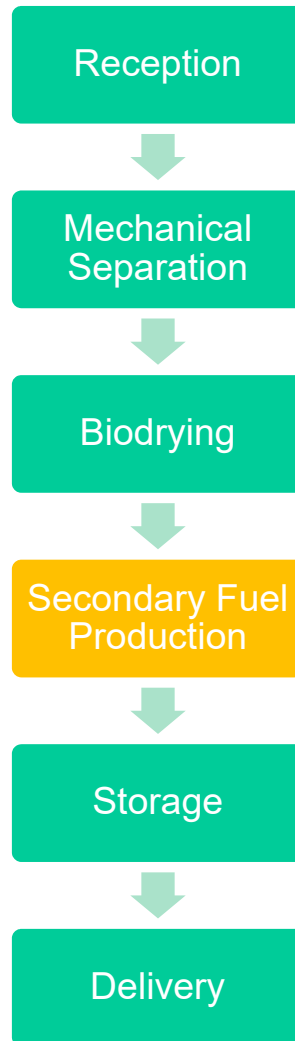
MBT Sofia, Biodrying



- < 200 mm to bunker
- 2 cranes distribute < 200 mm in to boxes
- Retention time in boxes 7 days – aerated
- After biobrying → RDF-production



MBT Sofia, Secondary Fuel Production



- Sieving in 3 fraction
 - > 60 mm
 - 30-60 mm
 - < 30 mm
- Fe-Separation
- Densimetric Tables/ Vibration sieves (separation light and heavy)
- Optical separation NIR – Infrared / Laser
- Eddy-Current Separation – Separation of NF-Metal



➔ Aim:

- RDF >14 Mj/kg ➔ Baling / container

- Extraction of Impurities and Recyclables

MBT Sofia, Storage and Delivery

Reception



Mechanical
Separation



Biodrying



Secondary Fuel
Production



Storage



Delivery

- RDF
 - Baled
 - Loose transport in containers



MBT Sofia- Status today

- About 800t/d - 1.100 t/d are treated daily
- Operation carried out by Municipal company
- Heavy problems identified for operation / maintenance and repair
- Many stops/breaks and damages through operation due to
 - Insufficient maintenance & repair
 - Complicate decision structures esp. in emergency cases
 - Insufficient number of qualified staff
 - High staff fluctuation due to low salary
- ➔ Questionable whether a municipal company under the administrative structure of municipality is able to operate such a plant
- ➔ Are DBO (Design-Build-Operate) projects/contracts a better solution?

Part 2: Potential of waste to contribute to renewable energy

Part 2:

Potential of the MBT to contribute to renewable energy

a comparison of existing WtE (waste to energy) options

Key message out of Sofia's MBT for whole Bulgaria

Existing energy potential out of waste for next 20 years

27 Million Barrel Crude Oil

Historical statement



***“Crude oil is a unnecessary excretion of
the earth,
a sticky and smelly liquid,
useless”***

Academy of Sciences, St. Petersburg, 1806

**Is it the same with waste / esp.
organic waste?
Is waste a forgotten energy
source?**



Energy containing waste

Organic Waste

Biodegradable waste

Non
degradable
waste

Paper

Kitchen
waste

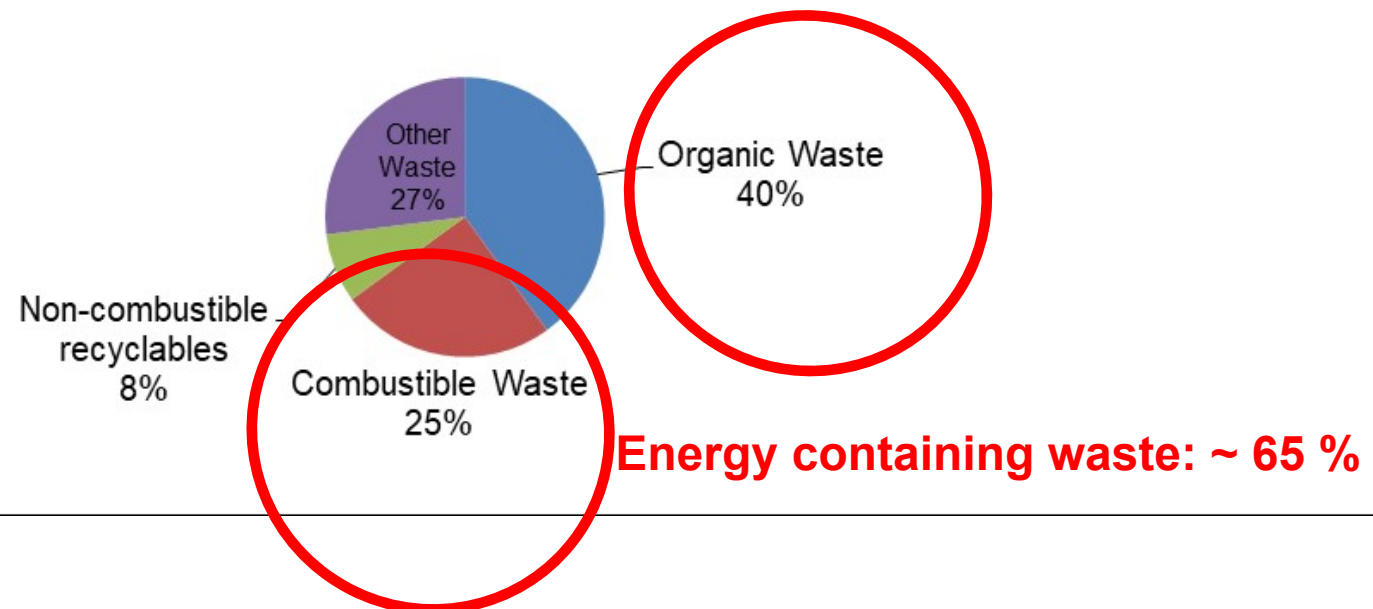
Garden
waste

Plastics

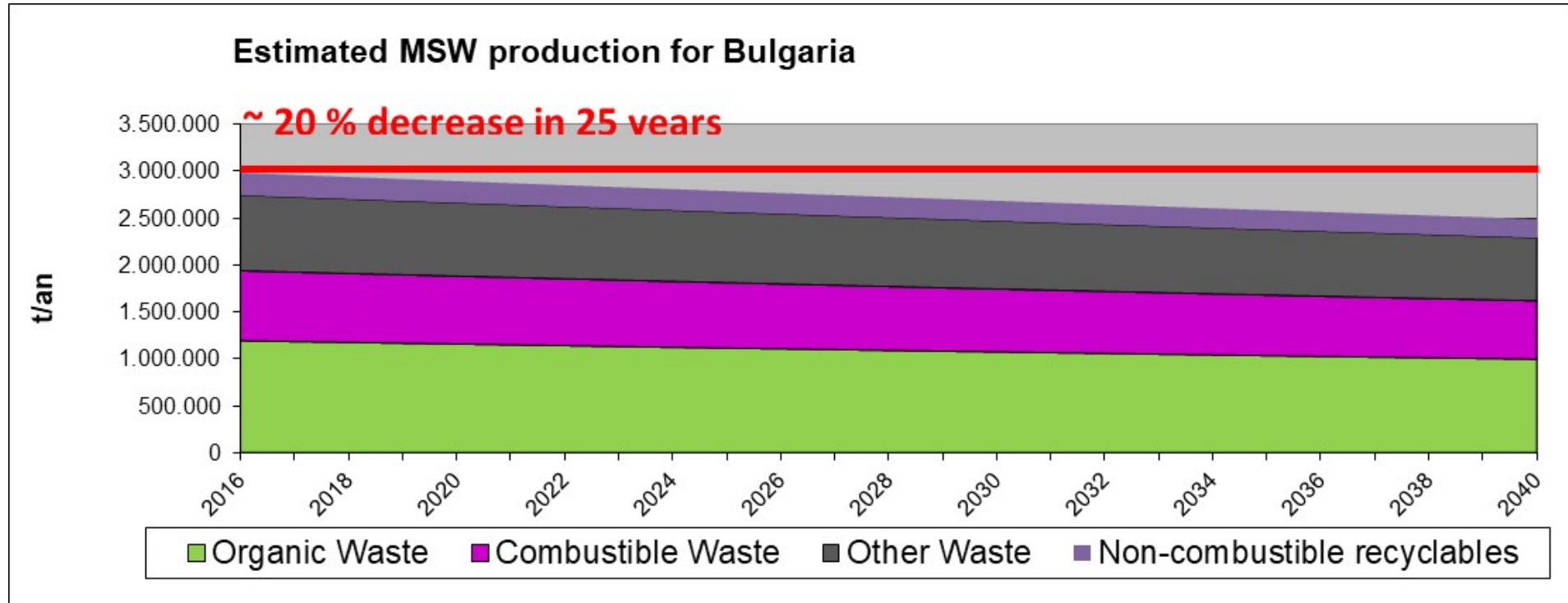
-
Synthetic
Rubber

Municipal Solid Waste composition in Bulgaria

Estimated composition of MSW in Bulgaria



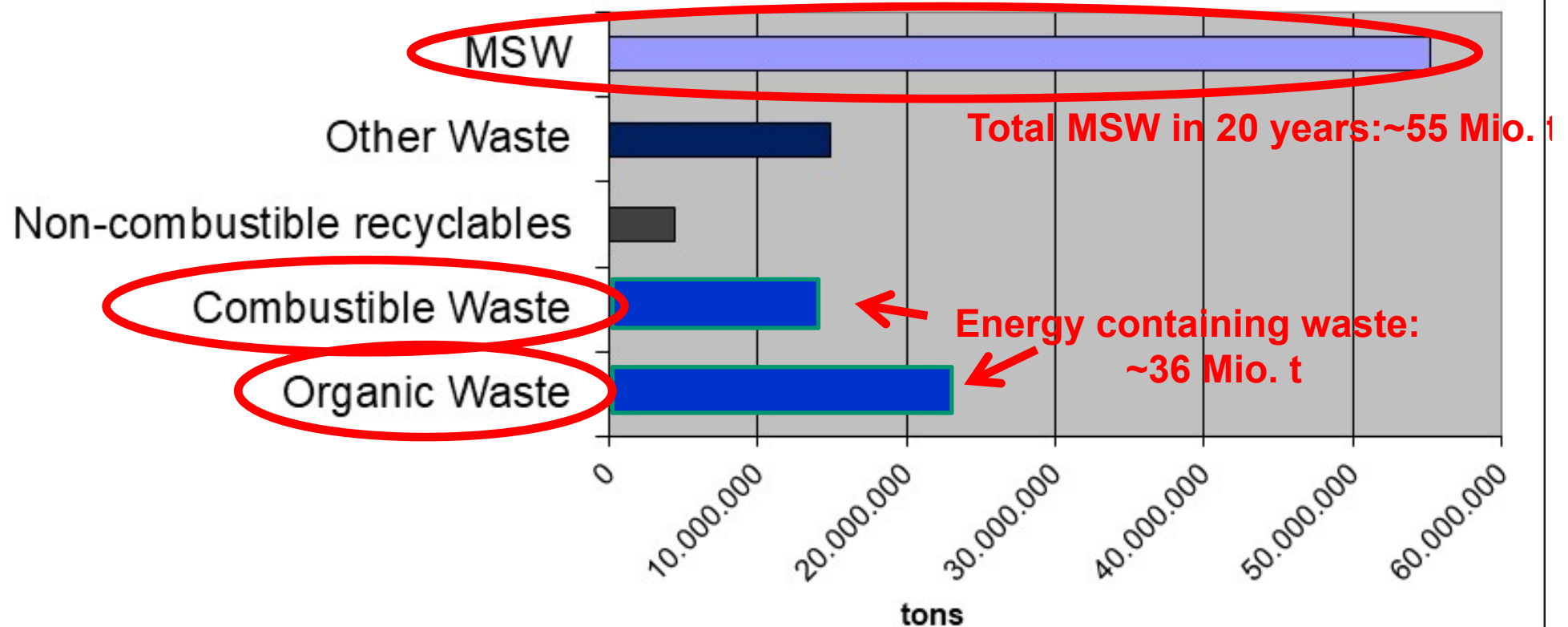
Municipal Solid Waste (MSW) production in Bulgaria



Estimated growth: -0,75 % per year

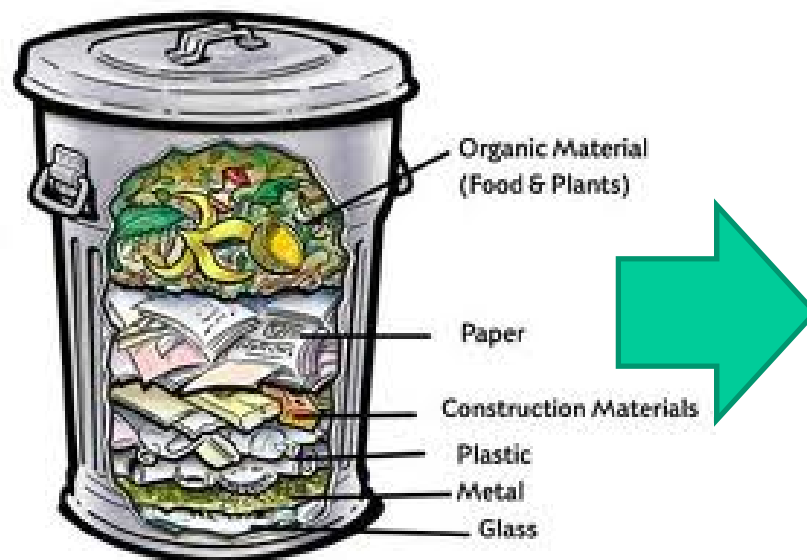
MSW production in Bulgaria

Estimated MSW production in Bulgaria for 20 years



Problem of organic waste: High water content (>60 %)

Consequence of no treatment and recycling



> 2/3 % of MSW (~ 36 Mio. t) must be landfilled additionally in next 20 years

20 years landfill without treatment in Bulgaria

~ 55 Million t/y waste

~ 8,3 Billion m³ gaz → GHG

~9,6 Million m³/y leachate → groundwater

costs for 20 years operation

health problems due to odour, vermin, pathogenic germs

100 %



Leachate emissions



each ton 150-200 liter

Gas emissions



each ton up to 150 m^3

Problems with landfill - Lessons learned

Emissions mainly are caused by energy containing biowaste



Problems with landfill

How can we reduce organic waste on landfills ?

Problems with landfill

Is this an option?



..... and who eats the cow ?

Conclusions for Waste Management

Organic waste (biowaste + plastics)

- causes significant problems if landfilled
- If pre-processed it's an energy source
- Appropriate technology required taking into account existing waste composition
- **Waste to Energy (WtE) is a very good option**

Typical Waste to Energy (WtE) technology options

WtE technology

Landfill gaz
utilization

Incineration

Biogas
Plants

Pre-
Processing
(MBT)

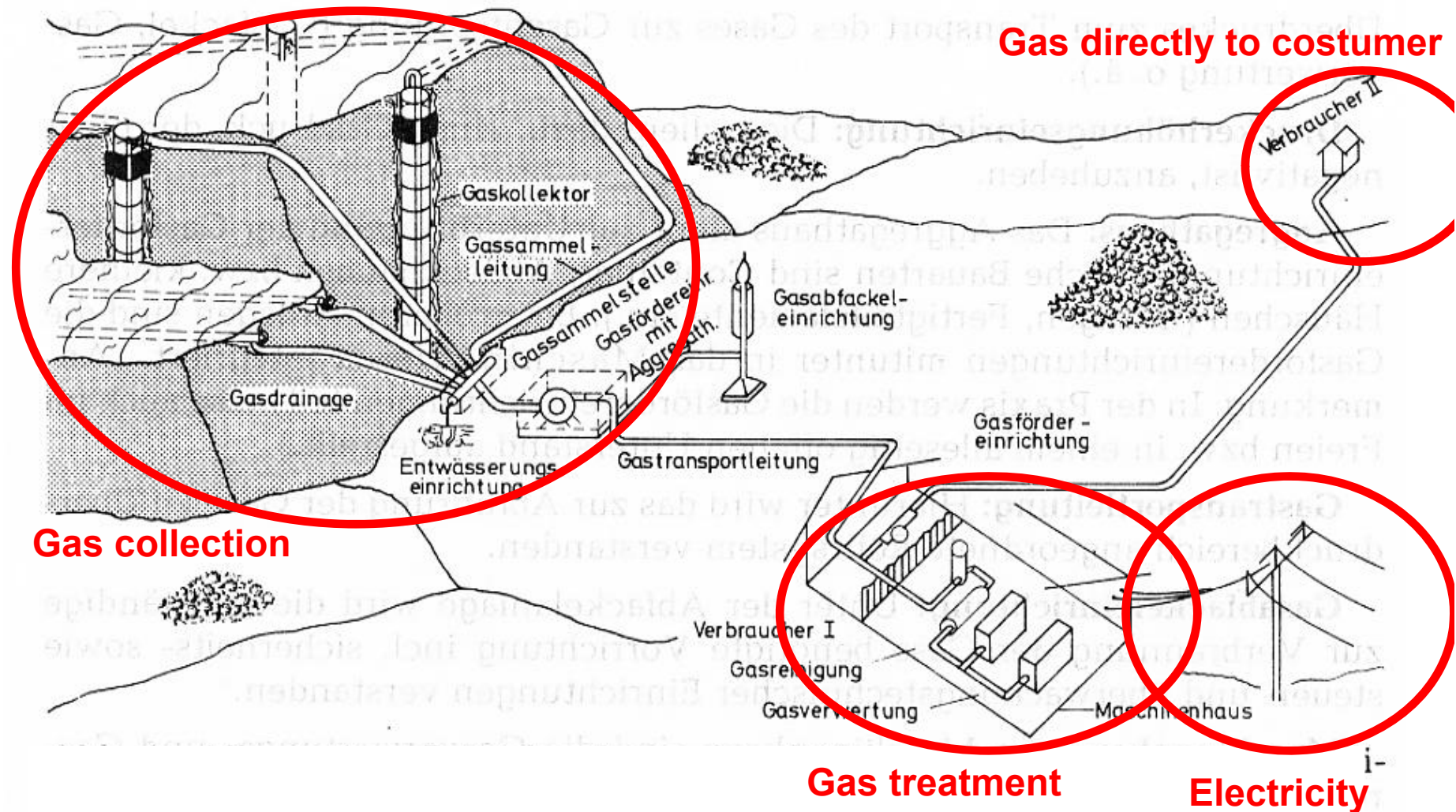
Output: ENERGY

Output: Secondary fuel

Typical Waste to Energy (WtE) technology options

Technology	Input	Energy Source	Used of Energy Recovery	Gas production per ton waste	Energy content per ton	Efficiency	Remarks
Landfill gas utilization	Municipal solid waste	Biowaste	100%	~ 150 m3 in 15-20 years	0,6-0,9 MWh	25-50 %	low efficiency high amounts of GHG
Biogas Plants	Separated biowaste	Biowaste	50%	~ 120 m3 in 3-4weeks	0,7- 0,9 MWh	70-80%	
Incineration	Municipal solid waste	Biowaste and plastics	100%	-	Developing and emerging countries: < 1,7 MWh	30-40%	due to high biowaste and organic content no efficient incineration possible
					Developed countries: 2-3 MWh	30-40%	incineration with energy revenues possible
Pre-Processing (MBT) with sorting of secondary fuel	Municipal solid waste	Paper and plastics	15%	-	4,2-5,2 MWh	40-60%	high system efficiency
Pre-Processing (MBT) with biodrying+sorting	Municipal solid waste	Biowaste and plastics	40%	-	3,6-4,7 MWh	40-60%	high system efficiency

Landfill gas utilization



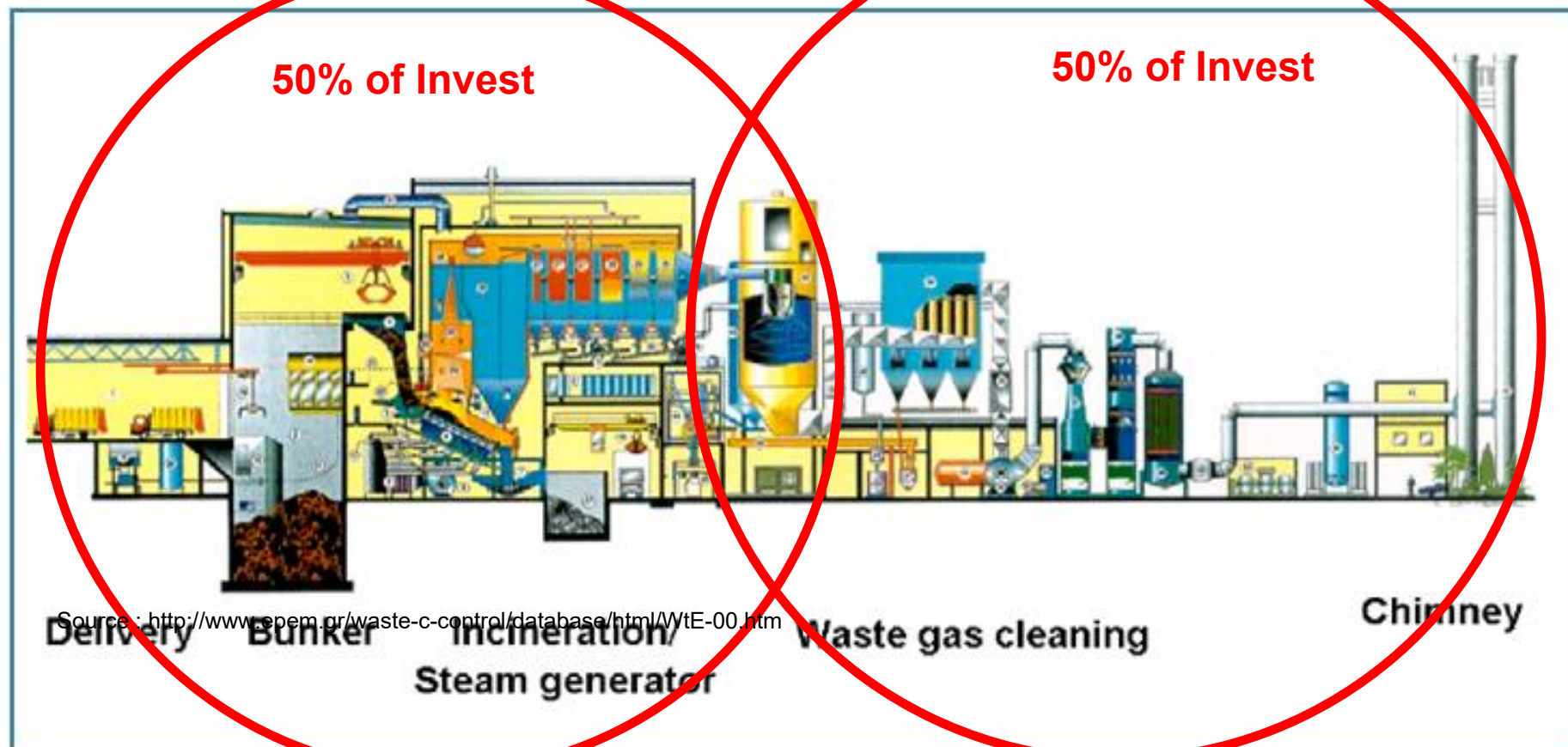
Incineration

Requirements:

Input > 6 MJ/kg

biowaste < 50 %

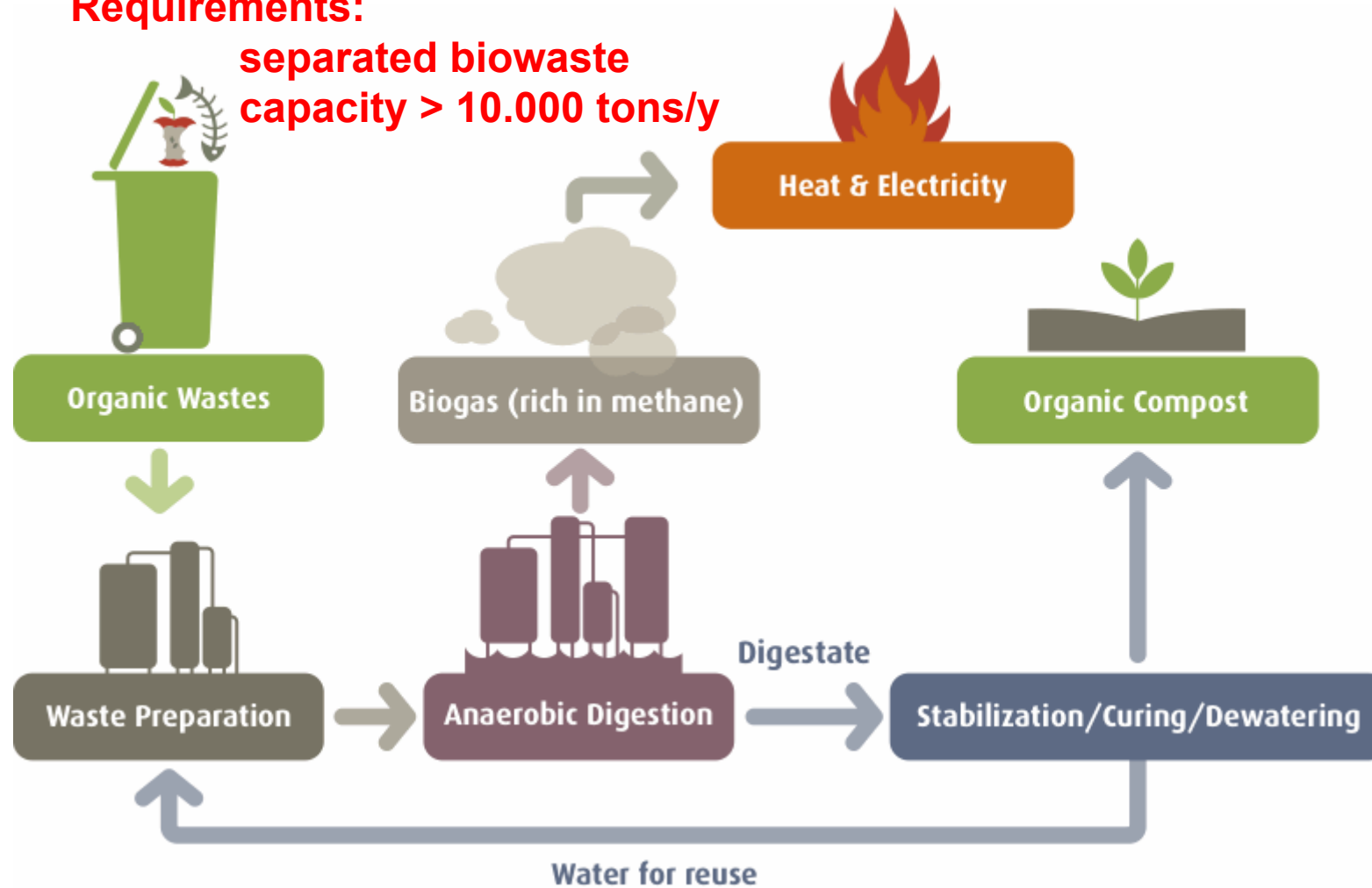
capacity > 100.000 tons/y



Biogas Plants

Requirements:

separated biowaste
capacity > 10.000 tons/y



Source: <http://www.ionacapital.co.uk/page/95/Anaerobic-Digestion-Adoption.htm>

Pre-processing/ Drying to increase usable energy



Drying

Fuel



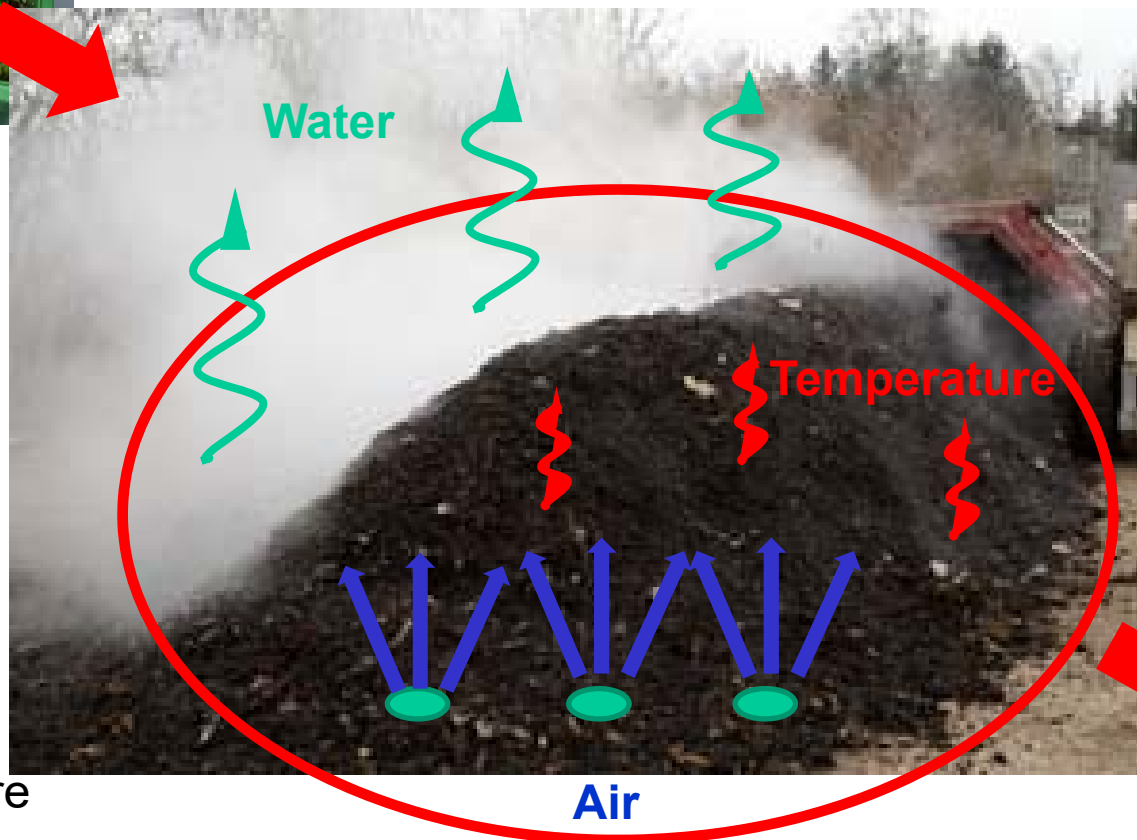
- Total energy content is same
- for wet material much energy required to evaporate containing water
- If too much water, available energy is not sufficient to evaporate water
- Additional fuel required to burn wet material
- For dry total energy is usable

Pre-processing / Biodrying



Biological drying

biodegradable waste rapidly heated through initial stages of composting.



Drying increased by biological heat and forced aeration.



Aim

remove moisture
reduce weight
produce secondary fuel (RDF)

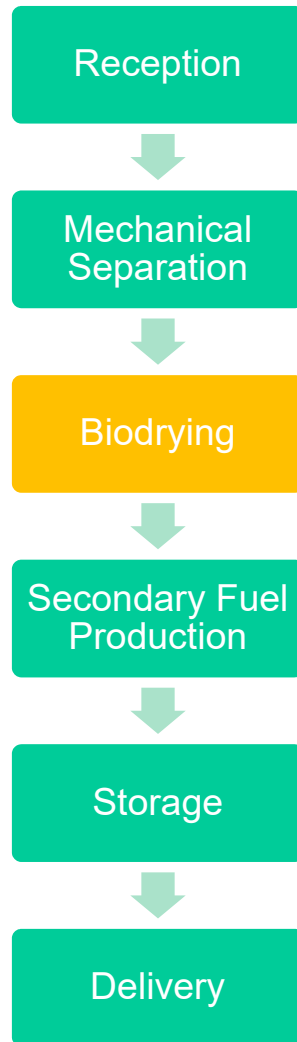
Pre-processing / Mechanical-Biological Treatment (MBT)

Aims

- Reduction of landfill emissions
- Quantity reduction
- Sorting of recyclables
 - Energy recovery
 - Material recycling

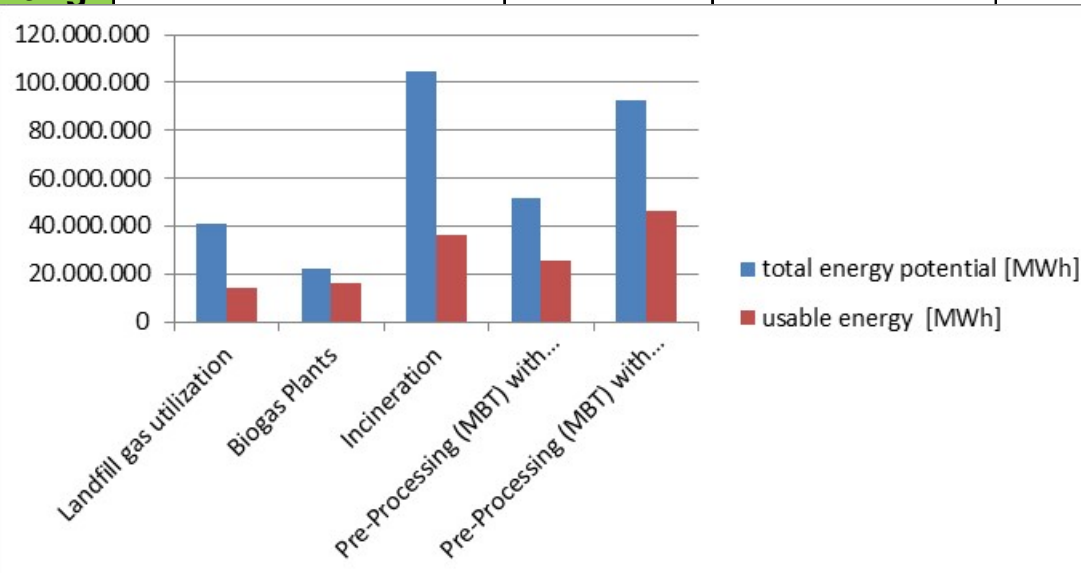
Appropriate for almost all kind of waste
No capacity limits

Mechanical-Biological Treatment (MBT) / Example Sofia, Bulgaria

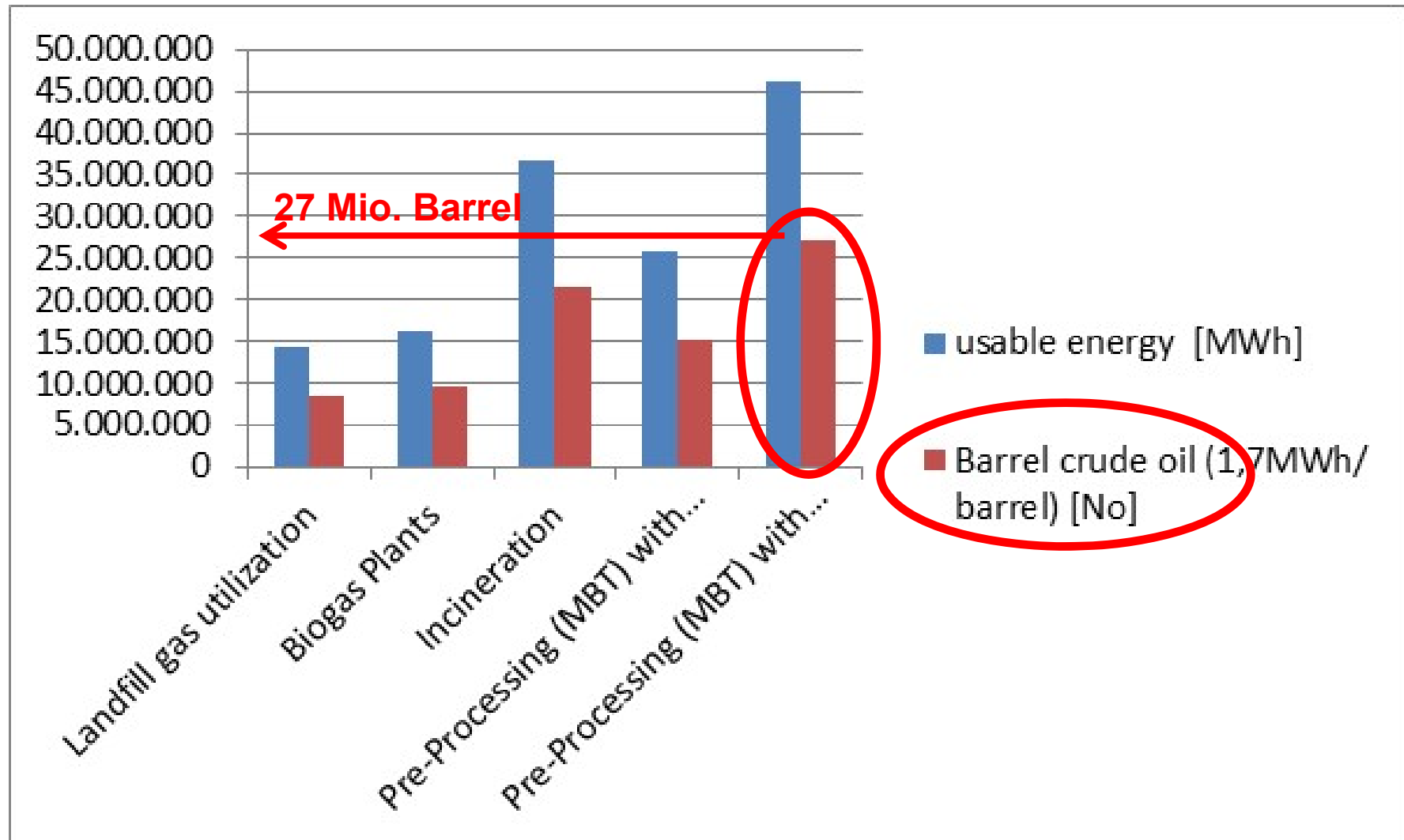


WtE technology Options – Available energy potential

Technology	waste quantity in 20 years	for energy recovery	total energy potential	efficiency in average	usable energy	Comparison in energy provision
	[tons]	[%]	[MWh]	[%]	[MWh]	[%]
Landfill gas utilization	55.000.000	100%	41.250.000	35%	14.437.500	100%
Biogas Plants	55.000.000	50%	22.000.000	75%	16.264.286	113%
Incineration	55.000.000	100%	104.500.000	35%	36.575.000	253%
Pre-Processing (MBT) with sorting of secondary fuel	55.000.000	20%	51.700.000	50%	25.850.000	179%
Pre-Processing (MBT) with biodrying+sorting	55.000.000	40%	92.400.000	50%	46.200.000	320%



WtE technology Options – Available energy potential

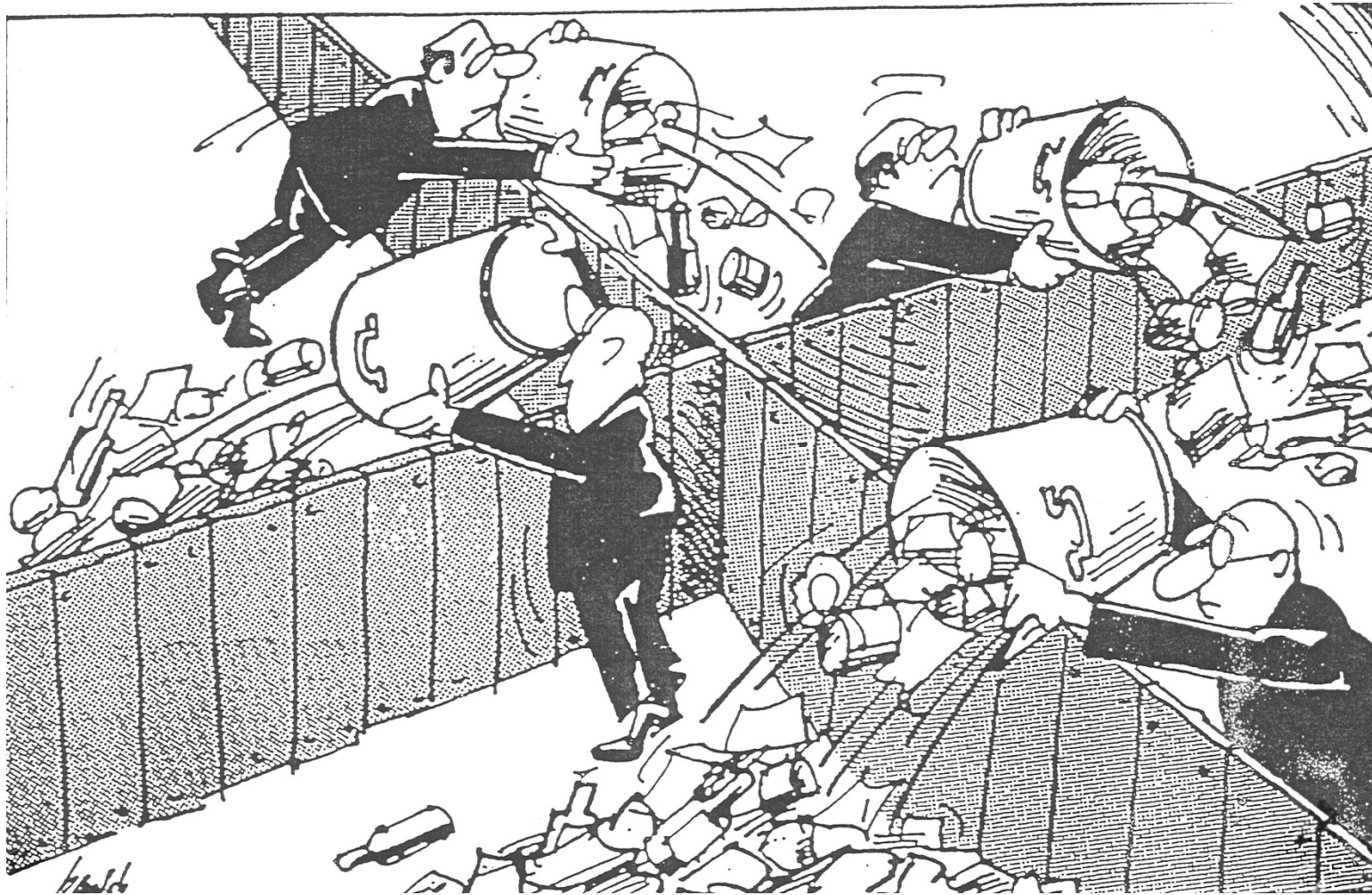


Conclusions for Waste Management in Bulgaria

„Waste is a significant source for renewable energy“

- **Available energy potential for next 20 y~ 27 Mio Barrel Oil**
 - **Appropriate WtE technology has to be taken into account**
 - **Incineration in most cases not useful – waste is too wet in most cases**
 - **Pre-processing (MBT) with RDF production is appropriate for all sizes/waste**
 - **Impacts for waste management:**
 - **Storage behaviour of pre-treated waste is significantly improved**
 - **Reduction of waste amounts (up to 80 % of input) to landfill**
 - **Increase of lifetime of landfill**
 - **Reduction of emissions (> 90%) for gas and leachate**
- **Combining „Need for Energy“ with „Waste Management“ → Win-Win Situation**

Waste Management Circle





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This was my contribution for today!!!!