# Development and Public Acceptance of Economically Successful Integration of Waste-to-Energy in Austria

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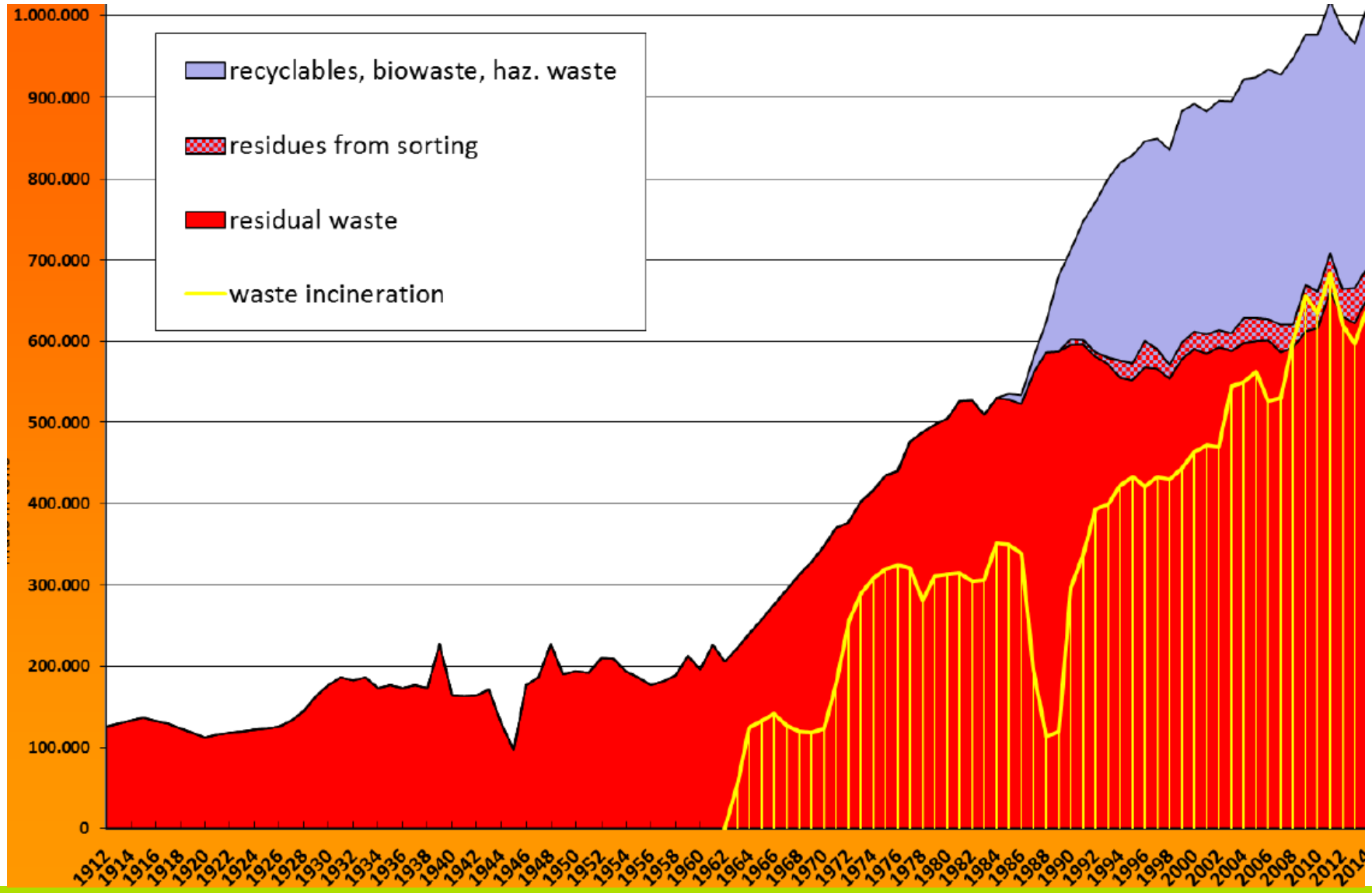
# Municipal Solid Waste Management Vienna, since 1912



# Historic Development of Waste Management Policy and the Legal Framework in Austria

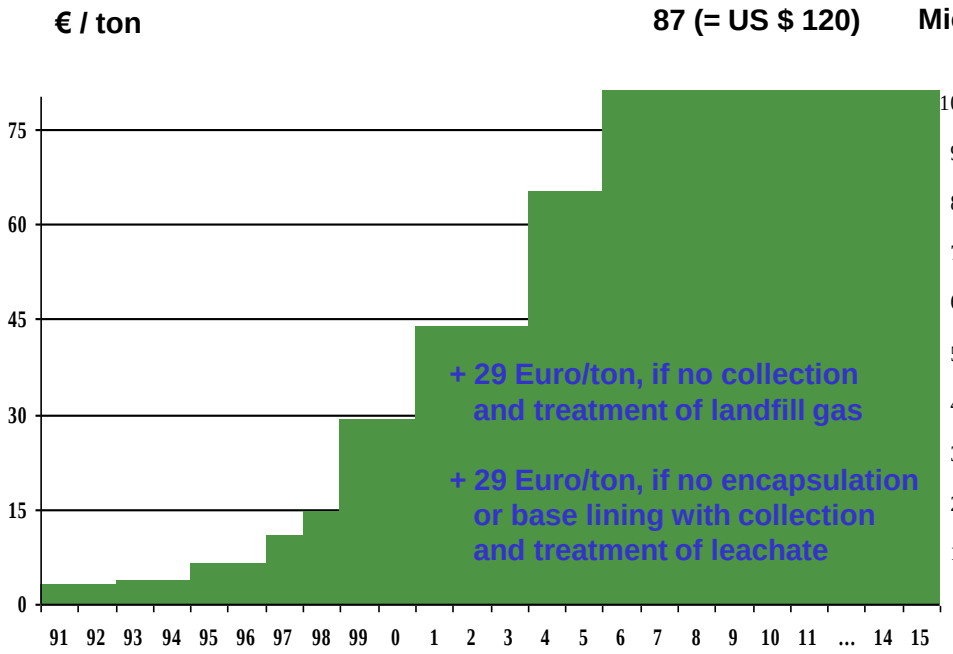
**Integrated waste management began in Austria about 33 years ago with increasing public awareness, environmental regulations and subsidies:**

- **Hazardous and Special Waste Management Act,** 1983
- **Federal legislation on the Environmental Protection Fund,** 1983
- **Guidelines for Waste Management in Austria 1988**
- Decree on separate collection of **Bio-Wastes**, 1991
- Decree on separation of **Construction and Demolition** waste, 1991
- Federal legislation on clean-up of landfills and contaminated sites, 1990 (including a **disposal tax on landfill operations** for clean-up activities)
- **Ban on disposal of hazardous wastes in landfills** (except of inorganic wastes encapsulated in closed salt formations) by July 2001
- Decree on landfills including the **ban on disposal of wastes exceeding 5 % TOC (Total Organic Carbon)** for new landfills by the beginning of **1997** and limitation for existing landfills until beginning of 2004 (limited exemptions until end of 2008, and some limited exemptions for stabilized residues from MBT Mechanical Biological Treatment).

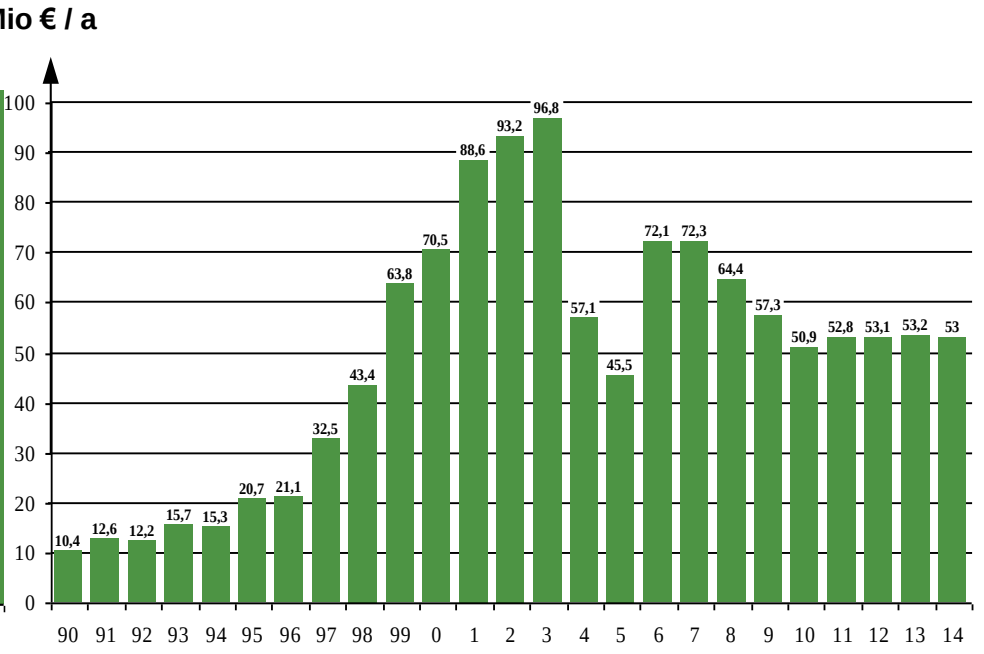
# Development of the Special Landfill Tax in Austria

**The development of waste management in Austria towards reduction of landfilled waste as well as recycling and recovery has been very effectively supported by a special landfill tax**

## Landfill tax in € / ton of waste (e. g. municipal waste)



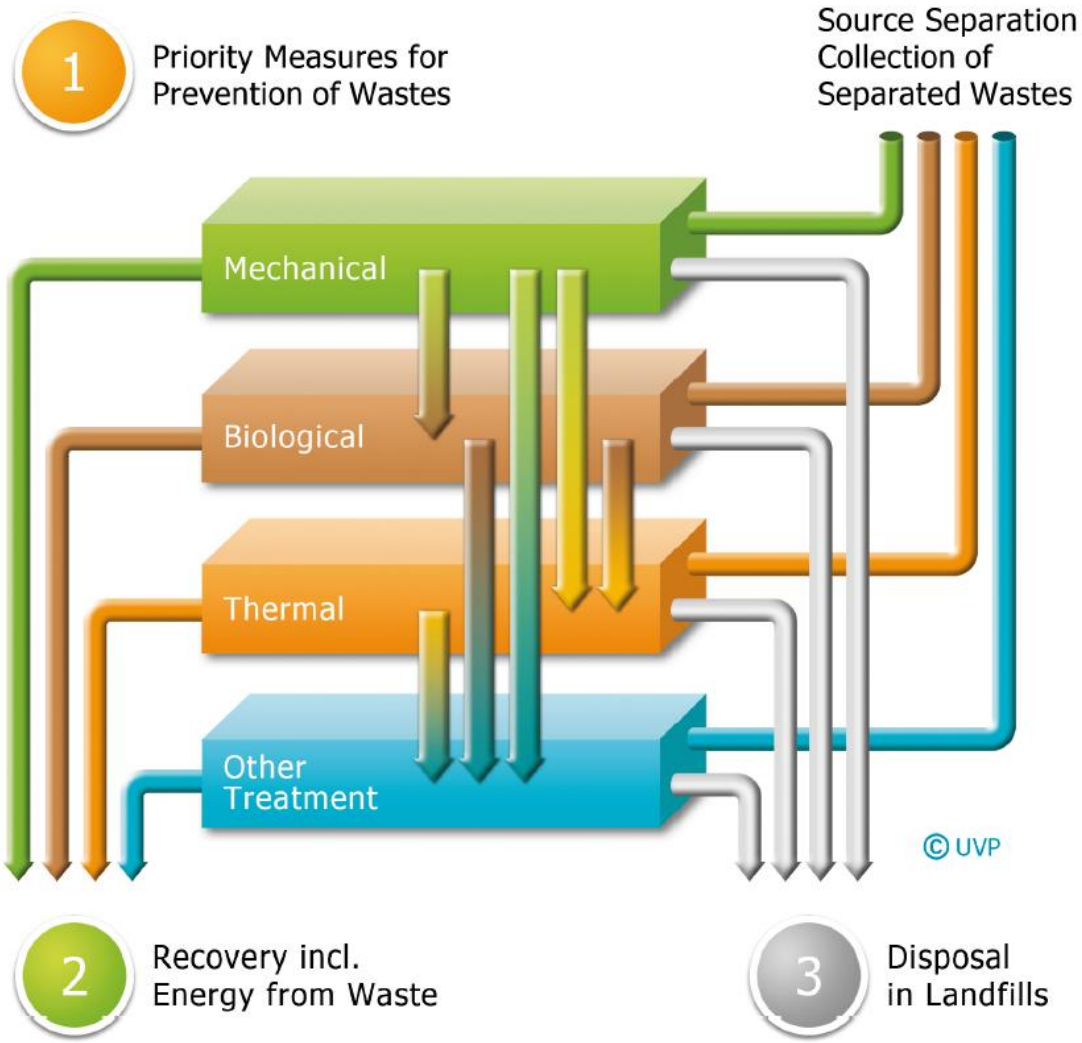

## Revenue from landfill tax in Million € / a (total revenue per year)




**3 criteria:**

- **Foreseeable for (at least 10) 20 years**
- **Environmental standard of the landfill**
- **Quality of waste to be landfilled**

# Environmental Consulting & Engineering for Future-oriented Integrated Systems for Sustainable Waste Management




**Different technologies are needed for specific wastes in an integrated treatment system.**

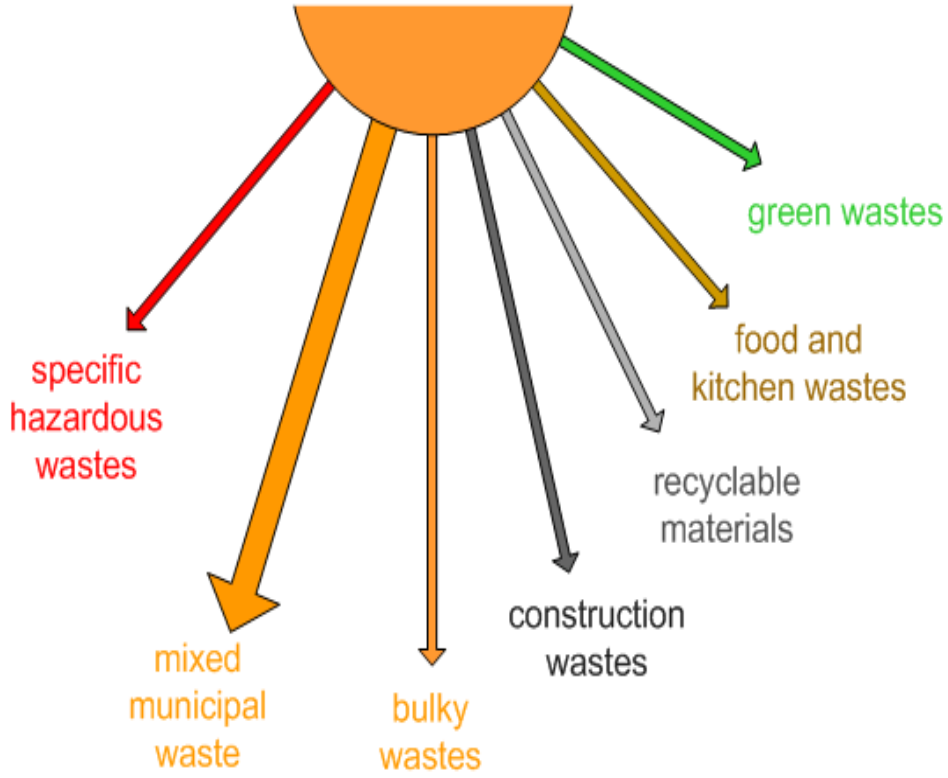
**Successful project design must be based on 1st and 2nd Law of Thermodynamics !**

**Our project designs are profitable for our clients and good for the environment.**

**(UVP, since 1991)**

# Source Separation & Separate Collection of Municipal Wastes for Recovery of Materials and Energy

## Separated collection of



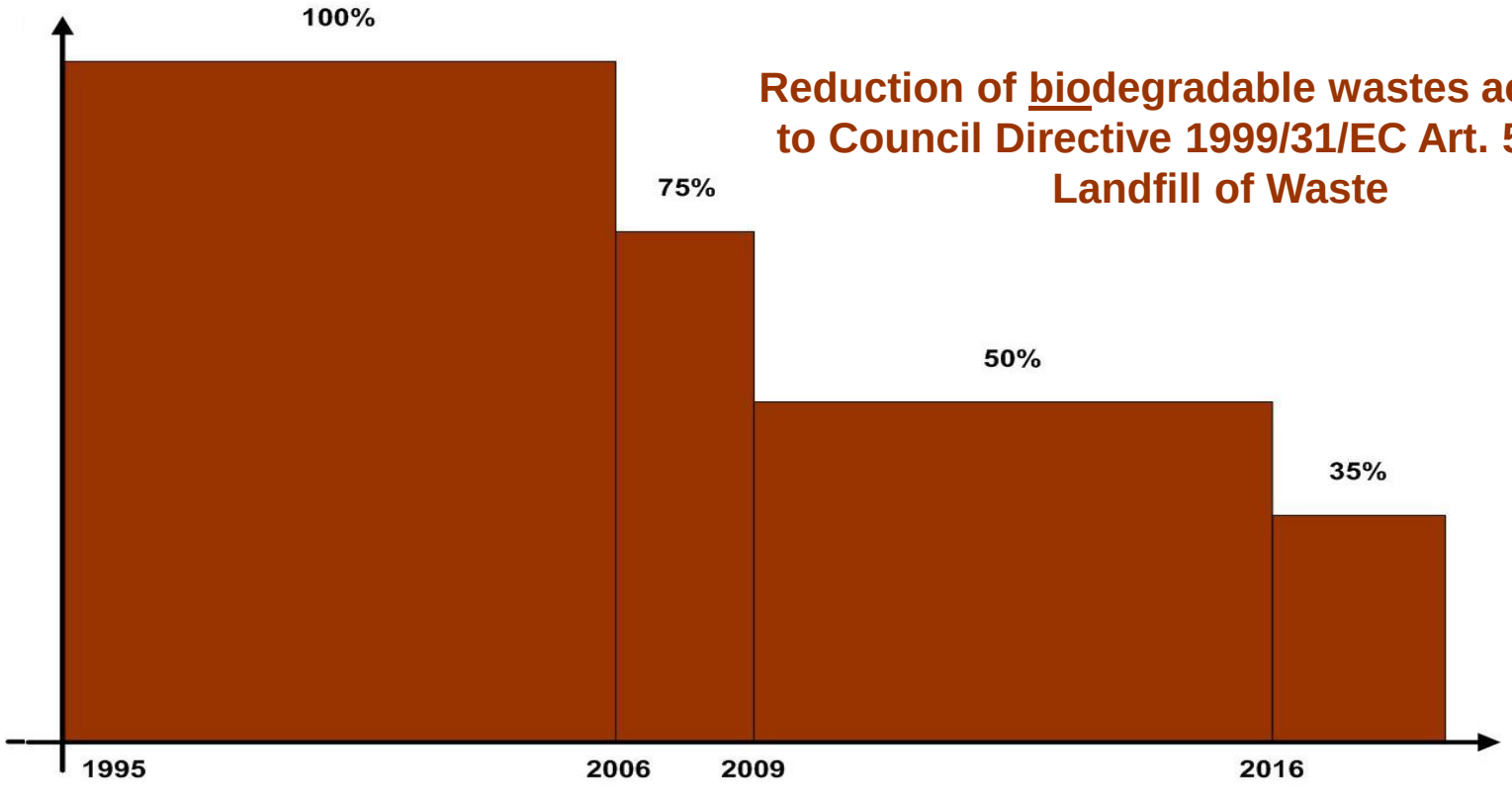

***Separate collection and recycling must be complemented by waste-to-energy***

| Type of waste fraction | Incineration in % weight | Comments |
|---|---|---|
| Paper, Cardboard | approx. 5 – 15 | Sorting and processing |
| Plastics, Composites | approx. 30 – 70 | “Plastic Packaging Bag“, “Oekobox“ |
| Packaging glass, Laminated glass | approx. 2 – 10 | Plastics, Composite films |
| Construction waste | approx. 10 – 40 | Wood, shavings, plastic pipes, foils, packaging, carpeting |
| Biological waste | approx. 5 – 10 | Plastics, non-biodegradable materials |
| Bulky waste, scrap tires | approx. 70 – 90 | Without metals and recyclable fractions |
| Non-recyclable garbage | approx. 45 – 98 | Without metals, due to biological processes (MBT) |

# EU - Limitation for Solid Waste Disposal in Landfills

**DIRECTIVE 2008/98/EC of 19 November 2008 on waste:**

**… that waste prevention should be the first priority of waste management, and that re-use and material recycling should be preferred to energy recovery from waste, where and insofar as they are the best ecological options.**




**Reduction of biodegradable wastes according to Council Directive 1999/31/EC Art. 5 on the Landfill of Waste**

# Treatment of Municipal Solid Waste in Different Countries within the European Union

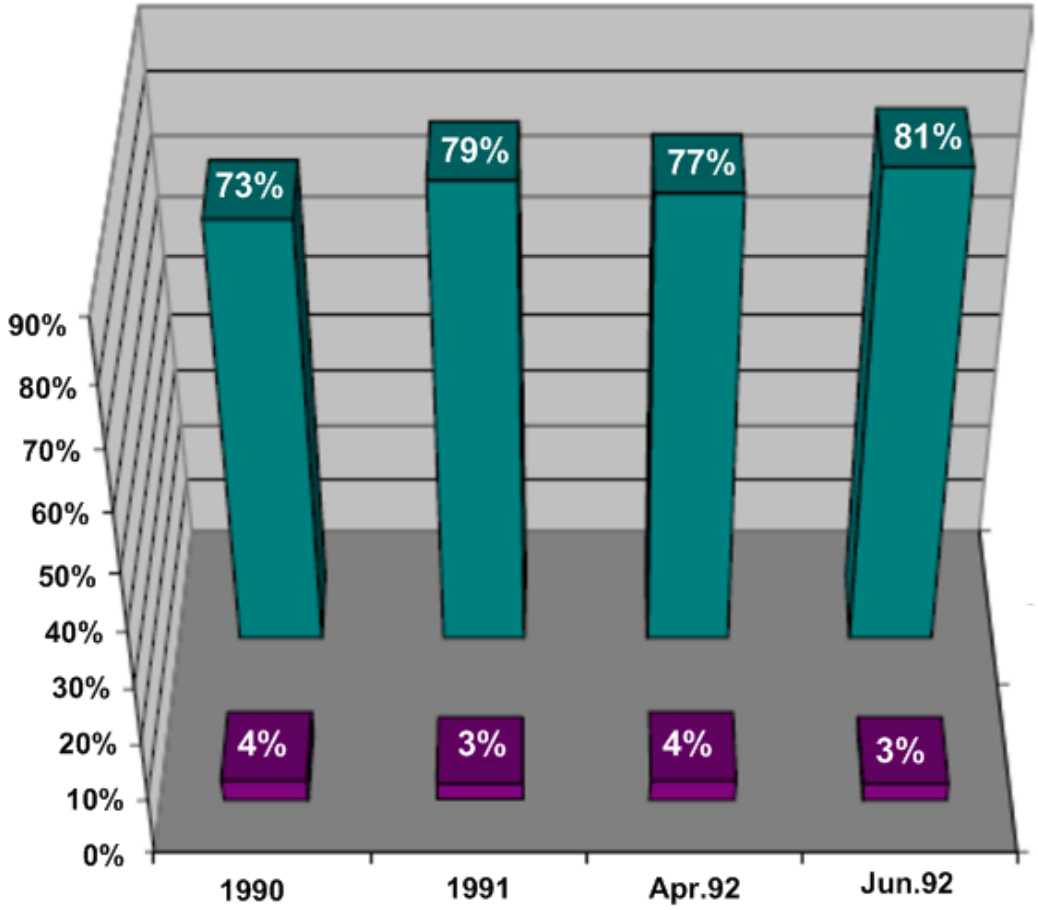
| | Municipal solid waste in kg per person | Treatment of municipal solid waste in 2014 (in %) | | | |
|---|---|---|---|---|---|
| | | *Land filling* | Incineration | Recycling | Composting |
| **Austria** | 578 | *4* | 37 | 24 | 35 |
| **Germany** | 617 | *0* | 35 | 47 | 17 |
| **Spain** | 449 | *60* | 10 | 20 | 10 |
| **France** | 530 | *28* | 34 | 21 | 17 |
| **Portugal** | 440 | *50* | 24 | 13 | 13 |
| **Italy** | 491 | *38* | 21 | 26 | 15 |
| **Greece** | 506 | *81* | 0 | 16 | 4 |
| **Bulgaria** | 432 | *70* | 2 | 25 | 3 |
| **Romania** | 272 | *97* | 0 | 3 | 0 |
| **Hungary** | 378 | *65* | 9 | 21 | 5 |
| **Slovenia** | 414 | *38* | 1 | 55 | 7 |
| **Czech Republic** | 307 | *56* | 20 | 21 | 3 |
| **Poland** | 297 | *63* | 8 | 16 | 13 |
| **Denmark** | 747 | *2* | 54 | 28 | 17 |

Source:EUROSTAT Press release of March 26th 2015

# Municipal Waste-to-Energy: Positive Example
# The Municipal Waste Incineration Plant Spittelau, Vienna

| | |
|---|---|
| Start of operation: | 1971 |
| (Re-) Start up: | 1989 |
| Re-vamping boilers: | 2013/15 |
| Site: | City of Vienna |
| Technology: | Grate firing |
| Fuel capacity: | 2 x 44.5 MW |
| Efficiency: | approx. 76 % (co-generation of electricity and district heat) |
| Steam production: | 2 x 60.5 t / h (40 bar, 400°C) |
| Average waste throughput: | 250,000 t / a |
| Fuel: | residual municipal solid waste |

# “Published“ vs. “Public“ Opinion on Waste-to-Energy in Vienna




**For** Waste-to-Energy with district heating

**Against** incineration

Source: Löffler, MA22, Vienna

**Austria was the 1st country worldwide with „Zero – Dioxin” Emission (< 0,1 ng TCDD $_{\text{Toxicity-Equivalent}}$ / $m^3_{N,11\%O2}$ – “against” MSW Incineration in Vienna)**
**Spittelau was the 1st Waste Incineration with Catalytic Flue Gas Cleaning and with worldwide respected Architecture of Friedensreich Hundertwasser**

# Integrated Waste-to-Energy at the Industrial Site of Lenzing in the Tourist and (Organic) Farming Region of Salzkammergut, Austria

**The waste-to-energy plant RVL (optional with 100 % to 0% coal) is integrated in the industrial site of Lenzing in Upper Austria with advanced environmental technology to protect the natural environment (incl. organic farming) in the famous tourist region around Lake Attersee.**

**The 3 arguments in public discussions / acceptance:**

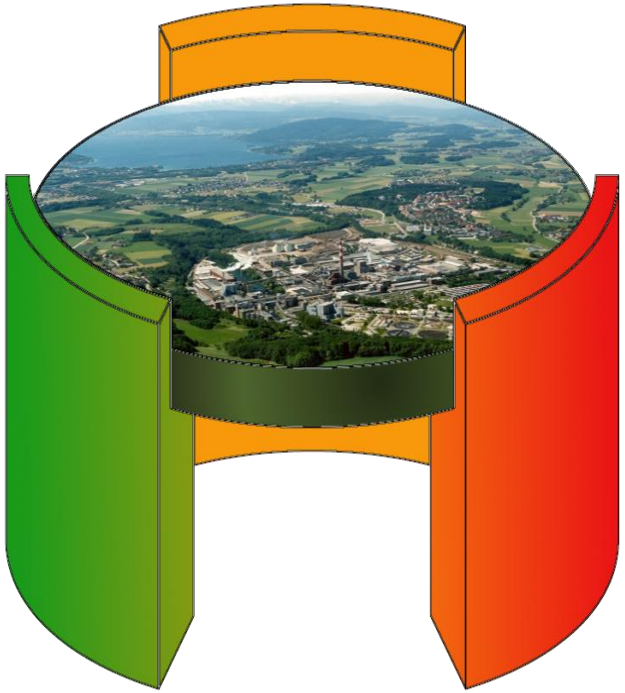
1. **Energy demand (90 MW)**
2. **Reduction of odour ($H_2S$, $CS_2$)**
3. **No landfilling (300.000 t / a)**

# Interdisciplinary Approach for the Implementation of Waste-to-Energy Projects: Example RVL

**legal & social acceptance**

**> 3,300 objections by citizens**
**11 years until final permit**

## Example RVL Lenzing (110 MW)



**ecological requirements**

**economic viability**

**Opposition by “green“ fundamentalists & landfill profiteurs & “miraculous“ new Technologies**

**Best environmental standard and economic performance since 1994/98**

# Example for a Future Perspective: MMK Cardboard Industry with New Energy Center, Frohnleiten, Styria



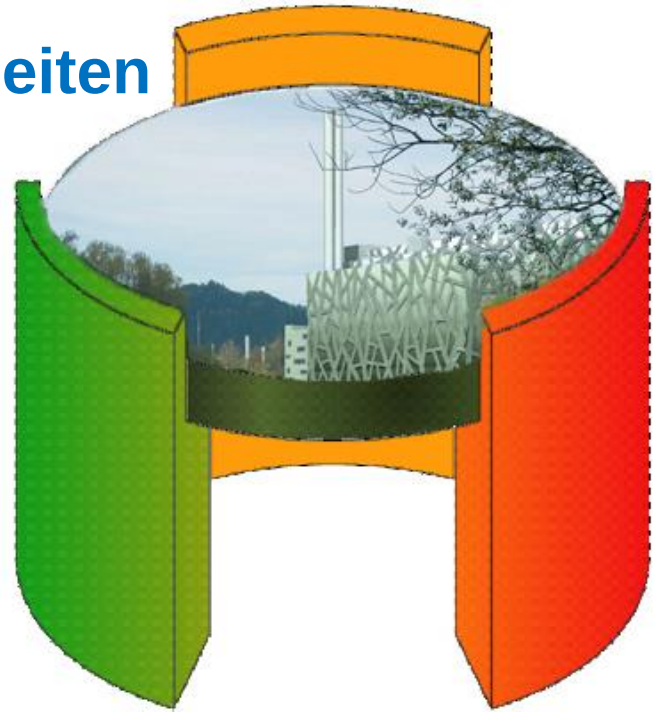
Architekt Hans Gangoly, March 2007

| | |
|---|---|
| **Planning (UV&P):** | **1994; 2005/07** |
| **Technology:** | **Fluidized bed** |
| **Fuel capacity:** | **2 x 80 MW** |
| **Efficiency:** | **ca. 80 % (co-generation)** |
| **Steam production:** | **190 t / h (70 bar, 470°C)** |
| **Average RDF throughput:** | **up to 1.360 t / d** |
| **Fuels:** | **Refuse derived fuel, residues from paper recycling, waste wood, sludge from waste water treatment (biomass, coal)** |

# Interdisciplinary Approach for the Implementation of Waste-to-Energy Projects: Example MMK

**legal & social acceptance**
**0 objections by citizens**
**1 year until final permit**

## Example MMK Frohnleiten (160 MW)



**ecological requirements**

**economic viability**

**Price dumping (landfills in neighbor regions) & high taxation & lack of funding & no green tariffs and carbon credits**

**Proven environmental standard and expected least-cost, but….**

# Necessary Cooperation and Know-how for Successful Implementation of Waste-to-Energy Projects

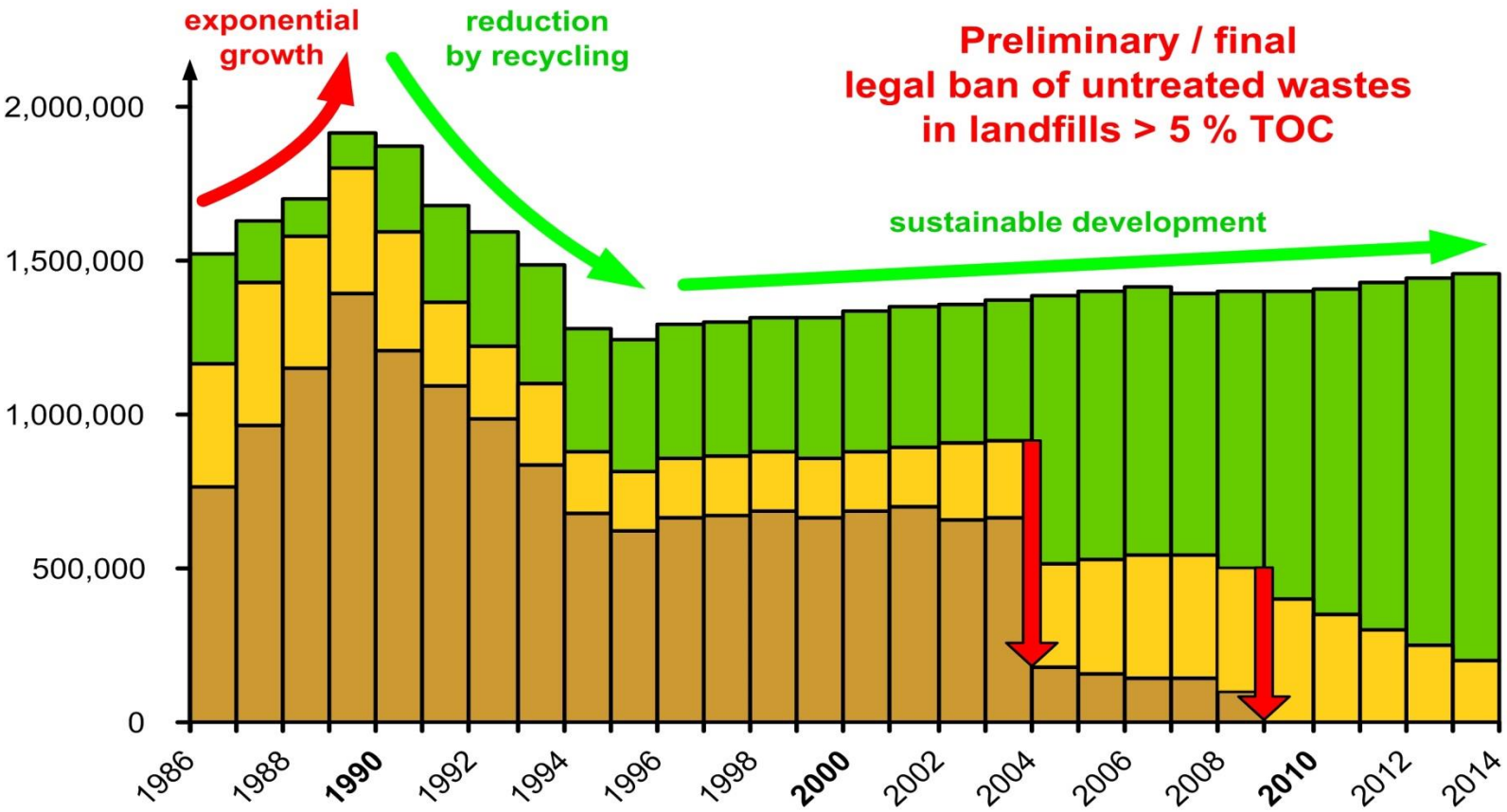
**Financing (co-Financing incl. Subsidies)**
Project Development, Planning, Investments of Equipment and Infrastructure


**Energy Efficiency**
Combined Heat and Power / Continuous Heat Demand

**Waste Management**
Supply of Waste Fuel / Recovery / Disposal of Solid Residues

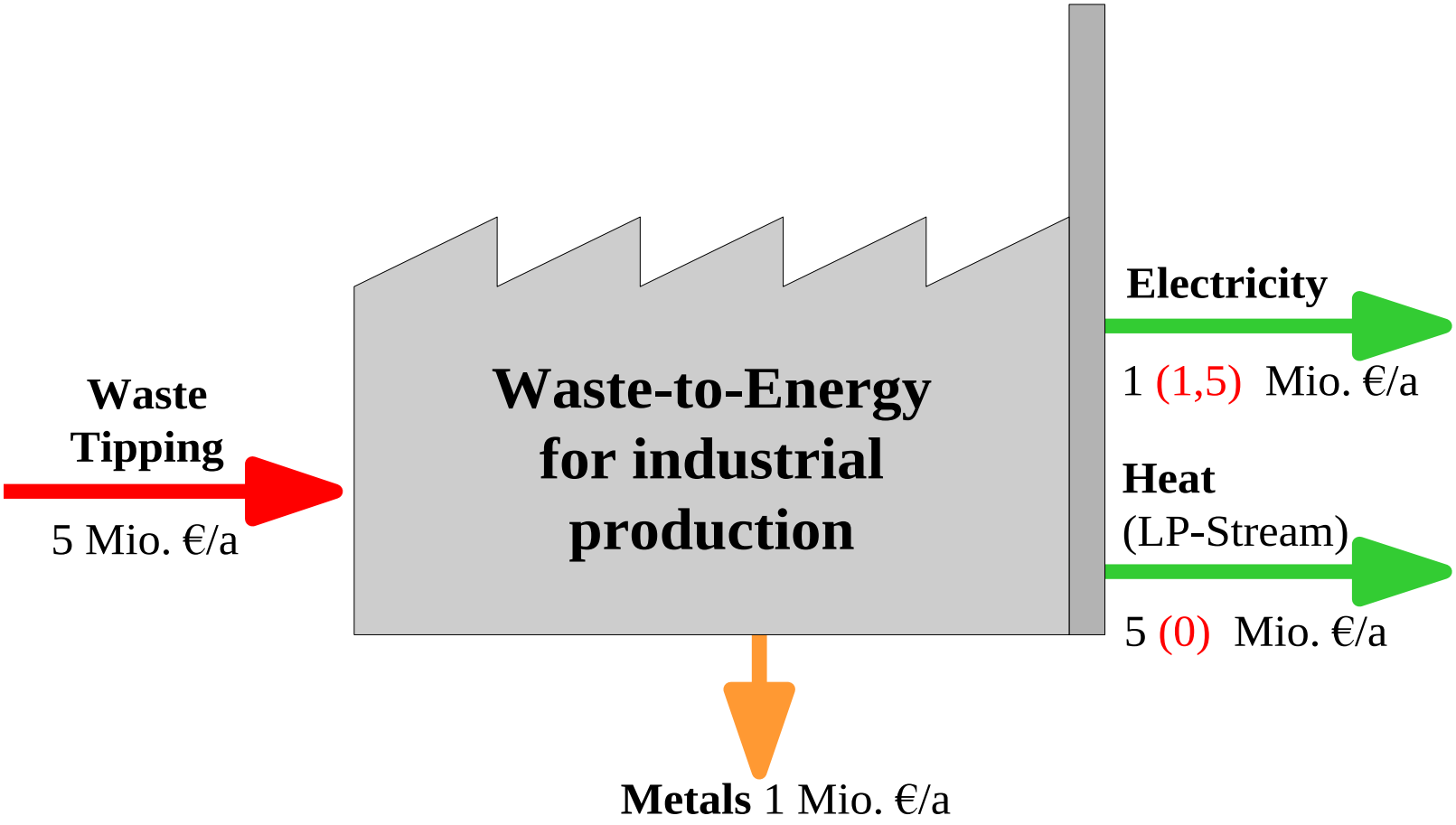
# Energy Recovery and Disposal of Residual Municipal Solid Waste: 30 Years of Development in Austria

**Residual Municipal Solid Waste collected in Austria**
**Figures in tons per year**




Source: Gerd Mauschitz, Klimarelevanz der Abfallwirtschaft IV, Studie im Auftrag des Bundesministeriums für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, 2010

# Sustainable Revenues from Waste-to-Energy in a 40 MW BFB Boiler with Integration to an Industrial Site in Austria (in 2014)

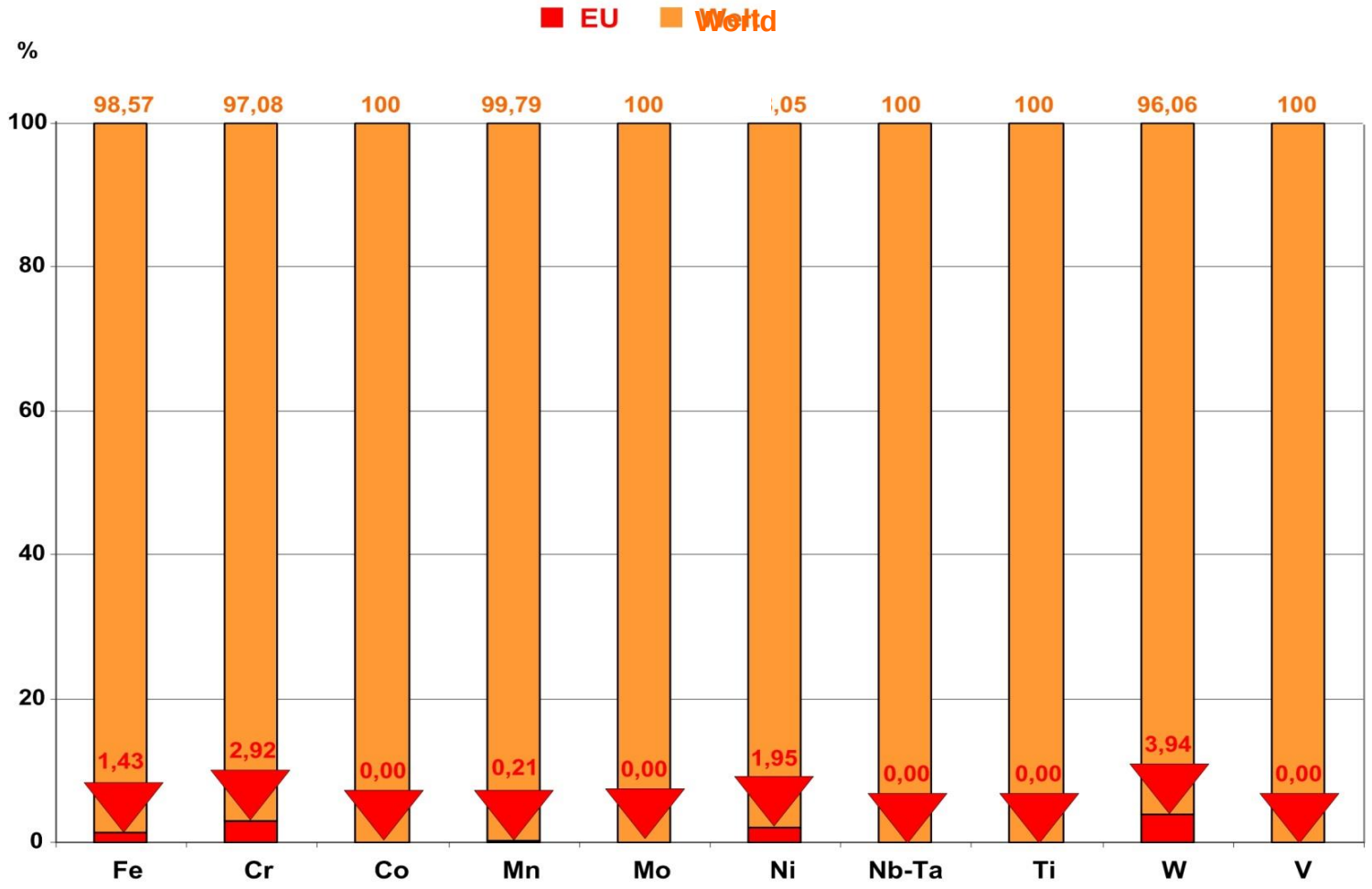



The 3 most important criteria in real estate are: **site, site, site**

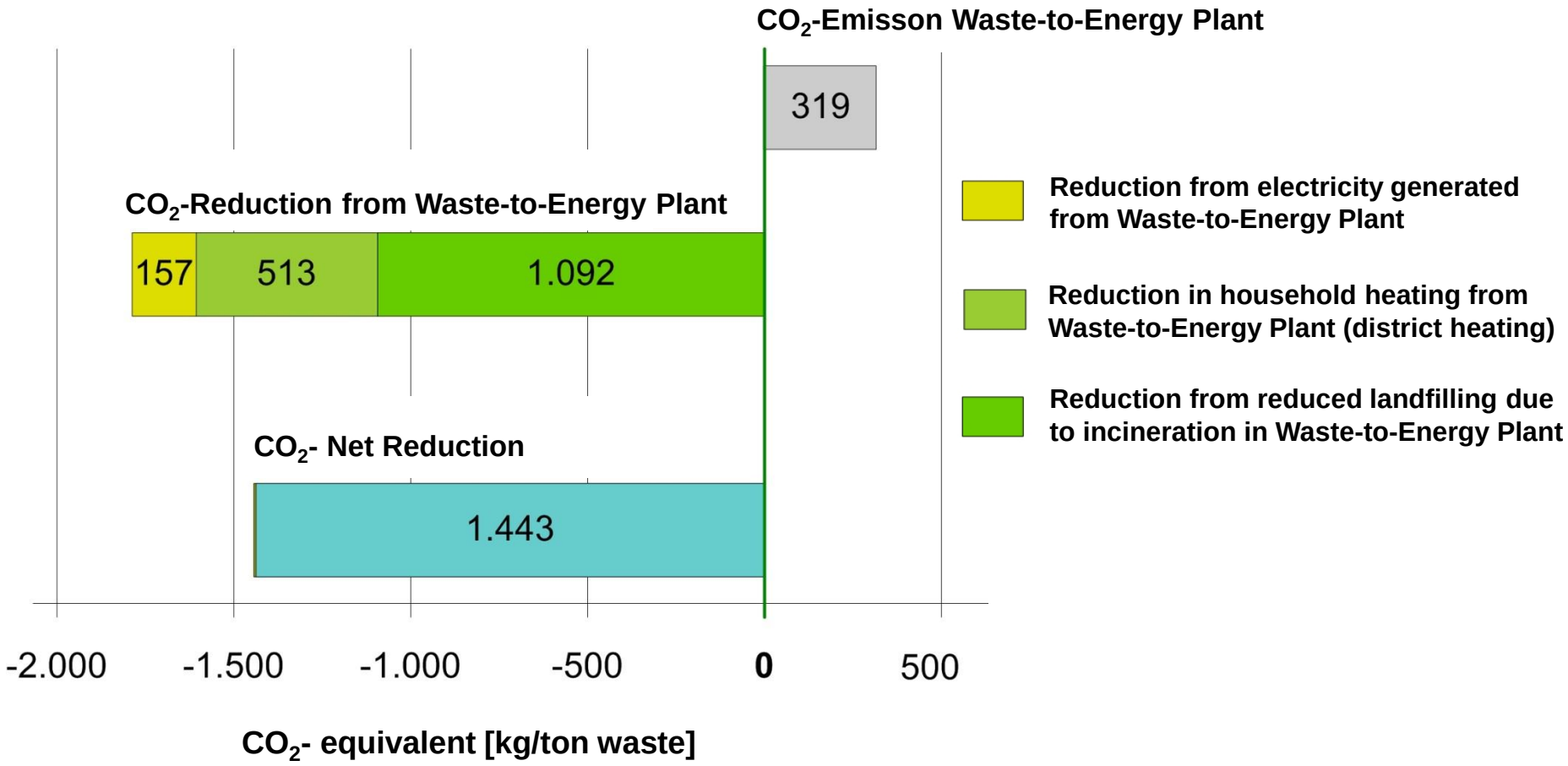
*Source: Pusterhofer, October 2014*

# Priority Need for Sorting / Recovery of Metals in the EU due to limited Resources (=> Circular Economy, Zero Waste, ...)

**Primary Metal Resources in % in the EU and in the World outside the EU**



# Reduction of Greenhouse - Gas Emissions by Municipal Waste Incineration in Vienna




Source: Kirchner, IIR Conference: Efficient future Waste Treatment Technologies, 2008

# Summary on Waste-to-Energy: Challenges and Opportunities for Municipalities and Businesses according to the EU-goals 2020/30

**The importance of "Prevention" in Sustainable Waste Management must be complemented by "Recovery" of both energy & materials according to the 20-20-20 [40-27-27] Goals of the EU for 2020 [2030] toward a more "Circular Economy" and the vision of "Zero Waste"**

- **20% [40%] less GHG – Emissions**
- **20% [27%] more Renewable Energy**
- **20% [27%] more Energy Efficiency**

**Prognosis for future perspectives:**
**In 2030 the $CO_2$ prices will be in the range of 87 to 190 €/ton and in 2050 in the range of 234 to 310 € per ton of $CO_2$** (Umweltbundesamt REP-0491, Vienna 2014)

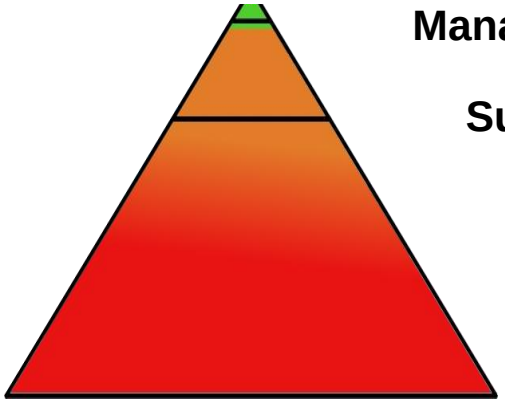
**WtE Spittelau saves approx. 1.5 tons of $CO_2$ per ton of MSW compared to sanitary landfill!**
**Austrian WtE (grate systems, FBC) saves approx.1 ton of $CO_2$ compared to MBT and RDF!**

# 7 Typical Mistakes in the Development of Waste Management based on Observations and Experience in Austria (Ernst P. et.al. 2004)

| | Principle | Practical examples for violation of principles |
|---|---|---|
| 1 | **Awareness** | Ignorance may cause substantial economic losses to present and future generations, health hazards and general environmental degradation (e.g. waste dumps: out of sight – out of mind) |
| 2 | **1st Law of Thermodynamics (balances of mass and energy)** | Technologies with technically foreseeable faults (e.g. inappropriate selection of sites with lack of utilization of heat from waste incineration) |
| 3 | **2nd Law of Thermodynamics (increase of entropy)** | Technologies with technically foreseeable faults (e.g. stranded investments in waste sorting plants for recycling of municipal garbage) |
| 4 | **Economic feasibility of the project** | Lack of consideration of waste markets, of economies of scale and of necessary cooperation |
| 5 | **Public information** and social acceptance of project | Lack of information and/or investment in public credibility of project applicants may prevent even environmentally friendly projects because of the “NIMBY-syndrome” (Not In My Back-Yard) |
| 6 | **Civil law and civil conduct; Control and enforcement** | Fraud, corruption, **overregulation, ignorance, Laissez-faire** in enforcement of law and standards by governmental authorities |
| 7 | **Foreseeable political development based on sustainability and justice** | **Increasing bureaucratic costs** and stranded investments caused by unforeseen political changes with subsequent frequent changes of regulations and/or of enforcement (e.g. delay of enforcement action; permits for waste export) |

# Know-How / Experience: Overall Costs for Project Development, Implementation and Operation of large Waste(-to-Energy) Plants

**Typical Cash-flow of large Waste-to-Energy Plants over Lifetime (e.g. in Austria: RVL Lenzing, EVN Lower Austria, RHKW Linz)**



**Concept- and Feasibility Studies approx. 0.2 – 0.5 Mio. Euro**

**Management, Consulting & Engineering approx. 10 Mio. Euro**

**Supply and Construction approx. 100 – 200 Mio. Euro**

**Operation and Maintenance of Plant: Turnover (approx. 40 years lifetime) approx. 600 – 2,000 Mio. Euro**

**Recommendation:**
**The determining factor for future success is the competent development and systematic evaluation of relevant technical alternatives and feasibility studies by independent expert teams in cooperation with local partners (costs < 0,01-0,1%!)**

# And don‘t make the mistake …


And don’t make the mistake …
Source: Stadtreinigung Hamburg-2008


**Next ISWA Study Tour**

**Waste-to-Energy**

**Is planned in the Alps**

**Incl. Salzburg - Bavaria - Upper Austria**

**June 18 - 24, 2017**

## Programme, June 19 - 25, 2016


Seminar and Technical Tour to 11 Plants and Facilities in Operation

Vienna ⇨ Niklasdorf ⇨ Wopfing ⇨ Brno ⇨ Budapest ⇨ Dorog ⇨ Vienna

Practice Seminar on Sustainable Waste Management in Europe based on Prevention, Recycling, Recovery, Treatment, and Intermediate Storage - without any disposal of untreated wastes exceeding 5 % TOC (Total Organic Carbon) in landfills

ISWA Austria International Solid Waste Association — Think Globally - Work Locally — ISWA International Solid Waste Association