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SOME ASPECTS OF NORWEGIAN EXPERIENCE WITH WASTE MANAGEMENT

1. Introduction

The amount of waste of all kinds produced by human societies is increasing in quantity. There has never been so much waste generated in Norway as today. In 1950 each Norwegian generated about 25 kg waste. Last year the amount was 324 kg per capita [www.miljostatus.no/Tema/Avfall/], and the mountain of garbage is growing with the growing economy.

The generation of waste and lack of adequate waste management represents a serious and growing threat to the natural environment and to human health, both locally and globally. Strong political and industrial measures are urgently needed to change this trend. Waste gives rise to a number of environmental problems in modern society. Serious environmental impacts are caused when material at the end of its lifecycle is deposited on a landfill or incinerated as waste. Inadequate waste-management results in toxic substances polluting the air, soil and water, emissions of greenhouse gases and the loss and depletion of natural resources.

In Norway waste management has been a prioritised political topic over the last decade. This paper will explore some of the challenges facing waste management in Norway and briefly discuss how Norway is dealing with these challenges. Some aspects of Norwegian experience with waste management might be useful to people, organisations or authorities in other countries and regions.

* *The Future in Our Hands* is a Norwegian environmental non-governmental organization with more than 20,000 members.

2. Some environmental challenges of waste management in Norway

The severity of the environmental impact of waste treatment and disposal depends on the volume of waste produced, its composition, the amount illegally disposed, the amount sent to final disposal and standards at treatment plants. The future impact of waste management will depend on how these factors change. Final treatment of waste means landfilling or incineration, and these two treatment methods result in different environmental impacts.

Landfilling leads to the generation and release of methane, a greenhouse gas, and of hazardous chemicals, which will also affect the environment. Methane from waste accounts for about 7 percent of Norway's greenhouse gas emissions and thus contributes to global warming [www.miljostatus.no/Tema/Avfall/avfall.stm]. Landfilling also represents a threat for coming generations, as emissions of gases and chemicals continue for a very long time after waste is dumped.

Incineration of waste leads to emissions of flue gases containing hazardous chemicals such as dioxins, dust and acidic components. In 1999, waste incineration accounted for 4 percent of Norway's total registered cadmium emissions into the atmosphere, 10 percent of mercury emissions and 4 percent of lead emissions. Even with the newest technology, incinerator ashes contain high levels of heavy metals and unburned toxic chemicals that must be treated as hazardous waste and represent serious environmental threats.

It is estimated that every year more than 30,000 tonnes of *hazardous waste* is dumped somewhere in Norway without any regulation [www.sft.no/nyheter/dbafile6884.html]. We are today just starting to see the consequences of "yesterday's sins". We simply do not know the exact consequences when thousands of new chemicals are being introduced to the environment. But we do know that many of them will contaminate ecosystems and affect human health. The following are, unfortunately, only two of many similar examples:

a) Observed levels of PCB and dioxins along the Norwegian coast are now so high that salmon farmers have to import much of their feed from other parts of the world. If farm salmon only eat feed produced from Norwegian fish, their meat will exceed safety health standard limits [Størm, 2002]. PCB continues to leak from landfillings into the Norwegian fjords.

b) Polar bears, to many a symbol of virgin Norwegian arctic nature, are observed to have malformations in their reproductive organs and reduced immune system, due to high levels of organic pollutants (POPs).

An increasing number of female bears are reported to have developed deformed penises, probably as a consequence of high PCB-levels [www.miljostatus.no/Tema/Polaromradene/forurensing/]. PCB is now prohibited in Western Europe, but continues to accumulate in arctic food webs: PCB is transported by wind and ocean-currents from all over the world, including from landfillings in Norway.

3. The state of Norwegian waste management

About 23.5 million tonnes of waste is produced annually in Norway. Of this, 3.1 million tonnes is mining debris; 13 million tonnes is soil, rock and concrete from construction work; 1.2 million tonnes is building waste; 4.9 million tonnes is generated by industry and other commercial activities, and 1.35 million tonnes by households. A total of 0.65 million tonnes of hazardous waste was generated last year. Norwegians generated 324 kilos of household waste per capita in 2001 [<http://www.miljostatus.no>, www.ssb.no].

Table 1. Total amount of waste of different types. Statistics from 1996 and projections for 2010

Type of waste	Mass [t]		Growth [%] 1996-2010
	1996	2010	
Paper	920 827	1 173 381	27
Metals	580 066	690 129	19
Glass	121 420	156 975	29
Organic (wet)	1 555 812	2 044 718	31
Others	2 550 642	3 025 006	19
Toxic waste	650 000	728 405	12
Total	6 378 767	7 818 614	23

Source: Statistics Norway: www.ssb.no

Norwegian legislation on waste management has seen important development during the 1990's. Norway has adapted most of the major principles of EU legislation, such as the polluter pays principle and the principle of extended producer-responsibility. Implementation has been relatively fast and collection and recycling systems have been introduced for several important types of waste. Norway's emission standards for landfills and incinerator plants have been tightened a great deal in recent years and emissions have dropped as a result. Methane, material and

energy recovery from waste is increasing, which reduces the impact on the environment and means that the resources in waste are better used.

Waste management is regulated in various ways, and there is an interplay between regulation at central and local levels. Central government authorities set the general framework, leaving municipalities and industry with a relatively free hand to design local solutions for collection and treatment. The authorities have already put in place a number of instruments (e.g. legislation, taxes, economic incentives) targeted at municipalities, business and industry. In spite of all the measures taken, the amount of waste is expected to increase by about 20 percent by 2010. Environmentally sound management of hazardous waste has been a national goal since 1990, but still more than 30,000 tonnes of hazardous waste is deposited without any regulation every year. The generation of hazardous waste is expected to increase by 10 percent by 2010 [www.sft.no/nyheter/dbafile6884.html].

4. More waste is being recycled...

Waste contains resources, both energy and material, which can be recovered in the recycling process. Recovery of material involves using the materials as inputs in the production of new goods while energy is saved by not using virgin materials. Some organic waste with high energy content can be used for generating energy.

The proportion of household waste that was recycled increased, from 9% in 1992 to 33% in 1998. In 1998 about 53% of all industrial and household waste was utilized either as a source of energy or as raw material in recycling plants. The remaining 47% was delivered for final treatment, such as landfilling or incineration without energy recovery.

The quantity of waste recycled has risen so much that the amount of waste landfilled and incinerated has declined slightly, despite the rise in the total amount of household waste generated. Waste volumes from industry have somewhat reduced over the last few years. This is largely due to improved waste-minimizing production processes and the fact that the business and industry sector is showing a growing interest in using the environmental attractiveness of its products as a marketing strategy. The government has made a voluntary agreement with companies producing and selling electric and electronic products, which has resulted in about 50% of the material in these products being recovered. In Norway the EU Directive on packaging is being implemented as an agreement between the government and the private sector. This has reduced the volume of packaging per product unit and increased the recycling rates of paper and plastic.

The stated goal for 2010 is that 75% of all waste should be recycled, either in the form of material recovery or as energy [http://www.miljostatus.no].

Table 2. Treatment of some types of waste in 2001 [%]

Material/Treatment	Paper	Plastic	Textiles
Recycled	47	2	7
Burned	12	15	16
Deposed	37	60	68
Unknown	4	23	9

Source: Statistics Norway: www.ssb.no.

5. ...but economic growth is likely to outweigh the benefits

Economic growth, or growth in production and consumption, is the key driving force behind the escalating waste volumes in Norway (see Figure 1) [http://www.miljostatus.no]. Larger homes, higher housing standards, frequent decoration and reconstruction, and increased spending on furniture and household appliances are typical examples of how affluence generates waste. Our lifestyle also dictates how much waste we produce. A hectic schedule makes disposable products attractive, and buying new products can be more appealing than repair.

Although the proportion of household waste recycled increased from 1992 to 1998 by 25%, we are continuing to produce and consume at

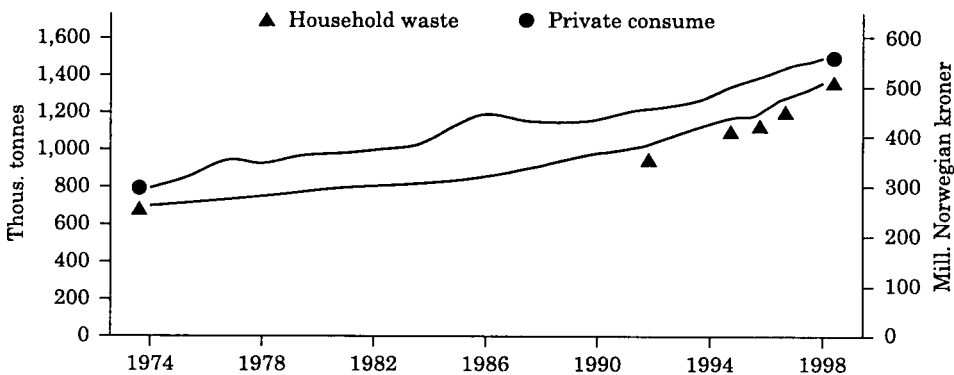


Fig. 1. Trends in household waste and consumption, 1998

Source: Norwegian Department the of Environment: <http://odin.dep.no/md/engelsk/>

increasing levels, and the growth in volume is likely to outweigh the effects of more efficient waste management. Between 1974 and 1999 the average amount of household waste generated per person per year rose from 174 to 314 kg, or by 80% in 25 years [www.ssb.no]. From Table 1 we see that this trend is likely to continue. If we take into consideration that energy and material is being used in the recycling process, the net gain is reduced even more. In a scarcely populated country like Norway logistical problems are obvious. One study indicates that outside of the biggest cities, collecting paper and glass for recycling is not worthwhile due to the costs and environmental impacts of transportation [www.ssb.no].

It is important to keep in mind that the amount of waste generated by a society only is a symptom of the pressure that society is putting on the ecosystems. Although we need much less land, materials and energy to produce a given amount of welfare today than 100 years ago, the consumption rates of these resources are much higher today. For example: the Norwegian population today consume 8–9 more lead (Pb), 11 times as much energy, 13 times more zinc (Zn), 20 times more iron and steel, 40 times more cement, 180 times more electricity, 220 times more chemical fertilizer and 3000 times more aluminium than we did 100 years ago [Hille, 2000] and we emit 10 times more CO₂. This insight provides a frightening perspective for future pressure on the world's resources and the need for efficient waste management systems, as economic growth is expected to continue in developing, as well as developed countries.

6. Concluding remarks

Norway has succeeded in increasing the rate of recycling and important steps are being taken to reduce and secure landfills and to clean incineration processes. It is important to continue and intensify efforts such as:

- Agreements with industry to take responsibility for the life-cycle of products.
- Prohibiting landfilling of organic material.
- Cleaning up landfills that contain hazardous waste.
- Reducing incineration without recovering energy.
- Minimising the incineration of all but clean and dry organic waste.
- Facilitating recycling for households and industry

However, while such measures are necessary, the experiences from Norway show that they will do little more than limiting the growth of environmental impact. The ultimate goal is to minimise the amount of

“virgin materials” consumed by society and to achieve short and closed material cycle. The environmental problems of waste will not be solved by solely cleaning up old landfills, developing new technology or increasing recycling rates.

So far the efforts made by Norway to disconnect waste generation from economic growth have not been successful. We know as a fact that we will produce even more waste in the years to come, and the market is failing to regulate emissions and environmental impacts. We believe that a holistic approach focusing on minimising the environmental impacts of total consumption patterns is needed. Greater public awareness of waste problems and involvement in the waste debate are necessary factors in reversing growth trends and in reducing the amounts of hazardous substances in products. The following are some suggestions that may help to minimise waste generation and environmental impacts:

- Differentiated fees according to waste volume should be introduced for both households and industry. It should be expensive to generate more than a certain volume of waste.

- Producer-responsibility should be introduced in all industrial sectors. Ideally the environmental costs both during production and final treatment should be internalised into the price of all products.

- International cooperation and standards are needed to reduce the amount of hazardous substances in products and to design products that can be easily recycled.

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