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For information

Advisory Council on the Environment
Report of the Study Visit to the Netherlands and Germany on Municipal Solid Waste Management and Treatment Technologies 19 to 26 March 2006

Abstract

This report covers the Advisory Council on the Environment's (ACE) study visit to the Netherlands and Germany on municipal solid waste management and treatment technologies in March 2006. The delegation comprises 9 ACE members and 2 representatives from the Environmental Protection Department of the Hong Kong Special Administrative Region (HKSAR) Government. The objective of the visit was to acquire more information and understanding of overseas experience and technologies on municipal solid waste management and treatment. Led by Prof. Lam Kin-Che, Chairman of the ACE, the delegation visited two waste incineration plants, one gasification plant, one mechanical-biological treatment plant and one processing/recycling plant for waste refrigerators and television sets. Discussion meetings with the Ministry of Housing, Spatial Planning and the Environment in the Netherlands, the Federal Ministry of Economics and Technology in Germany, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety in Germany and the Federation of the German Waste Management Industry were also held. Useful knowledge and understanding on various municipal solid waste treatment technologies and waste management measures such as producers responsibility schemes in the Netherlands and Germany were acquired.

Advisory Council on the Environment
Study Visit to the Netherlands and Germany on
Municipal Solid Waste Management and Treatment Technologies

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1. INTRODUCTION

1.1 Hong Kong is facing an imminent and serious solid waste problem: its limited waste disposal capacity will not be able to cope with the ever increasing amount of waste requiring disposal. In 2004, about 6.4 million tonnes of waste (of which 53% was municipal solid waste) were disposed of in three strategic landfills at Tseung Kwan O, Nim Wan and Ta Kwu Ling. These three landfills were planned in the 1980's at which time they were expected to serve Hong Kong well into the 2020's. However, owing to a faster increase in waste quantity from Hong Kong's growing population and economic activities, the three landfills are being filled up much faster than expected. It is projected that the existing landfills would only last 5 to 9 years if the waste volume continues to grow at the current trend.

1.2 To tackle the problem, the HKSAR Government has published "A Policy Framework for the Management of Municipal Solid Waste (2005-2014)" in December 2005 to set out a 10-year comprehensive strategy for the management of municipal solid waste (MSW) in the period from 2005 to 2014. One of the major policy initiatives is the development of Integrated Waste Management Facilities (IWMF) to achieve bulk reduction of MSW using advanced treatment technologies. The IWMF will employ state-of-the-art technologies with thermal treatment as the core treatment technology.

1.3 To decide how to proceed with the IWMF project, the Advisory Council on the Environment (ACE) wants to learn from the experiences of the Netherlands and Germany in waste treatment technologies. Apart from the IWMF, the ACE would also like to acquire knowledge and experience in waste reduction measures such as producer responsibility schemes and the relevant EU directives. The ACE would also take the opportunity to understand more about the overseas experience in nature conservation policy and management practices.

1.4 Subsequently, a schedule to visit waste management facilities, relevant government officials and trade representatives in the Netherlands and Germany in March 2006 was drawn up. The delegation comprises 9 ACE members and 2 representatives from the Environmental Protection Department (EPD) of the HKSAR Government and is led by Prof. Lam Kin-Che, Chairman of the ACE. The list of the members of the delegation is given in Appendix 1 and the itinerary of the visit is outlined in Appendix 2. The list of reference materials acquired during the visit is given in Appendix 3, while the reference materials are bound in a separate volume and kept by the Secretariat of the ACE.

2. VISIT PROGRAMME IN THE NETHERLANDS

A. Meeting with the Ministry of Housing, Spatial Planning and the Environment, the Netherlands

2.1 In the morning of 20 March 2006, the delegation was received by Mr. Kees Veerman, Policy Coordinator of the Ministry of Housing, Spatial Planning and the Environment in the Netherlands (NL). Mr. Veerman has more than 15 years' experience in waste management and is the instigator of the producer responsibility legislation in NL.

Photo no. 1 : Group photo with Mr. Kees Veerman, Policy Coordinator of the Ministry of Housing, Spatial Planning and the Environment in the Netherlands

2.2 Like Hong Kong, NL faces sharp declining numbers of landfills for waste disposal. The number decreased from some 400 sites in 1980 to only 27 in 2005. Some closed landfills even need to be dug out and reopened for accepting new waste for the coming 20 years.

2.3 Mr. Veerman explained that the total number of incinerators had no noticeable change and was about 11 to 12, except in 1995 when there was a crisis on dioxin incidents in Europe leading to the temporary closure of many plants. However, there had been a quick advancement in the gas emission control technology to fix the problem. Though no new incinerators were built, the plants were re-engineered with larger capacity. The total throughput of the incinerators increased sharply from 2.9 Mt/yr in 1995 to 5.6 Mt/yr in 2005.

2.4 He also explained that NL relied heavily on two economic instruments for steering waste management, viz. waste taxes and Extended Producer Responsibility (EPR).

2.5 The waste tax is levied on waste that is delivered to landfills and incinerators, and is applied in addition to the gate fees (€70 to €145/tonne for incinerators and €45 to €135/tonne for landfills). The main objective of the tax is to restrict and discourage the use of landfills by narrowing the cost difference between incineration and landfilling. The tax was introduced in 1995 at €13/tonne and was increased in 3 steps to €85/tonne in 2005 (for waste less than 1,100 kg/m^3 and for certain waste streams like dangerous waste and shredder waste). The tax for incineration is nil. As a result, landfilling is made more expensive than recycling and incineration.

2.6 Mr. Veerman then described the development of EPR in NL and the long consultation process with a broad range of stakeholders. The process to encourage voluntary industry program proposals began in 1989 and resulted in passing the legislation in 1998. Legislation began taking effect with large electrical appliances in 1999 and was extended to include all appliances in 2000. There was still some remaining resistance from the trade.

2.7 Under the EPR, the producers have the responsibility to take back and process their products after their service life and they are responsible for organizing and financing (part of) the waste management. The trade can form collective Producer Responsibility Organisations (PRO) to manage such tasks. PRO is usually product-based and one typical example is the Netherlands Association of Metal and Electrical Products (NVMP) which is responsible for handling the Waste Electrical and Electronic Equipment (WEEE). Individual companies in the trade pays a registration fee to the PRO and the fee level would depend on the market.

2.8 In NL, EPR has been implemented on a mandatory basis for car tyres, batteries packaging, agricultural plastic films and WEEE and on a voluntary basis for some other products such as end-of-life vehicles and plastic materials on building exteriors (e.g. float glass, PVC tubes and window frames). Regarding the voluntary schemes, it is up to the trade to come up with the details of the scheme such as the disposal fee. The Ministry will arrange the general binding declaration for them.

Photo no. 2: Meeting with Mr. Kees Veerman

2.9 Mr. Veerman also shared his experience that the government should act clearly as a lawmaker facilitating the EPR to happen and setting the conditions for the process. However, the government should not interfere in the trade's responsibility as the trade can organize such schemes in the most cost-effective way. He stressed that the legislation should promote collective PRO and this was considered to be the most cost-effective arrangement for the government and the consumers. When EPR was implemented out of competition from the trade, it would make the implementation quicker.

2.10 When asked about what needed to be considered in starting up a PRS, Mr. Veerman advised that EPR should start with products that had hazardous components threatening the environment, such as batteries and WEEE which could have adverse effect on the ozone layer from the release of chlorofluorocarbons (CFCs) and heavy

metals to the environment by improper handling and disposal. Other priority products should be those that had a net deficit in the chain of recovery, collection, recycling and treatment or where responsibility for realizing waste management was not clear.

2.11 He also pointed out that one should be clear about the financing mechanism, collection would usually be the weakest part and it would be important to have strong enforcement and let the trade know that all producers would need to join.

2.12 Regarding the impact of EPR, he remarked that from NL's experience, it had big impact on the enhancement and increase in the quantities of collection and recovery/recycling of waste stream concerned. However, except perhaps only for short life-cycle inexpensive products such as packaging waste, EPR did NOT enhance waste avoidance or waste prevention.

2.13 With all the measures implemented, the growth of household waste in NL has been curbed and is now slower than the growth of GNP. There are sufficient capacities of landfills and incinerators to deal with the waste in the coming years.

2.14 Mr. Veerman also shared with the delegation the following waste management issues -

- Regarding EPR for tyres, users would need to return the used tyres to the retailer when buying a new one. They would need to pay about €2 per tyre. The producers were required to take back as much as possible and recycle the tyres collected. In general, about 20% would be turned into recycled rubber and the remaining would be used for energy generation at power plants or kiln.
- The NL Government had no particular role in Green Procurement and tried not to interfere.
- About 25% by weight of MSW incinerated would become bottom ash, which was mainly used as construction material.
- For hazardous fly ash, it would be stabilised and disposed of at special mono-landfill.
- When starting up the EPR, there were negotiation meetings involving the trade and green groups. However, there was no opposition from the consumers.
- The charging method of household waste was different for different municipalities. Some charged by flat rate or by per head and some by variable rates such as by bins or by bags.
- There seemed no illegal dumping problem when charging was introduced, which was quite a long time ago.
- Their study concluded that incineration of household biodegradable waste was better than composting in environmental terms and life cycle cost under the situations of NL, though they would not advocate this as it would spoil the education efforts.
- The incineration sites were usually located at industrial areas or at existing old incinerators. Therefore NIMBY (Not in my back yard) syndrome was not a problem in NL.

B. Visit to the Coolrec BV, Dordrecht

2.15 The delegation was received by Mr. Rogier de Bode, Factory Manager of Coolrec BV in the afternoon of 20 March 2006. Coolrec BV is specialised in processing and recycling refrigerators and freezers, cathode ray tubes (CRT) equipment, small household appliances and information communications technology (ICT) equipment. However, it is not the collection agency for these items. Coolrec (a wholly-owned subsidiary of the Van Gansewinkel Group) has four plants in the Benelux (including the Coolrec, Dordrecht), one in France and one in the United Kingdom, making it one of the largest processors of WEEE in Western Europe.

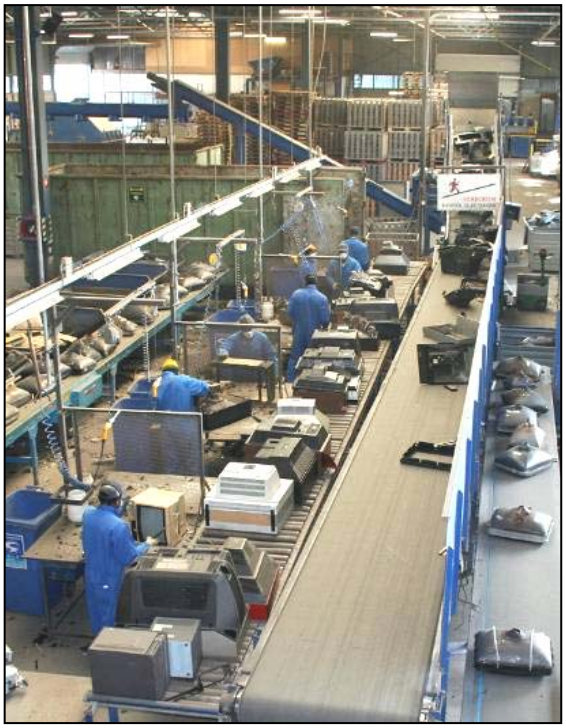

Photo no. 4: Coolrec – Area on the left for disassembly of television sets and monitors; conveyor on right delivers disassembled CRTs for mechanical cutting

Photo no. 3: Group photo with Mr. Bode at Coolrec BV

Photo no. 5: Processing line of refrigerators

2.16 CRT-containing equipment (television sets or monitors) is manually dismantled first. The housing, which is usually made of plastic or occasionally wood, is separated. Plastic housing is recycled (about 400 tonnes per month) and wood is disposed of separately. The CRT is then separated from its electronic components, which are sent to the plant in Recydel (Belgium) for further processing to recover the precious metal.

Photo no. 6: CRTs are manually processed

Photo no. 7: Electronic components recovered during manual disassembly of the equipment

2.17 Dismantled CRTs are sawn into two in the glass separation machine at a rate of 60 to 70 tubes per hour – the lead-containing back (cone glass) and the barium-containing front (panel glass). After the fluorescent layer on the inside of the panel glass has been removed, it can be reused for the production of new fronts for CRTs. The layer of iron oxide on the cone glass is removed in a machine specially developed by Coolrec. After this process, the glass can also be reused to produce new backs for CRTs.

Photo no. 8: Mr. Bode showing a cut of the CRT

Photo no. 9: Coolrec – CRT glass bunker

2.18 For refrigerators and freezers, the recovery of the harmful CFCs from the liquid coolants and insulation foam (PUR) is conducted using cryogenic condensation techniques. The CFCs are made liquid, collected in customised (pressure) containers and then sent to specialist companies for further processing.

Photo no. 10: Removal of CFCs

Photo no. 11 : New removal system of CFCs under commissioning

2.19 The remaining parts of the refrigerators and freezers are further broken down using various reduction and separation processes. More than 90% of the parts of a refrigerator or freezer can be recycled.

2.20 Mr. Bode explained that in early 1990s, WEEE was dumped and piled everywhere. In the late 1990s, with the EPR developed, the formation of the NVMP and the introduction of visible fees for WEEE, Coolrec won the tender and entered the market.

2.21 The major customers are the NVMP and organisations in the non-profit sector (e.g. hospitals, universities and other large institutions). Around 60% of Coolrec's income is from NVMP fees and 40% is from the sales of recovered materials that include steel, plastics, aluminium and compressors, etc. When they started the business in 2000, the ratio was 90% from fees and 10% from sales. The ratio has been improved because of improvement in cost-effectiveness and also the surge in oil prices, making the sale price for plastics to reach €200/t which is even higher than steel. In the coming years, they hope to improve the situation to have 40% from NVMP fees and 60% from sales. Coolrec also works with the European take-back systems operated by multinational companies, international industrial associations and companies with 'cross-border' operations.

2.22 The plant is located in a private industrial area with an area of about 10 ha. (50 m x 200 m). The government did not provide any support or assistance to get the land. The investment cost for the machinery and equipment was about €3 million. Coolrec is employing 60 persons working in double shift.

2.23 Coolrec currently receives or processes 2,000 to 2,500 refrigerators and 1,000 to 1,500 television sets per day, around 2,500 to 3,000 tonnes per month. Each unit costs approximately €10 plus €3 profit, with €8 income from gate fees and €5 from the sales of materials.

2.24 When asked about whether the rapidly declining market of CRT would affect their company's future, Mr. Bode explained that it was definitely a risk since all CRT plants in Europe might likely be closed in two years. In fact, the sale of panel glass had dropped drastically since November 2005. However, they were still optimistic and would strive to explore new markets.

2.25 Regarding the recycling of old computers, Mr. Bode considered that the priority should be the repair and re-sale of old computers, rather than to chip them into pieces to extract material. Noting the second-hand market was very active in Germany, he considered that the profit obtained could offset other not so profitable recycling work.

2.26 Comparing with NL, Mr. Bode reckoned that Hong Kong's densely populated environment could be an advantage since the collection cost could be much less and it would be relatively easier for people to bring recyclables to district collection points.

3. VISIT PROGRAMME IN GERMANY

A. Meeting with the Federal Ministry of Economics and Technology, Germany

3.1 In the morning of 21 March 2006, the delegation was received by Mr. Guido Peruzzo, Acting Director-General of Economic Cooperation, Ms. Gerlind Heckmann, Deputy Head of Division and Ms. Jana Held, Administrator of the Federal Ministry of Economics and Technology. The delegation explained that they would like to learn from the Ministry the application of German waste management technology to overseas countries, the support to the development of new waste management technology, and the support to the industry (waste management) in overseas business.

Photo no. 12: Group photo with the representatives of the Federal Ministry of Economics and Technology

3.2 Mr. Peruzzo explained that the function of the Ministry was to give political assistance to German waste companies and help them to look for counterparts in the overseas for business opportunities. The Ministry also implemented political decisions on EU member states from the EU Headquarter in Brussels.

3.3 In addition, the Ministry would also help German firms to participate in a broad range of international trade fairs, assist small companies in research and development (R&D) projects for new technologies. Mr. Peruzzo further remarked that at present, 2.5% of the Gross Domestic Product (GDP) was allocated for R&D projects on all kinds of new technologies. He hoped to increase this to 3% by 2010. However, he remarked that the Ministry's role was not for acknowledging, approving nor verifying the technology developed.

3.4 The other way to assist the waste management industry was that when the firm decided to sell a technology or equipment, the Ministry might help provide some kind of assurance and guarantee for the contacts.

3.5 When asked about whether there was any figures on the contribution of the waste recycling industry to German's GDP and job market, Mr. Peruzzo said that the whole environmental industry currently employed 1.5 million people out of the total labour force of 38 to 39 million. It showed that the German Government placed great importance on the waste management industry.

3.6 The delegation also enquired whether waste charges collected would be given to the municipalities for enhancing the waste recycling. Mr. Peruzzo explained that nearly all the municipalities were having deficits and needed the charge collected to try to balance their budget.

3.7 When asked about the Ministry's view on Government's Green Procurement Policy, Mr. Peruzzo replied that there was a general policy to encourage green procurement, but only as far as it was reasonable, feasible and within the financial limit. There was no prescribed target or special regulation controlling this.

B. Meeting with the Federation of the German Waste Management Industry

3.8 Also in the morning of 21 March, the delegation visited the Federation of the German Waste Management Industry (BDE) and met with Dr. Rainer Cosson, Managing Director, and Mr. Gerd Henghuber, Head of Public Relations of BDE.

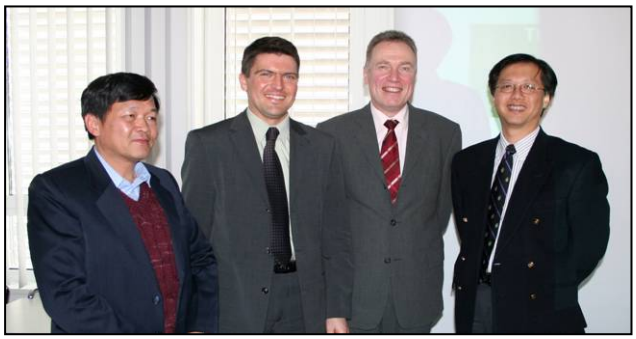

Photo no. 13: Dr. Rainer Cosson, Mr. Gerd Henghuber of the Federation of the German Waste Management Industry and Prof. Lam Kin-Che, ACE Chairman and Mr. Raymond Fan, Deputy Director of Environmental Protection

3.9 Mr. Henghuber explained that BDE was the association with the largest number of members of the German waste management industry and the biggest branch association throughout Europe. He advised that there were about 4,000 companies employing 160,000 employees in the German disposal and recycling industry. The accumulated turnover was €16 billion per year, within which private companies' share was €14 billion and the share of members of BDE was €9 billion.

3.10 He also briefly described the change in waste management in Germany from the 1970s when they relied heavily on some 50,000 landfills until 1993 when the introduction of complete ban on landfilling by 2005 was announced. Finally, landfilling of untreated biodegradable waste was prohibited in Germany since 1 June 2005.

3.11 BDE highlighted that the development of recycling and waste management sector was strongly supported by environmental legislation (product liability and separate collection schemes). The high environmental standards adopted by Germany encouraged the development of high-tech industry and the high prices of incineration (in the range of €150 - €180/t) encouraged the development in the recycling sector.

Photo no. 14: Meeting with the representatives of BDE

3.12 Mr. Henghuber also advised that the latest trend in waste management in Germany had been shifted to the prevention of greenhouse gas emissions (methane), the substitution of primary resources by increasing recycling quotas for individual waste streams (e.g. paper, glass, plastics), the attainment of sustainability through environmentally-sound waste treatment options and the promotion of renewable energy and increasing energy efficiency.

3.13 Regarding the reduction of greenhouse gas, during 1990 to 2005, 46 million tonnes CO_2-eq. was reduced, which represented 25% of total German commitment. It was hoped that by 2020, 10% of German commitment would be met by the waste sector because of the complete landfill ban for untreated biodegradable waste beginning in June 2005. Regarding the EU-wide emission reductions, the total reduction would need to reach 44 million tonnes CO_2-eq, of which 60% should be from the waste sector. Therefore, a European-wide landfill ban would be necessary.

3.14 The long-term strategy in German waste management sector was to establish a full circular flow economy by 2020, with the focus on the re-use of secondary raw materials in the production cycle (e.g. aluminium, copper) and the substitution of primary energy resources (e.g. coal) by increased use of secondary recovered fuels in co-incineration and waste-to-energy plants.

3.15 Mr. Henghuber explained that they acknowledged growing economies would produce pollution inevitably and the costs of pollution were enormous. However, they strongly believed that any investment in environmental technology would be cheaper than overall costs of extensive pollution mitigation. Therefore, since 1990, the German waste management companies had invested about € 20 billion in incineration plants, emission filters, biomass and composting plants, etc. German companies had gained a world market share of about 20% in this field and created about 100,000 new jobs. They estimated that the global market for environmental technology and services would agglomerate up to € 300 billion.

3.16 Upon further enquiries, BDE explained that the decision of diverting to various types of facilities by the municipalities was really a result of prices and political consideration. Recycling companies for packaging waste could not be self-sustained without the income from the license fee under the "Green Dot" system. Regarding individual material within the packaging waste, aluminium, paper and tin were relatively profitable and self-sustained. However, mixed plastics and mixed glasses were problematic and needed subsidy. For example, it would require €150 to €160/t to recycle mixed plastics but the sale price for the product would only be €40 to €70/t.

3.17 Regarding incinerators, BDE advised that there were some 60 to 70 incinerators and most of them were run by public bodies. Some of them were implemented by public-private-partnership led by a public body with a majority share of say 51%. The trend was to have bigger plants using new technology and less labour so as to become economically feasible. In recent years, there were some increases in the number of incineration plants. Most of them, about 5 to 6, were built in the eastern part of Germany where there were only landfills previously. Only one or two new plants were built in the western part of Germany.

3.18 Regarding the problem of anti-incineration, BDE advised that there were concerns on emissions and health problem, but these were all resolved and not an issue anymore.

3.19 BDE also briefly introduced the PRS for packaging waste in Germany – the Duales System Deutschland (DSD or "Green Dot" system). DSD had an overall responsibility for the separate collection and recycling of packaging. In 1991, DSD started collecting transport packaging and in 1992 started operating its parallel collection system, which covered almost 100% of German households with the exception of the city of Munich. Households were issued with a yellow packaging waste bin or bag, although glass and paper continued to be collected in existing bottle banks and containers. A green dot printed on consumer goods (sales packaging), for which manufacturers paid a license fee to DSD to finance the dual collection and recycling system, indicated that they would be collected by DSD.

Photo no. 15: Examples of packaging with the green dots

3.20 The company, as the umbrella organisation for the recycling of sales packaging marked with the Green Dot in accordance with the provisions of the Packaging Ordinance, neither owns nor operates any sorting or recycling plants. In contrast, DSD organises the collection, sorting and recycling of packaging waste in Germany with the support of some 700 waste management partners.

3.21 In 1991, there was only one organization running the DSD. However, the law has been changed to allow more competition in this field.

3.22 When asked about any sanction or punishment against people throwing non-recyclable into the recycle bins, BDE advised that it was not possible to have an active policing on this. It was difficult and resources demanded to prove and the legislation did not allow for this. In Germany, they rather relied on education and self-awareness to operate the system. In fact, there were regions/districts that were not as self-disciplined as others and the quality of recyclable collected was not so good.

C. Visit to the Thermal Waste Treatment Plant, T.A. Lauta

3.23 In the afternoon of 21 March 2006, the delegation was received by Mr. Hartmut Jäger, Managing Director of T.A. Lauta. The planning for T.A. Lauta (Thermischen Abfallbehandlungsanlage, thermal waste treatment plant) began in 1993. Biddings were called in 1995 on price per tonne for the design and operation of the plant for 25 years with given waste volume, and the plant commenced its operation in mid-2004. The plant was well received by the community with some 2,000 residents and interest groups visited the plant in 2005.

Photo no. 16: The multi-level flue gas purification system and the 55 m chimneys of the T.A. Lauta

3.24 The technical information of the plant is as follows -

Operator:	VEAG/STEAG Corporation Lauta oHG
Waste types:	domestic, trade and industrial wastes from the federation area of the RAVON and adjacent areas
Throughput:	225,000 tpa
Investment:	around € 127 million

3.25 The plant employs typical mass burn process, utilizing stroking grate and partially water cooled grate system to cater for future higher heat value waste (Figure 1). The features of the plant are as follows -

- Incineration process at a temperature of at least 850 °C
- Flue gases used for steam generation (2 processing lines of 37.5 MW each) in the subsequent waste heat boiler
- Steam is supplied to a turbo set for production of electricity (20 MW)
- Around 4 MW of the electricity is used for the internal requirement and the rest goes to the public grid

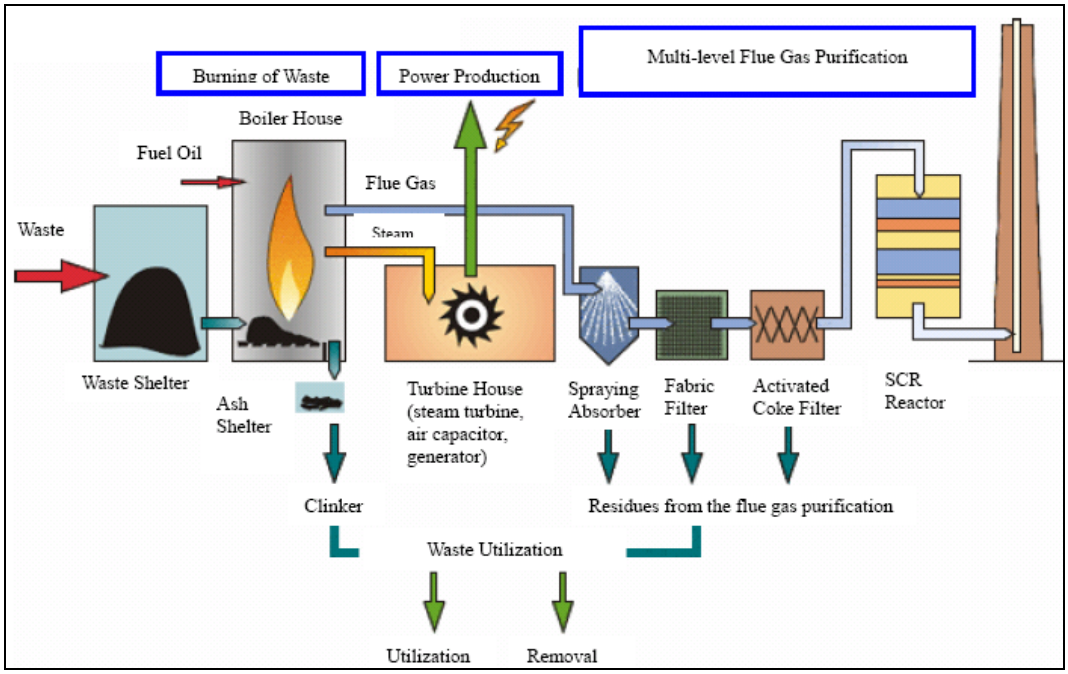

Figure 1 - Operation Diagram of T.A. Lauta

3.26 The special features of this plant are the stringent emission standard and the excellent emission performance. The successful tenderer submitted a very ambitious tender for a designed emission standard of generally 50% more stringent than the national 17 BimSchV. The emission control features and results are as follows -

- Multi-level flue gas purification plant comprising the following -
  - → dry lime spraying absorber using expensive high speed rotating atomizer (about 8000 rpm and € 35,000 per wheel);
  - → fabric filter;

→ activated carbon filter (as “police” filter for filtering dioxin and furan, very expensive as the cost of activated carbon is about €350/t); and

→ Selective Catalytic Reduction (SCR) reactor (with heated steam from exhaust at 180 °C to 190 °C).

- Cleaned flue gas exhausted through a 55 m high chimney.
- Dioxins and Furans of the residual waste are nearly 100 percent destroyed.

3.27 The resulting emission performance is around 50% of the design standard, i.e. some 25% of the national standard (Table 1 and Figure 2). Because of the high standard achieved, the plant can accept 118 types out of 120 types of approved waste. In addition, it can accept 12 kinds of special waste that need special monitoring such as hospital waste (syringes).

	National Standard	Design Standard	2005 Annual Average Value
Total Dust, mg/m³	10	5	0.23
Total Carbon, mg/m³	10	5	0.14
Hydrogen Chloride, mg/m³	10	5	1.67
Sulphur Dioxide, mg/m³	50	5	0.96
Nitrogen Oxide (NOx), mg/m³	200	70	40.6
Carbon Monoxide, mg/m³	50	40	11.3
Cadmium and Thallium, mg/m³	0.05	0.025	0.0006
Mercury, mg/m³	0.05	0.02	0.0013
Heavy Metals, mg/m³	0.5	0.25	0.09
Dioxins and Furans, ng TE/Nm³	0.1	0.05	0.0028

Table 1 - Emission Performance of T.A. Lauta

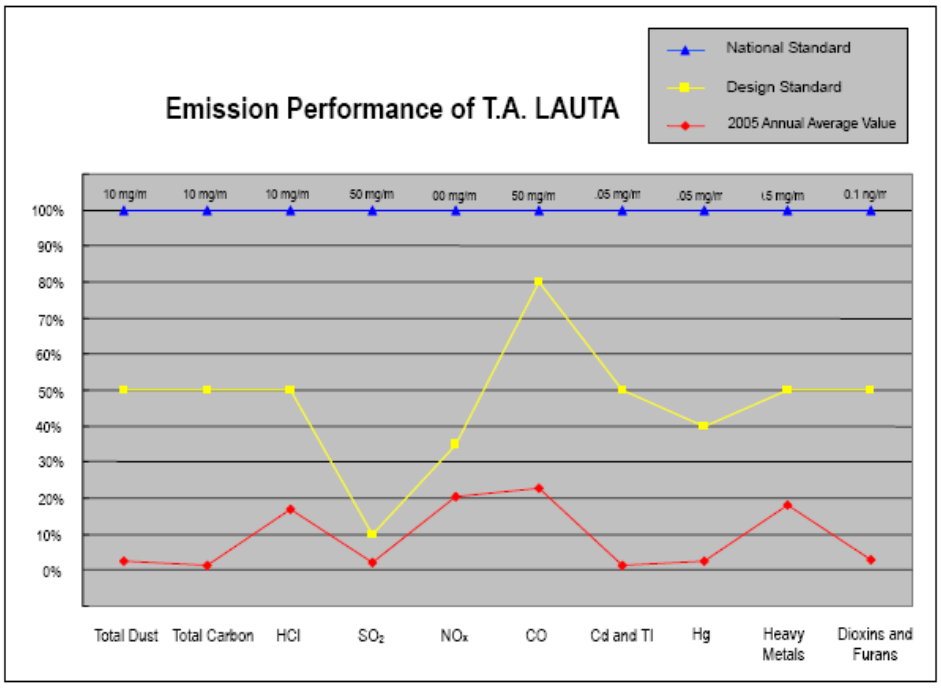

Figure 2 - Emission Performance of T.A. Lauta

3.28 Mr. Jäger explained that the desirable heat value of the MSW should be around 7MJ/kg to 12MJ/kg. However, because they were handling rural waste, which was much less homogenous than city waste, the heat value of the waste currently received was only 8 to 8.2 MJ/kg. He expected that heat value would rise because of the effect of landfill ban.

3.29 He also pointed out that the ash from lignite and wood used by the local communities for heating was usually mixed with the MSW. This increased the wear and tear in the plant, lowered the efficiency, and increased the ash content to a higher level of 29% of the incoming waste by weight.

3.30 Regarding ash management, the ash was stored in an 800t bunker and was carried by trucks to other companies for treatment. The bottom ash (slag) was used as construction material but they needed to pay €18/t. The fly ash, which is only 10% of the incoming waste, was added with additives to stabilise old mines, tunnels and caverns. Again they needed to pay € 100/t.

Photo no.17: Introduction of the control system of the T.A. Lauta

3.31 When asked about how to gain residents' support on the project, Mr. Jäger explained that there were about 5,000 habitants living around and they received objections from all of them. People were worried about the health hazard and traffic impact, although the waste delivered from 4 refuse transfer stations only amounted to some 50 to 60 trucks per day.

Photo no. 18: Inspection window of the furnace at T.A. Lauta

3.32 To tackle this, the company invited the best scientists in Germany to explain to the residents, arranged visits to similar plants and went through several hearings and legal proceedings to iron out the objections. Even after the plant was in operation, they still carried on the public relation programme and arranged visits for them. It was only through seeing the actual operation of the Lauta plant itself that the residents' worries were settled. Mr. Jäger cautioned that one should not give out money to subsidize the local community or provide betterment service to solicit people's support.

3.33 When asked about the amount of turnover, Mr. Jäger explained that they had just started the operation for a short period and were still in deficit. They were employing 55 employees. He expected to have a surplus of €2 million when the situation became stable.

D. Visit to the SVZ Schwarze Pumpe, Spreetal

3.34 In the morning of 22 March 2006, the delegation was received by Dr. Hans-Joachim Sander, the Managing Director of Sustec Schwarze Pumpe GmbH, and Ing. Rainer Giering, Project Manager for Corporate Development. This plant employed three types of gasification process to gasify low-grade coal and selected solid and liquid waste for the production of synthetic gases for power generation and production of methanol.

Photo no. 19 - The gasification plant of SVZ at Spreetal

3.35 The technical information of the plant is as follows –

Operator:	The Sustec took over the SVZ on 1 October 2005
Investment:	€150 million
Waste types:	Heat value rich solid and liquid wastes, including used plastics, contaminated wood, remainder waste, slurry-dredge, tar sludge, contaminated waste oils, solvent and oil waste mixture and shredder remains from automobile recycling
Throughput:	Total solid waste about 300,000 t per annum Total liquid waste about 100,000 t per annum Some specific items - Plastics 5 t/h Wood 5 t/h Domestic 20 t/h

Capacity of Methanol Plant:	100,000 tonnes/year
Electricity output:	75 Megawatts
Total site area:	200 ha. (2 km x 1 km)

3.36 In order to guarantee an adequately high heat value for the high-temperature process and to achieve certain mechanical solidity for efficient material handling, solid waste is turned into pellets first. About 50% of the pellets are made in the plant from loose waste such as packaging plastics, which needs to pay a gate fee of €130/t to them. The remaining 50% pellets are made by third party MBT and delivered to them with a gate fee of €40 to €80/t. The pellets are of very high heat value about 15MJ/kg to 20 MJ/kg.

Photo no. 20: The delegates were shown with the pellets which were fed into the gasification plant

Photo no. 21: The vitrified slag produced from the gasification plant

3.37 The plant was originally built to treat low grade saline coal dust in 1982. To strive for survival, it was gradually modified to treat liquid waste in the 1990s and then solid waste in 2000. Therefore, three types of gasification processes implemented at different periods are now employed. They are Entrained Flow Gasification (GSP), British Gas - Lurgi (BGL) Gasification and Pressurised Solid-bed Gasification.

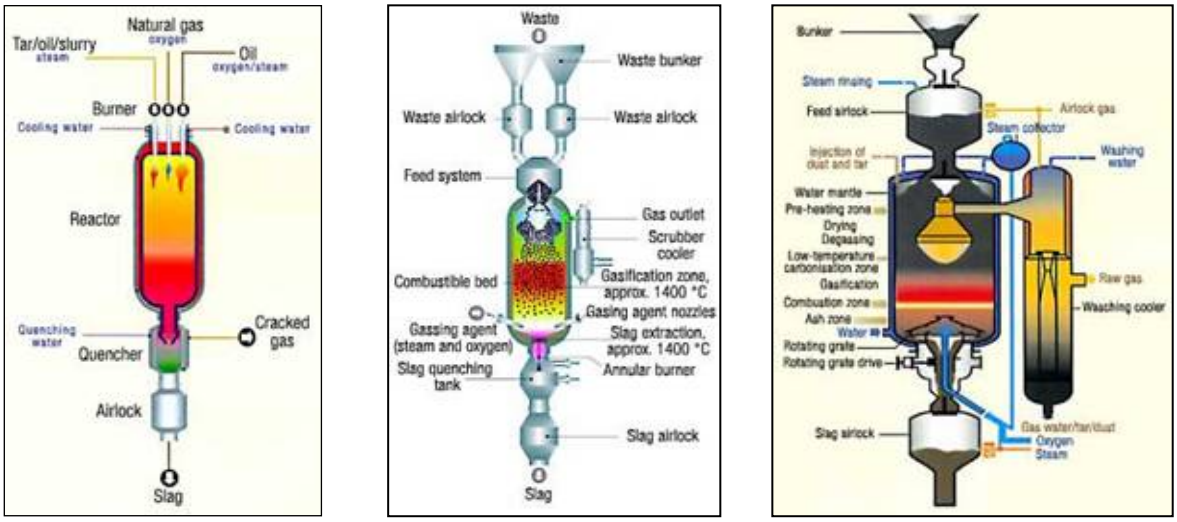

Figure 3 - Treatment processes and material flows at SVZ gasification plant (from left to right: Endrainet flow gasifier, BGL gasifier, Pressurised solid-bed gasifier)

- **Endrainet Flow Gasifier** (2 units)

    - Processing capacity: 15 tonnes/hr
    - Contaminated oils, tars and slurries are converted into synthesis gas at temperatures of 1,600 – 1,800 °C
    - Quenching of the gas prevents undesired subsequent reactions
    - Heavy metals are locked into the vitrified slag and cannot be eluted

- **British Gas - Lurgi (BGL) Gasifier** (1 unit)

    - Processing pre-treated solid waste at 35 tonnes/hr
    - Mixture of waste and coal enters the reactor via a double airlock system
    - Gasification takes place at temperatures of 1400 - 1600 °C and a pressure of 25 bars
    - Steam and oxygen are used as the gasification agents
    - The slag is removed in the form of a liquid and is then quenched to form a vitrified, granular slag in which all pollutants are locked and cannot be eluted

- **Pressurised Solid-bed Gasifier** (7 units)

    - Processes solid waste at 14 tonnes/hr
    - Waste mixes with coal and enters the reactor through an airlock system
    - Operates at a pressure of 25 bars
    - Uses steam and oxygen as gasification agents
    - Gasification at temperatures of 800 – 1,300 °C
    - The remaining solid residues, in the form of slag, comply with the requirements of the waste disposal class 1 of the German garbage disposal laws

3.38 The very high combustion temperature of over 1,000°C in an oxygen deficient environment ensures an efficient and effective destruction of dioxins and furans. The carbon dioxide emission is also 30% lower than other incineration plants. In addition, the inorganic pollutants and heavy metal are bound in the vitrified slag in such a manner that there is no risk of leaching. Therefore, the plant can accept some 200 types of waste, including waste with higher pollutant contents that cannot be accepted for co-combustion at power plant or cement kiln.

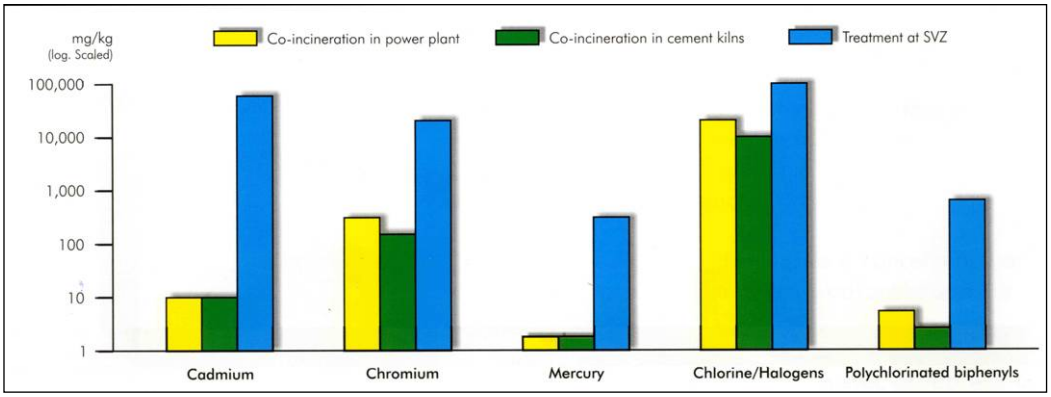

Figure 4 – Allowable waste concentration at SVZ gasification plant

3.39 Regarding the products of the plant, part of the synthetic gases produced from

the above processes is utilized for the production of steam and electricity, and part of it is turned into extremely pure methanol by separate chemical process. Methanol is a raw chemical material with a current high demand in various applications. There is a big client nearby buying 20% of the methanol for the production of formaldehyde that is in turn used extensively in furniture industry, compressed plywood, etc.

3.40 Dr. Sander advised that they would charge raw loose waste at €120 to €150/t, waste in bales at €140 to €180/t and sludge at €100/t. It was also interesting to note that they would charge the MBT plants for delivering RDF pellets to them, revealing that the RDF from MBT might not have a profitable market. Another significant part of their income was the selling of methanol, the price of which was controlled by the stock market and was currently €275/t.

3.41 When asked whether the plant was self-sustainable, Dr. Sander replied that they were working towards this as a target. Dr. Sander also pointed out that one would need a very good industrial infrastructure to support the entire gasification process, otherwise it might not be economically viable. The Schwarze Pumpe plant was the only gasification plant left in Germany. This was because there was an incident of syn-gas leakage some 5 to 6 years ago from Siemens' Thermoselect gasification plants, which might have been due to the scaling up from research prototype too quickly without financial backing or strength. Therefore, people have already lost faith for gasification. He said that if he were allowed to design a new plant from scratch, he would choose the BGL gasification units. They were considering constructing two new gasification units based on the experience gained.

E. Meeting with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany

3.42 In the afternoon of 22 March, the delegation met Mr. Stephan Contius, the Head of Division (United Nations, Cooperation with Developing and Emerging Countries), Mrs. Barbara Schaefer, Deputy Head of Division (United Nations, Cooperation with Developing and Emerging Countries), Dr. Claus Bergs, Head of Division (Waste from Human Settlements) and Dr. Bernt Johnke, Head of Division (Thermal Treatment of Waste) and Mr. Hartwig von Bredow.

Photo no. 22: Meeting with Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany

3.43 Dr. Bergs gave a presentation on the history and current status of waste management in Germany. He highlighted that the Technical Instructions on Waste from

Human Settlements 1993 aimed to recover as much as possible, reduce harmful substances, ensure an environmental treatment and landfilling, and most importantly suggested a 12-year transition period after which wastes could no longer be landfilled in Germany without pre-treatment. Prior to disposal, waste must be treated in such a way that it could not degrade further or release pollutants. This requirement was eventually stipulated in the Waste Storage Ordinance 2001. This became the main driver for the development of MBT and incinerators, as well as waste reduction and recycling in Germany.

3.44 He further pointed out that as a result of the legislation, the number of landfills in Germany had been reduced drastically from some 8,000 in 1990 to around 160 in 2006, and was expected to be reduced to 20 to 30 in 2020. The recycling rate had increased drastically from 13% in 1990 to 52% in 2001. Because of the landfill ban beginning in June 2005, the methane emission from landfilling of household waste had been drastically reduced from 26.7 Mt CO_2-eq in 1990 to only 0.1 Mt CO_2-eq in 2005.

3.45 EU-wise, the landfill ban on un-pretreated biodegradable waste in EU-15 can avoid 134 million tons of CO_2-eq. This is equivalent to 11% of the post-Kyoto maximum target of a 30% emission reduction in 2020.

3.46 Dr. Johnke then presented the Thermal Waste Treatment in Germany. Some background data about Germany in 2005 is as follows -

- 82 million inhabitants
- 46 Mt municipal solid waste per year [23 Mt/yr for recycling (material and energy) and 23 Mt/yr for disposal]
- 9 Mt hazardous waste per year
- 2.4 Mt sewage sludge (dry matter)

3.47 He then gave a comprehensive inventory of the existing waste treatment facilities in Germany as follows –

Landfills	• 162 Landfill sites (class II) for pre-treated municipal solid waste • 10 Landfill sites for hazardous waste • 4 Undermining waste disposal sites for hazardous waste, capacity 50,000 t/yr • 20 Packing mining sites (backfilling of inert material in holes) • Many inert material landfill sites
Municipal Solid Waste Incineration plants	70 Municipal Solid Waste Incineration Plants with a total capacity of 17 Mt • Throughput range from 34,000 t/yr to 670,000 t/yr, medium throughput 230,000 t/yr • 2 lines to 4 lines, ranges from 5 t/h to 35 t/h • All plants have grate firing systems (broad-band technique) • Thermal treatment cost/charges €95 to €285/t
Other advanced thermal treatment	• 1 Pyrolysis plant for MSW with 2 lines a 3 t/h, total capacity of 25,000 to 30,000 t/yr • 1 Pyrolysis plant (called Con Therm - System) for RDF in combination with a power plant, used as pre-treatment plant to produce pyrolysis gas and pyrolysis cokes. • Duotherm-System (Pyrolysis grate chamber, after burning

Other advanced thermal treatment	chamber with O_2-addition), pilot plant in a commercial-scale for MSW in Bremerhaven, throughput of 60,000 t/yr • 1 Gasification plant (Schwarze Pumpe) with 1 slag bath gasifier and 5 packed bed and current flow gasifier systems to produce methanol and slag • 1 Circulated fluidised bed gasifier (Rüdersdorf) as pre-treatment plant in combination with a cement kiln plant, 20 to 30 t/h throughput of RDF and other kinds of caloric waste to produce cokes and gas as substitute fuel
Mechanical Biological Treatment plants	50 Mechanical Biological Treatment plants with a total capacity of 5.5 to 6 Mt/yr • To produce RDF (refuse derived fuels from waste) for co-incineration (e.g. power plants, cement kilns) or RDF-incineration plants (WtE plants), (material recycling of Fe-metal, NE-metal, inert material (glass, ceramics) and stabilized rest (residual) waste for landfill • Treatment costs/charges €70 to €160/t
Others	• Waste to Energy incineration plants with circulating fluidised bed firing • 900 biowaste treatment plants with a capacity of 8 Mt/yr to produce compost • 30 Hazardous Waste Incineration plants with a total capacity of 1.2 Mt/yr, most plants use rotary kilns • 23 Sewage sludge incineration plants with a capacity of 0.6 Mt (dry matter)/yr, most plants have (stationary) fluidised bed incineration • 25 Co-Incineration plants (power plants for lignite and hard coal), most plants have dust firing or circulating fluidised bed firing • 8 MSW incineration plants co-incinerate sewage sludge • 1 clinical waste incineration plant • 2 MSW incineration plants co-incinerate clinical waste in separate systems and use the same flue gas cleaning system

3.48 Regarding the market outlets of incineration residues, Dr. Johnke advised that in Germany, each tonne of waste would produce about 250 to 300 kg of bottom ash. About 4.25 Mt of bottom ash was produced each year, of which 3.4 Mt (about 70%) was recycled for road construction and the remaining 30% for backfilling as inert material in holes of packing mining sites or used as construction material in landfill sites.

3.49 Regarding fly ash, depending on the emission control process adopted, each tonne of incinerated waste would produce about 8 to 80 kg of fly ash, which would be stabilised and disposed of at special landfills or old mines/caverns.

3.50 Although gasification was developed in Germany first, there was only one plant left and most of the gasification developments were now in Japan. Dr. Johnke advised that there had been several cycles of advocating gasification/pyrolysis in the past decades. However, because of some failure cases due to the scaling up of the laboratory prototype to industrial scale too quickly, people had serious doubts on these new technologies. Given that the state-of-the-art incinerators had already achieved very low emission which was far below the stringent national standard, they considered not worthwhile to pursue gasification. In addition, to achieve cost-effectiveness, the strategy was to turn waste into energy for sale as far as possible. Therefore, they did not want to waste the energy from the gasification to melt the ash, which could be stabilised

and disposed of in old underground mines easily and safely.

3.51 Mr. Contius also advised that because of stringent regulations, waste incineration plants were no longer a significant generator in terms of emissions of dioxins, dust and heavy metals. He explained that in Germany, the process to get people to accept incinerators near them was a rather difficult process. There were elaborated and lengthy procedures to go through and it was usually very dependent on the leader's political strength and will. Nevertheless, the debate on landfill versus incineration was settled some 25 years ago. They also considered zero waste was not possible and 40% to 50% of waste was unavoidable and still needed to be treated.

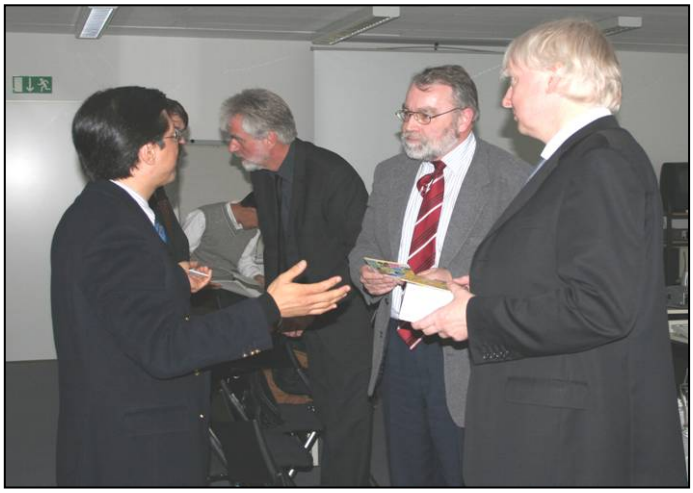

Photo no. 23: Members of the delegation exchanging views with the representatives of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

3.52 When asked about the principle guiding the financial measures, he explained that it was important to calculate how much citizens needed to pay for treatment and how much they were able to pay. In general, a household of 4 persons would need to pay €200 to €400 per year for waste collection, treatment and disposal. However, municipalities were not allowed to make any profit from the charge.

3.53 Regarding the PRS, Mr. Contius mentioned that the law now allowed more companies to set up PRO but they still had one PRO only. There was a legal requirement to mandate the PRO to set up collection bins/centres for the convenience of the citizens but placed no obligation for the citizens to place the correct material into the correct bins. Finally, they were thinking of extending the Green Dot system to WEEE.

F. Visit to the Waste Incineration Plant, MHKW Magdeburg

3.54 In the morning of 23 March 2006, the delegation was received by Mr. Helmut Herdt, Managing Director of SWM Magdeburg and Dr. Jörg Sinnesbeck, the Plant Manager of E On Engineering.

3.55 The technical details of the plant are as follows -

Operator:	The BKB corporation (BKB) and the urban works Magdeburg GmbH (SWM)
Throughput:	Approximately 630,000 t/yr
Calorific value:	7,2 - 15,0 MJ/kg
Shareholders:	BKB (51%); SWM (49%)
Limit of emissions:	17. BlmSchV
Total investment:	€ 250 millions
General supplier:	Alstom
Jobs:	100 direct / 200 indirect
Beginning of construction:	February 2003
Planned inauguration:	June 1st 2005 (unit 1+2) October 1st 2006 (unit 3+4)
Issuing approval:	28.02.03 construction and operation Unit 1+2 31.01.05 construction and operation Unit 3+4

3.56 Dr. Sinnesbeck explained that the first phase of MHKW (Müllheizkraftwerk, heat and power recovery garbage station) Magdeburg Rothensee had just commenced its operation in June 2005. It was in fact two plants developed in phases on one piece of land. When they won the contract in early 2000s, the plan was just to develop a plant with a throughput of 300,000 t/yr, i.e. units 1 & 2 only. However, because of their competitiveness and the pressure on the municipalities from the landfill ban to be exercised in June 2005, a lot of municipalities asked for their services. With more waste service contracts in hand, they were able to expand the plan and build another facility even before the first two units were in operation.

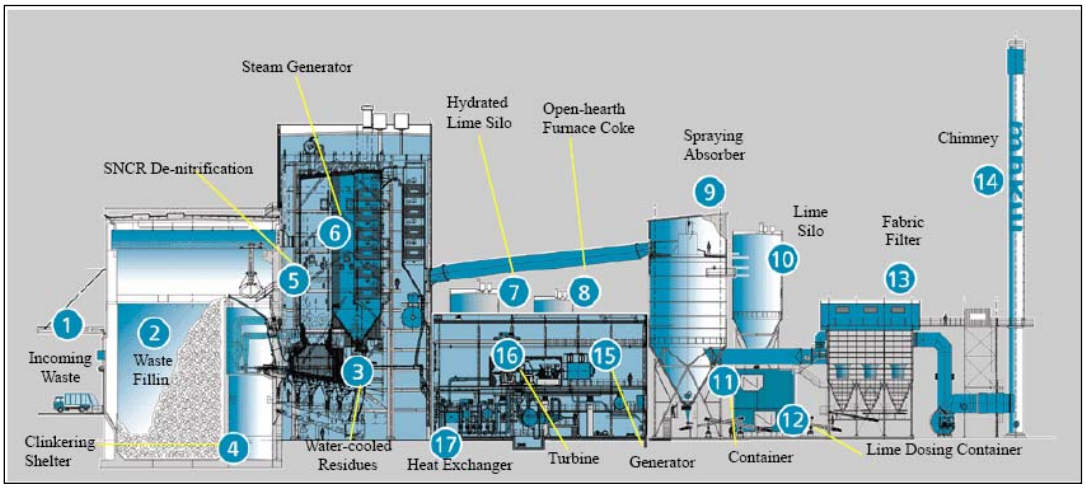

Figure 5 - Operation Diagram of MHKW Magdeburg

3.57 Dr. Sinnesbeck further remarked that they could offer very competitive prices because the companies owning the projects were in fact very big power and heating service providers in the country. They could utilize the old power plant site for the new incinerators and had no problem to put the electricity and heat from the incinerators into the power and heating grid. For example, they could just build a couple hundred metres of hot water pipe-work from the incinerator to join the local heating network, thus minimising the capital and operation cost.

3.58 The plant will eventually have 4 process lines, each with a capacity of 22 tonnes per hour and thermal output of 66.7 MW. Long-distance heating (350,000 MWh) will be provided to the heating net of 140 km (primarily) and 80 km (secondarily) piping network. The plants will also generate 370,000 MWh electricity for delivery to the existing public net (transformer station Rothensee) for 40,000 households in Magdeburg.

3.59 Location-wise, it has an advantageous infrastructural network, like railway, road and waterway connections, which enables them to secure the lowest transport costs for waste.

3.60 Regarding technology aspect, the equipment and system supplier for this plant is the same as the one for the T.A. Lauta. Therefore, the designs of these two plants are very similar, except that this plant is a bit larger with a throughput of about 300,000 t/yr for the first phase compared with 225,000 t/yr for the T.A. Lauta. Another major difference is that the plant is just designed to meet the national standard (17. BlmSchV) for achieving the highest cost-effectiveness. Therefore, unlike the T.A. Lauta, expensive activated carbon filter and SCR reactor are not installed in the flue gas cleaning system.

3.61 Dr. Sinnesbeck advised that the plant would generate around 180,000 tpa of bottom ash (i.e. about 27% of the input waste by weight). It was properly processed and utilized at a separate plant in Magdeburg. The newest technologies allowed the possible recuperation of different metals and high-quality products for use in the road and construction. They needed to pay about € 30/t for handling the bottom ash. Regarding the fly ash, around 30,000 tpa (i.e. less 5%) would be generated and they needed to pay about €60/t for others to use as fills and sealing material in the mining industry.

3.62 Regarding the phased development, Dr. Sinnesbeck replied that the two modular plants would be very similar. The common facilities that could provide synergistic effect were the fire fighting system, conference room, weighbridge and electricity system. The site area for the first phase (2 units) was about 85 m X 250 m (i.e. just above 2 ha.) and the total area for all the two phases would be around 150 m X 250 m (i.e. less than 4 ha.). The gate fee they charged the customers was below €100/t. The price of electricity they sold was about €0.5 KWhr, which the households would normally need to pay €0.6 KWhr.

3.63 Finally, when asked about how to gain residents' support for the project, Dr. Sinnesbeck explained that there were about 1,000 objections during the 2-month objection period. They had to go through all the lengthy legal procedures and public relation programmes to gain the support.

Photo no. 24: The outlook of the incineration plant in MHKW Magdeburg

G. Visit to the MBA Hannover Waste Treatment Centre [Mechanical Biological Treatment (MBT) Plant]

3.64 In the afternoon of 23 March 2006, Mr. Theo Schneider, Deputy Executive Director of MBA Hannover received the delegation and made a brief presentation about the plant. The MBT plant serves the city of Hannover and the surrounding municipalities, which are named as "Friendly Partnership Solid Waste Management Hannover Region (Zweckverband Abfall wirtschaft Hannover (AHA))".

3.65 Mr. Theo Schneider advised that they were employing 1,400 staff for collecting and treating the waste for more than 500,000 private properties and 40,000 commercial clients. Some 200 vehicles were employed in waste collection and transportation. There were 126,000 waste bins and containers, 18 recycling centres and 3 waste dumps in the region.

Photo no. 25: Mechanical Sorting Plant of the Hannover Waste Treatment Centre

Photo no. 26: Compost storage area of the Hannover Waste Treatment Centre

3.66 The technical details of the plant are as follows -

- Waste types: Private households and trade wastes
- Throughput: Around 55% of the total waste generated in the region (i.e. 200,000 tpa)
- Process: The MBT Plant has 14 unloading bays, 3 processing lines performing mechanical, aerobic and anaerobic biological treatment.

- Mechanical Waste Processing Plant (mA)
  - Wastes are shredded, sorted (60 mm sieve) and processed.
  - Metals are separated and brought to utilization.
  - High heat value coarse waste (e.g. paper, plastics and wood) is sorted, packed into containers and sent as refuse derived fuel to the adjacent incineration plant at a cost of roughly €100/t.
  - Fine waste is treated in the biological waste treatment plant to reduce the organic content.

- Biological Waste Compost Plant (BAK)
  - Converts about 160 tonnes per day of separately collected organic and green wastes to high-quality compost in an enclosed structure over a 6-week process.
  - Emission from the composting plant is treated by a bio-filter.

- Biological Waste Treatment Plant (BA)
  - Fine waste from the Mechanical Waste Processing Plant goes through dry fermentation (i.e. anaerobic digestion) and stabilization for meeting the legal requirements.
  - Dry fermentation is a batch-wise process conducted in a series of small tanks simulating the process inside a cow's stomach.
  - It turns biomass into biogas (methane) under anaerobic condition for 3 weeks, but requires less water, piping, storage capacity and process energy. The biogas is compressed and piped to the treatment centre's CHP plant to generate electricity for the national grid.
  - The residue is re-oxygenated with aerobic fermentation for a further six weeks and sent to the landfill.
  - The air extracted from the complex is thermally purified and released through a 35-metre chimney.

Photo no. 27: The delegates exchanging views with the management of the Hannover Waste Treatment Centre

3.67 Mr. Schneider remarked that the landfill ban was the driving force for the development of this plant. In 1997, to prepare for the ban in June 2005, the municipality decided to build a MBT adjacent to the 140 ha. Lahe landfill site. The total area of the plant was about 20 to 25 ha. The investment was about €60M (€5M for site formation, €10M for MT and €45M for BT). The net treatment cost was about €80/t to €90/t. He also advised that 75,000 t/yr to 120,000 t/yr of residue from the plant would

still need to be disposed of at the landfill, i.e. the MBT only directed 40% to 60% of waste away from the landfill. The plant had operated less than a year and some of the operational problems such as high biogas pressure and leak from the valves at the Biological Waste Treatment Plant were being fixed.

H. Visit to the Harz on Nature Conservation Policy and Management

3.68 On 24 March 2006, the delegation was received by Ms. Petra Wernicke, Minister for the Environment of Sachsen Anhalt, Mr. Pusch, Head of the Harz National Park, and Ms. Möser, Head of the Public Relations Department of the National Park. Mr. Pusch briefed the delegation about the background of the Harz National Park and the nature conservation policy and management strategy they employed.

Photo no. 28: The Harz National Park

3.69 There are 350 national parks in Europe and 14 are within Germany. The Harz National Park is a nature reserve in Lower Saxony and Saxony-Annhalt. It occupies an area of 247 km², with 30 km East-West and 35 km North-South. The altitude varies from 230 m to 1142 m above sea level at Brockensummit. It is an important natural habitat for Subalpine dwarf-heath, Montane Spruce-Forests, Beech-Spruce-Forests and Beech-Forests.

3.70 Mr. Pusch explained that their main tasks were to enhance the tolerance of natural process, develop the forests, and conduct practical researches and environmental education programmes. Instead of traditional species protection, their strategy was to protect the entire habitat and thus protect the whole diverse eco-system.

3.71 To tackle the conflicts between nature conservation versus tourism, their policy was to have an effective visitor management. Visitors were to be confined in designated areas, such as 780 km hiking trails and 145 km cross-country ski runs, so that the disturbance to the natural habitats would be kept to minimum. User-friendly information was prepared and readily available to the visitors. National park-guides, which were honorary posts with advanced training by the administration, provided guided tours to visitors.

Photo no. 29: Members of the delegation with Ms. Petra Wernicke, Minister for the Environment of Sachsen Anhalt and Mr. Pusch, Head of the National Park, at the Harz National Park

3.72 They also had excellent ranger-service providing care for visitors, performing environmental education, as well as giving warning tickets to visitors who violated the rules within the national park. The total number of staff involved in the entire national park management was about 200. When asked about whether special certification was required for the rangers, Mr. Pusch explained that the rangers needed to have 8 training units per year and special tests could be developed for them later.

3.73 He also briefed that the former inner-German border cut through the Harz National Park and it became "Green Belt" today. The Bracken and surrounding area had been a military prohibited area previously, thus making the area free from intensive development. When asked about whether there was pressure to open up the park for development like the border between Shenzhen and Hong Kong, he advised that under the law, no construction activity was allowed. The only problem they had was how to manage the large amount of visitors every year.

4. OBSERVATIONS

The delegation has the following main observations as a result of the visit -

4.1 Public Education and Partnership
o High level of environmental education and awareness are vital for the success of various policy initiatives of the Policy Framework. The Government should have a comprehensive community education programme on general waste issues, supported by focused campaigns on selected topics. o Members consider additional government resources should be committed for the implementation of waste reduction education programmes in tandem with various initiatives of the recently promulgated 10-year Policy Framework. The setting up of a dedicated fund from PRS or MSW charging for the development of the recycling industry and community education programmes is also supported.
4.2 MSW Charging
o Members note that some cities or municipalities just charge by flat rates and some by prepaid bin or bag system. o Members consider that MSW charging should be implemented as soon as possible and the MSW charges should be set at a higher level to provide "financial incentive" to change people's wasteful habits.
4.3 PRS
o Members agree with the Netherlands' (NL) experience that the establishment of collective Producer Responsibility Organisations (PROs) organized by the trade is more cost effective and is a very important element for the successful implementation. o Members also note Mr. Veerman's advice that collection is usually the weakest link and substantial improvement of collection service is necessary in Hong Kong. A professional image for the waste collection trade should be established. o If NL's Extended Producer Responsibility is applied to Hong Kong, the license fees for PRS may need to be high enough to offset the high labour and land costs. It may be necessary to adopt a lower fee first to cultivate the habit and then increase it to recover the full cost. o After visiting the WEEE recycling plant in NL, members note the importance of having a viable market outlet for the recycled products.
4.4 Territory-wide Source Separation
o It is important to have a good source separation system so as to ensure a cost-effective waste treatment downstream.
4.5 Green Procurement
o Members note that both the Dutch and German Government do not have a very specific or detailed Green Procurement Policy. They nonetheless encourage Green Procurement wherever reasonable and feasible within financial limits.

4.6 IWMF

Gasification

- While ash is totally detoxified, it is very expensive and requires a large land area of 200 ha. to handle only 300,000 tonnes of MSW waste per year.
- Members note the previous failures of the gasification plants by Siemens in Germany, which led to distrust on this technology.
- The investment should better be placed on encouraging behavioral change rather than all on technology.
- Members also note the development of gasification/co-combustion and ash melting technologies in Japan which can significantly reduce the residual bottom and fly ash requiring landfill disposal. Members would therefore keep an open mind on the use of these technologies if they are cost-effective for the Hong Kong situation.

MBT

- Debris and dust problems in the sorting area, and potentially serious odour problem have to be addressed if it is applied to Hong Kong.
- It requires a large area of about 25 ha. to handle 200,000 tonnes of MSW per year, and 40% to 50% of the waste would still need to be disposed of at the landfills.
- It seems not practical to handle mixed waste with MBT. Small scale of MT for source separated waste may be possible.
- MBT produces Refuse Derived Fuel (RDF) which still has to be incinerated. It cannot survive without incinerators. In some situations, the RDF produced cannot be sold for profit, but the MBT operators need to pay to the gasification or incineration plants for subsequent treatment.

Incineration

- Modern incinerators for mixed waste can comply with the stringent EU emission standards.
- If funding allows, plants like the one at Lauta can even be designed to 50% more stringent than the EU standards, with actual emission of only about 25% of the EU Standards in general.
- Area requirement is the smallest among all the types, about 2 ha. to handle 300,000 tonnes/yr of MSW.
- The plant at Magdeburg demonstrates that incinerators can be implemented in phases with each module of capacity of about 300,000 tonnes/yr.
- The plant at Hannover shows that IWMF can be built adjacent to the landfills.
- Unlike Japan where waste facilities would integrate well with the nearby community via provision of social facilities and better communication (e.g. exhibition, visit arrangements), the Germany facilities only provide good public relation programme and transparent emission monitoring to the public.

Composting

- Members agree that it will not be cost effective to treat all the putrescible waste from the mixed MSW by biological treatment like composting.
- It may be more feasible to treat only the source separated food waste, but the capacity which would not be greater than 500 tonnes/day. Members note that compost does not contain enough nutrients to be regarded as fertilizers and the market outlet of the compost will be a constraint.

4.7 Landfill Bans
o Members note from the German's successful experience that the banning on the disposal of untreated biodegradable waste to landfill provides the vital impetus to the development of waste recycling and various advanced waste treatment technologies. o Members therefore highly recommend the adoption of the landfill bans on untreated MSW in Hong Kong. o Members also note that both the Netherlands and Germany are committed to fulfilling their obligations to the Kyoto Protocol and reducing the over-reliance on landfilling as one of the ways to reduce the emission of methane which is one of the greenhouse gases.
4.8 Landfill Extensions
o Some members consider that the IWMF and Landfill Extension proposals should be put forward together to the public so that they know that they have to choose between two necessary evils.
4.9 Funding for recycling technology
o Members are amazed that 2.5% of Germany’s GDP is allocated for R&D for developing new technologies (not just for waste industry but all kinds of industries including car industry).

5. CONCLUSION

5.1 The visit has been very useful. The delegation members are able to gain more information and understanding on waste management practice and treatment technologies in the Netherlands and Germany, particularly PRSs, incineration, gasification and MBT facilities.

5.2 Members also note from the German's successful experience that the banning on the disposal of untreated biodegradable waste to landfill provides the vital impetus to the development of waste recycling and various advanced waste treatment technologies. Members therefore highly recommend the adoption of the landfill bans on untreated MSW at a target date to be agreed by stakeholders after consultation.

5.3 From the visit, it is observed that incineration is the most common technology used in the Netherlands and Germany for MSW treatment. These facilities can be designed and built to very high standards with excellent emission quality.

5.4 However, the successful implementation of advanced treatment plants can only be based on a high level of environmental education and awareness. The Government should have a comprehensive community education programme on general waste issues, supported by focused campaigns on selected topics.

5.5 Members considered that financial instruments such as MSW charging and PRS are important measures adopted in the Netherlands and Germany, and these should be implemented in Hong Kong as soon as possible. The MSW charges should be set at a higher level to provide "financial incentive" to change people's wasteful habits.

6. ACKNOWLEDGEMENTS

6.1 The delegation wishes to express sincere thanks to the staff of the Environmental Protection Department and the Brussels Office of the Hong Kong Economic and Trade Office of the HKSAR Government, the Consulate-General of Federal Republic of Germany in Hong Kong and many others for their assistance and arrangements made for the delegation before and during the visit.

APPENDIX 1

Members of the Delegation

Advisory Council on the Environment

Chairman	Professor LAM Kin-che	Director of Centre for Environmental Policy and Resource Management and Professor of Department of Geography and Resource Management, Chinese University of Hong Kong
Members	Mr. James Robert GRAHAM	Chief Executive, Jardine Engineering Corporation Limited
	Professor HO Kin-chung	Professor and Programme Leader of Environmental Studies, Open University of Hong Kong
	Ms. LAU Wai-kuen Goretti	Director and General Manager, The Quicken Textiles Limited
	Dr. NG Cho-nam	Associate Professor, Department of Geography, University of Hong Kong
	Ms. FONG Siu-mei May	Director, Friends of the Earth (Hong Kong)
	Professor POON Chi-sun	Professor in Civil and Environmental Engineering, Department of Civil and Structural Engineering, Hong Kong Polytechnic University
	Mr. TSANG Kam-lam	Technology Services Manager, Environmental Management Division, Hong Kong Productivity Council
	Professor WONG Yuk-shan	Vice-President for the Administration and Business, The Hong Kong University of Science and Technology

Government Officials

Mr. FAN Wai-ming Raymond	Deputy Director of Environmental Protection
Mr. Cheng Tak-kuen	Senior Environmental Protection Officer

APPENDIX 2

Itinerary for the visit
19 to 26 March 2006

Date & Time	**Event**
Sunday, 19.3.2006	
am	Arrive Schiphol Airport in Amsterdam
pm	Interview by Mr. Huang Jinhong of Sing Tao Daily (European Edition) at Airport Sheraton Hotel
Monday, 20.3.2006	
am	Meeting with Mr. Kees Veerman, Policy Coordinator, Ministry of Housing, Spatial Planning and the Environment, the Netherlands at Hague on "Waste management in the Netherlands" Reference: http://international.vrom.nl/pagina.html?id=7387
pm	Visit to the Coolrec BV which specialises in processing and recycling refrigerators and television Reference: http://www.coolrec.nl
Evening	Depart Amsterdam for Berlin
Tuesday, 21.3.2006	
am	Meeting with Mr. Guido Peruzzo, Acting Director-General of Economic Cooperation; Ms. Gerlind Heckmann, Deputy Head of Division of Economic Relations with East Asia; and Ms. Jana Held, Administrator of the Federal Ministry of Economics and Technology Reference: http://www.bmwi.de/English/Navigation/root.html
am	Meeting with Dr. Rainer Cosson, Managing Director and Mr. Gerd Henghuber, Head of Public Relations of the Federation of the German Waste Management Industry (BDE) Reference: http://www.bde.org/01seiten/documents/englischsprachinformationen.pdf
pm	Visit the T.A. Lauta which is a modern waste incineration plant Reference: http://www.t-a-lauta.de/

Wednesday, 22.3.2006	
am	Visit the SVZ Schwarze Pumpe which is a gasification plant producing electricity and methanol. Reference: http://www.svz-gmbh.de/GB/Seiten/rahmen.html
pm	Meeting with Federal Ministry for the Environment, Nature Conservation and Nuclear Safety Reference: http://www.bmu.de/english/aktuell/4152.php http://www.gruener-punkt.de/THE_GREEN_DOT.50+B6Jkw9MQ.0.html
Evening	Dinner hosted by the delegation for the Federal Ministry of Environment and the Federal Ministry for Economics and Technology
Thursday, 23.3.2006	
am	Visit the MVA Magdeburg which is a modern incineration plant Reference: http://www.mhkw-rothensee.de/umwelt_index.php
pm	Visit the abz Hannover Waste Treatment Centre which is a mechanical-biological treatment plant based on dry fermentation (anaerobic digestion) with production of refuse derived fuel Reference: http://www.aha-region.de/deutsch/abfall_ent/profil_abz.htm http://www.dryfermentation.com/dryfermentation-1.html
Friday, 24.3.2006	
am	Briefing on nature conservation and national park management at Harz by Ms. Petra Wernicke, Minister for the Environment of Sachsen Anhalt; Mr. Pusch, Head of the National Park; and Ms. Sylke Möser, Head of the Public Relations Department.
pm	Return to Hannover
Saturday, 25.3.2006	
am	Depart Hannover to Hong Kong via Frankfurt
Sunday, 26.3.2006	
am	Arrive Hong Kong

APPENDIX 3

List of Reference Materials Acquired

1. Presentation slides of “Waste Management in the Netherlands” by Mr. Kees Veerman, Ministry of Housing, Spatial Planning and the Environment, the Netherlands
2. Presentation slides of “LCA on the organic fraction of household waste in the Netherlands” by Marco Kraakman, senior policy-maker, Waste Management Council
3. Brochure of the Bundesverband Der Deutschen Entsorgungswirtschaft E.V.(BDE) [The Federation of the German Waste Management Industry] March 2005
4. Report of Environmental Study on Waste Sector’s Contribution to Climate Protection by Bundesverband Der Deutschen Entsorgungswirtschaft E.V.(BDE) [The Federation of the German Waste Management Industry] August 2005
5. Presentation Slides of “Waste Management: a genuine high-tech industry” by Bundesverband Der Deutschen Entsorgungswirtschaft E.V.(BDE) [The Federation of the German Waste Management Industry]
6. Technical newsletter of the Thermal Waste Treatment Plant, T.A. Lauta November 2004 [T.A. Lauta Info Einweihung 4. November 2004]
7. Technical newsletter of the Thermal Waste Treatment Plant, T.A. Lauta January 2006
8. DVD – Thermische Abfallbehandlung Lauta
9. Brochure of the gasification plant at SVZ Schwarze Pumpe – “We Close the Loop”
10. Presentation Slides of “The Future of Residual Waste – History and Current Status of Waste Management in Germany” by Dr. Claus-Gerhard Bergs, Federal Ministry of Environment, Nature Conservation and Nuclear Safety
11. Presentation Slides of “Thermal Waste Treatment in Germany” by Dr. Bernt Johnke, Federal Ministry of Environment, Nature Conservation and Nuclear Safety
12. Ordinance on the Utilisation of Biowastes on Land used for Agricultural, Silvicultural and Horticultural Purposes (Ordinance on Biowastes – BioAbfV) of 21 September 1998 – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13. Ordinance on Environmentally Compatible Storage of Waste from Human Settlements and on Biological Waste-Treatment Facilities of 20 February 2001 – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14. Waste from Human Settlements – Change in German legislation starting 1 June 2005, the situation now, action to be taken, and outlook for the future – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15. Thinking ‘reusable’ not ‘throwaway’, Questions and answers on the deposit on oneway drinks packaging, July 2005 – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

16. Brochure MHKW Rothensee – Thermishce Abfallbehandlung in Madeburg – Rothensee
17. Newsletter – Information der MHKW Rothensee GmbH, August 2004
18. Presentation Slides on MHKW Rothensee – We make waste disposal safe
19. Brochure – leistungen und Lösungen für heute und morgen, Aha, Abfallwirtschaft Region Hannover
20. Brochure – Germany’s National Park, Protecting the Natural Heritage for you to Discover
21. Presentation Slides of “Mysterious Wilderness” by Mr. Pusch, Head of the Harz National Park