Food Waste Disposers

An integral part of the EU's future
waste management strategy

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EXECUTIVE SUMMARY

The EU Commission is planning to propose a new directive on Bio-waste in 2004. Two working documents preparing the proposal contain a provision putting a ban on the use of Food Waste Disposers (FWDs). This report argues why this ban should be removed from the proposal, and why the EU Commission should instead endorse the use of FWDs as an integrated part of a modern waste management system.

EU's Waste Policy

The EU's Waste Policy should be sustainable and coherent but at the same time remain open to different technical solutions. A mix of various waste management solutions should be available. Whereas composting schemes are suitable in some Member States, anaerobic digestion or the use of FWDs fulfil a valuable function in other countries or regions of these countries. It is, thus, imperative not to shut the door to other alternatives or complementary technologies that have their own advantages, and which may contribute to ensure that a considerable share of the total amount of organic waste is recovered and not landfilled or incinerated.

The EU is currently in the process of completing legislation that will shape the EU's waste management strategy for the future. A Landfill Directive has been adopted, and a revision of the Sludge Directive, a new Directive on Biowaste and a Thematic Strategy for Soil Protection are in the pipeline. The effect of Food Waste Disposers on waste management and environment are in line with the three main elements put forward in the mentioned legal acts (improve the soil quality, increase recovery of organic waste to ensure that it is not landfilled or incinerated and improve the quality of sewage sludge) and will even enhance them.

FWDs and Recovery of Food Waste

To increase the recovery of organic waste and thus ensure that it is not landfilled or incinerated, the Food Waste Disposer can be used as an integral tool turning food waste into sludge, which subsequently undergoes anaerobic digestion or is spread on agricultural land. Moreover, the use of FWD only contributes positively to the quality of the sludge.

The Legal Picture

In some 50 countries, including the US, Canada, Mexico, Australia, New Zealand and many European countries, there are no restrictions on the use of FWDs. The approach and legislation in the 15 Member States on FWDs vary slightly depending upon factors such as the environmental awareness of local authorities and citizens, the dimension of the wastewater treatment plants, the market for sewage sludge and biogas, climate and cultural considerations and the attitudes towards new technological solutions.

In Ireland, Italy and the United Kingdom, there are no restrictions on FWDs, whereas in Denmark, Finland and Norway, permission (depending on the local authorities) is required. In Austria, Belgium, France, Germany, the Netherlands, Luxembourg and Portugal, the use of FWDs in households are either not allowed or discouraged. The most common argument against FWDs today is that the capacity of wastewater treatment plants is not sufficient.
However, several case studies in the US (New York City, University of Wisconsin study) and in Europe (Sweden, Germany, Norway and Italy), have shown that this problem is negligible, and that FWDs further have a range of other positive effects.

EU Environmental Legislation

The EU policy on the environment, under Article 174 of the EC Treaty, shall contribute to preserve, protect and improve the quality of the environment and allow for the rational utilisation of natural resources. The use of FWDs adds nutrients organic matter to sewage sludge improving the quality of the end product. Therefore, a ban on FWD would not contribute to the preservation or protection of the environment, rather the contrary.

A ban on FWDs would have negative consequences in terms of environment, competition, economy, trade and public health.

The Technique

The FWD technology is both new and old. The cornerstone and first link of this way of transporting food waste is the disposer, which grinds the food waste into small pieces and evacuates it by the help of water. The FWD is designed to ensure that only food waste goes through the disposer. Materials other than food waste (bottle caps, textile etc.) will lead to the jamming of the device. As grindable food waste represents up to 35% of the total amount of household waste, the potential use of FWD is relatively large.

European Standardisation

In order to avoid the risk of clogging of the sewerage system, European and international standardisation bodies have established standards for both the FWD unit and the connecting pipes. According to several scientific studies, very few problems occurred in the transportation of ground up food waste in the sewers and it did not increase deposits significantly. The capacity of the treatment plants differs a lot between the member States. But according to studies, and following EU legislation, the treatment capacity should increase 69% by 2005 in most Member States.

Furthermore, contrary to popular belief, the operation of FWD does not give rise to substantial increase in drinking water consumption used to flush down the ground up food waste.

Finally, the use of FWDs generates primary sludge richer in nutrients than many other types of sludge. Therefore, the organic matter can be used to produce biogas. There is also general agreement that the collection of food waste in inner-city districts is problematic. In other words, the storage of food waste causes odours and hygienic problems both for the households and the staff handling the collected fractions.

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CHAPTER ONE

INTRODUCTION: FOOD WASTE DISPOSERS AND THE EU'S CURRENT OBJECTIVES

The EU is the only body, which can create a sustainable and coherent waste policy for the whole European Community. Such a Waste Policy has to put up clear aims, but at the same time remain open to different technical solutions, in order to be able to meet these intentions. We believe that a mix of various waste management solutions must be available to accommodate the variety in factors such as existing and planned infrastructure, cost implications, regional/local peculiarities, climate etc. Whereas composting schemes are more suitable in some Member States, anaerobic digestion or the use of Food Waste Disposers fulfil a valuable function in other countries or regions of these Member States. Experience has shown that central or home-composting schemes are more suitable in some countries than others. Even in countries with favourable cultural, climate and environmental conditions such as the Netherlands and Denmark, the collection of food waste has not been entirely successful. This is mainly due to hygienic or convenience conditions which have had a deterrent effect on the participation in such collection schemes. It is, thus, imperative not to shut the door to other alternatives or complementary technologies that have their own advantages, and which may contribute to ensure that a considerable share of the total amount of organic waste is recovered and not landfilled or incinerated. Recycling of food waste through reapplication of sewage sludge to soil is a method in full line with EU environmental goals. Systems with proven success and concrete benefits for the environment must not be overlooked.
The EU is currently in the process of completing legislation that will shape the EU's waste management strategy for the future. A Landfill Directive has been adopted, and a revision of the Sludge Directive, a new Directive on Biowaste and a Thematic Strategy for Soil Protection are in the pipeline. We believe that legislation should define the required outcomes rather than the means of achieving them, it should not be a barrier to innovation and it should be proportionate to risk. In order to attain public and stakeholder confidence the supporting risk assessments and other bases for legislation should be published.
The effect of Food Waste Disposers on waste management and environment are in line with the three main elements put forward in the mentioned legal acts, and will even enhance them:

These aims can be described as following:

- Improve the soil quality
- Increase recovery of organic waste to insure that it is not landfilled or incinerated
- Improve the quality of sewage sludge

It is our aim with this information package to show that Food Waste Disposers not only fulfil these objectives but also that the FWD is a vital tool in the creation of a sustainable waste management system in Europe.

1.1 Improve the soil quality

The importance of protecting the soil from contaminating pollutants is vital. Therefore, it is essential that soil function and fertility are protected by preventing excessive contamination. It is also desirable to maintain (or increase) the content of soil organic matter. Another action of importance is to support the build-up of organic matter, especially in those regions of Europe where soil erosion is an issue. There are several techniques that can support this process and one of them is the recovery of food waste generating from Food Waste Disposers on fields. Food waste, in its pure form, contains organic matter and nutrients of value to the soil. This supports the line stated in the Thematic Strategy for Soil Protection that provides that when contamination of sewage sludge is prevented, it is a very beneficial and nutritious contribution to the soil.

1.2 Increase recovery of organic waste to insure that it is not landfilled or incinerated

There is a broad consensus on the fact that whatever waste management system the EU chooses it is desirable that it contributes to the recycling of nutrients, conservation of organic matter and does not entail unacceptable environmental impact, to ensure that recourse is had to other more sustainable waste management systems than landfilling. The Landfill directive establishes obligatory targets for MS to reduce the amounts of biodegradable waste disposed in landfills, such that only 35% of the quantity disposed in 1995 will be permitted by 2016 (or 2020). This will be a difficult task given that the amount of waste generated is increasing at 2%-6% per annum. There are different methods that can help the Member States to fulfil these objectives. The most common methods of today are composting, anaerobic digestion and incineration. As mentioned above, we consider the availability of several technologies important. The Food Waste Disposer is an integral tool turning food waste into sludge that can undergo anaerobic digestion. The method has strong advantages as it creates clean and recyclable waste in a way that is practical for the consumer.

1.3 Improve the quality of sewage sludge

Rightly or wrongly the most common negative perception of sewage sludge relates to chemical contaminants. Some are diffuse inputs and others identifiable sources. In nearly all municipalities a single wastewater collection system is used for domestic and industrial wastewater; in the older areas the system is also used to convey surface water. The inputs of pollutants from factories have been greatly reduced over recent years by co-operation of industry with sewerage agencies; in some areas there is room for further reductions. Modern sludges are very different from even 15 years ago, as reports to the EC under Directive 86/278/EEC show. The cost of duplicating the sewerage network and wastewater treatment in order to separate industrial and domestic wastewater would be unjustifiable. The use of FWD would not be detrimental to sludge quality and might even result in reduced concentrations of some parameters. Even if batteries (or similar) were incorrectly disposed in a FWD, it would be incapable of grinding them.

CHAPTER TWO

TRENDS AND CURRENT LEGAL SITUATIONS IN THE MEMBER STATES

2.1 The International Landscape

In some 50 countries there are no restrictions on the use of FWDs in households[1]. These countries include the US, Japan, Canada, Mexico, Australia[2], New Zealand and many European countries. There are approximately 110 million users all over the world. The FWD has gained the greatest foothold in the United States, where it was introduced in the 1930s and has been widely used since the 1960s. The degree of saturation in the USA is at around 48%. In all American cities, it is now permitted to use them in homes without any restrictions, and in some cities, such as Detroit, Los Angeles and Denver, they are mandated in new buildings. No empirical or scientific studies have warranted restrictions of its use. On the contrary it has won wide recognition for its hygienic and environmental characteristics. This recognition has been confirmed by numerous studies, some of which are discussed later.

In recent years there has been only one concrete case in the US where fears were voiced concerning the FWD use, namely that of the city of New York. The City of New York is a useful case in understanding the reasons for their use or non-use. Until October of 1997, a ban was in effect in the City of New York against the use of FWDs in areas where wastewater and rainwater flowed in a single sewerage pipe. The motivation behind the ban was the perceived risk of frequent obstructions in household pipes and major deposits in the sewerage pipes due to the high quantity of material flushed through poorly dimensioned and old pipes. The City ordered a preliminary study lasting 21 months to revisit the reasons for the ban to see whether it was still justified. The conclusion of the report[3] was that there were no tangible risks associated with FWD use, thus the ban was lifted. In November 2000, following the positive experiences (both from an ecological and economic perspective), the city authorities decided to give citizens who wished to install an FWD a waste disposal tax reduction of US$300[4].

In the rest of the world, FWDs are also spreading. It is estimated that the market penetration in Australia and Canada is at 10%, in New Zealand at 20%, while in the remaining countries there is a growth trend, though it is starting at rather modest levels.

2.2 The European Landscape

In Europe, FWDs have won recognition for their potential as a food waste management system only recently, which is also the main reason why Europeans have developed other food waste management systems such as composting. The saturation is the greatest in Great Britain, where 5% of households use FWDs. In total, it is estimated that about 100,000 FWDs a year have been sold in Europe and the annual growth rate of household saturation is less than 1%.

The EU's policy and legislation applying to non-hazardous waste leave it to the Member States to decide which approach and waste management methods to adopt. This is in line with the two fundamental principles on proportionality and subsidiarity. Hence, the approach and legislation in the 15 Member States on FWD vary slightly depending upon factors such as the environmental

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[1] Waste Management at the Source; Utilizing Food Waste Disposers in the Home – A Case Study in the Town of Staffanstorp, Project Manager: Peter Nilsson, University of Lund, 1990.

[2] Japan and Australia have some local restrictions.

[3] The Impact of Food Waste Disposer in Combined Sewer Areas of New York City (N.Y.C. Department of Environmental Protection).

[4] CITYLAW – Center for New York City Law (2001 Jan/Feb. – Vol. 7 – no. 1).

awareness of local authorities and citizens, the dimension of the wastewater treatment plants, the market for sewage sludge and biogas, climate and cultural considerations and the attitudes towards new technological solutions.

2.3 An overview of the legislative situation in the Member States

2.3.1 No restrictions

Ireland and the United Kingdom

Food Waste Disposers can be legally sold and used in the whole territory of Ireland and the UK.

Italy

In the first half of 2002, the Italian Senate lifted the ban on FWD set out in the "Ronchi" decree 22/97. The main reason for overturning the ban is twofold: insufficient grounds for a ban in the law's Articles, 5, 6 and 32 and the need for alternatives to the separate collection of organic waste which have encountered difficulties particularly in some regions. The use of disposers is even encouraged locally (e.g. Capri, Lombardy and Trezzano Sul Naviglio). According to the Ronchi decree:

- Actions must be favoured that are focused on reducing the quantity and danger of waste products and on developing clean technologies that provide increased savings of natural and economic resources.
- Actions and measures must be favoured that enable the greatest possible recovery and recycling of the substances sent for disposal. The waste must be recovered or disposed of without danger to the health of humans and without using procedures or methods that could cause damage to the environment.

2.3.2 Permission required

Denmark, Finland and Norway[5]

Permission to install Food Waste Disposer depends upon the local authorities responsible for the sewage system.

Sweden

Permission to install Food Waste Disposer depends upon the local authorities responsible for the sewage system. In Sweden several experiments with FWDs in new building have been initiated across the country (see case studies in next chapter).

2.3.3 Prohibition or extensive restrictions

Austria

Installation of Food Waste Disposers is not allowed.

Belgium

The use of Food Waste Disposers is decided regionally. The royal decree (9/08/1976) does not ban the FWD in itself but the act of "throwing away or discharging into public sewer solid waste, which has been broken mechanically" (art. 4).

France

The health regulations (administrative circular 9/08/1978, article 83) give the implementing authority to the Department level, implying that potential users need to seek permission at their local municipality.

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[5] Norway is a member of the EEA not of the EU.

Germany
The installation of Food Waste Disposers is discouraged, but state and municipal regulations apply.

- 16 German communities either do not mention the discharge of kitchen waste into the sewage system at all or only state that it is prohibited to discharge substances/residues that may impair the functioning of the sewage system.
- 39 of the 50 largest German communities do not specifically prohibit the use of disposers but prohibit the discharge of substances, even if chopped up into pieces, into the sewage system that may impair on the proper functioning of the public sewage system.
- 11 German communities have wastewater ordinances, which specifically prohibit the linking of Food Waste Disposers to the public sewage system.
- The German Waste Recycling Act may be read in a way that households are obliged to hand over their household wastes to public waste handling entities

The Netherlands
Legislation is currently prohibiting the use of FWD, but the Ministry of Environment has at several instances confirmed that this ban is founded on principle rather than on scientific studies and empirical information.

Luxembourg
Food Waste Disposers are banned. It is stated within the grand-ducal regulation from 7th of December 1997, which stipulates "release solid waste, even after treatment into a grinder, into sewer water is banned" (Article 6, point 5).

Portugal
The decree of 1995 (Article 117) prohibits the evacuation of food waste which may impair the functioning of the piping works linked up to the public sewage system or the treatment of wastewater. However, numerous scientific studies show that this is not the case.

2.3.4 EU Standards and Norms

The CEN standard EN 12056-1:2000 specifically allows for the use of FWDs. Additionally, all household disposers in Europe must meet CENELEC standards EN 60335-2-16 and EN 55014. CENELEC standards are based on IEC international standards, a platform for open markets in world trade. Commercial disposers must meet the requirements of the Machinery Directive. All products must carry CE marking. As such, the importation and sale of FWDs is allowed throughout the EU.

2.3.5 Considerations

The most common argument against FWDs today is that the capacity of wastewater treatment plants is not sufficient. However, researchers and local authorities are to an increasing extent exploring the potential and capacity of Food Waste Disposers as a vehicle to integrate liquid and solid organic waste (i.e. food waste and human excrements) and as an alternative to source separation for composting (see more on this in chapter 5); In none of the above-mentioned countries are restrictions based on empirical research and evidence, but rather on the application of the precautionary principle. When representatives of EUREAU were asked at a consultation meeting on the biowaste working document in November 2000, they said that they were not aware that deposition in sewers or capacity at wastewater treatment works was a significant problem that would justify banning FWD. There may be individual [small] plants that are close to the limit of their treatment capability for which the load from FWDs would be a problem, but this is neither a general problem for all plants in the EU nor within a Member State.

CHAPTER THREE

CASE STUDIES

3.1 USA

New York City

FWDs had been banned in combined-sewer areas of the City of New York since the 1970's mainly as a part of the strategy to restrict the direct discharge of raw organic wastes into water bodies surrounding the City and to prevent deterioration of the City's sewer system. However, in the light of the growing use of FWDs elsewhere in the US, which had not brought about any significant adverse effects, and the pressure from plumbers, consumers, and others to lift the ban, the Mayor of New York City authorised a 21-month pilot program. Another key motivator for New York City Mayor Rudy Giuliani was to reduce the amount of waste going to landfill, as the City's main landfill was scheduled to be closed (and since has been). The main aim of this program was to study the potential effects of using FWDs in combined sewer areas. Focal issues included:

- the impact of grease and food leftovers on the operation of combined sewers,
- the impact on water consumption,
- the impact on the nutrient content of raw effluent,
- the impact on the loads to receiving waters (e.g. BOD, COD and suspended solids),
- the impact on wastewater treatment process and sludge management,
- the impact on solid waste management,
- adverse effects on the environment, public health and safety and
- the impact on the cost of operating the wastewater and sewer system.

The pilot program was carried out in three different locations in New York City where 243 FWDs had been installed in 18 buildings. The study comprised sampling, a videotape survey and projections for the analysis years 2000, 2005, 2010, 2025 and 2035.

The study showed that the potential impact of FWDs was so marginal that a ban was no longer justified and *the New York City Department of Environmental Protection* recommended that the FWD ban be abolished. A cautionary flag should only be raised in case of high penetration rates of FWD use, which in US had been estimated to grow by 1% per year. However, the Department assessed that a high penetration was unlikely in light of the relatively high unit cost for FWD and documented experience in other parts of the US. In terms of the sewer system, no noticeable deposits of suspended material were observed in the videotapes. The additional water demand was estimated to be 3-4.5 litres per capita per day with FWDs, translating into the amount needed for a single modern toilet flush. *The Department of Sanitation (DOS)* recognised the potential positive impact of FWDs on New York City's municipal waste management. The amount of food waste diverted from other waste streams was estimated to be 3 % of the total household refuse collection. Furthermore, based on the assumption that 38% of the City's households have a FWD installed by 2035 and that those households places 50% of the food waste into the FWDs, the DOS would save $4 million in solid waste transport costs.

University of Wisconsin study

In the University of Wisconsin study[6] the environmental and economic implications of five different waste management systems for 100 kg food waste were compared during a period of four years to establish which system was the most favourable. The waste management systems studied were:

- Food Waste Disposers connected to a publicly owned treatment plant,
- Municipal solid waste collection/landfilling,
- Municipal solid waste collection/energy recovery,
- Municipal solid waste collection/composting,
- Food Waste Disposers linked to an on-site septic system.

In terms of **life cycle costs**, the systems ranked in this order (lowest to highest):

- Municipal solid waste collection/landfilling
- Municipal Solid Waste Collection /composting
- Food Waste Disposers connected to a publicly owned treatment works
- Municipal solid waste collection/energy recovery (incineration)
- Food Waste Disposers linked to an on-site septic system

However, in terms of **direct costs to the municipality**, the Food Waste Disposer/Publicly Owned Treatment Works, combination is, by far, the lowest cost. The rankings are:

- Food Waste Disposer / Publicly Owned Treatment Works
- Municipal Solid Waste Collection / Land-filling
- Municipal Solid Waste Collection / Composting
- Municipal Solid Waste Collection / Waste to Energy (Incineration)
- The Food Waste Disposer / On-Site Septic Tank is the highest cost of all, but since all costs are borne directly by the homeowner, there is zero cost to the municipality.

In terms of the environmental findings of the report, the main conclusions were:

- Diverting food waste through Food Waste Disposers to a publicly owned treatment works is optimal when solid handling systems are adequate, methane is combusted to generate energy and the solid matters are processed into sludge which is returned to soil.
- Among the five different disposal methods Food Waste Disposers processing food waste through a publicly owned treatment works has the least air emissions (e.g. greenhouse gases), converts food waste to sludge which may be recycled (soil cultivation or gas production) and is a good vehicle for source separation of food waste from the solid waste stream.
- Food waste is typically made-up of 70% water, and is therefore better suited to be processed in a wastewater treatment plant than in a waste facility for solid waste (e.g. landfill, incineration).
- Food waste is rich in carbon which enhances the generation of biosolids (sludge), increasing levels of nutrients, nitrogen and phosphorus (enriches the sludge for agricultural purpose)
- Sludge from food waste provides a valuable element in the de-nitrification process at treatment plants, due to its low nitrogen level.
- Food waste is suitable for composting since the high water content enhances the composting process. However, this extra moisture requires more turning of the material so that the

[6] Life Cycle Comparation of Five Engineered Systems for Managing Food Waste (Carol Diggelman - University of Wisconsin Study – April '98). See Annex I for more detailed data on the results of the analysis of the five management systems.

process does not go anaerobic, prolonging the composting process and increasing the presence of foul odours. These can force the facility to be located in remote areas, which again increase the cost for hauling the waste and the CO2 emissions caused by the refuse lorries. Furthermore, the nutrients in the food waste can be better utilized in sewage sludge than in compost.
- Finally, FWDs is the most hygienic way of managing food waste in the households.

3.2 Sweden

The Swedish authorities have long maintained a restrictive attitude toward Food Waste Disposers. During recent years, however, several municipalities have shown interest in using waste disposers in their waste disposal systems. This has led to a number of smaller and larger-scale projects to investigate the pros and cons of using Food Waste Disposers. In most cases, the FWD system was chosen primarily for its environmental and ecological potential. A number of cities in Sweden, like Surahammar, Piteå, Smedjebacken, and Västerås have promoted the installation of FWD in households through tax incentives, as an integral component of their local waste management programs.

Staffanstorp (University of Lund study)

In 1990 a case study[7] was undertaken in the town of Staffanstorp to investigate the possibility of using FWDs as a tool for source separation of solid waste. The study involved 100 newly constructed apartments and sought to establish the attitudes towards the FWD technology and to study the effects of FWDs on a number of factors:

- the indoor environment,
- indoor transportation,
- transportation in the wastewater conduits,
- wastewater treatment,
- sludge treatment collection and
- transportation of solid waste and solid waste treatment.

The project was carried out over a period of two years. It included a literature review concerning conduits, treatment plants and waste management systems, a study tour of towns where FWD had been installed and laboratory tests concerning pipe clogging, noise levels, sedimentation measurements and grinding experiments.

In brief, the study showed that the environmental effects of FWD use were overall positive in terms of solid waste handling, while it increased the load of organic matter with 50% resulting in an increase of sludge at the wastewater treatment plant. No problems associated with the transportation in the sewers were detected and households had a positive attitude to FWDs. As a result of the study several cases were identified where the "FWD system would be a very good solution to the waste problem".

In terms of FWDs impact on the conduit system, the inspections and photos taken after 1,500 and 3,000 cycles showed that only minor deposits were found in the 50 mm pipe. No significant clogging of the pipes occurred. The test was carried out with cold water exclusively and no dishwashing detergent, soap or other solvents were added. The water consumption for operating the FWDs was also measured prior to and two months after the installation of the FWDs. Tests concluded that the "potential consumption increase was so minor that it would not have an

[7] Waste Management at the Source; Utilizing Food Waste Disposers in the Home – A Case Study in the Town of Staffanstorp, Project Manager: Peter Nilsson, University of Lund, 1990.

appreciable effect on the readings"[8]. The wastewater conduit was videotaped in an influshed condition after one year of FWD use and compared with the result of a 9 month period prior to the installation. The results showed that the condition of the external conduit was at least as good as without them. To measure the quality of the wastewater prior to and after installation of FWDs, sampling was carried out in the external conduit. Nine samples were taken without FWDs and fourteen with. Organic and suspended material represented the greatest increase, which was expected, as the rationale of the FWD is to shift a large proportion of the organic fraction of solid waste to wastewater. BOD increased with close to 50%, whereas nitrogen only increased by 12% and the increase of phosphorus was too small to be measured.

Surahammar

Food Waste Disposers were installed in 40 % of the households connected to the municipal sewage system, equivalent to 1,500 households in the County of Surahammar in December 1998. 96% of users were either happy or very happy with FWD use. According to the local waste management plan, the County of Surahammar offered households three sorting-at-source alternatives for the food waste; installation of FWDs, home composting and collection for centralized composting.

To document the effect of disposers on processes and operations of the municipal wastewater treatment plant, studies were carried out prior to the installation and after they were put into operation. Other investigations (e.g. sewage system and local resident survey) were also performed by Surahammar Country. In general, the study concluded that the waste disposers had no effects other than positive on the sewage system and the operations at the local wastewater treatment plant[9]. No overflow and no service interruptions at the wastewater treatment plant were detected during the period of investigation. Other pertinent conclusions include:

- A slight increase in the amount of screened matter was detected
- No increase in the amount of incoming nitrogen, phosphorous or BOD was detected from the water analyses. The quality of the ingoing and outgoing wastewater remained at the same average level (in terms of nitrogen, phosphorus and BOD7) as during the previous years
- The biological stage did not seem to be affected; the aeration demand did not increase
- The energy consumption in the biological treatment stage has not been affected by the influx of food waste to any greater extent
- The increase in gas production seemed to correspond to the theoretical biogas potential of the waste
- Tendency towards an increased influx of phosphorus in the wastewater
- No effects on the sludge treatment were detected

Typical problems associated with the use of waste disposers were blockages in the pipes within the building (poorly functioning piping), materials caught in the disposer and problems due to incorrect installation. A satisfactory majority of the households were content with waste disposers as an alternative to food waste being sorted at source.

Hammarby Marina

Hammarby Marina, (Hammarby Sjöstad) is the largest current residential construction project in Sweden. It will be constructed between January 2002 and December 2003. About 8,000 apartments will be built during the next ten years. In focus are resource-efficient and environmental methods of

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[8] Waste Management at the Source; Utilizing Food Waste Disposers in the Home – A Case Study in the Town of Staffanstorp, Project Manager: Peter Nilsson, University of Lund, 1990, p. 30.

[9] Food Waste Disposers – Effects on Wastewater Treatment Plants - A Study from the Town of Surahammar, Tina Karlberg & Erik Norin, VA-FORSK REPORT, 1999-9.

construction. Hammarby Marina will be at the forefront of ecological building technologies and will be an inspiration for ecological life styles.

After visiting the Swedish municipality of Surahammar, where FWD had been installed in 40% of the homes, representatives from Hammarby Marina Environment and Stockholm Water were convinced that they should seriously investigate the use of FWD as a means of food waste management in the Marina.

Bokenäs

In 1994 Volvo AB built a holiday village in Western Sweden on an island which is neither connected to local electricity nor to local sewage lines. Volvo's aspiration was to create ultra-modern and environmental friendly facilities for company employees. The leisure facilities include a conference centre and 103 apartments. The aim of the local waste management system was to minimise the environmental impact on the nearby water recipient. The central elements of the waste management system were comprised of a FWD in each apartment, a sewage treatment plant, a digestion tank and biogas equipment, all based on new computerised technology. All activities at Bokenäs are founded on the principle of recycling and source separation and all apartments are equipped with three containers for waste separation.

The wastewater treatment process begins with operating the FWDs which are installed in each apartment. These FWDs are used to grind up food waste. The ground waste is then further broken down by bacteria in a digestion tank along with WC waste. The waste is then degraded by way of anaerobic digestions, generating biogas. After four weeks in the digestion tank, the digested sludge is separated from the sludge liquor. The nitrogen-rich sludge liquor undergoes a process, which binds up 90-95% of the nitrogen through precipitation of the mineral struvite, and the remaining liquor is transported to the sewage treatment plant for conventional purification in three stages[10]. The dewatered sludge is then mixed with the struvite and dried, producing a high quality soil conditioner. The biogas generated during digestion is used as fuel for heating and electricity generation. A part of the water from the sewage treatment plan is reused for flushing the toilets to reduce the consumption of drinking water. The water, which is not reused, is pumped to the stabilisation ponds, where it is subject to further purification and oxygenation. At the end of the process, the purified water is led into the sea.

The Bokenäs ecological system is the first of its kind in Sweden. The project has therefore raised interest among local authorities, environmental agencies and environmental researchers.

Havslunden and Vitruvius (Malmö*)*

The Swedish construction company, JM, constructed a series of ecological apartments in two residential communities in Southern Sweden as part of a building project on display at the European annual housing exhibition in Malmö, (Bomässan, Bo01). The guiding principles for the two communities are carefree, comfortable and attractive housing while fulfilling the objectives of ecologically sustainable living. Apart from using environmentally sound construction material; the apartments are equipped with Food Waste Disposers. The housing exhibition is in general known for its environmental commitment and the general thrust towards the creation of an ecologically sustainable future city.

Inspektoren (Kalmar*)*

A fundamental renovation and reconstruction of the 159 apartments in the neighbourhood Inspektoren was commenced in 1993. The tenants requested that the renovation should be environmentally adapted as far as possible. Hence, the contractor took a number of measures to minimize the environmental impact of the construction. First, only environmental construction

[10] Brochure: Bokenäs – A holiday village built for people and the environment, p.1.

material was used and all demolition waste was sorted. Secondly, a holistic waste management system was introduced comprising separation of all waste materials and the use of Food Waste Disposers as a vehicle to separate food waste. The project was funded by the EU's Sustainable Refurbishment Europe Program (SUREURO).

3.3 Germany

University of Karlsruhe study

This study[11] aims at examining alternatives to separate biowaste collection. The focus is the transport of ground food waste along with wastewater in the sewerage system. The waste should be used as carbon source for the enhanced biological nutrient removal or as substrate for anaerobic digestion and biogas production. The study underlines the suitability of food waste for fermentation, as food waste cannot be composted without the addition of structural material due to the high water content[12]. In contrast, garden waste, which can be stored for a long time in a drum, is more suitable for composting. The study concludes that the economic and ecological pros and cons of alternative waste systems should be investigated on a case-by-case basis. Clear advantages of transporting food waste through the sewer system are a reduction in emissions from refuse lorries, a drop in fuel usage to operate these lorries and an improvement of hygienic conditions in homes. In the light of foreign experience, the authors put into question the existing rejection of FWDs, based on principle, in Germany.

University of Hanover study

Researchers at the University of Hanover sought to investigate the potential of co-digestion of organic waste by anaerobic treatment and the influences of FWD application on wastewater and sludge treatment[13]. This study departed from the standpoint that due to the high organic loads and high water content of organic waste, waste from food processing industries and food waste from households, are in principle more suitable for anaerobic treatment rather than for aerobic treatment. Improvements in wastewater treatment processes, has resulted in larger capacities in municipal digesters for the treatment of organic waste. Concerning the transport of organic waste to the wastewater treatment plant, the use of FWDs is regarded to be more effective for food waste from households (particularly in cities with a separated sewerage system), whereas transport via truck is recommended for industrial waste. This alternative waste management system is explored in the context of rising problems such as high costs for waste management, increasing garbage mountains, climate change, odour emissions, leachate from landfills, and a new German law promoting electricity from renewable energy sources including biogas from municipal digesters. In Germany, food waste is mainly collected in special bins ("Biotonne") and transported with truck to a central composting facility. However, in inner-city districts this system is not functioning properly due to:

- odour emission during all process steps,
- increasing fractions of biowaste in other waste fractions,
- high costs for road transport due to the high weight of wet food waste,
- insignificant rates of home-composting,
- lack of space for biowaste bins and
- unsatisfying collection rates for food waste.

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[11] Co-transport and Co-reuse, An Alternative to Separate Biowaste Collection?, Jörg Kegebein, Erhard Hoffman and Herman H. Hahn, Instititute for Municipal Water Treatment, University of Karlsruhe.

[12] Co-transport and Co-reuse, An Alternative to Separate Biowaste Collection?, Jörg Kegebein, Erhard Hoffman and Herman H. Hahn, Instititute for Municipal Water Treatment, University of Karlsruhe, p. 2.

[13] Influences on the Anaerobic Sludge Treatment by Co-Digestion of Organic Wastes, K.H. Rosenwinkel & D & Influences of Food Waste Disposers on Swereage System, Waste Water Treatment and Sludge Digestion. Wendler, Institute for Water Quality and Waste Management, University of Hanover.

The study recommends the introduction of FWD into existing wastewater systems, provided that the sewerage system is in good condition and the wastewater treatment plant contains a primary clarifier, a sludge digester and has free capacities in terms of wastewater and sludge treatment. FWDs are regarded as suitable co-substrates to ensure that the co-digestion of easily biodegradable waste (food waste) does not entail prohibitive costs, which otherwise would be the case would the installation of expensive pre-treatment devices be necessary.

3.4 Norway

Cities of Frøya, Hitra and Bardu

The use of FWD were incorporated in their municipal waste management programs when they offered households a 15% reduction on the installation of FWD as one of three solutions (the other two were home composting and local collection) to sort wet organic waste from other waste streams.

3.5 Italy

As in Sweden, promotion of the FWD system mainly takes place at local level, particularly in regions or cities where the conditions for it are favourable. For instance, Trezzano sul Navaglio has enacted local regulations in 1995 requiring the installation of FWDs in all new homes. Furthermore, the local government of Lombardy has shown interest in the FWD idea by granting funding for studies aimed at paving the way for extended FWD use. Also the city of Capri endorsed the installation of FWDs in households when it adopted an ordinance in December 1998, granting a subsidy of US $180 to citizens opting for a FWD at home.

CHAPTER FOUR

NEGATIVE CONSEQUENCES OF A BAN

4.1 Legal concerns

The principle of proportionality

According to the proportionality principle, set out in Article 5 of the EC Treaty, the EU is bound to ensure that its measures are justified and do not go beyond what is necessary to achieve the objectives of the EC Treaty and its implementation (secondary legislation). Furthermore, the disputed measures must be the least restrictive possible under the given circumstances. And even if the EU action achieves the aim it must correspond to the relative importance of this aim and may not impose excessive burdens on the individual. Finally, in the choice of measure to achieve the aim, the EU has to consider the relative costs and benefits of the relevant measure.

Firstly, it cannot be established that a ban on FWD achieves the objective of Article 174 of the EC Treaty, which stipulates that the EU policy on the environment shall contribute to pursuit of a number of objectives such as the preserving, protecting and improving of the quality of the environment and allow for the prudent and rational utilization of natural resources. There is not a single study supporting a ban on FWDs. The additional amounts of sewage sludge produced by the use of FWD add nutritious organic matter to sewage sludge, improving the quality of the end product. Hence, a ban on FWD would not contribute to the preservation or protection of the environment, rather the contrary. The aim of the proposed ban in the working documents preceding the biowaste directive is to prevent an unjustified increase of sewage sludge. This aim does not necessarily correspond to the objective of Article 174 (i.e. to preserve, protect or improve the quality of the environment or allow for the rational utilization of natural resources). Per se, the use of sewage sludge is not at odds with environmental objectives as long as it can be applied on farmland without any risks to the environment. Risks arise when the sewage sludge contains too high concentrations of heavy metals, to which industry is the main culprit. The proposed EC measure aims at preventing an increase of good nutritious sludge and not sludge from industry containing dangerous substances which cannot be used unless subject to special treatment at the wastewater treatment plant. Furthermore, a ban on FWD would not necessarily entail a corresponding increase in the participation rate of composting schemes as many people neither can, nor wish, to take part in composting schemes. It would not reduce the amount of food waste being landfilled either. In conclusion, more food waste would end up on landfills or being incinerated. This result would not support any environmental objectives and would be at odds with the aim of the Landfill Directive. In any case, the importance of preventing a significant increase in sewage sludge is secondary to the importance of allowing a widely recognized environmentally sound disposal method.

The principle of subsidiarity

Article 5 of the EC Treaty stipulates that the EU shall take action only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by the Member States and can therefore be better achieved by the EU. Environmental policy is a policy field of "shared competences" in which Member States have substantial discretion in choosing the appropriate form and methods for implementing EC legislation, as the Member States, or indeed the local authorities, are most familiar with the geographic, climatic and regulatory peculiarities of their region. For instance, the Landfill Directive and the Sewage Sludge Directive leave Member States with a large margin of appreciation in assessing the necessity to restrict the annual quantity of sludge used in different outlets and to decide upon the content of the national strategy to reduce the quantity of biodegradable waste being landfilled. Similarly, in most Member States it is the local authorities who decide the conditions under which Food Waste Disposers may be used, as they possess the relevant information about the dimension and capacity of local waste water treatment plants and the quality of the sewerage system.

4.2 Other concerns

The Environment

A restriction or a total ban of FWD would result in a reduction of the quantity of food waste separated from the normal waste stream for recovery such as compost, biogas or agricultural fertilizer. This effect is at odds with the objectives of the Sixth Environmental Framework Programme and the EC Directive on Landfill, which call for reinforced efforts to recycle or recover organic waste. It has already been seen from cases where separate collection has been introduced that a significant amount of waste is disposed in the "rest-waste". In households where FWDs are used there is less reason for not removing food waste from the solid waste stream. Therefore the recovery of this fraction of domestic waste as biogas and soil improver is likely to be greater where there are FWDs.

The Competition

The fundamental principle of the Internal Market is free competition. It has an overall positive effect on the economy and on the welfare of citizens and any restrictions must be thoroughly justified. A ban on FWD would constitute elimination of a recognised technique to collect and process food waste, to the detriment of competition, local authorities, citizens and industry. It deprives the local authorities and households of the freedom of choice of how to attain the recovery target of food waste set out in the Landfill Directive.

The Economy

A ban on FWD would entail prohibitive costs for stakeholders, notably manufacturers and suppliers of FWDs, plumbers, restaurant users and local authorities who have invested in the technique. It is a painstaking exercise to appreciate the precise costs for the industry but it would certainly affect a large number of stakeholders and result in many layoffs in FWD affiliated jobs across Europe.

The Trade

A ban on FWD would constitute a trade barrier between the EU and not only the USA, but also the rest of the world. Many FWD suppliers import most or all of their disposers from the US. With a ban this trade will no longer be possible. A ban not thoroughly justified on environmental and legal grounds could be challenged before the WTO, as it might constitute a disguised trade restriction.

The Public Health

Households storing or composting food waste and personnel involved in the collection and treatment of food waste are subject to certain health risks in terms of exposure to pathogens, aerosols, insects, rodents etc. Recent studies[14] reveal that endotoxins and glucans released from compostable material kept in the home prior to municipal collection and treatment can attach to soft surfaces such as carpets, beds and sofas, exacerbating or causing respiratory diseases such as asthma. Hence, for sensitive groups of the population such as elderly people and individuals susceptible to allergies, storage and/or home composting of food waste could constitute a major health risk.

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[14] The Influence of Inddor Storage of Compostable Waste on the Concentration of Microbial Agents in House Dust, Inge Wother, Jan Paul Zock, Jeroen Douwes, Gert Doekes, Dik Heederik and Bert Brunekreef, Department of Environmental Scientices, Environmetnal and Occupational Health Unit, Wageningen, Agricultural University.

CHAPTER FIVE

FOOD WASTE DISPOSERS – FROM SINK TO FIELD

5.1 Food Waste Disposers – Another approach

The FWD technology is both new and old. The FWD gained ground already in the 1940's but was then sold as a convenience device for the kitchen. However, during the 1960's the environmental debate concentrated on water treatment and, because the then current belief was that FWDs increased the load in the treatment plants and could endanger the conduit systems it was seen as an unsuitable technology. Hence, during the 1970s and 1980s the growth of the use of FWDs was marginal due to restrictive regulations. During the 1980s and 1990s focus shifted from wastewater handling to solid waste handling as the landfilled garbage mountains grew. As a consequence almost all local communities in Europe have established some type of source separation system for solid waste. Seen from this perspective, the use of FWDs should be regarded as one of several possibilities to separate food waste at source.

The cornerstone and first link of this way of transporting food waste is the disposer, which grinds the food waste into small pieces and evacuates it by the help of water. Located under the kitchen sink and based on the principle of centrifugal force, it brings kitchen scraps into contact with an abrasive fixed metal ring that reduces the scraps into very small pieces. The sewage produced in this manner reaches the sewage system through the domestic conductors and then the treatment plant (see illustrations in Annex II).

The FWD is designed to only grind food waste. Materials other than food waste (bottle caps, textile etc.) will lead to the device jamming. Subsequently, it is a natural selector of food waste ensuring that only food waste is ground up and transported to the wastewater plant via the sewer. This can be compared to composting schemes where the quality of collection and composting largely depends upon the education and goodwill of the participants.

It is estimated that grindable food waste represents approximately 35% of the total amount of household waste, translating into 235 g per person per day or 85 kg per person per year[15]. Hence, the potential use of FWD is relatively large.

An important American study[16] demonstrated that between five different systems, the one consisting of FWDs/Sewerage/Treatment Plant was the best, in consideration of 12 different economic and ecological parameters. The other four systems considered were: (1) street collection/land filling (2) home collection/composting (3) street collection/incineration (4) FWD/private treatment. However, even if this may not be correct in all situations, local authorities are often best equipped to determine the appropriate waste management method as they are the best informed about local conditions, the capacity of wastewater treatment plants, the preferences of households etc.

5.2 Sewerage System

This is the most fragile element of the system because of the characteristics typically connected to local environmental situations (slopes – maintenance status – mixed or separated pipes, etc.). To

[15] Waste Management at the Source; Utilizing Food Waste Disposers in the Home – A Case Study in the Town of Staffanstorp, Project Manager: Peter Nilsson, University of Lund, 1990.

[16] Life Cycle Comparison of Five Engineered Systems for Managing Food Waste (Carol Diggelman - University of Wisconsin Study – April '98).

minimise the risk of clogging or sedimentation, European and international standardisation bodies have established standards for both the FWD unit (CENELEC EN 60335-2-16 and EN 55014) and the connecting pipes (CEN EN 12056 –1:2000). Furthermore, existing studies and practical experience over 65 years conclude that no particular clogging or sewer overflow problems have been recorded[17]. According to these technical studies only negligible problems occurred in the transportation of ground up food waste in the sewers. Laboratory studies[18] conducted in Italy did not show significant increases of deposits or the formation of biogas within the sewerage pipes with consideration of the average holding time for an Italian city.

Experience shows that penetration levels of up to 15–20% of established users do not result in significant variations in the characteristics of the arriving sewage. Between 20–35% penetration, an increase in energy consumption of the system is observed due to the greater respiration of the active biomass and a larger production of excess sludge. Beyond 35–40% diffusion, additional works must be done to the treatment plant. It should be noted that European penetration levels will not exceed 15% in the next 25-30 years. This is consistent with all other studies from around the world. Normal replacement and development of sewerage works will allow for accommodation of the increased load associated with FWD's.

Furthermore, contrary to popular belief the operation of FWD does not give rise to substantial increase in drinking water consumption used to flush down the ground up food waste. The increase in water use has been calculated at 2.1 m^3/year per typical family (2.7 individuals)[19] or 3-4.5 litres/(resident day), approximately the amount of a single modern toilet flush. Even under worst-case scenarios the change in water consumption following Food Waste Disposers is deemed insignificant[20].

5.3 The Treatment Plant

The capacity of the Treatment Plants is essential for a sustainable waste management policy. This capacity differs a lot between the Member States. In Finland and Sweden, the majority of the population was connected to sewers with wastewater treatment early in the 1980s. In Spain however, only around half of the population had their wastewater treated in treatment plants by 1995. Improvements are though on its way. According to the Urban Wastewater Treatment Plants Directive (UWWT) the capacity of treatments works is expected to be greater than, or equal to, the organic load in most Member States by 2005. The treatment capacity should increase 69 % by 2005.

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17 Food Waste Disposer – Effects on Wastewater Treatment Plants (A Study from the Town of Surahammar – Sept. '99); Waste Management at the Source; Utilizing Food Waste Disposers in the Home – A Case Study in the Town of Staffanstorp, Project Manager: Peter Nilsson, University of Lund, 1990 & Life Cycle Comparison of Five Engineered Systems for Managing Food Waste (W.F. Strutz - University of Wisconsin Study – April '98).
18 Acque Reflue e Fanghi (A. Frigerio, M. Schieppati - Gruppo Scientifico Italiano Studi e Ricerche – February '98).
19 Acque Reflue e Fanghi (Gruppo Scientifico Italiano Studi e Ricerche – A. Frigerio, R. Schieppati, February '98).
20 The Impact of Food Waste Disposer in Combined Sewer Areas of New York City (N.Y.C. Department of Environmental Protection).

Development in the capacity of treatment plants in EU Member States

	1992	1995	1998	2000	2005	Increase	
	1000 p.e.	1000 p.e.	1000 p.e.	1000 p.e.	1000 p.e.	1000 p.e.	%
Belgium	5.499	6.836	7.77	8.3	9.919	4.42	80
Denmark	5.95	9.246	9.246	9.246	9.246	3.296	55
Germany	111.456	131.403	141.221	142.022	143.831	32.375	29
Greece	2.058	2.785	5.028	8.624	8.637	6.579	320
Spain	23.872	30.152	45.713	60.862	73.754	49.882	209
France	40.333	51.188	60.761	66.924	69.378	29.045	72
Ireland	483	550	698	3.641	3.81	3.327	689
Luxembourg	777	808	939	948	969	192	25
Netherlands	21.396	21.705	22.053	22.053	22.053	657	3
Austria	14.413	14.413	16.945	18.864	19.467	5.054	35
Portugal	5.731	6.66	11.194	15.873	16.387	10.656	186
Finland	3.598	3.772	3.905	3.925	3.935	337	9
Sweden	13.038	13.038	13.038	13.038	13.038	0	0
United Kingdom	29.335	46.841	50.964	74.233	75.323	45.988	157
Total	**277.939**	**339.397**	**389.475**	**448.553**	**469.747**	**191.808**	**69**

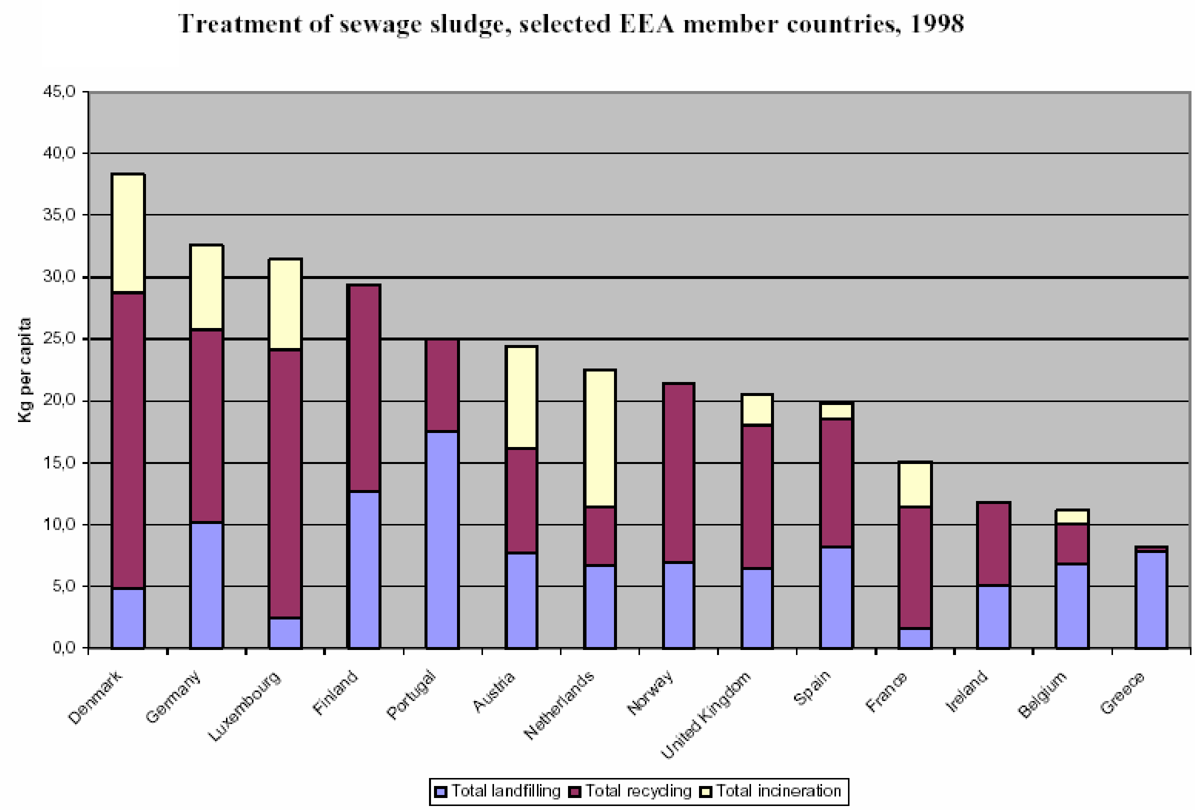
Source: (E8) Urban wastewater treatment, European Environment Agency

5.4 The Sludge

The use of FWDs generates primary sludge because it is held in the primary settler or by the fine screen. This sludge is richer in nutrients than many other types of sludge. Furthermore, the organic matter can be used to produce biogas. The European Environmental Agency has estimated that the proportion of sludge used for agricultural and soil conditioning will have risen by 73% in 2005, totalling 53% of the sludge produced[21].

Evidence is growing from an increasing number of sites that, even where there is separate collection of kitchen waste, the quality of source separation is not good enough to enable useful compost to be made. At Holbaek in Denmark an expensive tunnel composting system from source separated domestic waste has been abandoned because the finished compost was fit for nothing but landfill or incineration. It has been replaced with a mechanical separation stream that extracts biodegradable pulp [for biogas production] from domestic waste and sends the rest [high calorific value] to incineration with energy recovery. At Herning 2 co-digestion facilities (Sinding and Studsgaard) have ceased treating source separated biowaste because of accumulation of plastic in the digesters. Another co-digestion facility at Grindsted has to clean its digester of floating plastic 2-weekly. These are all rural communities, they demonstrate that source separated domestic biowaste is not clean enough to produce useful compost and that FWD would have been a better solution.

[21] Indicator Fact Sheet Signals 2001 – Chapter Waste, Sewage sludge – a future waste problem?, European Environment Agency, Copenhagen.



(W5.2) Treatment of sewage sludge, selected EEA member countries, 1998

Source: ETC/W survey May 2000 and information from report from Member States to the Commission concerning sewage sludge treatment, November 1998, following directive 86/278/EEC on sewage sludge

Furthermore, the proportion incinerated is expected to rise resulting in a further reduction in the amount landfilled. The upcoming revision of the Sludge Directive is expected to strengthen this tendency. Sludge unsuitable for application on farmland can be used in wooded areas, for infrastructure and recreational developments such as golf fields and public gardens. Additionally, in areas in which desertification and erosion are important problems, its use may be considered a valid alternative.

The organic fraction of household waste amounts to about 40% in weight. It is mainly made up of garden cuttings, food waste, paper, cardboard[22]. Food waste from households comprise vegetable waste, used coffee grounds, tea filters and food scraps (mainly cooked food). Particularly, cooked food and vegetable scraps have a high water content (at least 70%). Many scholars[23], waste management companies, local authorities and households recognize that the collection of food waste in inner-city districts is problematic. The collection rates are normally low and the storage of food waste cause foul odours and hygienic problems both for the households and the staff handling the collected fractions. For instance, in the Netherlands where composting and collecting schemes have been state of the art for the past decade, households, waste management companies and local authorities are in serious doubt as to whether this system is environmentally and economically sustainable, particularly in inner-city districts. It appears that the biowaste collected is not sufficiently "green" and that a substantial part of this waste fraction is more suitable for

[22] Influences of Food Waste Disposers on Swereage System, Waste Water Treatment and Sludge Digestion. Wendler,
[23] Influences on the Anaerobic Sludge Treatment by Co-Digestion of Organic Wastes, K.H. Rosenwinkel & D & Influences of Food Waste Disposers on Swereage System, Waste Water Treatment and Sludge Digestion. Wendler, Institute for Water Quality and Waste Management, University of Hanover.

incineration, giving due account to both environmental and economic factors[24]. People are also growing weary of the foul odours and hygienic issues[25] arising from collecting food waste in their apartments. The participation rates are therefore rather low. Municipalities are also faced with high costs of operating the collection schemes and this is one reason for the tendency of granting exemptions to some town areas from the obligation to run dedicated collection schemes for food waste.

Moreover, the wet fraction of organic waste is also causing some difficulties for the composting industry. The obstacles encountered are primarily linked to product purity (e.g. excess of salts and various impurities and a low content of nitrogen and phosphorous), which deteriorate the end product to the detriment of the final user. Hence, a large part of the wet waste, which has been separated by citizens, ends up either being incinerated or used as a filler of dumps, highway elevations or environmental renovations. It follows that only a limited part of this waste is eventually processed into soil improvers sold for agronomic use in flower cultivation, agricultural fertilizers and leisure gardening. It also appears that the profit (return on investment) from composting is poor, both from an economic and environmental perspective[26].

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[24] Article in Binnelands Bestuur of 8 January 1999: "Kitchen waste, in a little while, as was usual in the past, can be put into the grey plastic garbage bag - Separation of GFT (vegetables, fruit and garden) waste with a CO2 smell (unofficial translation).

[25] The Influence of Inddor Storage of Compostable Waste on the Concentration of Microbial Agents in House Dust, Inge Wother, Jan Paul Zock, Jeroen Douwes, Gert Doekes, Dik Heederik and Bert Brunekreef, Department of Environmental Scientices, Environmetnal and Occupational Health Unit, Wageningen, Agricultural University.

[26] Article in Binnelands Bestuur of 8 January 1999: "Kitchen waste, in a little while, as was usual in the past, can be put into the grey plastic garbage bag - Separation of GFT (vegetables, fruit and garden) waste with a CO2 smell (unofficial translation).

ANNEX I

ADVANTAGES AND DISADVANTAGES CONNECTED WITH THE USE OF FOOD WASTE DISPOSERS

USER	
ADVANTAGES	DISADVANTAGES
Simplification of the selection of the organic fraction from the remaining MSW fractions Elimination of placement of wet waste into common collection containers (boxes) Elimination of temporary storage of food waste needed because of the time frames and frequency of collection Elimination of unpleasant odours and insects and animals attracted to the waste Elimination of the risk of pathogens from the aerosol generated by the fermentation of stored waste Convenience for the consumer in the everyday management of food waste	Slight increase of water consumption calculated at approximately 1% of the average consumption of a typical family (about 4 Lt./Kg. of food waste) Negligible increase in electric energy consumption valued at approximately 0.1% of the average consumptions of a typical family (average operation time 4 min/day or 8.5 Kwh/year (5)) Cost of purchase and installation of device The risk of clogging domestic drains (particularly if old or small pipes) can be prevented by cleaning the pipes prior to the installation of the FWD

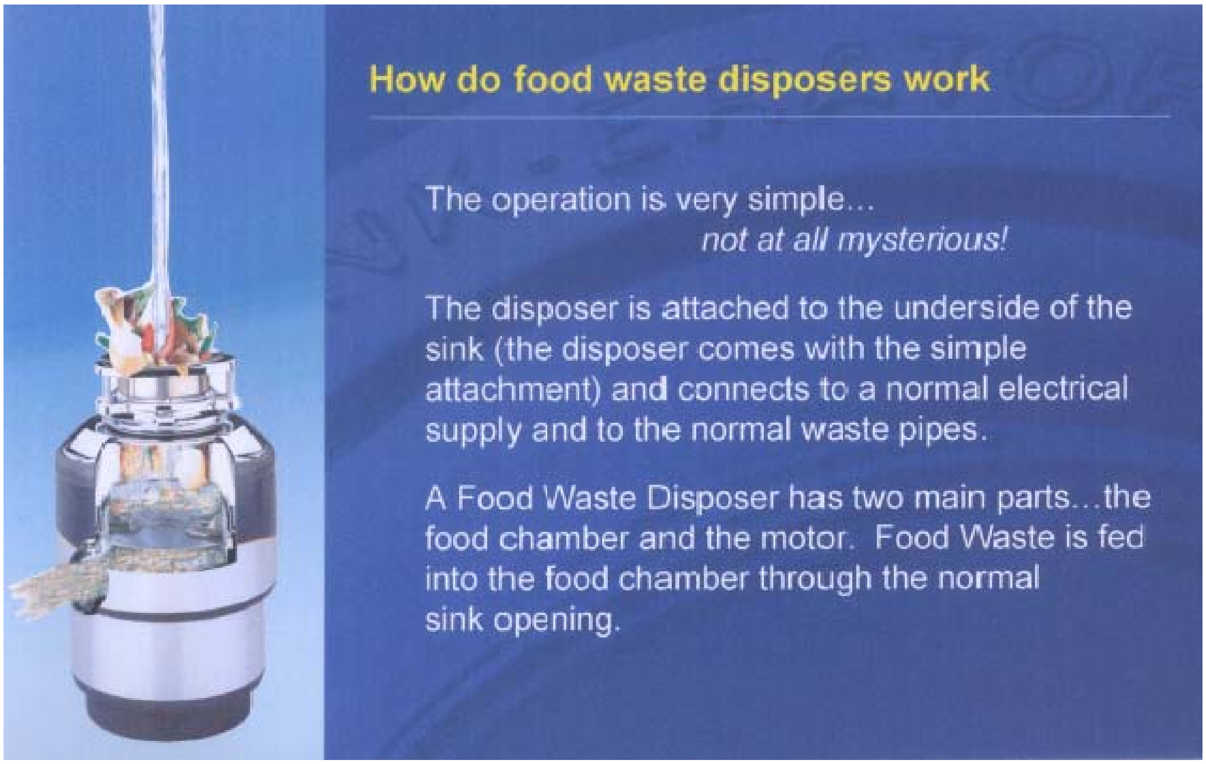
PUBLIC DECISION MAKERS AND MANAGERS	
ADVANTAGES	DISADVANTAGES
Low “political” profile of the decision compared to the problems typically connected to choice of dump sites, composting and incineration centres Excellent acceptance on the part of users, especially once they have “learned” the optimal use of the device Modular system: installations of devices can be controlled and managed locally (or in extreme cases banned) due to the increase in the number of machines if serious problems arise in the sewage/treatment plant system Savings of management costs in the treatment plant process by the introduction of waste carbon at no cost (de-nitrification process) (*) Production of biogas possible given the increase of fermented substances in the primary and secondary sludge (*) Greater combustion efficiency in the incinerators by the elimination of water in food waste, on average constituting 70% of their weight (*) (**) Reduction of costs through the decrease of amounts collected (*) Reduction of costs through the decrease of collection frequency (from bi-weekly to weekly/bi-monthly) (*) Reduction of costs connected to emergency decisions related to the presence of putrescible fractions (inodorous and toxic) Reduced costs: do not have to supply special bags, or collection vehicles or undertake education	Possible slight increase in the number of cleaning operations of sewerage system Possible need of thrust points in the lack of minimal slopes in the sewerage Adjustment of wastewater treatment system engineering if the degree of penetration of FWDs rises above a certain threshold, on average estimated at between 30% and 40% (highly unlikely in the next 25-30 years) Additional cost to the wastewater treatment works for treating the extra load and using or disposing the extra sludge. This is more than offset by the value of heat and power from biogas if there is anaerobic digestion and CHP, but where there is no CHP it is a cost.

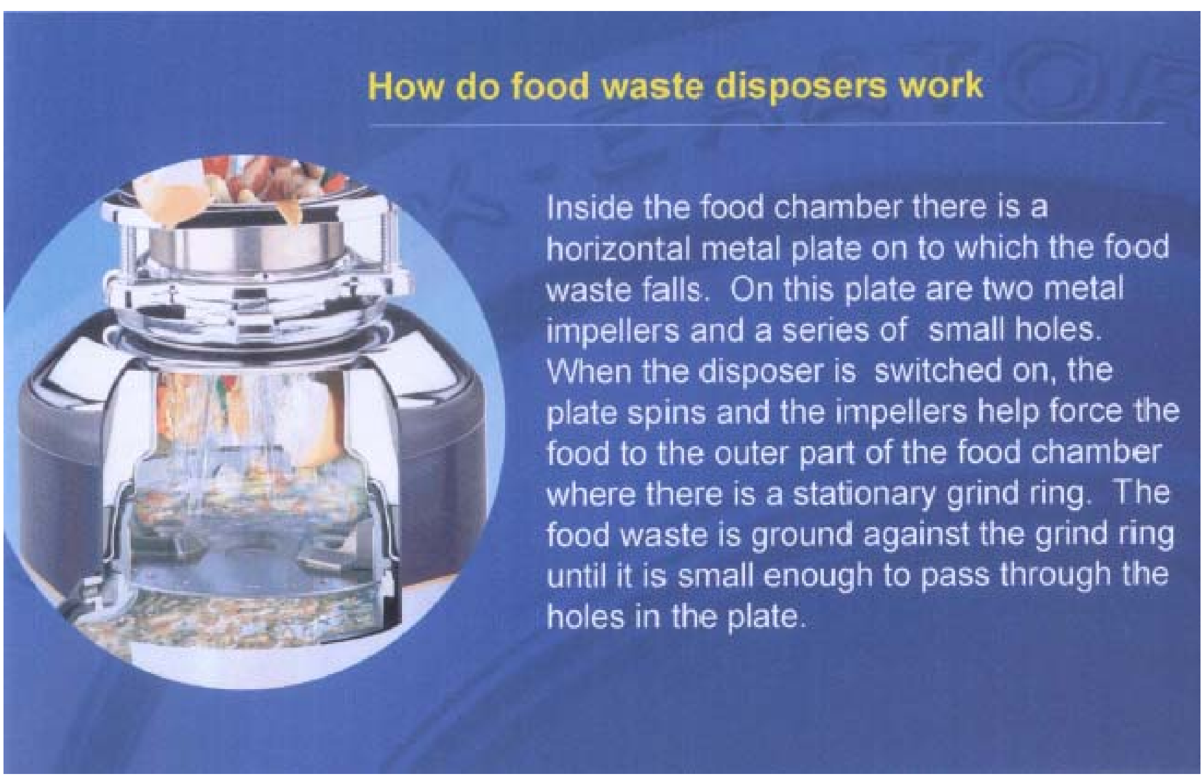
programmes about what to put in the biowaste and what to exclude. The fibre from biowaste improves dewatering of the digestate. The increased food: microorganism ratio can improve biological nutrient removal from wastewater, decrease the need to use chemical removal (cost), and improve effluent quality. (*) University of Wisconsin study April '98 (**) In the cited study, it is suggested that considering the low thermodynamic performance of incinerating the organic fraction the FWD/treatment plant system should be increasingly promoted as the best way of recycling, as it is "accepted" in the case of other non-combustible fractions (glass and metal)	

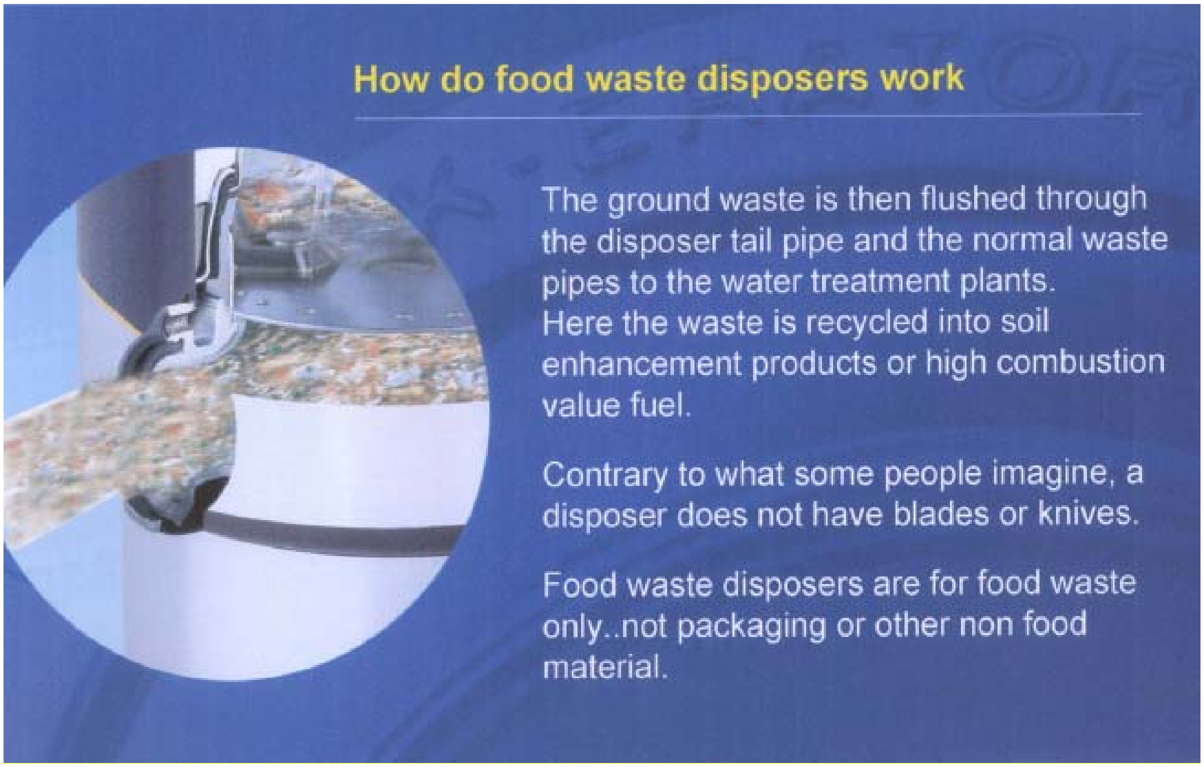
ENVIRONMENT	
ADVANTAGES	DISADVANTAGES
Reduction of "greenhouse effect" gas emissions, mainly of methane and carbon dioxide. In the case of methane, it has been calculated that 100 kg of waste treated with the FWD/treatment plant system or with collection and disposal in dump, the weight ratio of the quantity generated is 1:17.000 if the dump were equipped with an optimal system of gas conveyance, it is estimated that 34% is nonetheless lost in the atmosphere. In this case, the ratio would go down to 1:6.000. Reduction of exhaust gas of the transportation vehicles used for collection Decrease of landfill leachate (strongly acidic) that in the case of controlled dumps must be then disposed of in the water purifying systems with new transportation of the waste that has taken on the aspect of sewage Reduction of the percentage of heavy metals in the treated sludge with resulting improvement in its quality Improvement of separate collection of other fractions in terms of amount and quality Prevent slippage of waste streams other than food waste into the public sewer	A slight increase of water consumption for the operation of the FWD

ANNEX II

HOW DO THEY WORK? – GRAPHICAL PRESENTATION






How do food waste disposers work
The ground waste is then flushed through the disposer tail pipe and the normal waste pipes to the water treatment plants.
Here the waste is recycled into soil enhancement products or high combustion value fuel.
Contrary to what some people imagine, a disposer does not have blades or knives.
Food waste disposers are for food waste only..not packaging or other non food material.

ceced

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