

THE DANISH MODEL FOR SUSTAINABLE WASTE SOLUTIONS



*Transferring know-how and expertise
from Denmark to international solid and
hazardous waste management projects*

PREFACE

Denmark has long been actively working to address environmental pollution and improve conditions for man and nature. Much experience has consequently been gained and good solutions to the problems have been devised. More recently, Denmark has endeavoured to apply this experience to projects abroad, primarily in Eastern and Central Europe, as well as in the developing countries.

This publication describes the background for Danish solutions within the waste sector dealing with solid and hazardous waste, most of which are founded on

extensive cooperation between authorities, research institutes, private companies and public enterprises. Danish competence is highlighted – in particular regarding public responsibilities and the operation of recycling and waste treatment plants. Carefully adapted to local needs, Danish know-how and expertise could make a valuable contribution to waste sector projects abroad. Export of Danish know-how and expertise pertaining to sustainable water solutions takes place through cooperation between private enterprises and public institutions in Denmark and represent solid professional knowledge.

INDEX

● The Danish Waste Model	page 4
● Aims of the waste policy and strategy	page 6
● Principles behind Danish participation in international waste management projects	page 8
● Public/private partnership	page 10
● Danish know-how and expertise within waste management	page 12
● Areas of special competence in the Danish public sector – selected examples	page 14



THE DANISH WASTE MODEL

The Danish waste management system is often characterized internationally as "The Danish Waste Model", as the system is based on solid principles that join to form a coherent whole.

The most important criteria are:

1. One coherent public management, planning and regulatory system combined with an operational system enforced and controlled by public authorities.
2. One clear division of roles, responsibilities and competence between the individual actors of the waste system (state, regional authorities, local authorities, waste management companies and waste generators).
3. Fixed principles concerning the structure of the waste management system:
 - the system includes all types of waste (e.g. household, industrial, and hazardous waste)
 - the responsibility for the waste management system lies solely with the local authorities
 - the duty to assign waste treatment and disposal facilities lies with the local authorities, and waste generators are bound to use them
 - management, regulation and control of: waste generators, carriers and treatment plants
 - financing of the system rests on the-polluter-pays-principle
 - waste collection and waste treatment rest on the principle of source separation

The implementation of the Danish waste model has taken place over many years. So considerable experience is accumulated in Denmark (bad as well as good) including considerable expertise within specific areas.

Today, this know-how is available internationally via the participation of Danish public authorities and their consultants in international projects. In addition to always conducting international projects in close collaboration with local counterparts, the Danish public know-how as far as possible will be transferred in collaboration with and through Danish private consulting and operating/contracting companies.



AIMS OF THE WASTE POLICY AND STRATEGY

The integrated waste management solutions implemented in Denmark today are very much influenced by the general development in society and priorities set in the past and today by citizens and their elected representatives.

Similar to water supply and wastewater treatment, the solid waste management system has substantial bearings on infrastructure, human health and the environment. It enhances the standard of living of citizens and contributes to the professionalism and further development of the functional basis of enterprises.

Concurrently, it is imperative to reduce the impact of waste on human health and the environment. Further, a series of initiatives to prevent waste generation will secure conservation of nature and natural resources.

Thus, the Danish waste policy and strategy are based on the internationally recognized waste hierarchy prioritising the efforts as follows:

- initiatives to prevent waste generation
- maximum recycling and material recovery
- optimal recovery of the energy contents in waste
- minimal use of landfilling

Within all these areas, Danish experience exists concerning legislation and planning aspects as well as practical implementation of the physical infrastructure (vehicles, collection equipment, logistics, treatment plants, landfill facilities etc.).

One hundred years of waste management development makes it clear that the waste problems cannot be solved by recycling and energy recovery alone. There will always be a need for final disposal of waste that cannot be further recovered. Therefore well-controlled and organized landfills, also in Denmark, are a vital element in the basic structure of a waste management system.

Ensuring a solid basic structure for the waste management system is the best background for any gradual, further development of the entire system. This is often the basis for Danish participation in international solid waste management projects. However, the development of a waste management system must take place in consideration and respect of any existing local systems. This is important for a successful implementation and in total compliance with Danish tradition.



PRINCIPLES BEHIND DANISH PARTICIPATION IN INTERNATIONAL WASTE MANAGEMENT PROJECTS

Promotion of sustainable development

Any sustainable development must secure both sustainable health and environment and sustainable economy. This concept has formed the basis for the development of the solid waste management system in Denmark, and it is the basis for any Danish effort in international projects.

In a Danish context, the word "sustainability" is not just a headline!

A **sustainable environment** presupposes the development of goals and strategies, systematic planning, tested and safe technical solutions, use of recognized standards for environment, health and quality plus systems for safeguarding the optimal operation of waste collection, transportation, treatment and final disposal.

A **sustainable economy** presupposes availability of sustained financing of the waste management system. Decisions must be made as to future financing models: is it to be based on government financing, "non-profit cost-coverage" principles or user payment at market price. These decisions must be made and the systems developed and implemented.

The promotion of sustainable development is not so much a question of choice of technical solutions or securing financing of establishment costs. Rather it is a result of an interplay between legislation, management, planning, engineering, organization, economy and operational experience. This is the entity represented in "The Danish Waste Model".



Capacity building/Capacity development

Sustained solutions must be anchored to ensure legislative and administrative capacity as to planning, monitoring and control, follow-up and further development of the waste systems.

It can be difficult to secure not only coherence between the public administrative levels (state, regional and local), but also between areas of competence of different ministries. Ideally, solutions should be made where responsibility, competence and financing are as closely connected as possible.

Much Danish experience exists in these fields, and a fast increasing number of international waste management projects – with Danish participation – aim at exactly this element.



PUBLIC/PRIVATE PARTNERSHIP

The solid waste management sector is relatively costly. Thus it is understandable that models are preferred securing a coupling between analyses and planning projects and that resulting reports point out the need for further development of the physical structure of the waste management system (collection and transport means, treatment plants and land-fill facilities etc.).

In this connection, public/private partnership – or collaboration within and between the public and the private sectors – constitutes a central model in which interpublic co-operation combined with involvement of the private sector is a dynamic element in the implementation of new solid waste management systems.

In Denmark, the whole spectrum of solutions is found: private, public/private, semi-public, public and a large number of intermunicipal associations. Experience is extensive, but it is commonly recognized that well-developed public administration and legislation are prerequisites for any investors to enter the field of solid waste management.

The development of public/private partnerships is thus tightly connected to the capacity building of public administration and institutions.

Even when the private sector is involved in design, construction, financing and operation of waste management systems, important questions and tasks for the public sector remain.

Which models of organisation and co-operation are preferable: direct contracts for individual plants, concessions, franchises or open competition?

Which methods of control and regulation will be relevant for which objectives? When will a solution need direct legislation; when are incentives useful (e.g. tax reductions or subsidies); where do information campaigns work and are there limits to private sector involvement and performance?

Only by connecting the "soft components" (legislation, planning, design, administration etc.) of the solid waste management sector to its "hard components" (plants, equipment etc.) will a successful development of the waste systems be secured. This connection is part of the Danish model and will be brought into any international project by the Danish participants.



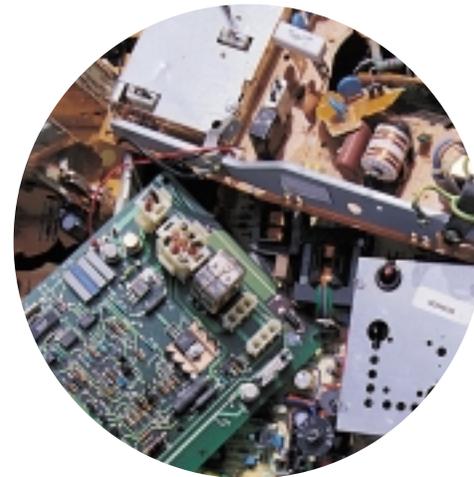
DANISH KNOW-HOW AND EXPERTISE WITHIN WASTE MANAGEMENT

In contrast to other infrastructure areas, such as water supply and wastewater treatment, the solid waste management sector is characterised by a large number of actors and a wide spectrum of services.

On the one hand, there are collection systems, transportation and logistics, recycling and treatment plants and landfill sites that could be termed the waste management sector *per se*. On the other hand, there are different systems aimed at different waste generators: households, industries etc. Finally, there is the large number of services developed for the different waste fractions: paper, glass, plastics, waste oil, used tyres and so on.

We have chosen to depict the collaboration possibilities offered by Danish consultants, suppliers, management and operational experts, public as well as private, whenever Danish public authorities, private consultant companies and suppliers participate in international waste management projects.

Denmark, Danish authorities and enterprises can deliver almost any service within the waste management sector. So can many others, but being able to connect all the different components is another matter. This is where Denmark makes a difference.



AREAS OF SPECIAL COMPETENCE IN THE DANISH PUBLIC SECTOR – SELECTED EXAMPLES

No matter which areas you wish to develop in the field of waste management - a new landfill, special systems for hazardous waste, health care waste or waste treatment plants (incineration, anaerobic digestion etc.), the technical design and the concrete delivery connected with new installations - Danish private consulting companies and manufacturers can provide just the solution you need. In each of these areas, however, the public sector has a very special and important role to play. The following sections provide examples -demonstrating the interaction between the private and public sectors in Denmark

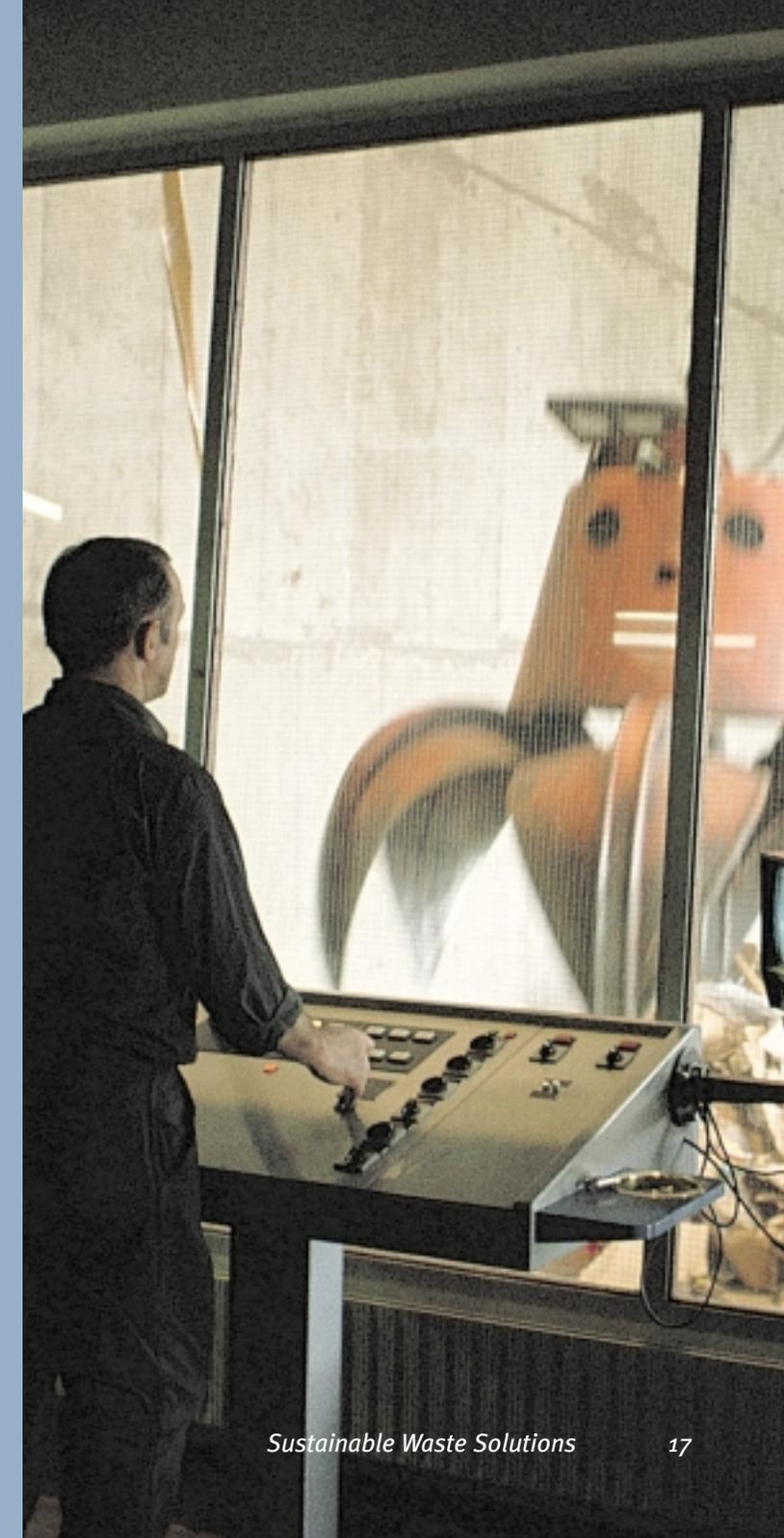


CAPACITY BUILDING WITHIN REGULATION AND ADMINISTRATION OF SOLID WASTE

The establishment or modernisation of systems for solid waste management is not only about introducing new technology/plants/systems to treat waste generated. If generators, collectors and handlers of waste are to act in accordance with the goals and strategies laid down in a master plan or strategy for waste management, it is necessary to implement instruments and capacity to regulate, prepare and administer the plan or strategy that has been agreed. New legislation, regulation and means of control of different kinds - e.g. economic instruments - must be implemented. At the same time, administration of legislation etc. at the national, regional and local levels must be implemented or strengthened. In parallel to the construction of systems for waste management, the goal is thus to produce efficient instruments and sufficient, qualified capacity that can ensure that the planned system fulfils agreed goals and strategies. These two aspects have developed in parallel in Denmark for more than 20 years, and much practical experience has been accumulated, including experience in collaboration between Danish waste authorities and their consultants. The means to obtain an efficient administration with efficient tools may include the following stepwise considerations:

Danish assistance

- Survey of existing waste legislation, administrative structure and apparatus
- Analysis and evaluation of needs for new regulations and relevant new legislative and administrative tools.
- Analysis and evaluation of needs for development of the administrative apparatus at a national, regional or local level.
- Elaboration of new waste legislation or adaptation of existing one – to achieve sufficient possibilities for implementation and enforcement of the new waste management strategy.
- Development and strengthening of administrative apparatus, including training and education of staff to perform all necessary functions.



PLANNING OF REGIONALLY INTEGRATED SYSTEM FOR SOLID WASTE MANAGEMENT

Solid and hazardous waste management is normally very cost-heavy and characterised by large cost-savings resulting from the establishment and operation of large plants for waste treatment and disposal instead of small. Costs for remote transport of waste do play a role, but normally do not contribute much to total costs in an integrated waste management system. Much economic advantage can be achieved by establishing regional collaboration for waste management covering e.g. 10-20 local authorities. Thus, it is the goal to identify a cost-efficient integrated system for the management of all wastes within a predetermined region. This is achieved by performing a master waste management plan including a number of activities where much experience has been gained by public authorities and their consultants for more than 20 years.

Subsequently, organisation for implementation and operation of the regional system must be established concurrently with building and strengthening of the local administrative and regulatory apparatus.

Danish assistance

- Analysis of present conditions, i.e. generation of waste from all sources in the region.
- Identification of requirements from national and international waste legislation that might influence the region's choice of management systems.
- Identification of possibilities at a regional level for recovery of resources in waste (recycling, energy recovery etc.).
- Identification of alternative technologies for management relevant in the regional context
- Construction of alternative integrated management systems (based on legislative requirements, relevant technological alternatives, local factors important for the management).
- Technical, economic and environmental assessments and comparison of the suggested alternatives followed by choice of the best possible system.
- Assessment and identification of alternatives for the region's waste generators between options of financing and cost recovery of any chosen system as well as affordability.



IMPLEMENTATION OF SERVICES FOR SOLID AND HAZARDOUS WASTE MANAGEMENT

For more than 100 years Danish local authorities have been directly involved in implementing services for citizens covering collection and landfill disposal of waste generated in households and commercial enterprises. It has been a tradition that the actual collection and disposal services have been carried out by the local authority itself – sometimes involving private enterprises in the operation. Since the late fifties treatment of the collected waste by composting or incineration (and later recycling) has been added to the operations carried out by the local authorities. In the same period private enterprises became involved to a larger extent in especially collection of waste from households and commercial/industrial enterprises.

This direct involvement in collection, recycling, treatment and landfill disposal has brought comprehensive hands-on experience and capacity to staff and organisations within the Danish local authorities and their consultants (which normally are consulting engineering firms).

Danish assistance

Collection:

- Detailed planning of services for collection of residual waste as well as selected recyclable fractions such as paper, glass, organic waste etc.
- Procurement of vehicles and container equipment to be operated within the local authority organisation responsible for the service.
- Tendering of the collection services to be operated by private enterprises/contractors. Tendering based on detailed or performance specifications resulting in delivery and installation of equipment or in providing the entire service.

Treatment and disposal:

- Detailed planning of facilities for composting, anaerobic digestion, incineration, sorting and baling of recyclable materials as well as landfilling.
- Design and construction of the planned facilities.
- Tendering of equipment delivery and installation based on detailed or performance specifications.
- Tendering of the entire service based on design, build, operate and finance (DBOF/BOOT).



ENVIRONMENTAL IMPACT ASSESSMENT OF WASTE MANAGEMENT

Since the start of the last century, waste collection and disposal has been regulated via local authority public health regulations. In the early 1970s a new comprehensive Environmental Protection Act was added to these regulations introducing integrated pollution control requirements whenever new facilities for treatment and disposal of solid and hazardous waste were planned and constructed.

For authorities and enterprises involved in waste management it became mandatory to carry out coherent environmental impact assessment of all operations connected to waste treatment and disposal facilities to be established. At the same time it became mandatory to carry out public hearings to ensure a dialogue with parties influenced by the new facility. For each new facility a special environmental approval was to be issued by the regional environmental authority (in Denmark the County Council). In this environmental approval a set of conditions were set up for the design and operation of the waste facility. Emission standards and other normative guidelines for planning, design and operation of waste facilities – prepared by the Danish Ministry of Environment - have formed the basis for these conditions.

During almost 30 years all waste treatment and disposal facilities in Denmark have been environmentally assessed, involving local, regional and national authorities and their consultants, resulting in the most modern and state-of-the-art technologies and operational concepts to the benefit of all. Vast experience and capacity have been developed in this long period, which can be transferred to all newcomers in the sector.

Danish assistance

- Systematic approach to evaluation of all types of environmental impacts from conventional treatment and disposal of solid and hazardous waste
- Field investigations and baseline surveys forming the basis for environmental impact assessments
- Planning and design of mitigation measures to reduce/prevent pollution from waste treatment and disposal facilities
- Execution of integrated pollution and prevention control procedures
- Involving public in consultations during planning and implementation of the facilities



ESTABLISHMENT OF A MODERN LANDFILL

Establishment of a modern landfill anywhere in the world is not an easy task. And so is the situation in Denmark. Nimbyism is widespread, but in spite of that Danish local authorities responsible for waste disposal have succeeded several times in establishing a modern landfill.

Focus is often on technical design when a modern landfill is planned. Which liners are acceptable – double or single liner, clay or plastic? Location of drainage systems, treatment of leachate, protection of the surroundings etc.

All are relevant questions, but basically problems that can be solved by experienced consultants and suppliers experienced in the best available technologies and procedures.

Siting of the most suitable location and subsequent acceptance by the public, however, often is the most difficult task for landfill developers.

All the considerations given prior to the establishment of a landfill, and the following operation of the facility, are of extreme importance to a successful implementation of a modern landfill project. In Denmark, the public sector and their consultants have compiled experience and know-how from these considerations during many years of practical operation.

Danish assistance:

A: Organisation of the landfill

- Which company structure is relevant.
- Elaboration of statutes for the landfill.
- Management system and structures of decisions.
- Financial model for capital investments and operating costs.

B: Localisation of the landfill

- Recipient quality planning.
- Other land use.
- Planning and implementation of public hearings.
- Citizen involvement activities.

C: Control and regulation of waste streams and waste composition

- Information campaigns.
- Guidelines for institutions and companies.
- Regulations/orders for rules and sanctions.
- Training courses for authorities, transport staff and waste generators.
- Differentiated fee systems.

D: Optimisation of operation systems

- Working procedures for staff in connection with filling-in.
- Means of personal protection and working environment.
- Quality and environmental management.
- Fee systems.
- Control and follow-up procedures.



FURTHER INFORMATION ABOUT KNOWLEDGE AVAILABLE FOR USE ABROAD CAN BE OBTAINED ON THE FOLLOWING WEBSITES:

www-Links

Association of Intermunicipal Waste Management Companies	www.renosam.dk
Danish Council of Consulting Architects and Engineers	www.par-fri.dk
Danish Environmental Protection Agency	www.mst.dk
Danish Waste Management Association	www.dakofa.dk
Green City Denmark	www.greencity.dk
International Solid Waste Association	www.iswa.dk
Ministry of Environment and Energy	www.mem.dk
Ministry of Foreign Affairs	www.um.dk
- Danida	www.um.dk/danida
The Association of County Councils in Denmark	www.arf.dk
The Confederation of Danish Industries	www.di.dk
The National Association of Local Authorities in Denmark	www.kl.dk
Waste Centre Denmark	www.wasteinfo.dk

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