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Environmental Fiscal Instruments for Solid Waste Management: Global Experience and Options for Lebanon



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Environmental Fiscal Instruments for Solid Waste Management: Global Experience and Options for Lebanon

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PREFACE

This report is one of several addressing the international experience with environmental fiscal instruments (EFIs) for environmental management and protection. It has been produced in the context of the EU-funded Support to Reforms: Environmental Governance (StREG) project being carried out through the Ministry of Environment in Lebanon.

What are EFIs?

The term “environmental fiscal instruments” is used to refer to tools that encourage sound environmental management by working through economic instruments and market mechanisms, as contrasted with “command and control” tools that protect the environment through mandatory compliance with fixed laws or regulations. These economic instruments classically include such tools as emissions taxes or cap-and-trade systems to manage pollution rather than reliance on fixed, technology-based emissions standards applicable to all industries and to all firms within them. In the solid waste arena, they include taxes on primary products to encourage recycling, and taxes on landfills or incinerators to encourage people to “reduce, reuse, recycle,” and “pay-as-you-throw” pricing for trash collection to encourage households to reduce their waste streams.

In an ideal world, all countries would implement the polluter pays principle, and subsidies would not be needed to encourage environmental protection. In the real world, however, almost all countries offer some subsidies for environmental protection. In some cases they are necessary to deal with market imperfections, for example when private financial markets consider new practices like recycling too risk to offer loans for industrial development, or when lack of information makes it difficult for firms to know how to reduce emissions in cost-effective ways. In many countries subsidies have been used to ensure that smaller or low-margin firms are not put out of business by mandatory emissions controls, with consequent loss of jobs. In countries for which environmental protection is new, subsidies may be used to encourage firms to begin emissions reductions before they become mandatory, or to ease the financial burden that will be incurred throughout the economy at that time. While such subsidies are not conventional market-based economic instruments, they nevertheless create important incentives in the process of introducing environmental controls, and are therefore considered in these reports.

Some other market-related tools go beyond what can be considered “economic instruments” and are not discussed in these reports. For example, information programs to help industry find suitable “green” technologies, public information campaigns to encourage source separation of waste, and green labeling may all be understood as mechanisms for enabling markets to work more smoothly by ensuring access to information. While they certainly do help markets work better, they are not considered in these reports, as they are considered too far removed from actual economic instruments or incentive-based tools. Similarly, tools such as minimum energy efficiency standards for appliances, while designed in part to reduce prices for efficient equipment by increasing demand, are not considered in these reports, as they are primarily regulatory rather than market-based.



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About these reports

One of the tasks called for from the EFI component of the StREG project was an overview of the use of EFIs elsewhere in the world. This series of reports is the response to that activity. The scope of “EFIs elsewhere in the world” has been narrowed to focus on application of EFIs to issues on which the project is focusing, and that fall under the jurisdiction of the Ministry of Environment. Each of these reports focuses primarily on the tools that can be used to encourage environmental protection and how they have been applied elsewhere in the world. The reports then more briefly consider which of the tools may be of interest to Lebanon and what additional analysis would be needed to determine how they might actually be used in that country.

These reports are being circulated within the Ministry of Environment and to key individuals outside the Ministry, to obtain their feedback on which tools they feel warrant additional analysis for possible application in Lebanon. Their recommendations will be submitted to a technical working group, which will determine what additional analytical work should be undertaken. That work will provide the more detailed information necessary to understand how the proposed instruments may interact with the market context, institutional framework, and legal context for environmental protection in Lebanon. If appropriate based on the additional analysis, more detailed recommendations and draft legislation will be prepared for the eventual introduction of the proposed EFIs.



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EXECUTIVE SUMMARY

This report is one of several being produced through the Support to Reform: Environmental Governance (StREG) project in the Lebanese Ministry of Environment. These reports consider how environmental fiscal instruments (EFIs) have been used elsewhere in the world as a tool for environmental management. EFIs are tools that encourage sound environmental management by working through economic instruments and market mechanisms, as contrasted with “command and control” tools that protect the environment through mandatory compliance with fixed laws or regulations. The term is typically used to refer to such mechanisms as emissions taxes, cap and trade systems, bottle deposits, or taxes intended to encourage “prevention, reuse, and recycling” of solid waste rather than landfilling or incineration. In addition, because direct subsidies for environmental protection are a widely used in countries beginning to tackle environmental problems, they are discussed here even though they do not apply the polluter pays principle that is at the core of all environmental policy.

This report considers ten economic instruments tools commonly used elsewhere in the world to support solid waste management:

- Landfill taxes, a surcharge on the tipping fees used to cover the operating costs of the landfill
- Pay-as-you-throw charges at household level, which charge for waste collection and management based on how much the household discards
- Incineration taxes, added to gate fees at trash incinerators
- Tradable permits for waste disposal, issued through a solid waste cap and trade system
- Recycling credits, a mechanism through which a public authority responsible for all waste collection and management pays a credit to those to recycle, in an amount up to what it would have cost that authority to collect and dispose of that material had it been discarded
- Deposit/refunds, particularly bottle deposits that create an incentive for reuse or recycling
- Extended producer responsibility, through which producers must take responsibility for recycling or reusing their packaging or in some cases their products
- Packaging taxes such as those imposed on plastic bags to keep them from drifting in nature
- Green public procurement, designed to use the purchasing power of government to increase demand for green products by enough to reduce their market prices
- Direct support; subsidies designed largely to support the recycling industry.

Discussion of how these tools could be used in Lebanon suggests three distinct areas that warrant additional consideration and analysis:

- Landfill and incineration taxes, along with the possibility of introducing a charge for household waste collection. The draft solid waste law (if it is passed) explicitly authorized household charges for waste management, landfill tipping fees, and incinerator fees. Anticipating that eventuality, additional work would be useful to consider how to introduce all three types of charge in order to cover the cost of municipal operations and create financial incentives to recycle rather than discarding waste.



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- Recycling incentives through credits, deposit / refund schemes, EPR, or packaging taxes. These four instruments are related, and should be analyzed jointly to figure out which one(s) make most sense. They do not have to wait until the draft law is passed or the issue of financing trash management are resolved.
- Direct support will be useful to further encourage recycling. The different measures through which such support could be provided – tax credits or abatements at different intervention points in the recycling industry, subsidized or guaranteed loans, and so on – will require further analysis to consider their economic impacts and effectiveness, the legal framework for their implementation, and the institutional and management issued involved.



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Abbreviations

ALSF	Aggregates Levy Sustainability Fund
AUB	American University of Beirut
CAC	command-and-control
CDM	clean development mechanism
CDW	construction and demolition waste
CNRS	Centre National pour la Recherche Scientifique
EEA	European Environment Agency
EFI	environmental fiscal instrument
EI	economic instrument
ELV	emissions limit values
EPR	extended producer responsibility
FCCC	Framework Convention on Climate Change
FODEP	Fonds de Dépollution (Pollution Reduction Fund)
GPP	green public procurement
IFC	International Finance Corporation
JI	joint implementation
LEPAP	Lebanon Pollution Abatement Project
NGO	non-governmental organization
PAYT	pay as you throw
QPA	Quarry Products Association (UK)
RGGI	Regional Greenhouse Gas Initiative
SWM	solid waste management
SWMP	solid waste management plan
WCA	waste collection authority
WDA	waste disposal authority
WRAP	Waste and Resources Action Programme
WtE	waste to energy



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1 INTRODUCTION

Fiscal instruments for solid waste management have been widely used in many parts of the world. They are implemented as part of a broader waste management strategy, which usually includes legally binding regulations, strategic targets, economic instruments, significant public information work, and in some cases targeted subsidies, to form a complete package of policies through which solid waste management can be made more environmentally sustainable.

In many countries the overall approach to waste management is set out as a hierarchy of techniques, generally in this order of priority (from best to worst):

- prevent the waste from being generated in the first place
- reuse the material
- recycle the material
- burn the material to generate electricity and thermal energy
- burn the materials to generate electricity
- burn the material without generating power
- put the material in a landfill

The hierarchy adopted by the European Union in its 2008 waste framework directive (Directive 2008/98/EC on waste) is illustrated this way:¹

Figure 1. EU Solid Waste Hierarchy



Source: <http://ec.europa.eu/environment/waste/framework/>

¹ The European Union experience offers models for much of the rest of the world on use of economic instruments, for two reasons. First, the EU countries have made consistent and significant efforts to improve their environmental performance, perhaps more than any other countries in the world. Second, the EU has extensively documented and analyzed the experiences of member countries in implementing its directives, so it is easy to find information about their use of a wide range of policy tools. Documentation and analysis has also been undertaken elsewhere, but it is not nearly as comprehensive as that for European countries; hence a possible appearance of imbalance in this report.



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The broad objective of waste management strategies, within this framework, is to always push up the hierarchy. Waste incineration is placed within the "recovery" category, which refers to recovering other "values" of the materials, such as its energy potential, if the material cannot be reused or recycled. Composting is part of the recycling category. Deposits on glass bottles to encourage their return for washing and refill fall under preparing for reuse. A mix of policies are used to move the management of waste up this hierarchy, with targets for reduced landfill, less waste generation, less incineration, and more reuse and recycling increasing over time.

This report considers how economic instruments have most commonly been used elsewhere in the world. It addresses ten tools, listed in the summary table below. The final section of the report discusses the tools that offer the most potential in Lebanon and the additional work that will be needed to analyze the economic, legal, and institutional aspects of their possible implementation. Table 1 summarizes the instruments that are considered in the rest of this chapter.

Table 1. EFIs for Solid Waste Management

Section	Instrument	Potential in Lebanon
2.1	Landfill Taxes	Not at present; could be of interest with implementation of SWMP.
2.2	Pay-as-you-throw charges at household level	Not realistic
2.3	Incineration taxes	Not at present; could be of interest with implementation of SWMP.
2.4	Tradable permits	No
2.5	Recycling credits	Could be of interest
2.6	Deposit/refunds	Could be of interest if specific types of trash are significant concerns (bottles)
2.7	Extended producer responsibility	Not realistic until effective recycling systems in place
2.8	Packaging taxes	Could be of interest if specific types of trash are significant concerns (plastic bags)
2.9	Green public procurement	Useful primarily to set an example; not to reduce cost of green products
2.10	Direct support	Useful in Lebanon if funds are available
2.11	Possible use of EFIs for solid waste management in Lebanon	



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2 USE OF ECONOMIC INSTRUMENTS FOR SOLID WASTE MANAGEMENT ELSEWHERE IN THE WORLD

2.1 Landfill Taxes

Landfill taxes are imposed on institutions (companies, municipalities) that bring their waste to a landfill for disposal. The amount paid is related to the quantity of waste, usually as a per-ton charge which is added to the "gate fee" or "tipping fee" charged for all disposal at the landfill.² Since the objective is to create an incentive to move up the waste hierarchy, different rates apply to different kinds of waste, in order to create incentives to separate waste at the source, recycle whatever can be recycled, incinerate what can profitably be converted to electricity and heat, and so on.

Landfill taxes have been extensively applied in Europe as a first step towards more effective waste management. Fischer et al (2012) provide an overview of their use in twenty different countries.³ Looking at the total charges for landfill use (taxes plus gate fees), they find considerable variety among the countries with respect to which kinds of waste are taxed, as shown in Table 2. Some countries impose landfill taxes on all of the regulated wastes, while others - Austria, Belgium, Denmark, Netherlands, Norway, Sweden, and Switzerland - totally ban combustible and compostable waste from the landfill stream, since options higher on the waste hierarchy are available for their disposal.

The tax rates applied in different countries, and the different types of waste taxed, vary considerably. There is also variation in the relative tax rates among wastes types. For example, in 2011 the Netherlands taxed combustible and biodegradable waste at about €107.49/ton, whereas all other wastes were taxed at only €16.79/ton. In contrast, in the Czech Republic waste is categorized into hazardous and non-hazardous; the charge for non-hazardous waste is €20 per ton, while those for hazardous waste come to €248 per ton, the highest rate recorded in the Fischer et al study (p. 25). Administratively, the hazardous waste charge has two components, a €60 fee covering the cost of municipal administration and the rest a hazardous waste tax paid into the State Environmental Fund. Most countries do not have such a wide range in rates; most taxes are less than €20 per ton, and few go above €60. Typically countries divide waste into only a few categories, which keeps both waste sorting and administration relatively simple. In some countries different landfills handle different kinds of waste, so the tax rates are set based on type of landfill rather than type of waste. In others, taxes are lowest on landfills with the most effective processing technology; this can create incentives for the landfill managers to modernize their facilities. This kind of incentive only makes sense where landfills are privately owned, of course.

The categories of waste and the rates are established based on the country's objectives in setting the tax and on the available waste management alternatives. Thus a country with effective composting facilities and a strong recycling industry will set taxes that keep those

² The term "tax" is used to refer to money collected in order to internalize externalities and influence behavior, for example to encourage waste management practices higher up on the waste hierarchy. In contrast, "fees" or "charges" are designed to cover the direct cost of services provided, e.g. for waste collection and handling. In practice, of course, fees assessed based on the quantity of service provided will also influence behavior, unless demand is totally price inelastic.

³ Although Switzerland and Norway are not European Union countries, they are following the EU lead in this area and are included in EU research on the subject.



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wastes out of the landfill. A country that is investing in waste-to-energy (WtE) facilities will set high landfill taxes on combustible materials, to ensure that they are directed to the incinerators instead. Some countries totally ban the landfilling of specific wastes, such as compostables or combustibles; this may be combined with high landfill taxes on recyclables or reusables, or fiscal instruments designed to encourage the use of reused or recycled rather than primary material.

Table 2. Landfill Taxes Applied in Twenty European Countries

	Soil & sand	Construction & inert waste	Residues from pre-treatment & recycling (a)	Residues from incineration	Hazardous waste	Combustibles & biodegradable waste
Austria	X	X	X	N-T	X	B
Belgium:			X			
Flanders	X	X	X	X	X	B
Wallonia	X	P-B	X	X	P-B	B
Bulgaria	X	X	X	X	N-T	X
Czech Rep.	X	X	X	X	X	X
Denmark	X	X	X	X	X	B
Estonia	X	X	X	X	X	X
Finland	X	X	X	X	N-T	X
France	X	X	X	X	X	X
Ireland	X	X	X	X	X	X
Italy	X	X	X	X	X	X
Latvia	X	X	X	X	X	X
Netherlands	X	P-B	X	X	X	B
Norway	X	X	X	X	N-T	B
Poland	X	X	X	X	X	X
Portugal	X	X	N-T	N-T	X	X
Slovenia	X	X	X	X	X	X
Spain:					X	
Andalusia	N-T	N-T	N-T	N-T	X	N-T
Catalonia	X	X	X	X	X	X
Madrid	X	X	X	N-T	X	X
Murcia	X	X	X	X	X	X
Sweden	N-T	X	X	X	X	X
Switzerland	X	X	X	X	X	X
UK	X	X	X	X	X	X

(a) "Pre-treatment" refers to treatment of materials prior to re-use.
 X: Taxed N-T: Not taxed B: Banned from Landfill P-B: Partially banned from landfill
 Source: Fischer et al (2012), p. 6, Table 1

Most countries initially introduce the taxes at a quite low rate and gradually increase them, giving companies and municipalities time to adapt to the new economic environment. The amount of waste going to the landfills in the higher-tax categories declines over time in response to the tax; this is, of course, one of its objectives. Consequently, the total revenues from the taxes typically rise and then level off or decline, as disposal practices move up the waste hierarchy and landfills become less important. It is therefore inadvisable for countries to expect this tax to replace other revenue sources over the long term, since the highest level of revenues will not be available indefinitely.



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The actual impacts of a landfill tax depend on the broad cost framework for waste management and the economic context, as the example of the Netherlands makes clear. Their landfill tax was first implemented in 1996, the rates increasing gradually over time. As mentioned above, there were two tax rates, a very high one applied to combustible waste, and a very low one applied to other materials; these were collected by the landfill operators based on the amounts of trash they received, and turned over to the Ministry of Finance. As the landfill tax rates rose relative to the incinerator gate fees, the waste incinerators had more fuel than they could handle, and turned away "lower quality" combustible waste, forcing that waste into the landfills despite the high taxes. After the economic downturn in 2008, however, the amount of combustible waste dropped, and the incinerators found themselves without enough fuel. To meet this need, landfill operators took to extracting combustible waste from the landfills to bring it to the incinerators, claiming and receiving refunds of the high taxes paid. The refunds placed a huge burden on the treasury, leading the Netherlands to eliminate its landfill tax altogether at the beginning of 2012. (Scharff, undated) The tax was subsequently reintroduced in October 2014 at a single rate of €17/ton, without the distinction between combustible and non-combustible waste that caused the earlier fiscal drain. (Weekers 2014)

2.2 Waste Management Charges - Pay as you throw (PAYT)

The landfill tax affects institutions that bring large quantities of waste directly to the landfill. Waste management charges, in contrast, are designed to both cover the cost of municipal trash management and create incentives for waste producers (households and commercial enterprises) to recycle as much as possible. There are several different approaches to setting the rates for such charges:

- In the simplest system, the same charge is paid by all households and businesses served by the system, irrespective of the quantity of waste produced. This is sometimes called a fixed tax (Cointreau and Hornig, 2003).
- A somewhat more targeted approach assesses each waste producer a solid waste charge proportional to its payments for metered services such as water or electricity. This uses consumption of these other services as a proxy for waste disposal, assuming that those who use more water or electricity will also generate more waste. This is sometimes called a "flat tax", although in fact it does vary across waste producers. (Cointreau and Hornig, 2003) This may be more equitable than a fixed fee, since it places the burden for trash management on those who either make more use of the service or are better able to pay for it. It does not create an incentive to reduce waste disposal, however.
- In the best targeted system, waste is measured by weight or volume, and charges are set accordingly; this is called a variable charge or "pay as you throw" (PAYT). The charges are often assessed based on the size of containers used to dispose of trash, though in more complex systems trash containers have instruments within them to either weigh or measure the volume of the contents, and households and businesses are invoiced based on how much they actually throw out. PAYT charges are often an add-on to a fixed charge paid by all households or businesses. The logic for a two-part charge that everyone benefits from the existence of an effective



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trash management system that can recover its operating costs, so they should all pay a base charge. The additional charge is designed to create an incentive to reduce waste generation. This may also be a way for municipalities to shift landfill taxes onto final consumers of waste management services. Where consumers are asked to sort their waste, for example between compostable material, recyclable material, and material that cannot be recycled, the PAYT charge typically applies only to the portion not recycled, or is higher for the portion not recycled.

From both equity and environmental perspectives, the PAYT approach makes a lot of sense. However, in practice it may be difficult to implement or ineffective, for several reasons. It requires a system for determining how much trash each household produces, which could be costly to implement. Moreover, in middle or high income countries the charges are likely to be minimal compared to household or business expenditures, so the savings may not be sufficient to generate much reduction in trash. On the other hand, in poor countries where the charges are a high enough share of income to change behavior, PAYT systems may lead to an increase in illegal dumping rather than an actual reduction in waste.

Zurich offers an extreme example of a quite successful implementation of PAYT taxes. In that city, waste must be put in a special bag - a Zuri-Sack - purchased at prices ranging from about €0.70 to €4.70 for bags holding 17 to 110 liters. Recycling is free, and the city has quite complex systems for collection of paper and cardboard, plastics, aluminum, glass, compost, used clothing, electronic waste, and other materials; some are picked up at curbside while others must be brought to neighbourhood collection points. Indeed, the rules are so complicated that whole webpages exist to explain to newcomers what they are expected to do with each kind of trash (Ramos, 2014). Non-compliance with these rules can lead to significant fines, and the city has the resources to identify those who are not complying. This has, not surprisingly, led to sharp reductions in the amount of waste actually being disposed of rather than recycled or reused, but it demands both significant management resources and extensive citizen compliance. (Rosenthal, 2005)

Hogg et al (2011) have carried out a detailed analysis of PAYT strategies for the Brussels region. They describe a number of different pricing schemes, based on weight, volume, frequency of waste collection, and combinations of the three. They also introduce the possibility of charging for disposal of compostable waste and recyclables. The logic for a compost charge would be to encourage households to home compost, saving the municipality money. The logic for a recycling charge is to encourage consumers not to buy products sold with excess packaging - i.e. to prevent the production of materials that will be disposed of, pushing households all the way to the top of the waste hierarchy.

Hogg et al conducted detailed case studies in Switzerland and Sweden, as well as looking at an array of other research on PAYT systems. As with all economic instruments, they found that the relative prices for each waste handling strategy will determine the incentives created at the household level. Beyond this, some of their more detailed findings are worth noting:

- Illegal disposal of waste is minimized when the separated waste streams (biodegradables, plastics, metal, paper, trash, etc.) are all collected at curbside rather than requiring households to bring them to a collection point.
- Revenues will more reliably cover costs if a flat fee is combined with moderate variable fees, rather than relying only on high variable fees.



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- Total waste generation is reduced the most if charges are leveled on compostables and recyclables as well as trash, rather than only charging for material that must eventually be thrown away.

2.3 Incineration Taxes

Incineration taxes are similar to landfill taxes, but are applied to waste brought to incinerators. As in the case of landfill taxes, there is a gate fee which covers a portion of the operating cost of the incineration plant (electricity feed-in tariffs also cover a portion of that cost), and the tax is added on to the gate fee to influence behavior.

The level at which incineration taxes are set may combine several different objectives:

- The total per-unit charge for incineration (gate fee plus tax) should be lower than the equivalent cost for landfill, to encourage incineration over landfill (unless there is an outright ban on landfilling combustible materials). This does not take into account the cost of transporting waste to the disposal site, however; depending on locations, individual consumers of disposal services may still find it is cheaper to bring their waste to a landfill rather than an incinerator, if the difference in transport costs outweighs the incentives created by the structure of gate fees and taxes.
- To encourage reuse or recycling rather than incineration, incinerator taxes may be set to ensure that burning waste will cost more than other options higher on the waste hierarchy.
- However the design of the incinerator may require it to consistently receive a certain waste stream in order to operate efficiently or cost-effectively. In this case, authorities may keep the combined charges for incineration lower than those for recycling, to ensure that there is always enough fuel to keep the incinerator operating properly. Clearly this runs counter to the general principles of the waste hierarchy, and could impose a significant financial burden on municipalities. However, if generating electricity or thermal energy from waste incineration is part of a country's energy strategy, this could be justified nevertheless. WtE plants sometimes establish contracts with the municipalities or companies relying on them for waste disposal, guaranteeing the plants a minimum fuel supply, even if this ends up being more expensive for the organization disposing of its waste. In this case the supply of waste may in effect become price inelastic, so incinerator taxes will simply be a means to shift resources from municipalities or companies to the taxing authority, and will not create an incentive to reduce incineration.
- Fourth, the financial viability of a WtE plant depends on the combined revenues from gate fees and feed-in tariffs (i.e. the price at which the plant can sell electricity to the national electrical grid). If the feed-in tariffs change because of unrelated changes in the country's energy system, the WtE plant could need to either raise gate fees (if it is a private operation that must be solvent) or receive public subsidy in order to maintain its revenue stream.

Watkins et al (2012, pp. 73-85) have looked at incineration charges and taxes in Europe. While most countries have landfill taxes, and many have incinerators, only six use incinerator taxes as part of their policy mix (Austria, Belgium, Denmark, France, Spain, and the Netherlands; at the time of their study the Dutch tax was €0). In all six countries, the incinerator taxes are lower than the landfill taxes, as suggested by the first objective mentioned above. In Austria, Belgium, France, and Spain, however, the combined gate fees and taxes are higher for incinerators than for landfills. Austria bans the disposal of



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combustible waste in landfills, so this is not a concern; however in the other countries it could push waste down the hierarchy towards landfills.

Watkins et al also looked at the relationship between total incineration costs (gate fees plus tax) and the share of municipal waste that is recycled or reused. In general, they found a positive correlation, suggesting that higher incineration costs do tend to push waste up the hierarchy towards more desirable methods of waste handling. However the data at their disposal did not allow them to do more rigorous analysis that might establish a causal relationship.

European countries are expected to produce 20% of their electricity from renewables by 2020, under the EU Framework Directive 2009/28/EC. The basic tool used to move towards that target is renewable energy quotas, which require companies selling electricity to purchase a specified share of their power from certified renewable producers. To ensure that sufficient renewable energy is available, economic instruments are being introduced to subsidize its production. In many (though not all) countries, these support WtE plants or refuse-derived fuel (RDF) systems as well as other types of renewable energy production.

Most important among the economic instruments affecting WtE plants is the establishment of the feed-in tariff for renewable energy. In Europe, independent producers of power from non-renewable sources have been selling into the grid for some time, so the policy variable here is the premium paid for renewable power. Twenty two countries have set tariffs for waste-derived renewable energy; eighteen of them adjust the tariff based on the type of waste. Some countries, such as Denmark, do not offer a renewable premium for electricity generated from mixed municipal waste. Where a premium is offered, it is typically lower than those for other waste sources. The objectives of the differential rates are clearly to encourage environmentally-preferable methods of generating electricity from waste, and to give less subsidy to methods that generate greater externalities. Some countries dispense with the fixed feed-in tariffs for renewable energy, instead simply setting a percent premium, subjecting renewable energy to the same market-based uncertainty about sale price as conventional electricity generators. (Watkins et al do not specify which countries have done this.) All of these tariffs give waste-derived energy a financial edge over other power production, in order to help the countries meet their renewables targets. Renewable feed-in tariff rates are guaranteed for periods ranging from one year (Slovakia) to twenty five (UK), with the average being fifteen. This reduces the financial uncertainty faced by the WtE plants, making it easier for them to operate efficiently.

2.4 Tradable Permits

Tradable permit systems are relatively common as a tool for reducing pollutant emissions, but are uncommon as a strategy for dealing with solid waste. They were introduced in the UK in 2005, to help meet the targets of the EU Landfill Directive (UK/DEFRA, undated).

These schemes allocate landfill allowances to each municipal authority, each allowance permitting the municipality to bring one ton of biodegradable waste to a landfill. The total number of allowances issued by each of the four countries (England, Scotland, Wales, and Northern Ireland) corresponds to its landfill target under the Landfill Directive. Authorities may use their allowances (i.e. bring waste to the landfill) or trade them with other authorities and find an alternate way to manage the waste (e.g. by composting more of it). Authorities that want to bring more to the landfill than the allowances they hold must either buy allowances from those wishing to sell, or borrow up to 5% of the next year's allowance; or



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course borrowing requires them to reduce more in the next year. (UK/DEFRA, undated) The trading scheme was ended in England as of March 31, 2013, but is still in operation in the rest of the UK. (CIWM 2014)

According to Hogg et al (2011), the trading system has not been very effective in England. According to that study, municipal authorities face very similar costs for reducing the quantity of biodegradable waste going to landfills. In general, the advantage of trading schemes is that they allow institutions for whom it is costly to avoid waste (or pollution) to buy extra allowances and discharge into the environment, while those for whom it is inexpensive to avoid waste sell their allowances and manage their wastes in other ways. In this way, waste is handled in the least expensive way possible throughout the country. If the cost of composting systems is uniform across the country, however, there is nothing to be gained, in terms of overall efficiency, through a trading system, and it will not be a cost-effective way to allocate landfill space. In England, therefore, this system was replaced with escalating landfill taxes as a more effective way to reduce the amount of waste going to landfills.

2.5 Recycling Credits

Recycling credits are monies paid to local authorities, NGOs, or individuals that collect specific waste items and bring them in for recycling. Typically they are paid by the authority responsible for disposing of the trash, to the organization or institution that collects it, because the former saves money if the recycles are kept out of the landfill. Historically, recycling credits have been most commonly used where there is no requirement to recycle, and no system in place for keeping waste out of landfills. Thus they may be useful in small communities or rural areas, where local government does not have enough staff to diversify into recycling, or in countries that have not yet introduced recycling as a major part of the trash management system.

The best documented use of recycling credits is the UK (UK / DEFRA, 2006). This system was first introduced through section 52 of the Environmental Protection Act of 1990, at a time when there was no obligatory recycling and there were no other policy instruments to encourage recycling. That law established that waste disposal authorities (WDA) were required to offer compensation to waste collection authorities (WCA) that separate materials for recycling. The amount of the compensation was set to match the per-unit cost of the most expensive disposal system that the WDA would have used had they received that material. The logic for that charge was that if the recycling activities of WCAs (or non-profits) enabled the WDAs to reduce their disposal activities, they would eliminate them most expensive technologies first. Thus these payments were expected to be revenue-neutral for the WDAs; they were to pass on all their savings directly to the WCAs. Recycling credits could be paid to non-profit organizations (or non-governmental organizations, NGOs) collecting recyclables as well as to governmental WCAs.

The system for granting these credits is relatively straightforward. Authorized WCAs collect the material to be recycled and bring it to a waste recycling company that has been accredited by the local authority. They are given a receipt by the company showing the weight of materials brought in. Upon presentation of the receipt to the WDA they are given the amount of credits due. According to Tojo (2006, p. 58), the credits per ton of recycled materials range from about £40 to £65 (€51 to €82.50) for a set of listed jurisdictions and authorities, based on the cost structure for their waste management systems. A credit of about £30 (€38)/ton would be given by any authority not listed.



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As the European Union began introducing a broader range of policy tools to move waste management up the hierarchy, the recycling credit system had to adapt to the new environment. In 2006 the 1990 legislation was amended to allow local governments to introduce other measures to encourage recycling in addition to the recycling credits. Local authorities (including WCAs and WDAs) were obligated to identify and apply the best practices to encourage recycling, whether these were the recycling credits or other tools such as landfill and incineration taxes and other regulatory and economic tools. A 2009 study by the Waste Improvement Network suggested that local authorities were "outgrowing" the recycling credit, as the overall system became more sophisticated in order to meet EU targets. (Letsrecycle.com, June 2009)

This approach to encouraging recycling essentially assumes that the WDA is responsible for bearing the cost of all waste management in the community, even if that material is recycled by someone else. It depends on the existence of a private recycling industry that can make a profit if it receives input materials without paying for them and does not have to pay the cost of transporting the material from the source to the recycling facility. If the margins of the recycling companies are high enough to cover the cost of collecting recyclables as well, then this charge is a subsidy to the industry, since they could collect the recyclables themselves and still make a profit. The authorized WCAs must be either government or NGOs; they may not be profit-making trash collection companies. If the (avoided) cost per ton of disposing of the waste (i.e. the recycling credit) is higher than the cost per ton of collecting that waste, then private companies might actually be interested in getting into the collection business, their revenues being the recycling credits; however this is not permitted. If the collection costs exceed the disposal costs (i.e. the recycling credit), WCAs will recycle because they have to collect the material anyway, and the recycling credit will cover at least a portion of their costs. In this case NGOs will recycle only if they believe this needs to be done, or if the work is done by volunteers who do not value the labor they contribute to the organization.

This suggests that this approach may make sense at the margins and in the short run, as a way to begin recycling as an alternative to landfilling. In the absence of any other system for recycling, it may offer a good way to accustom people to the idea of separating their waste streams and ensuring that recyclables do not go into the landfill, especially if the existing landfill is running out of space. In the longer run, however, this is probably not the best approach to ensuring that materials that can be recycled will be; other tools will be more efficient and effective.

2.6 Deposit-refund systems

Deposit-refund systems impose a surcharge on the items targeted at the time of purchase, which is returned when either the packaging or the item itself is returned at the end of its useful life. Such systems are often applied to beverage containers, for either reuse or recycling. They not only reduce solid waste going to landfills or incinerators, but also reduce litter, of which beverage containers are often a significant share. They have also been tried on various other products, including car batteries, tires, electronic items, and motor oil.

Bottle deposit systems to encourage reuse or recycling are common throughout the world. The OECD's searchable database on instruments used for environmental policy⁴ provides data on such systems in thirty two countries, and their system does not include most of the

⁴ <http://www2.oecd.org/ecoinst/queries/Default.aspx>



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developing world. In the OECD and EU countries, most beverage containers are returned for recycling rather than reuse, although there are some exceptions.⁵ In Africa, on the other hand, glass bottles - typically beer and soda bottles - are usually returned for cleaning and reuse rather than recycling; a glass bottle can be reused as many as 20 times before it must be recycled (Botes 2012). Beverage bottling plants, therefore, are in large part bottle washing plants, and customers are warned to take good care of their bottles so as to extend their useful life, as in this message from the Peninsula Beverage Company (South Africa).

Figure 2. Peninsula Beverage Company, Caring for Bottles to be Reused



TAKE GOOD CARE OF YOUR BOTTLES

Did you know that there are a number of benefits of taking care of your returnable bottles? These benefits include:

- A product in a good quality bottle that is not scuffed, dented or scratched.
- A product that tastes great because the bottle has only been used for its intended purpose

Taking care of your returnable bottles also plays a role in saving the environment. If you purchase a 1.5l returnable product you are entitled to a R3 deposit for every returned bottle.

Source: <http://www.peninsulabeverage.co.za/penbev/environment>

So-called "bottle bills" can be quite controversial. Typically beverage manufacturers and bottling companies oppose them, arguing that increased recycling could more easily be achieved by making recycling bins more accessible, without the administrative costs of collecting and then returning the deposits. Stores that have to handle the bottle returns often oppose them for similar reasons, although they generally receive a share of the deposit to cover their handling costs.⁶

Research into the impacts of container deposits suggests, however, that they do increase recycling rates significantly. Viscusi et al (2009) assessed the impact of a number of different factors on the rate at which individuals recycle bottles in the United States. They found that the presence of a strict recycling policy in the state will increase the share of bottles recycled by 6%, but if that policy is combined with a deposit on the bottles, that share will rise by 27%. (Viscusi et al, p. 14) In some communities, the recycling rate will be even higher, as individuals collect bottles out of public trash cans in order to collect the deposits; in Berlin, even pensioners on fixed incomes are supplementing their revenues in this way. (Whittle 2012)

Bottle deposits are also expected to have a significant impact on litter, since beverage containers often account for a significant share of trash dropped in the environment. There is little actual data on this impact; Figure 3 presents the information that could be located.⁷

⁵ See <http://refillables.grn.org/> for discussion of the experience with refillable containers in the United States, Canada, Latin America, and Western Europe. This website does not, however, discuss container deposits.

⁶ See, for example, <http://www.bottlebill.org/legislation/usa/allstates.htm>, for a comparison of the terms of bottle bills in ten US states and territories.

⁷ The data in this table have been cited and recited throughout the literature, each paper referencing the previous one but none figuring out where in fact the information came from. This appears to be the "original" data; however we still don't know how the figures in this table were arrived, and some of them are referred to as



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Figure 3. Impact of Container Deposits on Litter Composition

Table 1—Litter Reduction in Bottle Bill States

State	Beverage Container Litter Reduction	Total Litter Reduction
New York	70–80 % [1]	30 % [2]
Oregon	83 % [3]	47 % [4]
Vermont	76 % [5]	35 % [6]
Maine	69–77 % [7]	34–64 % [8]
Michigan	84 % [9]	41 % [10]
Iowa	76 % [11]	39 % [12]
Massachusetts	N/A	30–35 % [13]

[1] Final Report of the Temporary State Commission on Returnable Beverage Containers, March 27, 1985, p. 62.

[2] Projection from Center for Management Analysis, School of Business and Public Administration of Long Island University. New York State Returnable Container Act: A Preliminary Study (1984).

[3] Oregon Department of Environmental Quality, Oregon's Bottle Bill: The 1982 Report, p. 26.

[4] Ibid.

[5] U.S. General Accounting Office. Report to the Congress by the Comptroller General of the United States, Potential Effects Of A National Mandatory Deposit On Beverage Containers, December 7, 1977, p. 54.

[6] Ibid.

[7] U.S. General Accounting Office. Report by the Comptroller General of the United States, State's Experience With Beverage Container Deposit Laws Shows Positive Benefits, December 11, 1980, p. 9. [8] Ibid.

[9] Michigan Department of Transportation, Maintenance Division. Michigan Roadside Litter Composition Survey, Final Report, December 1979.

[10] Ibid.

[11] Iowa Department of Transportation, Highway Division. Litter Survey, April 1980.

[12] Ibid.

[13] Environmental Action Foundation. Bottle Bills in the 1980's: A Handbook for Effective Citizen Action, August 1987.

Source: US Senate 2004, Appendix 1

2.7 Extended Producer Responsibility

Extended producer responsibility (EPR) systems require the producers or importers of goods sold with packaging to take back the packing materials and ensure that they are recycled, or to participate in take-back schemes that ensure this is done. Most European countries have take-back requirements, as discussed in Kjær et al (2012). If producers directly manage the packaging in which their products are sold, they face a strong incentive to reduce packaging waste, and to design packaging that is easy to handle and recycle. However, direct involvement with recycling places a significant administrative burden on producers who cannot control the packaging of their products. In practice, therefore, virtually all countries with EPR requirements allow producers to join group take-back schemes which handle these responsibilities for them.

The details of the schemes vary somewhat from country to country, but the Irish one, called Repak, offers a useful example (<http://www.repak.ie>).⁸ Companies join the system through one of three membership types. Those with no legal responsibility to take back their waste join voluntarily, paying a flat fee, and receive a "green dot" certification that they can use to demonstrate their environmental stewardship. Small companies, such as retailers who are

projections rather than empirical evidence. Anyone seriously interested in the impact of bottle bills on litter might be advised to collect current primary data.

⁸ Kjær et al (p. 20, Table 3) provide a list of country schemes with their web addresses; the Irish one was the only one whose website was in English and could be read by the author. The URL for the French system is no longer valid.



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not directly responsible for the packaging of their products, pay fees proportional to the size of the business and the quantity of packaged goods they sell. Larger companies must provide actual data twice per year on the quantity and type of packaging they generate, and are assessed fees based on that information.

Joining this scheme exempts the firms from physically taking back and handling the packaging they generate. They do have an obligation to separate and ensure the recycling of their own waste, although this does not directly relate to the waste embedded in the products they produce or sell. The firms receive certificates that they present to the government, to demonstrate that they are in compliance with their packaging take-back liabilities; this legal compliance comes at a considerably lower cost than directly handling and ensuring the recycling of the packaging that they generate. Repak also does not take direct responsibility for collecting the packaging material or recycling it. Rather, the fees they collect are used to help local governments or other authorities set up recycling systems.

Thus these collective take-back schemes shift the costs for recycling packing materials from the organizations that actually handle this task to the firms who sell packaged goods, lessening the fiscal burden that the packaging would have imposed. However they do not necessarily create a strong incentive for firms to actually sell products with less packaging, since they are not confronted with the much more onerous task of managing that material themselves. The fact that these schemes are in use in most EU countries, however, suggests that they are effective in achieving the EU recycling requirements for packaging material.

2.8 Packaging taxes

Packaging taxes another tool for reducing the use of disposable packing materials, both to prevent waste generation and to prevent litter. As a broad tool to prevent waste generation, they are imposed on the producers or importers of goods sold with packing, and are assessed based on weight or volume, as well as based on the nature of the packing material (paper, plastic, wood, etc.). Such taxes are in use in a few European countries, such as Denmark and the Netherlands (Kjær et al, 2012), but they are considerably less common than the extended producer responsibility schemes discussed above.

A very common type of packaging tax, however, is imposed at the retail level on plastic bags. As the use of these bags has spread throughout the world, "plastic bag trees" and "plastic bag gardens" have spread with them, and concern has grown to restrict their use because of the litter they generate. Such restrictions take a variety of forms:

- Outright bans on all plastic bags, or on bags provided for free.
- Bans on specific kinds of bags; those less than specified thickness, those that cannot be composted, those made of primary rather than recycled material, etc.
- Taxes on bags provided by stores, or on bags provided by stores above a certain size (to avoid placing an administrative burden on small businesses).
- Requirements that all stores over a certain size that provide bags also accept them for recycling.

These systems are in place all over the world, with different approaches being used in different places. The US state of Florida, as part of its own analysis into whether it should regulate plastic bags, compiled detailed data on bag regulation worldwide, which is available at http://www.dep.state.fl.us/waste/retailbags/pages/_mapsandlists.htm. In a report prepared



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for the Florida legislature (Florida DEP, 2010), the state's Department of Environmental Protection reviewed bag regulations and taxes elsewhere in the US and the world. In the US, charges or limits were much more common than outright bans; elsewhere in the world bans, especially of thinner bags, are more common. Jurisdictions instituting charges for bags typically found that their use dropped rapidly at first, and then levelled off or slowly rose as people adapted to the fee.

Washington DC did a study of its \$0.05/bag tax and found reductions in both bag use and perceptions of the cleanliness of the city (DDOE 2013). Surveys of store owners suggested that bag use had dropped by 45-50% two years after the tax was introduced, and that the number of people bringing their own bags had increased substantially. Half of the store owners said they benefited financially from the bill, both because they purchased fewer bags and because they can keep a portion of the tax as a handling fee for those that they do give away. The tax is used to fund clean-up of the Anacostia River⁹, which apparently makes the public more willing to accept it. Revenues from the tax have been consistently between \$150,000 and \$200,000 per year since it was introduced, suggesting that bag use dropped at first and then leveled off (DeBonis 2014).

2.9 Green Public Procurement

Green public procurement (GPP) systems are designed to use the influence of large government purchasing systems to increase demand for "green" products, creating economies of scale in their production that can make it easier for those outside the government to "buy green" as well. The European Union set an indicative target that by 2010 50% of member governments' purchasing should be "green," and in 2011 attempted to determine whether this goal had been achieved (http://ec.europa.eu/environment/gpp/studies_en.htm).

The assessment focused for the most part simply on determining how much government procurement was in fact "green" - a challenge made more difficult because the definition of green purchases is not always clear. Beyond that, some work looked at whether green purchases cost more than conventional ones, and if so, how much more. Taking the analysis even further, to see whether the initial outlay by government created economies of scale or in other ways enabled private suppliers to reduce their costs so that green products would be less expensive to all purchasers, was for the most part beyond the scope of the assessment.

In terms of the actual costs of the products purchased, the study (Rudenaar et al, 2007) found that green procurement did not make a difference one way or another. However, because at the start it required changes to the standard procurement process, it did slightly increase administrative costs (Tepper et al, 2007). As the new procurement process becomes the norm, these costs should drop. A set of five case studies of specific purchases did attempt to analyse whether GPP influenced the cost of green production (DeFranceschi and Hidson, 2007) so private purchasers could benefit from economies of scale. They focus on engineered products such as air filters for trains, bus shelters, lighting systems, and buses, which are designed (or modified) to order for the purchaser - as opposed to, for example, solar panels or recycled paper, for which GPP would represent an increase in demand for a standard "green" item. They find that while there is a potential for this to be an

⁹ A notoriously polluted tributary of the Potomac that runs through the east side of Washington DC.



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effective tool, a single government authority will not be a big enough player in the market to have much impact.

2.10 Direct Financing

Public-private partnerships in the funding of solid waste management facilities or subsidies to create an incentive to use recycled material is not usually considered to be an economic instrument for environmental management. However, it can create economic incentives that influence behaviour, and such mechanisms are widely used throughout the world to encourage improved waste management, particularly recycling. It is not always clear where to draw the line between simple public funding of facilities such as landfills or waste-to-energy plants, public-private partnerships in such facilities, public financial support to investors in such facilities, and more limited incentives to change the market behaviour of the consumers of specific trash management systems or of their outputs, i.e. recycled products. All of these tools use taxpayer resources to cover some portion of the cost of the waste management system. From the purpose of this report, however, the interest is in tools designed to influence behaviour within the market or to correct market failures that may limit private investments, rather than on public support for major waste management infrastructure.

Such tools are often used to support the development of an effective recycling industry and market for recycled products. This is considered necessary because of a number of limitations of the market, especially when the industry is new; banks may be reluctant to invest, the supply of both recyclable material (inputs to a recycling facility) and recycled product (outputs of the recycling facility, and inputs to other industries) may be unreliable, and the potential end users may not be familiar with the products. Unlike other, completely private markets, public support for recycling is considered appropriate because of the social benefits from recycling instead of burning or landfilling waste. Even once the industry is operational, those social benefits may justify continued public support to buffer it from market fluctuations, in ways sometimes not considered appropriate for other industries.

Tools commonly used to support the recycling industry include (USEPA 1993, Sparks 1998):

- Loan guarantees. In the US, states have guaranteed loans to recycling and other environment-related businesses in order to reduce the risk faced by private lenders and increase their willingness to fund such operations.
- Subsidized (low interest) loans, supported with funds from state or national government.
- Grants, from funds directly provided by the state government.
- Tax exempt bond finance. In the US, private authorities have been permitted to raise funds for environmental projects by issuing bonds, the income on which is not taxable. This enabled them to obtain less expensive funding, since those buying the bonds would accept a lower return on their investments as that return was not taxable.
- Equity financing funds. These are publicly created funds that support the construction of economic activities that are considered too risky by private lenders. They are designed to make up for a lack of private finance, rather than necessarily to offer funding at below market rates. Such funds could receive equity in the business as payback or could offer loans that must be repaid once the business is operational.
- Tax credits for investment in recycling equipment.



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These tools were used and to some extent still are used in the United States to support the initial development of recycling activity. They were typically introduced at the state rather than federal level, and a mix of these mechanisms were used. For example, New Jersey, Pennsylvania, Indiana, and Wisconsin all made low-cost loans available to processors of recycled material, to support the purchase of recycling equipment. Pennsylvania capitalized its so-called Environmental Technology Fund using the tipping fees from state-run landfill (which suggests that the operating costs for those landfills must have been provided directly from the state budget). Pennsylvania, Minnesota, and Michigan also offered direct grants to cover a portion of the capital costs for recycling businesses, while Wisconsin provided cash rebates to firms purchasing recycling equipment.

Many US states supported development of the recycling industry through tax credits, deductions, or exemptions for the purchase of recycling equipment.¹⁰ A US EPA survey of such practices carried out in the late 1990s (Sparks, 1998) found 22 states had such programs. The details of these programs varied from state to state. Montana's program, for example, gave a 25% income tax credit for the first \$100,000 that a firm invested in recycling equipment, and lower credits for subsequent investments. New Mexico, concerned about employment, gave such credits only to firms whose new technology did not lead to any job loss. Texas aimed to encourage firms in other industries than recycling to think about recycling their own waste; they offered property tax exemptions to recycling equipment not used for the firm's primary activity. Delaware, seeking to bring recycling businesses to the state, offered tax credits of \$500 to \$750 for each \$100,000 invested in "green industries." Other states, such as Idaho, Louisiana, and Arkansas, supported the use of recycled inputs through tax credits for industrial equipment designed to process post-consumer or recycled materials rather than primary product (e.g. paper-making equipment designed to use recycled paper pulp rather than wood pulp).

The effectiveness of these programs was hard to assess, however. According to Sparks (1998, pp. 2-3), many states found that these direct subsidies were too expensive for the returns they provided, and began shifting to subsidized loans instead. Others found it was hard to avoid subsidizing firms for investments they would have made even without the state program, so the state funding led to no new investments in recycling. In some cases, firms had already purchased the equipment before they knew of the credits, so the subsidies clearly were not needed. In others, subsidies went to firms that could afford the purchases without them, rather than only going to firms for whom the subsidy makes the difference between recycling and not recycling. These cases illustrate a key challenge of many business subsidies, that it is hard to ensure that they are only used when they actually are needed to bring about different behaviour from what would have been done in the absence of a subsidy. If the public funds actually were not needed to bring about this change, then the subsidy is simply a transfer from the taxpayers to an individual firm, and does not serve the social purpose that justified it.

¹⁰ A tax credit is an amount of money deducted from the taxable income of the business or individual, prior to calculating the amount of the tax. A tax deduction or abatement is subtracted from the amount of the tax after it has been calculated; thus a tax deduction of \$100 is worth much more than a tax credit of the same amount. A tax exemption declares either that the business is not liable for a particular tax (for example, religious institutions often are exempt from income taxes) or that a particular tax is not charged on specific products (e.g. sales taxes or VAT often are not charged on food and other essentials).



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3 APPLICATIONS TO LEBANON

This paper has considered nine different economic instruments for encouraging more effective management of solid waste. Of these, a few may be of considerable interest in Lebanon, while others probably are not:

- Landfill taxes could be useful in the future; this may have to wait, however, until tipping fees are introduced at a significant number of landfills.
- Pay-as-you-throw pricing systems probably will not work in Lebanon. They are complicated to administer and would likely lead to increased illegal dumping rather than improved trash management at the household level. Charging households and commercial enterprises a solid waste fee to help cover the operating costs of trash collection, as an add-on to electric bills (and presumably in an amount related to the amount of the bill), might be worth considering, although given the problems with the electrical system it might be ineffective. This would not serve as an economic incentive to reduce waste generation, but would help cover the costs of providing the service.
- If incinerators are built, incineration taxes should be considered along with landfill taxes, since the two are related to each other. They must also be considered in light of the need to maintain a minimum waste flow to the incinerators.
- Tradable permits for waste disposal are too complex and would probably not work well in Lebanon.
- Recycling credits in some form may be useful in Lebanon, as a way to encourage more people to begin sorting trash and recognizing the value of recyclable materials even before broader recycling systems are in place.
- Deposit / refund systems may be useful in Lebanon, if specific products contribute significantly to the waste stream.
- Extended producer responsibility schemes serve objectives somewhat similar to the previous two strategies, and might be useful as well.
- Packaging taxes, particularly charges for plastic bags, could be useful if bag litter is perceived as a particular problem.
- Green public procurement probably is not going to influence markets in Lebanon or create economies of scale for greener products. It could set a good example for the private sector, but this may be a lower priority strategy.
- Direct support for recycling and other “green” practices will be of interest, in order to insure that there is a supply of recyclable material, firms that collect and reprocess it are financially viable, there is demand for their final product, and enough final product is available that its users can count on having enough to meet their needs.

This quick overview of the instruments discussed suggests three distinct areas that warrant additional consideration and analysis:

- Landfill and incineration taxes, along with the possibility of introducing a charge for household waste collection. The draft solid waste law (if it is passed) explicitly authorized household charges for waste management, landfill tipping fees, and incinerator fees. Anticipating that eventuality, additional work would be useful to consider how to introduce all three types of charge in order to cover the cost of municipal operations and create financial incentives to recycle rather than discarding waste.
- Recycling incentives through credits, deposit / refund schemes, EPR, or packaging taxes. These four instruments are related, and should be analyzed jointly to figure out



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which one(s) make most sense. They do not have to wait until the draft law is passed or the issue of financing trash management are resolved.

- Direct support will be useful to further encourage recycling. The different measures through which such support could be provided – tax credits or abatements at different intervention points in the recycling industry, subsidized or guaranteed loans, and so on – will require further analysis to consider their economic impacts and effectiveness, the legal framework for their implementation, and the institutional and management issues involved.

Before discussing how these might play out, it is helpful to consider some aspects of the current solid waste management system.

3.1 Who pays for SWM in Lebanon?

To answer question – and to think about where fiscal instruments would fit in - it may be useful to some readers to see a schematic overview of the system. Figure 4 shows the key players in the system - households (and commercial enterprises), industrial waste generators, the trash management facilities (landfills, incinerators, sorting plants), the environment (where waste may be dumped, bypassing the system), the municipality (collecting household trash, the central government (funding some municipal activity), and those who fund the central government (taxpayers, donors, lenders). It also shows flows of materials (trash, recyclables, compostables, electricity) and flows of money, many of which do not actually occur now. Items in [square brackets] represent possible policy tools for influencing the system (landfill taxes, solid waste fees, etc.).

In this simplified representation, we have two groups of waste generators, households and commercial enterprises, and industrial enterprises. The municipalities handle trash collection for the former; the latter is responsible for its own trash management. Waste is brought to the waste management facilities by both the municipal collection system (which contract with a private company) and the industries (who might also contract with a different private company). In the diagram, these include landfills, recycling facilities, and incinerators; in practice in most of Lebanon landfills are the only option.

There are two basic costs to the system; collecting the waste and managing it. At present, municipalities receive general revenue from taxes they impose on their residents and from the Independent Municipal Fund. Most municipalities use some of this money to pay the collection costs, whether they carry out collection themselves or hire a company to do it. In the Beirut area, however, the central government directly pays for waste collection, through the contracts with Sukleen and Sukomo, and deducts this money from the amount the municipalities receive from the Independent Municipal Fund. At present, households pay various taxes and fees to the municipalities, including one for street sweeping, but no specifically targeted solid waste fees. Industrial enterprises bring their own waste to the management facilities or hire private companies to bring it. Under some circumstances, waste is sometimes dumped directly into the environment rather than collected by the municipalities or private collectors.



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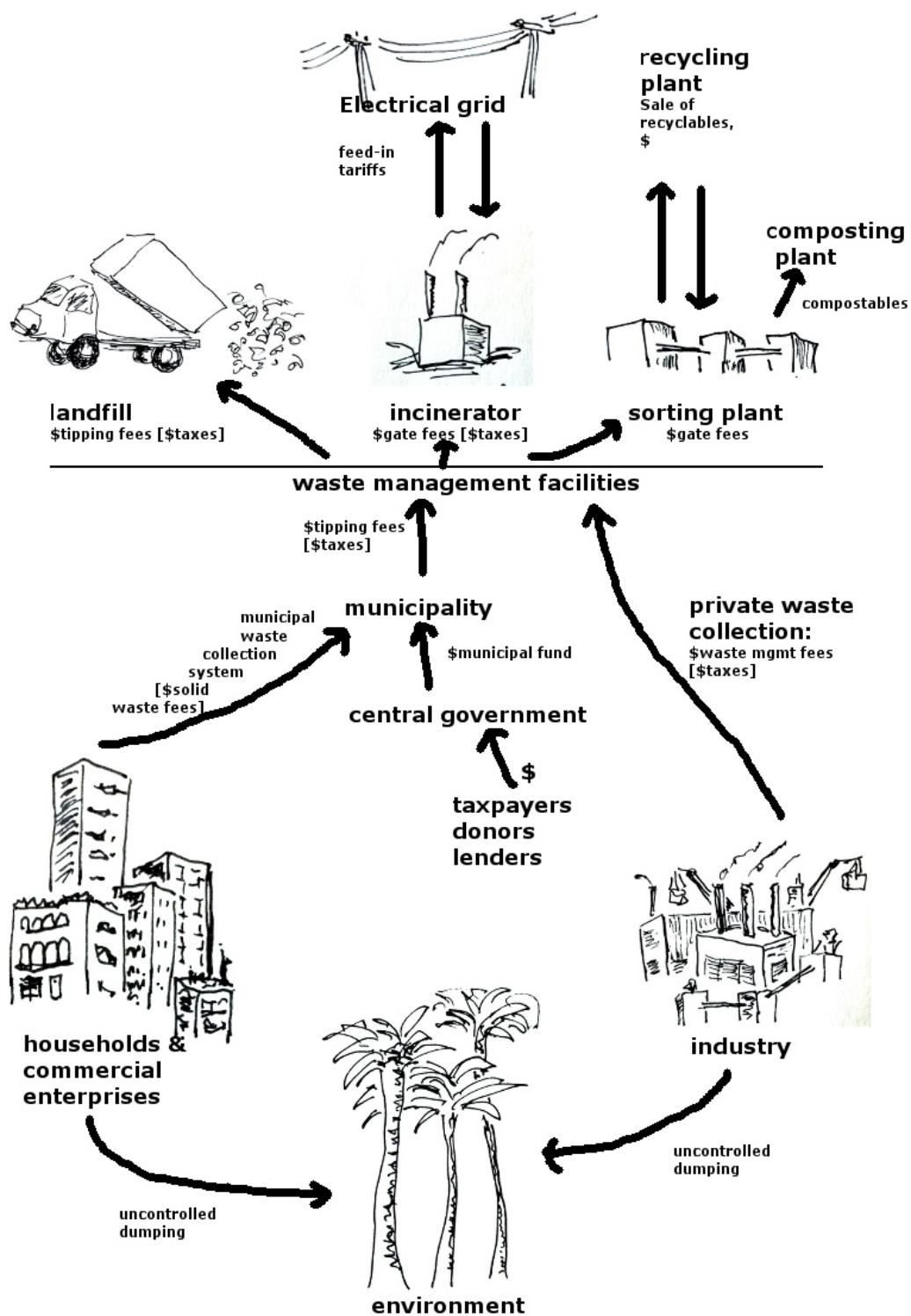
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Figure 4. Schematic overview of the solid waste management system





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If waste management facilities are privately owned and operated, or are run as cost centers within the public sector, they charge tipping fees (at landfills) or gate fees (at incinerators or recycling plants) which in principle should cover their operating and capital costs. If they are public operations, however, they may receive support from the central government to cover capital costs, operating costs, or both; even if they are private, or privately operated (but not owned), they often are partially supported by the central government. In practice in Lebanon, there are no tipping or gate fees at any solid waste management facilities; they are either directly operated by public authorities or funded through direct payments from municipal or national government.

The central government support comes, in principle, from the taxpayers; thus any time a share of the costs is covered by central government rather than the end users, it is the taxpayers as a whole are bearing this financial burden. This is generally considered acceptable, because all residents of the country benefit from a good trash management system, even if they personally don't generate much waste. In addition, if the tax system is progressive, then taxpayer support through the central government will ensure that wealthy people contribute more to the costs of keeping the environment clean than poor people, which is often considered appropriate.

In Lebanon, most of the costs of solid waste management are covered by the central government, either through its transfers to municipalities or, in the Beirut area, through its direct payment of Sukleen and Sukomo. However the government funds may not only come from the taxpayers; they may come from foreign donors, or from foreign lenders both private and private. When foreign donors pay capital costs, there is no problem. When they pay operating costs, it is helpful to the country, but when that money runs out the country will still need to find another way to support the system. When foreign lenders pay operating costs, even at subsidized interest rates, there is a major problem, since the country is simply putting off paying everyday expenses to the future; this is not sustainable. The analysis of fiscal instruments should, therefore, consider how they might contribute to resolving this problem where it is present.

3.2 Landfill Taxes, Incineration Taxes, and Solid Waste Fees

In Lebanon, landfill and incineration taxes and solid waste fees would all serve to shift the cost of the trash management system from the taxpayers to the beneficiaries. The two taxes are explicitly intended to change behavior as well, whereas the solid waste fee is only intended to generate funds with which to cover the costs of the system. The two taxes might be used for environmental purposes or they might go directly into municipal or national coffers to be used for other public services.

Outside Beirut: The existing solid waste management plans (the 2006 plan, which has been integrated into the 2010 and draft 2013 plans) call for sorting and composting of waste in almost all districts outside of the Beirut area. Some of the necessary facilities already exist, but most do not. The investment capital is not currently available for construction of the needed facilities, although it is certainly to be hoped that it will be found in the foreseeable future. However, it is clear that the central government will not be able to continue funding all solid waste management out of general revenues, and while some donor funds may be available, this cannot be counted on.



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At present there are very few tipping or gate fees at existing waste management facilities, so their operating costs are covered out of general municipal or national revenues, through local taxes or transfers from the Independent Municipal Fund. Consequently, imposing per ton landfill taxes to create an incentive to keep materials out of the landfill doesn't make sense; such taxes are appropriate when the operating cost the landfill is already covered by tipping fees. The Draft Solid Waste Management Law permits the collection of such fees; if they are imposed, it may be useful to also consider using landfill (and possibly incineration) taxes to influence trash management.

At present, however, it may make more sense to think first about how to shift the operating costs of the existing system to the direct beneficiaries, through solid waste fees that are unaffected by how much waste the individual beneficiary actually generates. In terms of the figure above, a solid waste fee would be represented by the [bracketed] "solid waste fees" flowing from households and commercial enterprises to the municipality. Where the existing landfills are shared by several jurisdictions, it may also be useful to introduce tipping fees, so that the jurisdictions share in their operating costs based on how much use they make of the facility.

Figuring out how to introduce municipal solid waste fees has been among the challenges facing the country for at least ten years. It might be feasible to begin by imposing them on commercial enterprises above a certain size and perhaps on apartment buildings or real estate developments above a certain size, if their organizational structure makes it possible to assess a charge on the building rather than residents. Over time, they could be extended to small enterprises and to all households. This will require additional consideration to determine whether it is a viable starting strategy.

Solid waste fees could be used in several ways. They must be applied to waste management, since this a fee-for-service rather than a source of general revenue. They could be used to support what the central government can't afford - the capital investment needed to build better waste management infrastructure. This would presumably be done by borrowing against the anticipated revenue stream, and using the fees to pay off the loans. Alternately, they could cover the start-up costs of a recycling credit system. Over time this would bring a financial benefit to the municipalities, since it would reduce the amount of waste to collect and dispose of in the landfill; this would free up the solid waste fees to use elsewhere. Or they could be applied to other waste management priorities of the community, whatever those might be. Hopefully the communities would not lose support from the Independent Municipalities Fund if their own revenues increased due to the solid waste fee; that would reduce the municipal incentive to actually introduce the fee in a serious way. Of course the actual amounts involved are unknown; much more detail is needed to determine what could actually be done with these funds.

Beirut Area: In Beirut the most recent SWMP proposes the construction of waste to energy plants to replace the existing over-used landfills, rather than the construction of additional sorting and composting facilities. As elsewhere, the funds are not available to build these plants; moreover, they are considerably more expensive than recycling and composting strategies plants. Even if the ultimate objective for large cities continues to be WtE, it will be some years before such plants could be built and the existing sorting and landfill facilities closed. Moreover, the existing system is costing the national government a great deal of money, which is not sustainable; beginning the introduction of solid waste fees is as important in Beirut as in the rest of the country.



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The WtE proposal raises additional fiscal issues, because their financial viability will be determined by the feed-in tariff established for renewable energy, and by the gate fee that municipalities can afford to pay if they bring their waste to the plants. At present there is no independent power generation in Lebanon, and private sales of electricity to the grid are not legal. Consequently, the study analyzing the feasibility of the WtE proposal (Ramboll 2012a, pp. 43-44) made an assumption about the feed-in tariff, setting it for the purpose of analysis at \$100 per MWh. Using that figure and a number of other assumptions about plant design and costs, they calculated that for privately capitalized plants to be financially viable, the gate fee would have to be set between \$70 and \$90 per ton. This is considerably higher than the estimated costs per ton for waste collection and sorting outside of Beirut, which are on the order of \$35/ton (GoL, pp. 8-10). They may also be higher than the costs that would be avoided in the current system (baling, wrapping, shredding, and landfilling), which the Ramboll study estimates at between \$60 and \$98 (Ramboll 2012b, p. 99, Table 57). Faced with high gate fees, municipalities in the Beirut area may be reluctant to sign waste management contracts that lock them into bringing waste to the plants, rather than choosing other less costly management practices.

Clearly none of these figures are accurate enough for reliable cost comparison. However, if the WtE plants are the preferred strategy for large municipal areas, it will be important to undertake an accurate comparative analysis, and to determine how the plants will be paid for if they are in fact more expensive than the alternatives. It will also be essential to determine the real feed-in tariffs, since this is the other key component of the financial picture. If these plants are to be built, and to the extent that municipalities have a choice about how to dispose of their wastes, the feed-in tariffs and gate fees will be the key environmental fiscal instruments used to influence municipal solid waste management practices in the Beirut area.

3.3 Recycling Incentives

Since funds are not currently available to build industrial sorting plants that would feed materials to the recycling industry, fiscal instruments that encourage source separation and collection of recyclable material for direct transfer to recycling companies may be useful, at least in the short run. For the municipalities, this has two benefits. First, if they do not have to collect the recyclable material, collection costs will drop in the short run. Second, a smaller waste stream will extend the working life of the landfills, a long-run benefit. In terms of Figure 4 above, this would be represented as a flow of recyclables from households and commercial enterprises directly to private recyclers, who bring the material to recycling plants without passing through the municipal waste collection system.

Recycling credits: A financial mechanism akin to that of the UK recycling credit system is one possible strategy to make this happen. Once past the start-up phase, such a system might become self-supporting, as it appears to be in the UK. The institutional arrangements in Lebanon are different from those in the UK, as Lebanon does not have separate waste development and collection authorities. The short-run benefits from keeping recyclables out of the landfill (reduced collection costs) would probably be shared at least between the municipality and those collecting recyclables in return for the credit, and might also be shared with recycling companies as well. Elsewhere in Lebanon small businesses that collect recyclables, e.g. from the Sukleen bins in Beirut, sell them to the recycling companies. This could happen elsewhere in the country as well, depending on the financial structure of the country's recycling industry. Alternately, the recycling credit might be



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sufficient incentive to lead recycling companies to come to the municipalities to collect recyclables.

From the perspective of those generating trash, this kind of system would be somewhat analogous to offering a tax break to those who recycle their waste – an approach not discussed above because it is not typically applied elsewhere. A recycling credit may be more effective than a tax break in actually bringing about recycling, because it would only be given when materials are actually collected and brought to a recycling company. Thus it could require less independent verification after the fact, which might leave less room for taking the credit without complying with the terms of it. The recycling credit could operate at any scale, as well; credits could go to households or informal sector scavengers as easily as to large enterprises. Moreover, a tax break benefits those who pay taxes, who are the well-off, whereas the recycling credits may be of more interest to low-income people who can earn money by collecting other people's recyclables in order to receive the credits. These suggested impacts should be part of an analysis of recycling credits, which must consider how they would compare with tax breaks funded through the municipal savings resulting from recycling.

The analysis of recycling credits should carefully consider the case of Beirut, where some material already is recycled before it gets to the Amroussieh and Karentina sorting plants, either separated at the source through the scattered Sukleen recycling bins or pulled out of the Sukleen trash bins by private sector recyclers. It is not clear what constrains the amount that is separated in these ways, either by Sukleen or by the private sector. Would it be cost-effective for Sukleen to install far more recycling containers? Is the private sector already collecting everything that can cost-effectively be taken out of the trash bins; or is it constrained by recycling capacity, competition with Sukleen staff emptying the bins as the trash is collected, the number of people interested in undertaking this activity, or other factors? Understanding the dynamics of this market will contribute to determining whether recycling credits will be useful, or how they should be designed.

Packaging taxes and deposit /refund schemes: These instruments would target specific recyclable items rather than the broad set of products that could be brought in through recycling credits. They would be of interest if specific items warrant that kind of attention; plastic bottles, tires, and plastic bags because they are regularly dumped in the environment, or electronic and electrical waste because it includes hazardous materials. There are plausible arguments both for and against this kind of tool. On the one hand, it may be simpler to implement than a broader recycling credit and may offer a good departure point for introducing the idea of regular source separation of waste. On the other, however, the administrative costs could be significant, possibly greater than the amount of taxes that could be collected. Even if the taxes did create desired incentives to recycle, and prevented environmental harm due to those specific products, if the cost exceeded the revenues the system would be hard to justify. As with other possible measures, more work is needed to compare the costs and benefits of this kind of scheme.

Extended producer responsibility: This approach may be less effective in Lebanon than the others discussed. As in Europe, businesses will probably be unwilling to take on direct responsibility for taking back their packaging materials or used products. However the alternate schemes that exist in Europe depend on the presence of effective recycling systems, and reliable institutions that can collect and reallocate funds and verify that businesses have in fact recycled their own internal waste. The recycling systems do not yet exist in Lebanon, and the funds transfer systems may simply offer too many opportunities for



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firms to work around the rules. In principle the advantage of an EPR system over other systems is that it would create an incentive to reduce packaging, but the funds transfer schemes do not really do this. Other fiscal incentives for recycling would probably be simpler to implement more effective in the Lebanese context.

As with a solid waste fee, we do not know enough about the structure of the recycling industry and markets to determine exactly how these instruments might be structured. More detailed analysis, including collection of primary data that would shed more light on the industry, will be needed to determine more precisely how they could best be used to improve the country's solid waste management system.

3.4 Direct Support for Recycling

As the Draft Solid Waste Management Plan is implemented, providing direct support to help grow the recycling industry will probably be quite useful, in addition to the recycling-related economic instruments mentioned above. Several legal mechanisms are now available or may become available in the future to provide such support.

Law 444 / 2002 on the protection of the environment authorizes three kinds of support, all of which are to be implemented through decrees that have not yet been drafted.

- Up to a 50% deduction of customs duties on imported equipment for recycling or other environmental protection purposes, which is authorized by paragraph 1 of the law.
- Up to a 50% deduction on any other tax affecting environmental protection activities, which could be introduced by decree under paragraph 2 of article 20 of the law. This could be used to provide income tax reductions, excise tax reductions, or reductions in the tax on built property if they seem to be useful.
- Up to a 50% deduction of VAT on imported equipment, which could be introduced by decree under paragraph 2 of Article 20 of Law 444. This would help companies with cash flow problems at the time of equipment purchase, since they would not have to lay out as much VAT when importing equipment, but would not actually save them money, since VAT they pay is reimbursed out of VAT collected on sales of their products or by the Treasury.

The income tax law also may provide exemptions to stimulate the recycling industry. Article 5/2, part II, of that law authorizes a 100% income tax exemption for the first ten years of operation of firms producing products that are new to Lebanon. Certain restrictions apply; the plant must be located in geographic areas designated as eligible for this subsidy, and the total earnings over the ten-year period may not exceed the value of the capital generating the earnings. However, since recycling is new in Lebanon, this mechanism may offer significant subsidies for new recycling activities.

The Draft Solid Waste Management Law authorizes the use of certain incentives, including (in article 27) income tax reductions for purposes to be defined in a decree; this could presumably include support to the recycling industry. The draft law does not mention a number of other possible subsidy mechanisms, imposition of special taxes to encourage



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recycling (such as landfill, incinerator, or aggregates taxes), reduction of the built property tax for green buildings, or other such mechanisms for offering subsidies to production or use of recycled material. As mentioned above, Law 444 on the Protection on the Environment, Article 20, authorizes up to 50% reduction in customs duties on imported recycling equipment and recycling and a 50% reduction in other unspecified taxes for environment-related economic activity; the draft SWM law references these provisions. The draft SWM law also does not mention subsidy instruments other than the grants embodied in these taxes; there is no discussion of subsidized loans, loan guarantees, or other incentive mechanisms that would cost the taxpayers less than direct grants. Further investigation of the legal framework proposed in this law will be necessary to determine if such mechanisms may be considered to fall within it.

Subsidies provided through the tax code will place the burden for these activities on the taxpayers and the treasury; they are not cost-free instruments. Various other sources of funding might be found through which to create incentives for recycling at less or no cost to the treasury. These might include:

- Grants from donors to the public sector (e.g. USAID, EU). Such funding could be used to provide direct grants for recycling activity, or to provide subsidized or guaranteed loans. They could also be used to undertake related activities needed to encourage recycling, such as education about source separation of waste, providing information to industry about use of recycled materials, and so on.
- Loans from donors for public infrastructure (e. g. IBRD) or recycling-related activities; obviously grants are preferable if available, since the taxpayers will have to pay back the loans.
- Loans from donors for private activity (e.g. IFC). These may be effective mechanisms to support growth of the recycling sector, in conjunction with other support.
- Support for Nationally Appropriate Mitigation Actions (NAMAs), under the Climate Change Convention. NAMA support is a form of donor funding granted because the projects it funds demonstrate reductions of greenhouse gas emissions. The Lebanese government has already chosen a set of projects which it will propose for NAMA funding, which includes the Beirut-area W2E plants. It would appear that adding other projects to that list is not possible now; however this might change.
- Green Climate Fund. This major climate change initiative should provide additional funds for activities that reduce greenhouse gas emissions, such as improvements to landfills or increased recycling. However it is not yet operational.



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