INFORMATION NOTE

Waste management policy in Denmark

1. Introduction

1.1 The Danish waste management has progressed markedly over the years, from its initial focus on the protection of human health, through the integration of environmental protection, to the extraction and recovery of resources in waste. A clear division of roles, responsibilities and competence between the individual actors of the waste system (such as state and local authorities, waste management companies and waste generators) has facilitated the progress. A coherent planning and regulatory system combined with an operational system enforced and controlled by public authorities also lend particular support. Denmark has now become one of the countries in the world achieving high incineration rates and minimized amount of landfilled waste.

1.2 This information note provides an overview of the waste management policy in Denmark, with special reference to thermal waste treatment technology in terms of its development, energy recovery process, monitoring and enforcement measures, and the extent of public acceptance of the technology in the country.

2. Regulatory framework for waste management policy

Responsible authorities

2.1 The Ministry of the Environment is the government agency in charge of the overall environmental policies and state-level administrative matters relating to the environment. The Environmental Protection Agency under the Ministry is responsible for waste matters and performs supervisory and control functions by setting out the overall framework for waste management.

2.2 Meanwhile, the municipalities are responsible for the management of waste, such as regulating the collection and treatment of household waste, controlling the flow of commercial and industrial waste to assigned treatment for disposal, and ensuring sufficient incineration capacity. Municipalities are also obliged to develop waste management plans every six years. The plans must include a 12-year perspective with projections for waste generation, national and locally-defined targets for waste management, and means to achieve these targets.

Relevant regulations

2.3 Waste management in Demark is primarily governed by the *Environmental Protection Act.* There are also specific waste management laws governing matters such as the relevant parties involved in waste activities and waste incineration plants:

(a) *The Statutory Order No. 48 on Waste of 13 January 2010* specifies the framework for waste incineration, environmental and efficiency report on incineration plant, and regulatory duty of municipalities such as waste management planning and drawing up regulations on fee imposition and waste collection; and

(b) *The Statutory Order No. 1451 on Waste Incineration Plants of 20 December 2012* ("*Waste Incineration Plants Order*") transposes the European Union *Industrial Emissions Directive* ("IED") into Danish national legislation. Specifically, the *Waste Incineration Plants Order* sets out the application requirements for operating an incineration plant, the provisions on plant operation and waste delivery and reception, the pollution control criteria and the emission limit values of various air pollutants and contaminants, and the reporting and disclosure requirements.

3. Waste treatment in Denmark

3.1 Landfilling without any kind of environmental protection was the primary means of disposing waste in Denmark in the 1970s. In fact, landfilling was so common at that time that the landfill capacity was exhausted in the Copenhagen region in the 1980s and waste became an environmental problem posing risk to human health.

3.2 In 1982, the Danish government revised the environmental protection law requiring counties and municipalities to devise waste disposal strategies. Not only were the counties obliged to set out general guidelines for future waste management targets according recycling a higher priority, municipalities were also charged to publish a municipal waste management plan to implement these targets. To improve municipal waste management, Denmark went further to introduce landfill and incineration taxes in 1987 and became the first country to completely ban landfilling of combustible waste in 1997.

3.3 The enactment of the European Union *Landfill Directive* in 1999[1] shifted the Danish waste treatment paradigm from landfilling to recycling. The amount of waste going to landfill decreased notably along with the separation of combustible and non-combustible waste. Moreover, the establishment of separate collection schemes for paper, glass packaging, and garden waste has contributed significantly to the increased level of recycling within the country. As a result, the recycling rate of municipal waste went up from 14% in 1995 to 31% in 2011. The incineration rate remained at around 55% whereas the percentage of municipal waste landfilled dropped considerably from 18% to 3% over the same period.

4. Development of thermal waste incineration

4.1 Thermal waste treatment was introduced in Denmark in 1903 with the establishment of the first waste incineration plant in Copenhagen. After more than a century of development, the technology has been integrated into the Danish waste management system with a high level of public acceptance. In particular, it has become more and more common to exploit the energy content of the waste for the production of heat and electricity by incineration.

4.2 Meanwhile, advanced thermal waste treatment such as pyrolysis and gasification is not currently in use in Denmark.[2] Experiments with pyrolysis were made at one of the municipalities during 1960s but it was met with little success.[3] As such, incineration has become the officially prescribed method for the treatment of incinerable waste in Denmark.

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1 The Directive aimed to reduce the environmental impact of landfill sites and restrict or prevent the landfilling of certain types of waste.

2 Based on the email reply from the Environmental Protection Agency dated 17 January 2014.

3 The municipality of Kolding experimented with pyrolysis but eventually chose incineration as its thermal waste treatment process. Several other municipalities showed an interest in pyrolysis, but no full-scale plant has ever been established.

4.3 At present, Denmark has 25 waste incineration plants that process waste from household and business sectors, with a total incineration capacity of around 4 million tonnes per year.[4] Most Danish incineration plants are owned by municipalities or inter-municipal companies. The municipal co-operation is to secure the establishment of the necessary incineration capacity. This is especially the case for new incineration plants of which sufficient feedstock must be secured over a payback period of about 10 years. Moreover, such arrangement ensures that the waste is managed according to the principles of proximity and self-sufficiency.

4.4 With the basic incineration capacity now in place, the Danish parliament has been discussing whether incineration plants should now be open to market conditions. This would imply that private waste collection enterprises will be able to decide themselves to which incineration plant to deliver waste. Household waste could then be sent to a specific incineration plant based on a competitive tender rather than at the municipality's behest. A final decision has yet to be reached on the market opening issue.

Energy recovery

4.5 Under the *Waste Incineration Plants Order*, any heat generated from waste incineration is to be recovered as much as practicable. As such, all waste is incinerated at plants with recovery of energy for the production of electricity and/or district heating. Electric power is then distributed in the national grid to residents and other users, whereas heat is distributed through the district heating grids. All these are accomplished at a lesser cost as energy generated by waste incineration is relatively cheaper than that by fossil fuel.

4.6 Waste incineration plants currently provide about 5% of the total energy supply in Denmark, representing about 20% of the total heat delivered to central heating systems and 4.5% of the total electricity supply. Furthermore, energy recovery at the Danish waste incineration plants provides environmental benefits for the society as energy recovered from waste produces lower carbon dioxide emissions than most other energy supplies in the energy system.

[4] Based on the email reply from the Environmental Protection Agency dated 17 January 2014.

Tax on incineration

4.7 Tax on incineration was introduced on 1 January 1987 along with the introduction of landfill tax. The new tax measure was to create an incentive to help reduce the amount of waste going to incineration plants and landfills so as to promote recycling. When first introduced in 1987, incineration tax was set at a relatively modest rate at DKK40[5] (HK$56) per tonne of waste but has since increased significantly during the past decades. At present, the tax for incineration is DKK261 (HK$368) per tonne of waste while that for landfill is DKK470 (HK$663) per tonne of waste. The waste tax is differentiated such that landfill tax is higher than incineration tax to disincentivize landfill as a means to dispose waste.

4.8 Incineration tax was originally based on tonnage of waste, but from 2010 onwards, the tax has been related to the amount of energy produced as well as the amount of carbon dioxide emissions produced from the fossil part of the incinerated waste. Revenue received from incineration tax is almost exclusively used to finance research and development of better waste management such as cleaner technology projects.

4.9 The introduction of landfill tax and incineration tax in Denmark has not resulted in a reduction in waste quantity. Instead, it has provided strong economic incentive for recycling. Private markets for compost products and recycled construction and demolition waste have been developed as a result.

Monitoring and enforcement measures

Environmental permit

4.10 In Denmark, an environmental permit from the Environmental Protection Agency is required for the installation of waste incineration plant, or when the operation of the plant is subject to significant changes or expansion. Plant operators must provide the following information when applying for the environmental permits:

[5] DKK is the currency code for Danish Krone.

(a) details of the plant's operation;

(b) the necessary measures to ensure compliance with the environmental standards;[6]

(c) the preventive and precautionary measures to be adopted in the event of an accident; and

(d) the best available techniques in accordance to the European Integrated Pollution Prevention and Control ("IPPC") Bureau.[7]

Environmental inspection and reporting

4.11 Environmental inspections of waste incineration plants are conducted by municipalities which are obliged to submit a report on their inspections and approvals to the Environmental Protection Agency. The report must include the comments regarding the environmental inspections of the municipal authority. Issues such as the number of inspections and enforcement actions must also be reported. The Agency hereafter conducts checks to ensure that all municipalities comply with minimum frequencies of inspection agreed between the Minister for the Environment and the local government.

Penalty

4.12 The *Waste Incineration Plants Order* imposes penalties on operators who fail to comply with the provisions on operating an incineration plant. Fines and/or imprisonment of up to two years may result if the offense is committed intentionally or through gross negligence resulting in financial gain or damage to the environment.

[6] These standards cover the types and amount of waste to be treated, plant capacity, design and operation of the plant, emission limit values for polluting substances and sampling methods, and measurement techniques used for monitoring of emmissions.

[7] The European IPPC Bureau was established in 1997 with the objective to organize an exchange of information between member states and the industries concerned on best available techniques as required under IED.

Public acceptance of waste incineration

4.13 Waste incineration plants have become the mainstay of garbage disposal and crucial fuel sources across Denmark, from wealthy exurbs to Copenhagen downtown area. Since incineration plants typically provide heat in addition to electricity for district heating systems, they are usually located in dense urban areas. Public acceptance of waste incineration is generally high in Denmark.[8] Danes rarely have objections to the localization of an incineration plant in their municipality or neighbourhood. Many of them are of the view that the plants are so cleanly run that more dioxin is released from home fireplaces and backyard barbecues than from waste incineration.[9]

4.14 To make incineration plants more attractive to local residents, new plants in Denmark are built based on creative designs and multi-functional purposes. For instance, the new Amager Bakke plant in Copenhagen, slated to be commissioned in 2017, is currently under construction with three artificial ski slopes of different grading on its rooftop serving as a recreational area for the public on top of the building.

4.15 In an effort to further increase public acceptance of waste incineration plants, operators of the plants often undertake public engagement for the community to understand the environmental protection enforced on these plants as well as various waste management activities engaged by the plants other than incineration. For instance, Vestforbrænding, the largest waste incineration plant in Denmark jointly owned by 19 municipalities, hosts public awareness campaigns apart from being an incineration plant. It operates a range of recycling facilities, as well as providing waste management consultancy for local companies, municipalities and individual households. The plant receives around 10 000 visitors annually and has established teaching facilities on waste management for school children and teachers.

8 See Danish Ministry of the Environment (undated).
9 See The New York Times (2010).

Latest development in waste incineration

4.16 Although Denmark has been successful in its waste management planning with its waste incineration policy, it is one of the countries in Europe producing the most waste per habitant, averaging 719 kg of municipal waste per capita in 2011. Against this, the Danish government has embarked on a new campaign "Denmark without Waste" to transit from waste to resources and called on the community to recycle more waste from household and service sector and incinerate less. The campaign covers various fronts and comprises a list of initiatives including improved recycling waste from households[10], service sector[11] and construction and demolition sector[12], energy recovery from garden waste[13], and promotion of green conversion[14].

4.17 Specifically for incineration, the "Denmark without Waste" campaign calls for setting up a more efficient waste incineration framework to help recycling and waste incineration management. For instance, food waste at present is incinerated which means that valuable nutrient components are not currently utilized. Treatment can therefore be improved to extract the material, nutrient and energy resources in waste.[15] The goal of the campaign is to promote greater efficiency in the incineration sector, more intelligent exploitation of recyclable waste which is currently incinerated as well as delivering waste to the most cost-effective incineration plant.

4.18 With the initiatives set out in the "Denmark without Waste" campaign, it is expected that 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).

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[10] This initiative involves setting the recycling goal of household waste, including food waste, to 50% by 2022, up from 22% at present.

[11] This initiative involves setting the recycling goal of paper, cardboard, glass, metal and plastic packaging from the service sector to 70% by 2018, up from 53% at present.

[12] This initiative involves recovering material from at least 70% of construction and demolition waste for other usages.

[13] This initiative involves recovering energy from 25% of garden waste in 2018, up from 4% at present.

[14] This initiative involves focusing on green technology and developing new competitive and resource-efficient solutions with export potential.

[15] For example, phosphorus is an element of which the supply cannot keep pace with demand and its price is rising. The Ministry of the Environment is currently providing funding on a research project to develop new techniques for phosphorus extract from ashes from the incineration of sewage sludge.

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