Country Report Germany

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1 Legislative Regulations on Waste Management

The general act for managing waste treatment and disposal in Germany is the Closed Substance Cycle and Waste Management Act (KrWG, Gesetz zur Neuregelung des Kreislaufwirtschafts- und Abfallrechts), which regulates the entire waste management area, including the provisions concerning the end of waste status of a material. This act was initially released in 1994 and has been amended in February 2012. It defines a new five-step hierarchy for waste management:

- avoidance,
- pre-treatment for recycling,
- recycling,
- other – in particular energetic – utilisation and finally
- disposal.

In terms of waste disposal Germany made the first attempt to reduce landfilling of waste in 1993. The Technical Instructions on Waste from Human Settlements (TASi, Technische Anleitung zur Verwertung, Behandlung und sonstigen Entsorgung von Siedlungsabfällen) stipulated a ban on disposal of untreated organic waste within 12 years. Since this ordinance had no legal power, provisions for the ban were only slowly or not made at all.

This TASi was, among existing national regulations in other countries, the basis of the EU Landfill Directive 1999/31/EC (LFD) issued in 1999. The German adaptation of the LFD, the Ordinance on Environmentally Compatible Storage of Waste from Human Settlements and on Biological Waste-Treatment Facilities (Abfallablagerungsverordnung, AbfAblV) set a ban for the disposal of untreated organic waste as of June 1, 2005, the exact limit scheduled in the TASi.

The AbfAblV was replaced in 2009 by the Waste Storage Ordinance (Deponieverordnung, DepV) to adjust to new EU regulations. This one was re-amended in 2012. The standards for access to the three landfill classes were not changed.

2 Energy Consumption

2.1 Primary Energy

Security of energy supply is for an industrial country such as Germany of fundamental importance, the more so since it is poor in natural resources and has to import a high share of its energy demand. The German government aims for a diverse mix of energy sources and energy suppliers. After the decision in 2011, provoked by the Fukushima disaster, to phase out nuclear power, renewable energy sources, such as wind and solar power, are planned to become the backbone of the German power market in future. Biomass is intended to be the major source in the heat market.

The sources of data used in chapter 2 are either statistics released by the Federal Ministry of Economics and Technology [Bundesministerium für Wirtschaft und Technologie 2012] or by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety [Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit 2012].

The primary energy consumption in Germany in 2011 was 13,521 PJ of which 4,241 PJ were coming from domestic sources. A breakdown into the different energy sources is shown in the left graph of Fig. 1 . Mineral oil was the biggest source delivering approximately one third of the primary energy consumption, followed by natural gas with 20.8 %, hard coal with 12.8% and lignite with 11.6 %. Lignite was the only domestic energy source, whereas 97.5 % of mineral oil, 86 % of natural gas and 79 % of hard coal had to be imported. Hydro and wind power contribute only little to the primary energy market.

’Other renewables’ represent the biogenic fraction of renewable energy sources. They comprise solid biomass, mainly wood, liquid biofuels, biogas and the organic fraction of municipal solid waste, which has been laid down as 50 % of the total energy inventory of waste. The non-renewable waste fraction is the main source in ‘others’.

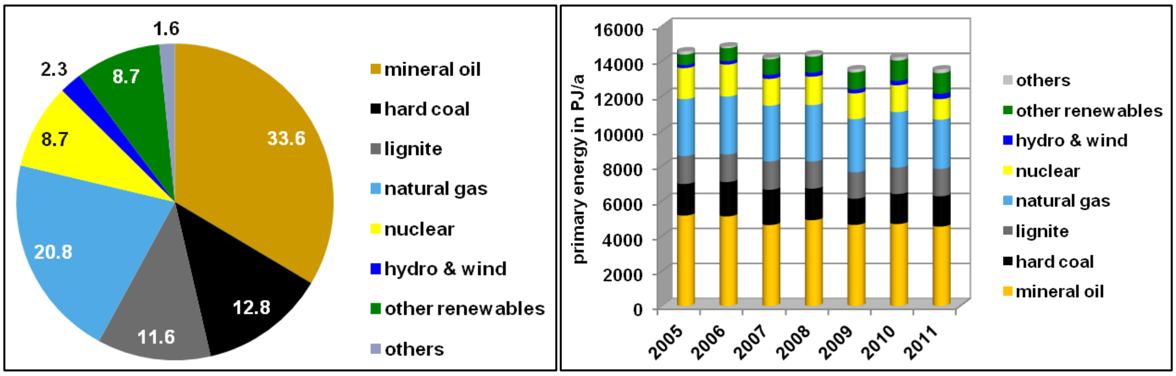

Fig. 1 Sources of primary energy consumption in 2011 (left, data in %) and its development since 2005 (right)

The right graph in Fig. 1shows the development of primary energy consumption and the share of the energy sources over the period of 2005 to 2011. The primary energy consumption was reduced by slightly more than 1,000 PJ during this time, mainly by reducing the use of mineral oil (-639 PJ), nuclear power (-401 PJ) and natural gas (-442 PJ). The contribution of hard coal and lignite stayed almost constant. Increasing sources were hydro and wind power which grew from 173 PJ (1.2 %) in 2005 to 311 PJ (2.3 %) and ‘other renewables’, which grew in the same time from 596 (4.1 %) to 1,175 PJ (8.7 %). This means that the contribution of renewable sources in the primary energy market doubled almost within six years from 5.3 to 11 %.

The breakdown of the renewable sources in 2011 is shown in the left graph of Fig. 2. As can be seen, Fig. 1solid fuels, such as wood or straw, were the major source with 33 %, followed by biogas with 23.5 %. Liquid biofuels and wind energy accounted roughly for 12 %. The total share of biogenic sources adds up to slightly more than 75 %.

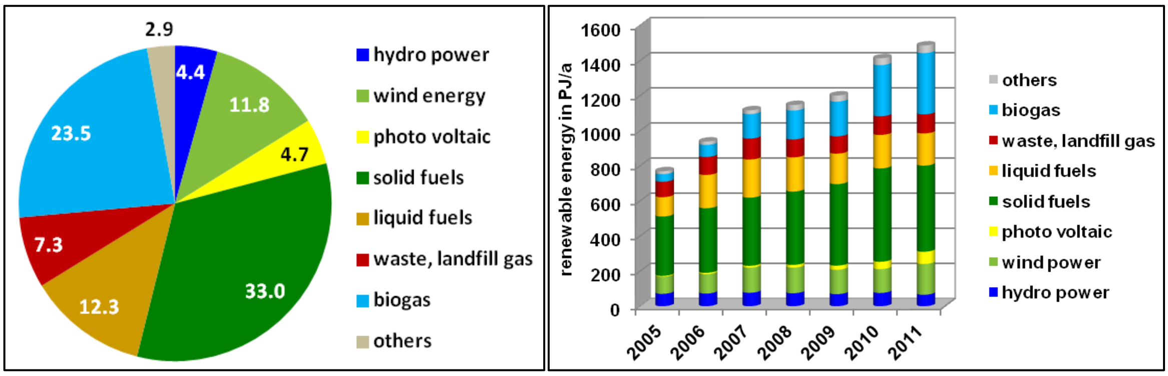

Fig. 2 Breakdown of renewable sources of primary energy consumption in 2011 (left, data in %) and its development since 2005 (right)

The right graph in Fig. 2 depicts the development of the contribution of the various renewable sources between 2005 and 2011. The biggest regenerative energy source, biomass, increased its input from 338 PJ in 2005 to 491 PJ in 2011, which is an increase of 45 %. Its relative contribution to primary energy, however, was reduced during that time from 44 % in 2005 to 33 % in 2011. A high increase is found for the second biggest source in 2011, biogas, which was politically heavily promoted and subsidised during the last years. In 2005 it contributed just 43 PJ or 5.6 %, in 2011 it reached 350 PJ or 23.6 %. The energy derived from that source jumped up by a factor of 8.1.

Liquid biofuels contributed 110 PJ (14.3 %) in 2005 and 183 PJ (12.3 %) in 2011, which means its relative contribution decreased. The rise in wind energy was almost 80 % from 98 PJ (12.7 %) in 2005 to 176 PJ (12.3 %); its relative share stayed almost constant. Almost constant were also the contributions of hydro power with approximately 70 PJ and that of waste and landfill gas with 100 to 120 PJ, their share on the primary energy market decreased from 9.1 to 4.4 % for hydro power and from 11.4 to 7.3 % for waste and landfill gas.

An extreme development underwent photo voltaic power, which was also heavily subsidised. Its gross contribution rose from 4.6 PJ or 0.6 % to 69.6 PJ or 4.7 % in 2011. This was an absolute increase by a factor of 15.

In spite of these positive changes the gross contribution of renewable energy sources has still to grow significantly before the development can be called an energy turnover.

Using efficiency factors the final energy consumption in Germany in 2011 was calculated to 8,692 PJ; the share of renewable energy averaged out to 12.5 %, 1.5 % higher than the share in primary energy. The share of renewable sources in the various types of energy markets is shown in Table 1. The table documents that the highest renewable energy share is found with slightly more than 20 % in the power market. In the heat market renewables contribute only 11 % and just 5.5 % in the market of liquid fuels.

Table 1 Contribution of renewable energy sources to energy supply in Germany in 2011

	percent contribution
total primary energy consumption	11.0
total final energy consumption	12.5
total electricity consumption	20.3
total heat consumption	11.0
total fuel consumption	5.5

The development between 2005 and 2011 of renewable sources in the power, heat, and fuel market is shown in Fig. 3.

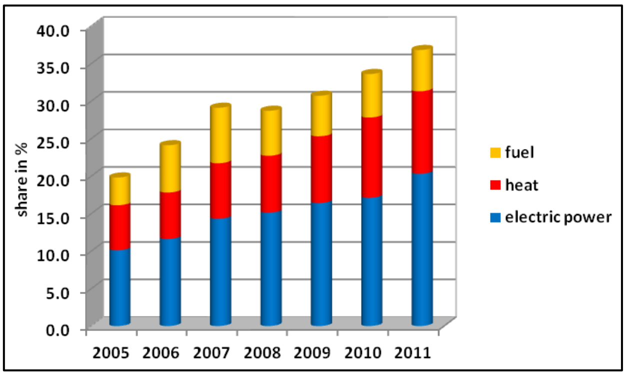

Fig. 3 Development of the share of renewable sources in the power, heat, and fuel markets

The graph documents a high increase of the use of renewable sources in the power as well as in the heat market; the share in both markets grew by roughly 100 %. The fuel market showed varying shares, since 2008 it stayed between 5.5 and 6 %.

2.2 Electric Power Market

The total power consumption in Germany in 2011 was 606.9 TWh, which is equivalent to approx. 2185 PJ. 123.2 TWh or 20.3 % were provided from renewable sources. The breakdown of these sources in the 2011 power mix is shown in the left graph in Fig. 4 and the respective development since 2005 depicts the bar plot in the right graph in Fig. 4.

Wind power was responsible for the highest contribution, delivering 48.9TWh, which accounted for 39.7 %. In 2005 the respective figures were 27.2 TWh and 38 %, indicating that this source grew in line with the growth of the total amount of renewable power.

The second highest contribution in 2011 was that of photo voltaics. This source increased dramatically since 2005, when it delivered 1.3 TWh, equivalent to 2 %. In 2011 the respective figures were 19.3 TWh and 15.7 %. The supplied energy increased by a factor of 15, as has been mentioned above.

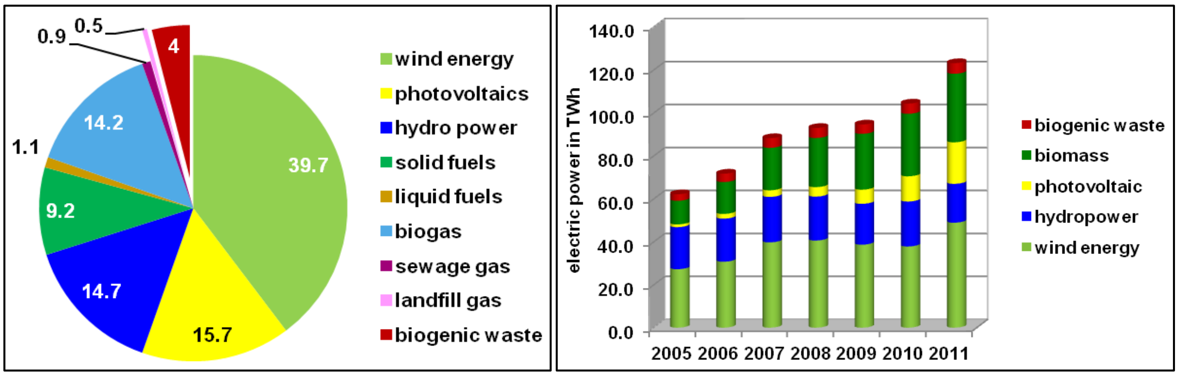

Fig. 4 Renewable energy sources in the power market in 2011 (left, data in %) and their development since 2005 (right)

Hydro power delivered an almost constant amount of approximately 20 PJ. The respective share in 2005 was almost 32 %, in 2011 just 15 %. The accumulated fractions solid biomass, liquid biofuels and biogas accounted for 31.9 TWh or 24.5 % in 2011. Their share in 2005 had been 11 TWh or 18 %. The contribution of biogenic waste increased from 3.0 TWh in 2005, were it accounted for 4.9 % of renewable power, to 5.0 TWh or 4 %.

2.3 Heat Market

The total heat supply in Germany in 2011 was 1304.5 TWh, which is equivalent to 4,696 PJ; renewable sources supplied 11 % or 143.5 TWh (516.6) to this figure. A detailed breakdown of the single renewable sources is depicted in the left graph in Fig. 5, the development of the major sources since 2005 shows the right graph of the same figure.

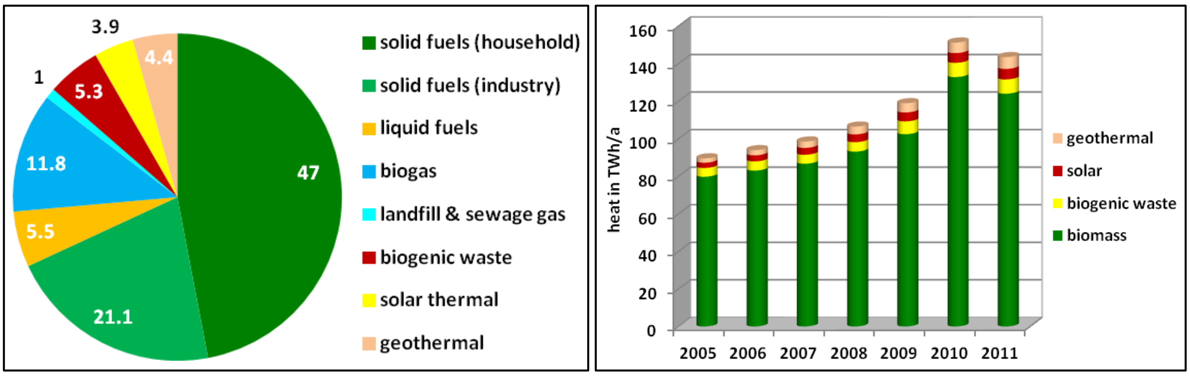

Fig. 5 Renewable sources in the German heat market in 2011 (left, data in %) and their development since 2005 (right)

The major heat source with almost 50 % is solid biomass used for house heating. Adding the use of solid biomass for industrial heating, its share added up to 68.1 %. 11.8 % of the heat was generated from biogas, another 5.5 % from liquid biofuels. The accumulated contribution of all biomass accounted for 86.4 % in 2011.

The absolute use of biomass for heating increased from 79.7 TWh (287 PJ) in 2005 by 55 % to 124 TWh (446 PJ) in 2011. Its share in the renewable sources in the heat market did not change much; it decreased from 89 % in 2005 to 86.4 % in 2011.

Heat from biogenic waste contributed 7.6 TWh (27.4 PJ) to the renewable heat sources, which was equivalent to 5.3 %. This source, too, showed a significant absolute increase of 62 % since 2005 (4.7 TWh), its contribution to the renewable sources stayed – with some scattering – almost constant at 5.2 %.

The only increase, although on a low level, is observed for solar and geothermal heat. Solar heat increased from 2.8 TWh (10 PJ), good for a share of 3.1 % in 2005, to 5.6 TWh (20.2 PJ) or a share of 3.9 %. Geothermal heat contributed 2.3 TWh (8.3 PJ) or 2.6 % to the renewable heat market in 2005 which increased to 6.3 TWh (22.7 PJ) or 4.4 % in 2011.

3 Waste Generation

3.1 Municipal Solid Waste

In Germany municipal solid waste (MSW) is managed by the public waste management system, which is partly operated by public bodies, partly by private companies owned by private bodies, or in private-public partnership. Statistics on waste generation and management are published by the German Federal Office of Statistics [Statistisches Bundesamt 2012]. Actually only data including 2010 are available.

Germany has separate collection for recyclable waste, preferentially packaging waste, biological waste, in particular kitchen waste, and residual waste. Glass and textiles are often collected in containers distributed across cities and villages, yard and garden waste are either collected on demand or have to be brought to special municipal facilities. This is also valid for bulky waste. The collection schemes will most likely be changed and harmonised in near future.

In the years 2010 the total annual generation of household waste (HHW) amounted to 44.9 mill. Mg, which is equivalent to a generation of 548.7 kg/cap. The respective figures for commercial waste (CW) were 3.43 mill. Mg and 41.9 kg/cap. MSW, which is the sum of HHW and CW, accounted hence for 48.3 mill. Mg or 591 kg/cap.

Fig. 7 shows the composition of household waste in the year 2010, Fig. 7 the development of MSW generation since 1995.

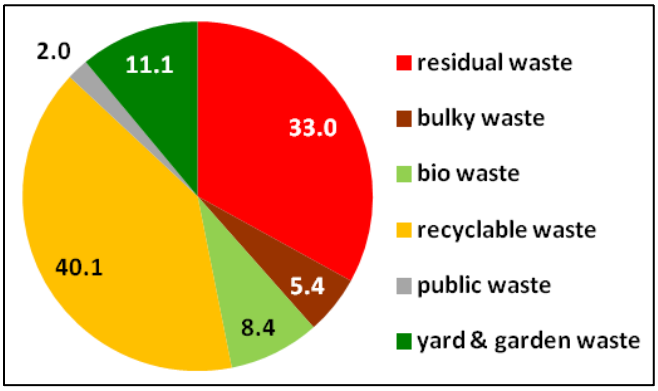

Fig. 6 Composition of HHW in 2010 (data in %)

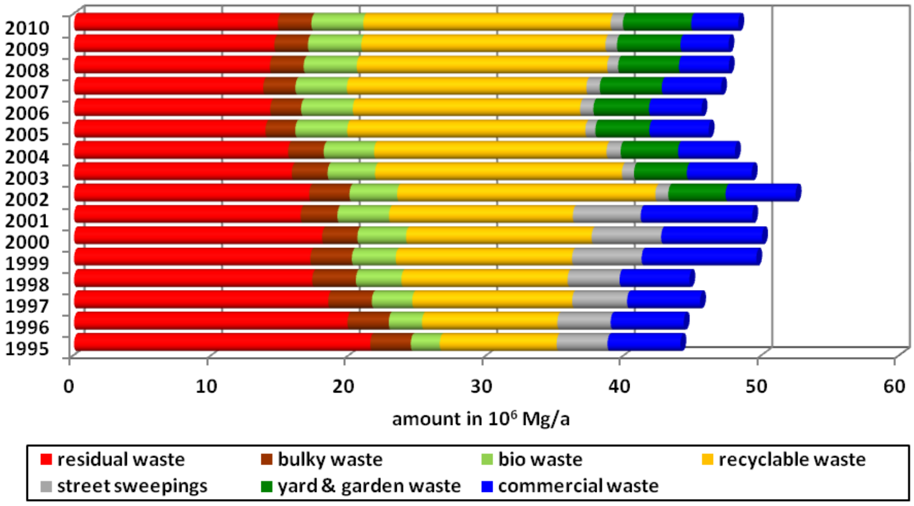

Fig. 7 Composition of MSW in 2010 (data in %)

The biggest fraction of HHW in 2010 was the recyclable waste with 14.8 mill. Mg (220 kg/cap) or almost 40 %. Biological or kitchen waste, which is also separately collected, accounted for 3.8 mill. Mg (46.1 kg/cap) or 8.4 %. This waste is mainly treated by anaerobic digestion.

Yard and garden waste, which is typically going to composting plants, made up almost 5 mill. Mg (60.7 kg/cap) or 11.1 %. Bulky waste, 2.4 mill. Mg (29.9 kg/cap) or 5.4 % of the total HHW, is partly going to sorting and recycling facilities, partly to waste incineration plants.

The term public waste includes market waste and street sweepings. With 0.9 mill. Mg (10.9 kg/cap) it represents just 2 % of the household waste. Its destinations are sorting, digestion or incineration plants, depending on the category of the sub-fractions.

An Analysis of the specific management of the various waste fractions indicates, that more than 65 % of the total MSW is separated for recycling or utilisation.

Regarding the total MSW generation since 1995 an almost steady increase is seen until in 2002 a maximum of 52.5 mill. Mg (636.6 kg/cap) was reached. The following four years were characterised by a significant reduction down to 45.6 mill. Mg (554 kg/cap), which was followed by a moderate increase to 48.3 mill. Mg (591 kg/cap) in 2010.

A more detailed analysis of the development of MSW generation reveals a great success achieved in waste management: the separate collection of recyclable waste, the share of which was 19 % in 1995 (8.5 mill. Mg or 103.9 kg/cap), increased to 37.3 % or almost two times that number in 2010.

The opposite development is seen for residual waste. Its amount of 21.5 mill. Mg (263 kg/cap) made up 48.8 % of the total residential waste in 2005. This fraction was reduced to 14.8 Mg in 2010 and its share accounted for 30.7 %. Bulky waste and public waste, which was split into street sweepings and yard & garden waste in 2002, showed no great changes with time. The amount of bio waste, however, doubled almost from 2.1 mill. Mg (25.7 kg/cap), which was equivalent to 4.8 % in 1995, to 8.4 % in 2010.

The above discussed development in waste generation is a great success for an industrialised country. It indicates that Germany was able to de-couple the MSW generation from its economic development, expressed as gross domestic product. This fact is illustrated in Fig. 8.

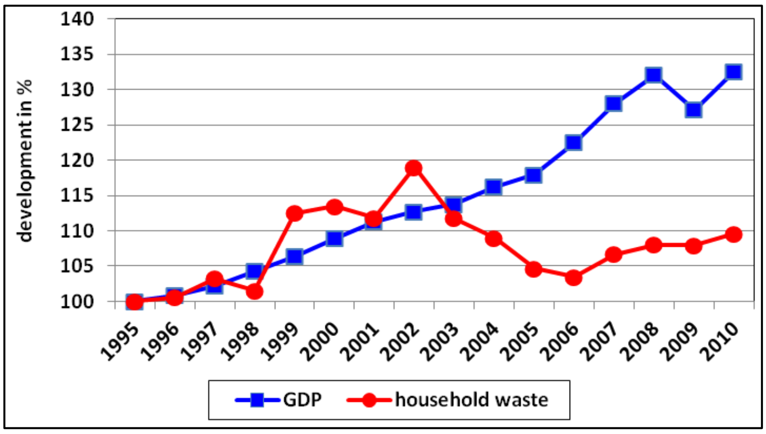

Fig. 8 Development of MSW generation and GDP since 1995

3.2 Solid Recovered Fuel

Solid recovered fuel (SRF) is a refuse derived fuel (RDF), which complies with the European CEN standards. In Germany RDF is called EBS (Ersatzbrennstoff, alternative fuel) or SBS (Sekundärbrenn-stoff, secondary fuel). It started to become popular in Germany in the 1980s and 1990s as an alternative to waste incineration. An actual driver was the need of industry for cheap fuel, especially in times of permanently rising energy prices.

EBS is mainly a product of mechanical and mechanical-biological treatment (MBT) of waste, where in various process steps high-calorific waste fractions, such as paper, wood and plastics, are separated from the incoming waste streams. Main problems associated with EBS are pollutants, in particular chlorine and mercury, and the economy of production and utilisation. To keep the inventory of pollutants low, waste streams from commerce and light industry are preferred for the production of solid fuel from waste.

Since a number of years a German association of EBS producing companies set up an own standard, the RAL certification mark, to guarantee a certain fuel quality. The lower heating values (LHV) published by producers vary from 11 MJ to 20 MJ/kg. Mean values are typically in the order of 14 MJ/kg, which fits the requirements of most consumers; cement kilns and power plants ask for LHV in the order of 17 MJ/kg. The mean Cl inventory is typically > 0.5 wt. %, but mainly below the limit of 1 wt. %, which is requested by most consumers.

Regardless of the production technology, EBS or SRF are still classified as waste according to German law and fall under the waste management regime. That means, their combustion has to take care of the regulations laid down in the 17. BImSchV and other ordinances and acts.

Data on the production of EBS are rare and often vague. According to 2006 data of the Federal Statistical Office there existed 64 publicly operated MBT or similar plants for MSW in Germany with a theoretical capacity of 6.1 mill. Mg. Obviously only 52 of these plants were in operation with an estimated throughput of 4.4 mill. Mg of waste and a production of 2.4 mill. Mg of EBS.

During the last years some MBT plants were closed due to technical, but also economic problems. According to the Umweltbundesamt 48 publicly operated plants were in operation in 2010 with a capacity of approximately 6 mill. Mg. It is estimated that these plants treated some 5.2 mill. Mg of waste.

Meanwhile a number of industrial plants for EBS/SRF production are in operation; their input is mainly commercial and light industrial waste, which is more homogeneous and less polluted by Cl or heavy metals. Total capacity and actual production data are not available.

4 Energy from Waste

4.1 Drivers

The main drivers for energy from waste in Germany are

- the Ordinance on Landfills and Long-Term Storage (DepV), which requires an inertisation of waste prior to final disposal,
- the demand of cheap energy for industry, which can make use of a subsidised fuel, be it MSW or EBS/SRF,
- the partly biogenic energy inventory of waste, which contributes to the efforts of saving CO_2 emissions..

There are also some obstacles to waste as energy source, such as

- the limited energy efficiency of waste incineration plants,
- the inventory of Cl and other pollutants, which limits or complicates the production of EBS/SRF and can make it very expensive,
- the need for gas cleaning, even for dedicated EBS/SRF combustion plants,
- the eventually difficult and expensive disposal of solid combustion residues, and finally
- the insecurity and partly even lack of a long term stable market conditions.

4.2 Waste Incineration

Germany has extended its waste incineration capacity significantly during the last years. Data referred to in the following chapter are taken from statistics of the Umweltbundesamt [Umweltbundesamt 2012] and the ITAD, the German association of MSW incinerator plant's operators [ITAD 2012].

In 2000 there were 56 waste incineration plants in operation with a total throughput of MSW of approximately 11 mill. Mg. These figures increased in 2010 to 69 plants with a MSW throughput of approx 16.3 mill. Mg. The development in the number of plants and in their throughput of MSW is depicted in Fig. 9.

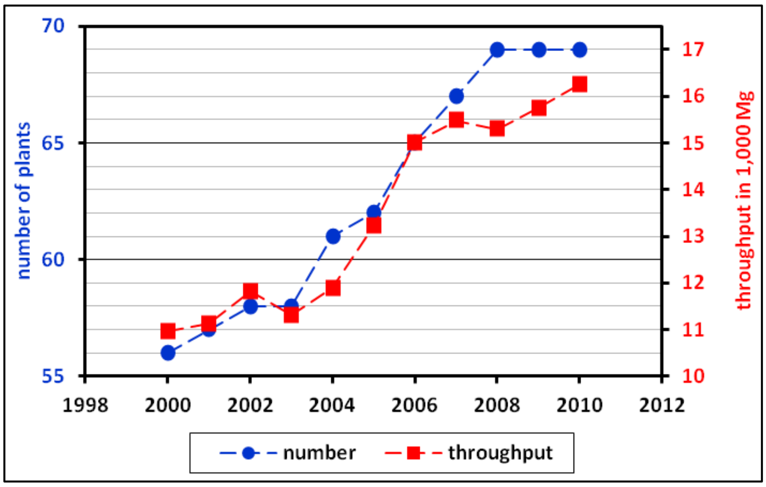

Fig. 9 Number of MSW incineration plants and their MSW throughput between 2000 and 2010

The graph documents a steep increase in number and capacity of waste incineration plants between 2003 and 2008. This rise reflects the effects of the landfill ban in June 2005. During this period of time 10 new plants were taken into operation and the throughput was increased by 4 mill. Mg/a or approximately 35 %.

Table 2 Throughput of MSW incineration plants in Germany in 2010/11 [ITAD 2012]

	throughput [1,000 Mg/a]		*throughput [1,000 Mg/a]*
Asdonkshof	246	*Krefeld*	355
Augsburg	220	*Lauta*	218
Bamberg	123	*Leuna*	390
Berlin-Ruhleben	523	*Leverkusen*	220
Bielefeld-Herford	400	*Ludwigshafen*	212
Böblingen	159	*Ludwigslust*	50
Bonn	245	*Magdeburg*	630
Breisgau	167	*Mainz*	350
Bremen	386	*Mannheim*	500
Bremerhaven	310	*München*	653
Burgkirchen	229	*Neunkirchen*	124
Coburg	137	*Neustadt*	62
Darmstadt	203	*Nürnberg*	230
Düsseldorf	403	*Oberhausen*	700
Emlichheim	365	*Offenbach*	250
Erfurt	80	*Pirmasens*	173
Essen-Karnap	689	*Rosenheim*	63
Frankfurt	480	*Salzbergen*	120
Geiselbullach	105	*Schwandorf*	426
Göppingen	138	*Schwarza*	78
Hagen	130	*Schweinfurt*	180
Hamburg Borsigstraße	334	*Solingen*	130
Hamburg Stellinger Moor	175	*Stapelfeld*	348
Hamburg Rugenberger Damm	338	*Staßfurt*	300
Hameln	300	*Stuttgart-Münster*	468
Hamm	284	*Tornesch-Ahrenlohe*	73
Hannover-Lahe	230	*Ulm*	155
Helmstedt	405	*Velsen*	228
Herten	255	*Weißenhorn*	99
Ingolstadt	241	*Weisweiler*	360
Iserlohn	250	*Wuppertal*	405
Kassel	179	*Würzburg*	210
Kempten	77	*Zella-Mehlis*	160
Kiel	140	*Zorbau*	332
Köln	726	*total*	**18,922**

The throughput of MSW incineration plants in 2011 or 2011, as published by ITAD, is compiled in Table 2. All plants listed in the table are recovering energy and all are accepting household as well as commercial waste. Most plants are equipped with shredding devices and hence accept also bulky household waste. Four plants co-combust EBS/SRF and most plants do accept sorting and MBT residues. It can be expected that sporadic co-combustion of low quality EBS/SRF and other waste fractions, such as automotive shredder residues, takes place. Many plants do also co-combust sewage sludge.

That is why the total annual throughput of all waste incineration plants is almost 19 mill. Mg or by 2.6 mill. MG higher than the above cited throughput of MSW. The actual total annual throughput is almost identical with the published total capacity of all waste incineration plants of 19 mill. Mg. Although some plants show an annual throughput below their name plate capacity, most plants are operated at overcapacity. Since the official capacity has been calculated for a certain calorific value of the feed, in case of low calorific waste coming in this does not indicate a violation of the permit.

For the time being the installed waste incineration capacity fits the demand to treat all German residual waste. In case that the waste generation can further be reduced, that recycling can even treat a higher fraction MSW, or that higher amounts of residual waste enter the SRF/EBS market, there will be an over-capacity of waste incinerators. This can easily be taken care of by the shutdown of some very old plants which started operation already more than 20 or even 30 years ago,

From 1986 on a small pyrolysis plant for MSW with a capacity of 25 000 Mg is operated in Bavaria. New technologies have been tested in Germany, but did not enter the market. For the Siemens Thermal Recycling Process a plant was erected in Fürth but did never get a permanent license and the Thermoselect plant in Karlsruhe was shut down for economic problems after few years of operation.

The energy efficiency of the single waste incineration plants varies to a great extent. Some plants built during the 1980th and 1990th were for public acceptance reasons located outside of residential and industrial areas and were only converting their recovered energy to power.

Although the APC systems of all plants were regularly upgraded, this was yet not the case for the energy recovery system. The primary or boiler efficiency was in most cases even for old plants in an acceptable range of > 75 %, however an efficient use of this energy was often hampered by local conditions.

However, meanwhile energy efficiency was set on the agenda and in many plants a better utilisation of the recovered energy could be achieved, e.g. by optimising steam export or CHP application.

Even some older plants are characterised by optimum energy use. Examples are the Schwandorf waste incinerator, which delivers high temperature steam to an aluminium smelter, serves a small district heating grid and operates a turbine, the Mannheim plant has its steam cycle coupled with a close-by power plant, and the Mainz plant has its boiler coupled with a combined cycle natural gas turbine and achieves in this coupled state an energy efficiency exceeding 40 %.

In future the R1 performance figure will classify a waste incinerator as disposal (R1<0.6) or recovery (R1>0.6) facility. At the moment the calculation of this indicator has not been finished for all German plants. The Umweltbundesamt estimates that almost 70 % of the German plants pass this limit and have already reached or will soon reach the status of energy recovery.

4.3 Energy from EBS/SRF

Since the year 2000 SRF became a more and more important energy source. Main users of SRF for co-combustion are cement and lime kilns, industry furnaces in paper and steel industry and some power plants. Cement kilns are the biggest consumers with an annual consumption in the order of 2 mill. Mg; approximately 1.5 mill. Mg is assumed to be used as fuel in paper industry.

The status of co-combustion in power plants is hard to estimate since no global data are available. Some plants, which practiced co-combustion, gave up for fear of boiler corrosion, induced by eventually high Cl inventory of the fuel.

During the last years SRF combustion in dedicated power plants became more common. The furnaces of these plants are in most cases equipped with reciprocating grates, but also some circulating fluidised beds are in use. Since EBS/SRF is a waste fuel, all plants have to comply with the 17.BImSchV, the German air emission regulation. That is why all plants are equipped with gas cleaning systems, almost totally practicing conventional dry scrubbing.

The development of the installed capacity of combustion plants, which preferentially burn EBS/SRF, has been published by the Umweltbundesamt [Umweltbundesamt 2012] and is shown in Fig. 10. Whereas less than 100,000 Mg/a of EBS/SRF were used in 2000, the available capacity at the end of 2012 reached 5.4 mill. Mg/a.

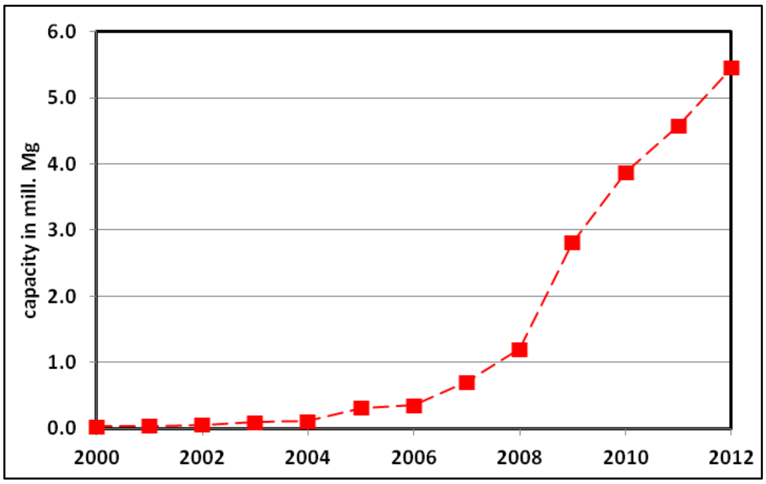

Fig. 10 Capacity development of SRF combustion plants

The plants in operation at the end of 2012, as listed by the Umweltbundesamt, are compiled in Table 3. Their capacity ranges from 25 Mg/a in Gießen to 675 Mg/a of the new plant in Frankfurt-Hoechst.

Table 3 SRF combustion plants (status end 2012)

	capacity [1,000 Mg]		*capacity [1,000 Mg]*
Amsdorf IKW	120	***Heringen MHKW***	270
Andernach IHKW	114	***Hürth-Knapsack EBS-KW***	240
Bernburg EBS-KW	400	***Korbach IHKW***	70
Bitterfeld TRB	110	***Meuselwitz HKW***	50
Bremen HKW	66	***Minden HKW***	40
Bremen MKK	226	***Neumünster TEV***	150
Brunsbüttel HKW	165	***Premnitz IKW/EVE***	250
Eisenhüttenstadt EBS-KW	340	***Rostock HKW***	230
Essen EVA	26	***Rüdersdorf IKW***	226
Frankfurt-Hoechst EBS-KW	675	***Schwarza TVA***	60
Gersthofen HKW	70	***Schwedt HKW***	250
Gießen TREA	25	***Stavenhagen HKW***	90
Glückstadt KW	270	***Weener DZ***	280
Grossraeschen EBS-KW	240	***Witzenhausen HKW***	270
Hagenow HKW	80	***total***	**5,403**

It is expected, that almost all plants listed above run close to full capacity, which is indicated by actual throughput data of some of these plants as published by ITAD. The Umweltbundesamt estimates that the installed capacity will stay constant for the next few years; there are no new plants in construction or in planning.

The future of EBS/SRF use is hard to predict. On one hand the technology to produce high quality SRF improves with time, which may reduce the production costs. On the other hand there are great efforts to be seen to increase the energy efficiency of conventional waste incineration plants.

Finally it is a question of economy, whether energy recovery from untreated waste in waste incineration plants or SRF production and its combustion in dedicated plants will be preferred. From a today's perspective it can be estimated that commercial waste will to a great extent be a source for EBS/SRF, but that residual MSW will mainly be treated by incineration.

5 Conclusions and Outlook

Evaluating the actual situation in the Waste-to-Energy market in Germany it can be concluded that the legal framework is in principle in line with the regulations on the EU level. The German decision to ban landfilling of untreated waste became a strong diver for improvement of energy recovery from waste. This increased not only the capacity of waste incineration plants, it caused also the development of improved energy efficiency of these plants, and it paved the way for a significant extension of EBS/SRF utilisation.

At the moment the amount of residual MSW can be easily taken care of by existing waste incineration plants. Whether there will be a capacity surplus in near future is unclear, however, this can easily be taken care of by shutting down some of the very old plants.

SRF combustion established a good share in the energy market. Its future importance is also not clear: it depends on guaranteed fuel qualities at guaranteed prices and on stable conditions on the energy market. This includes environment related political decisions, such as future acknowledgment of the biogenic energy fraction of waste and its indexing concerning subsidies and emission trading.

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