Orientering fra Miljøstyrelsen Nr. 4 2001

Waste Statistics 1999

Miljøstyrelsen
Miljø- og Energiministeriet

Contents

1 Introduction

In 1993, the ISAG (Information System for Waste and Recycling) was used for the first time. The 1999 reports are the seventh consecutive reports.

Reports to the ISAG for 1999 cover 414 plants distributed on 310 enterprises. In 1998, reports covered 420 plants distributed on 313 enterprises.

Waste Statistics 1999 follow the same layout as in previous years' statistics. Chapter 2 describes general developments in waste generation, whereas Chapter 3 presents recycling of waste.

Chapter 4 deals with generation and treatment of hazardous waste, and in Chapter 5 developments in imports and exports are described, both for ordinary waste and waste subject to mandatory notification.

In Chapter 6, a detailed description of developments in waste amounts and treatment of waste from different sources is given. Furthermore, figures are compared to targets for treatment in year 2004 in the Danish Government's Waste Management Plan 1998 - 2004, Waste 21.

Finally, Chapter 7 gives an outline of Danish incineration plants and landfills.

The following statements summarise briefly waste generation in 1999:

- Total waste amounts in 1999 amounted to 12,233,000 tonnes, which is unchanged compared to total waste amounts in 1998.
- If amounts of residues from coal-fired power plants are kept apart from statistics, there has been an increase in waste amounts of 170,000 tonnes, corresponding to around 2 per cent.
- The rate of recycling amounted to 64 per cent, which is a minor increase of 2 percentage points compared to 1998. Recycling in 1999 complied with the overall recycling target for year 2004.
- Waste amounts incinerated accounted for 24 per cent, which is also a minor increase of 2 percentage points compared to 1998.
- Amounts going to landfill in 1999 amounted to 12 per cent, which is a decrease of 3 percentage points compared to 1998 and complying with overall landfill targets for year 2004.
- Waste generation in households increased by 6 per cent, covering a minor decrease in domestic waste of 2 per cent and increases in bulky waste and garden waste amounts of 17 per cent and 6 per cent respectively.
- Waste from industry decreased by 130,000 tonnes, corresponding to a decrease of 5 per cent. This decrease is mainly due to large decreases in

the amounts of various non-burnable, beet soil and sludge. Targets for treatment are still not complied with.

- Waste generation in the service sector is unchanged compared to 1998.
- Amounts of construction and demolition waste remain almost unchanged compared to the previous year.
- Amounts of residues from coal-fired power plants decreased by 12 per cent, corresponding to a decrease of 170,000 tonnes.

2 Waste generation

2.1 Developments in waste generation 1994 - 1999

Total Danish waste generation in the period from 1994 to 1999 distributed on commercial sources is shown in Table 1.

As the table shows, waste generation peaked in 1996. Waste amounts increased by 16 per cent from 1994 to 1996. This is mainly due to especially large amounts of residues from coal-fired power plants in 1996 – which again is due to large exports of power to Sweden and Norway. After 1996, waste amounts decreased by around 5 per cent in the period from 1996 to 1999.

If the entire period from 1994 to 1999 is considered, waste amounts have increased by 10 per cent. This increase may be due to real increases, but also to the fact that not all treatment plants reported to the ISAG system in the early years – even if they should have done so. In other words, the coverage of the ISAG has increased since its beginning in 1994.

Table 1. Total waste generation in Denmark in				**000 tonnes**			**Development %**
1994 - 1999	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**1994-99**
Households	2,575	2,610	2,767	2,776	2,796	2,963	15
Domestic waste	*1,662*	*1,628*	*1655*	*1621*	*1702*	*1665*	*0,2*
Bulky waste	*606*	*618*	*639*	*588*	*572*	*672*	*11*
Garden waste	*286*	*326*	*401*	*443*	*438*	*464*	*62*
Other	*21*	*38*	*72*	*125*	*83*	*163*	*678*
Institutions/trade and offices	656	834	851	861	955	955	46
Manufacturing industry etc.	2,309	2,563	2,632	2,736	2,783	2,653	15
Building and construction	2,433	2,559	3,088	3,427	2,962	2,968	22
Wastewater treatment plants	1,156	1,195	1,212	1,248	1,251	1,379	19
Slag, fly ash etc. (coal)	1,962	1,699	2,332	1,775	1,469	1,299	-34
Other	14	6	30	34	18	15	7
Total	11,105	11,466	12,912	12,857	12,233	12,233	10

Sources: ISAG-reports for 1994 to 1999, Danisco, Association of Danish Recycling Industries and other large scrap dealers, Elsam, EK Energi, and reports to the Danish Environmental Protection Agency on sludge from municipal wastewater treatment plants applied to farmland etc. and incineration in sludge incineration plants (for 1999, figures from 1998 have been used). Figures for sludge are stated in wet weight. (Sludge in long-term storage has been included in amounts of sludge applied to farmland etc. Sludge for recovery has been included in sludge for incineration). Figures have been adjusted for imports of waste. The generation of waste in relation to the ISAG reports has been found by stating the quantity of waste delivered to waste treatment plants from primary sources. For this purpose, "primary sources" means waste generators that are not waste treatment plants (reprocessing facilities, incineration plants, composting and biogas plants, and landfills). Waste such as slag, fly ash, and flue gas cleaning products from waste incineration plants is therefore not included in the statement as it would otherwise be counted twice. Furthermore, waste from the source "recycling centres/transfer stations" is distributed on other primary sources. The principles for distribution are given in Annex 2.

With the exception of amounts of residues from coal-fired power plants, which decreased by 34 per cent, waste amounts from all commercial sources have increased in the period 1994 – 99.

Amounts of waste from households increased by 15 per cent. However, amounts of domestic waste have been relatively stable throughout the period.

Waste amounts from the service sector increased by 46 per cent. The major part of this increase took place from 1994 to 1995. From 1995 to 1999 the increase has only been 15 per cent.

Waste from industry peaked in 1998 with a little less than 2.8 million tonnes, which is 21 per cent more than in 1994. In 1999, amounts decreased by 130,000 tonnes, so that over the entire period of 1994 – 99 there has been an increase of 15 per cent.

Amounts of waste from the building and construction sector – a sector that is very sensitive to economic fluctuations – increased by 22 per cent from 1994 to 1999. This overall increase covers an increase of 41 per cent from 1994 to 1997, whereas amounts since 1997 decreased by 13 per cent.

Amounts of sludge from wastewater treatment plants increased by 19 per cent since 1994. However, stated by dry matter the increase has not been significant, and the change is mainly due to new sludge management technologies.

2.2 Waste generation in 1999 and developments 1998 - 99

Total waste generation in Denmark in 1994 - 1999 and developments in waste amounts from 1998 to 1999 are presented in Table 2.

Table 2. Total waste generation in Denmark in			000 tonnes				Development %
1994 - 1999	1994	1995	1996	1997	1998	1999	1998-99
Households	2,575	2,610	2,767	2,776	2,796	2,963	6
Domestic waste	1,662	1,628	1655	1621	1702	1665	-2
Bulky waste	606	618	639	588	572	672	17
Garden waste	286	326	401	443	438	464	6
Other	21	38	72	125	83	163	96
Institutions/trade and offices	656	834	851	861	955	955	0
Manufacturing industry etc.	2,309	2,563	2,632	2,736	2,783	2,653	-5
Building and construction	2,433	2,559	3,088	3,427	2,962	2,968	0
Wastewater treatment plants	1,156	1,195	1,212	1,248	1,251	1,379	10
Slag, fly ash etc. (coal)	1,962	1,699	2,332	1,775	1,469	1,299	-12
Other	14	6	30	34	18	15	-17
Total	11,105	11,466	12,912	12,857	12,233	12,233	0

Sources: ISAG-reports for 1994 to 1999, Danisco, Association of Danish Recycling Industries and other large scrap dealers, Elsam, EK Energi, and reports to the Danish Environmental Protection Agency on sludge from municipal wastewater treatment plants applied to farmland etc. and incineration in sludge incineration plants (for 1999, figures from 1998 have been used). Figures for sludge are stated in wet weight. (Sludge in long-term storage has been included in amounts of sludge applied to farmland etc. Sludge for recovery has been included in sludge for incineration). Figures have been adjusted for imports of waste. The generation of waste in relation to the ISAG reports has been found by stating the quantity of waste delivered to waste treatment plants from primary sources. For this purpose, "primary sources" means waste generators that are not waste treatment plants (reprocessing facilities, incineration plants, composting and biogas plants, and landfills). Waste such as slag, fly ash, and flue gas cleaning products from waste incineration plants is therefore not included in the statement as it would otherwise be counted twice. Furthermore, waste from the source "recycling centres/transfer stations" is distributed on other primary sources. The principles for distribution are given in Annex 2.

The table shows that total waste generation in 1999 amounted to 12,233,000 tonnes, which is identical to 1998.

Waste amounts from households increased overall by 6 per cent in 1999 compared to 1998, and accounted for 2,963,000 tonnes in 1999 against 2,796,000 tonnes in 1998. However, this overall increase covers a minor decrease of 2 per cent in domestic waste. As explained in section 2.1, amounts of domestic waste have been relatively stable from 1994 to 1999, and there have been only small fluctuations over the years.

Amounts of bulky waste and garden waste from households increased from 1998 to 1999 by 17 per cent and 6 per cent respectively. Furthermore, the group “other” increased by almost 96 per cent. However, this group only accounts for a very small part of waste from households and has therefore no significant influence on total amounts.

Generation of waste in the service sector peaked in 1998 with 955,000 tonnes and remained at this level in 1999.

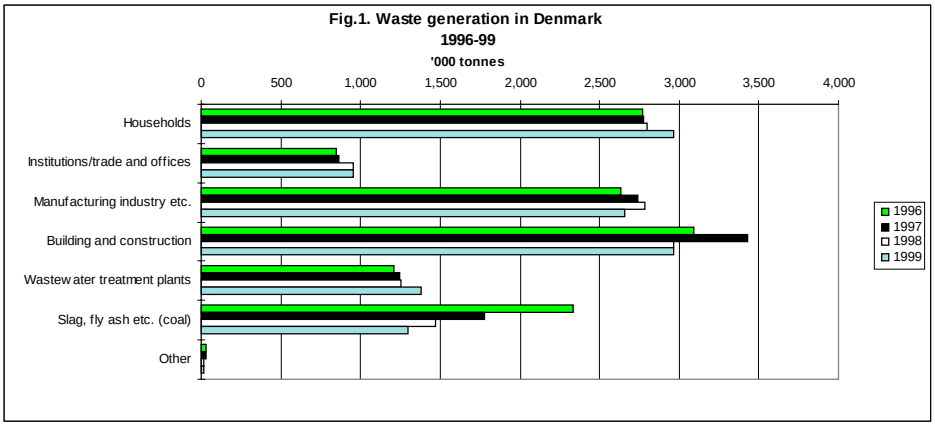
Waste from industry amounted in 1999 to 2,653,000 tonnes, which is 130,000 tonnes or 5 per cent less than the previous year. This decrease is in particular due to large decreases in the amounts of non-burnable waste, beet soil and sludge.

Amounts of construction and demolition waste are almost unchanged compared to 1998. There has been an insignificant increase of 6,000 tonnes from 2,962,000 tonnes in 1998 to 2,968,000 tonnes in 1999.

Stated in wet weight, the generation of sludge at wastewater treatment plants increased by 128,000 tonnes or 10 per cent from 1997 to 1998. However, there has only been a minor increase of 2,600 tonnes stated in dry weight. Some of this increase is believed to be attributable to the national wastewater tax, as this tax has meant that many wastewater treatment plants clean wastewater more than required in the discharge licence.[1]

Waste generation at coal-fired power plants decreased by 12 per cent, corresponding to a decrease from 1,469,000 tonnes in 1998 to 1,299,000 tonnes in 1999.

Total waste generation in Denmark in the last four years is illustrated in Figure 1.



Sources: ISAG-reports for 1996 to 1999. Danish Government’s Waste Management Plan 1998-2004 - Waste 21, Danisco, Association of Danish Recycling Industries and other large scrap dealers, Elsam, EK Energi, and reports to the Danish Environmental Protection Agency on sludge from municipal wastewater treatment plants (for 1999, figures from 1998 have been used. Sludge in long-term storage has been included in amounts of sludge recycled. Sludge for recovery has been included in sludge for incineration) and incineration in sludge incineration plants.

[1] Sewage sludge from municipal and private wastewater treatment plants in 1998. Review from the Danish Environmental Protection Agency, May 2000.

2.2.1 Without slag and fly ash

Amounts of residues from coal-fired power plants are not only related to Danish power consumption, but also to exports of power to Sweden and Norway. In addition, due to Energy 21 natural gas and renewable energy sources are used increasingly in power generation at the expense of coal.

Therefore, it may be reasonable to make a statement of developments in waste amounts WITHOUT slag and fly ash in order to obtain a more realistic picture of developments in waste generation, cf. Table 3.

Table 3. Waste generation WITHOUT slag and fly ash	000 tonnes						Development %
1994 - 1999	1994	1995	1996	1997	1998	1999	1998-99
Households	2,575	2,610	2,767	2,776	2,796	2,963	6
Institutions/trade and offices	656	834	851	861	955	955	0
Manufacturing industry etc.	2,309	2,563	2,632	2,736	2,783	2,653	-5
Building and construction	2,433	2,559	3,088	3,427	2,962	2,968	0
Wastewater treatment plants	1,156	1,195	1,212	1,248	1,251	1,379	10
Other	14	6	30	34	18	15	-17
Total	9,143	9,767	10,580	11,082	10,764	10,934	2

Source: as Tables 1 and 2.

The table shows that the implications for the developments in total waste amounts in the period 1998 to 1999 of keeping residues from coal-fired power plants apart from statistics are insignificant. In absolute figures, it gives an increase in waste amounts of 170,000 tonnes in 1999 compared to 1998 – an increase of a good 2 per cent.

The stabilisation in total waste amounts must therefore be attributed in particular to developments in waste amounts from households, the service sector, industry and the building and construction sector.

2.3 Waste treatment in 1999

Below, developments in treatment of total waste amounts are described. Furthermore, treatment is related to targets for treatment in the Danish Government's Waste Management Plan 1998 – 2004, Waste 21.

Table 4. Waste generation in 1996, 1997, 1998 and 1999 by mode of treatment, and target for year 2004									
'000 tonnes	1996		1997		1998		1999		W21
Treatment	tonnes	%	tonnes	%	tonnes	%	tonnes	%	%
Recycling	7787	60	8046	63	7542	62	7815	64	64
Incineration, of which	2507	19	2622	20	2740	22	2929	24	24
Sludge incineration plants	*170*		*177*		*161*		*138*		
Waste incineration plants with energy recovery	*2337*		*2445*		*2579*		2791		
Landfilling	2524	20	2103	16	1868	15	1472	12	12
Special treatment (1)	95	1	86	1	84	1	17	0	0

Sources: ISAG-reports for 1996 to 1999. Danish Government's Waste Management Plan 1998-2004 - Waste 21, Danisco, Association of Danish Recycling Industries and other large scrap dealers, Elsam, EK Energi, and reports to the Danish Environmental Protection Agency on sludge from municipal wastewater treatment plants (for 1999, figures from 1998 have been used. Sludge in long-term storage has been included in amounts of sludge recycled. Sludge for recovery has been included in sludge for incineration) and incineration in sludge incineration plants. (1) states that waste has been treated separately in a special treatment form. Comprises treatment of hazardous waste, including health-care waste.

It is seen from Table 4 that 7,815,000 tonnes, corresponding to 64 per cent of total waste amounts were recycled in 1999. This is an increase of 273,000 tonnes or 2 percentage points compared to the rate of recycling in 1998.

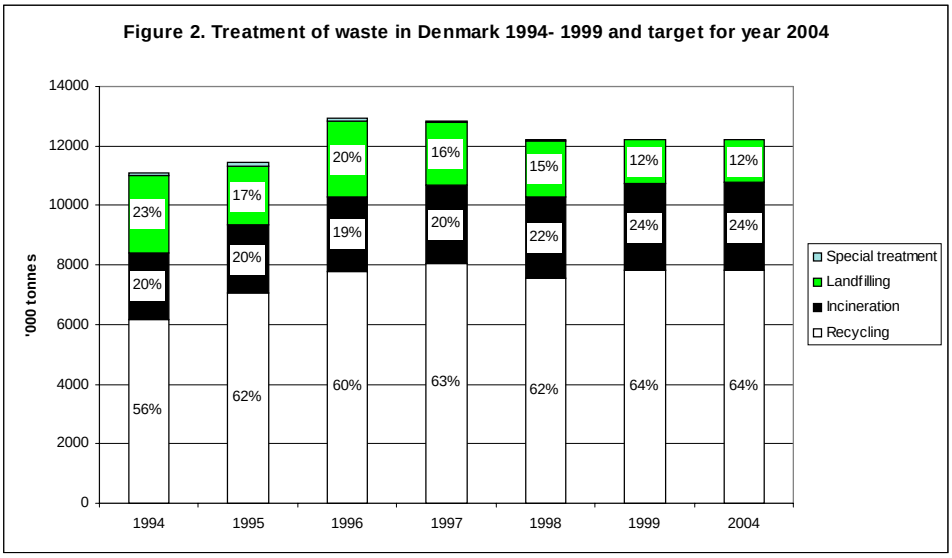
Waste incinerated in 1999 amounted to 2,929,000 tonnes - 24 per cent of total amounts – which is 189,000 tonnes more than in 1998. Landfilling in 1999 accounted for 396,000 tonnes less than in 1998, corresponding to a decrease of 3 percentage points.

In recent years, the relative distribution among treatment options has varied only little. Variations are often explained by developments in amounts of the different fractions. For example, variations in amounts of residues from coal-fired power plants and construction and demolition waste have large implications for the total rate of recycling, as these two waste types generally have a rate of recycling of 90 per cent or more.

According to Waste 21, short-term targets for stabilisation of waste generation are supplemented by a number of qualitative elements such as better exploitation of resources in waste, quality in treatment of waste and mitigation of problems caused by environmental contaminants in waste.

Overall, targets for sectors and fractions mean that the rate of recycling will increase, that more waste is incinerated, and that the need for landfilling will decrease. Overall targets in Waste 21 for waste management in year 2004 are 64 per cent recycling, 24 per cent incineration and a maximum of 12 per cent landfilling.

Figure 2. Treatment of waste in Denmark 1994- 1999 and target for year 2004



Source: As Tables 1 and 2 above. Remark that the figure has been designed in a way that total waste amounts year 2004 are similar to waste amounts in 1999. This should not be taken as an expression of projections of total waste amounts.

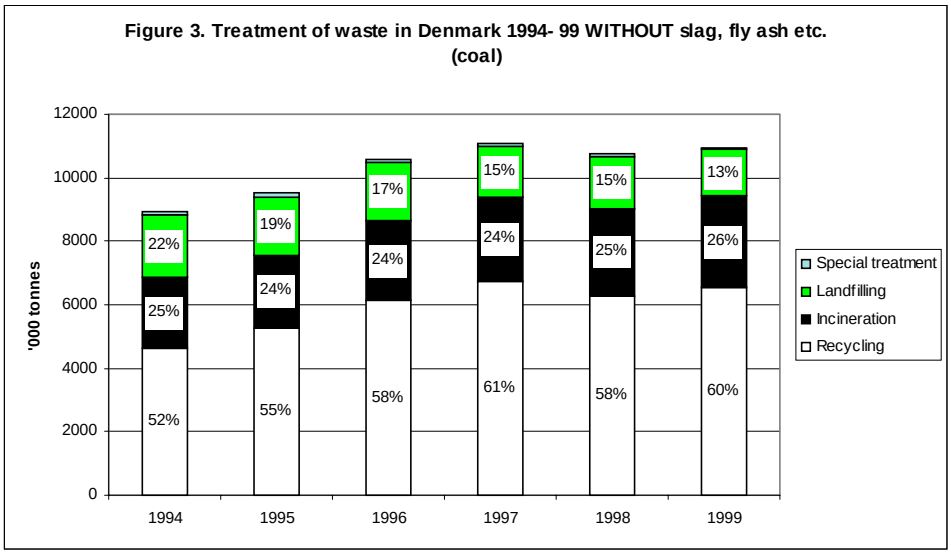
As Figure 2 shows, overall targets for waste treatment have been complied with in 1999. This is believed to be attributable to the ban on landfilling of waste suitable for incineration that came into effect on 1 January 1997. Furthermore, amounts of residues from coal-fired power plants have decreased, and they are furthermore recycled to a larger extent than in previous years where they were mainly landfilled.

Another significant factor is sludge. Sludge in long-term storage has been included in recycling. Sludge in long-term storage amounted to 396,000 tonnes in 1999. The correctness of including long-term storage in recycling

may be questioned as there is no guarantee that the sludge is actually recycled as intended.

2.3.1 Waste treatment, WITHOUT slag and fly ash

Figure 3 shows the distribution of waste on the different treatment options when residues from coal-fired power plants are kept apart from statistics.



Sources: ISAG-reports for 1994 to 1999, Danisco, Association of Danish Recycling Industries and other large scrap dealers, Elsam, EK Energi, and reports to the Danish Environmental Protection Agency on sludge from municipal wastewater treatment plants applied to farmland.

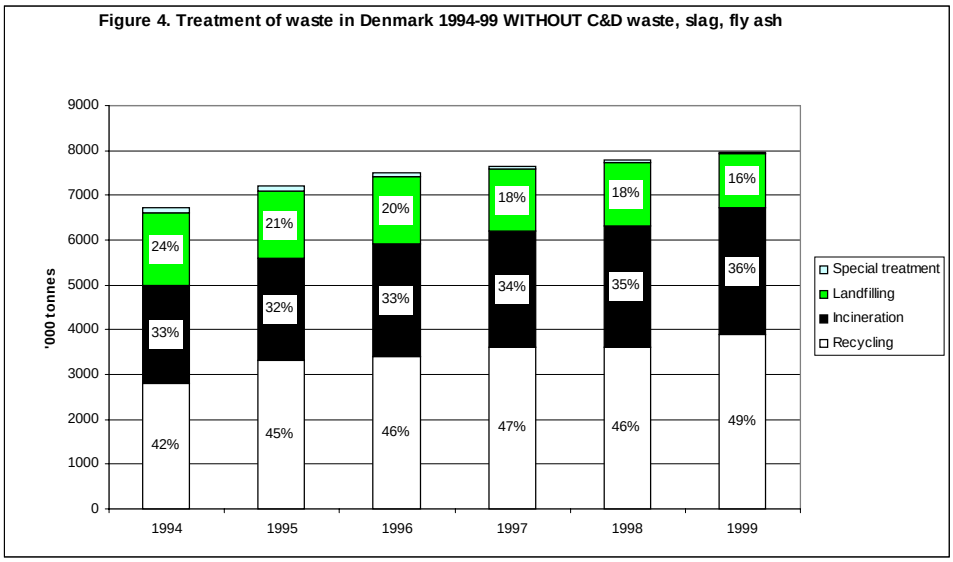
When residues are kept apart it is seen that 60 per cent of the remaining waste was recycled in 1999, which is an increase of 245,000 tonnes from 1998.

The share of remaining waste incinerated increased a little from 25 per cent in 1998 to 26 per cent in 1999, whereas the share of remaining waste going to landfill decreased by 2 percentage points compared to 1998. Thus, in 1999, 198,000 tonnes less than in 1998 went to landfill.

In absolute figures this means that without slag and fly ash 10,934,000 tonnes of waste were generated in 1999. Of this, 6,528,000 tonnes were recycled, 2,929,000 tonnes were incinerated, 1,460,000 tonnes went to landfill, whereas 17,000 tonnes were subjected to special treatment.

In Figure 4 waste from the building and construction sector is also kept apart from statistics. This causes the rate of recycling to decrease whereas the rates of incineration and landfilling increase.

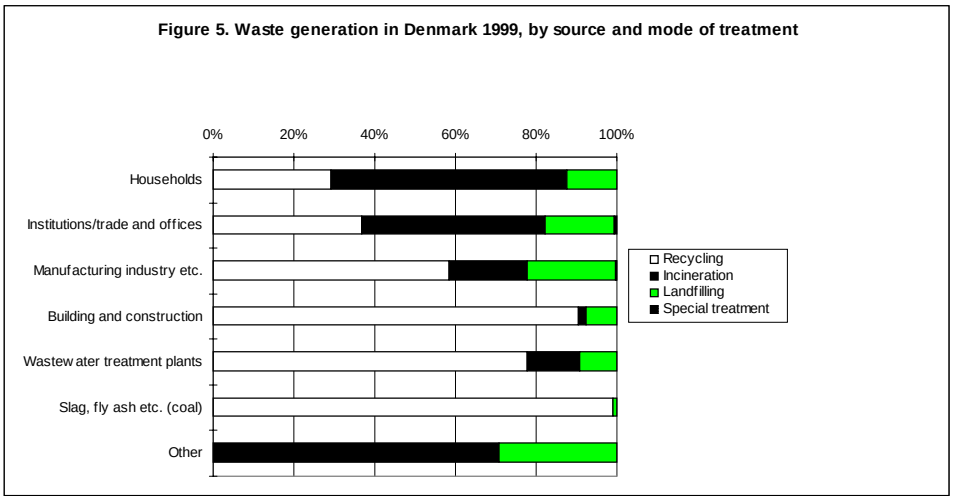
Residues from coal-fired power plants and construction and demolition waste are recycled to a very large extent: in 1999, 99 per cent and 90 per cent respectively. It is seen that these two fractions play a very significant role in the compliance with overall waste treatment targets in Waste 21.



Source: As Figure 3 above.

2.4 Treatment by sources and waste types

Figure 5 shows total waste generation in 1999 distributed on sources and treatment options. Figure 6 shows waste generation distributed on waste types and treatment options. Tables with detailed figures are given in Appendix 1.



Sources: ISAG-reports for 1999, Danisco, Association of Danish Recycling Industries and other large scrap dealers, Elsam, EK Energi, and reports to the Danish Environmental Protection Agency on sludge from municipal wastewater treatment plants applied to farmland etc. and incineration in sludge incineration plants (for 1999, figures from 1998 have been used). Figures for sludge are stated in wet weight. (Sludge in long-term storage has been included in amounts of sludge applied to farmland etc. Sludge for recovery has been included in sludge for incineration). Figures have been adjusted for imports of waste. The generation of waste in relation to the ISAG reports has been found by stating the quantity of waste delivered to waste treatment plants from primary sources. For this purpose, “primary sources” means waste generators that are not waste treatment plants (reprocessing facilities, incineration plants, composting and biogas plants, and landfills). Waste such as slag, fly ash, and flue gas cleaning products from waste incineration plants is therefore not included in the statement as it would otherwise be counted twice. Furthermore, waste from the source “recycling centres/transfer stations” is distributed on other primary sources. The principles for distribution are given in Annex 2.

Figure 5 shows that especially waste from the building and construction sector, coal-fired power plants and wastewater treatment plants reach a very high rate of recycling.

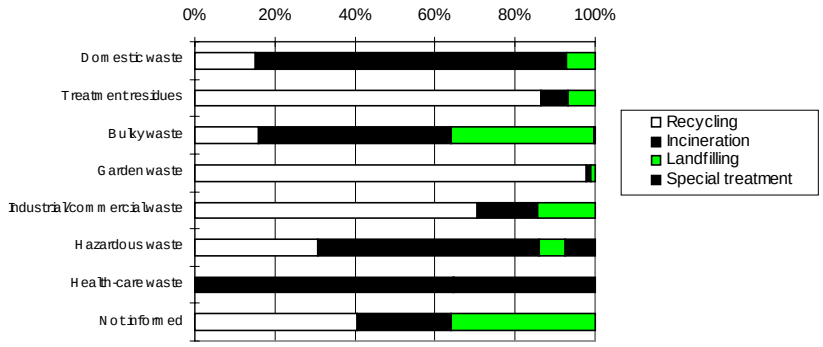
Waste 21 targets for recycling have been reached for waste from these three sectors.

Waste from industry also has a relatively high rate of recycling: 58 per cent. But still, the Waste 21 target of 65 per cent is far from being complied with. This is due to the fact that too much waste from industry still goes to landfill. In 1999, 22 per cent of waste was landfilled, which is 5 percentage points less than in 1998, but still some way from the target of a maximum of 15 per cent landfilling.

Correspondingly, recycling of waste from the service sector[2] is not sufficient in relation to the Waste 21 targets. In 1999 only 37 per cent of this waste was recycled; the target for year 2004 is 50 per cent. By contrast, the target of 45 per cent incineration was reached in 1999. The target for landfilling of waste from this sector in 2004 is 5 per cent.

As 17 per cent of waste from this sector goes to landfill it is necessary to divert more waste from landfilling to recycling if the targets are to be complied with.

Figure 6. Waste generation in Denmark 1999, by waste type and mode of treatment



Source: As Figure 5 above.

Treatment of domestic waste does not comply with targets in Waste 21. Only 15 per cent of this waste was recycled in 1999.

The target is to reach a rate of recycling of 30 per cent in 2004. 78 per cent of domestic waste was incinerated in 1999, whereas 7 per cent went to landfill[3]. The targets are 70 per cent and 0 per cent respectively.

[2] Waste from institutions/trade and offices.
[3] There is a general ban on landfilling of domestic waste. However, it is allowed to landfill domestic waste on islands that do not have land connections to the mainland.

3 Recycling

3.1 Recycling distributed on fractions

Table 5 shows waste fractions that are recycled, either by reprocessing, composting or biogasification. The table is not an outline of total amounts of these fractions.

Table 5. Recycling in Denmark in 1996, 1997, 1998 and 1999 of waste from primary sources, distributed on waste fractions. In '000 tonnes.

	1996	**1997**	**1998**	**1999**
Oil and chemical waste	53	72	56	80
Paper and cardboard	548	583	623	593
Bottles and glass	99	89	104	122
Plastic	29	28	33	38
Food waste/other organic	193	230	194	218
Branches, leaves, grass etc.	452	528	551	576
Ferrous metals (1) and (4)	899	1,004	968	973
Automobile tyres	8	20	31	27
Concrete	942	1,167	780	750
Tiles	93	125	123	126
Other construction and demolition waste	532	520	507	546
Asphalt	737	853	654	575
Wood	15	21	24	27
Soil and stone	391	353	388	398
Other recyclables	166	240	228	334
Fly ash and slag from coal-fired power plants (2)	1213	911	859	869
Fly ash and slag from other sources than waste incineration plants	2	2	2	1.5
Flue gas cl.products (gypsum, desulph., sulph. acid (2)	416	394	400	418
Sludge from municipal wastewater treatment plants applied to farmland, composting or biogasification	918	872	875	1071
Sludge from other sources	81	40	141	72
Total	**7,787**	**8,052**	**7541**	**7815**

Sources: ISAG-reports for 1996 to 1999, (1) Association of Danish Recycling Industries and other large scrap dealers, (2) Elsam and EK Energi, (3) Reports to the Danish Environmental Protection Agency on sludge from municipal wastewater treatment plants applied to farmland etc. (figures from 1998 have been used. Sludge in long-term storage has been included in amounts of sludge applied to farmland etc.. Sludge for recovery has been included in amounts of sludge incinerated), (4) Correction for ferrous metals removed from waste incineration plants has been made to avoid double counting. Some of the collective terms such as “Other recyclables”, “Other construction and demolition waste” and “Soil and stone” may contribute – after separation has been completed – to additional quantities of items such as tiles, wood etc.

As the table shows, total amounts of waste for recycling increased by 274,000 tonnes from 1998 to 1999. There is, however, no clear trend for the different fractions.

For example, recycling of paper and cardboard was 30,000 tonnes less in 1999 than in 1998, whereas recycling of plastic and bottles/glass increased by 5,000 tonnes and 18,000 tonnes respectively. It is also interesting to note that recycling of residues from coal-fired power plants in absolute figures increased by 10,000 tonnes despite the fact that total amounts of this fraction were 170,000 tonnes less in 1999 than in 1998.

Another fraction showing significant changes is “sludge from other sources”, which is mainly sludge generated in industrial manufacture. Total recycling of this fraction in 1999 amounted to 72,000 tonnes, which is 69,000 tonnes less than in 1998.

3.2 Paper and cardboard

Total collected waste paper in 1999 amounted to 593,000 tonnes, which is a decrease of 30,000 tonnes or 5 per cent compared to 1998. However, some of this decrease may be explained by a few cases of double or incorrect registrations in the ISAG in 1998[4]. This has meant that total registered amounts of paper and cardboard in 1998 were around 20,000 tonnes more than it should have been.

Table 6 shows the distribution of collected paper on sources. Not surprisingly, the largest amounts of waste paper are collected from households, the service sector[5] and industry.

Collected waste paper from the service sector increased by 9 per cent from 1998 to 1999, whereas there was a decrease of 14 per cent and 9 per cent respectively in the collected amounts from households and industry.

Table 6. Collection of waste paper by source in 1996, 1997, 1998 and 1999. Tonnes

	1996	1997	1998	1999
Households	160,469	183,116	208,486	179,477
Institutions	173,289	178,158	203,537	221,600
Manufacturing industries	214,015	220,935	210,278	191,264
Other	165	235	256	252
Not reported	213	731	0	0
Total	548,151	583,175	622,557	592,593

Source: ISAG reports for 1996 to 1999.

The consumption of new paper in the period 1995 to 1998 is stated in Table 7. Remark that the statement of consumption of virgin paper in 1999 is not available as yet[6].

Table 7. Consumption and recycling of paper and cardboard in 1995, 1996, 1997 and 1998. In ‘000 tonnes.

	1995	1996	1997	1998
Consumption of virgin paper[1]	1208	1181	1347	1304
Waste paper collected[2]	557	548	583	623
Waste paper collected as a percentage of virgin paper	46	46	43	48
Danish waste paper sent to Danish paper mills[2]	332	318	335	334
Net exports of waste paper[3]	150	220	204	242

Sources: (1) Material stream analysis of waste paper from the Danish Waste Management Information Centre and Statistics Denmark. (2) ISAG reports for 1995, 1996, 1997 and 1998. (3) Statistics Denmark. The discrepancy between waste paper collected, and Danish waste paper sent to Danish paper mills + net exports, may be due to stock enlargement, and it may be a consequence of applying different statistical sources and statement methods.

[4] The Danish Environmental Protection Agency does not make corrections in the ISAG database after final quality assurance and publication of data. If subsequently errors are found in the registers a note is entered into the database and deviations are explained in next year’s statistics.

[5] Institutions/trade and offices

[6] The statement is expected to be available by the end of 2000.

From 1997 to 1998 there was a decrease in the consumption of virgin paper. At the same time there was an increase in the amount of collected waste paper, leading to a collection rate of waste paper of 48 per cent in 1998.

The consumption of virgin paper per capita decreased a little in 1998 compared to 1997: 250 kg in 1998 against 259 kg in 1997. Furthermore, 120 kg paper and cardboard per capita were collected in 1998 against 112 kg in 1997.

Net exports of waste paper in 1998 amounted to 242,000 tonnes, which covers imports of a good 98,000 tonnes and exports of just above 339,000 tonnes.

3.3 Plastic

Plastic recycling in Denmark amounted in 1999 to 38,000 tonnes, corresponding to an increase of 5,000 tonnes from 1998.

The waste fraction plastic covers both production waste and waste plastic packaging. Every year, detailed statistics are prepared for waste plastic packaging.

The 1998[7] waste plastic packaging statistics prepared by the Danish Waste Management Information Centre show that in 1998 22,500 tonnes of waste plastic packaging were reprocessed in Denmark. The major part of waste – 13,700 tonnes – were imported.

11,500 tonnes of waste plastic packaging were collected in Denmark. Of this, 2,600 tonnes were exported for recycling abroad.

Total collected amounts correspond to around 7 per cent of the total Danish consumption of plastic packaging. Waste plastic of the type polyethylene (PE) accounted for 80 per cent of collected amounts.

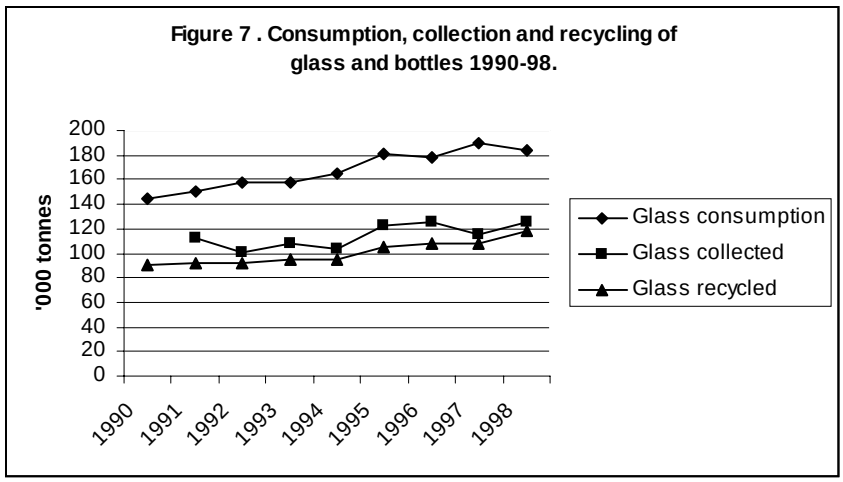
3.4 Bottles and glass

According to ISAG reports, recycling of bottles and glass from primary sources amounted to 122,000 tonnes in 1999. This is an increase of 18,000 tonnes compared to 1998.

By only including waste from primary sources, however, a complete picture of total material streams is not obtained. Of special importance is recycling of glass during which several collection and treatment steps have been passed.

As a consequence, the following description of total recycling of glass is based on Waste statistics for glass, bottles and cullets 1998 made by the Danish Waste Management Information Centre[8].

[7] The 1999 statement is expected to be available by end 2000
[8] As yet, the statement for 1999 is not available.



Source: Glass, bottles and cullets 1998, Waste statistics. Danish Waste Management Information Centre.

The consumption of glass packaging has been on the increase throughout the 1990s, but has remained relatively stable in the period from 1995 to 1998.

Also collection and recycling of glass packaging have been increasing throughout the 1990s. Collected glass amounted in 1998 to 126,000 tonnes, which is 11,000 tonnes more than in 1997. In 1998, 118,000 tonnes were recycled, which is 10,000 tonnes more than in 1997.

This means that the collection in per cent of total consumption in 1998 reached 68 per cent – an increase of 7 percentage points compared to 1997. The rate of recycling of total consumption in 1998 reached 64 per cent, which is also an increase of 7 percentage points compared to 1997.

Bottles for beer and soft drinks manufactured for reuse are not included in this statement. Refillable glass bottles, on average, make 30 trips. If these bottles were manufactured as single-use bottles, it would give an increase in waste glass of around 310,000 tonnes.

3.5 Ferrous metals

Table 8 shows amounts of collected ferrous scrap, distributed on consignees. It is seen that in 1999, 965,000 tonnes of ferrous scrap were recycled, and this is 6,000 tonnes less than in 1998.

Table 8. Recycling of ferrous scrap in 1996, 1997, 1998 and 1999. In '000 tonnes

	1996	**1997**	**1998**	**1999**
I. Danish ferrous scrap sent to foundries and the Danish Steel Works (2)	356	406	462	417
II. Ferrous scrap exported by scrap dealers (2)	612	684	535	570
III. Ferrous scrap imported by scrap dealers (2)	35	78	26	22
Total recycling of Danish ferrous scrap I + II - III	**933**	**1012**	**971**	**965**
Ferrous scrap imported by foundries and the Danish Steel Works (1)	263	210	216	230

Sources: (1) ISAG reports, (2) Information from the Association of Danish Recycling industries and other large scrap dealers. **Remark** that the statement used in table 8 is slightly different from the statement in table 5. For example, the correction for ferrous scrap removed from waste incineration plants has not been made, as this table shows the total balance for ferrous metals.

Total potential of ferrous scrap is not known precisely. Recycling industries normally estimate a recycling rate in excess of 90 per cent for ferrous scrap.

According to ISAG reports, the Danish Steel Works and other Danish foundries imported 230,000 tonnes of ferrous scrap in 1999, whereas scrap dealers imported 22,000 tonnes. Total imports thereby amounted to 252,000 tonnes of ferrous scrap, which is 10,000 tonnes more than in 1998.

3.6 Organic waste for composting, wood chipping and biogasification

Amounts of organic waste reprocessed through composting, wood chipping or biogasification are stated in Table 9.

Overall, there has been an increase in amounts of organic waste reprocessed: 153,000 tonnes more in 1999 than in 1998, corresponding to an increase of 17 per cent.

This increase is especially attributable to increasing amounts of garden waste (branches, leaves, grass etc.) for composting/wood chipping as well as increasing amounts of sludge for composting: an additional 83,000 tonnes and 77,000 tonnes respectively. Other organic waste and domestic waste for biogasification also increased: 37,000 and 5,000 tonnes respectively.

Table 9. Amounts of organic waste 1995-99 delivered to composting, wood chipping and biogasification, and removal from plants of compost, wood chips and screenings. Stated in '000 tonnes.

Material	1995	1996	1997	1998	1999
Branches, leaves etc. for composting/wood chipping	376	452	528	551	634
Organic domestic waste for composting	34	36	46	42	48
Organic domestic waste for biogasification	5	10	1	9	14
Other organic waste for composting	6	2	1	1	1
Other organic waste for biogasification	120	111	139	96	133
Other organic waste for fodder production	32	34	42	44	48
Sludge for composting	7	6	7	57	134
Sludge for biogasification	59	92	52	91	33
Total	**639**	**743**	**816**	**891**	**1,045**
Removal from plants of bark/wood chips	49	34	44	15	11
Removal from plants of compost	102	162	214	197	249
Removal from plants of screenings	5	19	13	16	18

Source: ISAG reports do not include information whether organic material is reprocessed as compost, wood chipping or biogas. The table is designed on the basis of estimates and calculations on ISAG reports as well as information in the Danish Environmental Protection Agency's status report on recycling of organic domestic waste and sludge of 25 February 2000.

Quantities of bark/wood chips and compost removed from the plants do not reflect the quantities generated. This quantity should be considered as reflecting the quantity sold or delivered free.

It is seen from the table that amounts of sold/removed bark/wood chips decreased from 15,000 tonnes in 1998 to 11,000 tonnes in 1999. In return, the amount of sold/removed compost increased from 197,000 tonnes in 1998 to 249,000 tonnes in 1999.

3.7 Tyres

In 1995, the Minister for Environment and Energy entered an agreement with a number of organisations, on a take-back scheme for used tyres from cars, vans, and motorcycles.

The purpose of the agreement is to ensure collection and recovery of used tyres in Denmark. Landfilling is avoided and resource recovery ensured, whereby material recovery is prioritised to energy recovery.

The scheme started 1 April 1995 and is financed by a fee on tyres comprised by the agreement and marketed in Denmark.

As per 1 April 2000 the scheme was extended to cover tyres for motor vehicles.

According to the agreement, the target is a take-back rate of at least 80 per cent.

Table 10 shows that the 1999 collection rate reached 87.4 per cent, which is almost identical to 1998.

Table 10. Take-back of car, van and motorcycle tyres. Tonnes

	2nd half 1995	**1996**	**1997**	**1998**	**1999**
Used tyres covered by the take-back scheme	8,725	16,705	18,405	19,378	19,816
Collected tyres	7,600	12,670	17,229	16,926	17,314
Of which for					
Retreading or continued use	*3,300*	*5,477*	*4,581*	*5,472*	3,508
Temporary storage	*955*	*1,133*	*0*	*0*	0
Rubber powder production	*3,345*	*6,060*	*12,648*	*11,454*	13,806
Collection, % tyres covered by the scheme	87.1	75.8	93.8	87.3	87.4

Source: Statement from Danish Environmental Protection Agency for the period 1.7.95 - 31.12.95 and reports from the Danish Tyre Trade Environmental Foundation for 1996, 1997, 1998 and 1999. 2nd half 1995 includes 1,000 tonnes collected in the first half of 1995, thereby increasing the collection rate.

4 Hazardous waste

Table 11 shows generation and treatment of hazardous waste in 1998 and 1999. The statement includes waste from primary and secondary sources.

Waste from secondary sources, such as waste from incineration plants, is not included in total waste generation, cf. Table 1. However, it is reasonable when assessing the total generation of hazardous waste to include waste from both primary and secondary sources.

It is not possible to make a direct comparison of the distribution of fractions on treatment options in 1998 and 1999. Waste treated at the hazardous waste treatment plant of Kommunekemi was up to 1998 registered as subjected to special treatment[9]. For 1999, however, waste treated at Kommunekemi has been registered as treated by tax-exempt incineration instead of special treatment. Thereby, a more real division on the treatment options of recycling, incineration, landfilling and special treatment has been made.

However, it is possible to compare developments in total amounts of primary and secondary waste. Hazardous waste from primary sources amounted in 1999 to 229,388 tonnes: 46,313 tonnes more than in 1998.

By contrast, hazardous waste from secondary sources decreased by 10,102 tonnes from 1998 to 1999 when it amounted to 89,349 tonnes.

This means that total amounts of hazardous waste in 1999 reached 318,737 tonnes, which is 36,211 tonnes or approximately 13 per cent more than in 1998.

Table 11. Generation and treatment of hazardous waste in 1998 and 1999. Tonnes.

Fraction	Recycling		Incineration		Landfilling		Special treatmen		Total	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Primary sources										
Lead batteries (1)	14644	15231							14644	15231
Hermetically closed nickel-cadmium batteries (2)	85	66							120	120
Waste oil delivered to district heating plants (3)			19797	14528					19797	14528
Washing and cleaning agent waste		3		2066		1	1837	36	1837	2106
Organic solvents w.org. halogen without inflam. solvents				426			438	16	438	442
Organic solvents w.org. halogen mixed with inflam. solvents				131			174	1	174	132
Organic solvents with org. halogen and/or sulphur	1			65			38		39	65
PCB and PCT waste				15			437	15	437	30
Liquid residues from org. synthesis w. toxic subs., hal./sulph.				130			16		16	130
Liquid residues from org. synthesis w. halogen/sulphur				358			362	1	362	359
Sludge from plastic coatings containing PVC				99		4	74		74	103
Solid residues from recovering solvents cont. halogen				21			22		22	21
Solid residues from recov. solvents w. toxic subs., hal./sulph.				15		1	80		80	16
Solid residues from organic synthesis w. org. halogen/sulphur				18		3	26		26	21
Organic aromatic solvents without org. halogen/sulphur				6757			6525	1	6525	6758
Org. solvents without aromatic solvents or halogen/sulphur	7			1884			1667	1	1674	1885

The table continues overleaf.

[9] Special treatment in this context means that waste was incinerated before going to landfill.

Table 11 continued

Fraction	Recycling		Incineration		Landfilling		Special treatmen		Total	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Printing inks, paint, varnish with organic solvents	10	14		10640		2	11269	815	11279	11471
Printing inks, paint, varnish without organic solvents	19			6572		7	7656	824	7675	7403
Tar and rust-protection oils		170		295			381		381	465
Alcohol/water mixtures from nylon plates	1			151			97		98	151
Residues from distillation of mixtures with acetone, styrene and unhardened polyesther				507			261		261	507
Organic metal compounds, except mercury compounds				112			70	1	70	113
Liquid organic residues from distillation without halogen/sulphur		34		1119			1051		1051	1153
Formaldehyde solvents < 30%				63			58		58	63
Aqueous phenol and formaldehyde emulsions				51			62	5	62	56
DI-isocyanides				122		1	197		197	123
Anti-freeze liquids	1838	393		743			748	983	2586	2119
Latex and rubber sludge containing organic solvents				51			83		83	51
Acidic sludge from used oil refining				14			21	14		28
Waste glue with organic solvents/two-component glue	3	3		497			653		656	500
Solid residues from organic synthesis without org. halogen/sulphur	1246			564			563	118	1809	682
Slip from production of brake linings etc.				88		31	84		84	119
Beet pulp containing lead compounds				4			5		5	4
Acidic, aqueous solutions with chromium compounds	994	855		95		4	652	419	1646	1373
Acidic, aqueous solutions with nitric acid, without hydrofluoric acid	4	2		31		1	169	338	173	372
Acidic, aqueous solutions with hydrofluoric acid and/or nitric acid salts	4			21			497	338	501	359
Acidic, aqueous solutions with hydrochloric/ sulphuric/ phosphoric acid	9	21		613		9	3679	3625	3688	4268
Photograph developing baths	1929	3051		1116		10	2915	60	4844	4237
Photograph processing baths containing chromium				7			4		4	7
Fixing baths	1401	1293		20			1035	963	2436	2276
Base aqueous solutions without cyanide	8	27		1636		4	2215	390	2223	2057
Base aqueous solutions with cyanide				79			254	152	254	231
Metal hydroxide and metal oxide sludge	776	1266		1306		3683	5491	145	6267	6400
Smoke rinsing sludge and smoke filter dust				369		743	2686	203	2686	1315
Dye-works waste				2			15		15	2
Aqueous sludge from pressurised impregnation of wood				14			75	7	75	21
Hardening salts				15			83	52	83	67
Mercury waste	62	140		4		20	188	93	250	257
Cloths and rags polluted with organic solvents	2			191			213	6	215	197
Waste from production and distribution of chemical neutralising agents				1163		4	1206	76	1206	1243
Waste from medicines				728			1098	557	1098	1285
Chemical waste from laboratories etc.	1	1		1056		54	1277	67	1278	1178
Glass and mineral waste containing phenols				54		2	43		43	56
Other hazardous waste	4534	6516		20785		276	7238	143	11772	27720
Motor oil	4776	6694		11371			7254	19	12030	18084
Gear and hydraulic oil	3	1		128			163		166	129
Hot transmission oil				42			36		36	42
Other lubricating oil				682			900		900	682
Oil and petrol separators	335	429		2407			826	2399	1161	5235
Drilling/cutting oil, unthinned	119	139		21			27		146	160
Oil emulsion	3200	3882		171			73		3273	4053
Lubricating grease				38			45		45	38
Motor petrol		69		52			25		25	121
Petroleum				5			0,3		0,3	5
Diesel oil		7857		52			32		32	7909
Gas oil				9			19		19	9
Fuel oil				118			143		143	118
Other products containing oil	4192	21594		2786		88	2680	426	6872	24894
Cutting oil				26			36		36	26
Cutting fluids				6			8		8	6
Mineral drilling/cutting oil in water				52			26		26	52
Synthetic drilling/cutting fluids in water				8			26	19	26	27
Oil and chemical waste	10300	27952			16446		1300	188	28046	28140
Health-care waste			110	1267			2963	2767	3073	4034
Dust-emitting asbestos					7635	12748			7635	12748
Sulphuric acid from coal-fired power plants (4)	6000	1000							6000	1000
Total primary sources	***58501***	***100702***	***21905***	***98651***	***26079***	***19695***	***84568***	***18282***	***185073***	***229388***
Secondary sources										
Filter dust from flue gas cleaning (1)	11046	11002							11046	11002
Fly ash (5)	285	376			5229	5771	17671	22413	23185	28560
Flue gas cleaning products (5)	5620	5170			28085	37434	31515	7183	65220	49787
Total secondary sources	***16951***	***16548***			***33314***	***43205***	***49186***	***29596***	***99451***	***89349***
Total	**75452**	**117250**	**21905**	**98651**	**59393**	**62900**	**133754**	**47878**	**284524**	**318737**

Sources: (1) Registrations according to EU Regulation 259/93 on shipments of waste, (2) Calculations by the Danish Environmental Protection Agency. The difference between total quantity (120 tonnes) and the amount collected (66 tonnes) is due to the fact that the batteries are not collected separately, but comprised by the general collection of waste, (3) Payment of subsidies for recovery of waste oil, (4) Elsam, (5) The figure for special treatment covers that the quantity is in storage. Remaining items: ISAG reports 1998 and 1999. Under the terms of Statutory Order no. 660 of 24th September 1986 on asbestos from the Ministry of Labour, asbestos is divided into three categories: I) dust emitting asbestos, II) asbestos that may emit dust, and III) non-dust emitting asbestos. Only asbestos of the first category is hazardous waste, but reports to the ISAG comprise asbestos of both categories I and II. Remark that figures for 1998 and 1999 cannot be compared directly, as the registration on different treatment forms has changed.

5 Imports and exports of waste

5.1 Imports

Table 12 shows amounts of waste imported in 1998 and 1999 distributed on waste fractions and treatment options. Amounts of waste imported in 1998 and 1999 are almost identical – there has been a minor increase of approximately 19,000 tonnes.

Amounts of waste imported in 1999 correspond to 4 per cent of total waste generation in Denmark.

Table 12. Imports of waste in 1998 and 1999 stated by fraction and in tonnes

Fraction	Recycling		Incineration		Landfilling		Special treatmen		Total	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Glass (2)	13200	9900							13200	9900
Paper and cardboard (2)	96900	84500							96900	84500
Plastic (2)	18400	26300							18400	26300
Ferrous metals (1 and 3)	262300	251700							262300	251700
Other burnable (4)			17900	45800					17900	45800
Health care risk waste (1)							0	2	0	2
Food waste/other organic (1)	4700	14200							4700	14200
Other recyclables (1)	39200	27100							39200	27100
Sludge (4)	9700	7100							9700	7100
Other notified waste (4)	8100	23000			900	90	7800	9600	8100	23000
Total	**452500**	**443800**	**17900**	**45800**	**900**	**90**	**7800**	**9602**	**470400**	**489602**

Source: (1) ISAG reports 1998 and 1999, (2) Statistics Denmark, (3) Association of Danish Recycling Industries and other large scrap dealers, (4) Registrations according to EU Regulation on shipments of waste.

85 per cent of imported waste is categorised as green waste for recovery according to the EU Regulation on shipments of waste, and it covers primarily glass, paper and cardboard, plastic, ferrous metals, as well as organic waste. Waste imported is destined for recycling or incineration with energy recovery.

The remaining 15 per cent of waste imported is listed on the OECD amber and red lists and is subject to mandatory notification under the EU Regulation on shipments of waste, cf. Table 13. Waste of this type is destined for disposal or recovery[10].

The distribution of imported waste on green waste and red and amber waste has changed from 1998, when 92 per cent of waste was green, whereas 8 per cent was subject to mandatory notification (red or amber).

[10] Disposal means either landfilling or incineration without energy recovery. Recovery is either recycling or incineration with energy recovery.

5.2 Exports

Table 13 shows amounts of waste exported from Denmark in 1998 and 1999. It is seen that amounts exported account for some 9 per cent of total waste generation in Denmark.

In 1999 1,124,297 tonnes of waste were exported which is around 78,500 tonnes or 7 per cent less than in 1998. This decrease is mainly due to a decrease in exports of "other burnable" and "ferrous metals", whereas there was an increase in exports of, for example, paper and cardboard, glass and flue gas cleaning products from waste incineration plants.

Table 13. Exports of waste in 1998 and 1999 stated by fraction and in tonnes		
	1998	**1999**
Glass (2)	233	12400
Paper and cardboard (2)	338500	382000
Plastic (2)	11400	19700
Ferrous metals (1 and 3)	535500	403700
Other burnable (1)	34500	8100
Fly ash and slag from coal-fired power plants (5)	146000	146200
Sulphuric acid from coal-fired power plants (5)	0	0
Slag and flue gas cleaning products from iron manufacture (1 and 4)	11000	11000
Lead batteries (4 and 6)	14600	15231
Nickel-cadmium batteries (4 and 6)	85	66
Flue gas cleaning products from waste incineration plants (4)	38000	56400
Ferrous metals from waste incineration plants (4)	8300	10700
Other notified waste (4)	64700	58800
Total	1,202,818	1,124,297

Source: (1) ISAG reports 1998 and 1999, (2) Statistics Denmark, (3) Association of Danish Recycling Industries and other large scrap dealers, (4) Registrations according to EU Regulation on shipments of waste, (5) Elsam and EK Energi, (6) Collectors of nickel-cadmium batteries registered by the Danish Environmental Protection Agency.

Around 73 per cent of waste exported from Denmark in 1999 belong to the category green waste for recovery and concern mainly the fractions "paper and cardboard" and "ferrous metals" which alone account for 70 per cent of exports.

5.3 Imports and exports of waste subject to mandatory notification

Table 14 shows countries of export and import of waste subject to mandatory notification.

The table shows that Denmark imported in 1999 around 9,700 tonnes of waste for disposal, which is 1,000 tonnes more than in 1998. Most waste originated from Ireland and Norway and consisted mainly of chemical waste and other hazardous waste.

In 1999 around 76,000 tonnes of waste were imported for recovery, mainly from Norway, Sweden and Germany. This is more than a doubling compared to 1998, when 36,000 tonnes were imported. Amounts imported from Germany are more or less identical, whereas there has been a considerable increase in amounts from Norway and Sweden. Waste in this context is especially slag from iron manufacture, chemical and oil waste.

Waste exported from Denmark for recovery in 1999 amounted to just below 96,000 tonnes, which is around 3,000 tonnes less than in 1998. Waste was primarily exported to Spain, Sweden and Germany and covered residues from ferrous metal manufacture, batteries and household waste.

In 1999 just below 57,000 tonnes of waste were exported for disposal, which is almost 20,000 tonnes more than in 1998. Waste was exported to Norway and Germany and covered residues from incineration of household waste and waste mercury.

Table 14. Imports and exports in 1999 of waste subject to mandatory notification. Stated in tonnes.

Country	Disposal:		Recovery:	
	Exports from DK to:	Imports to DK from:	Exports from DK to:	Imports to DK from:
Belgium				
AC220	0	0	253.68	0
AA040	0	0	95.30	0
AA130	0	0	1195.50	0
Total:	**0**	**0**	**1544.48**	**0**
Great Britain				
AC220	0	32.69	0	8.90
AD010	0	0	0	142.27
AD090	0	0	18.43	0
AD110	0	0	25.14	0
RX100	0	0	1969.72	0
AA060	0	0	1394.62	0
AA100	0	0	10.69	0
AA120	0	0	435.84	0
AA180	0	0	3.20	0
Total:	**0**	**32.69**	**3857.61**	**151.17**
Finland				
AA050	0	0	57.3	0
AA070	0	0	7044.56	0
Total:	**0**	**0**	**7101.86**	**0**
France				
AA180	0	0	22.7	0
Total:	**0**	**0**	**22.70**	**0**
The Netherlands				
AB010	0	0	0.00	2215.74
AB040	0	0	369.42	0
AD070	0	0	249.80	0
AA030	0	0	90.86	0
Total:	**0**	**0**	**710.08**	**2215.74**

Continues overleaf.

Country	Disposal:		Recovery:	
	Exports from DK to:	Imports to DK from:	Exports from DK to:	Imports to DK from:
Ireland				
AC090	0	193.03	0	0.00
AC210	0	4674.01	0	5323.20
AC220	0	411.06	0	607.61
AD010	0	894.47	0	141.33
AD020	0	17.95	0	0
AD060	0	25.59	0	0
RA010	0	1.71	0	0
RX100	0	12.30	0	0
AA060	0	0.00	3036.23	0
Total:	**0**	**6230.11**	**3036.23**	**6072.13**
Iceland				
AC220	0	61.64	0	0
RX100	0	338.03	0	0
Total:	**0**	**399.67**	**0**	**0**
Norway				
AB020	38498.42	0	0	0
AB040	0	0	0	35.94
AC030	0	0	0	200.76
AC080	0	0	0	1733.05
AC210	0	18.34	0	2079.99
AC270	0	0	0	237.16
AD060	0	0	0	22645.80
AD070	0	0	0	110.84
AD090	0	845.78	0	176.18
AD150	0	0	0	20.86
RA020	0	2119.54	0	38.50
RX100	0	41.75	0	0
AA020	0	0	1197.24	0
AA050	0	0	429.76	0
AA110	319.30	0	0	0
Total:	**38817.72**	**3025.41**	**1627.00**	**27279.09**
Poland				
AA070	0	0	0	7.44
Total:	**0**	**0**	**0**	**7.44**
Spain				
AA010	0	0	11001.80	0
Total:	**0**	**0**	**11001.80**	**0**

Continues overleaf.

Country	Disposal:		Recovery:	
	Exports from DK to:	Imports to DK from:	Exports from DK to:	Imports to DK from:
Sweden				
AB070	0	0	1209.70	0
AB110	0	0	4.64	0
AC030	0	0	0	7311.59
AC150	0	11.28	0	0
AC170	0	0	693.84	1841
AD020	0	10.30	0	0
AD070	0	0	0	1251.76
AD160	0	0	9157.64	0
RX100	0	1.76	5209.65	710.42
AA030	0	0	174.21	0
AA100	0	0	0.86	0
AA130	0	0	0	24.60
AA170	0	0	15310.39	0
AA180	0	0	35.24	0
Total:	**0**	**23.33**	**31796.17**	**11139.36**
Germany				
AB010	0	0	0	189.84
AB020	17865.62	0	10653.32	0
AB040	0	0	115.12	0
AC010	0	0	0	49.88
AC030	0	0	3100.38	2050.19
AC090	0	0	31.86	0
AC170	0	0	0	379.60
AC210	0	0	0	202.36
AC270	0	0	0	7137.93
AD060	0	0	0	5823.10
AD070	0	0	390.50	42.46
AD090	0	0	19.02	0
AD110	0	0	2.87	0
AD120	0	0	0.35	0
AD160	0	0	3483.46	0
RX100	31.24	0	12728.46	885.09
AA010	0	0	0	12367.47
AA020	0	0	87.83	0
AA040	0	0	136.04	0
AA050	0	0	1313.12	0
AA060	0	0	854.40	0
AA070	0	0	27.94	0
AA100	12.28	0	124.63	0
AA130	0	0	2091.36	0
AA160	0	0	8.70	0
AA170	0	0	43.69	0
Total:	**17909.14**	**0**	**35213.05**	**29127.91**
Total for all countries:	**56726.86**	**9711.21**	**95910.98**	**75992.85**

Sources: Danish Environmental Protection Agency, database of shipments. The registration is made on the background of completed consignment notes under EU Regulation 259/93 on shipments of waste. The consignee must send a copy of the filled-in consignment note to the competent authorities within three working days after receipt of the waste. OECD-codes are defined in Commission Decision of 21st October 1994 (no. L 288/36, Official Journal of the European Communities of 9th November 1994).

5.4 OECD codes

AA010	Dross, scalings and other wastes from the manufacture of iron and steel.
AA020	Zinc ashes and residues.
AA030	Lead ashes and residues.
AA040	Copper ashes and residues.
AA050	Aluminium ashes and residues.
AA060	Vanadium ashes and residues
AA070	Ashes and residues containing metals or metal compounds not elsewhere specified or included.
AA130	Liquors from the pickling of metals.
AA100	Mercury waste and residues.
AA120	Galvanic sludges.
AA160	Ash from incineration of printed circuit boards
AA162	Photographic film ash.
AA170	Lead-acid batteries, whole or crushed.
AA180	Used batteries or accumulators, whole or crushed, other than lead-acid batteries and waste and scrap arising from the production of batteries and accumulators, not otherwise specified or included.
AB010	Slag, ash and residues, not elsewhere specified or included.
AB020	Residues arising from the combustion of municipal/household wastes.
AB030	Waste from non-cyanide based systems which arise from surface treatment of metals.
AB070	Sands used in foundry operations.
AB080	Waste catalysts not on the green list.
AB100	Waste alumina.
AB110	Basic solutions.
AC030	Waste oils unfit for their originally intended use.
AC040	Leaded petrol (gasoline) sludges
AC070	Brake fluids.
AC090	Waste from production, formulation and use of resins, latex, plasticisers, glues and adhesives.
AC170	Treated cork and wood wastes.
AC210	Non-halogenated solvents.
AC220	Halogenated solvents.
AC260	Liquid pig manure; faeces.
AC270	Sewage sludge.
AD010	Waste from the production and preparation of pharmaceutical products.
AD030	Waste from the manufacture, formulation and use of wood preserving chemicals.
AD040	Inorganic cyanides, excepting precious metal-bearing residues in solid form containing traces of inorganic cyanides.
AD060	Waste oils/water, hydrocarbons/water mixtures, emulsions.
AD070	Waste from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish.
AD080	Wastes of an explosive nature, when not subject to specific other legislation
AD090	Waste from production, formulation and use of reprographic and photographic chemicals and materials, not elsewhere specified or included.
AD140	Wastes from industrial pollution control devices for cleaning of industrial offgases, not elsewhere specified or included.
RA010	Waste, substances and articles containing consisting of or contaminated with polychlorinated biphenyl (PCB) and/or polychlorinated terphenyl (PCT) and/or polybrominated biphenyl (PBB), including any other polybrominated analogues of these compounds at a concentration level of 50 mg/kg or more.
RC030	Leaded anti-knock compounds sludges
RX100	Other wastes not specified with an OECD-code

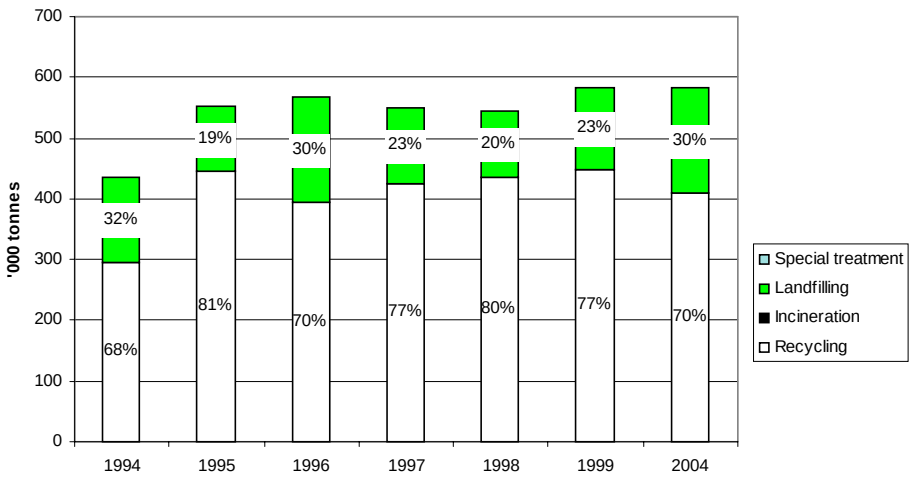
6 Waste fractions and status compared to targets for year 2004

6.1 Residues from waste incineration plants

Figure 8 shows amounts of residues (slag, fly ash, and flue gas cleaning products) from waste incineration in 1994 to 1999, stated in tonnes, as well as treatment option.

Residues from waste incineration plants have not been included in statements of total waste generation presented so far, as waste would otherwise be counted twice. However, residues constitute a significant waste fraction that should be used or disposed of one way or the other.

Figure 8. Treatment of residues from waste incineration plants



Source: See Tables 1 and 2. The figure has been designed in a way that total waste amounts year 2004 are similar to waste amounts in 1999. This should not be taken as an expression of projections of total waste amounts.

By far the largest proportion of residues is recycled, though with a decrease of 3 percentage points in 1999 from the 1998 rate of recycling.

Residues cannot be recycled if heavy metal contents are too high – in that case they will be led to landfill.

According to Waste 21, environmental contaminants such as PVC, impregnated wood and waste electrical and electronic equipment may no longer be assigned to incineration. This means that heavy metal contents in slag will drop significantly.

However, at the same time requirements for recycling will become more stringent in consideration of groundwater, and therefore targets from the

previous plan of action are maintained in Waste 21, which means a target recycling rate of 70 per cent.

Table 15 presents the use of residues from waste incineration.

Table 15. Slag, fly ash and flue gas cleaning products removed from waste incineration plants in 1996 - 1999.				
Related to treatment option. In tonnes.	**1996**	**1997**	**1998**	**1999**
Slag removed from waste incineration plants	509,200	493,800	468,500	519,479
Fly ash and flue gas cleaning products removed/exported from incineration plants	71,900	61,300	82,500	72,680
Total removed from waste incineration plants	*581,100*	*555,100*	*551,000*	*592,159*
Landfilled slag from waste incineration plants	126,300	87,100	76,400	92,302
Landfilled fly ash and flue gas cleaning products from waste incineration plants	45,300	36,600	33,300	43,102
Fly ash and flue gas cleaning products exported for landfilling	21,103	26,510	37,900	56,300
Total landfilled from waste incineration plants	*192,703*	*150,210*	*147,600*	*191,704*
Slag from waste incineration plants registered as delivered to reprocessing plants	101,800	106,100	115,200	108,742
Slag from waste incineration plants estimated as delivered directly to recycling	281,100	300,600	276,900	318,435
Total recycling from waste incineration plants	*382,900*	*406,700*	*392,100*	*427,177*
Fly ash and flue gas cleaning products estimated to be in storage	5,497	-1,810	11,300	-26,722

Source: Calculations based on ISAG reports for 1996, 1997, 1998 and 1999, and registrations according to the EU regulation on shipments of waste. Remark that Table 15 and Figure 8 cannot be compared directly, as exports are not included in Figure 8.

Amounts of residues from waste incineration naturally depend on amounts of waste incinerated. Slag and flue gas cleaning products account for around 20 per cent and 3 per cent respectively of waste feed.

The table shows that residues from waste incineration in 1999 amounted to 592,159 tonnes, which is some 41,000 tonnes more than the previous year.

Of the amount removed of 592,159 tonnes, 191,704 tonnes were landfilled and 427,177 tonnes were recycled. This means that amounts of fly ash and flue gas cleaning products in storage have been reduced by almost 27,000 tonnes.

6.2 Waste from building and construction activities

In 1999, waste from the building and construction sector amounted to 2,968,000 tonnes, an insignificant increase from 1998 of 5,000 tonnes.

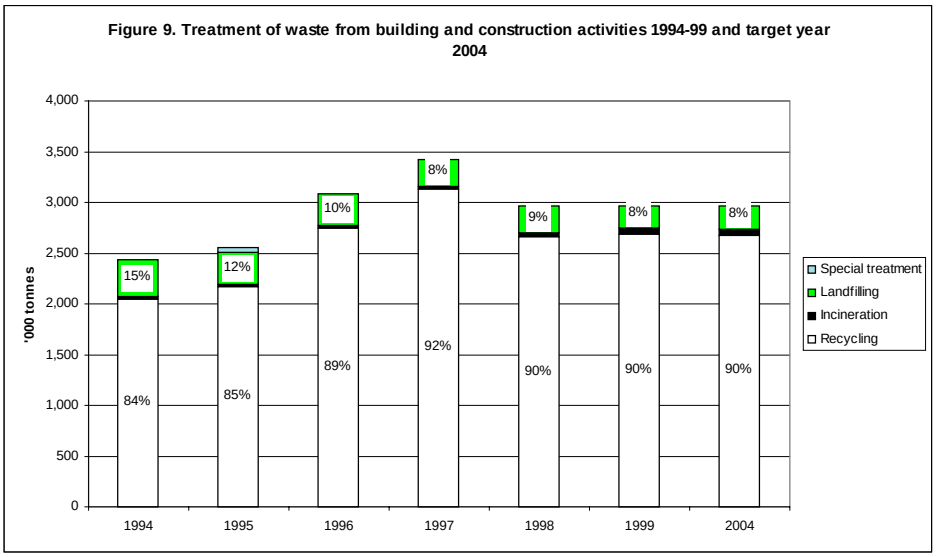
By far the largest proportion of construction and demolition waste is recycled: 90 per cent was recycled in 1999, 2 per cent was incinerated and 8 per cent landfilled cf. Figure 9. The figure shows that recycling of construction and demolition waste increased by 6 percentage points in the period 1994 to 1999. Correspondingly, the landfilled proportion of construction and demolition waste decreased by 7 percentage points.

The figure also shows that the distribution among the different treatment options in 1999 was in total compliance with the 2004 targets for treatment.

The high rate of recycling for construction and demolition waste is partly due to the fact that recycled waste is exempt from the waste tax, contrary to waste landfilled or incinerated. Furthermore, a circular[11] on municipal regulations regarding separation of construction and demolition waste with a view to recycling came into effect in 1995.

[11] Circular No. 94 of June 21, 1995

And finally, the Ministry of Environment and Energy has entered an agreement with the Danish Demolition Association on selective demolition of building materials.

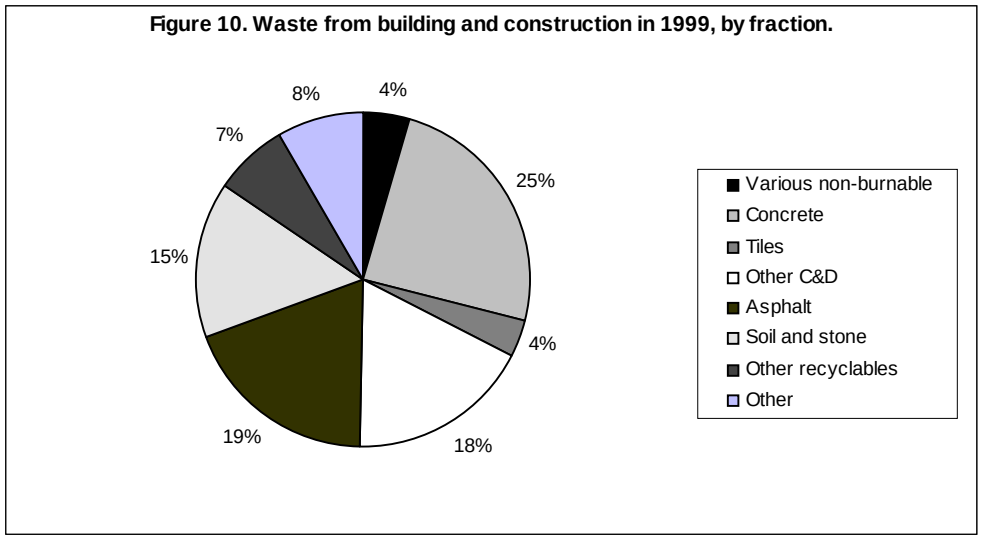


Source: See Tables 1 and 2. The figure has been designed in a way that total waste amounts year 2004 are similar to waste amounts in 1999. This should not be taken as an expression of projections of total waste amounts.

There is still scope for improving waste management. In future, special efforts shall be made to separate and treat the types of construction and demolition waste that are most harmful to the environment, such as PVC and impregnated wood.

Finally, “cradle-to-grave” assessments and environmentally correct design shall be used more extensively in connection with new building projects.

Figure 10 shows the distribution of construction and demolition waste among the different fractions in 1999. It is seen that the major part of construction and demolition waste consists of concrete followed by asphalt, other C&D waste and soil and stone.



Source: ISAG reports 1999. Legend: clock-wise from top.

A large proportion of construction and demolition waste is reprocessed in mobile crushing plants moved around the country for various assignments.

In some cases, both the owner of the crushing plant and his client report to the ISAG. The Danish Environmental Protection Agency is aware of this possible source of double counting, and great efforts are made in co-operation with enterprises reporting to subject data to quality assurance in order to avoid double counting.

6.3 Waste from households

Waste from households covers primarily the waste types domestic waste, bulky waste, and garden waste, which again can be divided into waste fractions such as paper and cardboard, bottles and glass, and food waste/other organic waste. See also Table 16 where fractions are stated, in so far as it has been possible to register them separately.

Amounts of, for example, paper and cardboard do not reflect the potential in household waste, but alone the amount separated for recycling. Other paper is covered by the fraction “various burnable”.

Total waste generation in households in 1999 amounted to 2,963,000 tonnes, which is an increase of 167,000 tonnes or 6 per cent compared to 1998. Bulky waste and garden waste amounts increased by 17 per cent and 6 per cent respectively, whereas amounts of domestic waste decreased by 2 per cent.

Table 16. Waste generation in households By fraction and stated in tonnes	**1996**	**1997**	**1998**	**% change 1998-99**
Various burnable	1,800,752	1,784,342	1,775,930	-0.5
Various non-burnable	164,356	155,590	146,707	-6
Paper and cardboard	160,469	183,116	208,486	14
Bottles and glass	64,903	67,771	83,033	23
Food waste/other organic	45,905	47,085	51,926	10
Branches, leaves, grass cuttings etc.	386,874	426,309	408,877	-4
Hazardous waste	16,214	12,668	14,395	14
Ferrous metals (1)	-	12,610	11,926	5
Other	127,479	86,571	94,569	9
Total	2,766,952	2,776,061	2,795,848	-0.7

Source: ISAG reports 1996, 1997, 1998 and 1999. (1) Ferrous metals were included in the figure for “other” in 1996.

Amounts of hazardous waste from households increased by 33 per cent from around 14,400 tonnes in 1998 to around 19,000 tonnes in 1999. Correspondingly, the amount of “various burnable” increased in 1999 after a constant decrease since 1996. From 1998 to 1999 the increase reached 9 per cent.

Also amounts of separately collected bottles and glass increased from 1998 to 1999: by 6 per cent. By contrast, amounts of collected paper and cardboard decreased by 14 per cent.

Developments and treatment of the different waste types are detailed below.

6.3.1 Domestic waste

Domestic waste from households covers waste that results from normal consumption in private households, i.e. paper, bottles and glass, organic food waste, and residual waste, collected at the household at regular intervals, normally weekly or every second week.

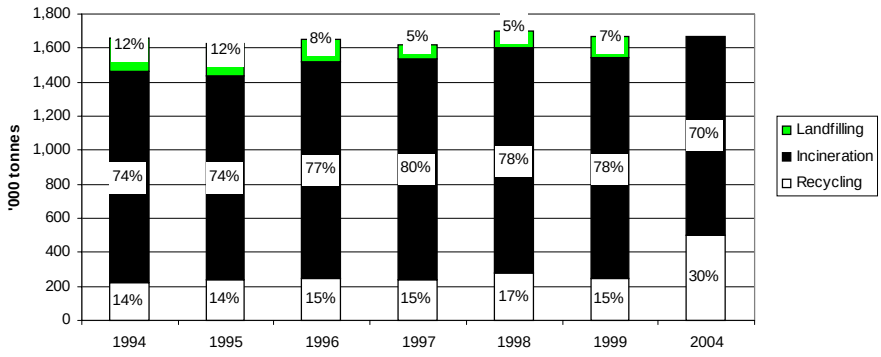
As mentioned above, amounts of domestic waste decreased from 1,702,000 tonnes in 1998 to 1,665,000 tonnes in 1999, corresponding to a decrease of 2 per cent. Since 1994 amounts of domestic waste have varied from one year to the next without showing any clear trend – in the entire period the amounts have remained more or less stable, cf. Table 1.

In 1999, 15 per cent of domestic waste was recycled, corresponding to 2 percentage points less than in 1998. 78 per cent – the same as in 1998 – was incinerated, and 7 per cent was landfilled in 1999, cf. Figure 11.

The figure also shows that the proportion of domestic waste for recycling has remained more or less stable in the period 1994 to 1999. The change among treatment options has been in the form of diversion from landfill to incineration, even if there has only been a modest increase in the proportion for incineration: 4 percentage points over the period 1994 - 1999.

Too much domestic waste goes to incineration and landfill compared to the targets in Waste 21.

Figure 11. Treatment of domestic waste from households 1994-99 and target year 2004



Source: See Tables 1 and 2. The figure has been designed in a way that total waste amounts year 2004 are similar to waste amounts in 1999. This should not be taken as an expression of projections of total waste amounts.

To meet the target for recycling in year 2004 of 30 per cent a number of initiatives will be launched in the coming years. For example, separate collection for recycling of glass, paper, and cardboard and plastic packaging will be extended.

Furthermore, initiatives will be launched with a view to recycling of a larger proportion of organic domestic waste. Today, only around 4 per cent is recovered in biogas plants. The target is a recycling rate of 7 per cent of organic domestic waste in year 2004.

6.3.2 Bulky waste

In 1999 Danish householders generated 672,000 tonnes of bulky waste. This is 100,000 tonnes more than the previous year and corresponds to an increase in bulky waste amounts of 17 per cent.

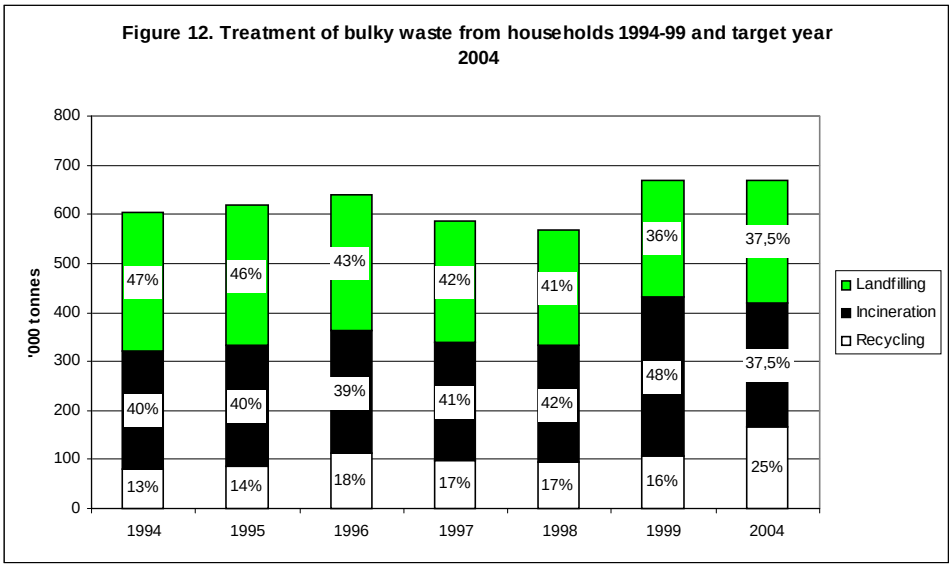
In the period 1994 – 99 bulky waste amounts have increased by 11 per cent overall, with a minor decrease in amounts in 1997 and 1998. This is due to a real increase in bulky waste amounts, but for a major part also to the introduction of collection schemes and bring schemes at recycling centres.

Since 1994, the distribution among the three treatment options has been more or less stable. However, in 1999, there has been a diversion among the treatment options, cf. Figure 12.

The proportion of bulky waste landfilled in 1999 only accounted for 36 per cent, which is a decrease of 5 percentage points from 1998, ensuring compliance with targets in Waste 21 of a maximum of 37.5 per cent landfilling in year 2004.

Unfortunately this does not mean that targets for other treatment options are complied with: the proportion going to incineration increased from 42 per cent in 1998 to 48 per cent in 1999, whereas the proportion recycled decreased from 17 per cent in 1998 to 16 per cent in 1999.

Figure 12. Treatment of bulky waste from households 1994-99 and target year 2004



Source: See Tables 1 and 2. The figure has been designed in a way that total waste amounts year 2004 are similar to waste amounts in 1999. This should not be taken as an expression of projections of total waste amounts.

If this result is compared with developments in the different waste fractions from households it may indicate that bulky waste developments are responsible for the significant increase in the fraction “various burnable”, cf. Table 15.

To comply with treatment targets in year 2004, many efforts are called for in relation to separate collection of more bulky waste fractions. A number of initiatives for, for example, cardboard, electrical and electronic products, impregnated wood, and PVC-containing waste have already been launched or are in the planning phase.

6.3.3 Garden waste

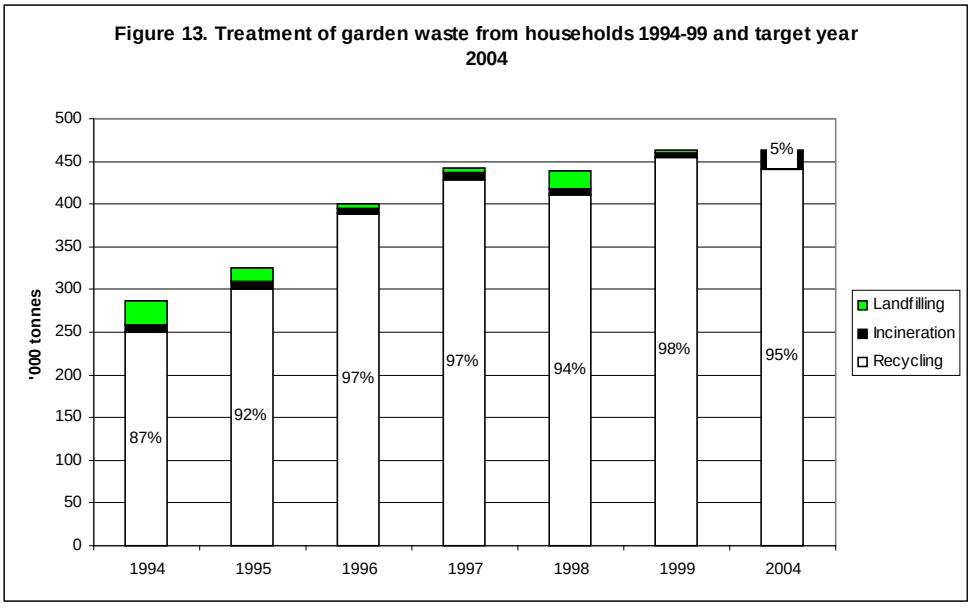
Garden waste collected from households in 1999 amounted to 464,000 tonnes, which is 26,000 tonnes more than in 1998. Garden waste amounts have been on a steady increase throughout the 1990s. Since 1994 the increase in garden waste amounts has reached 62 per cent.

This increase should not be seen as an expression of a real increase in garden waste amounts. It is rather the result of increasing opportunities – and obligations – for disposing of garden waste at municipal treatment plants at the expense of home-burning or home-composting of waste.

Garden waste treatment is presented in Figure 13. 98 per cent of garden waste was recycled in 1999, whereas 1 per cent was incinerated and 1 per cent led to landfill.

This means that recycling increased by 4 percentage points from 1998, whereas incineration and landfilling decreased by 1 and 4 percentage points respectively.

Figure 13. Treatment of garden waste from households 1994-99 and target year 2004



Source: See Tables 1 and 2. The figure has been designed in a way that total waste amounts year 2004 are similar to waste amounts in 1999. This should not be taken as an expression of projections of total waste amounts.

Thereby, targets for recycling and incineration of garden waste from households have been met with a good margin. It is estimated to be impossible to increase recycling of garden waste further. Therefore, future efforts with respect to garden waste will concentrate on maintaining the present situation.

6.3.4 Household waste per capita

Table 17 states the generation of household waste per capita and per household. The table covers both waste type and waste fraction.

Table 17. Householders' waste generation in 1997, 1998 and 1999 per capita and per household.

Stated in kg. Waste type and fraction	1997		1998		1999	
are included	Per capita	Per househ.	Per capita	Per househ.	Per capaita	Per househ.
Households total	526	1,161	528	1,162	558	1223
Domestic waste total	316	698	322	707	313	687
of which separately collected						
Domestic waste/paper	*31*	*68*	*35*	*77*	*29*	*64*
Domestic waste/glass	*12*	*27*	*15*	*33*	*16*	*35*
Domestic waste/food waste	*9*	*20*	*10*	*22*	*9*	*21*
Hazardous waste from household	2	6	3	6	4	8
Garden waste from households	84	185	83	182	87	191
Bulky waste from households	111	246	108	238	126	277
of which						
Paper	*4*	*9*	*5*	*10*	*5*	*10*
Glass	*1*	*2*	*1*	*2*	*1*	*2*

Source: ISAG reports 1997 and 1998. Population figures and number of households per 1st January 1997, 1998 and 1999 respectively have been used. **Remark** that Tables 16 and 17 cannot be compared directly, as Table 16 concerns waste generation stated by fractions, whereas Table 17 also includes waste type. For example, householders generated in 1999 455,000 tonnes of the **fraction** branches, leaves, grass cuttings etc., cf. Table 16, whereas 464,000 tonnes of the **waste type** garden waste were generated, cf. Table 17 and Appendix 1.

Householders' total waste generation per capita in 1999 was 30 kg larger than in 1998. Stated by household, householders' waste generation increased by 61 kg. Of this, amounts of domestic waste per capita and per household decreased by 9 kg and 20 kg respectively. Amounts of garden waste increased by 4 kg and 9 kg respectively, whereas amounts of bulky waste increased by 18 kg and 39 kg respectively.

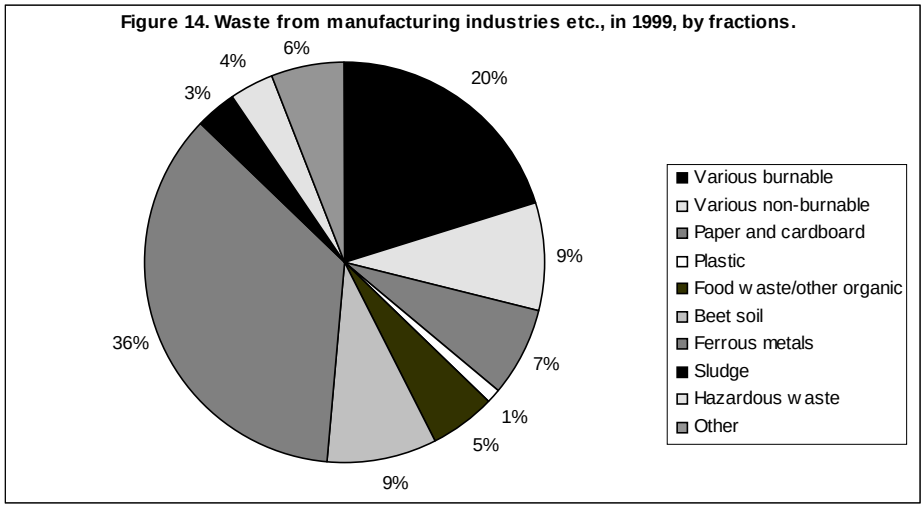
6.4 Waste from manufacturing industries

In 1999, waste generation in industry amounted to 2,653,000 tonnes, corresponding to 130,000 tonnes and 5 per cent less than in 1998.

Waste from manufacturing industries is presented in Figure 14. It can be seen that ferrous metals account for the largest waste fraction, followed by various burnable, various non-burnable, beet soil and paper and cardboard.

The distribution of waste from industry on the different waste fractions remained more or less the same in 1999 as in 1998. However, sludge from industrial production only accounts for 3 per cent of waste from industry in 1999, against a share of 6 per cent i 1998.

This is partly due to the fact that registrations have been changed from 1998 to 1999. Some waste products from food production were registered in 1998 as sludge instead of "food waste/other organic" as it should have been. This has been changed in 1999.



Source: ISAG reports 1999. Legend: clock-wise from top.

However, this change in registrations cannot explain all of the decrease in industrial sludge amounts: 44 per cent from around 154,000 tonnes in 1998 to around 86,400 tonnes in 1999.

From 1998 to 1999 an increase has been registered in the fractions plastic, food waste and hazardous waste of 11 per cent, 24 per cent and 10 per cent respectively which in absolute figures correspond to 3,000 tonnes, 26,600 tonnes and 8,800 tonnes. Amounts of ferrous metals remain more or less unchanged, whereas there has been a decrease in other fractions.

Amounts of beet soil decreased by 20 per cent from 288,000 tonnes in 1998 to 231,000 tonnes in 1999. Beet soil generation depends on weather conditions during harvesting of sugar beets, and weather conditions were better in 1999 than in 1998.

Other remarkable fractions are amounts of paper and cardboard, which decreased by 9 per cent from around 210,300 tonnes in 1998 to around 191,300 tonnes in 1999, and amounts of non-burnable waste, which decreased by 20 per cent from around 290,400 tonnes in 1998 to around 230,600 tonnes in 1999.

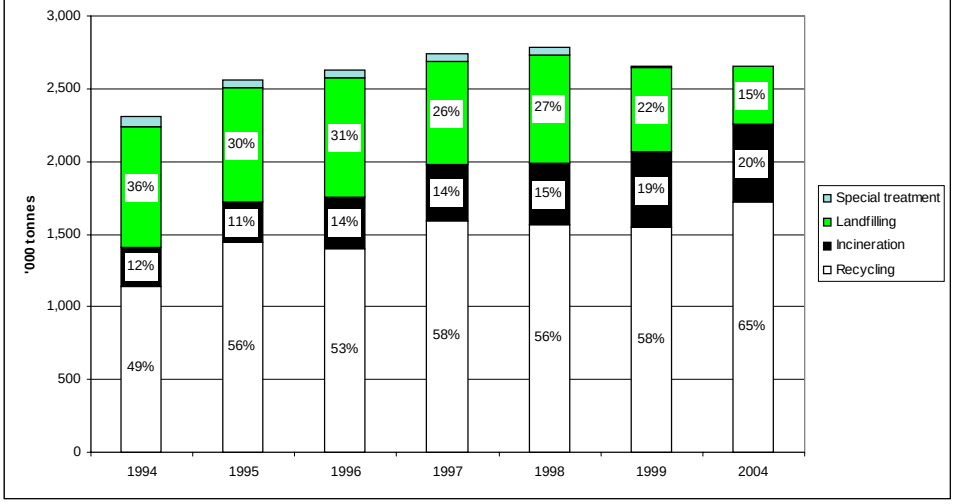
Treatment of waste from manufacturing industries is shown in Figure 15. 60 per cent of waste was recycled in 1999, which is 4 percentage points more than in 1998. In absolute figures, however, there has been a decrease of some 14,000 tonnes.

Since 1994, the proportion of waste from industry that has been recycled has increased by 9 percentage points, whereas the proportion going to landfill has decreased by 14 percentage points.

The proportion of waste from industry incinerated in 1999 accounted for 19 per cent, which corresponds to 3 percentage points more than in 1998. This is still within the targets for year 2004. By contrast, only 22 per cent was landfilled in 1999, which is 5 percentage points less than in 1998.

Even if recycling and landfilling rates have developed in a positive direction, there is still some way to go before targets for these two treatment options are met.

Figure 15. Treatment of waste from manufacturing industries 1994-99 and target year 2004



Source: See Tables 1 and 2. The figure has been designed in a way that total waste amounts year 2004 are similar to waste amounts in 1999. This should not be taken as an expression of projections of total waste amounts.

Amounts and composition of waste from manufacturing industries depend on the sector generating the waste, as well as size and number of enterprises. Possibilities of preventing or recycling waste will therefore differ from one waste fraction and sector to another.

Recently, the Danish Environmental Protection Agency has implemented a number of changes to the ISAG system so that from year 2001 it will be possible to state waste from industry on eleven different sectors. All other things being equal, this will increase possibilities of conducting sector-specific analyses and initiatives.

In order to meet targets in Waste 21, the Danish Environmental Protection Agency has selected a number of waste types from industry to come into focus.

One such waste type is shredder waste. New treatment technologies shall contribute to diverting shredder waste from landfilling to recycling. Another waste type in focus is hazardous waste, for which collection schemes shall be established with a view to separation and recycling.

6.5 Waste from institutions, trade and offices

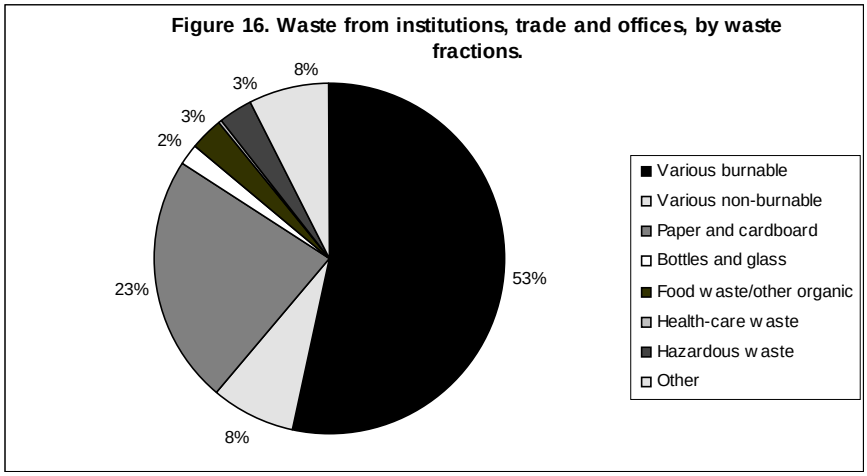
Waste from institutions, trade and offices in 1999 amounted to 955,000 tonnes, which is identical to 1998.

The distribution of waste from institutions, trade and offices in 1999 is presented in Figure 16 and is almost similar to 1998.

However, the proportion of various non-burnable waste has decreased by 2 percentage points from 1998, while the proportion of various burnable and paper and cardboard increased by 1 and 2 percentage points respectively.

These minor variations cover a decrease in absolute amounts of various non-burnable of 25 per cent, an increase in separately collected paper and cardboard of 9 per cent and a minor increase in amounts of various burnable of 2 per cent.

Furthermore, amounts of collected bottles and glass decreased by 12 per cent, whereas amounts of separately collected hazardous waste increased by 5 per cent.



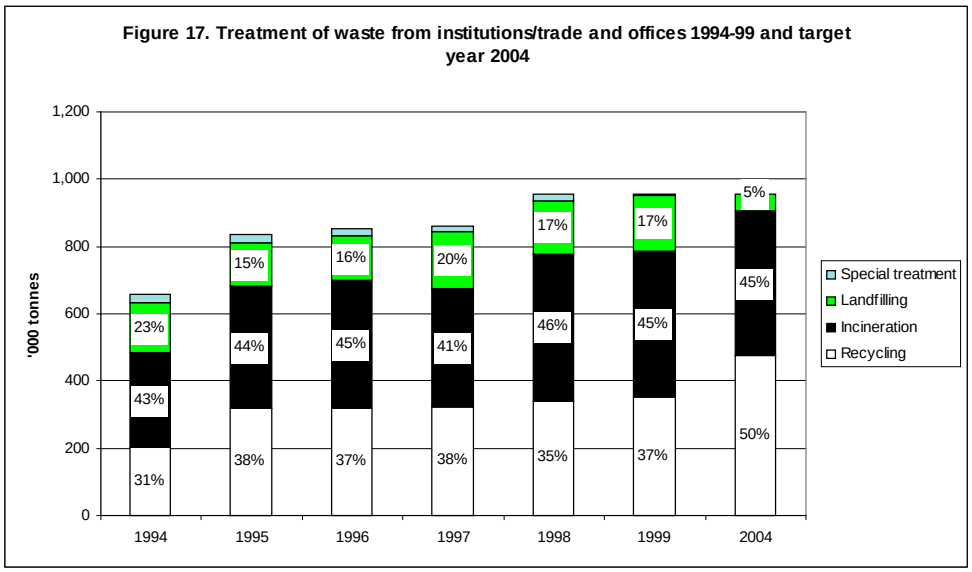
Source: ISAG reports 1999. Legend: clock-wise from top.

Of 955,000 tonnes of waste generated by the service sector in 1999, 37 per cent was recycled, 45 per cent was incinerated and 17 per cent went to landfill, cf. Figure 17.

The distribution among treatment options has thereby changed only little from 1998, when 35 per cent was recycled, 46 per cent incinerated and 17 per cent landfilled. Compared to 1994 the largest diversions among the different treatment options have taken place among recycling and landfilling that have increased/decreased by 6 percentage points each.

Compared to targets for treatment in Waste 21 too little waste was recycled and too much landfilled in 1999 from this sector.

If targets are to be met, separation and collection of waste must be improved so that a larger proportion of recyclable material can be recycled and environmental contaminants separated and treated separately.



Source: See Tables 1 and 2. The figure has been designed in a way that total waste amounts year 2004 are similar to waste amounts in 1999. This should not be taken as an expression of projections of total waste amounts.

6.6 Residues from coal-fired power plants

Amounts of residues from coal-fired power plants vary over the years due to variations in Danish power exports to Sweden and Norway. As Figure 18 shows, exports of power were especially high in 1996 which resulted in large amounts of residues: 2,332,000 tonnes.

Since then, amounts of residues have decreased by 44 per cent and amounted to 1,299,000 tonnes in 1999. The decrease from 1998 to 1999 reached 12 per cent.

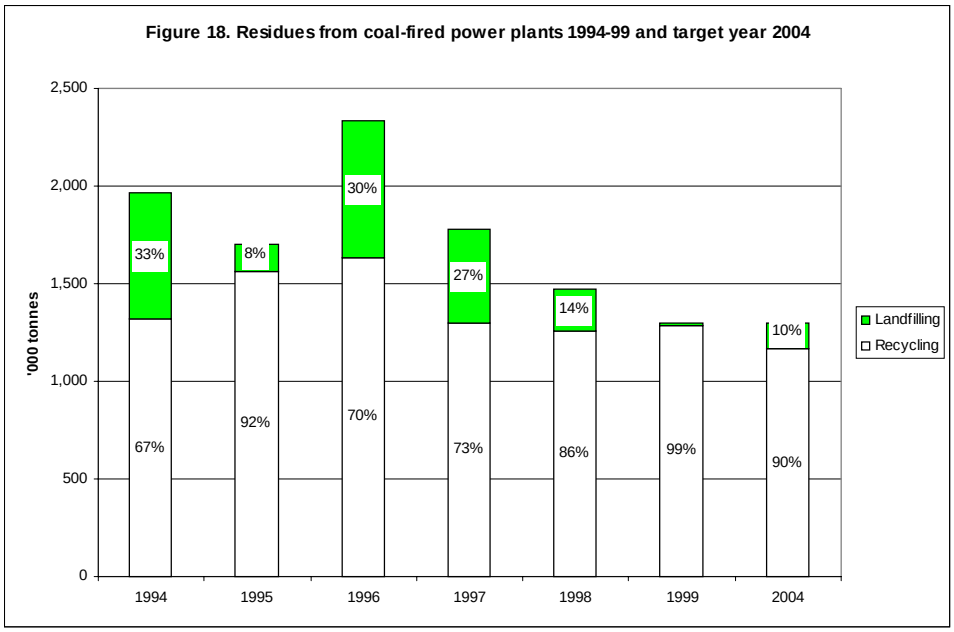
This decrease is explained partly by less power exports in the years since 1996, and partly by the Government's Energy Action Plan 1996, "Energy 21", according to which natural gas and renewable energy sources, including bio-fuel, shall substitute coal in the long-term perspective. It is reflected in energy statistics[12] that an increasing part of electricity generation is based on natural gas and renewable energy sources.

Also in future, Energy 21 will result in a decrease in residues from coal-based energy generation, whereas there will be an increase in fly ash and bottom ash from bio-fuels.

By far the largest proportion of residues from coal-fired power plants can be recycled. In 1999 the rate of recycling of residues reached 99 per cent, which is 13 percentage points more than in 1998.

Targets for treatment of residues from coal-fired power plants have thereby been met by a good margin, cf. Figure 18.

[12] Energy Statistics 1999, is found on the homepage of the Danish Energy Agency www.ens.dk



Source: See Tables 1 and 2. The figure has been designed in a way that total waste amounts year 2004 are similar to waste amounts in 1999. This should not be taken as an expression of projections of total waste amounts.

In Table 18 recovery options for residues in 1999 are presented in more detail. Almost 85 per cent of recycled residues was used as raw materials in industrial manufacture of, for example, cement, concrete and plaster board. Around 14 per cent was recycled either under the terms of Statutory Order no. 586 of 6 December 1983 from the Ministry of Environment and Energy, or as backfilling with special approval under the Danish Environmental Protection Act.

Table 18. Recovery of residues from coal-fired power plants. 1999. '000 tonnes.	Fly ash	Slag/bottom ash	Gypsum	Dry de-sulph.	Sulph. acid	Total
Cement	350		62			412
Concrete	238					238
Porous concrete	9					9
Asphalt	37					37
Roofing felt	2					2
Backfilling cf. Statutory Order 568	43	19				62
Backfilling cf. Part 5 approvals (Env. Prt. Act)	116	8				124
Granulates				3		3
Fertiliser				3	1	4
Backfilling				18		18
Plaster board			305			305
Various			0.3			0.3
Exports for recycling		45				45
Desulphurisation				26		26
Total	**795**	**72**	**367**	**50**	**1**	**1285**

Source: Reports from Elsam and EK Energi.

6.7 Sludge from municipal wastewater treatment plants

Sludge from municipal wastewater treatment plants stated in wet weight in 1999[13] amounted to 1,379,000 tonnes, which is 128,000 tonnes or 10 per cent more than the previous year. The statement only includes sludge, excluding sand and screenings.

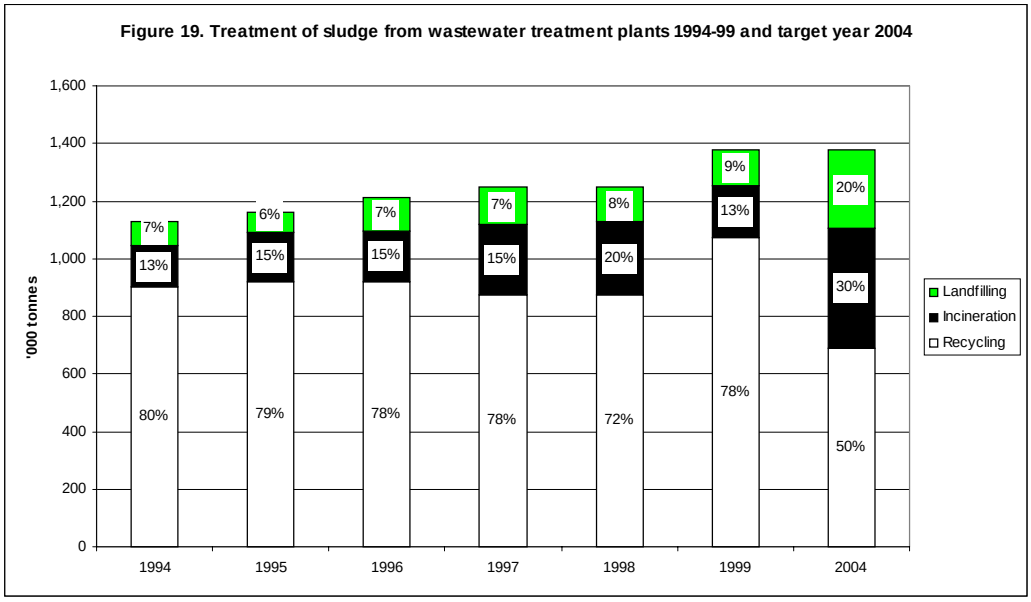
[13] The 1999 statement of amounts of sludge from municipal wastewater treatment plants applied to farmland etc. and incineration of sludge at sludge incineration plants is still outstanding. Figures from 1998 have been used.

Stated in dry weight there has only been a minor increase in sludge amounts from the previous year of 2,600 tonnes. Total sludge amounts in 1999 reached 153,800 tonnes dry weight.

Some of this increase is believed to be due to the national wastewater tax as this tax has meant that many wastewater treatment plants clean wastewater more than required in the discharge license.

Sludge treatment is distributed by 78 per cent for recycling, 13 per cent for incineration and 9 per cent for landfilling, cf. Figure 19.

Amounts for recycling include 396,000 tonnes of sludge wet weight, corresponding to 4,300 tonnes dry weight in long-term storage with the objective of mineralisation. It is expected that this amount will be recycled in some years, and therefore it has been included in the recycling figure.



Source: See Tables 1 and 2. The figure has been designed in a way that total waste amounts year 2004 are similar to waste amounts in 1999. This should not be taken as an expression of projections of total waste amounts.

Sewage sludge is mainly recovered as fertiliser on farmland. In future, more stringent requirements for the contents of certain organic and chemical substances will be made in relation to application to farmland. In the short-term perspective, the rate of recycling is therefore expected to decrease.

However, in future, the quality of sludge is expected to improve due to the general policy of phasing-out of xenobiotic substances.

It seems that alternative methods for the recovery of sludge are being developed to a still larger extent. After sludge incineration, the inorganic residue is recovered in production of, for example, sand blasting agents or cement. Sludge recovered in such alternative methods in 1999 amounted to around 40,000 tonnes[14]. In Figure 19 these 40,000 tonnes have been calculated as incinerated.

[14] Cf. footnote 13 figures are from 1998.

7 Incineration plants and landfills

7.1 Incineration plants

In 1999, total waste incineration capacity was around 2,726,000 tonnes, distributed on 31 plants, cf. Table 19. This is an increase in capacity of 253,000 tonnes compared to the 1996 capacity.

In the beginning of the nineties, an extensive conversion of waste incineration plants from heating generation to combined power and heating generation took place. In this connection, capacity adjustments were effected in relation to expected waste amounts for incineration in future.

As a result of the ban on landfilling of waste suitable for incineration that took effect on 1st January 1997, there is now increasing pressure on incineration capacity. Amounts of non-recyclable waste suitable for incineration will be surveyed regularly in order to ensure necessary incineration capacity.

Table 19. Number of incineration plants and available incineration capacity in 1989, 1993, 1994/95, 1996 and 1999	**1989**	**1993**	**1994/95**	**1996**	**1999**
Number of incineration plants	38	31	31	31	31
Theoretic capacity, '000 tonnes	2164	2329	DH: 1217 CPH: 1315	DH: 1060 CPH: 1413	DH: 992 CPH: 1734
Nominal capacity, tonnes/hour	313	335	DH: 174 CPH: 188	DH: 171 CPH: 194	DH: 166 CPH: 271

Sources: Rambøll & Hannemann 1990: Analysis of data for energy plants based on waste, for the Danish Environmental Protection Agency and the Danish Energy Agency. The Danish Environmental Protection Agency and the Danish Energy Agency 1994: Waste resources for waste incineration 1993 and year 2000. The Danish Environmental Protection Agency and the Danish Energy Agency 1997: Waste amounts for incineration year 2000. Rambøll A/S 2000: Unpublished statement of incineration capacity. Figures for 1989 and 1995 are calculated on the basis of nominal capacity at 7,000 hours/year. Figures for 1996 are based on actual hours of operation of plants. District heating capacity (DH) may be subject to restrictions under the Act on heating supply. CPH = combined power and heating. In figures for 1999 the nominal capacity includes plants erected in 1999. This gives a larger nominal capacity as furnaces have not been fully implemented in 1999.

7.2 Landfills

Total remaining capacity at landfills in 1994 amounted to 24.7 million tonnes distributed on 64 sites. Remaining capacity at landfills for inert waste in 1994 was 6.4 million tonnes distributed on 49 sites. Remaining capacity at separately located mono-landfills amounted to 6.2 million tonnes in 1994, distributed on 63 sites.

A landfill is defined as a site receiving waste that, immediately or over time, presents a risk of pollution of groundwater, surface water and/or air. A

landfill for inert waste is a site receiving waste that does not, or only to a very limited extent presents a risk of pollution of groundwater, surface water and/or air. A mono-landfill is a site receiving only one or a limited range of waste types with known composition.

As a consequence of the above-mentioned ban on landfilling of waste suitable for incineration, in combination with an increased and further differentiated waste tax, a drop in landfill capacity needs is expected. Thus, at the national level, it is not expected that there will be a need for large extensions of landfill capacity in future.

Table 20. Number of landfills, inert waste landfills, and separately located mono-landfills, and available landfill capacity in 1992 and 1994

	Landfills		Inert waste landfills		Separately located mono-landfills
	1992	1994	1992	1994	1994
Number of sites	60	64	70	49	63
Remaining capacity, million tonnes	30.9	24.7	14.3	6.7	6.2
Annual filling rate, million tonnes	2.1	1.7	0.9	0.12	0.8

Sources: Danish Environmental Protection Agency. Working report no. 54, Landfill capacity 1992, Danish Environmental Protection Agency 1997: Working report no. 33, Landfill sites in Denmark, and internal calculations.

Annex 1. Tables outlining waste generation

Table 1. Waste generation in Denmark in 1997, 1998 and 1999, and target for year 2004. Stated by source and treatment option. Stated in '000 tonnes and in per cent.

ENTIRE COUNTRY	Recycling							Incineration							Landfilling							Special treatment							Total					
	1997		1998		1999		Target	1997		1998		1999		Target	1997		1998		1999		Target	1997		1998		1999		Targe	1997		1998		1999	
Source	1000 t	%	1000 t	%	1000 t	%	%	1000 t	%	1000 t	%	1000 t	%	%	1000 t	%	1000 t	%	1000 t	%	%	1000 t	%	1000 t	%	1000 t	%	%	1000 t	%	1000 t	%	1000 t	%
Households	818	29	839	30	869	29	0	1.602	58	1.585	57	1.730	58	0	343	12	355	13	361	12	0	14	0	17	1	4	0	0	2.776	22	2.796	23	2.963	24
Domestic waste	*239*	*15*	*281*	*17*	247	15	30	*1.298*	*80*	*1.324*	*78*	1.301	78	70	*83*	*5*	*98*	*6*	117	7	0	*0*	*0*	*0*	*0*	0	0	0	*1.621*	*13*	*1.702*	*14*	1.665	14
Bulky waste	*98*	*17*	*96*	*17*	108	16	25	*241*	*41*	*239*	*42*	323	48	38	*248*	*42*	*234*	*41*	239	36	38	*1*	*0*	*4*	*1*	2	0	0	*588*	*5*	*572*	*5*	672	6
Garden waste	*428*	*97*	*411*	*94*	455	98	95	*8*	*2*	*8*	*2*	6	1	5	*6*	*1*	*20*	*5*	3	1	0	*0*	*0*	*0*	*0*	0	0	0	*443*	*3*	*438*	*4*	464	4
Other	*52*	*42*	*51*	*62*	60	40	0	*55*	*44*	*14*	*17*	99	57	0	*5*	*4*	*3*	*4*	2	2	0	*12*	*10*	*14*	*16*	2	1	0	*125*	*1*	*83*	*1*	163	1
Institutions/trade and offices	324	38	338	35	353	37	50	352	41	438	46	434	45	45	170	20	161	17	164	17	5	16	2	18	2	5	0	0	861	7	955	8	955	8
Manufacturing industry etc.	1.590	58	1.564	56	1.550	58	65	389	14	425	15	513	19	20	707	26	746	27	582	22	15	51	2	47	2	9	0	0	2.736	21	2.783	23	2.653	22
Building and construction	3.136	92	2.664	90	2.685	90	90	21	1	32	1	60	2	2	264	8	266	9	224	8	8	5	0	1	0	0	0	0	3.427	27	2.962	24	2.968	24
Wastewater treatment plants	872	70	875	70	1.071	78	50	245	20	252	20	182	13	30	130	10	124	10	126	9	20	0	0	0	0	0	0	0	1.248	10	1.251	10	1.379	11
Slag, fly ash etc. (coal)	1.300	73	1.259	86	1.287	99	90	0	0	0	0	0	0	0	475	27	210	14	12	1	10	0	0	0	0	0	0	0	1.775	14	1.469	12	1.299	11
Other	6	17	3	17	0	0	0	13	39	8	46	11	71	0	15	44	7	37	4	29	0	0	0	0	0	0	0	0	34	0	18	0	15	0
Total	8.046	63	7.542	62	7.815	64	64	2.622	20	2.740	22	2.929	24	24	2.103	16	1.868	15	1.472	12	12	85	1	83	1	17	0	0	12.857	100	12.233	100	12.233	100

Source: ISAG reports 1997, 1998 and 1999, Waste 21 – The Danish Government's Waste Management Plan 1998 - 2004, Danisco, Association of Danish Recycling Industries and other large scrap dealers, reports to the Danish Environmental Protection Agency on sludge applied to farmland etc. (for 1999, figures from 1998 have been used) and incineration of sludge at waste incineration plants (for 1999, figures from 1998 have been used) . Waste amounts from wastewater treatment plants include sand and screenings.

Table 2. Waste generation in Denmark in 1997, 1998 and 1999 stated by waste type and treatment option. Stated in tonnes and in per cent.

	Recycling						**Incineration**						**Landfilling**						**Special treatment**						**Total**	**Total**	**Total**
Waste type	1997		1998		1999		1997		1998		1999		1997		1998		1999		1997		1998		1999		1997	1998	1999
	tonnes	%	tonnes	%	tonnes	%	tonnes	%	tonnes	%	tonnes	%	tonnes	%	tonnes	%	tonnes	%	tonnes	%	tonnes	%	tonnes	%	tonnes	tonnes	tonnes
Domestic waste	263,907	16	301,280	17	265,381	15	1,331,666	79	1,366,690	77	1,352,040	78	89,031	5	109,128	6	122,631	7	0	0	0	0	0	0	1,684,604	1,777,098	1,740,052
Bulky waste	98,253	17	95,512	17	107,585	16	240,511	41	238,929	42	323,417	48	247,778	42	234,128	41	238,975	36	1,243	0	3,545	1	1,829	0	587,784	572,114	671,806
Garden waste	530,159	96	552,546	94	575,960	98	9,654	2	9,120	2	7,703	1	14,126	3	23,869	4	6,255	1	0	0	0	0	0	0	553,940	585,535	589,918
Ind./comm. Waste	4,909,762	73	4,380,896	69	4,485,034	71	766,597	11	858,403	14	963,017	15	1,061,182	16	1,104,627	17	906,778	14	2,968	0	987	0	1189	0	6,740,509	6,344,913	6,356,018
Hazardous waste	50,679	35	51,472	38	46,628	31	9,387	7	768	1	83383	55	4,359	3	5,414	4	9,928	7	78,731	55	76,062	57	11,443	8	143,156	133,716	151,382
Health-care waste	0	0	0	0	0	0	5,345	63	4,130	58	5,050	64	173	2	44	1	34	0	2,923	35	2,962	42	2,766	35	8,441	7,136	7,850
Treatment residue	2,177,586	70	2,149,540	77	2,327,628	86	258,746	8	260,952	9	190,210	7	669,305	22	389,854	14	182,122	7	0	0	0	0	0	0	3,105,637	2,800,346	2,699,960
Not reported	15,903	48	10,367	87	6,415	41	444	1	797	7	3703	23	16,805	51	690	6	5669	36	0	0	0	0	0	0	33,152	11,854	15,787
Total	8,046,249	63	7,541,613	62	7,814,631	64	2,622,351	20	2,739,789	22	2,928,523	24	2,102,758	16	1,867,754	15	1,472,392	12	85,865	1	83556	1	17227	0	12,857,223	12,232,712	12,232,773

Source: ISAG reports 1997, 1998 and 1999, Waste 21 – The Danish Government's Waste Management Plan 1998 - 2004, Danisco, Association of Danish Recycling Industries and other large scrap dealers, reports to the Danish Environmental Protection Agency on sludge applied to farmland etc. (for 1999, figures from 1998 have been used) and incineration of sludge at waste incineration plants (for 1999, figures from 1998 have been used).

Annex 2. Principles for distribution of waste received at recycling centres and transfer stations.

Recycling centres/transfer stations

The ISAG covers a commercial source "recycling centres/transfer stations". This means that waste, for example from households, delivered via transfer stations is not recorded as waste from "households".

The source "recycling centres/transfer stations" is therefore distributed on the original sources. This distribution is obviously based on estimates.

- All domestic waste from "recycling centres/transfer stations" is converted into domestic waste from the source "households".

- All bulky waste, apart from the fractions "paper and cardboard" and "bottles and glass", from "recycling centres/transfer stations" is converted into bulky waste from the source "households".

- All bulky waste covering the fractions "paper and cardboard" and "bottles and glass" is converted into "domestic waste" and transferred from the source "recycling centres/transfer stations" to the source "households".

- All garden waste from "recycling centres/transfer stations" is converted into garden waste from the source "households".

- All industrial and commercial waste from "recycling centres/transfer stations", apart from the fractions "concrete", "tiles", "other construction and demolition waste", "asphalt", "wood", and "asbestos", is converted into industrial and commercial waste from the source "institutions, trade and offices".

- All industrial and commercial waste from "recycling centres/transfer stations", covering the fractions "concrete", "tiles", "other construction and demolition waste", "asphalt", "wood", and "asbestos", is converted into industrial and commercial waste from the source "building and construction sector".

- All hazardous waste from "recycling centres/transfer stations" is converted into hazardous waste from the source "households".

- All waste of the type "treatment residues" and "not registered" from "recycling centres/transfer stations" is converted into a new source: "other".

Bulky waste

- All waste of the type "bulky waste" from the sources "institutions, trade and offices", "manufacturing industries", and "building and construction sector" is converted into "industrial and commercial waste", although deriving from the same sources.

Ferrous metals

- Reports to the ISAG on ferrous metals are made according to the Statutory Order on waste by enterprises, including smelting works, that reprocess collected and separated ferrous metals by remelting. Scrap dealers that collect ferrous metals are not subject to mandatory reporting to the ISAG, but are requested to uphold a register in accordance with ISAG regulations.

- The Danish Environmental Protection Agency receives information from scrap dealers directly from the Association of Danish Recycling Industries and other large scrap dealers. In waste statistics, such ferrous scrap has been attributed to the source "manufacturing industry".