SMARTAGRI
CAMBODIA

SmartAgriCambodia: Advancing Sustainable Agriculture in Battambang

2025 - 2027

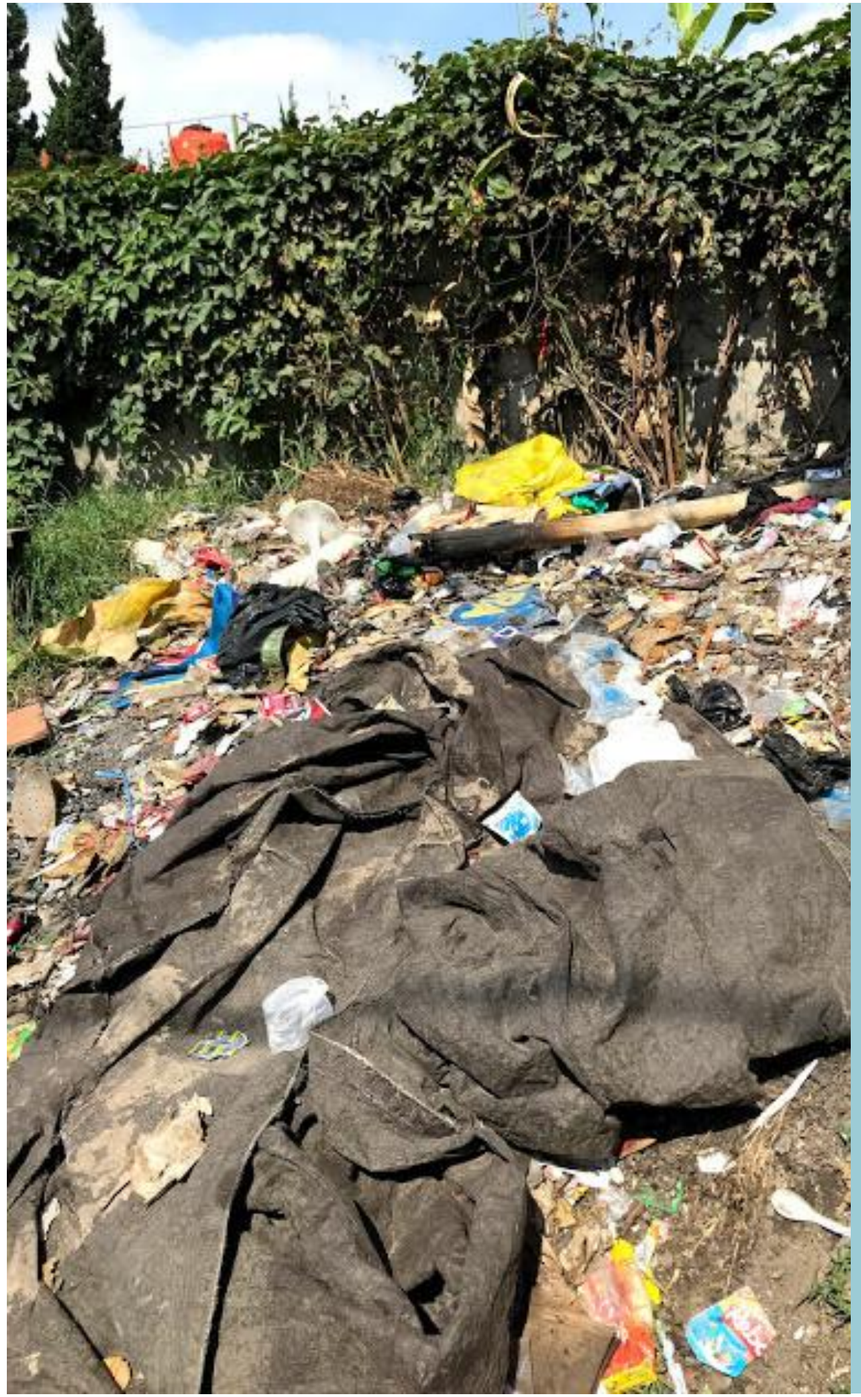
Processes?

Landfill in developing countries?

= **Open dumping** (no cover layers, no leachate control)

- Waste spreading (by wind, animals, rivers)
- Hazard of explosions, landslides
- Insufficient Waste Management
  - Low waste sorting
  - Bad infrastructure
  - Government disinterest

Waste Management | Thermal Treatment



LOW PUBLIC AWARENESS

- Waste is useless
- No differences between organic and inorganic waste
- Environmental impacts

LACK OF INFRASTRUCTURE

- Insufficient services
- Inappropriate waste treatment technologies

POLICY

- Underfunding of sector
- Support of "controlled" landfills

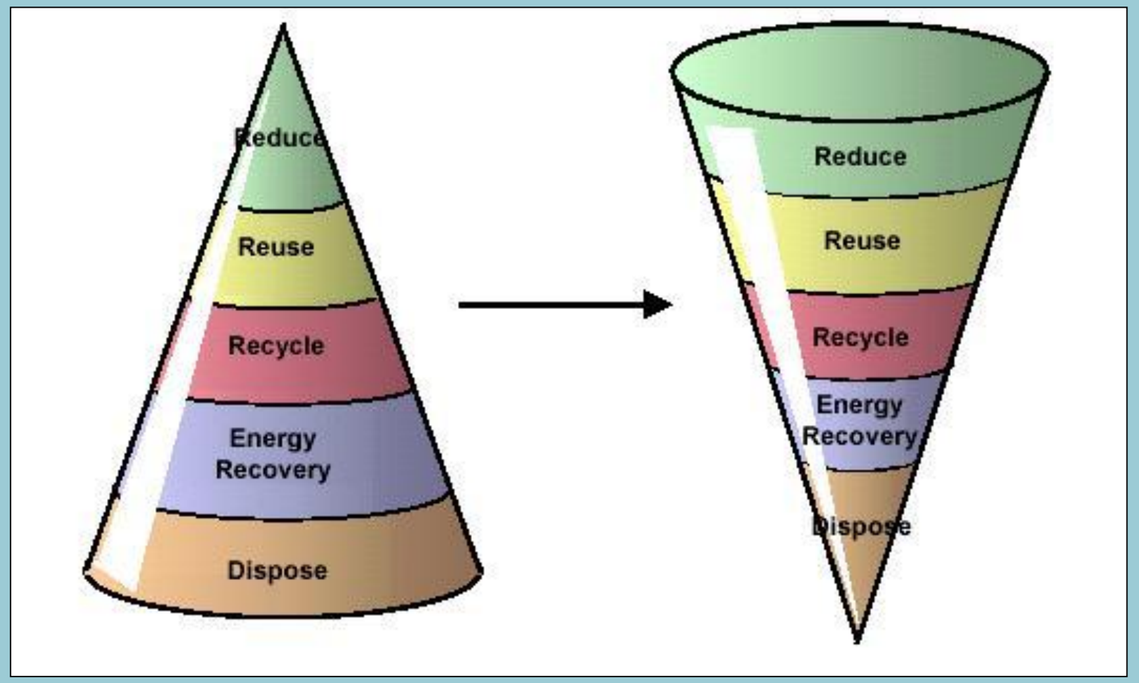
- Increasing population
- Rising production of waste
- Increasing the share of inorganic waste
- No more space for landfills

New Solution?

SUITABLE WASTE MANAGEMENT

Energy recovery/ waste-to-energy

- Incineration facility
- Gasification
- Pyrolysis



Reduce production

- Decrease of waste production

Reuse waste materials

Recycling

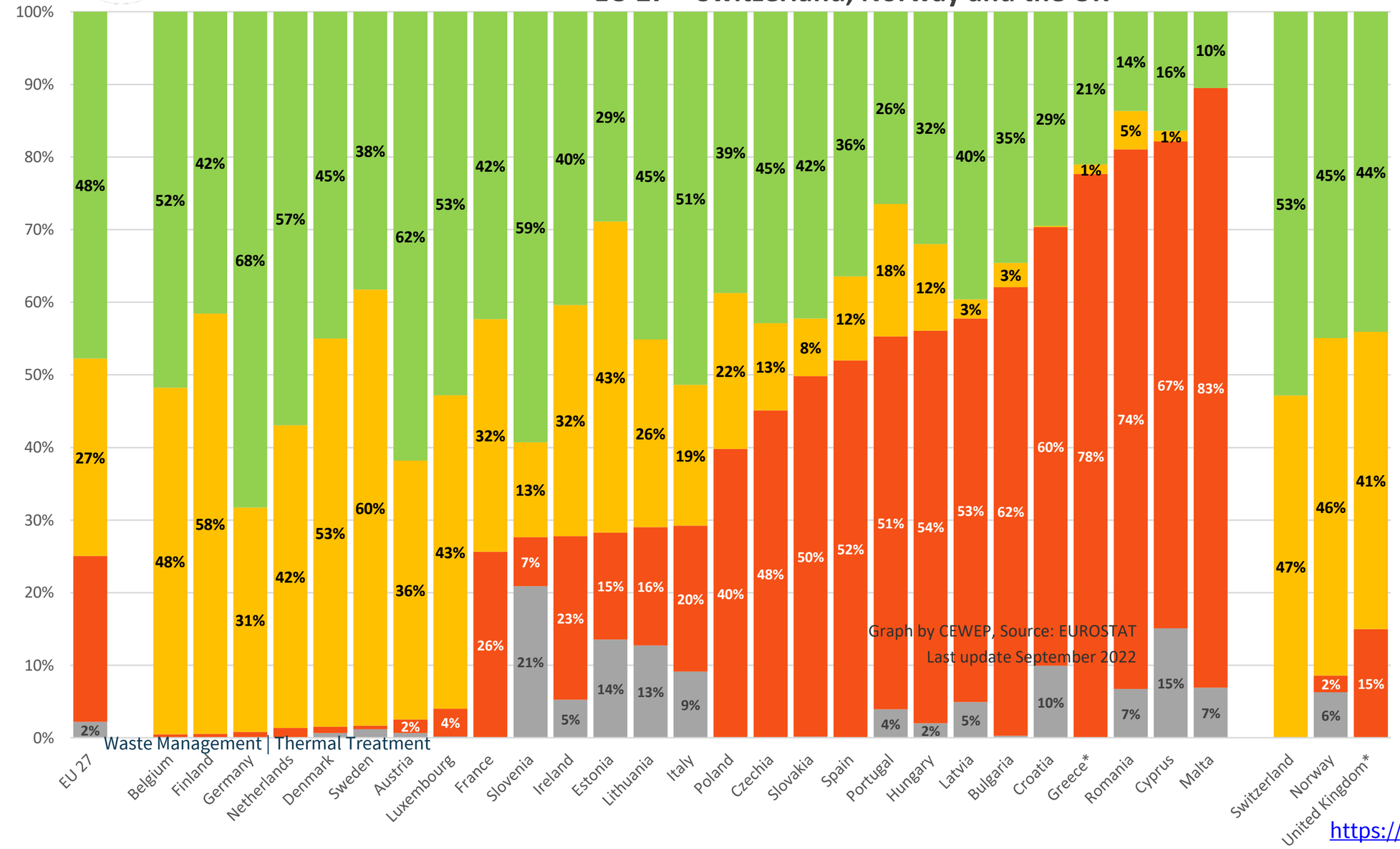
- Waste sorting
- Waste recycling facilities (paper, glass, plastic, metals)

Composting Biofuels production

- Organic waste sorting/reuse
- Composting facilities
- Production of solid, liquid, gaseous biofuels

Municipal waste treatment in 2020

EU 27 + Switzerland, Norway and the UK



Landfill

Waste-to-Energy

Recycling +Composting

Missing data

Percentages are calculated based on the municipal waste reported as generated in the country

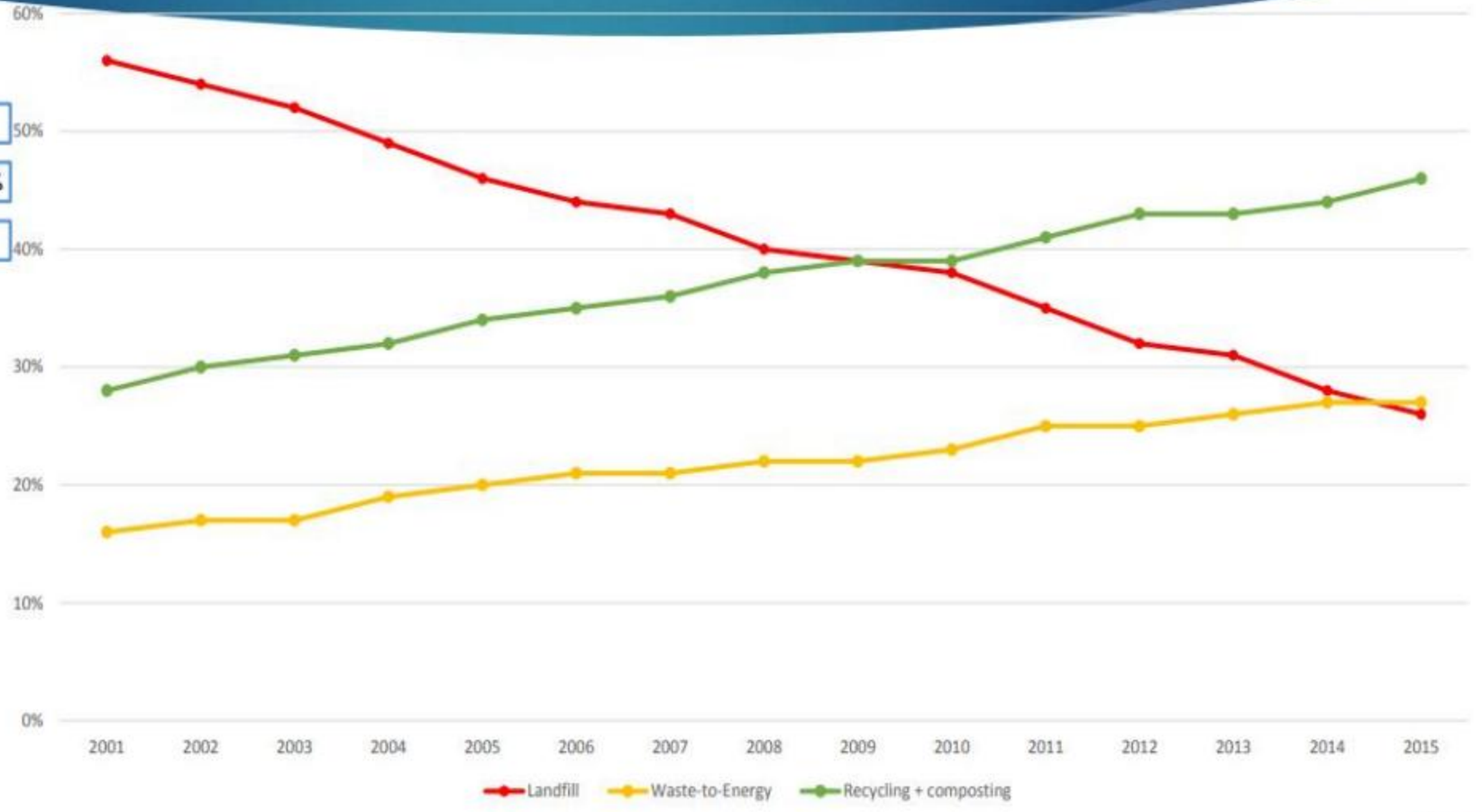
*: last available data

https://www.youtube.com/watch?v=_7SsOuGwUKQ

Municipal waste treatment trends 2001-2015 EU 28

Graph by CEWEP,
Source: EUROSTAT 2017

- Landfilling -30%
- Waste-to-Energy +11%
- Recycling +18%



CEWEP

PRAŽSKÉ SLUŽBY, a.s.

MSW Energy Recovery

(thermal treatment, thermochemical process!)

INCINERATION

- Incineration is a high temperature waste treatment process (>850ºC) that involves the controlled combustion (**in excess of oxygen or air**) of combustible substances contained in waste materials.
- 900°C - 1300°C

- Most integrated Waste-to-Energy technology for MSW
- High emissions (dependent on technology)

Combustible waste:

- plastic, paper, tires, fibers, organics…

- different characteristics (moisture, calorific value, chemical composition)

Waste Treatment Thermal Methods

INCINERATION

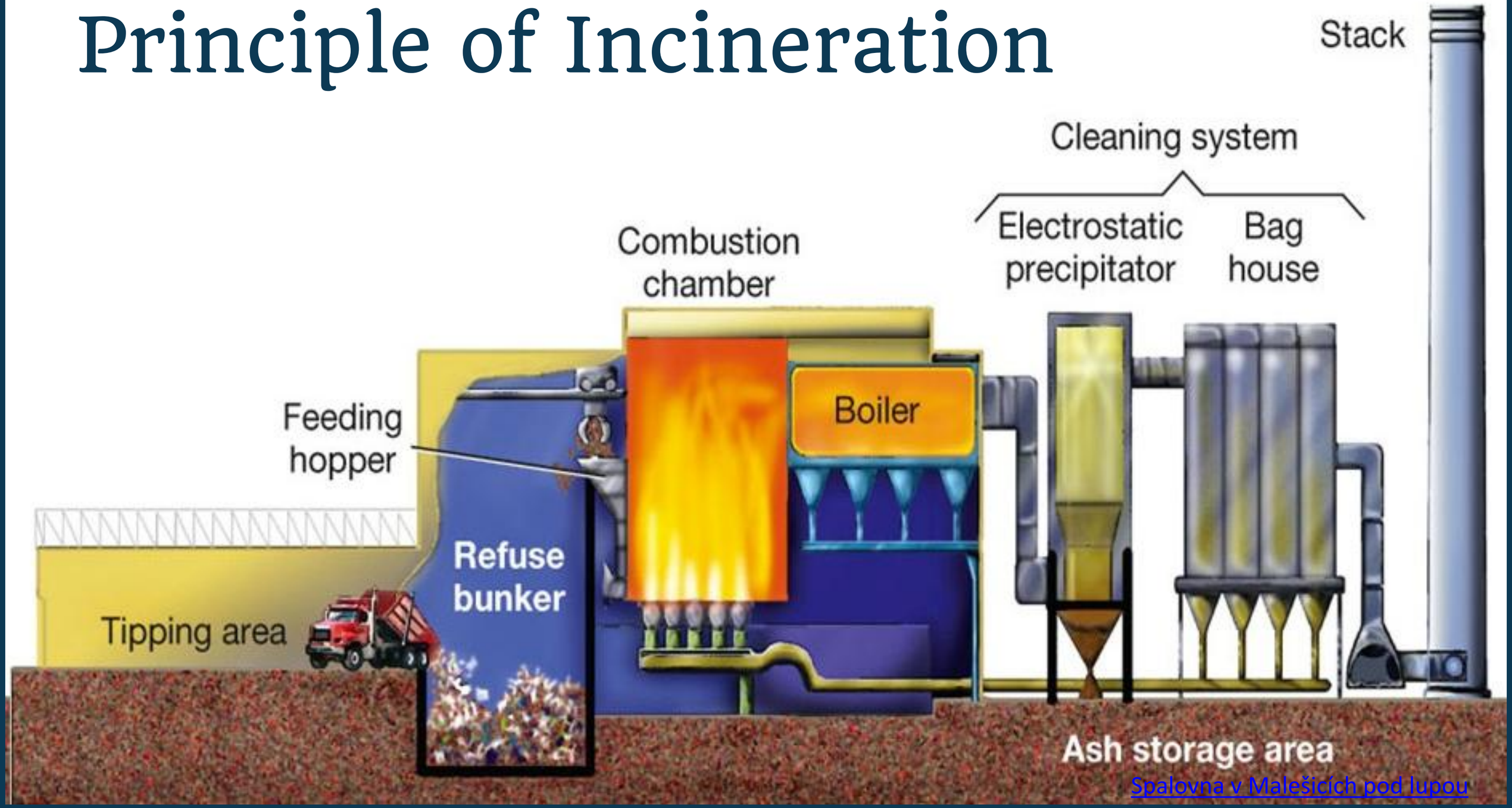
- Immediately reduce of waste
  - volume up to 90-95%
  - mass up to 80-85%

- Waste turned into heat, ash and flue gas
  - Heat: water/space heating, electricity (how?)
  - Production of bottom ash/slag (construction material), recycling of metals (resource)

  - Ash contain heavy metals
  - Flue gas contain toxins

  destruction of hospital, industrial waste…

Principle of Incineration



Spalovna v Malešicích pod lupou

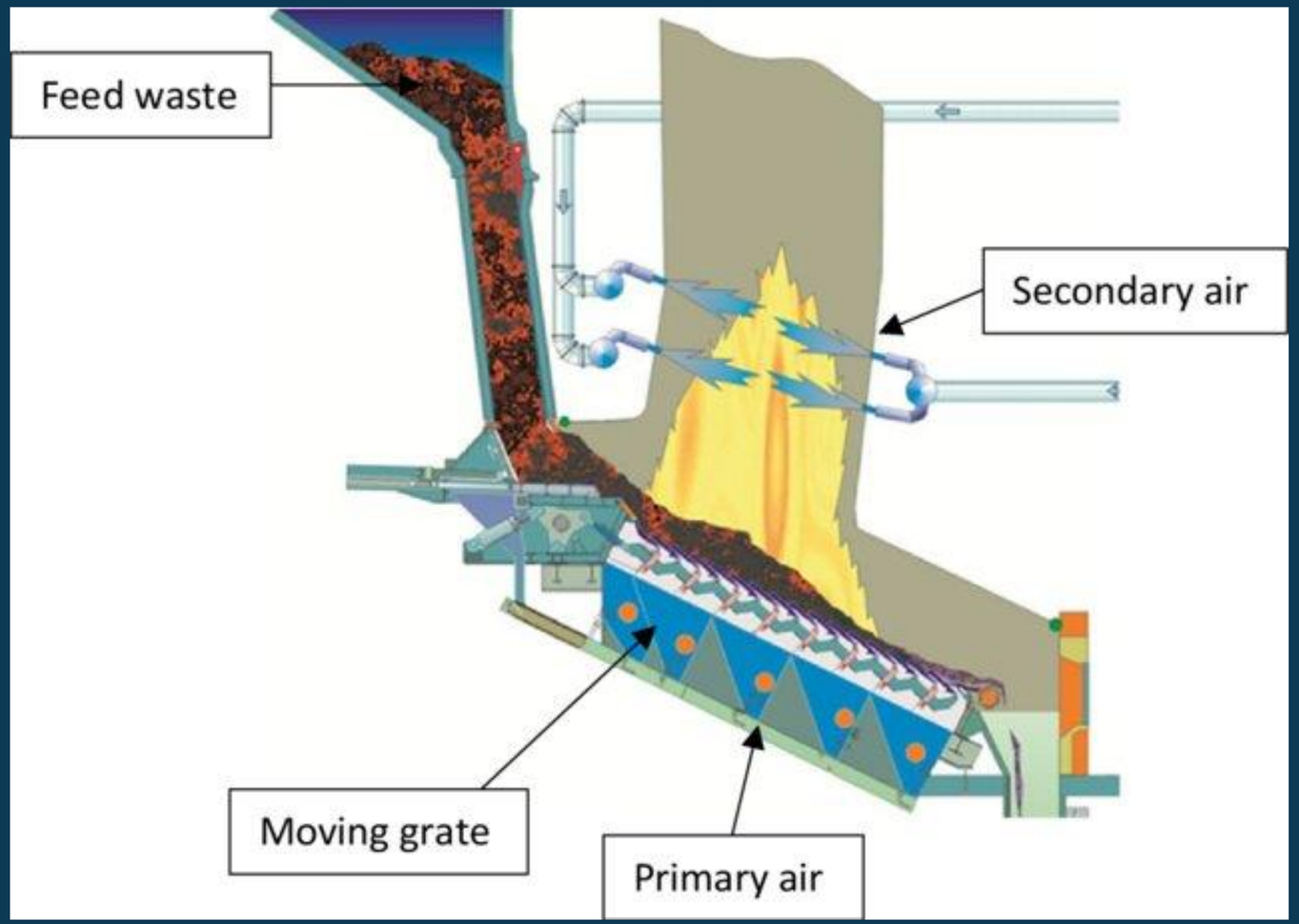
Waste Treatment Thermal Methods

INCINERATION

- Concerns about the environment
  - Underdeveloped facilities
  - No proper treatment
  - Low gas cleaning

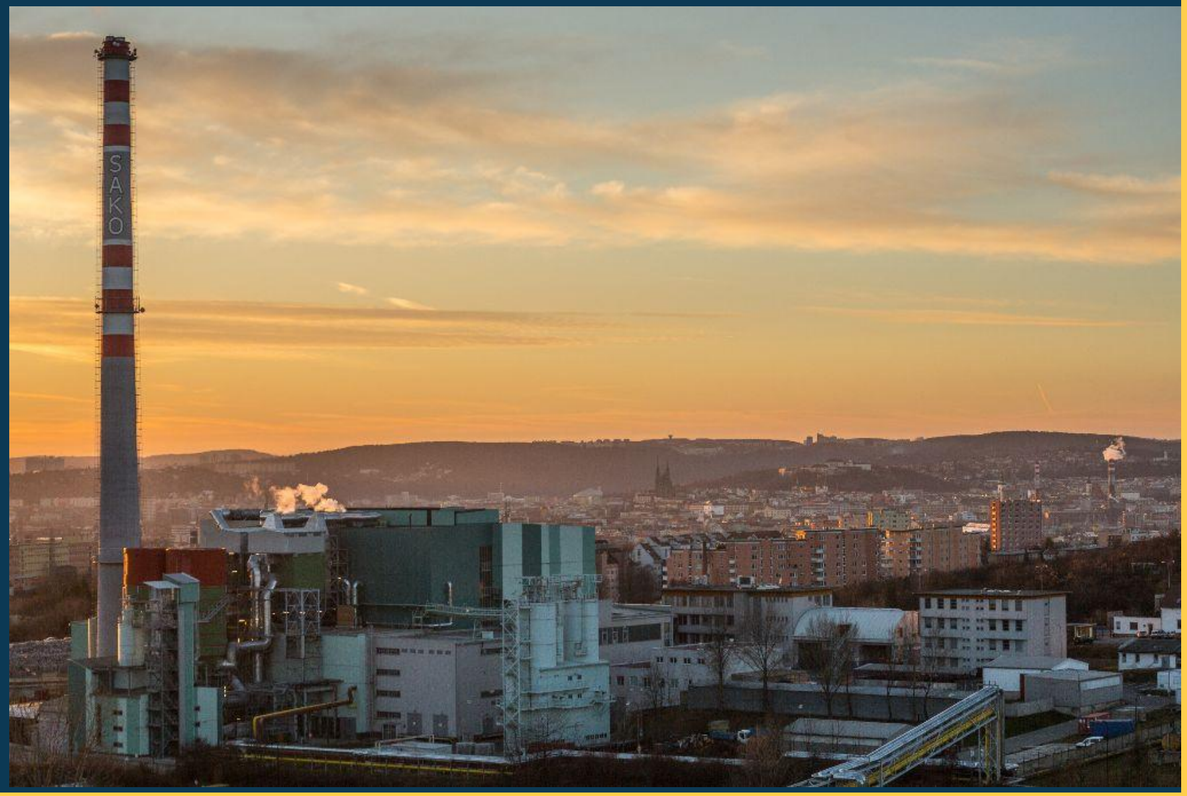
Waste Treatment Thermal Methods
INCINERATION

- Variation of plant designs
  - Moving grate
  - Fixed grate
  - Rotary-kiln
  - Fluidized bed



Waste Treatment Thermal Methods
INCINERATION

- Flue gas cleaning
  - Represent 70 % of plant
  - Particle filtration
    - Electrostatic precipitators (ESP)
    - Baghouse filters
  - Chemical cleaning
    - Acid gas scrubbers

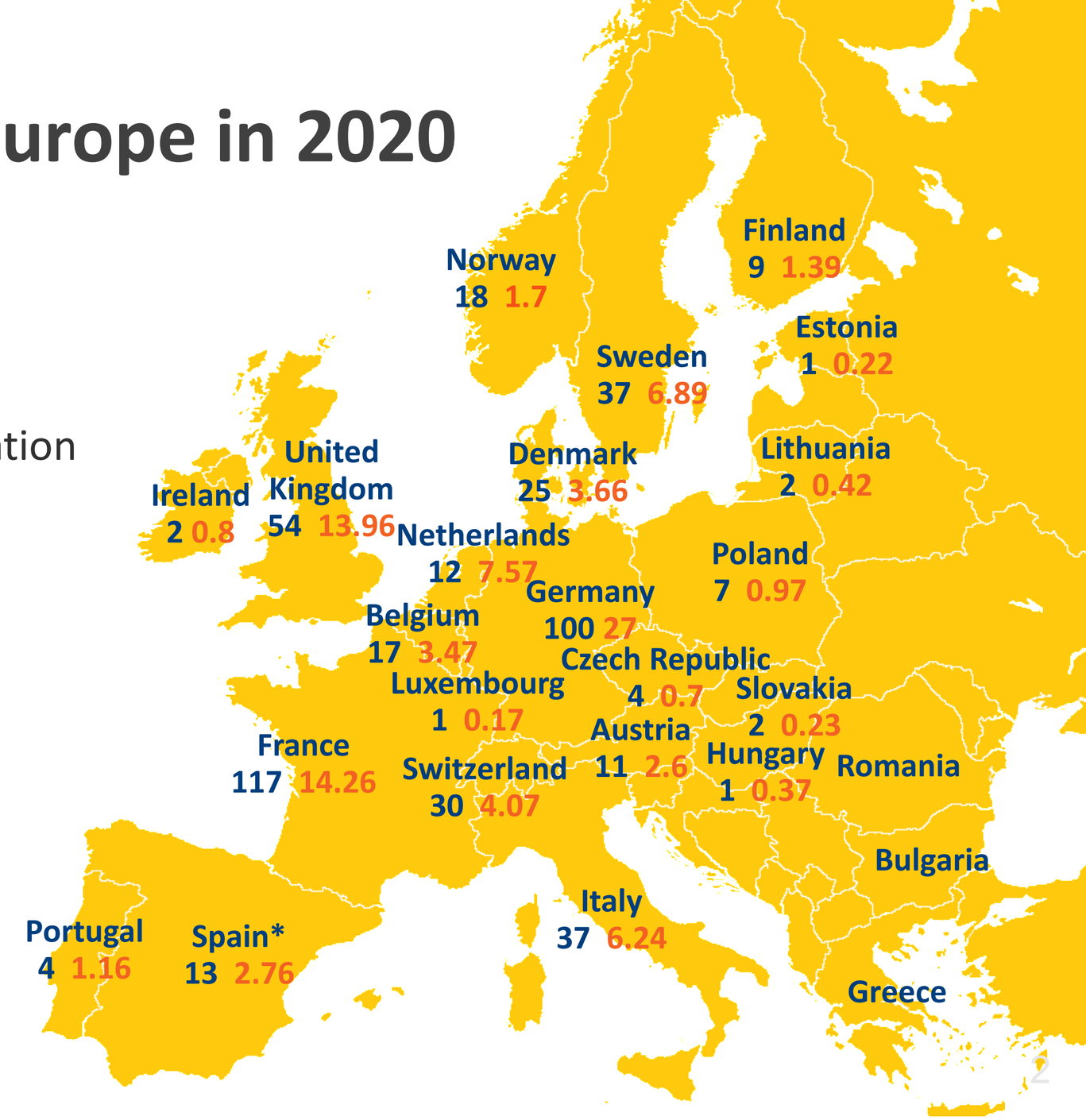


Waste-to-Energy in Europe in 2020

- WtE Plants operating in Europe (not including hazardous waste incineration plants) : **504**
- Waste thermally treated in WtE plants (in million tonnes): **101**

Data supplied by CEWEP members and national sources

***: Includes plant in Andorra and SAICA plant**



CEWEP Confederation of European Waste-to-Energy Plants

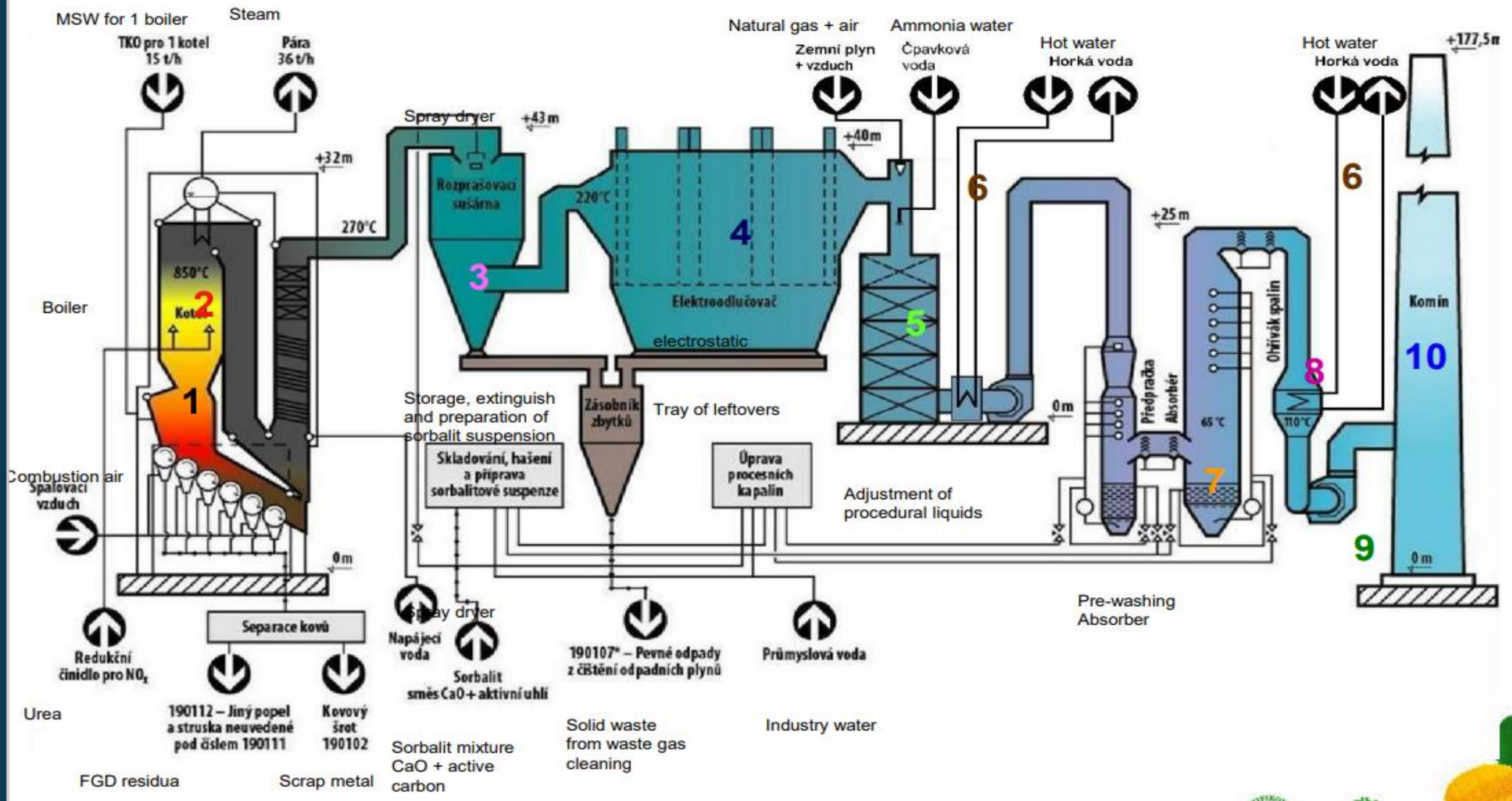
Real example of Incineration

ZEVO Malešice Prague

- 1997 launch of heat production
- 2001 flue gas cleaning application
- 2011 cogeneration electricity production
- 2024? additional capacity for waste combustion

Technological Scheme of ZEVO today

1.Incineration 2.SNCR DeNOx 3.Semidry absorption 4.ESP 5.SCR DeDiox/DeNOx
6.Heat recuperation 7.Wet flue gas washing 8.FG reheating 9.Flue gas fan 10.Chimney



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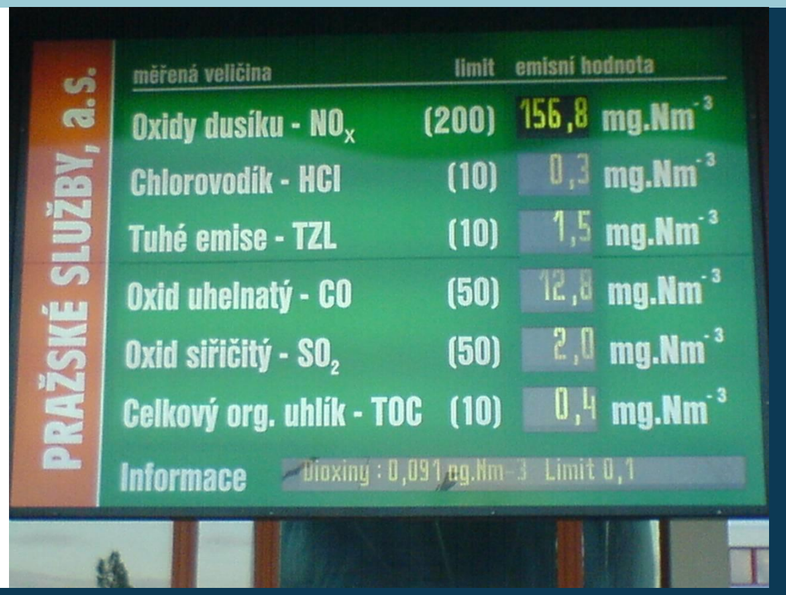
Description of the ZEVO Technology

- Checking the entire waste for sources of ionising radiation
- Weighing and crushing of voluminous waste
- Storage of waste in above ground dump
- Technology…
  - Incineration with steam generation
  - Steam 3x38 t/h, pressure 1,22 MPa, temperature 235°C
  - 5-step flue gas cleaning
  - Heat recuperation from flue gas
  - Steam utilization – Combined heat and power generation
  - 17,5 MW electrical output, 35 MW thermal output
  - Separation of iron scrap from incinerator bottom ash (slag)

- Heat production/consumption 850 TJ/60 TJ/year
- Electricity production/consumption 65 GWh/25GWh/year
- Continuous monitoring of emissions

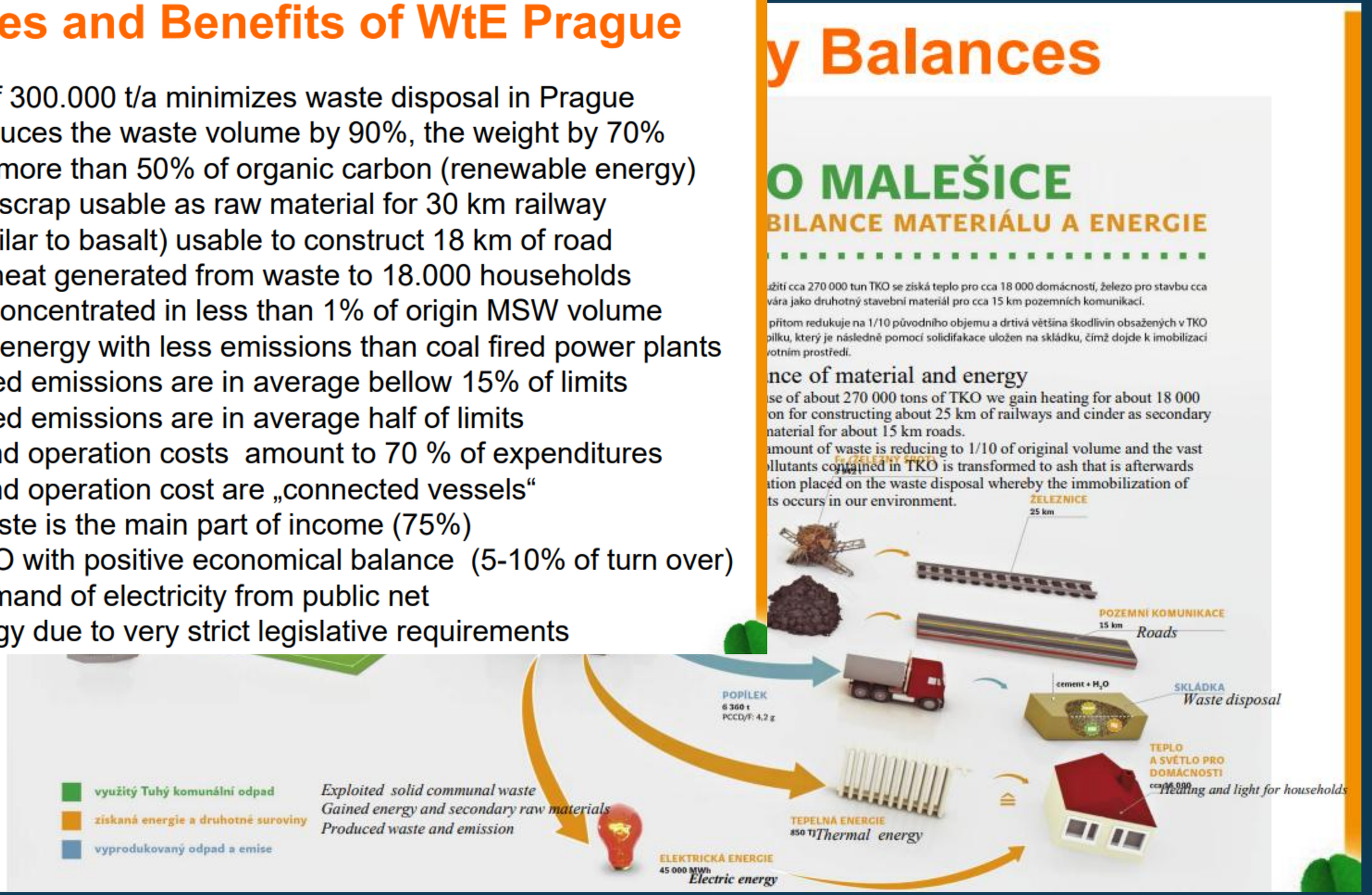


Material and Energy Balances

https://www.youtube.com/watch?v=r-q5V6LDxEY

Balances and Benefits of WtE Prague

- WtE capacity of 300.000 t/a minimizes waste disposal in Prague
- Incineration reduces the waste volume by 90%, the weight by 70%
- MSW contains more than 50% of organic carbon (renewable energy)
- Separated iron scrap usable as raw material for 30 km railway
- Innert slag (similar to basalt) usable to construct 18 km of road
- Electricity and heat generated from waste to 18.000 households
- Pollutants are concentrated in less than 1% of origin MSW volume
- WtE generates energy with less emissions than coal fired power plants
- 7/11 of controlled emissions are in average bellow 15% of limits
- 4/11 of controlled emissions are in average half of limits
- Depreciation and operation costs amount to 70 % of expenditures
- Depreciation and operation cost are „connected vessels“
- Gate fee for waste is the main part of income (75%)
- Operating ZEVO with positive economical balance (5-10% of turn over)
- No external demand of electricity from public net
- Clean technology due to very strict legislative requirements



Fakulta tropického zemědělství

HEATING VALUE OF MUNICIPAL SOLID WASTE

Journal of Material Cycles and Waste Management (2023) 25:550–564
https://doi.org/10.1007/s10163-022-01534-2

REGIONAL CASE STUDY

Evaluation of properties and composition of the mixed municipal waste fine fraction, the case study of Czech Republic

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Abstract
Estimation of mixed municipal waste composition is important for the option of suitable waste treatment. Many studies have presented their methodologies for analysing the composition of mixed municipal waste, but no uniform approach is available. The significant part of mixed municipal waste can be the fine fraction, depending on the analysis approach used. Nevertheless, the more detailed composition of fine fraction is unknown. This contribution aims to present chemical analysis of fine fraction of mixed municipal waste obtained from the city of Brno, Czech Republic. The mixed municipal waste in study area consists of about 25% fine fraction. The amount of moisture and the combustible part of the waste are first monitored in fine fraction. The elemental composition of non-combustible waste and its phase composition is further evaluated. The approach to chemical analysis has been designed to be easily repeatable and can complement routine manual waste analyses. The results of the analysis in the studied area showed the potential for energy utilisation of the fine fraction, even if the waste separation is increased. In addition, fine fraction contains metals suitable for material recovery, which can be separated from the slag after incineration and thus promote the material recovery of waste.

Keywords Fine fraction · Mixed municipal waste · Waste composition · Waste treatment · Combustible waste

Introduction

Within Circular Economy Package (CEP), EU member states commit to waste treat efficiently in accordance with waste management hierarchy [1]. The transition to a circular economy is ensured by the partial targets set out in the CEP. The year 2035 is crucial when landfilling of municipal solid waste (MSW) will be limited to 10% [2], see Fig. 1. The horizontal line shows this landfilling target for 2035. It is obvious that in 2020 most EU member states do not meet this target of 10% landfilling. In this contribution, data on the composition of mixed municipal waste (MMW) in a specific Czech city will be processed. As can be seen in Fig. 1, 49.4% of MSW is currently landfilled in the Czech Republic; therefore, it is desirable to address the potential for greener waste treatment. From the MSW perspective, recycling targets for 2025, 2030, 2035 are also crucial [3], see Fig. 2. The horizontal lines in Fig. 2 illustrate recycling targets that are not met for most EU member states in 2020. For the Czech Republic it is only 33.8% of MSW recycling in 2020. The trend in recent years has led to changes in waste treatment according to the waste management hierarchy, MSW treatment in 2017 was illustrated in the study [4]. Most EU member states still have a long way to go to achieve EU targets.

The increase in recycling is closely linked to the efficiency of MSW separation. MSW that has not been separated is collected as MMW; the MMW is often transported directly to waste incinerators or landfills. This precludes its recycling though the MMW is composed of separable waste fractions (paper, plastic, glass etc.), apart from metals which can be separated from the slag after incinerating. So, the potential for more efficient MSW separation and subsequent recycling is hidden in MMW composition. In the past, a number of studies have been devoted to the composition of MMW. A substantial part of MMW is the fine fraction; nevertheless, the composition of the MMW fine fraction is

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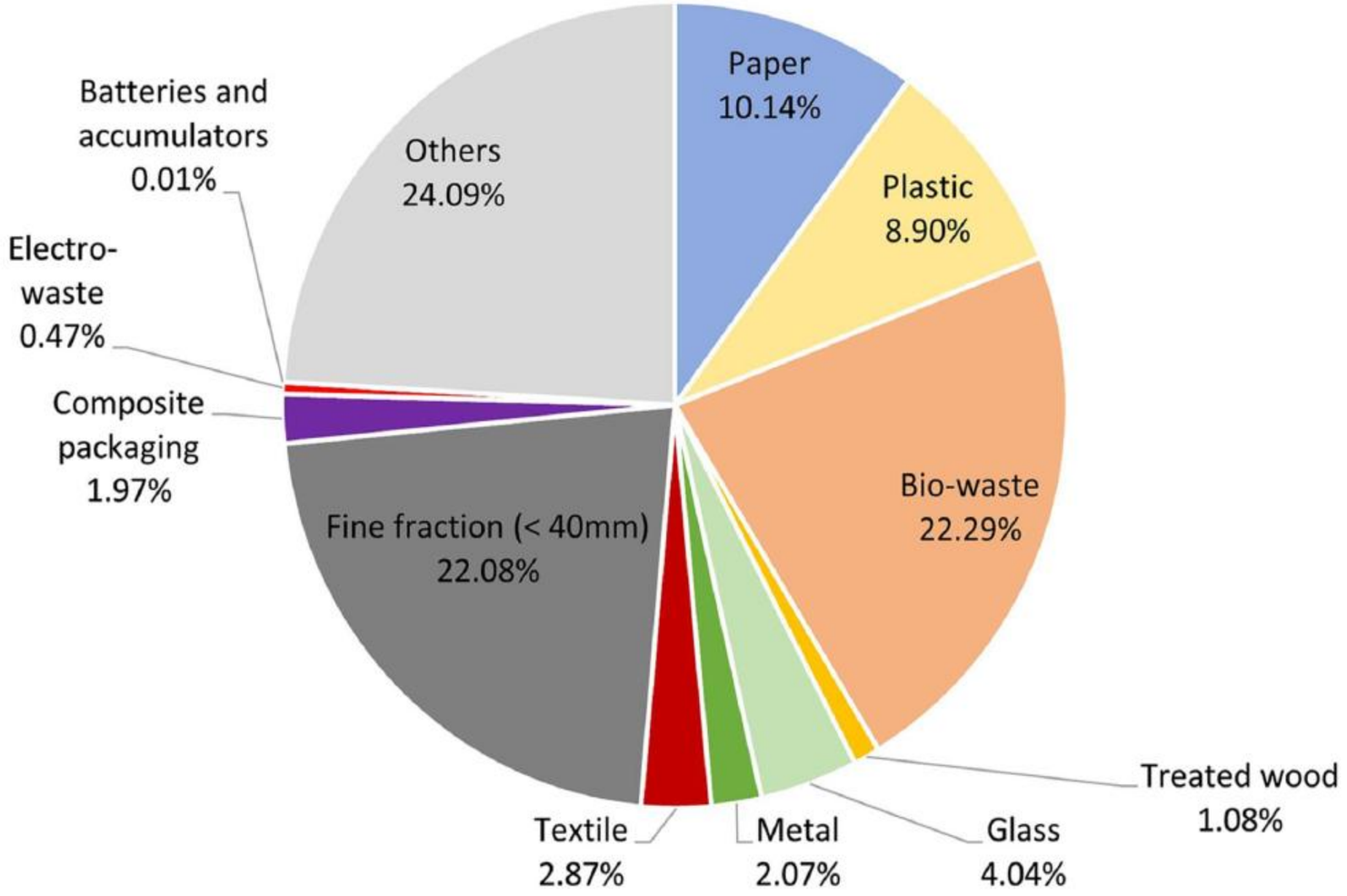

Fig. 1 MMW composition in winter season 2020, the city of Brno, Czech Republic, urban building (Source: Palovčík et al. 2022)

m=1,000 kg

TYPE	%	MJ/kg	MJ
Paper	10	16	
Plastic	9	32	
Bio-waste	22	5	
Wood	1	18	
Textile	3	18	
Composite packaging	2	15	
Glass, metal, electro waste, batteries and accumulators, fine fractions, others	53	0	

m=1,000 kg

TYPE	%	MJ/kg	MJ
Paper	10	16	1,600
Plastic	9	32	2,880
Bio-waste	22	5	1,100
Wood	1	18	180
Textile	3	18	540
Composite packaging	2	15	300
Glass, metal, electro waste, batteries and accumulators, fine fractions, others	53	0	0

Why Is Waste Management Important?

It's more than just a hobby

Waste incineration vs landfilling??

- Responsibility
- Sustainability
- Environment
- Health

Thank You for Attention!

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