POLICY FOR IMPLEMENTATION OF SUSTAINABLE WASTE MANAGEMENT BASED ON 40 YEARS EXPERIENCE IN AUSTRIA AND EUROPE

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ABSTRACT

Sustainable waste management is an extremely complex issue. Therefore an optimum mix of specific policies is needed to prevent and minimize the negative impacts of waste disposal. In contrast to the Laissez-faire approach, there are three basic principles which can be combined for a most effective approach in waste management policy:

* Legal restrictions (to command, monitor, control and enforce – "the stick")
* Economic subsidies for innovation and implementation (to motivate – "the carrot")
* Emission fees, e.g. a disposal tax for land filling of wastes (to effectively "internalize external costs" according to the "polluter-pays-principle" in a market economy). The level of taxation should also consider the environmental standard of the landfill. The quality of waste to be landfilled and should be foreseeable in its significant increase for an operational period of 10 to 20 years.

Austria has introduced increasingly stringent restrictions on disposal of wastes, including a legal ban for any waste exceeding 5% TOC (Total Organic Carbon) by 1.1.1997 in new landfills and by 1.1.2004 on existing landfills (with some limited exemptions until the end of 2008). The disposal of hazardous wastes in landfills has been banned since July 16, 2001. The collected landfill taxes are being used for investigation and clean-up of abandoned waste disposal and contaminated sites with hazardous impact on human health and environment. Due to the overal policy mix comprising legal restrictions, subsidies and increasing disposal fees, it became necessary (and profitable) to develop new technologies and to implement new facilities. However, several of the proposed projects failed due to local political conflicts, usually combined with delays in receiving legal permits for project implementation within an acceptable time frame. Austria, together with Switzerland and West Germany, have become worldwide leaders in sustainable waste management due to their ambitious development in waste management policies and technological innovations during the 1980s and 1990s.

KEYWORDS

Waste management, legal framework, landfill taxation, external costs, subsidies, diversion from landfilling, innovation, sustainability, Circular Economy, zero waste disposal, Austria, EU, know-how transfer.

INTRODUCTION

> *"In many regions in the world, the present waste management can be best described as "WILD WEST" (i.e. out of sight – out of mind) characterized by ignorance of 1st and 2nd Law of Thermodynamics, by the wasting of resources, by environmental pollution and health hazards".*
>
> *(F. Neubacher, Environmental Protection Fund, 1984)*

With the steady growth of industrialisation and material prosperity in Western Countries since the 1960s, severe environmental pollution (Figure 1) and waste disposal practice in landfills (Figure 2) was increasingly perceived by the public as a serious problem and a source for conflicts of interests.

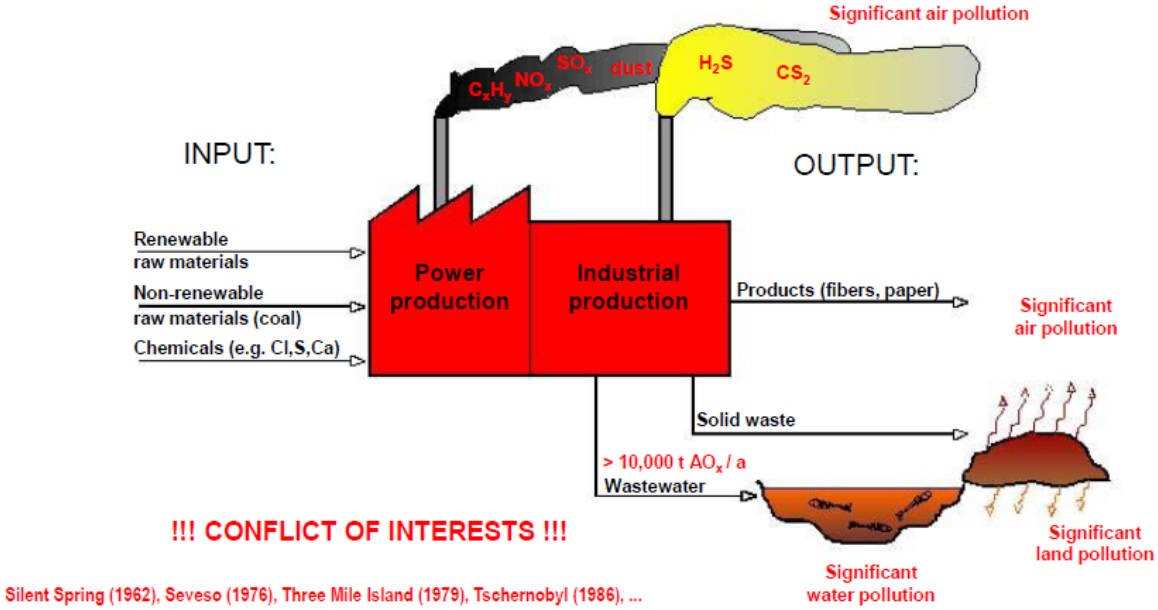


Figure 1: Environmental pollution by industrial production – for example in the production of paper and manmade cellulose fibre production in Austria (since the 1940s until the 1980-1990s)

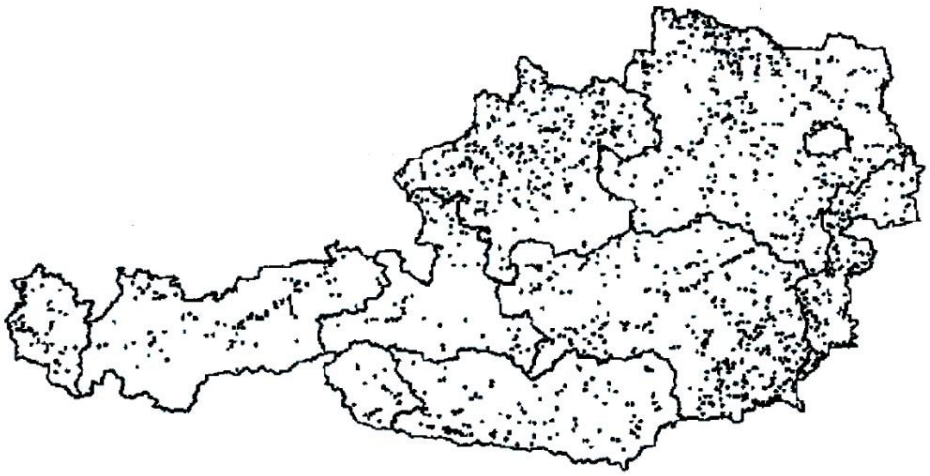


Figure 2: Legally registered landfills in Austria in 1984 (pprox.. 7 Mio. inhabitants and 1,800 landfill sites, not accounting for large numbers of unregistered dumpsites; source: OBIG, 1985).

The first “classified measures” for the treatment of waste in industrialised countries involved the planning and construction of landfills and the elimination of waste through incineration, in some cases even burning waste on open land or on waste dumping sites.

However, these landfills and such waste incineration practices were considered to be an “environmental pollution disaster” and a “public nuisance.” Thus, the public opinion and environmental activists proved to be significant political barriers in establishing additional or even better waste disposal sites. Despite this, the major political and administrative efforts still focused on finding new sites for hazardous waste and for municipal garbage disposal. These efforts resulted typically in fierce rejection of any new waste treatment plants by the local population and environmental activists. This phenomenon became also known as the N.I.M.B.Y syndrome (“not in my backyard”).

LEGAL FRAMEWORK AND REGULATION FOR WASTE MANAGEMENT

40 years of development of a legal framework for waste management in Austria

In 1977, the Austrian Federal Ministry for Agriculture and Forestry issued a first guideline on sanitary landfills for solid waste disposal.

In 1983, the first Federal Act on “Hazardous and Special Waste Disposal” was issued and the Federal Environmental Fund (“Umweltfonds”) was legally established in order to promote necessary investments for waste treatment facilities as well as the development of pilot technologies and demonstration plants. The subsequent dynamic in the development of the legal framework was fostered by public awareness, environmental activists, education and independent media. Austria has also been a pioneer in establishing the most stringent emission standards worldwide, including the emission limit of 0.1 ng/m³ “Dioxins”. The following Table 1 shows the milestones in the development of a future-oriented regulatory framework for integrated sustainable of waste management in Austria.

Table 1: Milestones in development of the regulatory framework for waste management in Austria

Year	Federal Regulation, Directives and Guidelines in Austria
1983	Hazardous and Special Waste Management Act Federal legislation on the Environmental Protection Fund
1988	Guidelines for Waste Management in Austria
1989	Federal legislation on clean-up of landfills and contaminated sites, including a Disposal Tax on landfill operations earmarked for clean-up activities
1991	Decree on separate collection of Bio-Wastes Decree on separation of Construction and Demolition waste
1996	Ban on disposal of hazardous wastes in landfills (except of inorganic wastes encapsulated in closed underground salt formations) by July 2001 Decree on landfills including the ban on disposal of wastes exceeding 5 % TOC (Total Organic Carbon) for new landfills by the beginning of 1997 and exemption for existing landfills until beginning of 2004 (with extended limited exemptions by the State Governor until end of 2008), and limited exemptions for stabilized residues from MBT (Mechanical Biological Treatment).

Notes: (a) Landfill tax for landfilling of untreated waste (e.g. MSW) exceeding 5 % TOC escalated from 43.6 Euro per ton by beginning of 2001 to 65 by beginning of 2004 to 87 by beginning of 2009 (in contradiction to Austrian stipulation, e.g. in case of export or illegal landfilling of waste).

1995 – Austria becomes EU Member State

Based on a referendum in 1994 (after massive pro-membership campaigning 2/3 of the votes turned out to be “yes”) Austria became EU member State by 1995. As a consequence, EU regulation has to be followed additionally. Due to the gradual abolishment of borders between EU member states and differences in environmental standards and waste management practice, the higher environmental standards for waste management in Austria became an economic hardship for established high quality project investments in Austria due to transboundary waste shipments (profit-oriented wastes haulers direct their waste flows to the temporarily cheapest destination, without consideration of environmental impact, as illustrated in Figure 3).

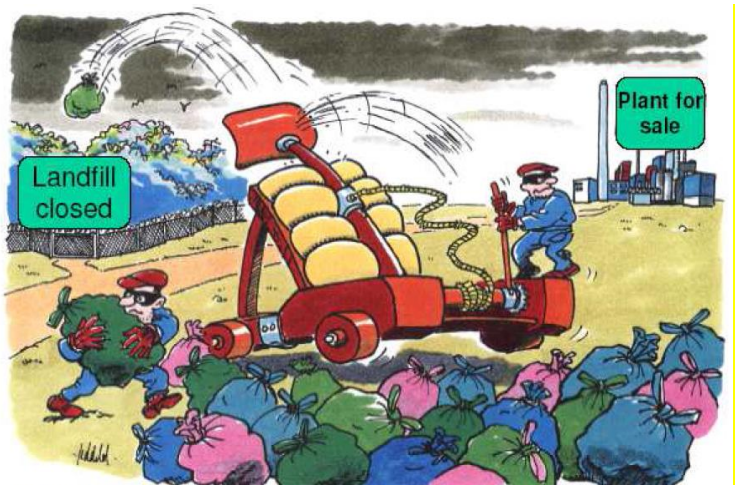


Figure 3: Illustration of waste shipment for profitable disposal (Stadtreinigung Hamburg, 2008)

The following Table 2 illustrates the very significant differences in management of MSW (Municipal Solid Waste) in selected EU countries even two decades after Austria joined the EU. New Member States were given certain time extensions to fulfil the framework, causing reverse economic effects due to “eco-dumping” – standards, set by “dumping of untreated wastes in sanitary reactor-landfills”.

Table 2: Treatment of MSW in selected different countries with the EU (Source of the statistical data: EUROSTAT Press release, March 26, 2015)

	Municipal solid waste in kg per person	Treatment of municipal solid waste in 2014 (in %)			
		Land filling	Incineration	Recycling	Composting
Austria	578	*4*	37	24	35
Germany	617	*0*	35	47	17
Spain	449	*60*	10	20	10
France	530	*28*	34	21	17
Portugal	440	*50*	24	13	13
Italy	491	*38*	21	26	15
Greece	506	*81*	0	16	4
Bulgaria	432	*70*	2	25	3
Romania	272	*97*	0	3	0
Hungary	378	*65*	9	21	5
Slovenia	414	*38*	1	55	7
Czech Republic	307	*56*	20	21	3
Poland	297	*63*	8	16	13
Denmark	747	*2*	54	28	17

ECONOMIC SUBSIDIES – EXAMPLE OF ENVIRONMENTAL FUND IN AUSTRIA

The Austrian Environmental Fund (in the following called „Fund“) has been established by federal law in October 1983. The actual operation began in April 1984, when the two managing directors and a interdisciplinary team of engineers were appointed. The purpose of the Fund is to financially support appropriate measures for the protection of the environment with respect to air pollution, noise emission and pollution by special wastes (Note: The Austrian regulation distinguishes mainly between municipal solid waste and other, special waste). Special waste may be either hazardous or non-hazardous. In addition, another fund (Water Management Fund) is in operation for the purpose of water management, especially for water supply and sewage treatment. The budget of these funds consists primarily of federal tax revenues.

Since the operational start of the Federal Environmental Fund 1984 in Austria, the principal hierarchy of (1) Prevention & Reuse, (2) Recovery of materials & energy from wastes and (3) Disposal of waste has been established, and was then also requested in the 1988 Guidelines for Waste Management in Austria.

Prerequisites for funding

An application for co-financing must be accompanied by necessary technical, legal and economical documents and received by the Fund through one of the authorized banking institutions. The applicant must be a member of the Chamber of Commerce, thus only industry and certain entrepreneurs qualify. The banking institution must evaluate the economic credibility of the applicant and the economic and financial feasibility of the project.

Form of funding

The most common form of funding is the payment of 6 percent interest on a loan – for the environmentally relevant part of the investment – with equal pay-back annuities over a ten year period, which is equal to a net present value of approximately 20 to 25 percent of the investment sum. In special cases, the pay-back period may be up to 15 years, in which the first 3 years are pay-back free. Alternatively or in addition to the support of the interest payment, investment or other direct subsidies may be given. In exceptional

cases the Fund may give a grant. The financial support by the Fund excludes any other form of federal financial aid, except for tax deduction.

The decision making process for funding

The application is reviewed by the expert team according to the Guidelines of the Fund. A detailed technical and economical evaluation of the project, including site inspection by technical experts, will be done by the expert team of the Fund. In addition, specific evaluation by external experts can be done as needed on a contract basis with the Fund.

The result of the evaluation, with special emphasis on the ecological impact of the project, is the basis for the preliminary decision by the Directors of the Fund. Consequently, the preliminary decision is submitted together with the application and the expert analyses to the Commission of the Fund.

The Commission is based on broadest political basis comprising members of the following:

- relevant federal ministries
- members of the Austrian Social Partnership (incl. Labor Union, Chamber of Commerce, Chamber of Agriculture and Forestry)
- a representative of each political party represented in the parliament.

The Commission makes a recommendation to the assigned Federal Minister (previously “Health and Environment”, currently “Sustainability and Tourism”), which is officially responsible for the final decision of the Fund. According to the law, applicants have no legal claim on funding. The final decision for funding is put into the form of a contract under private law between the Fund and the recipient. In return for the funding, specific conditions, such as stringent emission standards or modes of operation (monitored by competent environmental authorities at regional level), are included in the contract. Thus, the Fund has become very instrumental in stimulating improvement in environmental technology and replacement of initially state-of-the art facilities by advanced and more efficient technologies.

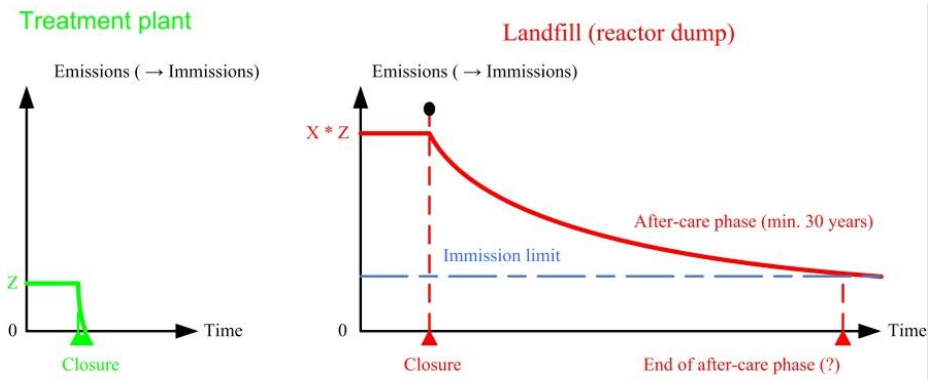
EMISSION FEES - EXAMPLE OF A LANDFILL TAX

Long-term cost of environmental pollution and loss of valuable resources

Negative environmental impacts are typically not included in the short-term commercial decision making of the polluter, e.g. in discarding wastes at minimum effort and cost, but with long-term hazards and liability. These costs are – in economic decisions – “external”. For example, mixed municipal waste (sometimes referred to as “garbage”, or as “residual waste” after deduction of the separately collected waste materials for recycling and recovery, also referred to as the “post-recycling waste”) is chemically “reactive.”

The biological and chemical activities in waste disposal cause odorous smells, potential fire hazards, air pollution by gases, bio-aerosols and particles, leaching of pollutants, and consequently pollution of ground and surface water. Chemical engineers classify such landfills with uncontrolled mixed wastes as “reactor dumps”. These dumps are a long-term environmental hazard and, from an economical point of view, are a waste of waste materials (including a calorific value of residual municipal waste comparable to lignite coal).

The following Figure 3 illustrates the significant difference in emissions from a waste treatment plant (e.g. waste incineration with integrated flue gas cleaning and treatment of residues) which is limited and controlled and can be stopped within short time, whereas the emissions from a reactor dump can be severely detrimental for a century or more as indicated by pollution of aqueous leachate.



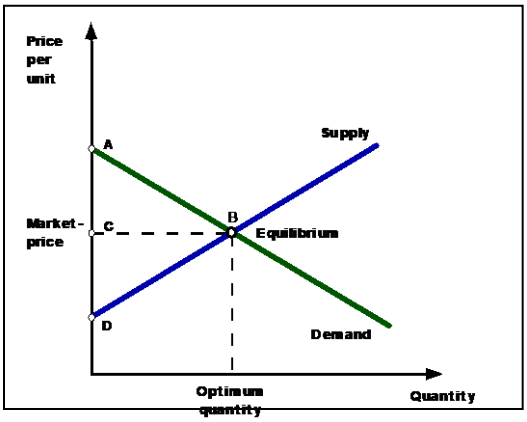
Parameter	Küpelbeck & Ehring (2000)	Heyer et al. (1997)	Kruse (1994)	Belevi & Baccini (1989)
C_{org}				500 - 1.700
CSB	65 - 320	80 - 360	280	
Cl	25 - 130	90 - 250	210	100 - 150
AO_X	40 - 100	30 - 120		

Figure 3: Emission concentrations and aftercare time for waste disposal indicated by the number of years until leachate quality might reach tolerable immission limits.

Internalization of external cost by a tailor-fit taxation of emission

In principle, waste can be viewed like any other commodity on the market, although the market price might be of “negative value“ – meaning that the owner of the waste must pay in order to “sell“ the commodity on the market. The market can be described by two principal measures: supply and demand of any given commodity. The quantity of supply increases with increasing price (relative to the price of other commodities) as more producers are entering the market, as well as existing producers increasing their production. Demand for normal goods decreases as the price increases. The market equilibrium, i.e. market price and quantity, is the intersection of the supply and demand curve (see Figure 4). By definition, the consumers‘ surplus is the difference between the consumers‘ valuation of a product (expressed in the demand curve) and the market price (at the equilibrium). Analogously, the producers‘ surplus is the difference between the market price and the producers‘ costs (expressed by the supply curve). Total surplus, which is a measure for the aggregate benefit of production to the consumers and producers, is the sum of the consumers‘ and producers‘ surplus (McCloskey, 1982).

In recent years, the “polluter-pays-principle“ including the “extended producer responsibility” have become widely accepted among policy makers. Consequently, the costs for pollution abatement, treatment and disposal of waste should be fully included in the product price. In practice, however, costs associated with environmental pollution are usually not included by the (private as well as government-owned) producer. The overall effect is a net loss for the whole society, as indicated in Figure 4 by the difference of the ”private optimum“ (with external pollution costs – to be paid by others) and the ”social optimum“ (pollution costs are internalized in the product price – according to the „polluter-pays-principle“). The net social loss, which is the total surplus minus pollution costs, is represented by the area BCD. Obviously, the private optimum leads to an inefficient outcome for the society as a whole (no statement is made of who gains which portion of the total surplus and who bears which portion of the costs attributable to pollution and discarding of waste).



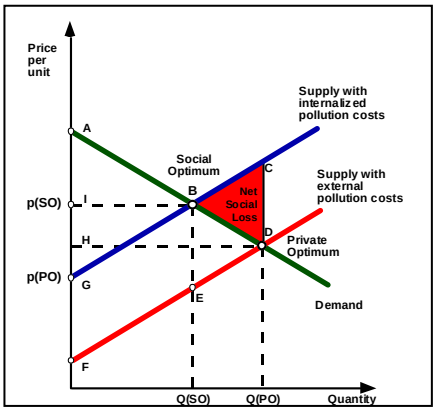


Figure 4: The dynamic market equilibrium yields for a market price with an optimum quantity between supply (producers of goods, generators of waste) and demand (consumers) as indicated in the left graphic. External costs (as well as subsidies on waste disposal) will increase the quantity of waste generated and reduce the price for disposal, leading inevitably to large quantities of waste and a significant net social loss to society as indicated in the graphic on the right.

In essence, all governments use taxes to generate funds for public goods and employ taxes, as well as subsidies, to implement various policies. Despite the obvious inefficiency of tax collection with partial redistribution of collected funds caused by necessary administrative and bureaucratic costs, the efficient outcome of the market will be influenced as indicated in Figure 4. The argument is not opposing subsidies and taxes (which might be effectively internalizing external cost) in general, but to increase awareness of distortive effects and potential losses (or gains) to the whole society.

Example of the Landfill Tax in Austria

One of the most effective measures in waste management policy is the introducion of a tailor-made "landfill tax" (the term for this tailor-made tax in Austria is “AlSAG” fee – referring to the designation of the generated fund for investigation and clean-up of contaminated historic sites, from times before 1989 when the AlSAG regulation came into force).

The objective of the special Austrian landfill tax is twofold: to provide incentives for sustainable waste management with diversion of wastes from landfilling (thus avoiding long-term cost) and to generate necessary funds for remediation of contaminated sites, both historic landfills with severe environmental impact as well as contaminated sites due to releases from industrial activity (e.g. in bombardments during the war).

The level of taxation should be sufficiently high to encourage diversion from landfilling and should consider the environmental standard of the landfill, the quality of waste to be landfilled and should be foreseeable in its significant increase for an operational period of (minimum) 10 to 20 years (the extended time horizon beyond 20 years is more ffective for project planning and investment decisions, e.g. highly efficient waste-to-energy facilities integrated to industrial sites with continuous demand for thermal power and have a technical lifetime of 40 years or more).

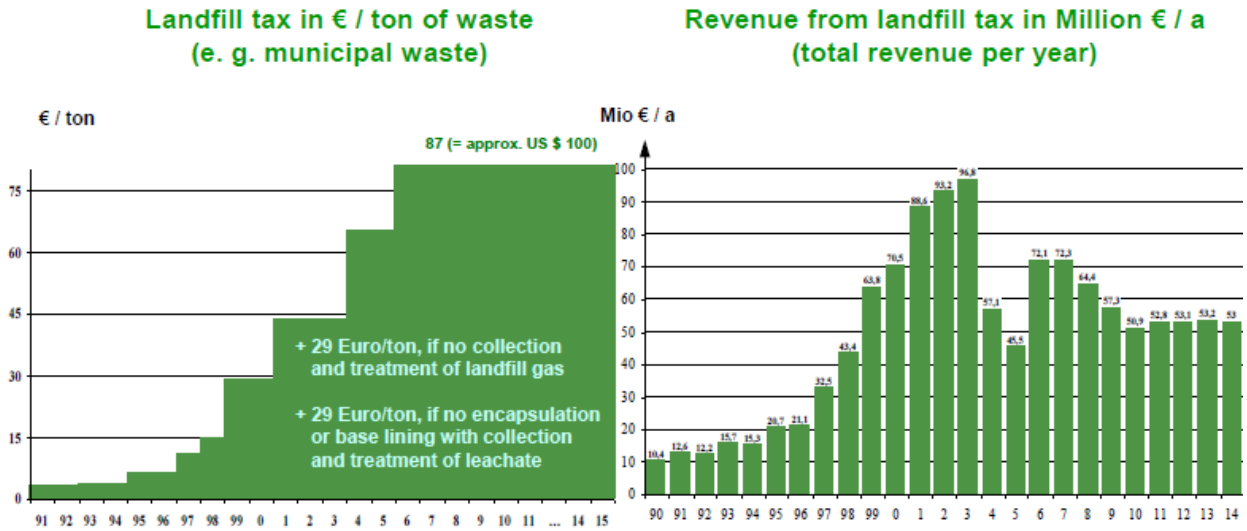


Figure 5: Development of the special Landfill Tax in Austria (BMLFUW, 2015)

Remediation of contaminated sites in Austria

The model for remediation of contaminated sites in Austria has been active for more than 25 years and is quite unique in international terms and well-respected throughout the world. There is no comparable funding model in the whole of EU which channels earmarked funds from waste disposal exclusively into remediation of contaminated sites (BMNT, 2018).

The management of contaminated sites in Austria includes:

- Registration of historically contaminated sites: Contaminated sites are designated as those where more than a slight contamination of the subsoil is assumed. The addition of the word "historical" serves to delimit these from current accidents and relates to sites where contamination occurred prior to 1990. All these sites should be registered by 2025.
- Risk assessments: The potential repercussions of contaminated sites on human health and the ability of the environment to function depend, in addition to the nature and extent of contamination, also on factors specific to the respective site and its use.
- Implementation of measures: Depending on the respective storage volume, dispersion of pollutants in the environment, and the specific use, different measures are possible in the case of substantially contaminated sites ('confirmed contaminated sites'), which may range from restrictions of use and monitoring to remediation (decontamination or securing). "Substantial contamination" is assumed to exist in Austria on approximately 5,000 former disposal sites. All the measures required on these sites should be completed by 2050.
- Reintegration of contaminated sites into subsequent use (land recycling).

CONCLUSIONS

Optimum policy mix for development of sustainable waste management

Sustainable waste management is an extremely complex issue. Therefore an optimum mix of specific policies is needed to prevent and minimize the negative impacts of waste disposal. In contrast to the Laissez-faire approach, there are three basic principles which can be combined for a most effective approach in waste management policy:

- Legal restrictions (to command, monitor, control and enforce – “the stick”)
- Economic subsidies for innovation and implementation (to motivate - “the carrot”)
- Emission fees (e.g. landfill tax - to effectively “internalize external costs” according to the “polluter-pays-principle” in a market economy).

The successful development of waste management in Austria towards reduction of wastes being landfilled has been very effectively supported by a special landfill tax, which also provides necessary funding for investigation and remediation of polluted sites, including historic landfills.

Of course, each of the policy instruments needs careful preparation (including evaluation of experience and lessons learned from mistakes in other regions), consultations with all stakeholders as well as effective information and open dialogue with the public and continuous monitoring, control and strict enforcement. Therefore, “keep it simple”, don‘t copy / paste from lobbyists with specific economic agendas and bureaucracy from a different legal culture. Excessive bureaucracy and administration can be a significant cost factor and hindrance for development of sustainable waste management.

The following Figure 6 illustrates an optimum design of a policy mix comprising legal standards, emission fees and subsidies (which may also include guarantees by the public authority for long-term financing) with a minimum of bureaucratic and administrative burdens. Zero waste can be an orientation, but in reality it is not achievable.

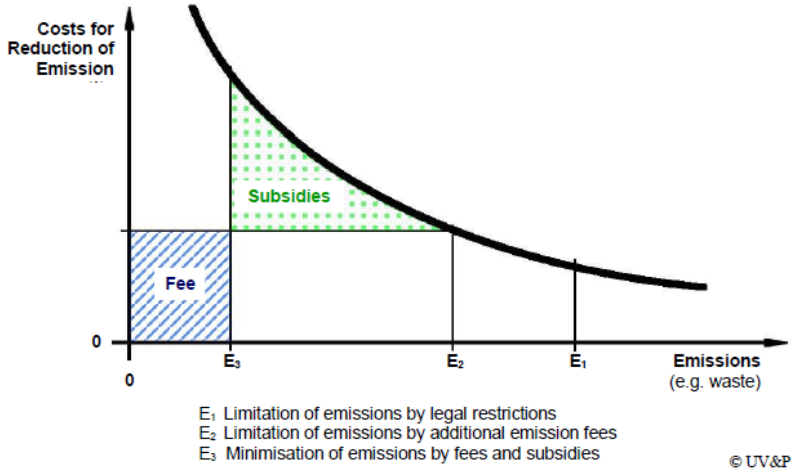


Figure 6: Optimum policy mix in combination of legal restrictions, emission fees and subsidies.

Development of IPPC Integrated Pollution Prevention Control in industry

The development of industrial pollution (as it was indicated in Figure 1 for the example of paper and manmade cellulose fiber production in Austria since the 1940s until the 1980-1990s) has been changed tremendously within a few decades due to major efforts and innovations, as illustrated in Figure 7 for the same industrial site.

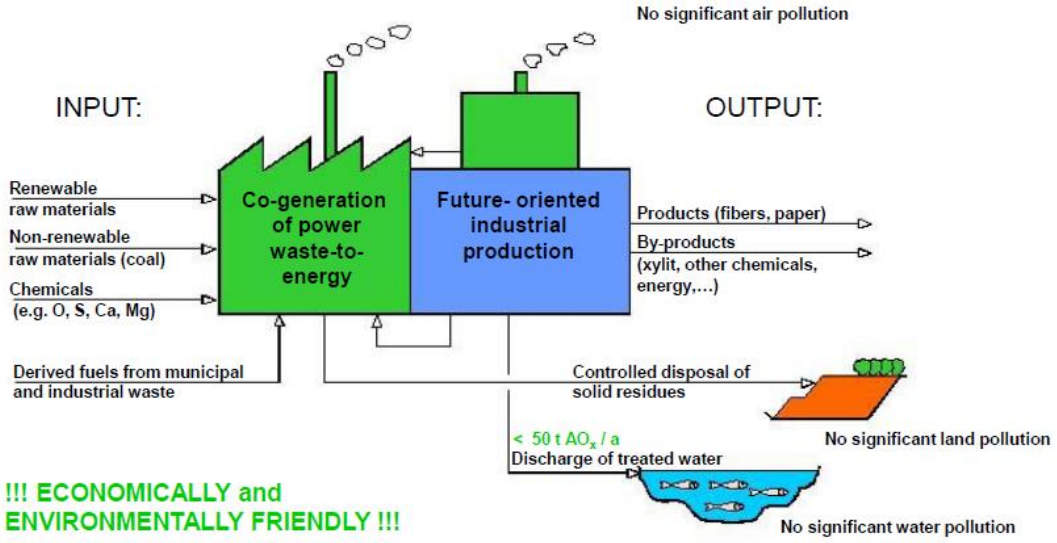


Figure 7: Integrated Pollution Prevention and Control: Step-by-step improvement since about 1980

Development in the treatment of residual Municipal Solid Waste (MSW) in Austria

The following Figure 8 illustrates the development in management of mixed residual municipal waste (after deduction of source separated or sorted materials for specific recovery) in Austria.

Despite significant efforts in public education and application of a highly developed policy mix, the remaining mixed residual waste has been increasing slightly for the past 20 years, due to increase in population, average smaller size of households (with specifically higher waste volumes per person) and increase in material consumption due to modern lifestyle. However, with respect to postconsumer household wastes, there is “ZERO WASTE” going untreated to landfills. Material recovery (recycling and composting) accounts for about 60 % and waste incineration with recovery of energy for about 40 % in integrated treatment of MSW in Austria. Considering residues from recycling and composting, the role of recovery of materials and energy are balanced at about 50:50, and thus about equally strong (for illustration: Austrian mountain people and soccer players also know that two equally strong legs allow for best performance).

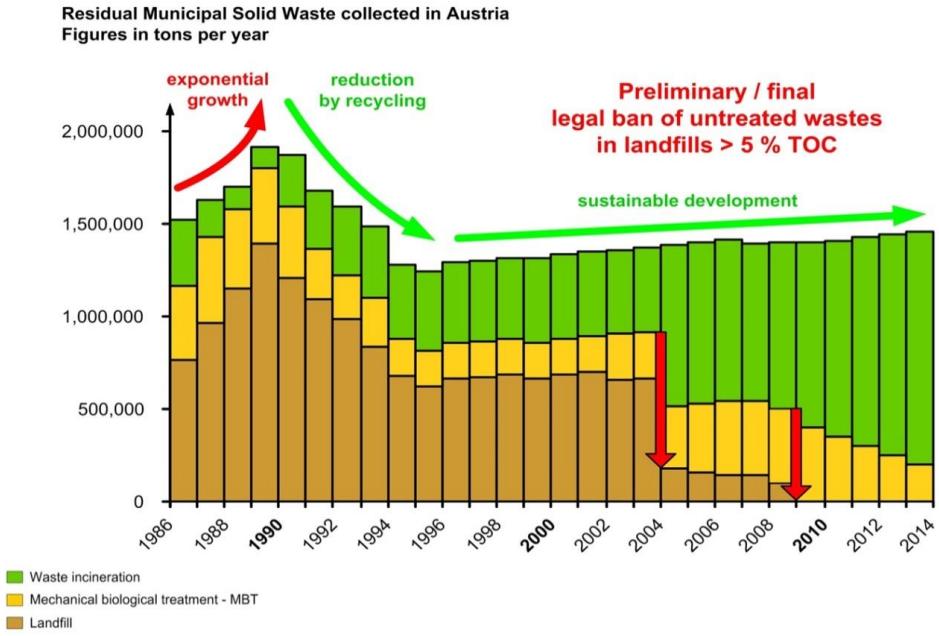


Figure 8: Development of quantity, energy recovery and disposal of residual MSW in Austria.

Know-how transfer and cooperation could save time and reduce financial risks in the urgent need to implement resource efficiency and environmentally friendly waste treatment in other industrial countries.

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