

MVA Pfaffenau

# Waste to Energy – Treatment of Residual Waste



City of  Vienna  
*Vienna is special.*



Emptying of waste containers

### Reliable disposal

The City of Vienna has always been committed to discharging key municipal services, such as waste management, on its own. As a result, the municipal administration is not only responsible for the entire chain of waste disposal, but also handles the processing of residual waste independently – from collection to thermal treatment and, finally, depositing of the incineration residues at a municipally-owned landfill. Reliable disposal of municipal waste is ensured even in case of downtimes at waste incineration plants: if necessary, a modern waste logistics centre guarantees efficient treatment and interim storage. The smooth operation of all these services is contingent on a sophisticated waste management system.

The collection and operation of treatment plants by the City of Vienna safeguard compliance with the principles of short distances and autonomous disposal. Vienna's municipal waste management services meet their tasks in keeping with the very highest environmental and quality standards and at affordable prices for the benefit of Vienna's population.

### Collection of residual and bulky waste (combustible mixed waste)

Vienna's more than 1.75 million inhabitants live in approx 850,000 households. However, the waste volume generated is also in part due to

both roughly 250,000 commuters working in the Austrian capital and tourists, as Vienna records over 12 million overnight stays annually. Every year, Vienna produces approx. 500,000 tonnes of residual waste, 25,000 tonnes of bulky waste from households, 30,000 tonnes of street cleaning waste and approx 85,000 tonnes of other combustible mixed waste, which are collected by Municipal Department 48 (MA 48).

Roughly 225,000 waste bins are used for residual waste collection. The emptying rounds are effected by close to 160 waste collection patrols with the required number of drivers and approx. 430 waste handlers. The residual waste containers are installed right on the properties and emptied between one and six times a week; in individual cases, even twice daily. The residual waste is collected in containers with a capacity of 120, 240, 770, 1,100, 2,200 and 4,400 litres.

Smaller containers are used wherever there is little space for installing and handling them or if no larger volume is needed. Above all in old inner-city buildings, it is often necessary to put up the containers in the basement because of cramped conditions. In new residential buildings, waste storage rooms are specially provided and must be designed and equipped according to the requirements of MA 48. According to the Vienna Building Code, all plans must

be submitted to MA 48, which then checks and approves the dimensions and location of the waste storage rooms.

Bulky waste from private households may be left at the 19 waste collection centres free of charge (up to a volume of 1 cubic metre) or is picked up by MA 48, against payment, at the person's home.

Street waste and sweepings are collected by street cleaning personnel manually or mechanically or from 17,300 public waste bins installed by MA 48 all over the city.

### Waste utilisation for power generation

The City of Vienna has thus created all preconditions to dispose of the city's waste in an ecologically sustainable manner and hence to generate clean electricity, district heating and, for the past few years, even district cooling from waste. Since 2009, only incineration residues are deposited; residual waste is not landfilled anymore.

Vienna's three waste incineration plants – Flötzersteig, Spittelau and Pfaffenu – as well as the fluidised bed furnace 4 are used for the thermal treatment of residual waste, bulky waste and other combustible mixed waste collected in the city. In all, these facilities offer a treatment capacity of approx. 780,000 tonnes/year, which corresponds to an average weekly treatment capacity of roughly 16,000 tonnes.



Production of electricity and district heating at the MVA Pfaffenau

The residual and bulky waste collected is subjected to thermal treatment in three waste incineration plants (German abbreviation “MVA”) directly, without any further processing. Conversely, the fluidised bed furnace 4 (German abbreviation “WSO 4”) is also destined for the incineration of sewage sludge; as a result, the incineration technology used at that facility is only suitable for processed residual waste. Before incineration, the mechanically processed residual waste is comminuted and demetallised at the adjacent waste logistics centre.

In addition to these plants for the thermal treatment of residual and bulky waste, three fluidised bed furnaces for the incineration of sewage sludge as well as one rotary kiln for the incineration of hazardous waste are situated on Viennese territory. Being located in Vienna, all plants are connected to the 1,169-kilometre district-heating network. This entails advantages in terms of greater energy efficiency and fewer waste transport trips to the sites. The possibility of feeding district heat into the system and at the same time to generate electricity makes op-

timum use of the energy content of waste and results in high conversion efficiency (up to 80%). Wien Energie, a full subsidiary of the City of Vienna, operates these plants and supplies over 328,000 flats – roughly one third of all households – as well as more than 6,400 edifices of major customers with space and water heating. About one third of the heat thus generated originates from thermal waste treatment and energy generation from renewable resources, i.e. a wood-fired biomass power plant and the biogas facility of MA 48. Since 2009, district cooling for eco-friendly air-conditioning is also offered in addition to electricity and district heating: the cooling division of the Spittelau waste treatment plant supplies such large-scale facilities as Vienna General Hospital, a university or office buildings via refrigeration pipes.

The taking into operation of the latest waste incineration plant Pfaffenau in September 2008 created sufficient treatment capacities in Vienna and ensures that all combustible mixed waste can now be incinerated. Again, the plant is owned by MA 48 and operated by Wien Energie’s



Waste delivery to the MVA Pfaffenau

Plant	Commissioned in	Capacity	Types of waste	Energy generated	Owner / Operator
MVA Flötzersteig	1963	200,000 t/a	Residual and bulky waste	District heat	Wien Energie (district heating division)
MVA Spittelau	1971	250,000 t/a	Residual and bulky waste	District heat, electricity	Wien Energie (district heating division)
MVA Pfaffenau	2008	250,000 t/a	Residual and bulky waste	District heat, electricity	MA 48 / Wien Energie (district heating division)
WSO 4	2003	80,000 t/a	Pre treated residual waste	District heat, electricity	Wien Energie (district heating division)



Waste logistics center and interim bale storage

district heating division. This facility alone generates approx. 65 gigawatt hours of electricity and 410 gigawatt hours of district heat annually from 250,000 tonnes of waste collected in the Austrian capital. The heat produced corresponds to the annual consumption of about 50,000 Viennese households, while the electricity generated supplies roughly 25,000 households in the city. Vienna's incineration plants produce a total of more than 1.2 million megawatt hours of heat, approx. 81,000 megawatt hours of electricity and 38,000 megawatt hours of district cooling.

All thermal waste processing plants in Vienna are equipped with cutting-edge emission control technologies, which reduces their environmental impact to a minimum. All plants are operated with modern filters for fly ash separation and (at least) three-stage flue gas scrubbing. The waste incineration plants and the fluidised bed furnace 4 are provided with a DeNOx system for combined catalytic denitration and dioxin destruction. The Viennese plants operate markedly below the legal emission thresholds for waste incineration units.

#### **Waste logistics centre**

This high-tech facility processes residual waste for the fluidised bed furnace 4 (WSO 4). In case of downtimes at one of the four waste incineration plants due to repairs or technical glitches, additional residual and bulky waste can be pre-treated, compacted and stored here on an interim basis in

## WASTE LOGISTICS CENTRE

### Inauguration:

August 2013

### Surface:

45,000 cubic metres

### Regular treatment volume:

480 tonnes per day for WSO 4

### Exceptional treatment volume (downtimes at waste incineration plants):

up to 2,600 tonnes per day

### Bale size:

1 by 1 metres, up to 1.8 metres

### Maximum capacity of bale storage site:

44,000 bales

bales until it can be incinerated. In this way, reliable waste disposal is guaranteed even in case of plant downtimes or lack of capacities due to fluctuating waste volumes delivered to the plants.

Residual and bulky waste is treated mechanically in the pre-processing hall, where the waste is comminuted and sifted. The pieces remaining must not present a diameter in excess of 30 centimetres, which can be optimally processed at the adjacent WSO 4. At the same time, metals are eliminated and taken to be recycled. As a rule, approx. 480 tonnes of waste per day are shredded, demetal-

lised and transported to the WSO 4 on a 120-metre conveyor belt. In exceptional cases – i.e. downtimes at waste incineration plants or insufficient waste capacities –, the plant allows for the daily pre-treatment and interim storage of up to 2,600 tonnes of waste. For this purpose, the pre-treated waste is compacted into bales and placed in interim storage. The bale dimensions are about 1 by 1 metres and may be up to 1.8 metres long; moreover, they are sealed airtight in foils and hence odourless and dust-free. Up to 44,000 bales can be stored directly on-site in a special bale storage area. This helps to balance seasonal fluctuations in waste production, compensate for plant downtimes and even out the capacity load of the incineration plants.

All necessary work phases take place in closed halls with state-of-the-art air extraction and filtration units. Air extraction units are likewise installed at the tipping points, where bin transport vehicles directly tip the waste into the bunker. As a result, dust and odour formation around the site is negligible.

### Treatment unit for incineration residues at “Rinter Tent”

The thermal processing of residual and bulky waste, sewage sludge and hazardous waste in suitable waste incineration plants inevitably leaves a certain extent of residues. About one third of the input volume remains as various incineration residues at the Spittelau, Flötzersteig and Pfaffenau plants and at the Simmering furnaces



Metal deposited from the combustion residues



Rautenweg landfill

– e.g. as slag, bottom ash, filter ash as well as flue dust and filter cakes from flue gas purification. In figures, this corresponds to 151,000 tonnes of incineration residues and bed ash, approx. 34,000 tonnes of fly ash and about 2,400 tonnes of filter cakes from thermal waste treatment plants per year.

All these residues with the exception of filter cakes and ash from the incineration plant for hazardous waste are taken to the treatment unit for incineration residues of the “Rinter Tent” for further processing.

During mechanical treatment comprised of several processing steps – sifting, crushing, demetallising –, iron components and non-ferrous metals (e.g. aluminium, copper, brass, etc.) are removed from the slag. Moreover, the slag is reduced to a particle size that ensures optimum mixing with filter ashes, cement and water to produce ash-slag concrete. This is necessary to comply with the strict legal requirements of the Landfill Ordinance for the permanent disposal of this concrete at the Rautenweg landfill.

### **Rautenweg landfill**

The Rautenweg landfill is situated in the northern part of Vienna, about 10 kilometres north of the city centre, and is the only municipal landfill of Vienna. The trapezoid-shaped landfill



covers an area of approx. 60 hectares and has been in use for this purpose since the 1960s. Originally, the location served as a gravel pit; the first permit to use the site for depositing residual waste was granted on 26 June 1961 by the competent supervisory authority. With 14 million cubic metres of approved depositing volume, the Rautenweg landfill is the biggest of its kind in Austria. While in 2006 the waste deposited here was composed by 70% (approx. 150,000 tonnes) of treated incineration residues from Vienna's waste incineration plants and by about 30% of untreated bulky and residual waste from Vienna's households, practically only treated residues from Vienna's waste incineration plants are landfilled here since 2008, when the Pfaffenau waste incineration plant was taken into operation. Legally speaking, the Rautenweg facility today is a landfill for residues from incineration plants without subdivision into compartments.

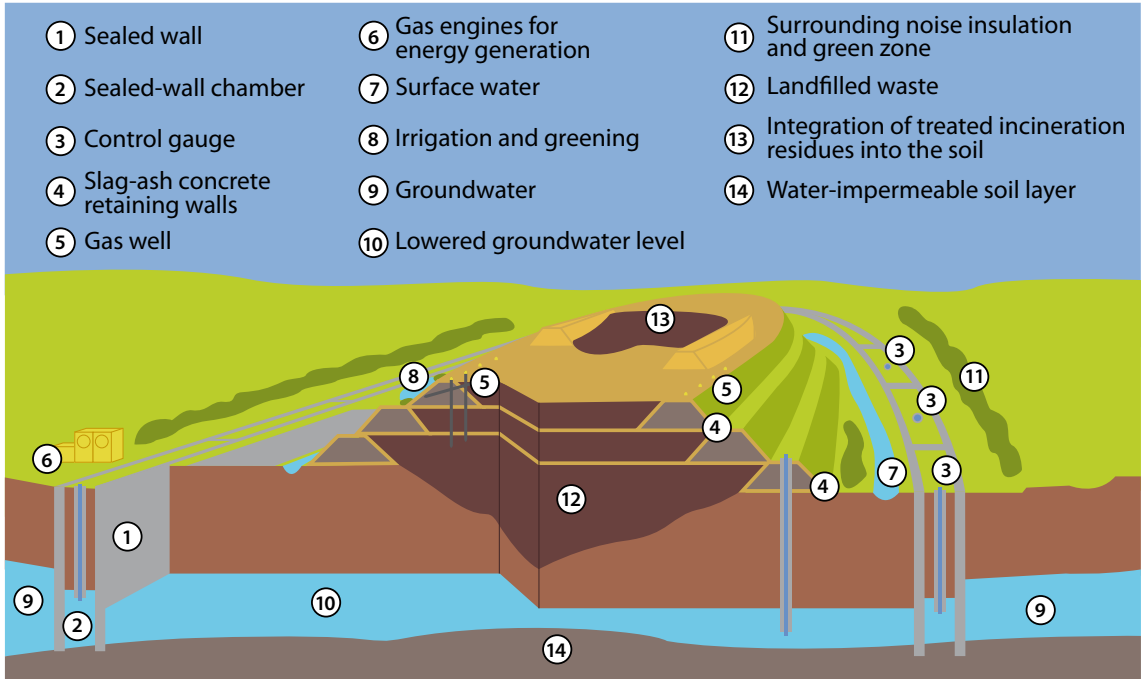
**The Vienna sealed-wall chamber system**

In June 1986, the first turf was dug for the Vienna sealed-wall chamber system, a key element in safeguarding the reliable functioning of the landfill.

Along its boundaries, the landfill was enclosed by two sealing walls installed at a distance of eight metres between them; both walls extend down into the aquiclude (the non-water-

carrying stratum of the soil). This separates the groundwater inside the landfill from the surrounding groundwater body. The two sealing walls are linked by 49 transverse barriers that permit subdividing the space between the two walls into a total of 49 sealed-wall chambers, each of which is annually checked for tightness. Moreover, pumping water from the landfill body creates a hydraulic gradient from outside into the landfill. The pumped-out water is introduced into the sewer network and

purified at the Simmering sewage treatment plant (German acronym "EbS"). This measure ensures that no water can escape from the landfill into the surroundings unchecked. The groundwater level changes outside the landfill caused by the construction of the sealing walls are offset by a system of extraction wells for the upper groundwater current and injection wells for the lower groundwater current. This measure re-establishes natural groundwater flow conditions.



Vienna sealed-wall chamber system

- ① Sealed wall
- ② Sealed-wall chamber
- ③ Control gauge
- ④ Slag-ash concrete retaining walls
- ⑤ Gas well
- ⑥ Gas engines for energy generation
- ⑦ Surface water
- ⑧ Irrigation and greening
- ⑨ Groundwater
- ⑩ Lowered groundwater level
- ⑪ Surrounding noise insulation and green zone
- ⑫ Landfilled waste
- ⑬ Integration of treated incineration residues into the soil
- ⑭ Water-impermeable soil layer

### Landfill gas utilisation

Methane gas resulting from decomposition processes in the old domestic waste deposits is extracted and utilised by means of an active degasification plant. This system is composed of approx. 160 gas wells, gas manifolds and gas compressor stations.

The thus obtained landfill gas is relayed to a privately owned company for power generation in a landfill gas conversion plant (three gas engine modules with a capacity of 330 kilowatt each). The power generated is then fed into the Wien Energie network. In 2012, approx. 2,200

Viennese households were thus supplied with electricity. In all, about 3.5 million cubic metres of gas were extracted from the landfill in 2012. However, the gas volume extracted is on the decrease, as only incineration residues may be deposited at the site since 2009. The carbon required for methane gas production thus originates from pre-2009 deposits and is steadily decreasing due to microbial degradation.

### Fauna and flora

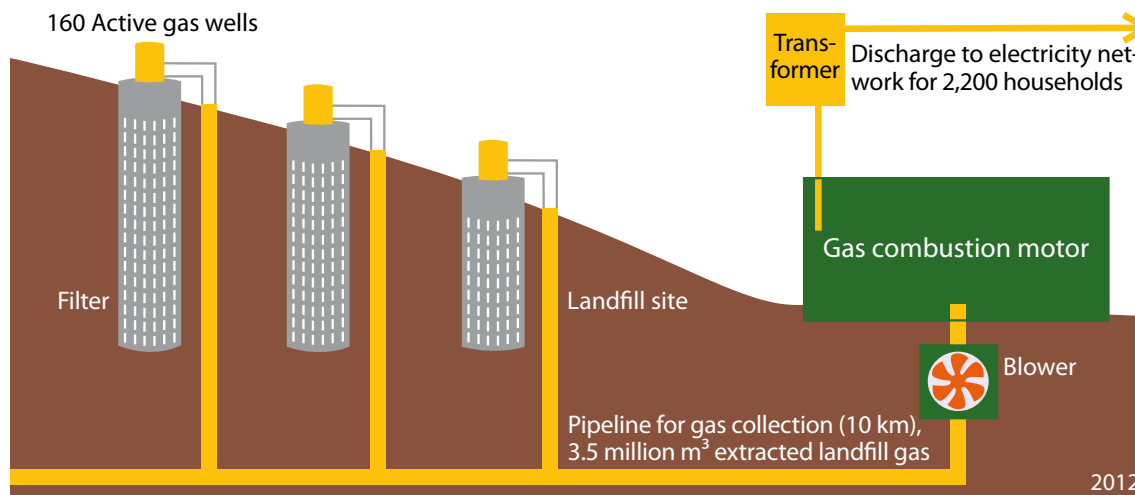
Due to its steppe-like environs, the Rautenweg landfill offers a unique habitat for numerous plants, mammals, birds and insects. Ducks,

crows, deer, hares, 26 species of butterflies, 47 species of spiders, 43 species of ground beetles, locusts, etc.: the landfill boasts a splendid retreat for animals and a unique vegetation cover. Some animal species have actually settled in the area because of the landfill, as this provides them with ideal living conditions. One case in point is the crested lark, a semi-steppe bird whose habitat is strictly protected across the entire municipal territory of Vienna under the Vienna Nature Conservation Act.

Since the early 1990s, the landfill has also been home to the Pinzgau goat. In the early 1990s, it was first considered to keep the grass of the increasingly large green areas at the landfill in check by means of "natural lawnmowers". Although this functional aspect was originally predominant, the establishment of a herd of these animals also served the purpose of species protection – after all, fewer than 200 specimens of the Pinzgau goat had remained in all of Austria in the early 1990s.

However, the Rautenweg landfill is also an Eldorado for botanists: boxthorn, many thistle and rose species, rocket, ragwort, mullein, teasel and larkspur are just a few of the numerous plants that can be found at the landfill. In particularly dry spots, the burr medick appears – this plant is even inscribed on the Red List of Threatened Species.

### Degassing scheme at Rautenweg landfill





Pinzgauer goats at Rautenweg landfill

### Financing

The financing of the collection and treatment of all municipal waste is based on the residual waste fraction in order to create an incentive for separate waste collection. Thus property owners are charged a quarterly waste management fee calculated from the volume of the residual waste containers installed on their properties and the frequency of bin emptying. This residual waste management fee finances the collection and treatment of all waste in Vienna (with the exception of packaging material, used electrical appliances and batteries). The more material is collected separately, the smaller the container volume that needs to be installed, and the lower the cost. The minimum container capacity for residual waste is 120 litres; for hygienic reasons, every residual waste container must be emptied at least once a week. The collection and treatment of packaging material, used electrical appliances and batteries are financed via manufacturers and importers according to the principle of manufacturer's responsibility.





## Disposal of stabilised combustion residues at Rautenweg landfill

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