

WASTE IS VALUE

SUSTAINABLE WASTE
AND RESOURCE
MANAGEMENT IN
DENMARK

DAKOFA 





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The Danish waste system is integrated, intelligent and professionalised, with clearly defined roles and a transparent management approach. It builds on the polluter pays principle, with strong economic incentives to push waste streams upwards in the waste hierarchy. Businesses that develop and supply waste management technologies must meet exacting standards for resource efficiency, energy efficiency, data delivery, environmental performance and, occupational health and safety.

The results speak for themselves. Denmark has:

- One of the highest recycling rates in the world (69%),
- Highly efficient energy recovery of nearly all non-recyclable waste - providing almost 25% our central heating demand,
- Very small amounts of waste going to landfills (4%).

OUR APPROACH



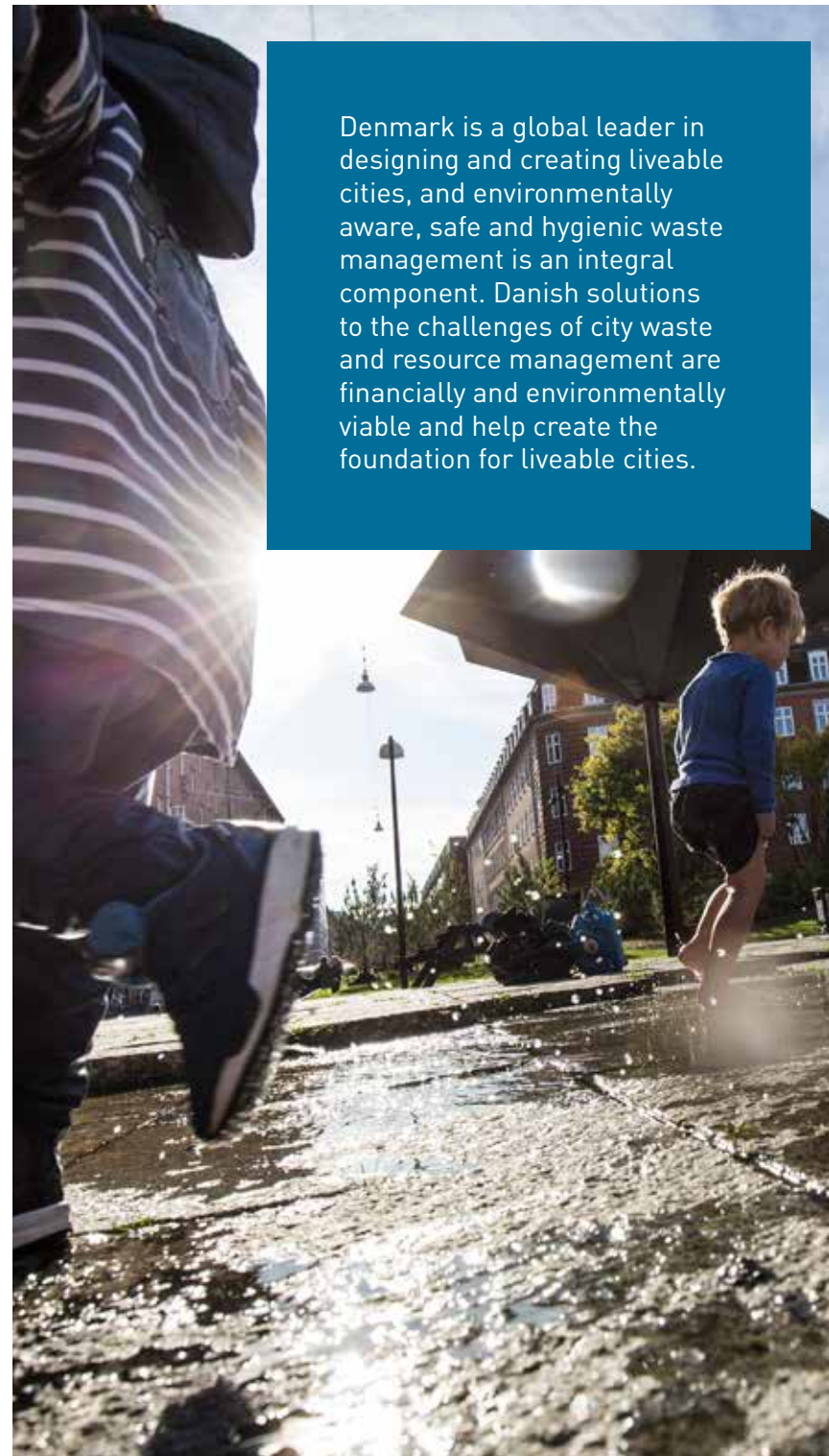
Denmark is a global leader in designing and creating liveable cities, and environmentally aware, safe and hygienic waste management is an integral component. Danish solutions to the challenges of city waste and resource management are financially and environmentally viable and help create the foundation for liveable cities.

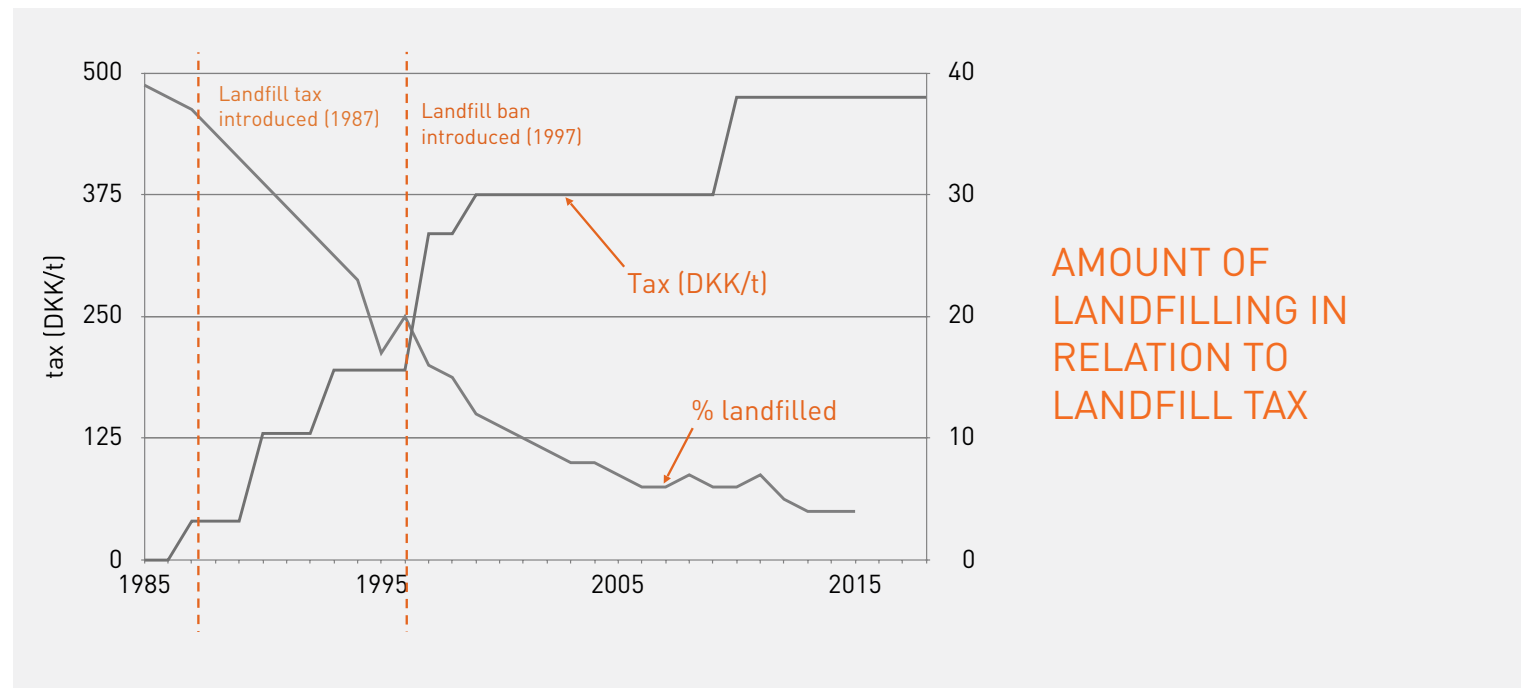
69%

Denmark recycles 69% of all waste, which is one of the highest recycling rates in the world

Key components of the Danish waste system include:

- An integrated, intelligent waste management system and associated know-how.
- Logistic, technical and digital solutions for optimising collection, sorting and separation of waste for high quality and sustainable waste management.
- Recycling and optimisation of organic waste and dry recyclables from household and commercial waste
- Energy recovery in highly efficient waste-to-energy facilities when material recovery is not possible.





DANISH WASTE POLICY

Thirty years ago Denmark introduced a landfill tax with the aim of diverting waste from landfills towards energy recovery in incineration plants. This served to reduce the environmental impacts of landfilling and protect the groundwater from leachate, and contribute to the Danish energy balance by generating district heating and, later, electricity.

Ten years later, this tax was supplemented with a ban on landfilling of all combustible waste. The landfill tax and the landfill ban, together with a tax on incineration have been key drivers for the Danish success.

Today we are intensifying focus on recycling by setting goals and creating funds to promote the development of new green solutions. The financial incentive structure of waste management in Denmark implements the polluter pays principle, and favours recycling and reuse over other treatment options.

For example, Denmark's National Resource Strategy aims to double the national recycling rate for specific household waste streams over a ten-year period – from 22% in 2012 to 50% in 2022. This target covers bio-waste, metal, wood, plastic, paper, cardboard and glass from households. By increasing the quality and quantity of waste going to high-level recycling, both citizens and businesses save on the costs of waste management.

Aside from material recovery, Danish national waste policy aims to minimise CO₂ emissions and the negative environmental effects of waste, and enable and maintain high standards for occupational health and safety within the industry. In Denmark, the national waste policy provides direction and targets, but is actually implemented and managed at the municipal level.

Municipalities are the main competent authority for waste policy enforcement: they ensure that waste is handled according to the waste management hierarchy as well as the waste management plan of the municipality. Many municipalities are working together in inter-municipal companies and in close cooperation with the private sector to provide cost effective solutions that benefit from economies of scale.

Data on waste streams is reported to a national waste data system, by collectors, transporters and treatment facilities – this means that all waste streams are regulated and registered from collection all the way to the final treatment or recycling facility. Actors in the Danish waste sector are professionally educated, registered as waste professionals, and regulated to ensure compliance with waste policy.

COLLECTION AND SORTING

In urban environments, where people primarily live in apartment buildings, household waste bins tend to be located within specially designed areas in enclosed backyards. Apartment residents typically sort paper, cardboard, plastics, glass, metal, bio-waste, bulk waste and hazardous waste into separate waste containers. In some cases, the backyard collection system is supplemented with a system of recycling islands in public spaces. This approach is typically used for glass collection.

Residents can find information about waste collection, schedules, and sorting guidance through a smartphone app, which also facilitates direct communication with the municipality waste department. They can also be notified by text message when their waste is collected.

As a supplement to door-to-door recycling collection and the recycling islands, household waste can also be delivered at local recycling stations. These accept a broad range of waste types – up to 50 different waste fractions in some recycling centres – including recyclables, garden waste and construction and demolition waste, but also various hazardous waste types, WEEE and textiles. The newest recycling stations are being developed as “resource parks” where recycling is optimised, and citizens are being educated and involved. They are also designed to be “liveable parks” within the cities.

More than half of Danish household waste is delivered to the recycling stations, 75-80% of which is recycled.

Residual waste from households and from recycling stations ends almost exclusively in highly efficient incineration plants with energy recovery.

Waste from the retail sector is also largely recycled. For example, supermarkets are obliged to source separate paper, cardboard and packag-

ing (glass, plastic, metal and wood). The packaging waste is compressed packed into smaller bales, weighed by use of smart solutions and sold on the open market. Many supermarkets also source separate food waste, which can either end in anaerobic digestion to produce energy and compost, or be shared with charitable organisations.

Today, Denmark recycles 65% of paper, cardboard, glass, metal and plastic packaging from the service sector, and the current development trajectory of collection and sorting technology should increase this to 70% in the service sector in 2022.

65%

Denmark recycles 65% of paper, cardboard, glass, metal and plastic packaging from the service sector

Route planning for waste collection is iteratively optimised through smart data systems to save time, reduce route distance, reduce fuel use and minimise CO2 emissions and ultimately reduce costs. Once collected, recyclables are transported either to central sorting or pre-treatment facilities, or directly to a final recycling facility.

recycling facility.

Where sorting is required – for example with the collection of mixed dry recyclables – the waste is mechanically sorted using a variety of modern techniques. Some processes have even begun to employ robots! Denmark is among the front runners in developing new waste sorting solutions, including within robot-technology, scanning- and other recognition technologies.



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PRE-TREATMENT AND RECYCLING

Danish pre-treatment solutions result in clean valuable output that can economically compete with waste-to-energy treatment. The solutions generally employ a very high level of automatization and ensure high standards for occupational health and safety. These solutions help ensure high quality recycling of Danish waste fractions, maximise value and minimise the potential for downcycling. Denmark currently exports pre-treatment equipment all over the world.



Danish businesses have also developed innovative solutions for recycling as well as production with recycled materials. Danish businesses can sort, clean, separate and recycle plastic products such as plastic packaging. Others have solutions for producing new plastic products that contain recycled material.

All supermarkets accept return beverage bottles and cans as part of a nation-wide deposit-return system, where a small fee is added to the cost of a product when purchased, and refunded when the bottle or can is returned. More than 90% of all included plastic bottles, glass bottles and metal cans are delivered back into the system, making it one of the most efficient take-back systems in the world. All the materials are either reused or recycled back into beverage bottles and cans.

Wood waste can be transformed into particleboard, while paper and glass are reused or recycled into new products.

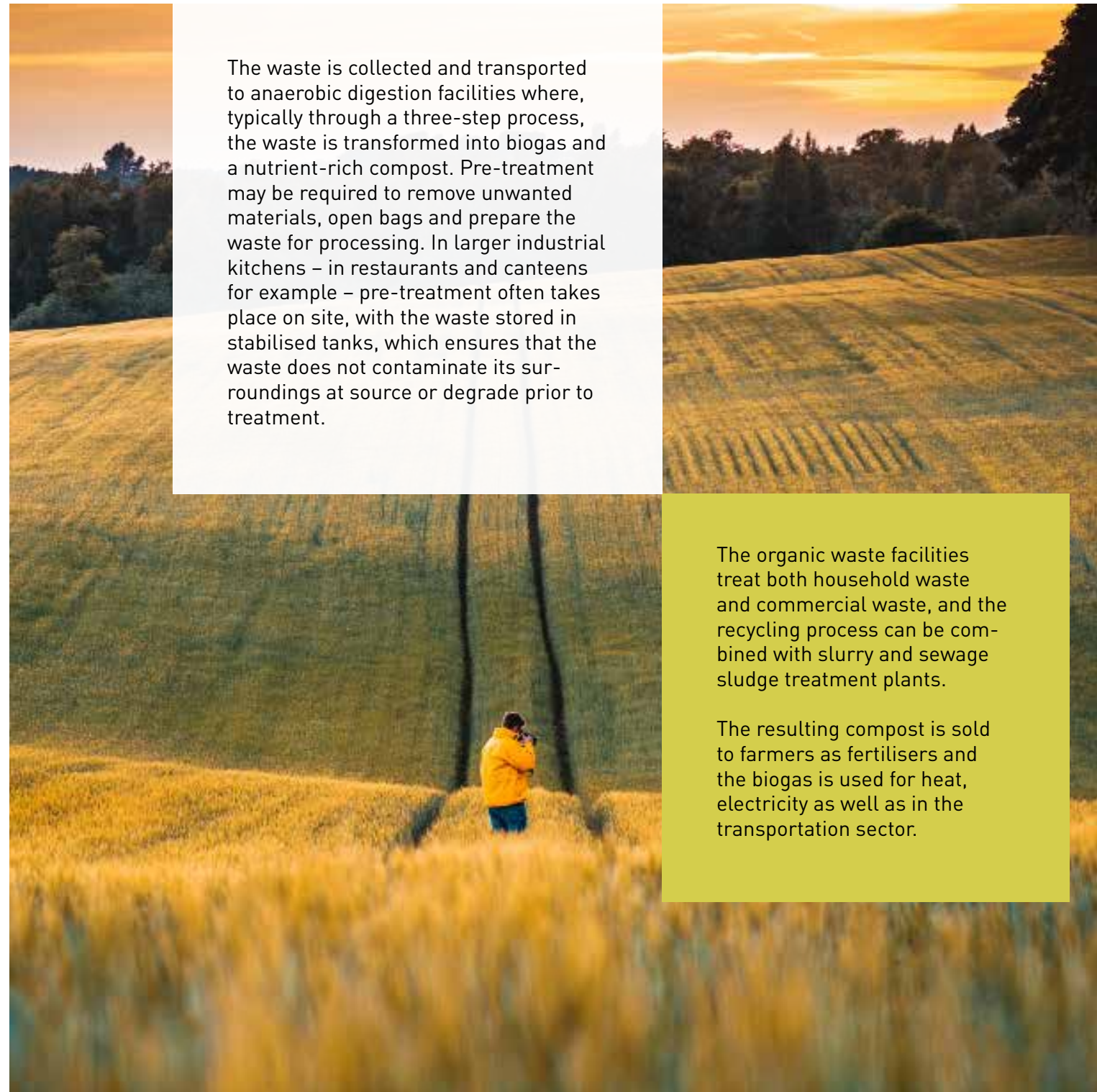




Food waste is separately collected from households, canteens, restaurants and supermarkets, public institutions and private companies. This is a relatively recent development but a roaring success.

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ORGANIC WASTE



The waste is collected and transported to anaerobic digestion facilities where, typically through a three-step process, the waste is transformed into biogas and a nutrient-rich compost. Pre-treatment may be required to remove unwanted materials, open bags and prepare the waste for processing. In larger industrial kitchens – in restaurants and canteens for example – pre-treatment often takes place on site, with the waste stored in stabilised tanks, which ensures that the waste does not contaminate its surroundings at source or degrade prior to treatment.

The organic waste facilities treat both household waste and commercial waste, and the recycling process can be combined with slurry and sewage sludge treatment plants.

The resulting compost is sold to farmers as fertilisers and the biogas is used for heat, electricity as well as in the transportation sector.

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NON-RECYCLABLES

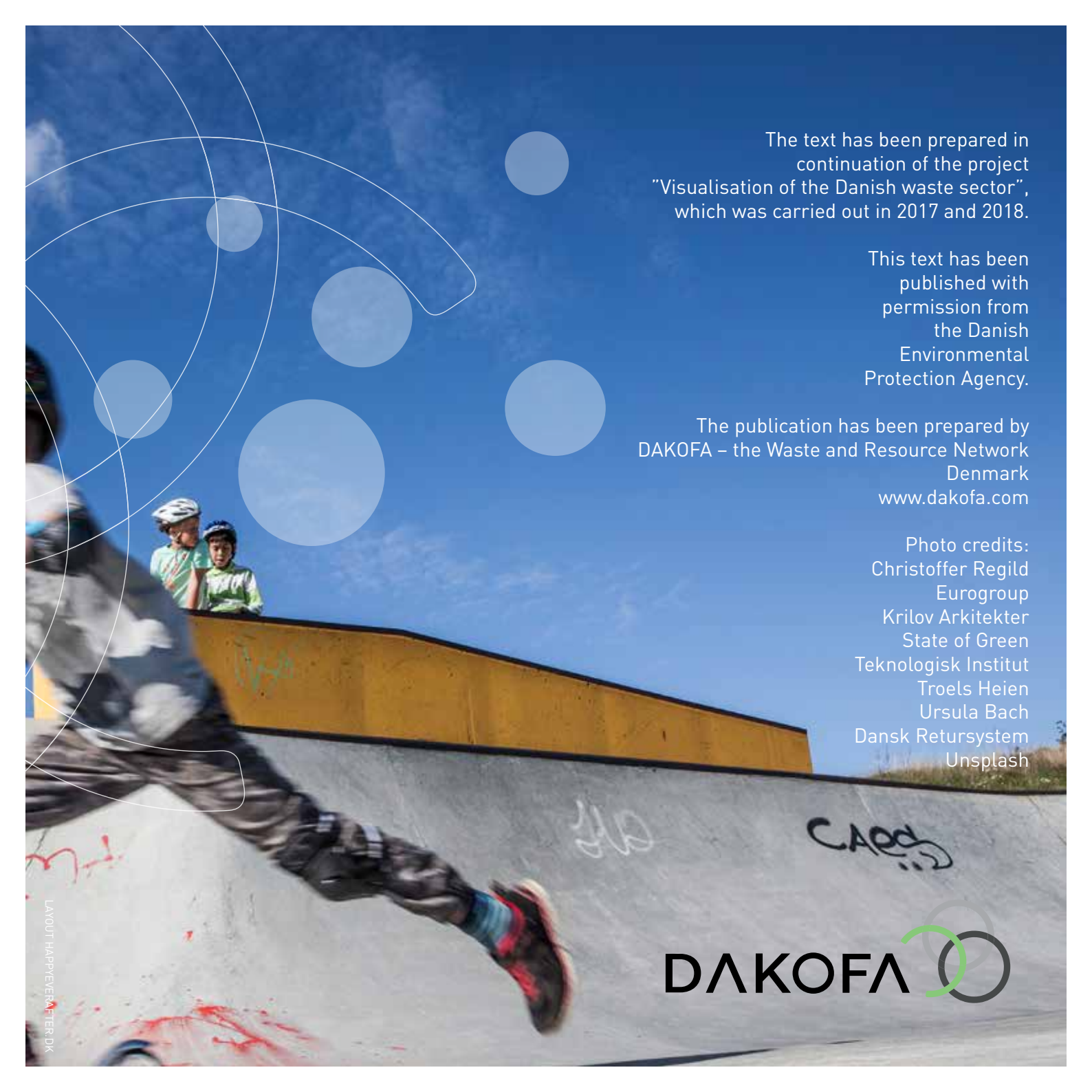
RECOVERING ENERGY - WASTE INCINERATION PLANTS

Residual waste – waste that cannot be recycled – is used as an energy source in Denmark. Residual waste is incinerated in highly efficient waste-to-energy plants that generate both heat for Denmark's extensive district heating system, and electricity to feed the national grid. Around 25% of the heat in the district heating network comes from these plants, and they also generate around 5% of the total Danish electricity consumption. During the summer, this can be used for district cooling.

The bottom ash from the incineration plants is mechanically sorted, and the metal component recovered for recycling. The remaining ash is used for backfilling and for road construction. Danish waste-to-energy plants have very strict air-emission control, meaning that they can be sited in urban areas, reducing transportation costs and environmental burdens. In Copenhagen, the incineration plant is located just across from the Queens Palace.

SAFE DISPOSAL - SANITARY LANDFILLS

Denmark's highly efficient waste system means that only around 1% of household and commercial waste is sent to landfill. All landfills are 'sanitary' and to ensure tight control over the process, they are all owned and controlled by the municipalities. Emissions from the landfills are measured and controlled and de-commissioned landfills are still monitored for leachate and other emissions. At larger landfills, methane gas is captured and utilised. At smaller sites, methane is transformed into a less climate-aggressive gas via a system of bio-covers and leachate cleaned to protect the groundwater.



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