FAQs

For all those interested in the details of the thermal waste utilisation plant of Zwentendorf/Dürnrohr

including its extension by a third line

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Content

1. Waste management: facts and figures

The best course of action is to avoid waste whenever possible. Austrians are top performers when it comes to separating refuse and recycling glass, paper, metals and plastics as well as the composting of biogenic waste. But no matter how conscientious their efforts, there will always be some residual waste that cannot be recovered.

Every inhabitant of Lower Austria produces altogether 419 kg of garbage per year, of which some 173 kg are residual and bulk waste. In all of Austria, 1.5 million tons of residual and bulk waste are produced every year.
(Data from the Federal Waste Management Report of 2004)

Total waste production in Lower Austria (residual waste, bulk waste, biogenic waste, problem waste, electric scrap, used materials such as paper, glass, metals, light fractions, textiles, oils, wood) stood at 640,409 tons in 2004. In all of Austria households produced altogether 3.4 million tons of garbage.

Where to put all this refuse? Landfills consume a lot of land and, worse, decomposition may take up to 300 years, with harmful substances contained in the waste threatening the groundwater and thus constituting a veritable time bomb that involves a high long-term risk. They pollute the groundwater and fresh water supply and generate greenhouse effects through the methane gas produced from decomposition. Accordingly, the dumping of untreated waste was banned as of 1 January 2004, by a Landfill Ordinance and the Water Law.

The most sensible and environmentally friendly solution thus obviously is to recover valuable materials, such as paper, glass, metals, biogenic fractions, and incinerate the remaining waste, which has the added bonus that it generates energy which can be put to good use.

This is exactly what is done to perfection at the Thermal Waste Utilisation Plant operated by AVN at Zwentendorf/Dürnrohr, the largest and most advanced plant of its kind in Austria.

It is based on the idea of making energy from waste. Like any biogenic material (such as wood, straw, etc.), waste can be perceived as a renewable source of energy. It is constantly produced – it has the calorific value of lignite – and it can therefore be practically used as a substitute for the ever scarcer resources of fossil energy (oil, coal, natural gas, etc.) in the generation of energy (electricity, heat, process steam for industrial use).

2. Basics

AVN's Thermal Waste Utilisation Plant at Zwentendorf/Dürnrohr processes some 300,000 tons of waste per year. The greater part of this garbage is obtained from Lower Austrian waste management associations. In addition to accepting household residual refuse and bulk waste from Lower Austria, AVN also processes industrial waste from other customers in Austria. Its largest private customer is UEG, a waste disposal company in Styria. Ever since the start of 2004, there has been a ban in Austria on dumping untreated waste on landfills.

Waste incineration reduces the waste delivered to about a tenth of its original volume. Its content of hazardous substances is destroyed by the high temperatures or collected and extracted in the flue gas cleaning plant.

The inert, rock-like slag produced by incineration can be dumped on landfills without any risk to the environment. The filter cake, containing the concentrated pollutants which survived incineration, is specially conditioned, i.e. immobilised in concrete and deposited at the Erzberg dump.

The AVN plant was built right next to the coal and gas power station operated by EVN at Dürnrohr. The energy contained in the garbage (at 10–11 MJ/kg, waste has about the same calorific value as lignite) is converted into steam and fed to the Dürnrohr station where it is used to generate electricity. This translates into fuel savings of 50,000 tons of coal and 10 million cubic metres of natural gas per year: a satisfactory economic factor and – even more important – a reduction of emissions and thus better and cleaner air for the entire region.

To give just one example: By avoiding the methane production from the decomposition of dumped garbage, CO_2 emissions are reduced by fully 471,000 tons per year. Similarly major reductions can be achieved for other pollutants: carbon monoxide emission is cut by 43 tons a year, and sulphur dioxide emission by 7 tons.

The AVN plant is currently Europe's most modern thermal waste utilisation plant. It is rightly called an environmental protection system because it makes use of all the technology available to utilise waste in the most ecologically compatible and economically efficient manner.

The incineration process destroys the pollutants contained in the garbage and extracts those that are indestructible for safe storage. All internal processes are constantly monitored using state-of-the-art metering methods. The pure gas exhausted through the smokestack first passes through numerous systems in the emission metering station. Their values are sent online to the Lower Austrian government and can even be viewed on AVN's homepage.

The plant's actual operating values are far below the limits prescribed in the plant licence and considerably lower than the statutory limits. All emissions are at least 50% below the allowed limits, and, specifically, fully 90% lower than the statutory limit for dust, and 80% lower than the limit for SO_2 and CO specified in the Waste Incineration Ordinance.

By combining forces with the caloric power plant at Dürnrohr, it is possible to achieve fuel savings of 50,000 tons of coal and 10 million cubic metres of natural gas per year, which in turn through reduced emissions greatly improves the air quality in the region.

This was documented by AVN in the course of the environmental impact assessment. This analysis, which was stipulated by law and which took almost four years to complete, examined all effects that the incinerator might have on the environment. It was based on an environmental impact declaration prepared by AVN, which comprised 100,000 pages of in-depth studies and 7000 detailed technical drawings. This effort ensured that all environmental requirements specified by the public, and especially by the neighbours, would be fully complied with. As a result of the assessment, the authorities issued a licence that identified exact specifications which AVN is obliged to satisfy. They span all aspects of environmental protection, such as clean air, climate, water, soil, geology, hunting, fishing, tourism, noise abatement and transport.

3. The AVN Project – history and project development

Already in 1994, long before the Landfill Ordinance was issued and the dumping of untreated waste prohibited (1 January 2004), the State of Lower Austria had decided to find an ecologically sensible solution for the treatment of garbage. With such a solution in mind, the government of the State of Lower Austria invited EVN AG to set up a joint subsidiary, known as AVN Abfallverwertung Niederösterreich GmbH, which was requested to develop and implement a suitable solution.

The first step: a feasibility study

An interdisciplinary team of scientists was commissioned by AVN to investigate, within the scope of a large-scale feasibility study, a number of garbage treatment methods and select the ecologically most sensible method. It was found that a purely thermal treatment of waste offered the greatest benefits. The Lower Austrian diet then unanimously decided, in May 1995, to build a thermal waste utilisation plant to be centrally located in Lower Austria, instructing AVN to design, construct and operate the plant.

The next step: the search for a site and its advantages

In looking for an optimal site for a central waste incinerator in Lower Austria, AVN did not take the easy road. It examined fully 24 possible sites in great detail for their ecological and economic aspects before it finally opted for Zwentendorf/Dürnrohr.

This location offers an advantage that is unique in Europe:

Thanks to its immediately adjoining the Dürnrohr coal and gas power station, the incineration plant can deliver all of the energy generated by it to Dürnrohr where it is used to generate electricity and district heating, thereby saving on the consumption of fossil fuels (coal and natural gas). Thanks to the steam from the incinerator, the Dürnrohr caloric power plant can save fully 50,000 tons of coal and 10 million cubic metres of natural gas a year.

What's more, with negligible emissions from the incinerator (AVN's thermal waste treatment plant emits the approximate equivalent of three trucks), the entire region benefits from the substantial reduction of emissions and thus a substantial improvement of the air quality.

Garbage delivered by rail

In order not to forego this substantial ecological benefit by shipping in the garbage by trucks, 90% of it is delivered by rail – in special environmentally compatible containers, while only the waste from the immediate vicinity arrives by truck. In this way, emissions from road transport can be avoided.

Referendum

Such crucial ecological benefits were duly considered by the inhabitants of Zwentendorf when they were asked to vote at a referendum held in June 1997: at a turnout of 72%, 74% of the citizens opted to have the thermal waste utilisation plant built at the Zwentendorf/Dürnrohr site.

Environmental impact analysis

Before AVN was able to start on construction works in the summer of 2001, the project had to undergo an environmental impact analysis which was mandated by law and which took almost four years.

The analysis involved an exhaustive study into all possible effects that the incinerator at Zwentendorf/Dürnrohr might have on the environment.

More than 100,000 pages of expert opinions and 7,000 detailed technical drawings were prepared by AVN in the course of the proceedings.

The result was exact stipulations that AVN has undertaken to fully comply with. They cover clean air, noise and transport, as well as the protection of agriculture and forestry, hunting and fishing. In order to observe the nature conservation laws, AVN even established its own ecological site supervisor.

Plant engineering

In June 2001, AVN obtained its building licence from the authority and in the next month started upon construction works, which were completed in December 2002 – after just one and a half years. Start-up and commissioning was begun in January 2003 and successfully completed in early August of the same year. Following the successful completion of the trial operation and ultimate performance tests, the thermal waste utilisation plant was ready to take on the garbage of its customer punctually on 1 January 2004. Designed to a capacity of about 300,000 tons of garbage per year, the plant is already operating at its limit thanks to its two major customers (the Lower Austrian waste management associations NÖ BAWU and the Styrian waste disposal company UEG) and a number of private customers.

AVN – engineering and competence at the service of the environment

With its plant, AVN can offer the most practical alternative to landfills: the thermal disposal and utilisation of residual waste at its state-of-the-art plant at Zwentendorf/Dürnrohr, where garbage is incinerated in a controlled process at a temperature of more than 1000°C, destroying the pollutants in the waste and reducing the garbage to about a tenth of its original volume. As an additional bonus, the waste yields a substantial amount of energy thanks to the combined operation with the next-door caloric power plant of Dürnrohr.

4. Truck unloading shed and waste bunker

A key element in AVN's concept is the delivery of 90% of the waste by rail.

Only 10% of the refuse is supplied by garbage trucks – this involves garbage from the direct vicinity which would be impractical to handle by rail.

Arriving at the truck unloading shed, the waste is discharged into the bunker. The shed is provided with a system of air locks: when the garbage vehicle arrives, the door of the shed opens to let it in. Once inside, the door is closed before the gate to the bunker is opened. This method effectively prevents any smells from escaping when the garbage is discharged.

The waste bunker is of an impressive size: its capacity of 40,000 cubic metres corresponds to 50 family homes. As, in consideration of the population, garbage is delivered only from Mondays to Fridays, the waste bunker doubles as a "storage room" for the weekend or a number of consecutive holidays. The bunker can hold sufficient waste to keep operations going through several holidays or a long weekend, so that the plant can be operated round the clock all year round – after all, garbage knows no holiday.

Within the bunker, two specially designed clamshell cranes with a gripping capacity of 10 cubic metres each transport the garbage to the grate. Taking up a gripfull of waste in the bunker, the crane places it on the garbage chute from where it slides down in a constant flow onto the grate where it is pushed forward by a special ram.

The garbage assembled in the bunker is a kaleidoscope of bits and pieces: AVN's customers (Lower Austrian waste management associations and private waste disposal companies) supply it with residual household waste, bulk waste (about 180,000 tons per year) and industrial waste. The most colourful component is certainly provided by the residual household waste.

The cranes thus have their work cut out in mixing the garbage in the bunker so that the calorific value achieved from incineration will remain at a relatively steady level. Thus, "older" dry waste is mixed with more "recent" moist waste, either by the crane operators or by an automated crane control system introduced by AVN.

5. Rail container unloading crane and rail delivery

Fully 90% of the garbage is shipped by rail – a crucial factor for the plant's environmental compatibility. After all, there are some 300,000 tons of refuse delivered every year, as well as the residues from their incineration to be removed from the site – almost all of it by environmentally friendly rail transport. This concept developed by AVN is unique worldwide.

To implement its concept, AVN has built separate sidings to the plant and purchased two rail engines to shunt the trains. These arrive from the Moosbierbaum station, where they run through the land of DonauChemie on that company's sidings and then on to the AVN site. Three trains arrive on each weekday, usually two in the morning and the third one in the afternoon.

Trucks are used solely to transport garbage from the immediate vicinity to the AVN plant. They are unloaded in a separate truck unloading shed fitted with air locks.

The containers arriving by train are customised designs developed by AVN together with logistics experts and its customers. They are suitable for transporting waste and for being handled by the automated container crane. Each container holds up to 14 tons of refuse, filled from the top or, optionally, from the side and fitted with a waste press. It is unloaded by tipping, a method that is of particular advantage in winter when freezing is possible.

The automated container unloading crane system optimises the handling path and time by exactly coordinating all processes. Every weekday, some 1,500 tons of garbage are shipped in by rail – corresponding to some 150 containers per day, arriving by three trains, two in the morning and one in the afternoon. This means a saving of some 16,000 truck runs per year – a major ecological benefit.

In order to avoid any offensive smells during rail delivery, a special air lock system has been set up for unloading the rail containers: the lock opens to let in the container and then closes before the bunker gate is opened.

Thanks to two more sidings and equipment to accept roll-on/roll-off containers that are not provided with ISO corners for automated unloading by a container unloading crane, AVN has made provision for all garbage unloading systems available on the market: garbage trucks to deliver refuse from the vicinity in the truck unloading shed; roll-on/roll-off containers with ISO corners developed specifically by AVN for unloading by the automated crane; and, finally, the roll-on/roll-off containers used by NÖ BAWU which are lifted from the rails by customised AVN trucks.

6. Slag hall and slag bunker

Incinerated on the grate at a temperature of over 1000°C, the garbage turns into ash and slag. At the end of the grate run, the slag drops off into the wet slag remover where it is cooled in a water basin before being discharged into the slag bunker.

The slag is an inert, rocklike mass of coarse to fine grain and not hazardous at all. It is collected in the slag bunker and can be easily dumped without any risk to the environment. In Germany, the Netherlands and other countries it is used for road gravelling or in noise barriers.

Incineration of the residual waste reduces the volume of the garbage to about a tenth of its original size. In terms of weight, all that remains of one ton of garbage is 250 kg of slag and boiler ash, 30 kg of scrap iron and 1 kg of filter cake.

7. Boiler and grate

With a length of about 10 metres and a surface of almost 95 square metres, the grate in the AVN's thermal waste utilisation plant is among the largest of its kind in Europe. It is at the heart of the plant because it is here that the waste is continuously incinerated and the larger part of the pollutants contained in the waste is destroyed.

In order to ensure that the garbage will be burned only when the temperature has exceeded 1,000°C, natural gas is used to start up the plant. The furnace needs to have an operating temperature in excess of 850°C before the residual waste is incinerated. This waste has about the same calorific value as lignite and thus burns on its own without the addition of natural gas.

With temperatures in excess of 1000°C, most of the pollutants contained in the waste are safely destroyed. The combustible parts of the residual waste are converted into flue gas.

The hot flue gas gives off its heat to the water passing through the boiler walls.

The boiler itself is of an impressive size. Its heating surfaces make up 8,443 square metres. Inside the boiler, steam is generated which is then used to produce electricity at the next-door Dürnrohr power station.

By heating the water in the boiler walls and converting it into steam, the flue gas cools down from over 1000°C to some 170°C and then passes on to the flue gas cleaning system.

If a failure should occur, such as an interruption in the flow of garbage delivered to the grate, the system is immediately and automatically shut down.

All processes in the boiler and on the grate are controlled by the automated process control system and constantly monitored by the AVN staff at the central control room.

The AVN plant consists of two lines, i.e. all systems, with the exception of the garbage bunker, are provided in duplicate. Accordingly, there are two boiler/grate systems each of which incinerates 150,000 tons of garbage per year. The boilers have a height of 40 metres and are suspended from the boiler house roof because they expand by up to 150 mm at high temperatures.

8. Flue gas cleaning plant

Cooled down to some 170°C through the heat transfer, the flue gas passes through a flue gas cleaning plant of three stages: dry, wet and catalytic.

The first, or dry, stage consists of fabric filters where dust particles as well as organic pollutants such as dioxins and furans plus gaseous heavy metals are extracted through special teflon bag filters. Alternatively, activated carbon and lime powder may be injected into the flue gas flow upstream of the fabric filter. The flue gas passes through the bag filters from the bottom to the top. The collected fabric filter dust is extracted as ash by a worm conveyor and transported, together with the filter cake from the wet stage, by rail to the Erzberg dump in Styria where it is bonded and immobilised with cement.

The fabric filter extracts almost all of the dust from the flue gas, which then passes through valves and a large flue gas duct to the second or wet stage. Just before reaching this stage it flows through a gas/gas heat exchanger where its temperature is reduced from 170°C to 105°C.

The second stage of the flue gas cleaning process consists of a wet-type scrubber. It is made up of two types of scrubbers: the first one is a HCl scrubber, also known as “acid scrubber”, where an acidic liquid is sprayed in to extract the chlorine and fluorine compounds and the soluble heavy metals such as mercury. Passing through a mist collector, the gas then reaches the second scrubber stage known as SO2 or gypsum scrubber, where sulphur dioxide is extracted by a fine spray of suspended gypsum. The sulphur dioxide is transformed into gypsum which is in much demand from the construction industry and can thus be sold by AVN.

The wet-type scrubbers produce waste water which needs to be treated in the waste water cleaning plant. The resulting filter cake is forwarded to the Erzberg dump together with the dust from the fabric filters, and deposited after being immobilised with cement. The clarified waste water is pumped to the Danube through a penstock line, mixed with water from the Danube and discharged into the river.

As the third stage of the flue gas cleaning plant, the deNOx stage involves reducing the nitrogen oxide to a harmless compound of nitrogen and steam.

First heated in a gas/gas heat exchanger, the flue gas is sprayed with aqueous ammonia, in order to obtain nitrogen and water from NOx. A steam heat exchanger further increases the flue gas temperature to 240°C, so that the NOx can be finally split in the catalytic converter.

At the end of the process, the hot flue gas flows around the pipes of the gas/gas heat exchanger, thus heating the flue gas entering the deNOx stage.

Having passed the three cleaning stages, the flue gas is checked and tested repeatedly before being discharged through the smokestack into the open air. The smokestack holds the emission metering station which continuously checks and examines the gas for the parameters specified by the authorities. The values are transmitted online to the Lower Austrian Government and are on display on the AVN’s homepage at www.avn.at.

9. Fire pond, reed sewage treatment plant

The fire pond holds 2,500 cubic metres of water as stipulated by the authorities to supply the fire department with water in case of a fire.

The two basins of the reed sewage treatment plants are used to collect and clean the surface water from precipitation on the site before it is returned to the groundwater.

10. Combination of waste incinerator and caloric power plant

The Zwentendorf location chosen for the thermal waste utilisation plant operated by AVN ideally meets all ecological and economic requirements that a state-of-the-art incinerator is expected to fulfil.

AVN did not only consider how to ensure that waste would be properly disposed of in ecological terms, but it also took into account how to efficiently use the energy generated from such disposal.

In its system, the energy content of garbage is harnessed for the production of steam which is then utilised to generate electricity at the nearby power station of Dürnrohr.

Through this concept, the Dürnrohr plant can save on fully 50,000 tons of coal and 10 million cubic metres of natural gas – a saving not only of fossil energy carriers that protects scarce resources, but also a reduction of emissions, which in turn makes for better air quality in the entire region. Carbon monoxide emissions are cut by almost 44% and reductions are similarly substantial for other air pollutants.

The steam delivered by the AVN plant is fed into the turbine cycle of the Dürnrohr plant where it generates electricity through the plant's large-scale turbine and through generators with a high level of efficiency – more than 300,000,000 kWh per year, the electricity consumption of about 100,000 households.

11. Residues from incineration

The incineration of residual waste reduces the waste volume to about a tenth of its original mass. One ton of garbage after incineration leaves some 250 kg of slag and boiler ash, 30 kg of scrap iron and 1 kg of filter cake.

The inert, rocklike slag left over from incineration can be easily deposited without any harm to the environment. In Germany, the Netherlands and other countries, it is even used as gravelling for roads and in noise barriers.

The gypsum extracted from the flue gas in the wet-type scrubbers is used by the building industry.

The only residues to be specifically treated for disposal and storage are the components retained by the filters of the flue gas cleaning plant – the so-called filter cake and the filter dust. These contain substances that are indestructible regardless of the temperature used for incineration, included in products encountered in our daily life that will anyway end on the dust heap: cadmium, lead, chlorine, fluorine, mercury, etc. Concentrated by the flue gas cleaning system, they are shipped to the Erzberg dump in Styria where they are immobilised in cement and deposited.

The iron components in the garbage are recovered from the slag in the form of scrap, using magnetic separators, and sold to scrap dealers.

12. Plant emissions

The emission rates of the AVN plant are not only safely below the statutory limits, but also substantially below the rates specified in the government permit. And they are even below the rates expected by AVN itself.

The plant's emissions equal those of just three trucks.

The detailed rates can be checked by all comers, in the form of half-hourly mean rates displayed in the internet at www.avn.at.

13. Visitors catwalk and infocentre

Long before construction started in 1994, AVN had decided not just to process waste in the ecologically most beneficial manner, utilise all the energy contained in the refuse and ship 90% of the garbage by rail, but also to develop an integrated concept that would ensure a full flow of information to the population and all interested visitors.

The plant is open to all interested parties. Visitors can look at everything without any risk to themselves, even though their tour spans a major industrial plant – which is the essential nature of a waste incinerator.

Accordingly, AVN provides for a visitors catwalk at the topmost floor right across the plant, from which visitors get a good look of the garbage bunker through four large windows and see the boiler house with the two boilers through a panorama window, enabling them to watch the incineration process.

The catwalk is fitted with plenty of diagrams and photographs, showing visitors the history of the plant from the groundbreaking ceremony to the completion of the plant.

The no-risk tour terminates at the infocentre where visitors can watch movies that show information of the plant at three levels of detail. A three-dimensional starter movie provides initial information on waste management in general and the processes in the AVN plant. Each segment of the plant (such as flue gas cleaning, boiler, energy utilisation, environment, transport, etc.) is then covered by more detailed movies. For those visitors wanting even more detailed information, fact sheets are provided that include all in-depth data on the plant segments.

AVN also offers a special three-dimensional cartoon for kids, telling the story of a punctured football and a worn sneaker to illustrate the problems of waste incineration to the young visitors, especially school children touring the AVN plant on a school excursion.

14. Addition of a third line

Two years after the thermal utilisation plant at Zwentendorf/Dürnrohr was launched, AVN is already faced with the need to extend its operation. Plans are to add a third line to the two existing processing lines.

The marked growth of waste volumes to be processed, fuelled by the entry into force of the Technical Instructions for Household Waste and the Waste Disposal Ordinance in Germany which ban the cross-border shipment of waste, together with the higher calorific value of the refuse currently arriving which reduces the plant's throughput capacity, makes it necessary to add capacities at the highest technological level. In addition, the Federal Waste Management Plan finds that the incineration capacities available in Austria today will not suffice to ensure self-sufficient disposal in Austria even when the additional capacities envisaged to be available by 2008 are included.

The Zwentendorf plant is already noticing a rise in garbage volumes to be processed. Over the past six months, waste production has increased so massively that the plant has been on permanent full-load operation.

As a result of such developments, the AVN plant is to be extended from its current output of 120 MW to 210 MW by 2010. Same as the two current lines, the new line will be used for the thermal utilisation of the incinerated waste and the production of steam fed to the Dürnrohr power plant for electricity and district heating and to the neighbouring Agrana bioethanol plant in the form of process steam. In this way, AVN will not just make another important contribution to the environmentally compatible disposal of waste, but also help the Dürnrohr power station to cut down on energy consumption and CO_2 emissions through its interconnected energy generation system.

Further ecological laurels can be earned through AVN's method of using the rail to ship 90% of the garbage in and removing the residues. This innovative logistics concept will certainly be similarly applied to the new line. After all, it is not enough to process garbage in as environmentally friendly a manner but the entire logistics effort involved needs to be compatible with environmental goals.

The plant's appearance will not be much affected by the new addition. The new line will be constructed in parallel to the two existing lines, similarly consisting of a grate and boiler and a three-stage flue gas cleaning system that comprises a dry stage (fabric filter), a two-step wet-type scrubber (acid scrubber and gypsum scrubber) and a deNOx plant (catalyst). The new addition will simply broaden the plant and the current entrance area will be "shifted" somewhat to the northwest.

A new addition will be the so-called "initial bunker" to serve as an extension of the current garbage bunker in order to hold the additional waste volumes to be expected. It will be added on to the south of the plant bridging the red automated container crane delivery station. This initial bunker will be fitted with another three tipping stations and a bulk garbage shredder. From this initial bunker the garbage will be conveyed into the main bunker by a travelling crane.

As to the procedure observed in adding a new line, AVN will certainly pass through the process of an environmental impact analysis. On 31 May 2006, all documents prepared by AVN's experts were handed over, combined into an environmental

impact statement, to the licensing authority at the Office of the Lower Austrian Government.

Over the coming months, the 20 expert opinions combined in the statement will be examined by experts of the Lower Austrian Government who will then submit their own opinion. AVN expects to receive a decision by the spring of 2007. Construction is then envisaged to start in the summer of 2007. The construction works, startup and commissioning will take about three years so that the third line should be available for service in 2010.