



Denmark without waste

Recycle more
– incinerate less

November 2013

The Danish Government





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Foreword

We incinerate an enormous amount of waste in Denmark; waste which we could get much more out of by more recycling and better recycling.

We must move towards perceiving waste as a resource which can be reused and recycled, and away from considering waste and just something to throw away.

Waste from businesses and households contains materials and valuable assets which it makes good sense to recycle. Paper and cardboard can become new products; aluminium trays can be melted down and recycled, and sewage sludge can become fertiliser on farmland.

Denmark without Waste is the Government's presentation of a new approach to waste. Over recent decades, in Denmark we have been incinerating almost 80 % of our household waste. Even though this has made an important contribution to green energy production, materials and resources have been lost which could otherwise have been recycled.

Now, we are going to change this. The Government has set a goal that in 2022 we will be recycling 50 % of our household waste. This means that we will have to more than double the recycling rate for household waste in Denmark in less than 10 years. This is an ambitious goal, because in future we will not just be separating the waste we are already used to separating, such as paper, cardboard and glass; we will also have to focus on other household waste, including food waste.

Our goal is yet another example of how the Government is putting action behind its words about the green transition.

The municipalities will be playing a pivotal role in realising the Government's new waste policy, and the Government has every confidence that, in partnership with the Danish public, they will succeed.

Of course citizens and businesses will continue to produce waste and of course they will be able to get rid of it. Waste incineration will continue to contribute to energy supply. However, in Denmark without Waste the Government proposes that over the next ten years we will become much better at recycling materials and resources and returning them to the economic cycle. This will be a giant leap for the green transition in Denmark.



Ida Auken

Danish Minister for the Environment





Denmark without waste

We are well aware of waste as a consequence of economic activity in society. The more vigorous the economy, the more waste we produce. However, waste can contain materials and resources which it can make sense to recycle.

Denmark has come a long way in environmentally responsible waste management and in waste incineration. However, Denmark is also one of the countries in Europe producing the most waste per inhabitant. In 2011 Danish households produced 447 kg of waste per person. This corresponds to every Dane throwing away more than 8 kg of waste every week.

Therefore the Government has a vision that Denmark will protect its resources and materials, and recycle more household waste, while incinerating less. This will entail more materials being sent back into the economic cycle with benefits for the environment. At the same time it is important to organise efforts cost-effectively and appropriately in a societal context.

The new approach for the waste area is building on a strong Danish tradition. For many years now we have been aware of our diminishing natural resources and we have been trying to exploit and protect them sensibly. We are taking care of our groundwater so that we can still drink clean water direct from the tap. We have drastically cut our discharges of nitrogen into watercourses and the sea and we have ambitious goals for reducing pesticide loads from agriculture.

Outside Denmark too, resource-efficiency is high on the agenda. All the EU Member States have agreed on the 7th Environmental Action Programme "Living well, within the limits of our planet", and on a roadmap for a resource-efficient EU. Globally the world's heads of state and government are debating the green economy and resource-efficiency. Denmark is playing an active part in these negotiations.

Increasing prices for materials and resources will make it ever more attractive to develop and apply solutions which make our use of raw materials more efficient, or which replace them. Many Danish enterprises are working to produce and develop just such products and solutions. Therefore there may be new market opportunities for Danish businesses which can deliver technological solutions and know-how.

Denmark without Waste is a Denmark in which, in the long term, we will recycle much more and incinerate much less waste. The same applies for landfilling, which in the long term we will only use for materials which are uneconomical to recycle or incinerate.

In Denmark without Waste the Government is proposing the following overall focus areas:

1. We will incinerate less waste and be better at exploiting the value and resources it contains.
2. We will reduce environmental impacts from waste so that economic growth does not cause parallel impacts on nature and the environment.

3. Recycling will be high quality, and hazardous substances will be separated from waste before it is recycled.
4. We will ensure that reorganisation of waste management is through stronger public-private collaboration. The municipalities have primary responsibility for waste schemes, especially for household waste. Private enterprises have competencies and knowledge to develop the technological solutions. Therefore it is important that municipalities and enterprises work together to develop new waste solutions.
5. We want flexible initiatives and we will closely monitor developments in the waste area, particularly for recycling household waste. The Government places priority on local room to manoeuvre to find the right solutions. Some municipalities have already come a long way in their work, while others have yet to start. The Government will closely monitor developments in the waste area, with focus on recycling, especially for household waste. Therefore the Government will conduct an evaluation of the strategy in 2016 and assess whether there is need for further efforts.

Box 1 **Future work**

Denmark without Waste will be implemented in a resources plan for waste management, with an associated environmental assessment. Furthermore, the Government will present a strategy on waste prevention, which will focus on resource efficiency and waste prevention and on ensuring overall and specific initiatives.



Denmark without waste

Resources Strategy for waste management – an overview

In 2011 about 9 million tonnes of material ended up as waste in Denmark. At total of 61 % of this was recycled, 29 % was incinerated and 6 % was landfilled. This means that far too many of the valuable materials today end in waste incineration plants or at landfills. Therefore, more waste must be recycled, and the quality of the recycled material must be improved.

A change in course for Danish waste policy

The goal is that over the next 10 years Denmark is to recycle more than twice as much household waste as today. This is a marked change in waste policy.

Some waste is more suitable for recycling than for incineration, for example metal and glass, which cannot be burnt and give energy. For example, recycling 1 tonne of aluminium instead of extracting new aluminium can globally save up to 10 tonnes of CO₂.

Today, the recycling rate for the important metals in waste is much less than 50 % and for rare earth elements, which are used in mobile phones for example, the recycling rate is only 1 %. This is due to the way in which we collect and process the waste, and due to the fact that it can be too costly to recover the metals. However, technological advances can change this in the future.

Paper and cardboard burn well but they are also worth recycling because, for example, energy is saved on processing new wood and the prices of recycled paper mean it is profitable to recycle.

Organic waste, typically food waste from households, can be used to produce biogas, which is both valuable for the energy system and can help reduce environmental problems from livestock production. Denmark has already taken the lead in this technology, and this also means that the nutrients from the organic waste are used as fertiliser on fields; something which would be impossible if the waste were incinerated.

The Government places priority on local room to manoeuvre to find the right solutions to reach the goal of more recycling of household waste. Therefore the Strategy contains no new requirements for individual municipalities. It will still be up to the individual municipality to set the level of service and organisation of waste management. Some municipalities will find it attractive to reorganise waste management within a short time-frame, while others will benefit more with a longer phase-in period.

The goal to double recycling of household waste requires more waste separation in future. This could be source separation at households and at central separation facilities. These decisions will be made locally. At the same time it is important to organise efforts cost-effectively and appropriately in a societal context.

There may also be potential to recycle more waste from enterprises. This may be by separating and recycling, but it may also be by transferring surplus materials from one enterprise for use in another enterprise.

This means that enterprises can save money by recycling waste rather than procuring new resources.

There are benefits for the environment in many parts of the world from optimal exploitation of material resources, and the pressure on our global natural resources can also be eased.

Conversion of the Danish waste sector

If we are to recycle more and incinerate less, and do so more environmentally and economically efficiently, this will require a conversion of the Danish waste sector. The Government will modernise organisation of the

incineration sector to ensure that waste incineration is at the most efficient plants and that the waste sector supports recycling.

What will be the effects of the Strategy?

Together with the other frameworks and initiatives, the goal to double household-waste recycling, with the associated initiatives, is expected to lead to a significant increase in total materials recycling in Denmark.

A cost-effective conversion to more recycling requires that both the waste sector and households have time to reorganise themselves. The following is a table of the most important effects of implementing the initiatives in the Strategy (Table 1).

The Strategy covers initiatives for 2013 to 2018, although the goal itself for household waste is in 2022.

Table 1
The expected effects of the Resources Strategy

SOURCE	EXPECTED EFFECTS			THE CURRENT SITUATION (2011 FIGURES)		
		2018	2022 GOAL	Recycled	Incinerated	Landfilled
	Material type (fraction)	Min %	Min %	%	%	%
Households*	Recycling of organic waste, paper, cardboard, glass, wood, plastic and metal waste*		50	22	75	0
	Collection of waste electronic equipment	75		68**		
The service sector	Recycling of paper, cardboard, glass, metal and plastic packaging	70		53	47	0
	Recycling of organic waste	60		17	83	
Alle	Energy recovery from garden waste*	25		87	4	4
	Collection of waste electronic equipment	65				
	Collection of batteries	55		47		
	Recovery of shredder waste	70		0		
	Recycling of phosphorus in sewage sludge	80		—		

* A smaller volume for temporary storage and special treatment is not shown in this table. Therefore the sum of the three treatment options shown is not 100%.

** Average of amount placed on the market in the past 3 years.





” Waste can contain resources which can be profitably recycled at enterprises to benefit both the environment and the Danish economy.

The effects shown do not include all waste, but they focus on specific types of material (waste fractions). Therefore, the amounts of waste in the table differ from the calculations of total waste amounts (table 2).

Initiatives aiming at quality in waste treatment are not included in the table, as their effects result in changed waste volumes. For example, these include construction and demolition waste and some of the initiatives for waste electronic equipment.

With the goals and initiatives in the Strategy, Denmark is expected to meet a number of EU targets, for example those set for packaging and waste electronic equipment, as well as those for more recycling of household waste. The effects of the Resources Strategy are illustrated in figure 1. The figure shows changes in the amount of recycled waste, incinerated waste and landfilled waste,

with and without the initiatives in the Strategy up to 2018, and then on towards the goal for recycling of household waste in 2022.

With these initiatives, a total of 820,000 tonnes less waste will be incinerated in 2022 than would otherwise have been the case. This figure includes incinerating less waste from households and the service sector, but also slightly larger amounts of garden waste and shredder waste (waste from treating iron and metal waste, e.g. end-of-life cars and old bicycles). For example it will mean that around 22,000 tonnes less plastic from households and service enterprises will be incinerated in 2022, giving a total CO₂ saving of just over 25,000 tonnes.

Figure 1
Expected changes in incineration, landfilling and recycling
(initiatives in the Resources Strategy excl. construction and demolition waste)

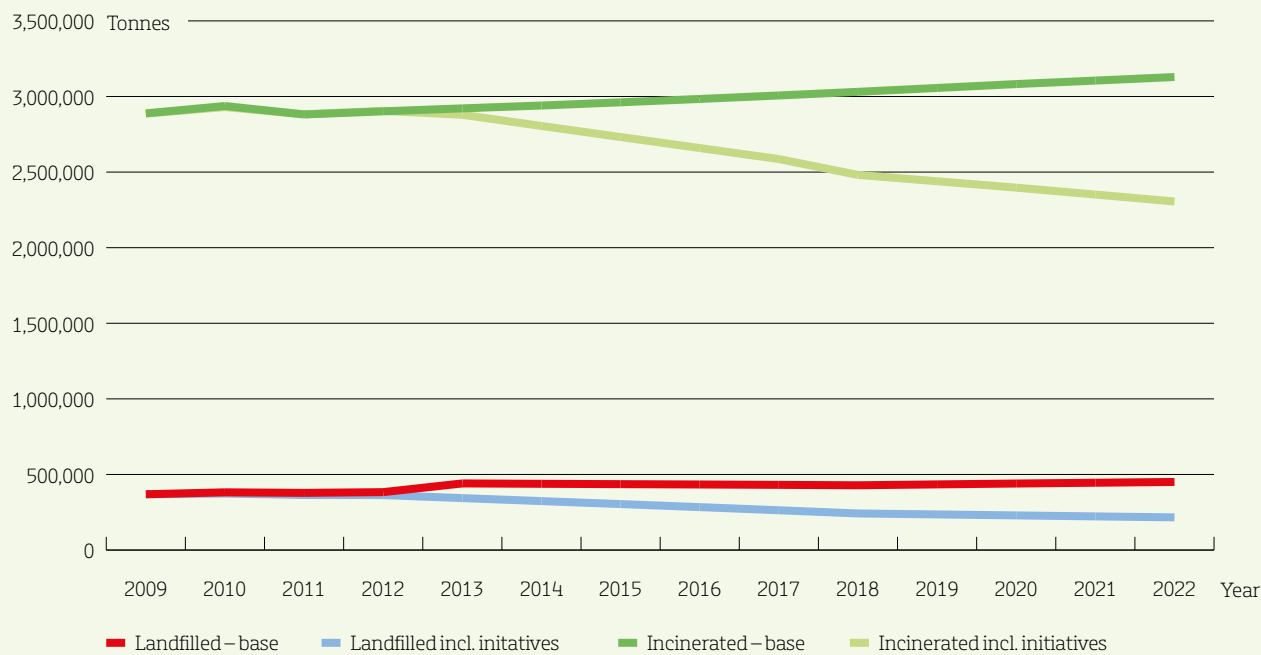
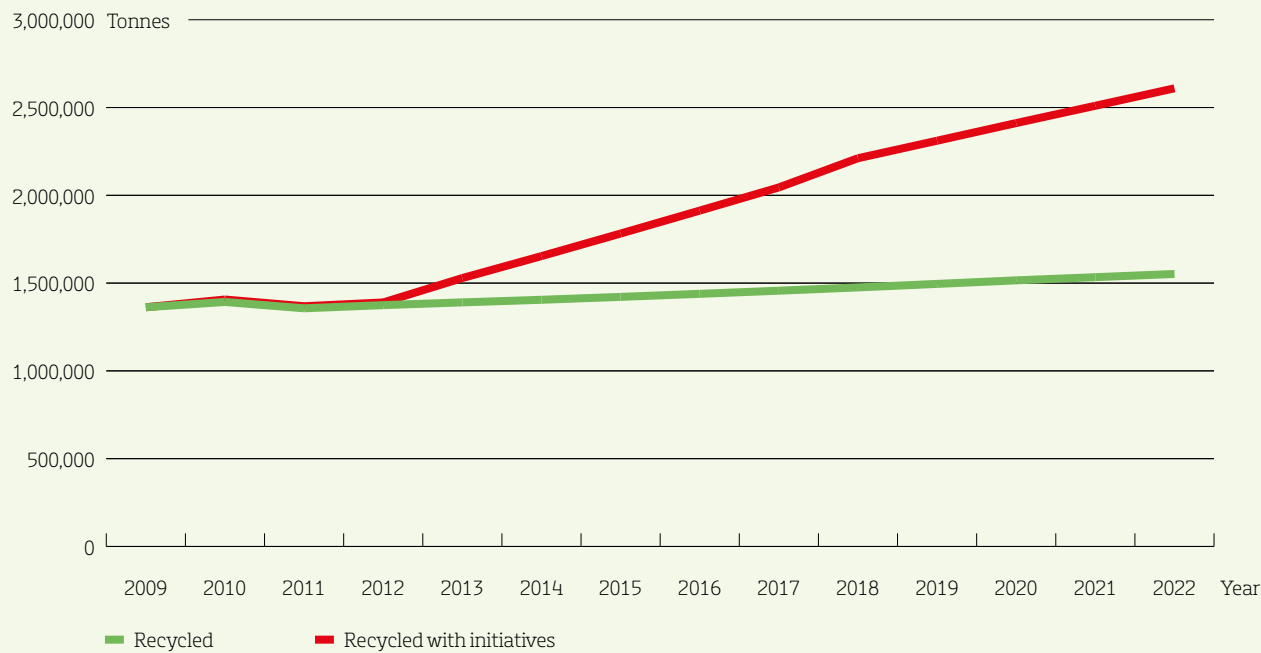
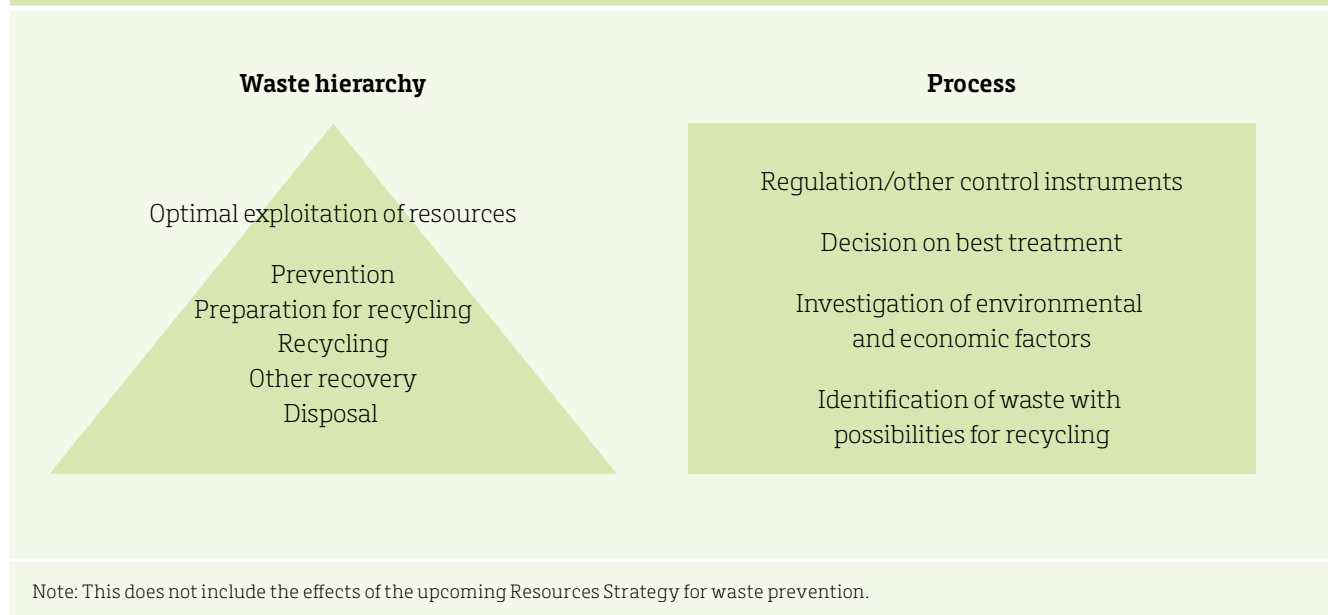


Figure 1 shows the expected effect of the initiatives in the Strategy up to 2022. The projection is based on ISAG data (2009).
Excl. construction and demolition waste

Figure 2**Box 2****What are treatment requirements and how are they set?**

1. Possible methods of collection and treatment are selected for analysis for the type of waste in focus in the assessment. For example, there are different methods of recycling and incineration at different types of installation, or there is separation and collection at source compared with central separation. This entails screening possible collection and waste-treatment technologies.
2. Scenarios are established. These are to illustrate different ways of collecting and treating the waste. The scenarios are analysed for their environmental, climate and economic effects. The latter includes an assessment of socio-economic effects, including distribution effects, effects on government finances and corporate finances, as well as consequences for the public. The analyses are partly based on lifecycle analyses to assess the environmental and climate effects, as well as socio-economic methods following guidelines from the Ministry of Finance
3. The scenarios are compared by applying the environment, climate and the economy as the most important parameters. There are also possible supplementary assessments, e.g. effects on imports and exports of waste or the maturity of technologies which will be relevant if a treatment requirement is stipulated for a given waste type.
4. The assessment is applied in a decision on the type of regulation which will underpin the most appropriate solutions in a socio-economic context, taking into account the environment, the economy, and competitiveness. The overall assessment provides a scientifically rooted decision-base for assessing whether treatment requirements or other instruments are relevant.
5. Any notification for the European Commission according to the EU Directive on procedure for the provision of information (if the treatment requirement is not already based on EU regulations).



Today Denmark already has a number of instruments to promote recycling. There are taxes on landfilling and incineration, but not on recycling. Moreover there is a deposit on cans and bottles, which ensures that almost all of these are returned and can be reused or recycled. Finally there is a treatment requirement for different types of waste of very high concern such as requirements that waste containing PVC must be landfilled and that paper which can be recycled is actually recycled. There are more treatment requirements on the way, for example for plasterboard waste, see box 2.

As part of the Strategy, in the years to come there also will be ongoing analyses of a number of different material flows. If there are environmental, corporate financial and socio-economic benefits from increased recycling, treatment requirements can subsequently be considered, see figure 2 as well as the description of the process for treatment requirements in box 2. Figure 2 describes the process towards best exploitation of resources.

Box 3

The link between the Strategy and other initiatives

The Resources Strategy is a follow-up to the Government's Plan for Growth for Water, Bio and Environmental Solutions and it is linked to the chemicals initiatives to remove undesirable substances from products, and thereby also from waste. Furthermore, the Strategy also supports the recommendations from the Panel for Green Transition (Erhvervspanelet for Grøn Omstilling).





Waste in Denmark today

Denmark produced a total of 9 mill tonnes waste in 2011¹. A total of 61 % was recycled, 29 % was incinerated and 6 % was landfilled.

A smaller volume for temporary storage and special treatment is not shown in this table. Therefore the sum of the three treatment options shown is not 100 %².

The total amount of waste from households is almost 2.4 mill. tonnes. This corresponds to each member of a household producing 447kg of waste a year. The amount includes waste collected from households, such as bulky waste, and waste delivered to recycling sites. Household waste accounts for about one-quarter of the total

amount of waste. More than one-third of household waste is recycled, but more than one-half is incinerated.

Historical developments in waste treatment

Over the past 20 years, by far the majority of Danish waste has been recycled (figure 3). The recycling rate went up from 55 % in 1994 to 61 % in 2011. The incineration rate went from 21 % in 1994 to 29 % in 2011, whereas the percentage of waste landfilled dropped considerably from 22 % to 6 % during the same period. The low percentage of waste being landfilled is due to a mixture of bans against organic waste in landfills and taxes on landfilling.

Table 2
Den danske affaldsproduktion og behandling i 2011, ekskl. jord.

	TOTAL	RECYCLING		INCINERATION		LANDFILLING	
SOURCE	Tonnes	Tonnes	%	Tonnes	%	Tonnes	%
Households	2,399,000	856,388	36	1,342,724	56	100,442	4
Building and construction sector	2,663,448	2,317,832	87	88,230	3	208,152	8
Industry	1,076,041	764,640	71	165,652	15	55,995	5
Service sector, including public institutions	1,857,514	1,093,414	59	626,791	34	58,227	3
Utilities and other commercial waste	1,105,757	560,358	51	381,538	35	126,635	11
TOTAL	9,101,760	5,592,632	61	2,604,935	29	549,450	6

1. In 2010, the Danish EPA switched to the new Waste Data System to collect waste statistics. The design of the Waste Data System is considerably different from the ISAG Waste Information System it succeeds. Unlike the previous ISAG system, all waste operators, and not only the plants receiving waste, must now report to the Waste Data System. The fact that waste operators must report to the system makes it possible to collect more accurate data about what industry from which the waste originates. However, the 2010 and 2011 datasets are characterised by the fact that waste operators and waste reception facilities have had to get used to reporting to the system, and even though the Danish EPA has conducted quality assurance of the figures, there is still some uncertainty in the data. Moreover, not all waste operators reported their waste in 2011, and the volumes for 2011 are likely to be underestimated.

2. Waste Statistics show a decrease in waste volumes from 12 million tonnes in 2009 to 9 million tonnes in 2011. The Danish EPA replaced the data collection system in 2010, and the decrease in total waste volumes is primarily due to a lack of reporting to the new system. In 2009, registrations are missing for about two million tonnes of slag from coal power plants and sewage sludge, which is normally recycled. Therefore, recycling in 2011 is probably actually higher than the 61% shown in table 4. Data for slag from coal-fired power plants will be collected for 2012 and onwards. Sludge for spreading on agricultural soil will also be part of the system in the future.

Recycling and the other countries in the EU – how does Denmark compare?

Denmark is 8th on the list of EU Member States for recycling waste collected by municipalities, see figure 4. We are not achieving the same recycling rate as the European countries recycling the most. Usually, these countries do not incinerate waste to the same degree as we do in Denmark, but they either recycle or landfill a larger percentage of waste.

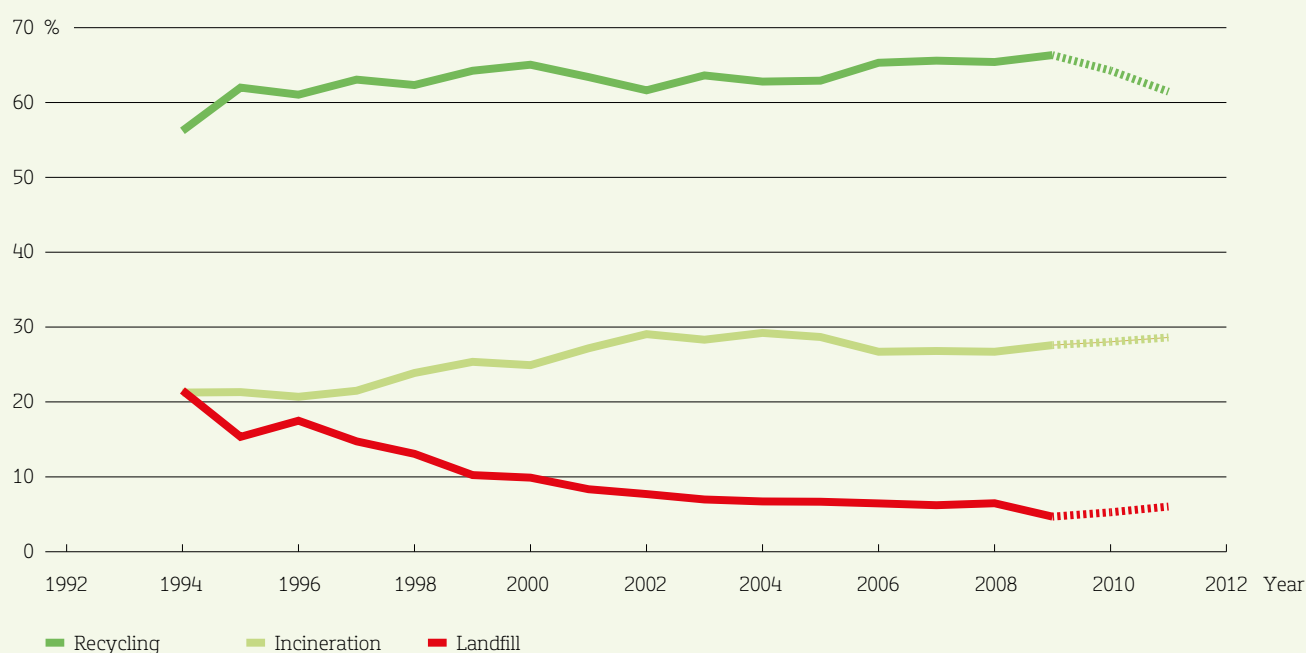
Comparisons across EU countries require certain reservations. There are great differences from country to country in the amount of commercial waste included in “Waste collected by municipalities”, so the figures vary according to what this category actually includes.

How does Denmark compare overall?

Since the 1990s in particular, Danish waste treatment has shifted from landfilling to incineration. In comparison with other EU countries, Denmark has successfully reduced the waste volumes sent to landfill because waste incineration has taken over. Energy recovery through incineration has been an important waste-treatment option. Now it is time to focus also on the resources in waste by increasing recycling where this can pay and without compromising the quality of the recycled material. At the same time, the energy from organic waste can be exploited for biogas instead of for electricity and heating at incineration plants.

We have successfully achieved a high rate of recycling for construction and demolition waste, but the aspect which cannot be measured in tonnes, that is the quality of recycling, needs to be improved significantly so that the recycled material does not cause new environmental problems and so that hazardous substances are managed better.

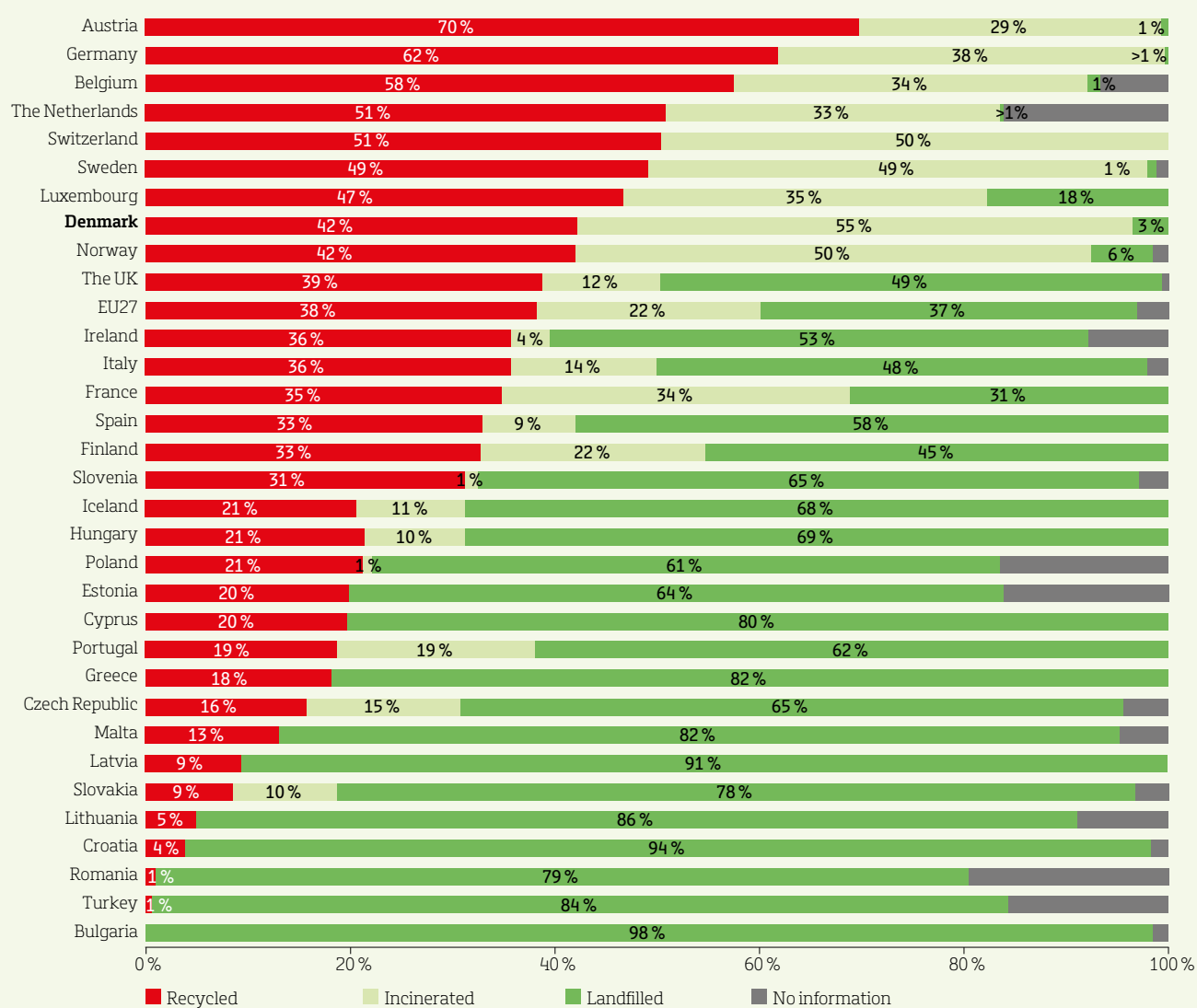
Figure 3
Waste volume and waste treatment trends from 1994-2011



Data is excluding soil³. The dotted line indicates that a new waste data system has been introduced and therefore there is a break in the data.

3. Data from 1994-2009 is based on ISAG Waste Information System data, whereas data for 2011 is based on the Waste Data System. Due to the change in reporting system, there is a data loss from 2009 to 2011. The Danish EPA assesses that recycling for 2011 has probably been underestimated as reports are lacking.

Figure 4
Recycled waste collected by municipalities



Treatment of waste collected by municipalities in the EU etc. in 2010 (waste collected by municipalities in Denmark amounts to 42 % of total waste volumes). Due to the transition to a new Danish waste data system, not all reports on recycling have been received for previous years. Therefore, the Danish recycling rate for 2010 is probably larger than stated.

Source: Eurostat & EEA (2010)

Box 4
How is waste managed?

Municipalities are primarily responsible for the waste area, especially for household waste. They are responsible for ensuring collection of household waste and that there is adequate capacity to treat Danish household waste as well as waste suitable for incineration and landfill which arises in the municipality. Recyclable commercial waste separated at source is subject to market conditions. The majority of the existing landfill facilities are owned by the public sector. Most incineration plants are owned by municipal companies. With regard to recycling, in many cases capacity is ensured by the municipality establishing agreements with private recycling companies. Most types of waste that are recycled are processed abroad, but there are many Danish enterprises – private and public – which separate and pre-treat the waste before it is exported. Irrespective of whether it comes from households or businesses, waste is primarily collected and transported by private companies.

Initiatives

The Resources Strategy for Waste Management – Denmark without Waste has the following initiatives:

1. More recycling of materials from households and the service sector	23
2. More recycling of materials from waste electronic equipment and shredder waste	27
3. From waste incineration to biogasification and recycling	31
4. Better exploitation of important nutrients such as phosphorus	33
5. Improved quality in recycling construction and demolition waste	34
6. Green conversion – new commercial opportunities	37

These initiatives and their expected effects are described in the following six sections.



1. More recycling of materials from households and the service sector

Danes want to reuse and help recycle their waste. They are aware that materials must not be wasted and that the hazardous substances in waste must not be spread.

Danish recycling sites are very popular. However, many Danes also say that they want to be sure that the time they spend on separating waste is time well spent.

Today we incinerate about 80 % of the waste collected directly from households. By recycling more, we can ensure that many materials which could otherwise be exploited are not just wasted. Recycling a number of ordinary materials such as paper, cardboard, plastic, glass and food from households has not really moved forward for the past ten years.

Ambitious goals for increased recycling

The Government's ambition is that over the next 10 years or so we will recycle twice as much household waste, so that one-half of household waste is recycled in 2022. Today we recycle just 22 %.

In future we will not just be separating the waste we are already used to separating, such as paper, cardboard and glass; we will also have to focus on all our household waste, including food waste. With this Resources Strategy, Denmark will be meeting the EU objective of separating 50 % of "dry" household waste (such as paper, cardboard, glass, plastic and metal) in 2020. However, the Government is setting an even more ambitious national goal in which the "wet" organic waste is also included. It is expected that we will move from only separating 50,000 tonnes of organic waste to reaching up to 300,000 tonnes in 2022.

The Resources Strategy therefore anticipates that over the years to come more household waste will be separated and recycled rather than being incinerated at waste incineration plants. Therefore, up to 2022 more household waste will be separated at households and at central separation facilities. In the municipalities that start source separation of household waste, this may mean that citizens will see more containers on their drives, under their sinks or down in the yard, for example for organic waste.

As is the case today, the individual municipality itself will be setting the level of service and deciding how collection and treatment of the waste is to be organised. Some municipalities will be quick to start reorganising waste management, while a longer phase-in period will be more relevant for others. This ensures space for local priorities. This is entirely in line with the Government's approach in the Resources Strategy for waste management, which places priority in not placing more requirements on municipalities.

An evaluation will be conducted in 2016 to ascertain developments in recycling in municipalities. On the basis of this, further initiatives may be considered.

Initiatives in municipalities, the state and at enterprises

In order to support work by the municipalities on increasing recycling, a number of initiatives will be implemented such as information and guidance, with examples of municipal experience and solutions. It will also be possible to apply for subsidies for technological development, for example of separation facilities and for information about separation and recycling.

It is also important that the right incentives structure and the best instruments to increase recycling are in place, so that recycling is increased where most appropriate in an environmental and economic context. For example, a number of municipalities in Sweden and Denmark have set waste fees according to the amount of waste the individual household delivers for incineration. There is a need for an overall assessment of where such models support efficient environmental and socio-economic conversion to more recycling.

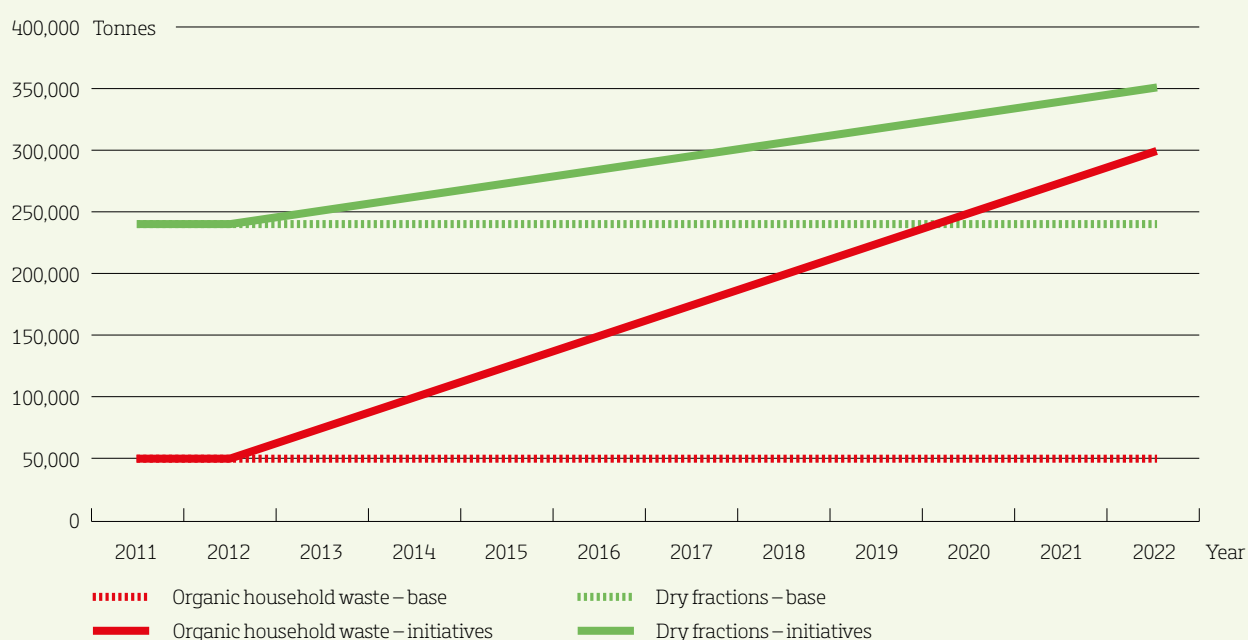
A lot of garden waste delivered to recycling sites is treated at composting plants, and this means that the nutrients can be recycled as fertiliser. However, larger branches only contain few nutrients and these are a good carbon-neutral fuel which it would be better to burn instead.

Finally, the rules must be adjusted if they actually prevent recycling. For example, a number of enterprises have said that they want to set up their own return schemes so that they can take back their products after they have ended their useful life at customers. For example plastic bottles or lids which can be recycled, or metal bottle-tops can be used in new products. Enterprises wanting to take the lead must be allowed to do so.

Service enterprises can also recycle more

Initiatives to recycle more waste from enterprises have focussed on industrial waste and waste from the building and construction sector. However, the service sector produces about 1.9 mill. tonnes of waste every year; almost 50 % more than industry, and the amount has been growing in recent years in line with a growing service sector.

Figure 5
Recycling of household waste – expected effects of the initiatives in the Strategy



Projection of the unseparated volumes of dry fractions (paper, cardboard, glass, plastic, wood and metal) and organic waste from households. The basic graph assumes the same waste treatment as today. The projection of the expected effects is based on ISAG data (2009).

Waste from the service sector is similar to household waste and has great potential to contribute to higher recycling rates. This applies for organic waste, paper, cardboard, plastic, metal and glass waste.

Many enterprises in the service sector are not aware of the possible benefits and savings arising from more recycling. This may be because the costs of waste management account for a relatively small proportion of a service company's total costs. Initiatives in the service sector build on voluntary efforts and information; both for those producing the waste and those who collect it. Dialogue must be established with the sector on more recycling of the most important fractions (including organic waste, plastic and packaging waste).

Initiatives and expected effects

More recycling of waste materials from households and the service sector.

The following effects are expected from the initiatives in the Resources Strategy:

- Twice as much household waste will be recycled (organic waste, paper, cardboard, glass, plastic, wood and metal waste). Today 22 % is recycled and the goal is 50 % in 2022.
- Energy recovery from 25 % of garden waste in 2018. Today this figure is 4 %.
- Recycling of paper, cardboard, glass, metal and plastic packaging from the service sector increased by 25 %. Today we recycle about 53 %. The expected level in 2018 is 70 %.
- Almost four-times as much organic waste from restaurants, food shops etc. collected and exploited for biogas. Today we collect about 17 %. The expected level in 2018 is 60 %.

Initiatives

- Support development of new collection schemes in municipalities which ensure citizens easy access to separate and thereby recycle more household waste, including organic waste, plastic and metal waste.
- Funding for development and demonstration of better separation and treatment facilities, including to manage dry fractions (e.g. plastic and metal) from domestic waste and bulky waste.
- Partnership for plastic waste, in which companies, knowledge institutions, etc. together promote treatment technologies which increase recycling.
- Partnership between municipalities, enterprises, designers, anthropologists etc. to develop simple, easily accessible waste systems.
- Pool to support projects by green entrepreneurs which can contribute to local implementation of the green conversion. For example, these may be projects which secure sustainable consumption.
- Establishment of possibility in legislation for private businesses to set up their own return schemes for products placed on the market in other areas than electronic equipment.
- Campaign/information initiatives for the public in order to promote recycling, for example, of organic, plastic and metal waste, including at recycling sites or through local information initiatives.
- Dialogue with the service sector on recycling initiatives up to 2018, common information initiatives on separating and treating waste from the service sector, e.g. organic waste, plastic and metal waste.
- Guidelines with examples of 3-4 solutions which work well and which support waste separation (including organic, metal and plastic waste) so that the separated waste can replace materials, for example in fertiliser, or so that it is suitable for processing to new high-quality products.
- Analysis of fee structures in the waste area which can support the goals in the Resources Strategy for more recycling.



2. More recycling of materials from waste electronic equipment and shredder waste

Waste electronic equipment and shredder waste contains many valuable materials, including in particular the 14 resources which the EU has designated as “critical” raw materials. Many of the resources in waste electronic equipment are already being recycled to a large extent, e.g. copper and iron, but many of the critical raw materials are still being lost. This applies in particular to rare earth elements such as neodymium, which is an essential raw material in wind turbines, computer hard discs and electric cars. Environmentally there may be benefits in recycling metals and rare earth elements globally rather than extracting new ore.

If the prices on the world markets for these rare earth elements continue to rise, in the long term it will be profitable to recover even small amounts from electronic appliances before they are destroyed.

Box 5 WEEE

The revised Waste Electric and Electronic Equipment Directive requires that from 2016, waste electronic equipment corresponding to 45 % of the volume placed on the market must be collected. From 2019 the collection requirement is 65 %. The Directive was finalised during the Danish Presidency in 2012 and it is an ambitious objective at EU level. Even Denmark will need new initiatives to increase collection. It entails changing the behaviour of citizens and enterprises.

New initiatives have to be developed which motivate delivery of obsolete electronic equipment by making this simple and easy. There is already a requirement that manufacturers of electronic equipment and batteries must contribute actively with solutions. A partnership for collection will identify the fractions on which increased collection is to focus, and propose initiatives to increase collection.

The first requirement for recycling is that the waste is actually collected. We are already doing this in Denmark and we are one of the best in the EU at collecting waste electronic equipment and batteries from households. Almost 100,000 tonnes is being collected in Denmark every year. However, we can do even better. There is a need to focus initiatives so that mobile phones, energy-saving bulbs and digital cameras are not incinerated, but are collected separately and recycled. This is where there are the most hazardous substances and the greatest recycling potentials.

” We must recycle metals and mineral resources in waste electronic equipment and shredder waste, where this is profitable.

When waste is collected, we must ensure that the recycling potential is exploited and that there is good quality recycling. The market for treating waste electronic equipment is international and specialised across waste enterprises with different roles and competences in the process. Initiatives will have the greatest effect at EU level and therefore common EU regulation and standards are vital.

The EU roadmap for a resource-efficient Europe sets up a number of goals and targets for better exploitation of resources and more recycling to support more resource-efficient production. In addition, it establishes a large number of initiatives, e.g. requirements pursuant to the Ecodesign Directive, to promote material exploitation in products and their recyclability, development of innovation partnerships, and focus of EU research funding on key goals for resource-efficiency.



If we focus on technological development of the processes in which waste electronic equipment is pretreated and separated into different material fractions, we can increase recycling, for example of plastic, glass and metal-containing fractions. For some metals, such as gold, silver and copper, there are already high levels of recycling, while other resources in waste are being lost during waste treatment. More effective treatment could also increase recycling of valuable metals such as rare earth elements.

Shredder waste is composed of old bicycles and cars, for example, which contain hazardous substances, and today large amounts of this type of waste are landfilled. In fact so much is landfilled that shredder waste is one of the largest waste types for landfilling in Denmark. This waste contains resources which could be exploited far more appropriately.

Initiatives and expected effects

Recycling of metals to be increased through more collection of waste electronic equipment and batteries, improved treatment of waste electronic equipment as well as more and better separation and recycling of shredder waste.

New technologies are constantly entering the market. It is vital that we find the right treatment option and therefore there will be attempts to establish a partnership between relevant players, especially in relation to end-of-life electric and hybrid vehicles. In the future, these will be included in shredder waste and they contain large volumes of electronics. Therefore there are good potentials for recycling metals, including rare earth elements, when, at some time in the future, this type of vehicle becomes waste.

The expected effects for waste electronic equipment will be achieved by ensuring effective collection of the waste and at the same time supporting development of technologies which can separate metals and rare earth elements from each other so that they are not wasted. With regard to shredder waste, recycling will be supported by the financial incentives in waste taxes on landfilling and incineration and by funding for technological development. If there are environmental and socio-economic benefits from increased recycling, treatment requirements may be considered later. Any treatment requirements should also be assessed in light of whether they entail additional costs for enterprises and households, see box 2 on treatment requirements.

The following effects are expected from the initiatives in the Resources Strategy:

- In 2018 a total of 65 % of the electrical and electronic equipment placed on the market is to be collected, including 75 % from households.
- In 2018 a total of 55 % of the portable batteries placed on the market are to be collected. In 2011, 47 % were collected.



- In 2018 more and better shredder waste is to be collected, no more than 30 % of shredder waste is to be landfilled without treatment, and 70 % is to be recovered (minimum 10 % recycling). Today almost all shredder waste is landfilled.

Initiatives

- Partnership between manufacturers, municipalities and registered collectors on collecting small waste electronic equipment. Among other things, the partnership will identify the fractions and product categories for increased collection as well as propose initiatives to increase collection.
- Partnership between relevant players to increase recycling of end-of-life electric and hybrid vehicles so that these are reused and recycled to the same extent as other types of vehicle.
- Investigation of possibilities for a voluntary scheme to collect mobile phones, for example in phone shops.
- Strategic collaboration – preferably international – for recycling waste electronic equipment, including funding to develop, test and demonstrate new technology for pre-treatment of waste electronic equipment, see box 5 on WEEE.
- Contribute to EU work on the technical foundation for setting standards for treating waste electronic equipment with a view to ensuring exploitation of resources.
- Preparation of lifecycle analysis and socio-economic analysis of shredder waste.



3. From waste incineration to biogasification and recycling

In the 2012 energy agreement, the Government has set ambitious objectives for Danish energy supply. The goal is that we are to be independent of fossil fuels by 2050.

Today, waste is part of energy supply and around one-quarter of all Danish waste ends at waste incineration plants. These plants supply about 20 % of district heating and 5 % of electricity. Denmark leads the world in exploiting the energy resources in waste. We will continue to do so, but in the future there is a need to exploit the energy in waste even better. At the same time we will exploit the materials resources, where this is profitable. We know that today we are incinerating waste which could be recycled. 80 % of organic waste, such as food waste, is water and this is burnt away.

Organic waste is a valuable supplement in manure-based biogas plants which gasify livestock manure, and it increases their energy production. This means we will be supporting biogas production in line with the initiatives to promote biogas in the 2012 energy agreement. We can also exploit valuable plant nutrients such as phosphorus and the contents of carbon in food waste, because it can be used as fertiliser.

There must be cohesion between the capacity at incineration plants and biogas plants. The system must be organised so that there are no barriers to recycling. Reorganisation of the Danish waste-incineration sector must help ensure that we recycle more and incinerate less. There is a difference of DKK 600 per tonne in the price of incinerating waste at different incineration plants. This indicates that there is considerable potential for efficiency improvements in the sector. Analyses show that there is a socio-economic efficiency-improvement potential of up to DKK 380 mill. per year for the sector.

” In future, waste incineration will play a less important role and there will be focus on the material resources, in parallel with energy recovery. We must recycle more and incinerate less.

Initiatives and expected effects

A framework must be established for a more efficient incineration sector. Reorganisation must entail that the waste for incineration is sent to the most economically effective plant so that waste is utilised most appropriately in a socio-economic context.

The following effects are expected from the initiatives in the Resources Strategy:

- Greater efficiency in the incineration sector, more intelligent exploitation of recyclable waste which today is incinerated, and waste sent to the most cost-effective incineration plant.
- Increased collection, for example of organic waste from households and the service sector for biogasification.

Initiatives

- A framework must be established for a more efficient incineration sector. Reorganisation of the sector must ensure that the waste incineration sector helps ensure recycling and that waste is incinerated at the most cost-effective plant.
- The Government will present a model for the new organisation of the waste incineration sector.

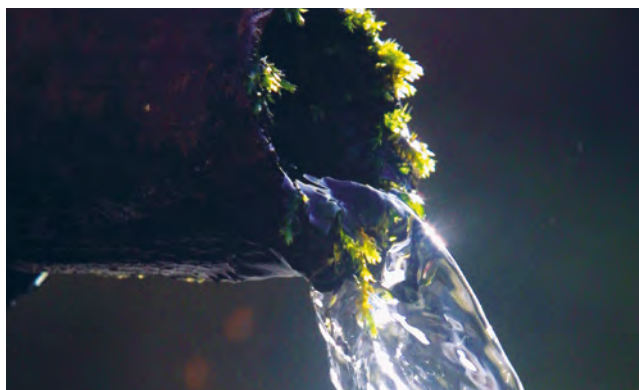


4. Better exploitation of important nutrients such as phosphorus

There are important nutrients in sewage sludge and livestock manure. The substances are valuable resources which are impossible to replace, especially in agricultural production. An important example is phosphorus, where at the moment supply cannot keep pace with demand and prices are rising.

The largest sources of phosphorus and other nutrients are livestock manure, sewage sludge and to a lesser degree organic waste from households and service enterprises. We must exploit the phosphorus resource in this waste at the same time as exploiting the energy as efficiently as possible.

Today a total of 2.6 mill. tonnes sewage sludge, 32 mill. tonnes livestock manure and 0.7 mill. tonnes organic waste are produced. Together this waste contains around 50,000 tonnes phosphorus. There is a potential to exploit the phosphorus in the ash arising from incinerating sewage sludge and to be more targeted in exploiting the phosphorus in livestock manure so that it is absorbed by crops without impacting the soil and aquatic environment with excessively large amounts of nutrients which are not absorbed by the crops.



Initiatives and expected effects

The Strategy supports increased exploitation of important and critical nutrients such as in waste with a particularly high phosphorus content.

The following effects are expected from the initiatives in the Resources Strategy:

- In 2018, 80 % of phosphorus from sewage sludge is to be recycled through exploiting the phosphorus in the ash from incinerating sludge as fertiliser, or by spreading it on agricultural soil. Today 50-55 % of sludge is recycled.
- Phosphorus from livestock manure is to continue to be used as a fertiliser, when the fertiliser is used for energy recovery.

Initiatives

- Funding for developing, testing and demonstrating technologies for recovering phosphorus from sewage sludge.
- Follow-up of lifecycle and socio-economic analyses of treatment requirements for sewage sludge and possibly livestock manure so that the content of phosphorus is exploited, e.g. in ash after incineration. In this context it is important to take into account whether any treatment requirements entail financial costs for businesses, see box 2 on treatment requirements.
- Possible establishment of “phosphorus banks” for separate landfilling of ash from incineration of sewage sludge.

5. Improved quality in recycling construction and demolition waste

Construction and demolition waste accounts for by far the largest percentage of total waste volumes; about 87 % of construction and demolition waste is recycled.

Much of construction and demolition waste contains hazardous substances. Therefore it is important to remove these substances so that they are not spread into the environment and be aware of new substances which may pose a risk for the environment and health. Consequently, initiatives on substances of concern in waste must be supplemented by measures in a new chemicals initiative, amongst other things to ensure that chemicals in products do not prevent or complicate future recycling, and focus on making it possible for materials and products to return to the resources cycle.

PCB is a hazardous substance for the environment and health. The initiatives regarding waste in the 2011 PCB Action Plan are being implemented so that construction and demolition waste containing PCB is managed to ensure better quality recycling.

The Resources Strategy therefore focuses the aims of the PCB Action Plan to improve the quality of recycling. There is a need to improve management of the often mixed waste materials. There is also a need to secure better quality of the demolition materials which are crushed and used as a substitute for gravel and stone in roads. This may mean that recycling drops for a period. This drop has already been apparent over the past couple of years in line with increasing awareness of PCB. In the long term recycling rate will again increase, but such that it does not impact the environment by spreading hazardous substances.

However, there are also other substances harmful to the environment in construction and demolition waste, and these provide potential for better and safer recycling.

District-heating pipes comprise an iron core which is insulated with plastic foam. From the 1960s and up to 2002, the plastic foam was produced using halogenated hydrocarbons such as CFCs (e.g. freon). When the plastic foam in the district-heating pipe is treated, technology should be applied which collects the ozone-depleting gas and helps alleviate the greenhouse effect.

Moreover, in the years to come we will be facing the largest ever expansion of wind turbines. This means that many smaller wind turbines will be pulled down to be replaced by new, larger turbines. This is a result of the government goal for 50 % of electricity production to come from wind energy in 2020. Therefore it is important to find the best possible way of ensuring that end-of-life wind turbines are used and exploited as a resource. Partly because the materials can be used for other purposes and partly because the blades are difficult to deal with, if they are landfilled.

In addition to implementing the PCB Action Plan, life-cycle analyses and socio-economic analyses will be initiated in order to assess whether treatment requirements can help ensure better quality recycling, see box 2.

” We must improve the quality of recycling of construction and demolition waste and ensure that hazardous substances are not spread in the environment.



The following effects are expected from the initiatives in the Resources Strategy:

Better quality in recycling construction and demolition waste while maintaining a high recycling rate. Specifically this means:

- Restricting unacceptable spread of substances of concern in the environment from construction and demolition waste by improving the quality of the waste used for new purposes (recovered).
 - Materials in at least 70 % of the total amount of construction and demolition waste will be used for new purposes (recovered).
- Stricter requirements for demolition of buildings to enable a better and more comprehensive overview of the materials and substances contained in building waste.
 - Enhanced requirements for the qualifications of demolition companies.

Initiatives

- The waste-relevant initiatives in the Government's PCB Action Plan will be implemented, including:
 - Stipulation of limit values for the content of PCB in building waste.

- Investigation of the possibilities for better recycling of concrete and investigate the advantages and disadvantages of new treatment requirements for bricks and impregnated wood as well as requirements to separate roofing felt, see box 2.
- Support for recycling of end-of-life wind-turbine blades and investigation of the advantages and disadvantages of introducing treatment requirements for end-of-life wind-turbine blades, see box 2.
- Investigation of the advantages and disadvantages of introducing treatment requirements for district-heating pipes, see box 2.

In addition to environmental and socio-economic aspects, assessment of the advantages and disadvantages of introducing new treatment requirements will focus on whether possible requirements entail increased costs for businesses, see box 2.



6. Green conversion – new commercial opportunities

Global development, with a growing middle class of consumers and rising demand means there will be increasing needs for new and resource-efficient solutions. Efficient use of raw materials and other materials are the largest Danish business sector within the environment and a number of large Danish export companies are market leaders in the area. Therefore global development could be extremely important for these Danish companies.

The key word for companies is competitiveness, in part for those that supply innovative solutions, and in part for the Danish companies which implement these solutions to achieve more resource-efficient production.

The Resources Plan for waste management will promote more separation and recycling of household waste. This will support Danish technological development and strongholds, for example, within separation, recycling materials, incineration and treatment of organic waste. This must be supplemented by exploiting the opportunities linked to improved waste prevention, among other things with the Resources Strategy for waste prevention.

The Government has placed priority on subsidies to develop new technological solutions which can promote resource-efficiency and the green transition in Denmark. Furthermore, we must help green technology enterprises to reach out to export markets.

” We must develop new competitive and resource-efficient solutions with export potential.

The following effects are expected from the initiatives in the Resources Strategy:

- Better solutions for waste management and to establish closed resources cycles, as well as increased exports of Danish solutions in the waste and resources areas.

Initiatives

- More focus on green technology, for example through the Programme for Green Technology.
- Promote better quality and more recycling of household waste and similar waste from the service sector.
 - Develop a state-of-the-art waste separation facility which will contribute to more recycling and better exploitation of the resources in dry waste fractions (plastic, metal, cardboard etc.).
 - Optimise resource consumption at enterprises in order to reduce waste volumes and increase recycling.
 - Reuse and recycle construction and demolition waste.
 - Better exploit the resources in shredder waste, slag from incineration plants and waste electronic equipment.
 - Recover more phosphorus from sewage sludge and livestock manure.
 - Design products which establish closed resources cycles.

- Establish a knowledge centre for resources which will collect knowledge and experience within closed resources cycles.
- Strategic collaboration – preferably international – for recycling waste electronic equipment, including announcement of funding to develop, test and demonstrate new technology for pre-treatment of waste electronic equipment.
- Investigate how, in connection with changes in consumer behaviour, new business models can contribute to lower resource consumption and more reprocessing and recycling.
- Analysis of Danish technological development potentials in waste management of electric and hybrid vehicles and reuse of batteries for electric vehicles in the renewable energy system.
- Green conversion loans for resource-efficiency improvements at enterprises.
- Green conversion fund will contribute to equipping Danish enterprises for the resources-scarce economy of the future. The fund will aim at business development, production, sales and market-maturity of green products and solutions.
- Promote industrial symbiosis in which enterprises link together their materials flows so that waste from one enterprise can become a resource for another enterprise.
- Enhance green export initiatives by developing, disseminating and providing advice about green solutions abroad.
- Denmark will contribute actively to the EU process on a roadmap for a resource-efficient Europe, including development of efficient markets for secondary raw materials.
- Denmark will contribute to implementation of the EU 7th Environmental Action Programme in which sustainable consumption and production play a prominent role, including how consumer demand can contribute to promoting eco-friendly design and increased use of secondary raw materials in products.



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