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# INVESTIGATION INTO THE PERFORMANCE (ENVIRONMENTAL AND HEALTH) OF WASTE TO ENERGY TECHNOLOGIES INTERNATIONALLY




Stage One - Review of Legislative and Regulatory Frameworks for Waste to Energy Plants.

WSP Environmental Ltd, on behalf of the Government of Western Australia's  
Department of Environment and Conservation

January 2013



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## Client

Waste Management Branch  
Department of Environment and Conservation  
Level 7, The Atrium, 168 St Georges Tce  
PERTH WA 6000  
Locked Bag 104 Bentley DC WA 6983

## Consultant

Mick Fanning  
Associate Consultant  
WSP Environmental Ltd.  
Tel: +44 207 7314 5883  
Fax: +44 207 7314 5005

## Registered Address

WSP Environmental Ltd.  
WSP House, 70 Chancery Lane, London, WC2A 1AF,  
United Kingdom  
**[www.wspenvironmental.com](http://www.wspenvironmental.com)**

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## Summary and Conclusions

This Stage One report summarises the key policy and legislative instruments relating to waste-to-energy plants across four separate geographies. It finds a complex and varied set of strategies within each, at Federal, State and Local Authority levels, to ensure the maximum level of resource efficiency is achieved whilst retaining a detailed focus on protection of human health and the environment.

At policy level, the implementation of fiscal drivers for change, such as environmental taxes, has been successful in achieving their objectives to varying degrees. For example, a landfill tax with on-going incremental increases, on the whole, appears to be a successful incentive to divert waste from landfill and in the longer term support investment of alternative processing technologies. Other environmental taxes such as the incineration tax in Norway was introduced, amended and later withdrawn.

At regulatory level, bans on certain waste materials being sent for landfill disposal are already established in some countries. There is now strong policy development within the EU to shape future legislation to ensure waste materials that can be recycled are banned from waste-to-energy plants and to ban specific waste materials from landfill disposal. This raises parallel debate on the issue of lifecycle assessment for specified waste materials and respective merits and environmental benefits of processing these at different levels of the waste hierarchy. The outcome of these long term objectives will have an impact on residual municipal waste composition and therefore the design, operational requirements and emission control for waste-to-energy facilities.

The introduction of the new recovery status given to waste to energy processes in the EU meeting specified energy efficiency requirements (R1 energy recovery criterion) is resulting in tangible changes in the way certain waste fuels are being managed, to include increasing cross border activity.

Emissions control and regulation also varies across the selected geographies. Notably national air emission limit values in Japan are, in many cases, substantially less stringent than those under the EU Waste Incineration Directive. However, the Japanese national environmental regulations allow Prefectural Governments who plan to construct waste treatment facilities to decide on emissions limits in accordance with emission regulation of local government and/or agreement with communities, which may, in theory, be more stringent than the national requirement.

It is therefore clear that the shaping of policy, legislation and guidance to ensure the most appropriate future waste treatment infrastructure needs to remain mindful of these and related key issues and the impact on all stakeholders and the environment.

## List of Abbreviations

ACT	Advanced Conversion Technology ( <i>UK</i> )
AEL	Associated Emission Level ( <i>EU</i> )
AWT	Alternative Waste Technology/Treatment
BAT-AEL	Best Available Technique-Associated Emission Level ( <i>EU</i> )
BAT	Best Available Technique ( <i>EU</i> ) or Best Available Technology ( <i>US</i> )
BCT	Best <i>practicable</i> Control Technology ( <i>US</i> )
BDE	Bundesverband der Deutschen Entsorgungs (Federation of German Waste, Water and Raw Materials Industry Association) ( <i>EU</i> )
BMW	Biodegradable Municipal Waste ( <i>EU</i> )
BPT	Best <i>conventional</i> Pollutant Control Technology ( <i>US</i> )
BREF	Best Available Technique reference document ( <i>EU</i> )
C&D	Construction and Demolition
C&I	Commercial and Industrial
CAA	Clean Air Act ( <i>US</i> )
CCST	California Council on Science and Technology ( <i>US</i> )
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act ( <i>US</i> )
CFR	Code of Federal Regulations ( <i>US</i> )
CHP	Combined Heat and Power
CISWI	Commercial/Industrial Solid Waste Incinerator ( <i>US</i> )
COAG	Council of Australian Governments
CV	Calorific Value
CWA	Clean Water Act ( <i>US</i> )
DA	Development Application ( <i>Australia</i> )
DEFRA	Department for Environment, Food and Rural Affairs ( <i>UK</i> )
EA	Environment Agency ( <i>UK</i> ) or Environmental Assessment ( <i>US</i> )
EAW	Environmental Assessment Worksheet ( <i>US</i> )
EC	European Commission
EFTA	European Free Trade Association
EG	Emission Guideline ( <i>US</i> )
EHS	Extremely Hazardous Substance ( <i>US</i> )
EIA	Environmental Impact Assessment ( <i>EU</i> )
EIS	Environmental Impact Statement ( <i>US</i> )

ELV	Emission Limit Value
EPA	Environment(al) Protection Agency/Authority
EPCRA	Emergency Planning and Community Right-to-Know Act <i>(US)</i>
EPER	European Pollutant Emission Register
EPHC	Environment Protection and Heritage Council <i>(Australia)</i>
E-PRTR	European Pollutant Release and Transfer Register
EU	European Union
FDEP	Florida Department of Environmental Protection <i>(US)</i>
HMR	Hazardous Materials Regulations <i>(US)</i>
IED	Industrial Emissions Directive <i>(EU)</i>
IPPC	Integrated Pollution Prevention and Control <i>(EU)</i>
JEGS	Japan Environmental Governing Standards
LA	Local Authority
LACW	Local Authority Collected Waste <i>(EU)</i>
LATS	Landfill Allowance Trading Scheme <i>(UK)</i>
MACT	Maximum Achievable Control Technology <i>(US)</i>
MBT	Mechanical Biological Treatment
MEI	Minnesota Environmental Initiative <i>(US)</i>
MPCA	Minnesota Pollution Control Agency <i>(US)</i>
MRF	Materials Recovery Facility <i>(UK)</i>
MSW	Municipal Solid Waste <i>(EU)</i>
MW	Megawatt
MWC	Municipal Waste Combustor <i>(US)</i>
NAAQS	National Ambient Air Quality Standards <i>(US)</i>
NEPA	National Environmental Policy Act <i>(US)</i>
NEPC	National Environmental Protection Council <i>(Australia)</i>
NESHAP	National Emissions Standards for Hazardous Air Pollutants <i>(US)</i>
NGER	National Greenhouse and Energy Reporting <i>(Australia)</i>
NIEA	Northern Ireland Environment Agency <i>(UK)</i>
NPDES	National Pollutant Discharge Elimination System <i>(US)</i>
NPI	National Pollutant Inventory <i>(Australia)</i>
NPPF	National Planning Policy Framework <i>(UK)</i>
NSPS	New Source Performance Standard <i>(US)</i>
NSW	New South Wales <i>(Australia)</i>



NWI	National Water Initiative ( <i>Australia</i> )
NYSDEC	New York State Department of Environmental Conservation ( <i>US</i> )
OECD	Organisation for Economic Cooperation and Development
PAYT	Pay-As-You-Throw ( <i>EU</i> )
PHMSA	Pipeline and Hazardous Materials Safety Administration ( <i>US</i> )
PPSA	Power Plant Siting Act ( <i>US</i> )
RCRA	Resource Conservation and Recovery Act ( <i>US</i> )
RDF	Refuse Derived Fuel
RET	Renewable Energy Target ( <i>Australia</i> )
RMSW	Residual MSW
RO	Renewables Obligation ( <i>UK</i> )
ROC	Renewables Obligation Certificate ( <i>UK</i> )
ROD	Record of Decision ( <i>US</i> )
ROO	Renewables Obligation Order ( <i>UK</i> )
SA	South Australia
SARA	Superfund Amendments and Reauthorisation Act ( <i>US</i> )
SCEW	Standing Council on Environment and Water ( <i>Australia</i> )
SEPA	Scottish Environment Protection Agency ( <i>UK</i> )
SIP	State Implementation Plan ( <i>US</i> )
SRF	Solid Recovered Fuel
TEEP	Technically, Environmentally, Economically Practical ( <i>UK</i> )
TWG	Technical Working Group ( <i>EU</i> )
UNECE	United Nations Economic Commission for Europe
USEPA	United States Environmental Protection Agency
WARE	Waste Avoidance and Resource Efficiency ( <i>Australia</i> )
WFD	Waste Framework Directive ( <i>EU</i> )
WID	Waste Incineration Directive ( <i>EU</i> )
WIN	Without Incineration Network ( <i>UK</i> )
WMAA	Waste Management Association of Australia
WtE	Waste-to-Energy
WSP	WSP Environmental Ltd.

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# 1 Introduction

In March 2012 the Waste Authority published the Western Australia Waste Strategy *Creating the Right Environment*. Central to the success of the strategy is the utilisation of high quality information to support effective decision making.

This Stage One report presents the findings of the international literature review encompassing prevailing international legislative and policy context together with scientific understanding with respect to waste-to-energy (WtE) technologies. The review considers how such legislative or policy instruments may affect the feedstock supply, constituents, subsequent storage, management and the handling of waste feedstock. The review also specifically considers recent State or National decisions relating to WtE and emissions standards, monitoring and abatement requirements and reference to any associated guidance documents.

Geographies within the scope of this study include:

- Australia, including the States of New South Wales, Queensland, Victoria and South Australia (Section 2);
- European Union (EU) and, in particular, the UK (Scotland, England and Wales), The Netherlands, Sweden, and Germany. Norway is included as part of wider Europe whilst not being an EU member (Section 3);
- Japan (Section 4); and
- USA (Federal and State level) and in particular Florida, Minnesota, New York and California (Section 5).

Each section presents a summary of the legislation and trends in the relevant jurisdiction. To understand prevailing thought and approaches to the content of legislation and policy frameworks, the review of selected geographies and regulatory approach was undertaken to specifically understand:

- The nature and availability of feedstocks, handling and end disposal;
- Future regulatory changes potentially impacting supply or composition of feedstock;
- The critical aspects for the environment and stakeholders with respect to emissions and available technology controls; and
- Established WtE infrastructure and any impact on future developments.

The following sections present a summary for each jurisdiction. General trends and conclusions are presented in Section 6.

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## 2 Australia

### 2.1 Introduction

This section presents a summary of how WtE plants are regulated in Australia and how policy at National and State level may impact future developments, particularly in the context of this report, thermal treatment WtE plants.

This review was undertaken by local experts and based on a combination of their knowledge and experience, discussions with policy makers and desktop research.

At a National level it describes the overall policy and regulatory framework, how this relates to WtE, specific policy instruments and fiscal drivers aimed at incentivising change.

### 2.2 National Legislation and Policy

#### Overall Policy and Regulatory Framework

Australia has three levels of Government: Commonwealth (Federal), State and Local Government.

The Council of Australian Governments (COAG) Standing Council on Environment and Water (SCEW) incorporating the National Environmental Protection Council (NEPC), is the national intergovernmental body that has law-making powers as defined in the National Environment Protection Council Act 1994 (Commonwealth).

The Council's Priority Issues of National Significance, as agreed by COAG are:

- Pursuing seamless environmental regulation and regulatory practice across jurisdictions;
- Progressing national water reform, including through implementing the National Water Initiative (NWI), the outcomes of the forthcoming COAG review of the NWI, and other COAG commitments on water;
- Implementing the National Waste Policy;
- Implementing a national partnership approach to the conservation and management of land, waters, the marine environment and biodiversity at the landscape and ecosystem scale, and to building resilience in a changing climate; and
- Developing and implementing a National Plan for Clean Air to improve air quality and community health and wellbeing.

More specifically, the NEPC has two primary functions that are to:

- Make National Environment Protection Measures (NEPMs); and
- Assess and report on the implementation and effectiveness of NEPMs in participating jurisdictions.

NEPMs are broad framework-setting statutory instruments that are agreed on by Australian, State and Territory governments. They outline an agreed consistent national approach for protecting or managing particular aspects of the environment.

Each of the State and Territory environment protection agencies have their own legislative frameworks to implement the NEPMs in their respective jurisdiction and are required to comply with the NEPMs.

It should also be noted that COAG has a priority aim to develop and implement a National Plan for Clean Air to improve air quality and community health and well-being.

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## National Waste Policy and Guidance

### National Waste Policy: Less Waste, More Resources 2009

The National Waste Policy provides direction for Australia to produce less waste for disposal and manage waste as a resource to deliver economic, environmental and social benefits until 2020.

The National Waste Policy, which was agreed on by all Australian environment ministers and endorsed by the Environment Protection and Heritage Council (EPHC), establishes a comprehensive work programme for national coordinated action to avoid and reduce the amount of waste generated and increase the quantity of resources recovered from end-of-life products. The policy drives at the following six key areas:

- Reducing hazard and risk;
- Tailoring solutions;
- Providing the evidence;
- Taking responsibility;
- Improving the market; and
- Pursuing sustainability.

### National Waste Policy: Less Waste, More Resources, Implementation Plan 2010

The Implementation Plan presents the aims, key directions, priority strategies and roles and responsibilities of governments (Federal and State) as outlined in the National Waste Policy: Less Waste, More Resources. The Implementation Plan identified 16 strategies that have been developed under the six key areas under the National Waste Policy.

The National Waste Policy discusses the significance of WtE and its relevance to enhancing organic resource recovery and the opportunity to reduce greenhouse gas emissions from landfills. The Policy cites the important role of State and Territory Governments in building on their existing programs, including the need to consider the use of alternative waste treatment technologies, WtE plants and bio-digesters.

**Table 1: Key waste-related elements sourced from the Implementation Plan:**

Table No.	Title	Comment
2	Timeframe for delivery of EPHC priorities and commitments	Information is presented in accordance with the six National Waste Policy directions
3	National Waste Policy - priority initiatives and major milestones	Outlines next steps and key milestones for each of the 16 National Waste Policy strategies for the period 2010-2015
4	Strategy clusters for implementing the National Waste Policy	Sorts the 16 National Waste Policy strategies into seven groups
5	Lead agencies in each jurisdiction responsible for implementing the National Waste Policy	Provides web addresses for general waste information in each jurisdiction
6	Outcomes of the National Waste Policy	Sets out the high level vision for the National Waste Policy

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### National Pollution Inventory

The National Pollutant Inventory (NPI) was developed under the National Pollution Inventory NEPM. The NPI tracks pollution across Australia, and provides the community information about the emission and transfer of toxic substances which may affect them locally.

The NPI is an internet database designed to provide the community, industry and government with information on the types and amounts of certain substances being emitted to the environment.

The desired environmental outcomes of the NPI programs are to:

- Maintain and improve air and water quality;
- Minimise environmental impacts associated with hazardous waste; and
- Improve the sustainable use of resources.

The NPI contains data on 93 substances emitted to land, air and water that have been identified as important due to their possible effect on human health and the environment. The data comes from facilities like mines, power stations and factories, and from other sources such as households and transport.

Facility operators using more than a specified amount of the substances listed on the NPI reporting list are required to determine their own emissions and transfers annually. Diffuse emissions from households and other sources such as motor vehicles are estimated by government agencies.

- New South Wales implements the NPI NEPM under the provisions of the Protection of the Environment (General) Regulation 2009.
- Queensland implements the NPI NEPM under the Environmental Protection Regulation 2008 (EP Regulation).
- South Australia implements the NPI NEPM through the Environment Protection (National Pollutant Inventory) Policy 2008 or NPI EPP.
- Victoria implements the NPI NEPM through the Industrial Waste Management Policy (National Pollutant Inventory) (IWMP NPI).

### **National Fiscal Drivers**

Australia has recently introduced a carbon tax, which came into effect on 1 July 2012. Under the scheme, approximately 500 of the biggest carbon polluters in Australia will be required to pay for pollution under a carbon pricing mechanism. Under the pricing mechanism, the carbon price will be fixed for the first three years, starting at AUS\$23 per tonne of carbon dioxide (CO<sub>2</sub>). From year four it will be determined by the market.

Most landfills within Australia will be captured under the recently introduced carbon tax scheme so there is an expectation that landfill prices will increase across the board from 1 July 2012. Landfills which generate more than 25,000 tonnes of greenhouse gases a year will pay the carbon tax.

Moreover, landfills in Australia often have waste levies, which are set by each State or Territory.

As an incentive to increase the production of renewable energy, renewable energy power stations can produce large-scale generation certificates, which provide a revenue opportunity for facilities that can demonstrate renewable energy generation.

### Renewable Energy (Electricity) Act 2000

The Renewable Energy (Electricity) Act 2000 provides a legislative basis for the uptake of renewable energy within Australia. It does this by legislating for the recognition and accreditation of renewable energy producers, liable entities that need to acquire renewable electricity and for the creation, transfer, and use of renewable

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energy certificates, either when the certificates are small-scale technology certificates (STCs) or large-scale generation certificates (LGCs).

Moreover, the Renewable Energy (Electricity) Act 2000 under section 17 sets out what is an eligible renewable energy source, and while materials or waste products derived from fossil fuels are not eligible renewable energy sources, several biogenic wastes are eligible with respect to obtaining large scale generation certificates for accredited power stations. These eligible renewable energy sources include:

- energy crops;
- wood waste;
- agricultural waste;
- waste from processing of agricultural products;
- food waste;
- food processing waste;
- bagasse;
- biomass-based components of municipal solid waste; and
- biomass-based components of sewage;

Although this differs somewhat to the ROCs legislation employed in the UK, it is functionally similar and aims to achieve the same effect

#### Renewable Energy Target Scheme

The Renewable Energy Target (RET) Scheme is an undertaking that by 2020, 20% of Australia's electricity supply will be sourced from renewable sources.

#### **National WtE Regulatory Framework**

The key legislation and policy measures of relevance to WtE technologies and facilities at the Australian Federal level are described as follows:

##### National Environment Protection Council Act 1994 (NEPC Act)

This Act establishes the NEPC which is a national ministerial body with the responsibility to develop appropriate national legislation to be protective of the environment (media including - air (quality and noise), water, soil and groundwater). This Act is mirrored in all States and Territories.

##### Environment Protection (Sea Dumping) Act 1981 & Environment Protection (Sea Dumping) Regulations

This Act provides for the protection of the environment by regulating the dumping into the sea, and the incinerating at sea, of certain waste and other matter and objects. Through this Act, Australia gives effect to the International Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matters (Marpol).

##### Ambient Air Quality NEPM 1998

The National Environment Protection Measure for Ambient Air Quality (Air NEPM) was made in 1997 and specifies standards and goals for ambient levels of the 'criteria' air pollutants. The criteria pollutants are ubiquitous in urbanised areas and are general indicators of air quality.

The Air NEPM sets national standards for the six key air pollutants to which most Australians are exposed: carbon monoxide, ozone, sulfur dioxide, nitrogen dioxide, lead and particulates. Under the Air NEPM, all Australians have the same level of air quality protection (refer to Appendix A).

### Environment Protection and Biodiversity Conservation Act 1999 & Environment Protection and Biodiversity Conservation Regulations 2000

The Act is the primary Commonwealth legislation directed to protecting the environment in relation to Commonwealth land and controlling significant impacts on matters of national environmental significance. The Act requires assessment and approval of actions that either will significantly affect matters of national environmental significance, or are undertaken by a Commonwealth agency or involve Commonwealth land and will have a significant effect on the environment.

### Air Toxics NEPM 2004

The National Environment Protection (Air Toxics) Measure (Air Toxics NEPM) establishes 'monitoring investigation levels' for five air toxics:

- Benzene;
- Formaldehyde;
- Benzo(a)pyrene as a marker for Polycyclic Aromatic Hydrocarbons;
- Toluene; and
- Xylenes.

Monitoring data gathered under the Air Toxics NEPM will inform future decisions on the management of these pollutants.

### Used Packaging Materials NEPM 2011

This NEPM sets out a national regulatory framework for the reuse recycling and recovery of all used packaging materials. The goal of the Used Packaging Materials NEPM is to:

- Reduce environmental degradation arising from the disposal of used packaging;
- Conserve virgin materials through the encouragement of waste avoidance; and
- The reuse and recycling of used packaging materials.

The NEPM instrument for each jurisdiction is provided in Table 2.

**Table 2: NEPM Instruments**

Jurisdiction	Name of the NEPM Instrument	Introduced
Queensland	Environmental Protection (Waste Management) Regulation 2000	December 2005
Victoria	Waste Management Policy (Used Packaging Materials)	March 2006
New South Wales	Protection of the Environment (Waste) Regulation	September 2006
South Australia	Environmental Protection (Used Packaging Materials) Policy 2007	March 2007

### National Product Stewardship Act 2011

Product stewardship is a key commitment under the Australian Government's long-term National Waste Policy. The Product Stewardship Act 2011 provides the framework to manage the environmental, health and safety impacts of products, and in particular those impacts associated with the disposal of products. The framework includes voluntary, co-regulatory and mandatory product stewardship.

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Under the National Product Stewardship Act, a list will be published each year of products being considered for coverage by the legislation. The Product Stewardship Act allows for industries and products to be regulated in several ways.

Products currently on the National Waste Policy implementation plan for product stewardship action include televisions and computers (see below), packaging, tyres and mercury-containing lights. Proposals for future schemes under the product stewardship framework will need to be evidence based, taking into account both the costs and benefits.

#### Product Stewardship (Televisions and Computers) Regulation 2012

The National Television and Computer Recycling Scheme involves a combination of government regulation and industry action to take responsibility for the collection and recycling of waste televisions, computers, printers and computer products.

The scheme requires importers and manufacturers to participate in industry-run collection and recycling efforts.

#### Carbon Pricing and Clean Energy Legislation

The National Greenhouse and Energy Reporting (Measurement) Determination 2008 (the Determination) supports the aims of the *Clean Energy Act 2011* and the *National Greenhouse and Energy Reporting Act 2007*. In the Determination there are methods for calculating the covered CO<sub>2</sub> e from waste incineration. The methods available to estimate emissions include:

- though derived means, using knowledge of the waste inputs and likely oxidising factors for waste inputs entering the incineration process (under 5.53), or
- through direct measurement (under Part 1.3 Method 4) or
- through another emissions calculation method that is consistent with the *General principles for measuring emissions* (under 1.13 of the determinations).

#### **Air Emissions Standards**

Australia does not have national air emissions standards applicable to industrial facilities such as WtE plants. Environment protection authorities in individual States and Territories set such standards. Specific air emission targets are generally set for a development as part of the licencing and permitting stage and are site specific with respect to location, adjacent uses and meteorology.

However it is of note that in 1985 the National Health and Medical Research Council (NHMRC) published emissions limits for new industrial facilities, the National Guidelines for Control of Emissions of Air pollutants from New Stationary Sources<sup>1</sup>. The guidelines applied to incinerators, however the emissions limits were subsequently rescinded in 2000 in line with NHMRC policy, to avoid the guidelines still being active, while effectively being outdated and superseded by other newer sources of information. No specific point source emissions limits are known to have been published by the Council subsequently. It should be noted that the limits included in the guidelines do not represent modern best practice and are significantly less stringent than current limits in other jurisdictions.

#### Western Australia Emissions Standards

Operators of used tyres incinerators are required to meet air quality emissions limits published in the Western Australian 'Environmental Protection Regulations 1987', provided in Table 3.



**Table 3: Western Australia emissions limits for used tyre incinerators**

Pollutant	Unit	Maximum concentration
Particulate matter	mg/m <sup>3</sup>	50
Carbon monoxide	mg/m <sup>3</sup>	1,000
Zinc	mg/m <sup>3</sup>	3
Cadmium	mg/m <sup>3</sup>	3
Aluminium	mg/m <sup>3</sup>	3
Dioxins	ppm	0.005

The emissions limits for particulate matter, carbon monoxide and cadmium are significantly higher than many current national and transnational limits for thermal treatment of waste, such as the limits prescribed in the EU Waste Incineration Directive. However, the 1987 regulations pre-date much current legislation concerned with emissions limits from incineration and can now be considered out of line with modern best practice. There may be an opportunity to update and consolidate the emissions limits for incineration of used tyres in line with any future limits that may be set in Western Australia for WtE more generally.

## 2.3 State Legislation and Policy

Legislation in the various States and Territories is indirectly applicable to WtE projects, but generally does not contemplate this form of project as a 'prescribed activity' (or equivalent terminology).

### New South Wales

#### WtE Regulatory Framework

In New South Wales (NSW), the governing framework of relevance to WtE comprises:

- The Protection of the Environment Operations Act 1997 provides for setting environmental standards, goals, protocols and guidelines. The Act requires licensed waste facilities in NSW to pay a contribution in respect of each tonne of waste received for disposal at the facility. The levy rate for 2010-11 for the Sydney metropolitan area is AUS\$70.30 per tonne.
- The Waste Avoidance and Resource Recovery Act 2001 requires the development of a NSW waste avoidance and resource recovery strategy. The Act also established a framework for extended producer responsibility schemes for industry.
- Waste Avoidance and Resource Recovery Strategy 2007. The Strategy aims to maximise the conservation of natural resources by avoiding waste and minimising environmental harm from waste management and disposal of solid waste.
- Waste Processing and Recycling Corporation (Authorised Transaction) Bill 2010 (No 2). With the assent of the Act on 23 March 2010, the legislation permits the Government to privatise the publicly owned Waste Processing and Recycling Corporation.
- A WtE policy paper is due soon and will consider the role such activities can deliver for NSW.

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## Planning Control

Developers of WtE plants require planning permission which is primarily handled at the relevant State or Territory level of government.

For NSW the principal relevant planning legislation is the Environmental Planning and Assessment Act 1979 (EP&A Act) supported by the Environmental Planning and Assessment Regulation 2000 (the Regulations). For the most part, WtE proposals are defined as Designated Development under Schedule 3 of the Regulations (either 13 'Composting' facilities or works or 32 'Waste Management' facilities or works) resulting in the Minister for Planning (State) being the consent authority. The exceptions occur for projects of limited size in which case lesser environmental assessment is required.

References to WtE projects also occur in other legislative instruments as follows:

- Protection of Environment Operation PoEO Act 1997 - Schedule 1 Composting and Schedule 18 Energy Recovery;
- Waste Avoidance & Resource Recovery Act 2001 - Objective 3 (b)(ii) resource recovery (including energy recovery); and
- State Environmental Planning Policy (Infrastructure) 2007 - Part 3 Division 23 Waste or resource management facilities.

Designated Development projects require a Development Application (DA) supported by a comprehensive Environmental Assessment (EA). Both the DA and the associated EA are required to be exhibited publicly and there is a requirement for public consultation to allow the public to provide submissions to object or raise concerns in relation to the proposed development. In the case of a proposed WtE development, these submissions may relate to air quality concern (odour and dust emissions), socio-economic impacts such as land devaluation, noise, increased traffic on affected roads. Government agencies and Local Councils are required to provide submissions in relation to any such proposed development.

In parallel to the EP&A Act, the PoEO Act, which is administered by the NSW Environment Protection Authority, (EPA) will cover off on all licencing and permitting requirements for any WtE development. This will include the setting of emissions targets, discharge to air and water, noise, odour etc. as well as monitoring and reporting requirements.

### NSW White Paper on Waste to Energy

The NSW Environmental Protection Agency produced white paper for the Environment Minister setting out what it considered best practice in the sector to inform the future assessment process and permitting for Waste-to-Energy facilities.

The policy was developed focusing on two key issues i.e. air emissions and ensuring recovery does not compete with resource efficiency. For the latter, there was clear focus on demonstrating Waste-to-Energy is not considered waste disposal, but complimentary to materials recovery.

It also specifies five key technical criteria for future plants to meet if they are to receive a permit:

- Must maintain combustion conditions at a temperature of 850°C for two seconds;
- Must undertake continuous monitoring and publish this in the public domain;
- Monitoring must include metals, dioxins, furans, hydrogen fluoride and other trace contaminants. Dioxins and Furans at least twice annually;
- Must meet Group 6 European air emission standards, and
- Must demonstrate complete combustion and be net producers of energy.

The EPA acknowledged the policy drew heavily from European experience and specifically, the Waste Incineration Directive.

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## Victoria

### WtE Regulatory Framework

In Victoria, the governing framework of relevance to WtE comprises:

- The Environment Protection Act 1970 is the principal piece of legislation regulating the waste industry in Victoria. Amendments to the Act in 1985 introduced industrial waste management policies. In 2002 the Environment Protection (Resource Efficiency) Act permitted EPA Victoria to develop waste management policies. This change meant that policies that deal with municipal waste could also be developed.
- The Victorian Zero Waste Strategy was launched in 2005. The strategy established four State-wide targets for waste reduction, resource recovery and littering by 2014. The strategy contains 28 key actions consisting of industry incentives, education, and advisory support. Strategies focus on the improvement of waste management systems and infrastructure, the establishment of product stewardship agreements, the development of both new and existing markets for recycled products, and raising the awareness and capacity of communities and business.
- A statutory authority, Sustainability Victoria, was established to support and coordinate the implementation of Towards Zero Waste. Sustainability Victoria is very much a programme delivery agency and develops State-wide strategies for municipal, commercial and industrial wastes. It provides information and advice to businesses, government and the community on various issues including: recycling; energy efficient buildings; and green power.
- Levies apply to municipal, commercial and industrial and prescribed industrial wastes deposited onto land at licensed facilities in Victoria. The levy for metropolitan and provincial Melbourne is AUS\$40 per tonne.
- Whilst there is currently no specific policy position or Victorian regulations dealing with WtE facilities, EPA Victoria has an existing system for dealing with such developments through its works approval and licensing processes. Any major new development, including WtE proposals, with the potential for environmental harm and risk, would be subject to EPA Victoria assessment and approval.
- There has been some discussion about a new 'waste policy' being prepared for Victoria during 2012/13. Given recent reviews and efforts to harmonise environmental policy development and implementation in Victoria, it is expected that the Department of Sustainability and Environment will lead the process, but that guidance on specific issues be provided by EPA Victoria, Sustainability Victoria, regional waste management groups and other agencies. The process will likely involve the preparation of guidelines for WtE developments.

### Planning Control

For Victoria the principal relevant planning legislation is the Environment Protection Act 1970 (EP Act). This includes reuse, recycling and recovery of energy in its principles of waste hierarchy. The objectives of the Act include 'maximising the sustainable recovery of materials from waste for reuse, recycling, reprocessing and energy recovery'.

The EPA administers the Act and issues Works Approvals, licenses, permits, pollution abatement notices etc. A waste management facility includes a composting facility. The EPA may delegate some of its powers to Regional Waste Management Groups. The Act includes the requirement for Industry Waste Reduction Agreements and Environment and Resource Efficiency Plans.

As part of the approval process, the EPA may require a Statement of Ecological Impact (another name for an EA).

The Environment Protection (Environment and Resource Efficiency Plans) Regulations 2007 support the EP Act. The Regulations define the requirements for a scheduled activity and the criteria for an Environment and Resource Efficiency Plan.

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The Environment Protection (Industrial Waste Resource) Regulations 2009 also support the EP Act and encourage industry to utilise industrial waste as a resource including using it as an input as raw material and for energy recovery.

## Queensland

### WtE Regulatory Framework

In Queensland, the governing framework of relevance to WtE comprises:

- Waste Reduction and Recycling Strategy 2010 - 2020 sets clear targets for reducing waste, and explains how the targets will be monitored and reported. Over the next decade Queensland will: reduce waste to landfill by 50%; reduce landfill gas emissions by 50%; and increase the recovery and recycling of resources across all waste streams.
- Environmental Protection Regulation 2008 and the Environmental Protection (Waste Management) Policy 2000. The policy establishes a preferred waste management hierarchy and principles for achieving good waste management. Waste legislation in Queensland is administered by the Department of Environment and Resource Management.
- Queensland did not have a landfill levy until 1 December 2011, when it was introduced due to concerns that the State would become a dumping ground for waste from other States. However, the levy has been reduced to AUS\$0 per tonne from 1 July 2012 under the Waste Reduction and Recycling Bill 2011.
- Waste Avoidance and Resource Efficiency (WARE) fund was an AUS\$28 million programme designed to stimulate investment in waste minimisation and resource recovery infrastructure. Grant funding of between AUS\$5,000 and AUS\$5 million was available. The cutting of the WARE programme comes as a direct result of the rollback of the Queensland landfill levy from 1 July 2012.
- The overall level of Government policy and programmes on waste management and resource recovery appears to have slowed considerably in recent months, partly as a result of the waste levy being rolled back. This combined with a Departmental and Divisional restructure has resulted in limited activity.
- Specifically related to WtE, it is understood that the Department had planned to investigate Alternative Waste Technologies (AWTs) (including WtE technologies) during 2012, however the funding cuts and restructures mentioned above have temporarily deferred such activities. Personal communication with the Department notes that Queensland does not have a policy or official position on WtE facilities, with no evidence of recent studies or reviews.
- The Queensland Environment Minister is establishing a Ministerial Forum in 2012 to enable stakeholders to discuss current and future issues, barriers and opportunities, and potential AWTs including what Queensland should do with regard to WtE facilities. The timing of the Forum's creation and its scope is timely given interest from local government and their desire to manage and minimise their carbon emissions.
- It is also likely that the Queensland Department of Environment and Heritage Protection will undertake a review of its Waste Reduction and Recycling Strategy. This is likely to stimulate discussions around AWTs and their future use. Dedicated WtE facilities are quite embryonic in Queensland, although some companies have been running co-generation processes using residual wastes and green waste as a fuel substitute for coal. Queensland also operates a small number of bioreactors.

## South Australia

### WtE Regulatory Framework

In South Australia (SA), the governing framework of relevance to WtE comprises:

- The Environment Protection (Waste to Resources) Policy 2010 requires waste from metropolitan Adelaide to be taken to resource recovery facilities prior to disposal at landfill, and bans a variety of wastes from landfill.
- Zero Waste SA Act 2004. Zero Waste SA (ZWSA) is the primary agency responsible for meeting the target 'reduce waste to landfill by 25% by 2014' in South Australia's Strategic Plan and they developed Waste Strategy 2005–2010. A Consultation Draft for the next phase (2010–2015) was released in August 2010. The first Waste Strategy focused on introducing kerbside recycling systems in Adelaide and engaging communities in recycling practices.
- ZWSA also established the Waste to Resources Fund. As of July 2010, a landfill levy in South Australia was payable at a rate of AUS\$26 per tonne in metropolitan areas and AUS\$13 per tonne in non-metropolitan areas.
- SA is the only State that has a container deposit refund scheme. This was introduced in 1977, and allows South Australians to collect a refund deposit for each beverage container they return to a recycling depot. SA has also banned lightweight plastic bags.
- With regard to WtE specifically, ZWSA is planning to undertake some investigative work in relation to AWTs and WtE albeit more from a strategic policy perspective rather than a detailed technology performance viewpoint. ZWSA is currently in the process of developing a tender specification for this study.
- ZWSA recognises that energy security, carbon pricing and other factors influence the relevance, viability and acceptability of WtE facilities, however as a Government programme agency they are also seeking to understand and adopt the most appropriate option for SA mindful of maximising materials sustainability and overall life cycle impacts and benefits against the option of a 'once off energy dividend'.
- ZWSA is also of the view that there may be potential for homogenous waste streams e.g. agricultural waste streams / biosolids that could lend themselves to WtE (e.g. anaerobic digestion) and are currently undertaking an Organics Mapping Exercise in a couple of peri-urban councils as a preliminary study to ascertain the opportunities and barriers that may be present.
- The SA government, through their EPA, has produced a number of waste reform guidelines including 'the standard for production and use of refuse derived fuel'. The SA EPA is aware of a number of large industry players that are scoping various WtE technologies eg. gasification but none are in the development phase as yet.
- In summary, it appears that SA, through ZWSA, is actively considering their position on WtE and whether to confirm or adjust their 2006 position paper on AWTs. The findings of the forthcoming studies are likely to help develop a revised ZWSA Board position and potentially a whole of State government policy position.

## Planning Control

In SA the principal relevant planning legislation is the Environment Protection Act 1993. The EPA is the administration authority and can grant, renew, condition and transfer environmental authorisations (including works approvals, licences or exemptions).

This Act is supported by the Environmental Protection Regulations 2009 and the Environment Protection (Waste to Resources) Policy 2000.

None of the above legislation specifically deals with WtE activities, but all documents refer to waste and recycling depots, recovering energy or other resources from waste and composting meaning that WtE projects can be addressed under the legislation.

Environmental authorisations can be obtained by supplying certain information about the activities and the way that pollution and emissions are reduced and managed and the EPA may require tests and/or monitoring or audits or even issue Environment Protection Orders.

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## 3 Europe and European Union (EU)

### 3.1 Introduction

This section presents a summary of how WtE plants are regulated in Europe and how policy at national and state level may impact both existing plants and future developments. This review was undertaken by local experts and based on a combination of their knowledge, experience and desktop research.

At a national level it describes the overall policy and regulatory framework, how this relates to WtE, specific policy instruments and fiscal drivers aimed at incentivising change.

### 3.2 European Union

#### EU Policy Overview

EU waste policy aims to coordinate and contribute to increasing resource efficiency and reducing the negative environmental and health impacts over the life-cycle of resources throughout the EU, founded on the basic principles of preventing waste and promoting reuse, recycling and recovery so as to reduce the negative environmental impact.

In May 2003, the European Commission (EC) adopted a Communication 'Towards a Thematic Strategy on the Prevention and Recycling of Waste', setting out a wide range of suggestions and ideas for the possible future development of policy on waste in the EC. The Communication was the first step in the development of a strategy to cover both waste prevention and recycling in Member States. In December 2005 the Commission published a Communication on the Thematic Strategy on the prevention and recycling of waste, one of the seven thematic strategies programed by the 6th Environmental Action Plan (EAP)<sup>1</sup>, aimed to ensure legislation is in place to tackle most environmental challenges in the EU.

#### 'Towards a Thematic Strategy on the Prevention and Recycling of Waste' May 2003

The strategy specified a long-term goal for the EU to become a recycling society, seeking to avoid waste as far as possible and to use waste that is generated as a resource. It proposed a combination of measures promoting waste prevention, recycling and reuse in such a way as to produce the optimum reduction in the accumulated impact over the life cycle of resources, including:

- A renewed emphasis on full implementation of existing legislation;
- Simplification and modernisation of existing legislation;
- Introduction of life-cycle thinking into waste policy;
- Promotion of more ambitious waste prevention policies;
- Better knowledge and information;
- Development of common reference standards for recycling; and
- Further elaboration of the EU's recycling policy.

In January 2011, a report<sup>2</sup> on progress to date on the target objectives set out in the strategy was adopted, reviewing the main actions taken by the Commission in the key areas specified in the strategy and summarising the main forthcoming challenges and recommendations for future actions.

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<sup>1</sup> <http://ec.europa.eu/environment/newprg/index.htm>

<sup>2</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0013:FIN:EN:PDF>



The review concludes that the Strategy has played an important role in guiding policy development and improvement and gives specific reference to the simplification of legislation, the establishment and diffusion of key concepts, such as the waste hierarchy and life-cycle thinking, on setting focus on waste prevention, on co-ordination of efforts to improve knowledge and on setting new European collection and recycling targets. From a quantitative aspect on measuring success, it states the following:

*‘Overall, recycling rates have improved, the amount of waste going to landfill has decreased and the use of hazardous substances in some waste streams has been reduced. Current policies have led to a decrease of the relative environmental impacts per tonne of waste treated. However, this is offset by the negative environmental impacts caused by the expected increase in waste generation.’*

#### Report on a Resource-Efficient Europe’ May 2012

In May 2012 the EC published a ‘Report on a Resource-Efficient Europe’<sup>3</sup>. As well as proposing an end to waste to landfill, the plans approved by the EU will see a cap set on the amount of recyclable and compostable waste that can be sent for energy recovery via incineration imposed across the continent. The following is an extract from this report on this issue:

*‘...calls on the Commission to streamline the waste acquis (the accumulated legislation, legal acts, and court decisions which constitute the body of European Union law), taking into account the waste hierarchy and the need to bring residual waste close to zero; calls on the Commission, therefore, to make proposals by 2014 with a view to gradually introducing a general ban on waste landfill at European level and for the phasing-out, by the end of this decade, of incineration of recyclable and compostable waste; this should be accompanied by appropriate transition measures including the further development of common standards based on life-cycle thinking; calls on the Commission to revise the 2020 recycling targets of the Waste Framework Directive; is of the opinion that a landfill tax – as has already been introduced by some Member States – could also help achieve the above ends;...’*

### **EU Legislation Overview**

Environmental legislation and policy is well established within Europe. The EC is responsible for drafting proposals for new legislation within the EU, managing the day-to-day business of implementing policies and ensuring that the EU Member States abide by the numerous treaties and laws. Member States are obliged to implement EU Directives through national regulations and policy.

### **Ambient Air Quality Directive 2008/50/EC**

The 2008 Ambient Air Quality Directive<sup>4</sup> replaced nearly all the previous EU air quality legislation, except for the Fourth Daughter Directive (2004/107/EC)<sup>5</sup>. It sets legally binding limits for concentrations in outdoor air for major air pollutants that impact public health including particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) and nitrogen dioxide (NO<sub>2</sub>), whilst the Fourth Daughter Directive sets parallel targets for levels in outdoor air for certain toxic heavy metals and polycyclic aromatic hydrocarbons.

The Directive allows for the possibility to provide evidence that exceedances are attributable to natural sources, not to be considered as such for the purpose of complying with the relevant provision of the Directive i.e. effectively a discount for natural contributions.

The European Commission is required to review the directive in 2013 and this is expected to consider strengthening provisions for fine particulate matter (PM<sub>2.5</sub>).

<sup>3</sup> <http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+REPORT+A7-2012-0161+0+DOC+PDF+V0//EN>

<sup>4</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF>

<sup>5</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:023:0003:0016:EN:PDF>

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## Integrated Pollution Prevention Control Directive (IPPC) 2008/1/EC

IPPC defines the obligations with which industrial and agricultural activities with a high pollution potential must comply. It establishes a procedure for authorising these activities and sets minimum requirements to be included in all permits, particularly in terms of pollutants released. The aim is to prevent or reduce pollution of the atmosphere, water and soil, as well as reducing the quantities of waste arising from industrial and agricultural installations, to ensure a high level of environmental protection. It also focuses on the prudent use of natural resources.

The original IPPC Directive (96/61/EC) has been amended four times since it entered in force. The first amendment reinforced public participation in line with the Aarhus Convention (United Nations Economic Commission for Europe Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters).

The second amendment clarified the relationship between the permit conditions established in accordance with the IPPC Directive and the EU greenhouse gas emissions trading scheme.

The last two amendments relate to changes regarding Comitology (committee procedures) and European Pollutant Emission Register (EPER).

IPPC manages the activities of significant sites, called 'installations' by regulating and permitting:

- Raw material and energy use;
- How the site operates and the technology used;
- Emissions into air, water and land;
- How any waste produced is managed; and
- Accident prevention.

In order to receive a permit, an industrial or agricultural installation must comply with certain basic obligations. In particular, it must:

- Use all appropriate pollution-prevention measures, namely the best available techniques (which produce the least waste, use less hazardous substances, enable the substances generated to be recovered and recycled, etc.);
- Prevent all large-scale pollution;
- Prevent, recycle or dispose of waste in the least polluting way possible;
- Use energy efficiently;
- Ensure accident prevention and damage limitation; and
- Return sites to their original state when the activity is over.

In addition, the decision to issue a permit must contain a number of specific requirements, including:

- Emission limit values for polluting substances (with the exception of greenhouse gases if the emission trading scheme applies - see below);
- Any soil, water and air protection measures required;
- Waste management measures;
- Measures to be taken in exceptional circumstances (leaks, malfunctions, temporary or permanent stoppages, etc.);
- Minimisation of long-distance or trans-boundary pollution;



- Release monitoring; and
- All other appropriate measures.

In order to coordinate the permit process required under the Directive and the greenhouse gas emission trading scheme, a permit issued in compliance with the Directive is not obliged to contain the emission limit values for greenhouse gases if these gases are subject to an emission trading scheme, provided there is no local pollution problem. The activities at an installation are expected to be operated using 'Best Available Techniques' under a permit, refer to the Industrial Emission Directive 2010/75/EU which is replacing IPPC, however its provisions remain applicable until 6 January 2014.

### Waste Framework Directive (WFD) 2008/98/EC<sup>6</sup>

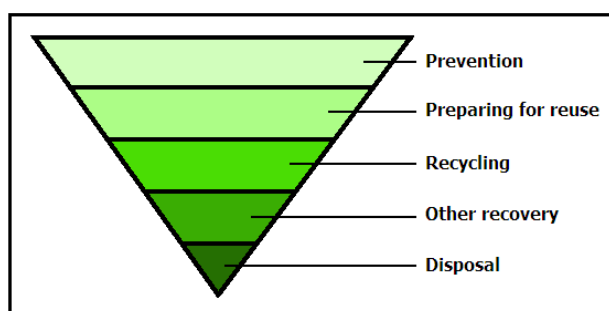
European Commission Directive 2008/98/EC (known as the revised Waste Framework Directive) entered in to force in December 2008 (revised because it further developed previous versions implemented in 1975, 1991 and 2006). Member States were required to implement into national legislation by December 2010.

The WFD sets out the basic concepts and definitions related to waste management and lays down waste management principles such as the 'polluter pays principle' and the 'waste hierarchy'. It aims to set a framework for waste management in the EU, promoting both reuse and recycling, including energy recovery as a recovery activity within a revised waste management hierarchy and dealing with 'end of waste' classification. There are also options for Member States to implement stronger measures for Extended Producer Responsibility if they so wish, taking into account existing waste stream specific and product specific legislation (such as WEEE, Batteries etc.).

#### Waste Hierarchy

An integral part of the WFD is the waste hierarchy, a priority order in waste prevention and management legislation. This requires waste producers to prioritise the re-use and recycling of waste over energy recovery and disposal to landfill. All organisations that produce, keep or manage waste must demonstrate that the hierarchy has been applied when transferring waste to another party; this includes local authorities.

**Figure 1: The Waste Hierarchy explained<sup>7</sup>**



#### Stages Include

- Prevention: Using less material in design and manufacture. Keeping products for longer; reuse. Using less hazardous materials.
- Preparing for reuse: Checking, cleaning, repairing, refurbishing, whole items or spare parts.

<sup>6</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0098:EN:NOT>

<sup>7</sup> <http://www.defra.gov.uk/environment/waste/legislation/waste-hierarchy/>

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- Recycling: Turning waste into a new substance or product. Includes composting if it meets quality protocols.
  - Other recovery: Includes anaerobic digestion, incineration with energy recovery, gasification and pyrolysis which produce energy (fuels, heat and power) and materials from waste; some backfilling.
  - Disposal: Landfill and incineration without energy recovery.

The incorporation of lifecycle thinking in waste management solutions has caused some controversy in some Member States (refer to UK regulatory framework section for a specific example). The EC has recently ruled lifecycle impacts can take precedence over the waste hierarchy for certain materials and has produced detailed guidance<sup>8</sup>, legally binding for all EU Member States. The EC has declared that the rules can be deviated from if it can be proven that following the hierarchy would not be in the 'best environmental interest' of a product's lifecycle.

*'For special waste streams Member States are allowed to depart from the waste hierarchy when this is justified by lifecycle thinking on the overall impacts of the generation and management of those specific waste streams.'*

In general, it continued, the waste hierarchy should apply 'as a priority order in waste prevention and management legislation and policy' while allowing Member States a 'degree of flexibility'.

### End of Waste

The EC is committed to developing end-of-waste criteria for materials such as aggregate, paper, glass, metal, tyres and textiles.

Once a substance or object has become waste, it will remain waste until it has been fully recovered and no longer poses a potential threat to the environment or to human health. From this point onwards, it ceases to be waste and there is no longer any reason for it to be subject to the controls and other measures required by the WFD.

### By-products

A production residue is defined as a material that is not deliberately produced in a production process but may or may not be a waste. When it not a waste it may be considered a by-product. The WFD sets out the following four conditions that a production residue must meet in order to be considered a by-product:

- Further use of the substance or object is certain;
- The substance or object can be used directly without any further processing other than normal industrial practice;
- The substance or object is produced as an integral part of a production process; and
- Further use is lawful, i.e. the substance or object fulfils all relevant product, environmental and health-protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts.

These tests are cumulative, meaning that all four conditions must be met. The origin and meaning of the criteria are discussed in the following sections.

### R1 Energy Recovery

The EU had considered the incineration of waste in a WtE plant to be a 'disposal' activity and not a 'recovery' (of energy) activity. The revision of the WFD has caused this subject to be discussed at length in Brussels as it is related to the European policies on climate change. Proposals have been made to allow a WtE plant to be

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<sup>8</sup> [http://ec.europa.eu/environment/waste/framework/pdf/guidance\\_doc.pdf](http://ec.europa.eu/environment/waste/framework/pdf/guidance_doc.pdf)

considered as a recovery operation if it meets the energy efficiency requirements of the R1 formula, currently proposed to be 0.60 for existing plants and 0.65 for new plants. This outcome ensures that any new proposed WtE plant that demonstrates an R1 value above 0.65 would be considered a 'resource recovery' plant and therefore sit higher up the waste hierarchy than less efficient plants. Such plants may also be at an advantage when seeking to gain political approval whereas for a project classified as a low efficiency 'disposal' plant may find political approval more challenging to secure.

The calculation formula for the R1 Efficiency Indicator can be found in the WFD and is based on work undertaken by the EU Best Practice Committee in Seville, Spain<sup>9</sup> and initially proposed in the BREF<sup>10</sup>.

$$\eta = \{ (E_p - E_i) / 0.97 \times (E_w + E_f) \} \times 100$$

where:

- $\eta$  = the R1 Efficiency Indicator
- $E_p$  = annual gross energy produced (combined total of electricity plus heat as equivalents<sup>11</sup>)
- $E_i$  = annual energy imported that does not contribute to steam production
- $E_f$  = annual energy input to the system by fuels with steam production
- $E_w$  = annual energy input to the system by waste
- 0.97 = factor to allow for energy losses (sensible heat losses from the plant walls and in the bottom ash).

The thermal efficiency of a WtE plant, based on the ratio of 'useful energy out' to 'energy in', is usually in the range of 18-22% for a plant producing electricity only. Typically this is insufficient to classify as a recovery operation, so newer plants have an incentive to operate efficiently. Most plants, particularly at large scale, can meet the criteria on the basis of producing only electricity, but the use of Combined Heat and Power (CHP) can dramatically increase the thermal efficiency and help to meet the R1 recovery criteria.

In 2009, the Confederation of European Waste-to-Energy Plants (CEWEP) published its updated Energy Report II (status 2004-07) providing specific data for energy, R1 plant efficiency factor and Net Calorific Value for 231 European Waste-to-Energy plants. It found 'electricity only' plants were achieving the lowest R1 factor of 0.64 as a non-weighted average, and that only 46 out of 75 are reaching the R1 standard i.e.  $\geq 0.6$ . In contrast, CHP plants achieved the highest R1 factors at 0.84 as a non-weighted average, and that 98 out of 115 are reaching the R1 standard.

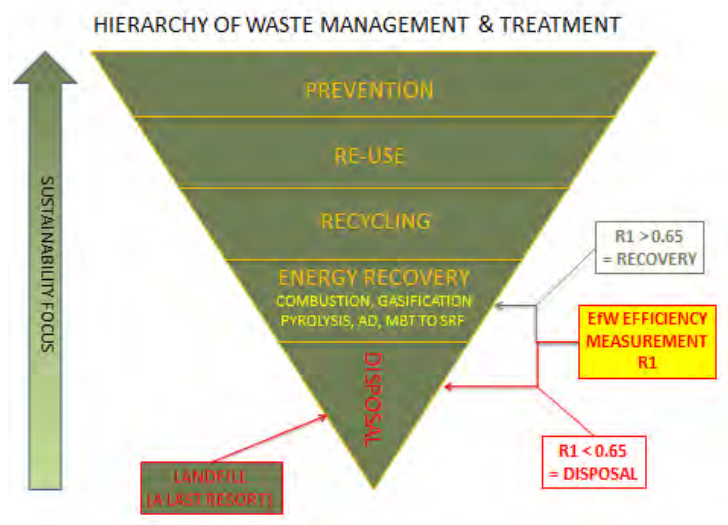
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<sup>9</sup> BREF entitled Waste Incineration (WI) produced as a result of an information exchange carried out under Article 16(2) of Council Directive 96/61/EC (IPPC Directive)

<sup>10</sup> Best Available Technique (BAT) Reference Document

<sup>11</sup> This methodology requires the energy flows to be input as equivalents. There are different forms of energy unit; i.e. MWh, MWhe and MWth, therefore conversion factors are needed. Assuming an overall European average of 38% conversion efficiency for utility electricity generation then 1 MWh = 0.38 MWhe or 1 MWhe = 2.6136 MWh and for heat generation an efficiency factor of 91% is applied then 1 MWh = 0.91 MWth or 1 MWth = 1.0989 MWh.

**Figure 2: R1 and the Waste Hierarchy**



### Recycling and Recovery Targets

The WFD sets out a range of provisions in relation to recycling and reuse, setting targets for increasing recycling rates for both household and construction and demolition (C&D) waste.

The targets in the Directive are:

- To recycle or prepare for reuse 50% of household waste by 2020; and
- To reuse, recycle or recover 70% of non-hazardous C&D waste by 2020.

It also specifies a requirement to set up separate collection of 'at least the following: paper, metal, plastic and glass', from the household waste stream by 2015 and the separate collection of waste paper, metal, plastic and glass from businesses from January 2015, where technically, environmentally and economically practicable. This has been seen as controversial in its interpretation in some Member States e.g. the UK, where the relevant merits of co-mingled and source-separated recycling collections have been debated at Government level.

In June 2012, the EC confirmed this requirement can be met by co-mingled collections of recyclables if high quality recycling is achieved.

### Waste Management Plans

Waste Management Plans are to be established by each Member State to include the production of a national waste prevention programme by the end of 2013, with a requirement for six yearly reviews.

### **Landfill Directive 1999/31/EC<sup>12</sup>**

Directive 1999/31/EC on the landfill of waste (referred to as the Landfill Directive) aims to prevent or reduce as far as possible negative effects on the environment, in particular the pollution of surface water, groundwater, soil and air, and on the global environment, including the greenhouse effect, as well as any resulting risk to human health, from the landfilling of waste, during the whole life-cycle of the landfill.

The Landfill Directive supplements the IPPC Directive by setting a variety of technical standards of operation for landfill and sets out a timetable for existing sites to be brought up to standard or close.

<sup>12</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:NOT>

The Directive requires, amongst other objectives, that a biodegradable waste strategy is enacted by each member state that achieves the progressive diversion of biodegradable municipal waste from landfill. The Directive set targets for reducing the quantity of biodegradable material sent to landfill to 35% of 1995 figures by 2020.

It also required changes to the way waste was landfilled in the EU, including:

- Certain wastes were banned from landfill;
- All landfill sites were to be classified specifically for inert waste, hazardous waste or non-hazardous waste, the latter category covers most biodegradable waste;
- Outlined standard waste acceptance criteria (WAC) for different classes of landfill;
- Introduced the requirement to pre-treat waste going to landfill (treatment could include sorting); and
- Required the UK practice of co-disposal in landfills of hazardous and non-hazardous waste to end by July 2004.

### Industrial Emissions Directive (IED) 2010/75/EU<sup>13</sup>

The EC adopted the proposal for a Directive on industrial emissions in December 2007. It entered into force in January 2011 and has to be transposed into national legislation by Member States for January 2013 for all new installations and January 2014 for existing installations previously subject to the seven Directives that IED replaces, to include IPPC and the Waste Incineration Directive (WID).

The IED aims to reduce emissions from industrial activities with a major pollution potential defined within Annex I to the Directive; for the purpose of this report it specifically includes WtE installations. Operators of industrial installations undertaking the prescribed activities are required to obtain an integrated permit from the competent authority in each EU member country. It is important to note that **the emissions limits to be contained in the IED will be identical to those currently defined in the Waste Incineration Directive (WID)**, and there are currently no specific plans to amend the emissions limits for WtE plants operating in the EU.

The IED is based on several principles, namely an integrated approach, best available techniques, flexibility, inspections and finally, public participation.

The integrated approach means that the permits must take into account the whole environmental performance of the plant, covering e.g. emissions to air, water and land, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, and restoration of the site upon closure.

The primary aim of the IED is to achieve significant benefits for the environment and human health by reducing harmful industrial emissions. Permit conditions and pollutant emission limit values (ELVs) have to be set on the basis of the application of Best Available Techniques (BAT), as specified in the relevant BREF or 'BAT reference document'. Associated Emission Levels (BAT AEL) are the expected range of emissions where BAT is applied. BAT conclusions become the reference point for applying permit conditions, specifying emission limit values less than or no greater than the BAT AELs.

BAT is defined In Article 3(10) of the IED as follows:

*“best available techniques’ means the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole:*

<sup>13</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32010L0075:EN:NOT>

- (a) 'techniques' includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;
- (b) 'available techniques' means those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator;
- (c) 'best' means most effective in achieving a high general level of protection of the environment as a whole.'

BREF<sup>14</sup> documents are provided by the EU Best Practice Committee and are the work of technical experts from throughout the EU as part of a Technical Working Group (TWG). This work is co-ordinated by the European IPPC Bureau of the Institute for Prospective Technology Studies at the EU Joint Research Centre in Seville (Spain). BREFs are based on the exchange of information drawn up for defined activities and describing applied techniques, present emissions and consumption levels, techniques considered for the determination and conclusion of BAT and any emerging techniques, giving special consideration to the Annex III of the Directive i.e. listed 12 point criteria for determining BAT.

It is important to note that the TWG base their considerations on an exchange of information presented to them by operators of established industry installations, EU Member States and environmental organisations, therefore regulations and permits based upon BAT can be perceived to be a form of self-regulation. The process however takes several years to work through and as part of the process the reference material is then assessed by representatives of operators themselves. Moreover, the definition of BAT requires the techniques identified to be technically and economically viable across the target sector as a whole, thus providing a balance between what is technically possible and that which is economically sensible. This can also be used as a reference point for setting permit conditions.

The periodic review of BREFs and developments in BAT may lead to adoption of new technologies or improved abatement. This in turn may require industry to invest in new technology to ensure compliance.

Permits issued by the competent authority in each Member State must provide for the necessary measures to ensure compliance with the operator's basic obligations and environmental quality standards. These measures must comprise at least:

- ELVs for polluting substances;
- Rules guaranteeing protection of soil, water and air;
- Waste monitoring and management measures;
- Requirements concerning emission measurement methodology, frequency and evaluation procedure;
- An obligation to inform the competent authority of the results of monitoring, at least annually;
- Requirements concerning the maintenance and surveillance of soil and groundwater;
- Measures relating to exceptional circumstances (leaks, malfunctions, momentary or definitive stoppages, etc.);
- Provisions on the minimisation of long-distance or transboundary pollution; and
- Conditions for assessing compliance with the emission limit values.

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<sup>14</sup> <http://eippcb.jrc.es/reference/>

The IED contains certain elements of flexibility by allowing the competent authorities to set less strict ELVs in specific cases, only applicable where an assessment shows that the achievement of emission levels associated with BAT as described in the BAT conclusions would lead to disproportionately higher costs compared to the environmental benefits due to either geographical location, local environmental conditions or the technical characteristics of the installation. The competent authority however, must always document the reasons for the application of the flexibility measures in an annex to the permit including the result of the cost-benefit assessment and as with IPPC before, this is open for examination by the EC.

The IED contains mandatory requirements on environmental inspections. Member States must establish a system of environmental inspections and draw up inspection plans accordingly. The IED requires a site visit shall take place at least every one to three years, with the frequency being determined using risk-based criteria.

The Directive ensures that the public has a right to participate in the decision-making process, and to be informed of its consequences, by having access to permit applications, permits, results of emissions monitoring and the European Pollutant Release and Transfer Register (E-PRTR). In E-PRTR, emission data reported by Member States are made accessible in a public register, which is intended to provide environmental information on major industrial activities. E-PRTR has replaced the previous EU-wide pollutant inventory, the EPER (refer to the IPPC).

#### Waste Incineration BREF (2006)

The Waste Incineration BREF covers installations for the incineration of hazardous and municipal waste. Although incineration provides the main focus, other thermal treatment techniques are also described in general, as they relate to some common waste streams. It does not deal with other situations where waste is thermally treated, e.g. co-incineration processes such as cement kilns and large combustion plants. The three focus areas are:

- Incineration;
- Pyrolysis; and
- Gasification.

The BREF considers relevant techniques in chapter four of the document, describing in detail the emission reduction and other techniques that are considered to be most relevant for determining BAT and BAT-based permit conditions.

Section 2.5 of the BREF presents a detailed description of applied flue gas treatment systems and further discussion on how these can be applied to minimise emissions for specific pollutants.

The European Commission recently revised its timetable for the revision of BREF documents; submission of the final draft Incineration BREF to the IED Article 13 forum for an opinion is scheduled for 2016.

#### Waste Treatment Industries BREF (2006)

The Waste Treatment Industries BREF covers the installations of a number of waste (hazardous and non-hazardous) treatments, relevant from the perspective of this report as it includes potential treatment options for processing the residual waste arising from the thermal treatment of waste e.g. combustion ashes and flue gas treatment residues.

The BREF acknowledges residual waste from thermal waste treatment processes as one of the main waste streams treated by stabilisation and solidification processes. Other methods include vitrification, purification and recycling of some components (e.g. salts). Another method of treating combustion ashes involves the fusion of ash by plasma at very high temperatures in order to vitrify the inorganic compounds in a glass/ash matrix structure. The BREF refers to one such installation in France with a total treatment capacity of 3,500 tonnes per year and there are several operating in Japan.



Submission of the final draft Waste Treatment Industries BREF to the IED Article 13 forum for an opinion is scheduled for 2015.

### Waste Incineration Directive (WID) 2000/76/EC<sup>15</sup>

Whilst the IED replaces WID as part of the overall recast of the seven specified established waste directives, in advance of Member States' implementation in their respective domestic regulations, this section summarises the requirements of WID since implementation within the EU.

The aim of WID is to prevent or limit, as far as practicable, negative effects on the environment, in particular pollution by emissions into air, soil, surface and groundwater and any resulting risks to human health, from the incineration and co-incineration of waste. It aimed to achieve this high level of environmental and human health protection by requiring the setting and maintaining of stringent operational conditions, technical requirements and emission limit values for plants incinerating and co-incinerating waste throughout the EU.

In order to guarantee complete waste combustion, WID requires all plants to keep the incineration or co-incineration gases at a temperature of at least 850°C for at least two seconds after the last injection of air. If hazardous waste with a content of more than 1% of halogenated organic substances, expressed as chlorine, is incinerated, the temperature has to be raised to 1,100 °C for at least two seconds after the last injection of air. The heat generated by the incineration process has to be put to good use as far as practicable.

The determination of limit values for co-incineration plant emissions to air is set out in Annex II. In addition, special provisions are laid down relating to cement kilns and combustion plants which co-incinerate waste.

For water discharge, plants must have a permit which authorises the discharge of used water produced from exhaust-gas clean-up. This permit will ensure that the emission limit values set out in Annex IV to the Directive are complied with.

Incineration or co-incineration residues must be reduced to a minimum and, as far as possible, recycled. When dry residues are transported, precautions must be taken to prevent their dispersal in the environment. Tests must be carried out to establish the physical and chemical characteristics, and polluting potential, of all residues.

The Directive requires the installation of measurement systems to monitor the parameters of an installation and relevant emissions. Emissions to air and to water must be measured continuously or periodically in accordance with Article 11 and Annex III of the Directive.

For emissions to air, the limit values for incineration plants are set out in Annex V to the Waste Incineration Directive and Table 4 compares the specific WID requirements with those adopted by Member States and Norway.

**Table 4: Air Emission Limit Values as applied in Europe for waste incineration plants**

		Averaging Periods	EU WID/IED	Sweden	Norway	Germany	Netherlands	UK
<b>Particulates</b>	mg/Nm <sup>3</sup>	Daily	10	10	10	10	5	10
<b>TOC</b>	mg/Nm <sup>3</sup>	min 0.5-max 8hrs	10	10	10	10	10	10
<b>HCl</b>	mg/Nm <sup>3</sup>	Daily	10	10	10	10	10	10
<b>HF</b>	mg/Nm <sup>3</sup>	Daily	1	1	1	1	1	1

<sup>15</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0076:EN:NOT>



<b>SO<sub>2</sub></b>	mg/Nm <sup>3</sup>	Daily	50	50	50	50	50	50
<b>NO<sub>x</sub></b>	mg/Nm <sup>3</sup>	Daily	200 /400 <sup>1</sup>	200 /400 <sup>1</sup>	200	200	200	200 /400 <sup>1</sup>
<b>CO</b>	mg/Nm <sup>3</sup>	Daily	50	50	50	50	50-150 <sup>2</sup>	50
<b>Hg<sup>3</sup></b>	mg/Nm <sup>3</sup>	Daily	N/A	N/A	0.03	0.03	N/A	N/A
		min 0.5-max 8hrs	0.05	0.05	N/A	0.05	0.05	0.05
<b>Cd,Tl</b>	mg/Nm <sup>3</sup>	min 0.5-max 8hrs	0.05	0.05	0.05	0.05	0.05	0.05
<b>Metals</b>	mg/Nm <sup>3</sup>	min 0.5-max 8hrs	0.5	0.5	0.5	0.5	0.5	0.5
<b>Dioxins and Furans<sup>4</sup></b>	ng/Nm <sup>3</sup>	min 6 hrs max 8 hrs	0.1	0.1	0.1	0.1	0.1	0.1

1 - 200 for existing waste incineration plants with a nominal capacity exceeding 6 tonnes per hour or new waste incineration plants, 400 for less than 6 tonnes per hour

2 - 97% of daily average is 50 mg/m<sup>3</sup>, all half-hourly average in any 24 hour period is 100 mg/m<sup>3</sup> or 95% of all 10-minute average in any 24 hour period is 150 mg/m<sup>3</sup>

3 – WID specifies a min 0.5-max 8hrs averaging period for Hg, Germany also have a daily limit and Norway, who is not within the scope of WID, only have a daily average limit

4 - The emission limit value refers to the total concentration of dioxins and furans calculated using the concept of toxic equivalence in accordance with Annex I.

The setting of NO<sub>x</sub> and CO emission limit values in the Netherlands (Table 5) demonstrates how Member States may interpret and adapt WID to align with their own regulatory requirements.

**Table 5: Specific requirements for Nitrogen Oxides in the Netherlands**

	100% of the daily averages	100% of the month averages	100% of the half-hourly averages	97% of the half-hourly averages in a calendar year
Combustion plants ≥ 20 MW *	200 mg/m <sup>3</sup>	70 mg/m <sup>3</sup>	400 mg/m <sup>3</sup>	200 mg/m <sup>3</sup>
Combustion plants <20 MW and an energy efficiency ≥ 40% *	200 mg/m <sup>3</sup>	130 mg/m <sup>3</sup>	400 mg/m <sup>3</sup>	200 mg/m <sup>3</sup>
Combustion plants <20 MW and an energy efficiency <40% *	200 mg/m <sup>3</sup>	70 mg/m <sup>3</sup> 200 mg/m <sup>3**</sup>	400 mg/m <sup>3***</sup>	200 mg/m <sup>3***</sup>

\* If the only hazardous waste incinerator to be burned, the ELVs from 1 January 2007 except for the monthly average value

\*\* The ELVs for incinerators which are located in a facility which has multiple incinerators referred to in regulation 1.1, first paragraph, with a total installed capacity amounting to at least 20 MWth

\*\*\* The ELV for other incinerators.

For emissions to water, the ELVs for incineration plants are set out in Annex IV to the WID and Table 6 compares the specific WID requirements with those adopted by Member States and Norway.

**Table 6: ELVs for discharges of wastewater**

	Suspended Solids <sup>1</sup>	Hg	Cd	Tl	As	Pb	Cr <sup>2</sup>	Cu	Ni	Zn	Dioxins & Furans
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ng/l
EU WID/IED	30-45	0.03	0.05	0.05	0.15	0.20	0.50	0.50	0.50	1.50	0.30
Sweden	30-45	0.03	0.05	0.05	0.15	0.20	0.50	0.50	0.50	1.50	0.30
Norway	30-45	0.03	0.05	0.05	0.15	0.20	0.50	0.50	0.50	1.50	0.30
Germany	30-45	0.03	0.05	0.05	0.15	0.10	0.50	0.50	0.50	1.00	0.30
Netherlands	30-45	0.03	0.05	0.05	0.15	0.20	0.50	0.50	0.50	1.50	0.30
UK	30-45	0.03	0.05	0.05	0.15	0.20	0.50	0.50	0.50	1.50	0.30

### Other Relevant EU Directives

The following section summarises remaining EU legislation that can impact the composition of waste feedstock for WtE plants.

#### Waste Shipments Regulation (EC 1013/2006) as amended

The EU established a system for the supervision and control of shipments of waste within its borders and with the countries of the European Free Trade Association (EFTA), the Organisation for Economic Cooperation and Development (OECD) and third party countries which are signed up to the Basel Convention.

This Regulation aims at strengthening, simplifying and specifying the procedures for controlling waste shipments to improve environmental protection. It also seeks to include into Community legislation the provisions of the Basel Convention as well as the revision of the Decision on the control of transboundary movements of wastes destined for recovery operations, adopted by the OECD in 2001.

Wastes subject to notification are set out in the 'Amber List' (all waste intended for disposal and hazardous waste intended for recovery, Annex IV), while wastes subject only to information requirements are set out in the 'Green List' (non-hazardous waste intended for recovery, Annex III). Wastes for which export is prohibited are listed separately (Annex V).

The relevance of cross-border movement of non-hazardous waste as fuel to WtE facilities is best considered in the light of the changes introduced across the EU as a result of the decision on the R1 criterion. For instance, the UK Environment Agency has granted waste companies permission to export Refuse Derived Fuel (RDF) to facilities on mainland Europe, where in some States there is an over-capacity of recovery facilities. UK law prohibits the disposal of waste material abroad under the Transfrontier Shipment of Waste Regulations.

#### The Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC<sup>16</sup>

The WEEE Directive is one of a number of European Directives that implement the principle of extended producer responsibility. Under this principle, producers are required to take financial responsibility for the environmental impact of the products that they place on the market, specifically when those products become

<sup>16</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0096:EN:NOT>

waste. It seeks to reduce the amount of such waste going to landfill by encouraging separate collection and subsequent treatment, reuse, recovery, recycling and environmentally sound disposal.

The WEEE Directive is primarily focused on the prevention of WEEE, and to promoting the reuse, recycling and other forms of recovery of such wastes so as to reduce disposal. It also seeks to improve the environmental performance of all operators involved in the life cycle of electrical and electronic equipment, e.g. producers, distributors and consumers, and in particular those operators directly involved in the treatment of waste electrical and electronic equipment. The legislation provides for the creation of collection schemes where consumers return their used e-waste free of charge.

The WEEE Directive contains a list of categories of products covered in Annex IA and specifies a list of products falling into these categories in Annex 1B. Member States may include other products in national legislation implementing the WEEE Directive.

It is estimated that only one third of electrical and electronic waste in the EU is reported as separately collected and appropriately treated, with the remainder assumed to be still going to landfills and to sub-standard treatment sites in or outside the EU<sup>17</sup>.

The EC is now revising the Directive to ensure an increase in the amount of e-waste collected and treated and to reduce the volume that goes to disposal or other inappropriate disposal or treatment routes. The EC will set mandatory collection targets equal to 65% of the average weight of electrical and electronic equipment placed on the market over the two previous years in each Member State. The recycling and recovery targets of such equipment would cover the reuse of whole appliances and weight-base targets would increase by 5%.

#### Batteries and Accumulators and Waste Batteries and Accumulators Directive 2006/66/EC<sup>18</sup>

The EU Batteries Directive aims to reduce the impact on the environment of the manufacture, distribution, use, disposal and recovery of batteries. The Directive achieves these aims by placing requirements on the design of all new batteries and maximising their separate collection, treatment and recycling. This further aims to reduce the disposal of batteries and accumulators in the municipal waste stream.

Key requirements of the Directive include:

- Restrictions on the use of cadmium and mercury in the design and manufacture of new batteries (subject to exemption and review).
- Labelling requirements - all new batteries to be marked with a crossed out wheeled bin symbol and the appropriate chemical symbol where applicable.
- Registration of all 'producers' e.g. manufacturers or importers of batteries into the UK.
- Collection targets for waste portable batteries of 25% of average annual sales in Member States by 2012, rising to 45% in 2016.
- A ban on the disposal of untreated automotive and industrial batteries in landfill or by incineration.
- A requirement for 'producers' or third parties acting on their behalf to arrange for the collection and recycling of waste industrial and automotive batteries.
- Requirement for 'producers' or third parties acting on their behalf to arrange for the collection and recycling and/or sound disposal of waste portable batteries deposited at collection facilities.

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<sup>17</sup> [http://ec.europa.eu/environment/waste/weee/index\\_en.htm](http://ec.europa.eu/environment/waste/weee/index_en.htm)

<sup>18</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006L0066:EN:NOT>

### Packaging Directive 94/62/EC<sup>19</sup>

The Packaging Directive aims to harmonise national measures to prevent or reduce the impacts of packaging on the environment of all Member States and remove obstacles to trade and distortion or restriction of competition. It aims to prevent the production of packaging waste and reduce the amount of waste for final disposal through packaging re-use, recycling and other forms of recovery.

The recovery and recycling targets set by the original Directive for packaging waste were revised in 2004 by an amending Directive 2004/12/EC, increasing the recycling targets to be met by Member States by 2008 to 60% overall recovery of packaging waste (55% minimum and 80% maximum recycling of packaging waste). The amending Directive also set material specific recycling targets by weight, as follows:

- Glass (60%);
- Paper and board (60%);
- Metals (50%);
- Plastics (22.5%); and
- Wood (15%).

### Municipal Waste Management within Europe

Whilst the traditional definition of Municipal Solid Waste (MSW) is applied throughout this report in line with EU terminology, it may also be referred to as Local Authority Collected Waste<sup>20</sup> (LACW) to accommodate the element of commercial type waste collected by local authorities (LAs) in addition to MSW.

Data on LACW arising within the European Union/European Free Trade Association (EU/EFTA) region is provided by Eurostat<sup>21</sup>. Table 7 provides the 2009 data set.

**Table 7: EU/EFTA LACW data 2009**

Country	LACW 2009 Tonnes					
	Total	Per Capita	Landfill	Incineration/ EfW	Recycled	Other incl. Composting
Belgium	5,258,256	0.49	268,827	1,806,517	1,881,789	1,258,110
Bulgaria	3,575,079	0.47	3,430,555	0	0	0
Czech Republic	3,307,743	0.32	2,386,600	345,429	73,273	62,805
Denmark	4,580,016	0.83	176,366	2,199,069	1,570,764	633,817
Germany	48,135,383	0.59	164,005	15,580,448	22,468,646	8,118,233
Estonia	463,784	0.35	286,849	0	52,276	42,893
Ireland	2,945,920	0.66	1,722,162	111,251	845,506	89,001
Greece	5,146,004	0.46	4,177,609	0	934,613	33,781
Spain	25,068,010	0.55	13,015,201	2,199,752	3,666,254	6,140,975

<sup>19</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0062:EN:NOT>

<sup>20</sup> Local Authority is the local government of the region (cf. municipality)

<sup>21</sup> <http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/introduction>

France	34,437,494	0.54	11,135,862	11,650,816	6,243,807	5,342,639
Italy	32,424,337	0.54	15,971,988	4,143,110	4,023,020	11,468,608
Cyprus	617,578	0.78	537,891	0	79,688	0
Latvia	755,272	0.33	696,479	0	56,532	2,261
Lithuania	1,209,304	0.36	1,095,408	0	36,849	16,749
Luxembourg	345,944	0.70	59,714	124,362	92,285	69,584
Hungary	4,313,319	0.43	3,209,912	411,270	571,766	90,279
Malta	268,019	0.65	255,197	0	11,167	0
Netherlands	10,072,816	0.61	65,943	3,214,728	2,703,669	2,373,953
Austria	4,937,959	0.59	33,421	1,453,815	1,487,236	1,963,486
Poland	12,050,937	0.32	7,855,990	114,408	1,411,027	686,446
Portugal	5,494,288	0.52	3,336,957	1,083,980	648,262	425,090
Romania	8,513,452	0.40	6,535,579	0	64,496	0
Slovenia	910,498	0.45	625,967	14,227	343,469	20,324
Slovakia	1,742,746	0.32	1,407,186	119,070	48,710	86,596
Finland	2,556,631	0.48	1,177,115	463,389	612,526	303,600
Sweden	4,461,559	0.48	64,794	2,165,985	1,582,835	610,919
United Kingdom	32,399,018	0.53	15,953,129	3,572,515	7,884,172	4,558,037
Iceland	177,569	0.56	121,360	18,204	22,994	4,152
Norway	2,255,648	0.47	321,550	935,854	614,304	355,145
Switzerland	5,406,703	0.70	0	2,634,035	1,848,445	924,223

In 1996 the 27 EU countries landfilled on average 290 kg per capita and by 2009, this reduced to 192 kg per capita. For the UK over the same period, this reduced from 440 to 259 kg per capita. The main drivers for this reduced dependence on landfill were Government policy at national and regional levels and the increasing burden of landfill tax and decreasing landfill capacity, resulting in higher gate fees for landfill disposal. In the UK, landfill tax was introduced in 1996 at £8 per tonne for 'active' waste and as of April 2012, stands at £64 per tonne. The tax will continue to increase by £8 per tonne and will not fall below £80 per tonne. This tax is in addition to the fee charged by the landfill owner, which is variable across the UK and throughout Europe.

### 3.3 Germany

#### Background

Modern waste management in Germany is an integral component of a sustainable material flow management system. Priority is the highest possible degree of utilisation of already naturally removed materials to save resources and avoid the production of waste. The aim is a stronger decoupling of waste generation from economic growth in the municipal waste sector.

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The environmental goal of the federal government is completely consistent segregation of wastes, their treatment, recycling or energy recovery of waste-bound substances and materials and as a result to ensure the withdrawal of landfilling of municipal waste to the greatest possible extent.

Avoidance before recovery before disposal. This is the principle of the waste hierarchy which is the basis for waste management in Germany. In the past waste was simply landfilled, but it has been recognised that it contains valuable raw materials which can be used to conserve natural resources. Waste avoidance means consuming less raw materials and reducing burdens on the environment. Waste recovery means that raw materials and energy are reintroduced into the economic cycle. Waste management is an important industrial sector in Germany which provides high-quality technology for the efficient use of waste as a resource and the environmentally sound disposal of the remaining residual waste.

The German government aims to achieve almost complete high-quality recovery, at least of municipal waste, by 2020. This will eliminate the need to landfill residual wastes, which has adverse effects on the climate. Resource and climate protection will be incorporated into waste management to a greater extent at European and international level over the next years, for example by minimising methane and CO<sub>2</sub> emissions or substituting fossil fuels. Germany adds know-how and innovative technology to reaching this target.

## Government Policy

### *Towards materials flow management*

The German government wants to develop a closed cycle waste management into a sustainable resource efficient materials flow management over the next few years. By strictly separating wastes, through pre-treatment, recycling and the recovery of energy, Germany aims to make full use of substances and materials bound in wastes and therefore make landfilling of wastes superfluous. Significant ecological progress was made with the entry into force of the ban on landfilling of untreated household wastes or general waste from industry since 1 June 2005.

### *Key instrument - product responsibility*

Product responsibility is at the heart of waste management policy in Germany. It puts into practice the idea that waste avoidance is best achieved by holding the generator of waste responsible. This way, producers and distributors must design their products in such a way as to reduce waste generation and allow environmentally sound recovery and disposal of the residual substances, both in the production of the goods and in their subsequent use. The legal bases for this are the Act for Promoting Closed Substance Cycle Waste Management and Ensuring Environmentally Compatible Waste Disposal (replaced by the German Recycling Act as of 1 June 2012) and the Federal Emissions Control Act.

### *Using innovative waste concepts for responsible resource management and climate protection*

Sustainable waste management that includes modern and efficient treatment technologies for waste helps to protect both resources and climate. At national level the German government supports sustainable waste management concepts for obtaining raw materials or WtE. German waste management has the highest waste recovery quotas worldwide, and thus already contributes significantly to sustainable management and climate protection.

### *Strengthening supervision under waste management law*

The German government advocates an efficient and economical supervision of waste. The act for simplification of supervision under laws pertaining to waste management, which entered into force on 1 February 2007, was an important step to ease the bureaucratic burden on waste management administration on the industry and to strengthen the efficiency of supervision under waste management law. Every year, tonnes of valuable raw materials such as copper or platinum are lost to the German raw materials cycle due to export of waste. The German government advocates a clear European regulation under which exporters must

prove that the appliances to be exported still function and are not waste. Exporters will be charged for the costs of monitoring. There is no landfill tax in Germany.

## Regulatory Framework

Germany has mandatory targets in common with the rest of the EU related to minimising disposal to landfill and increasing recycling and recovery rates. Several key pieces of legislation primarily relate to the implementation of EU directives. In addition there are various national and regional acts of legislation that influence the treatment of waste.

There are some differences in the regulatory framework and waste management policies in the constituent German Federal States though the EU directives and targets apply to Germany as a whole. The legal basis for waste management in Germany can be found in European law, the German federal law, the law of the Federal States and in the statutes of local municipalities on waste management.

### Waste Framework Directive

The WFD is transposed into German National Law by the following act and associated ordinances:

- German Recycling Act (KrWG), which entered into force on 1 June 2012 and replaced the existing until then German Closed Substance Cycle and Waste Management Act (KrW-/AbfG, entry into force 6 October 1996).
- BioAbfV - Ordinance on the Utilization of Biowastes on Land used for Agricultural, Silvicultural and Horticultural Purposes 1998 - this regulation applies to untreated and treated biowaste and mixtures, which are released for recycling as fertiliser on agricultural, forestry or horticultural land.
- GewAbfV - Ordinance on the Management of Municipal Wastes of Commercial Origin and certain Construction and Demolition Wastes 2003 - Ordinance on the disposal of industrial and municipal waste from certain construction and demolition waste.
- AltholzV – Waste Wood Ordinance 2002 - Ordinance on the Management of Waste Wood.
- AltÖlV – Waste Oil Ordinance 2002 - Ordinance amending provisions for disposal of waste oil.

### Landfill Directive

The Landfill Directive is implemented into the German legislation through the Landfill Ordinance as amended to date. Since 2005 landfilling of untreated municipal waste landfills is no longer allowed. The ban applies to both domestic and commercial waste, which decompose in landfills biologically. Non-recyclable materials must be either thermally or mechanically-biologically treated, before they can be deposited.

Germany could prove to the EU that the requirement of the Landfill Directive, which requires that the amount of biodegradable municipal waste deposited on landfills is reduced by to 35% in 2016, was already met in Germany in 2005 for all biodegradable waste.

The strategy in Germany for reduction of biodegradable municipal waste (BMW) is as follows:

- separate collection of biodegradable waste;
- composting or anaerobic digestion of non-biodegradable waste; and
- the establishment of classification criteria, in particular the limitation of organic content, which classifies the waste depending on their pollution potential, and assign them to landfill classes after security aspects; which means a pre-treatment (thermal or mechanical-biological pre-treatment) of waste.

With the amendments of the Landfill Ordinance from 2009, high standards apply for landfills, depending on the waste deposited there, and the associated risks to the environment. No later than 2009, all landfills had to



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meet these requirements. For the disposal of especially hazardous waste, the Landfill Ordinance regulates the disposal in deep underground salt mines. Such waste and the contaminants it contains are closed permanently from the biosphere in deep salt mines.

The Landfill Ordinance of 2009 also regulates the conditions under which waste is used as landfill replacement construction materials on above-ground landfills. Comparable standards for underground recycling have been specified with the Backfill Ordinance, which entered into force in December 2011. Paragraph 6 sets the conditions for the deposition of waste.

#### Waste Incineration Directive (WID)

The basis for this Directive was the German Ordinance on Incineration Installations for Waste & Other Flammable Substances of Similar Composition (17.BImSchV of 1990). WID is implemented in Germany via the Ordinance on Waste Incineration (Seventeenth Ordinance to the German Clean Air Act, 17.BImSchV, which entered into force in August 2003).

The Ordinance relates to the Federal Emissions Control Act (BImSchG), which regulates the protection of human health and environment from harmful effects of air pollution, noise, vibration and related events. The Act and its related ordinances regulate the approval procedure for industrial and commercial facilities. The law was put in force in 1974, when industrial emissions were recognised as a serious problem for the environment and human health ('environmental awareness'). Starting points of the law were certain forms of environmental impacts and exposure, defined as 'air pollution, noise, vibrations and similar activities' that can only be imponderable. The Fourth Ordinance to the Federal Emissions Control Act (Ordinance on Installations requiring a Permit, 4.BImSchV) regulates which installations and facilities require an environmental permit.

Under the German legislation developers of any proposed WtE plant must apply for an Environmental Permit (see below section 'Planning' for further details) for any proposed WtE plant (4.BImSchV Section 2).

WID allows Member States to set additional emission limit values for other pollutants. In this connection Germany has set stricter limits for some emission parameters for pollutants from the incineration for pollutants from the incineration of waste in comparison to the WID. These are defined in the 17.BImSchV. Special provisions apply for plants and installations for the production of cement clinker and cement, as well as for plants and installations for burning lime in which waste materials are incinerated.

In addition the German Ordinance on Direct Wastewater Discharge (AbWV) sets emission limits to water from waste incineration and co-incineration plants. These are also specified in Table 6.

The 17.BImSchV regulates the monitoring and reporting of emissions of WIP. Monitoring is regulated in sections 9 -16 to include the following:

Measurement methods and measuring equipment:

*10 (2) The operator needs to present a certificate issued by the authority of the supreme state or specific authority under state law for calibrations of the correct installation of measuring devices for continuous monitoring before the start of the incineration or co-incineration plant.*

*(3) The operator must have the proper measuring equipment used for continuous determination of the emissions and have them inspected once a year on functional capacity, the calibration has to be repeated at intervals of three years. The reports on the results of calibration and verification of operation have to be submitted to the authority within twelve weeks of calibration and examination.*

Evaluation and assessment of continuous measurements:

*12 (1) During operation of incineration or co-incineration plants the half hour average value has to be composed and converted to the oxygen content. For substances for which emissions are reduced by emission control devices and limits, the conversion is only allowed for the days where the measured oxygen content is above the reference oxygen content.*



12 (2) The operator must submit a test report to the authority about the examination of the continuous measurements, within three months after the end of each calendar year. The operator must keep records of the emission data for five years.

Reports and assessment of individual measurements:

14 (1) A report detailing the results of individual measurements, has to be submitted by the operator within eight weeks after the measurements have been conducted. The report must include information on the measurement planning, the result of each individual measurement, the measuring method and the operating conditions significant for the analysis of the results.

14 (2) The emission limits are considered observed if no result of a single measurement exceeds the average value in accordance with section 5 paragraph 1 of Annex II.

### **German Waste, Water and Raw Materials Industry Association (BDE) and the Recycling Act**

The WFD classifies waste incineration into a 'recovery' or a 'disposal' operation. The determination is made based on the energy recovery efficiency of the plant. In the opinion of the Federation of German Waste, Water and Raw Materials Industry Association (BDE), the new Recycling Act violates the European WFD. The BDE says that the Recycling Act counteracts with the Brussels five-step waste hierarchy. They state that the thermal treatment (step 4 of the Waste Hierarchy) is equated to the reuse and recycling of waste (steps 2 and 3), in which the heating value of the specific waste is at least 11,000 kilojoules per kilogram (kJ/kg). The calorific value clause will cause the burning of appropriate recycling waste in large quantities, because the German waste incinerators are likely to receive more than 80% of its status as recycling facilities (after the R1 formula of the WFD), so that the combustion is basically a recovery operation, and thus stand on a the same level as recycling.

At time of writing, the EC has received complaints from five industry associations and six environmental groups against the German Recycling Act, including two complaints of the BDE. Seldom has a bill, even before entry into force, been justified and resisted in equal measure by the interested stakeholders.

The Recycling Act has not properly regulated many of the important industry points hoped to be implemented to strengthen recycling in Germany. There are neither ambitious recycling rates set nor a consequent implementation of the Brussels five-step waste hierarchy, which would give recycling a clear priority over combustion.

### **Planning Control**

Under the German legislation, developers of any proposed WtE plant must apply for an Environmental Permit under German Ordinance on Installations Requiring Permit (4.BImSchV Section 2 Appendix Column 1 No. 8.1).

The permit application is determined in the Ordinance on Installations requiring a Permit (4.BImSchV) cipher 8.1 (column 1) for WtE plants. The permit procedure is described in the Ordinance on Permitting Procedure under the Federal Emissions Control Act (9. BImSchV).

As part of the permit procedure, the developer of a WtE plant is generally required to perform an Environmental Impact Assessment (EIA) as regulated by the EU Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment and its implementing legislation in Germany, the Federal Act on EIA and its related ordinances. The permit is issued by the appropriate environmental regulatory body for each German State.

### Public approval procedure

Local Authority and the community are statutory consultees to the permit application. This means that all application documents, the EIA and all other relevant documents for the environment and neighbourhood shall be open to public inspection for one month. This public display must be announced through official notice. In

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this one month and two weeks afterwards every person can raise an objection against the planning and construction of the plant.

To protect the rights of the local residents in close vicinity of the planned installation, there are a number of requirements which the operator of the incineration plant must meet in order to receive a permit. They are regulated in the following pieces of legislation:

Federal Emissions Control Act (BlmSchG)

- Section 6 Prerequisites for Licensing;
- Section 16 Major Alteration of Installations Subject to Licensing; and
- Section 15 Alteration of Installations Subject to Licensing.

EIA

Annex I no. 8.1.1 Waste incinerators, regardless of the incineration capacity are always subjected to EIA.

- Recycling Act (KrWG);
- Technical Instructions on Air Quality Control (TA Luft);
- Technical Instruction on Noise Protection (TA Lärm);
- Ordinance on Waste Incineration and Co-Incineration (17.BlmSchV);
- Federal Nature Conservation Act (BNatSchG); and
- General Construction Regulations.

## WtE Infrastructure

In Germany in 2011 there were 73 waste incineration plants with a total annual throughput capacity of about 19 million tonnes. All existing waste incineration plants produce energy for electricity, process steam and /or district heating. The overall utilisation rate of all plants is above 50%. The existing facilities could deliver significantly more energy, especially in form of steam, such as district heating, if the delivery and acceptance conditions at the plant sites could be improved. In some of the plants municipal waste is thermally treated together with municipal sewage sludge. All waste incineration plants are equipped with exhaust gas purification systems which meet the requirements of the 17.BlmSchV. With the exception of two incineration plants all emission control devices are operated without wastewater.

In general, bottom ashes and slags are treated with the aim of recycling in road construction. Beyond that, metallic components such as iron scrap and non-ferrous metals are separated and forwarded for recycling.

The only pyrolysis plant for treatment of municipal waste and sewage sludge disposal is located in Burgau (Günzburg). The plant has been operational since 1987 and has a throughput of about 25,000 tonnes per year. A second pyrolysis plant based on the same design is operating at Hamm near Dortmund. The capacity of this plant is 100,000 tonnes per annum<sup>22</sup>.

In addition to the conventional waste incineration plants Germany also operates RDF power plants. RDF power plants are generally medium to high calorific value waste fractions, which are treated in upstream processing plants and made up as 'fuel' to use. As of December 2011, 30 plants with an average annual capacity of about 4.5M tonnes are in operation. RDF power plants are usually coupled with other industrial facilities on the same site and supply them with process heat (steam) or electrical energy. They replace the otherwise required generation of heat and electricity by fossil fuels (e.g. coal and gas).

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<sup>22</sup> <http://expertpc.org/gasifier/idea2.pdf>

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More RDF power plants are currently under construction, so that at the end of 2012 an annual capacity of about 5.4 tonnes is to be expected.

About 2 million tonnes of dry matter sewage sludge accrues from municipal sewage treatment plants in Germany. In 2010 for the third consecutive year, more than half (53.2%) of the biological treatment of wastewater from municipal sewage treatment plants produced was thermally incinerated. Since 2010, no sewage sludge is assigned to landfill disposal. As regulated in the requirements of the Waste Disposal Ordinance (June 2005) landfilling of untreated sewage is prohibited.

### Other procedures for the thermal treatment of waste

In Germany there are other facilities where waste is treated using other thermal processes (e.g. gasification, liquefaction). These systems, however, play only a minor role in the waste management sectors in the country due to immature technology and the low throughput.

### Future Impacts for Waste Feedstock

In the next few years, the market will be determined by discussions on the continuity of temporary storage of waste, the efficiency of mechanical-biological treatment, Refuse Derived Fuel (RDF) production and the German Green Dot system.

Future waste streams in Germany are determined through consideration of the emergence and availability of wastes and residues potentially usable for thermal treatment and the connected capacity developments of energy recovery facilities with new buildings, continued use, or closure.

A further increase in the existing incineration capacity by building new waste incineration plants is not expected. The trend is likely to assume a reduction of existing incineration capacity at individual sites. In some cases it may lead to an increase in the annual plant throughput quantities, as waste is burned with lower heat value. For some systems this may mean that they will achieve, as a result of lower heating values of waste delivered an annual throughput capacity above the nominal plant capacity.

This general trend in waste incinerators must not apply equally to the mono sewage sludge incineration plants, if the sensibility of the perspective of the protection of natural resources will strengthen the use of combustion ash for phosphate recovery in the future.

Boosting energy efficiency and optimising energy use are the central challenges faced by state-of-the-art waste incineration.

The forthcoming IED is expected to be implemented in Germany by January 2013. At present it is not anticipated that there will be significant impact on WtE as a result of this, but significant changes are required to the Federal Emissions Control Act (BImSchG) to ensure implementation in Germany is achieved.

Other legislation and strategy in Germany for the future includes:

- 'Goal 2020' of German waste management policy defines the entire recycling/recovery of municipal waste and the abandonment of disposal above ground to a great extent.
- A widespread introduction of the recycling container for plastic and metals in 2015.
- Separate storage and the separate collection of organic waste from households by 2015.
- European Commission 'Report on a resource-efficient Europe' May 2012: As well as proposing an end to waste to landfill, the plans approved by the EU will see a cap set on the amount of recyclable and compostable waste that can be sent for energy recovery via incineration imposed across the continent.

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## 3.4 The Netherlands

### Background

The Dutch have a reputation for being forward-thinking in their approach to waste management and in 1979 Ad Lansink, a Dutch Member of Parliament proposed the four-step model that became a fundamental part of recent waste legislation in The Netherlands. This model is known nationally as ‘Lansink’s Ladder’ and is similar to the waste hierarchy as it is based upon avoiding creating waste as much as possible, recovering valuable raw materials where possible and generating energy by thermally treating residual waste; only the remainder should be landfilled in accordance with strict acceptance and operational criteria.

The Dutch government needed to take measures to reduce the need to landfill waste due in part to the lack of available capacity, but also in response to increasing environmental awareness.

### Government Policy

The Ministry of Housing Spatial Planning and the Environment (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieu VROM) is the overall Dutch regulator of the WtE sector. In The Netherlands, the interests of all stakeholders of the waste management sector are represented by the Dutch Waste Processing Association (Vereniging Afvalbedrijven VVAV).

The legal duties of provinces mostly encompass the licensing and enforcement of waste treatment facilities (including incineration and landfilling), including the regulation of waste prevention in individual licenses. The provinces are also responsible (financially, administratively and organizationally) for the aftercare of the individual landfills. To make this task possible they have the possibility to charge a levy for the amounts of landfilled waste. With this levy an aftercare fund is built up for the landfill aftercare.

The goal of the Dutch regulators is to keep waste in a ‘closed cycle’ in order to minimise residual waste. The policy for organic waste from businesses is aimed at promoting separate collection, followed by processing and recycling or recovery.

A distinction is drawn between four groups of steering instruments - communication, financial, incentives and regulations. It is not always possible to draw a clear line between these instruments, as they often overlap, e.g. incentives and financial instruments. Also, regulation is not possible without the accompanying communication.

In 1997 there was a decision to centralise responsibility for waste management, implying a shift in powers from the provincial authorities to the central government. The Environment department has to draw up a Waste Management Plan once every six years. The plan must stipulate policy for the management of all waste covered by the Environmental Management Act. The National Waste Management Plan 2002-2012 (LAP) was the first plan that complies with the obligation imposed by the above Act. The plan is developed for the period 2009 to 2015, with a strategic view to 2021.

The National Waste Management Plan is the binding regulation for the national authorities, provinces and municipalities concerning waste management in the Netherlands. The plan implements applicable international regulations and sets the rules for waste management of specific waste streams.

The Waste Management Association aims to provide an efficient and sustainable waste management system for waste in The Netherlands. It is a partner of governments and other organisations. The Association promotes the interests of waste companies operating throughout the waste chain on national and international level. The companies are engaged in the collection, recycling, processing, sorting, fermentation, composting, incineration and landfill. Even companies that are active in sewer maintenance are members.

Municipalities are responsible for the (separate) collection of household waste in their own city. The definition of household waste covers all wastes arising from private households with the exception of wastewater and end-of-life vehicles. Bulky household waste items are usually analysed separately. The basic pattern is weekly collection of waste near each premise. Authorities are obliged to collect organic household waste separately,

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door-to-door, though there may be deviations in specific circumstances. Local authority bylaws mainly include rules on disposal of household waste, for example, which components have to be kept separate, frequency of waste collection and the agencies that carry out the collections.

### Plastic Waste

Recycling of industrial used plastic succeeds, whereas recycling of municipal plastic waste is still a problem although the political pressure generated is ambitious. In 2009 the recycling rate was 32%, increasing to 38% by 2010 and 42% by 2012. A new tax package will both increase the pressure on waste disposal and also serve for the procurement of modern sorting machines for plastic waste.

### Organic Waste

The monitoring of the separate collection of organic waste takes place annually on the basis of a combination of reports to the National Waste Hotline and industrial statistics of the Centraal Bureau voor de Statistiek (CBS).

With a chain approach to waste policy a further reduction in environmental impact of waste is intended. To prevent waste early in the chain (as a product) the pressure to other phases of the material chain is minimised. Separation of organic waste for recycling is the next approach. Processing of swill for animal feeding is prohibited and together with organic waste from households it is processed in a composting or fermentation facility.

Some waste incineration plants will be upgraded to so-called 'R1 status', i.e. they will become waste recovery plants, which will make it easier for them to source waste for incineration from other countries. This has been set out in the Dutch Waste Incineration Capacity Regulation Agreement (Covenant capaciteitsregulerend afvalverbranding). The combustion residues (bottom ash mainly) can be used as filling material in road construction, as foundation material in noise barriers and as an aggregate additive to asphalt and concrete.

All installations in the European legal framework with respect to emissions and the stricter interpretation of limits apply in The Netherlands. A higher thermal efficiency is possible.

The Department of Energy from Waste within the Dutch Government will include joint positions to the field of waste incineration, WtE, the emission policy and the residues of combustion processes. The Department is policy-making and a regular interlocutor of various ministries and international organisations. The members represent 80% of the total combustion sector in The Netherlands and process some 6.3 million tonnes of waste. It produces heat and energy representing approximately 15% of the total Dutch production of renewable energy.

In The Netherlands, waste streams like glass, paper, organic waste (green bin), metal and residual waste are separately collected.

In addition, The Netherlands is a signatory to the Basel Convention (Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal).

### Fiscal Drivers

In The Netherlands, Article 8.36(f) of the Environmental Management Act requires landfill operators to charge rates which cover their costs. The tax on the landfill of waste was introduced in 1995. At the moment the actual charge is €85 per tonne.

Some municipalities offer volume-based-waste fee systems, or variable-waste charging. This means that households do not pay a fixed fee. Instead, they pay for the amount of waste collected at the household. The wheeled bins are weighted before emptying.

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Many Dutch cities manage their waste with pay-as-you-throw (PAYT) systems. Residents of the city of Maastricht buy plastic garbage bags based on how much waste they expect to generate. The larger the amount of waste, the larger the bag, and the larger the bags, the more they have to pay.

## Regulatory Framework

The Netherlands has mandatory targets in common with the rest of the EU relating to minimising disposal to landfill and increasing recycling and recovery rates. Several key pieces of legislation relate primarily to the implementation of EU directives. In addition, there are various national and regional acts of legislation that steer and coordinate the treatment of waste.

### Waste Framework Directive (WFD)

In The Netherlands the European Commission Directive 2008/98/EC is implemented by the Environmental Management Act.

### The Dutch Environmental Management Act

Municipalities are responsible for preparing local acts for implementing and enforcing the requirements in the national Environmental Management Act and other applicable national environmental regulations. The Environmental Management Act covers matters such as separated waste collection, disposal of hazardous waste, air quality, and noise nuisance, and the granting of environmental permits for industrial and commercial activities.

The provincially organised waste management e-law was replaced by national governance and finally this resulted in the revised National Waste Management Act in March 2002. The National Waste Management Act is imbedded, as a separate chapter, within the National Environmental Governance Law ('Wet Milieubeheer') and also creates the basis for the development of a National Waste Management Plan.

The first Dutch Waste Management Plan came into force in March 2003 incorporating all national policies up to 2012. Apart from the general aims for prevention of waste and stimulating reuse, the Plan includes also some quantitative goals:

- The extent of useful applications from waste has to rise from 77% in 2000 to 83% in 2012;
- The remainder of combustible waste that was still landfilled in 2002 must be zero in 2007; and
- The amount of waste disposed of by landfilling or incineration must be reduced to 9.5 million tonnes per year in 2012.

Because of the environmental implications and the EU Waste Framework Directive (2008/98/EG), national waste management plans have to be drawn up every six years. The most recent Second Dutch Waste Management Plan (LAP2) covering the period 2009-2021 is in line with all national and international Directives and policies. The major objectives are:

- Stimulating waste prevention;
- Increasing recycling (of all waste in general, and of household waste in particular);
- Reducing the deposition of combustible waste in landfills to zero, by 2021;
- Reducing the environmental impact (from production to treatment) of seven specific waste streams (e.g. waste from construction and demolition, PVC, textile, food, and paper);
- Cradle to Cradle; and
- Increasing producer responsibility.



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Within the 'Wet Milieubeheer' (National Environmental Governance Law) organic waste must be collected separately; however local Councils are allowed to deviate from this obligation if deemed necessary. Every household has a 'green bin' to collect organic waste separately from other waste. Councils can decide to collect only a fraction of the organic waste, such as garden waste or to collect the organic waste together with other waste streams. It is the responsibility of the municipality to decide the frequency of organic waste collection; in general this is done once every two weeks. Environmental regulations may vary from one municipality to another, for instance on separated waste collection from households and commercial and industrial activity, and the treatment, recycling and disposal of waste.

#### Landfill Directive

Landfill of waste has been considered for a long time to be the least preferable method of waste treatment in The Netherlands. Since 1997 a law is in force that prohibits the disposal of any waste that can be reused or combusted for energy recovery. When the European Landfill Directive was introduced in 1999, it was judged to have very little effect on Dutch everyday practices.

Since the introduction of the 'ladder van Lansink' (document by Ad Lansink, a Dutch politician, 1979), incorporated into the Dutch National Waste Control Plan (LAP), Dutch priorities for Waste Management are ranked as follows:

- Prevention of formation of waste material;
- The preparation of products from waste derived materials without negative consequences to the environment (re-use in new products);
- Reuse of waste derived products (recycling);
- Reuse of waste derived (raw) materials;
- The use of waste as a fuel for energy generation; and
- Disposal.

The 'Ladder van Lansink' became part of legislation in 1994 and was updated in 2001. The above ranking is also incorporated in the 'Wet Milieubeheer'. Therefore most of the legislation necessary to comply with the Landfill Directive was already in force before the directive was adopted; minor adaptations of applicable Dutch legislation were necessary.

The Dutch National Waste Management Plan 2002-2012 defines landfill as the least desirable method of disposal, permitted only for waste substances which, whether temporarily or not, cannot be utilised or disposed of by incineration.

The European Landfill Directive contains the requirement that in 2018 the amount of landfilled biodegradable municipal waste is limited to 35 weight per cent of the amount collected in 1995. Municipal waste is in this sense all the waste that is collected by or on behalf of governments and applies in all cases to waste from households, but also a part of the waste from businesses, in addition: vegetable, fruit and garden waste, organic waste, paper and wood. Waste streams such as textiles, carpets and leather/rubber are also partially biodegradable.

The Netherlands already meets this objective by including the separate collection of vegetables, fruit and garden waste from households, businesses and organic waste paper and cardboard from households and businesses.

In The Netherlands, Articles 8.47 to 8.51 of the Environmental Management Act contains rules on closed landfills. Landfill operators must draw up an after-care plan, which is subject to approval by the authority responsible. Chapter 6 of this regulation implements the requirement for landfills relating to soil protection and also contains rules regarding closed landfills. These include: monitoring of the quantity and composition of the

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leachate and surface water; measurement of the composition and atmospheric pressure of gas emissions; the efficiency of the gas collection system; maximum and minimum groundwater levels are ascertained, etc.; all require half-yearly monitoring.

### Waste Incineration Directive (WID)

The key legislation governing the operation of WtE facilities in The Netherlands (planned and existing) is the 'Besluit verbranden afvalstoffen' (Bva – Waste Incineration Decree).

For the implementation of Directive 2000/76 the 'Besluit verbranden afvalstoffen' was aligned in April 2004. It combined the 'Besluit luchtemissies afvalverbranding' (Bla - Ordinance of Air Emissions Waste Incineration) and 'Regeling Verbranden Gevaarlijke Afvalstoffen' (Rvga - Hazardous Waste Incineration Regulations).

Before the EU Incineration Directive (2000/76/EC) was implemented into Dutch legislation in 2004, emission limits were already set by the Besluit luchtemissies afvalverbranding 'Emissions to Air by the Incineration of Waste Decree'. This decree restricted the emissions of dioxins/furans, NO<sub>x</sub>, total dust and mercury. After the introduction of the WID, the former limits for mercury, dust and NO<sub>x</sub>, which were more stringent than the EU-limits, were maintained. Although nearly all incinerators dated from before 2004, the Dutch waste incinerators still employ advanced, state-of-the-art gas cleaning facilities, due to the early pre-European law.

Emissions limits to wastewater are defined in the Dutch Decree of wastewater discharges of flue gas cleaning (Regeling lozingen afvalwater van rookgasreiniging; see Table 6).

The 'Besluit verbranden afvalstoffen' (Bva - Waste Incineration Decree) lists emission thresholds for the following industries:

- Waste incineration plants;
- Co-incineration plants;
- Cement clinker and cement; and
- Plants and installations for burning lime in which waste materials are incinerated.

Table 4 summarises the emissions limits specified in the Bva for waste incineration plants.

The Decree aims at reducing the environmental impact of the incineration of waste and to prevent or restrict the potential risks to human health (Art. 1), including different types of waste, such as hazardous and non-hazardous waste.

The Decree is based on the premise that the emissions hazard is not dependent on the source, but on the emitted substances themselves. Therefore, for the (co-)incineration of hazardous and non-hazardous waste the same emission limits apply as for incineration of hazardous waste only.

The Decree also covers the discharge of wastewater from flue gas cleaning. Special provisions apply for the above mentioned plant categories.

The applicable EU regulation (Waste Incineration Directive) includes requirements on measurement systems. These are defined in the corresponding Dutch legislation, Besluit luchtemissies afvalverbranding.

The requirements for the waste water from flue gas cleaning are included in the control of wastewater discharges from flue-gas, entered into force in 28 December 2002.

### Waste Shipment

The European Waste Shipment Regulations (Regulation (EC) 1013/2006) (WSR) came into force on 12 July 2007. It sets out rules for the import and export of waste. The WSR is directly applicable and does not need to be transposed into Dutch law. The core of the WSR is the supervision and control of shipments of waste within, into and from the EU. Premise of the European waste policy is that waste as much as possible has to be



processed in the country of origin (self-sufficiency principle) and in the nearest treatment facilities (proximity principle).

Currently, The Netherlands exports some waste to Germany as it is partly cheaper to do so as well as depending on where the waste originates, the distance to German waste processing facilities might be shorter (for example: to the Eschweiler Waste Incineration Plant near the south eastern border).

### WtE Infrastructure

Currently about 60 million tonnes of waste are produced in The Netherlands per year and about 83% of that waste is recycled. The overall recycling rate for household waste is 60%. There are specific rates for packaging components (biodegradable), 75% material recycling for paper and 25% for wood. Only a small portion of the waste, around 9.6% is sent for incineration or landfilling. Household waste is the largest source in the waste incineration market (3.4 million tonnes per year) with industrial waste the second largest at 1.2 million tonnes per year.

In total, 34 biomass installations are in operation, generating 22 MWe of power (of which 15 MWe is from co-digestion). The current average power capacity is 200 kWe per plant and the trend is that the capacity per plant will increase to 300-500 kWe in the medium term and up to 2,000 kWe in the long term. Under the current Dutch legislation all produced digestate is considered as a fertiliser, including if a non-animal co-substrate has been used. The use of digestate within agriculture is governed by strict rules.

The cost of disposal of digestate is currently €3-15/tonne. For the time being there is a strong lobby for recognition of digestate as replacement of (artificial) fertiliser. Furthermore, there is also an interest in the upgrading of the biogas to natural gas quality for grid injection. The maximum degree of natural gas substitution at this time is estimated at only a few per cent.

The Dutch WtE plants currently deliver almost 12% of all renewable energy produced in The Netherlands. The renewable energy gains from WtE can be increased by improving access to national power grids for WtE plants, incentives to maximise electricity production from waste, and promoting infrastructure for district heating and cooling.

WtE plants thermally treat residual household and similar waste that cannot be reused or recycled in an economic or environmentally beneficial way. The heat and electricity is delivered to housing and industry and replaces fossil fuels used by conventional power plants. The residual bottom ash and the ferrous and non-ferrous metals it contains are utilised in construction projects and by industry. Sophisticated filtering devices minimise atmospheric emissions. Flue gas and wastewater are cleaned according to the strictest environmental standards prior to release in the environment. The fly ash and other residues from flue gas treatment are sent to specialised treatment facilities. The resulting product is used to stabilise salt mines or as a backfilling material in road construction.

### Future Impacts for Waste Feedstock

At the moment there is no expansion of the Dutch capacity for waste incineration planned until 1 January 2020. The current National Waste Management Plan is based on article 10.2 of the Environmental Management Act and is developed for the period 2009 - 2015 with a view to 2021.

The overall objectives of the future National Waste Management Plan are as follows:

- To limit the growth in waste generation (by decoupling from the economic growth);
- To reduce the environmental impact of 'waste' (by optimising recovery and reuse);
- To minimize the environmental product chains (raw material extraction, production, use and waste management including reuse);
- Increase producer responsibility; and

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- Cradle to Cradle.

Quantitatively the objects include the following:

- Limit the waste production to 68 million tonnes in 2015 and 73 million tonnes in 2021.
- Promote the total waste recovery from 83% in 2006 to 85% in 2015.
- Promote the waste recovery/reuse of household waste from 51% in 2006 to 60% in 2015.
- Promote the waste recovery/reuse of waste from small business from 46% in 2006 to 60% in 2015.
- At least hold the current recovery/reuse rate for construction and demolition waste at the rate of 95%.
- At least hold the current recovery/reuse rate for industrial waste at the rate of 90%.
- Reduce the landfilling of combustible waste from 1.7 million tonnes in 2007 to zero in 2012.
- Reduce the environmental pressure of seven specific waste streams.

Currently the existing landfill capacity in The Netherlands is considered sufficient based on the long term strategy of The Netherlands to reduce landfilling to zero by 2021. Consequently, under the existing National Waste Management Plan no more approvals will be granted for establishing of new landfills or expanding the existing locations.

## 3.5 Norway

### Background

Norwegian waste management policy and regulation is developing in line with its close neighbour Sweden. Norway also exports a large volume of its waste to Sweden for waste combustion but a significant volume is still sent for landfill disposal. The amount of waste sent to landfill is the lowest ever recorded since the waste accounts started in 1995. Of that sent for landfill disposal in 2010, less than 20% was classified as biodegradable, due in part to political measures such as a ban on the landfill of biologically degradable waste, landfill tax and improved infrastructure for recycling. In 2009 there were 13 thermal WtE plants operating in Norway<sup>23</sup>.

### Government Policy

The Norwegian Government periodically produces a White Paper on the environment. This outlines national waste targets and associated delivery strategies. The Government proposes climate action plans and sector targets for the main sectors responsible for greenhouse gas emissions in Norway and one of these is the waste management sector. Part of the action plan set out in the 2007 paper was the introduction of a ban on biodegradable waste to landfill.

This is effectively their national waste management plan in the form of a report on the state of the environment and a discussion on the government's future policy on this particular field<sup>24</sup>.

### Fiscal Drivers

Taxation for the final treatment of waste was introduced in Norway in 1999. Waste to landfill was taxed with 300 NOK/tonne of waste. The tax for incineration consisted of two elements, one base tax of 75 NOK/tonne and a variable element of 225 NOK/tonne which was dependant on energy utilisation, set as such to encourage the owners of WtE plants to improve the energy utilisation. To obtain a permit for a WtE plant there was a requirement for energy utilisation of 50% of the energy recovered in the boiler system as heat and/or electricity. A plant with 50% energy utilisation would then have a tax of  $75 + 0.5 \times 225 = 187.5$  NOK/tonne. This tax regime was in place and was indexed until July 2005 when the basis for taxation was changed and based upon emissions rather than energy utilisation to encourage the plants to lower their emission levels. The tax was removed in autumn 2010 to reduce the difference in taxation between Norway and Sweden.

The following is a comment from an operator of a Norwegian WtE facility on this taxation.

*'I am of the opinion that a taxation on emissions is better than having the taxation on energy utilisation which I believe can be dealt with in the permitting process e.g. like the requirement of 50% utilisation. By using the emissions as the basis was in my opinion very effective. It forced the operators to have focus on keeping the emissions low and to make necessary new investments in the plant to avoid exposure to high tax. It did work in accordance to the intentions'.*

### Regulatory Framework

In Norway, Central Government authorities provide a general framework for waste regulation; municipalities and industry are then responsible for municipal and industrial wastes with a relatively high degree of discretion to design local collection and treatment solutions<sup>25</sup>.

<sup>23</sup> [http://www.cewep.eu/information/data/studies/138.Interactive\\_Map\\_European\\_WtE\\_Plants\\_in\\_.html](http://www.cewep.eu/information/data/studies/138.Interactive_Map_European_WtE_Plants_in_.html)

<sup>24</sup> [http://scp.eionet.europa.eu/facts/factsheets\\_waste/2009\\_edition/factsheet?country=NO](http://scp.eionet.europa.eu/facts/factsheets_waste/2009_edition/factsheet?country=NO)

<sup>25</sup> <http://www.environment.no/Topics/Waste/Waste-and-recovery/#A>

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The Norwegian Pollution Control Act distinguishes between legal and illegal pollution and the main aim of the act is specified as: it is not allowed to possess, do, or initiate anything that may entail a risk of pollution, unless this is specifically permitted by law.

Almost all pollution activity in Norway is based on individual permits or licenses issued by the Norwegian Pollution Control Authority or the county environmental agencies. Whether a permit is granted or not, depends on the professional judgment of the pollution control authorities.

The Pollution Control Act of 1981 included the regulation of pollution and waste management activities. Specific waste management requirements are now given in the Act Waste Regulation (Avfallsforskriften, 2004). There are a number of waste regulations covering waste treatments such as landfill and incineration or waste management of specific waste streams. Whilst Norway is not a member of the EU it has, however, decided to comply with the requirements of certain key environmental directives, specifically for the regulation of landfill and incineration.

The organisation Avfall Norge (Waste Management Norway) has significant collaboration with Avfall Sverige (Waste Management Sweden) and the Norwegian regulatory framework is very similar to the Swedish one.

Norway, like Sweden, also prohibits the landfill of organic or combustible waste, primarily paper, wood, garden waste, food, textiles (since July 2009).

Norway is also following EU WID in relation to emission limits, except for mercury (Hg) where the emission limit in Norway is 0.03 mg/Nm<sup>3</sup> compared with 0.05 mg/Nm<sup>3</sup> in WID. These ELVs are presented in Table 6.

Norway has also followed legislation based on EU producers' responsibility for WEEE waste.

## 3.6 Sweden

### Background

Sweden is in the forefront when it comes to waste management and is one of the leaders globally in recovering energy from waste. Waste incineration is a well-established source of energy and has been since the later part of the 1940s when the district heating network was expanded. In Sweden, waste is seen as an inexpensive source of energy and is imported from neighbouring countries in order to produce heat and electricity. In 2009 there were 31 WtE plants in Sweden<sup>26</sup>.

### Government Policy

The Swedish Environmental Protection Agency produced a national waste management plan<sup>27</sup> based on environmental quality objectives and sub-targets for 2010 and 2015. It was in part also produced to meet the great demand for information about Swedish waste management from politicians, public officials, journalists, corporate environmental managers, students and other interested parties. The plan explains the significance of the objectives and clarifies the connection between objectives and measures taken. It also analyses the effects of various policy instruments and measures, and points the way to the future by defining five areas given priority within waste management:

- Implement the regulations and use the instruments decided on, and monitor progress to ensure they achieve the desired effect;
- Place greater emphasis on reducing the quantity of waste and the hazard it poses;
- Improve knowledge about pollutants;

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<sup>26</sup> [http://www.cewep.eu/information/data/studies/138.Interactive\\_Map\\_European\\_Waste-to-Energy\\_Plants\\_in\\_.html](http://www.cewep.eu/information/data/studies/138.Interactive_Map_European_Waste-to-Energy_Plants_in_.html)

<sup>27</sup> <http://www.naturvardsverket.se/en/Start/Om-Naturvardsverket/Vara-publikationer/ISBN1/1200/91-620-1249-5/>

- It must be easy for households to sort their waste; and
- Develop Swedish participation in EU work in the waste management field.

Sweden has a 'Zero Waste' philosophy which is supported by two long-term goals for 2020:

- To break the relationship between waste and growth, and
- To achieve clear, strong upward movement in the waste hierarchy.

#### Fiscal Drivers

In 2000, a landfill tax was introduced which was gradually increased by 75% from its introductory rate until 2006, and since has remained unchanged at 435 SEK/tonne. A tax on household waste going to WtE incineration was introduced in 2006 with the purpose of promoting re-use or other steps higher up in the waste hierarchy. This was not achieved and more waste was sent to landfill; therefore in part, the tax was abolished by 2010 i.e. the abolition only applies to combined heat and power plants where the electrical efficiency exceeds 15 %, to promote the production of electricity.

The overall cost of waste management is covered by fees and taxes; the municipal costs are charged as a separate waste collection fee and the producers' cost is included in the price of the product. The fee can also be used as a means of control in order to achieve a higher recycling rate. Municipalities that provide a voluntary collection of food waste lower the fee for households that choose a food waste subscription. The fee for waste collection is in some municipalities based on weight; households pay per kilogram of waste collected which encourages householders to produce less waste.

#### **Regulatory Framework**

The Environmental Code was introduced in Sweden in 1999 to promote sustainable development and protect the environment for present and future generations. The code specified five key objectives:

- Human health and the environment are protected against damage and detriment, whether caused by pollutants or other impacts.
- Valuable natural and cultural environments are protected and preserved.
- Biological diversity is preserved.
- The use of land, water and the physical environment in general is such as to secure long term good management in ecological, social, cultural and economic terms.
- Reuse and recycling, as well as other management of materials, raw materials and energy are encouraged so that natural cycles are established and maintained.

The code incorporates the overall laws for WtE plants on the basis of the EU Directives.

#### Waste Framework Directive (WFD)

The WFD was transposed into Sweden's national law by the devolved administration in the form of Avfallsförordningen SFS 2011:927 (The Waste Regulations). Everyone participates in the effort to achieve maximum environmental and societal benefits in waste management according to the waste hierarchy.

The Swedish waste management system has three categories of players with responsibility for waste. The municipalities are responsible for household waste and provide various collection points where the households are urged to sort, separate and deposit their waste.

Producers are responsible for their various product groups:

- Cardboard/carton for drinking products/packaging carton;

- Glass;
- Packaging plastics;
- Packaging metal;
- WEEE<sup>28</sup> waste;
- Pharmaceutical waste;
- Tyres;
- Batteries; and
- Motor vehicles.

Waste which does not fall under the two aforementioned categories is handled by the responsible operator.

Waste is treated in the following methods:

- Recycling of materials such as packaging, paper, metal scrap, WEEE and batteries.
- Biological treatment is implemented through anaerobic digestion or composting.
- WtE produces heat and electricity and is a method well suited for waste which cannot be treated in any other way.
- Landfill is only used for waste which cannot or should not be recycled. Landfill of organic or combustible waste is forbidden<sup>29</sup>

Sweden's All Party Committee on Environmental Objectives proposes the following targets, which includes some extension compared to the targets set by the WFD:

- By 2015, food waste shall be reduced by at least 20% compared with 2010.
- By 2015, at least 40 % of food waste from households, caterers, retail premises and restaurants will be biologically treated to provide fertiliser and energy.
- By 2015, at least 60 % of phosphorous pollution in effluent shall be treated and used on productive lands, of which at least half should be used on arable land.
- By 2020, reuse and material recycling of non-hazardous construction and demolition waste shall be at least 70%.
- By 2020, recycle or prepare for reuse 50 % of household waste.

#### Landfill Directive

The collection of statistics regarding household waste deposited to landfills was started in 1994 by the organisation Avfall Sverige (Swedish Waste Management) and since then the amount of landfilled waste has decreased by 97%. The target set by the European Commission Directive 1999/31/EC is to reduce the biodegradable municipal waste to 35% of 1995 level by 2020. Sweden already meets this requirement. In 2012, approximately 1% of the total amount of household waste is sent for landfill disposal.

#### Waste Incineration Directive

The WID was introduced in Sweden's legislation in 2002 and has applied to all Member States of the EU since 2006. In principal, the air emission limits set within the WID have been adopted in Sweden, however every

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<sup>28</sup> Waste Electrical and Electronic Equipment

<sup>29</sup> The limit for Total Organic Carbon (TOC) and Dissolved Organic Carbon (DOC) is 5% and 800 mg/kg respectively

plant have their own permits which may in some cases be stricter than the EU legislations. Local authorities may decide on stricter permits. The R1 energy recovery criterion is met by Swedish waste incineration plants. The Swedish Government is on track to implement the IED on time (January 2013).

### Planning Control

The Swedish land and environmental court (Mark och Miljöödomstolen) authorises WtE plants processing in excess of 100,000 tonnes of waste per year or for plants which incinerate hazardous waste. Smaller plants are authorised by the county administrative board (länsstyrelsen).

## 3.7 United Kingdom

### Background

There are some differences in the regulatory framework and waste management policies in the constituent countries of the UK. England and Wales are currently regulated as one entity (the Environment Agency is the regulator for both), but the devolved nations of Scotland and Northern Ireland are regulated and administered independently (Scottish Environment Protection Agency (SEPA) and Northern Ireland Environment Agency (NIEA) respectively). They also have differing targets and legislation to England and Wales, though the EU directives and targets apply to the UK as a whole. The UK currently has 30 operating WtE plants.

### Government Policy

#### Government Review of Waste Policy in England (2011)<sup>30</sup>

Under the current coalition Government, the Department for Environment, Food and Rural Affairs (DEFRA) reviewed existing waste policy (most recently Waste Strategy for England 2007) with the view for England to become a 'zero waste' society, i.e. the amount of waste being sent to landfill is to be significantly reduced in favour of reuse, recycling or WtE infrastructure. The 2007 DEFRA *Waste Strategy for England* presented the Government of the day's vision for managing waste and resources in a more sustainable manner.

The review sets out a number of principal commitments, including:

- Prioritise efforts to manage waste in line with the waste hierarchy and reduce the carbon impact of waste;
- Develop a range of measures to encourage waste prevention and reuse, supporting greater resource efficiency;
- Develop voluntary approaches to cutting waste, increase recycling, and improve the overall quality of recyclable material, working closely with business sectors and the waste and material resources industry; and
- Support WtE where appropriate and for waste which cannot be recycled.

In parallel with the aims of the 2011 Policy review, DEFRA's Business Plan 2011-2015<sup>31</sup> has the following aims:

- Agree goals for 2014/2020 and set the path towards a 'zero waste' economy through review of waste policies;
- Explore voluntary responsibility deal on waste among businesses; and
- Set out steps to promote increased WtE through anaerobic digestion.

<sup>30</sup> <http://www.defra.gov.uk/publications/2011/06/14/pb13540-waste-review/>

<sup>31</sup> <http://www.number10.gov.uk/wp-content/uploads/DEFRA-Business-Plan1.pdf>



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The coalition Government also intends to set a new national target for the reduction of commercial and industrial waste going to landfill, following the results of a national waste audit of businesses that was published in December 2010.

The Waste Review states: *'In 2012 we will consult on introducing a restriction on the landfilling of wood waste, with the aim of diverting the still substantial tonnage that ends up in landfill to better uses up the waste hierarchy and delivering clear environmental benefits.'*

#### Zero Waste Plan: Scotland<sup>32</sup>

The Scottish Government's Zero Waste Plan, launched in June 2010, set out actions to deliver important changes to how Scotland treated and managed waste. The plan was designed as an economic and resource strategy, not simply a waste strategy. It aimed to maximise the value of all the material resources used in Scotland's economy, helping to create new business opportunities as well as savings to existing businesses and local authorities in how they manage waste. To support this aim, the following key measures were agreed:

- Development of a Waste Prevention Programme for all wastes, ensuring the prevention and reuse of waste is central to all Scotland's actions and policies
- Landfill bans for specific waste types therefore reducing Scotland's greenhouse gas emissions and capturing the value from these resources
- Separate collections of specific waste types, including food, to avoid contaminating other materials, increasing reuse and recycling opportunities and contributing to Scotland's renewable energy targets
- Two new targets that will apply to all waste: 70% target recycled, and maximum 5% sent to landfill, both by 2025
- Restrictions on the input to all WtE facilities, in the past only applicable to municipal waste, therefore encouraging greater waste prevention, reuse and recycling.
- Encouraging local authorities and the resource management sector to establish good practice commitments and work together to create consistent waste management services, benefitting businesses and the public.
- Improved information on different waste sources, types and management highlighting further economic and environmental opportunities
- Measure the carbon impacts of waste to prioritise the recycling of resources which offer the greatest environmental and climate change outcomes.

#### Fiscal Drivers

The main fiscal tool to discourage the use of landfill disposal for waste is the Landfill Tax, levied on each tonne of material sent to landfill (currently at £64 per tonne for active waste i.e. non-inert), increasing by £8/tonne per annum until 2014. It was first introduced in the UK in October 1996 and between 1997 and 2009, the tax contributed to a 32% reduction in the proportion of waste sent to landfill and a similar increase in recycling. It was estimated it also saved 0.7 million tonnes of CO<sub>2</sub> equivalent emissions a year<sup>33</sup>.

Another UK fiscal driver is the Landfill Allowance Trading Scheme (LATS), discussed in the Landfill Directive UK implementation section of this review to align with biodegradable municipal waste diversion targets. This will only run until the end of 2012/13 scheme year.

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<sup>32</sup> <http://scotland.gov.uk/Topics/Environment/waste-and-pollution/Waste-1/wastestrategy>

<sup>33</sup> [http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/d/Budget2009/bud09\\_landfill\\_tax\\_964.pdf](http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/d/Budget2009/bud09_landfill_tax_964.pdf)



The Renewables Obligation (RO), which covers England and Wales and similar legislation in Scotland and Northern Ireland are designed to incentivise renewable generation into the electricity generation market. These schemes were introduced by the then Department of Trade and Industry, the Scottish Executive and the Department of Enterprise, Trade and Investment respectively and are administered by the Gas and Electricity Markets Authority (whose day-to-day functions are performed by Ofgem).

The UK Government's aim is that renewable energy will make an increasing contribution to energy supplies in the UK, with renewable energy playing a key role in the wider Climate Change Programme. The RO is the main support scheme for renewable electricity projects in the UK. It places an obligation on UK suppliers of electricity to source an increasing proportion of their electricity from renewable sources. A Renewable Order Certificate (ROC) is a green certificate issued to an accredited generator for eligible renewable electricity generated within the United Kingdom and supplied to customers within the United Kingdom by a licensed electricity supplier.

### Renewable Obligation Certificates<sup>34</sup>

WtE may qualify for ROCs under the RO depending on the technology used and the efficiency of energy recovery. In all cases, only the biomass fraction of the waste feedstock is eligible. For MSW this is deemed at 50%, however direct sampling is required to prove the biogenic content for other waste streams. The following WtE technologies are eligible for ROCs support:

- Combustion – only when operating as a Combined Heat and Power (CHP) plant; and
- Gasification and Pyrolysis – electricity only or CHP.

In October 2011, the Government launched a consultation process into the levels of banded support available under the Renewables Obligation (RO) for the period 2013-17, and a number of matters relating to the Renewables Obligation Order 2012 (ROO). The proposals impact the banding of Advanced Conversion Technologies (ACT), specifically gasification and pyrolysis. The support for conventional combustion (incineration) is unchanged; i.e. only available for CHP plants meeting strict efficiency criteria.

The initial ACT bandings were classified into 'advanced' and 'standard' gasification and pyrolysis, the difference being the calorific value of the syngas produced. However, the Government has seen little evidence that the banding has encouraged increased energy efficiency and as a result proposed to replace the separate standard and advanced gasification and pyrolysis bands with two new ACT bands from April 2013, to ensure that 'support is differentiated between generating electricity using the conventional Rankine steam cycle versus more thermally efficient conversion techniques such as gas engines, gas turbines and ultimately fuel cells and those more innovative technologies that have the potential to produce a wider range of energy outputs and products'. However, feedback received as part of the consultation process suggested that the efficiency of gas engines may not always be better than steam cycle systems and that the proposed reduction in support for steam cycle plants had the potential to stall a developing industry. Therefore the final decision was made in July 2012 to introduce a single consolidated band for ACT regardless of the energy recovery technology employed.

The level of and future ROC support for WtE technologies is summarised below in Table 8.

**Table 8 Technology Banding under the RO Scheme**

Technology	Current support (for projects commissioned before April 2013)*	Proposed support from 2013 to 2017**
Advanced Conversion Technologies (ACT) – Gasification and Pyrolysis	Split into 'advanced' and 'standard' categories depending on syngas CV. 'Advanced' receives 2 ROCs/MWh, 'standard' receives 1 ROC/MWh.	2 ROCs/MWh (falling to 1.9 in 2015/16 and 1.8 in 2016/17)

<sup>34</sup> <http://chp.decc.gov.uk/cms/renewables-obligation/?phpMyAdmin=ff232c1d3b302ac6e951f554eeeeafdf>

Energy from Waste with CHP	1 ROC/MWh	1 ROC/MWh (unchanged)
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\* Different levels of support may apply to certain types of generating station accredited before 1 April 2009. The default rate of 1 ROC/MWh applies to eligible generation that does not fall within any other banding provision.

\*\* Years refer to obligation periods under the RO. For example, 2013/14 refers to the period 1 April 2013 to 31 March 2014.

## Regulatory Framework

The UK has mandatory targets in common with the rest of the EU relating to minimising disposal to landfill and increasing recycling and recovery rates, and several key pieces of legislation primarily relate to the implementation of EU directives. In addition there are various national and regional acts of legislation that influence the treatment of waste.

### Waste Framework Directive (WFD)

In the UK the European Commission Directive 2008/98/EC was transposed into UK national law by the devolved administrations in the form of:

- England and Wales: The Waste (England and Wales) Regulations 2011;
- Scotland: Waste Management Licensing (Scotland) Regulations 2011 and The Waste (Scotland) Regulations 2011; and
- Northern Ireland: Waste Regulations (Northern Ireland) 2011.

In Scotland the Zero Waste Regulations (part of the Waste (Scotland) Regulations 2011) take the aims of the Directive further than England and Wales. Pertinent to WtE development is the ban on any metal, plastic, glass, paper, card and food collected separately for recycling from going to incineration or landfill from 1 January 2014.

The key points outlined in the new Waste (Scotland) Regulations are as follows:

- A ban on municipal biodegradable waste going to landfill, the first of its kind in the UK;
- A ban on material collected for recycling going to landfill or incineration;
- A new requirement to remove key recyclables from residual waste prior to incineration;
- A requirement for local authorities and businesses to present recyclable material for collection, and
- A requirement for local authorities and businesses to present food waste for collection from most households and businesses.

The Waste (England and Wales) Regulations 2011 implement the revised Waste Framework Directive and in summary;

- Require businesses to confirm that they have applied the waste management hierarchy when transferring waste and to include a declaration on their waste transfer note or consignment note;
- Require a new waste hierarchy permit condition and where appropriate a condition relating to mixing of hazardous waste
- Introduce a two-tier system for waste carrier and broker registration, which includes those who carry their own waste, and introduces a new concept of a waste dealer;
- Make amendments to hazardous waste controls and definition; and
- Exclude some categories of waste from waste controls, notably animal by-products whilst including a small number of radioactive waste materials.

The regulations also require the separate collection of waste paper, metal, plastic and glass from 1 January 2015. This can be interpreted under the new EC ruling as co-mingled dry recyclables if high quality recycling is achieved.

#### **Implications of lifecycle assessment and the waste hierarchy under the WFD**

In the UK, DEFRA interpreted the WFD requirement for separate collection to allow recyclable wastes such as paper, metal, plastic and glass to be collected together (commingled) as long as they are subsequently separated, for example in a Material Recovery Facility (MRF). This caused some controversy, highlighted by the judicial review brought by Campaign for Real Recycling in relation to this decision to allow commingled collections. They argued this failed to fully transpose the WFD and suggested the quality of recyclable material will be inferior to that of that of individually collected recyclables. They also argued that other Member States had not interpreted the definition of separate collection in this way.

The EC believes lifecycle impacts can take precedence over the waste hierarchy for certain materials and has produced detailed guidance, legally binding for all EU Member States. The EC declared that the rules can be deviated from if it can be proven that following the hierarchy would not be in the best environmental interest of a product's lifecycle. In June 2012 the EC confirmed the requirement for separate collection can be met by commingled collections of recyclables if high quality recycling is ultimately achieved.

DEFRA has requested adjournment of the judicial review and accepts that the wording in the Waste (England and Wales) Regulations 2011 requires an amendment to clarify this position and ensure the WFD is to be properly transposed in accordance with EC guidance. The High Court agreed to this adjournment request and the review has been put on hold until June 2013. DEFRA is now however consulting on changes to the 2011 regulations and its proposed changes are based on allowing commingled collections when an individual collection is not Technically, Environmentally, Economically Practical (TEEP).

#### Landfill Directive

European Commission Directive 1999/31/EC (known as the Landfill Directive) was transposed in the UK through the Landfill (England and Wales) Regulations 2002, Landfill (Scotland) Regulations 2003 and Landfill (Northern Ireland) Regulations 2003.

Key changes to the way waste was landfilled in the UK were adopted from the Directive, including:

- Certain wastes were banned from landfill;
- All landfill sites were to be classified specifically for inert waste, hazardous waste or non-hazardous waste, the latter category covers most biodegradable waste;
- Introduced the requirement to pre-treat waste going to landfill (treatment could include sorting), and
- Required the UK practice of co-disposal in landfills of hazardous and non-hazardous waste to end by July 2004.

In addition to the above, the UK is required to meet the following targets, based on the weight of biodegradable municipal waste (BMW) landfilled in 1995:

- Reduce BMW landfilled to 75% of 1995 level by 2010;
- Reduce BMW landfilled to 50% of 1995 level by 2013; and
- Reduce BMW landfilled to 35% of 1995 level by 2020.

The implementation of the Landfill Directive's requirements for diversion of BMW required primary legislation and was implemented through the Waste and Emissions Trading (WET) Act 2003. This put in place the necessary legal framework to allow the UK to meet its targets and help advance policies both to combat climate change and to move towards more sustainable waste management, via:

- The setting of a maximum amount of BMW to landfill from each county in the UK

- The allocation on landfill allowances, which may be tradable, to waste disposal authorities
- The preparation, in each county of the UK, of a strategy for reducing the amount of biodegradable waste going to landfills
- Details of the landfill allowances scheme being established in subordinate legislation by the appropriate authority in each county of the UK

The subsequent Landfill Allowance Trading Scheme (LATS) was designed to encourage local authorities to develop alternative waste treatment options. In England and Wales the on-going requirements of the Directive are applied under the Environmental Permitting (England and Wales) Regulations 2010.

### Waste Incineration Directive (WID)

WID is implemented in the UK via the following regulations:

- England and Wales: The Environmental Permitting Regulations (England and Wales) 2010.
- Scotland: Pollution Prevention and Control (Scotland) Regulations 2000
- Northern Ireland: Pollution Prevention and Control Regulations (Northern Ireland) 2003

Developers must apply for an Environmental Permit for any proposed WtE plant. The Permit is issued by the appropriate environmental regulatory body for each country:

- England and Wales: Environment Agency (EA);
- Scotland: Scottish Environmental Protection Agency (SEPA); and
- Northern Ireland: Northern Ireland Environment Agency (NIEA).

The Environmental Permit is issued for activities listed under Part A of the Pollution Prevention and Control (PPC) regime. Integrated Pollution Prevention and Control (IPPC) also applies to plants incinerating more than three tonnes per day (to be replaced by the Industrial Emissions Directive).

The air emissions limits for pollutants from the incineration of waste in the UK are as defined in WID (addressed in Article 7, with specific values provided in Annex V). WID allows Member States to set additional emission limit values for polycyclic aromatic hydrocarbons (PAH) or other pollutants; however the UK has not set any further limits beyond those explicitly defined in WID. Despite this, the Environmental Permitting Regulations (England and Wales) 2010 require operators of WID plant to measure 'dioxin-like polychlorinated biphenyls and poly-cyclic aromatic hydrocarbons' at least two times each year, which goes beyond the WID requirement to measure only dioxins and furans at this frequency (Article 11(2)(c)), despite there being no specific limits for such pollutants.

Emissions limits to water are as per WID requirements (see Table 6).

### **Other Regulations**

In addition to the above the following acts and regulations have an impact on residual solid waste composition in the UK:

- Household Waste Recycling Act 2003 - designed to increase the proportion of household waste recycled by requiring local authorities to collect at least two types of recyclable waste from households by 2010;
- Waste Electrical and Electronic Equipment (Amendment) Regulations 2010 - designed to increase the proportion of electrical goods re-used and recycled, and hence reduces the proportion sent to WtE or landfill;

- Responsibility Obligations (Packaging Waste) Regulations 2005 amended in 2007. Producers of waste are responsible for proving that their packaging waste is diverted from landfill, demonstrated through the use of Packaging Waste Recovery Notes (PRNs) from accredited re-processors or recyclers.
- In England, the Waste Batteries and Accumulators Regulations came into force May 2009 and established a producer responsibility system for the collection, treatment and recycling of waste portable, industrial and automotive batteries.

### Planning Control

Developers of WtE plants must apply for planning permission, which can be done before or in parallel with the environmental permit application. Planning permission is determined by the relevant Local Authority (typically at County level in non-metropolitan authorities). The Local Authority and the Environment Agency (EA) are also consultees to each process, so the EA will have the opportunity to comment on the planning application whilst considering the permit application. For WtE plants this process can take considerable time (several years in some instances).

Local planning strategies can also influence waste policy, and the opportunities for WtE, in specific areas of the UK as a result of the following factors:

- Technology bias: for example, the London Plan which heavily favours 'advanced conversion technologies' (e.g. pyrolysis and gasification) over conventional mass-burn incineration, or
- Target setting: The adoption of targets for waste management, such as minimum recycling rates, potentially has an impact on both the composition of the feedstock and the development of new facilities.

In addition the recently introduced Localism Act 2011, intended in part to give local communities and individuals a greater say in planning decisions, has the potential to make obtaining planning permission for WtE facilities more onerous.

### National Planning Policy Framework (NPPF) 2012

The NPPF sets out the Government's economic, environmental and social planning policies for England and provides a framework within which local people and councils can produce local and neighbourhood plans.

Despite hopes that the Framework would provide clarity on planning policy for the development of waste infrastructure, the waste sector will have to wait for the publication of the government's National Waste Management Plan for England which will replace Waste Strategy for England 2007 as the national waste management plan for these purposes. This may not be published until the end of 2013.

Until the publication of the Plan, the Department for Communities and Local Government framework document states:

*'This Framework does not contain specific waste policies, since national waste planning policy will be published as part of the National Waste Management Plan for England. However, local authorities preparing waste plans and taking decisions on waste applications should have regard to policies in this Framework so far as relevant.'*

### Planning Policy Statement 10: Planning for Sustainable Waste Management (Revised March 2011)

Planning Policy Statements were taken into account by local planning authorities in the preparation of local development documents. They could also be material considerations to decisions on individual planning applications. As of March 2012, the majority of these documents have been replaced by the NPPF; however PPS10 will remain in place until the National Waste Management Plan is published in 2013.

With regard to waste management, PPS10 outlines the following:

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*‘Regional planning bodies and all planning authorities should, to the extent appropriate to their responsibilities, prepare and deliver planning strategies that:*

- *Help deliver sustainable development through driving waste management up the waste hierarchy, addressing waste as a resource and looking to disposal as the last option, but one which must be adequately catered for;*
- *Provide a framework in which communities take more responsibility for their own waste, and enable sufficient and timely provision of waste management facilities to meet the needs of their communities;*
- *Help implement the national waste strategy, and supporting targets, are consistent with obligations required under European legislation and support and complement other guidance and legal controls such as those set out in the [Environmental Permitting regulations];*
- *Help secure the recovery or disposal of waste without endangering human health and without harming the environment, and enable waste to be disposed of in one of the nearest appropriate installations;*
- *Reflect the concerns and interests of communities, the needs of waste collection authorities, waste disposal authorities and business, and encourage competitiveness; and*
- *Ensure the design and layout of new development supports sustainable waste management’.*

The UK government is attempting to address health and environmental concerns surrounding energy-from-waste facilities in a guidance document to be published summer 2012.

DEFRA’s Waste Review of June 2011 declared it would publish an energy-from-waste that would seek to address fears about the environmental and public health impacts of building these facilities near local communities<sup>35</sup>.

We will work to remove barriers to other WtE technologies by ensuring information is available and readily understood. We will publish a guide to WtE to help all involved make decisions best suited to their specific requirements. While remaining technology neutral, we will look to identify and communicate the full range of recovery technologies available and their relative merits – right fuel, right place and right time. The Government will also provide the necessary framework to address market failures and ensure the correct blend of incentives are in place to support the development of recovery infrastructure as a renewable energy source.

At a recent public event on WtE, DEFRA’s Director for climate, waste & atmosphere Colin Church stated “We are also looking to stimulate the debate about WtE in local communities and we are looking to produce a guide to WtE looking at the health and environmental impact that should be ready in the coming months.”

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<sup>35</sup> <http://www.defra.gov.uk/publications/files/pb13540-waste-policy-review110614.pdf>



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## 3.8 Other EU States

To further develop an understanding of how Member States have implemented the key EU directives and interpreted this in their own domestic legislation, this section summarises policy, legislation and WtE infrastructure in a selection of countries.

Austria, Belgium, Bulgaria, Denmark, Finland, France, Italy, Poland, Romania and Spain have been selected to reflect the varying periods of time of EU membership (from founder members to the most recent) and regional geographies. Brief summaries highlighting key aspects have been presented herein.

### AUSTRIA

#### Background

According to the Austrian constitution, responsibility of waste management is divided between the federal and provincial government. The federal government is responsible for hazardous, packaging and other wastes that require country-wide provisions; while provinces are responsible for the management of municipal waste.

Integrated waste management in Austria began more than 30 years ago with the issuance of technical guidelines on landfill and the Federal Act on Hazardous Waste Disposal. Since acceptance into the EU in 1995, mandatory targets have been placed on Austria in common with the rest of the EU relating to minimising disposal to landfill and increasing recycling and recovery rates, and some domestic legislation primarily relates to the implementation of EU directives.

In addition there are various national and regional acts of legislation that influence the treatment of waste such as for:

- Biodegradable Municipal Waste: Ordinance on the Separate Collection of Organic Wastes, Gazette II No. 68/1992 Law on the prohibition of incinerating biogenic materials outside of facilities, Gazette I No 405/1993 Ordinance on Compost, Gazette II No 292/2001;
- Packaging: Ordinance on the prevention and recovery of packaging waste and certain product residues and on collection and recovery schemes, Law Gazette II No 648/1996 Ordinance on the take back and deposit charging for refillable beverage packaging made of plastic, Law Gazette II No 513/1990; and
- Construction and Demolition: Ordinance on the Separation of Materials Accumulated during Construction Work, Law Gazette II 259/1991.

#### Policy

##### The 2011 amendment of the Federal Waste Management Plan (FWMP), 1992

This is the 'White Paper' of Austrian waste management, which since 1992 when it was first published by the Federal Ministry of Agriculture, Forestry, Environment and Water has been amended every six years.

##### Fiscal Drivers

The Austrian AISAG fee (Altlastensanierungsabgabe) is a policy measure aimed at reducing the quantity of waste sent for landfill disposal, it is an additional fee paid to a Federal Fund for the clean-up of contaminated sites. This fee has risen incrementally over the years and can be as much as €87 per tonne depending on the technical standard of the landfill and quality of the waste. This measure aims to promote other treatment options, such as recycling and energy recovery, by make landfill disposal a less preferred option. There is currently no incineration tax in Austria.

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## Regulatory Framework

### Waste Framework Directive

Austria has incorporated the WFD into its national legislation, through the following:

- 2010 amendment (AWG Novelle) of the Waste Management Act (AWG) 2002, which came into force in 2010;
- The nine federal provinces in Austria also have their own waste laws which govern municipal waste, which is not covered by the legal status of the Federation. All provincial Waste Management Acts pass over the responsibility of municipal waste to the municipalities and cover topics such as waste fees and waste management plans for waste associations. Though, there are no provincial laws specific to WtE.

The Landfill Directive has been implemented throughout Austria via the introduction of:

- A ban on disposal of hazardous wastes to landfill (except inorganic wastes encapsulated in closed salt formations) in July 2001.
- A strict restriction on waste going to landfill by enforcing a legal ban on any waste containing more than 5% total organic carbon (TOC).

### Waste Incineration Directive

The provincial Ordinance on Waste incineration transposes the EU Waste Incineration Directive of 2000.

The legal emission limits in Austria are similar to those stipulated by the EU directive though it is a planning requirement under the Austrian Waste Management Act that emission of pollutants are within limits achievable under state-of-the-art (Best Available Technique) techniques. Austria was the first country to implement the strictest legal emission standard for dioxins/furans as far back as 1988 and also implemented a more stringent emission limit of 100 mg/Nm<sup>3</sup> for NOx emissions<sup>36</sup>.

## Planning

In Austria, planning permission does not govern the designated use of an area, but rather it is governed by the zoning plan, (Flächenwidmungsplan). If the area is zoned for a particular development, a developer can then apply for a building permit. The planning authority is the relevant local municipality or borough in which the development is being proposed. Each Austrian province has its proprietary building and landscaping laws as a result requirements for planning permission varies<sup>37</sup>.

## WtE Infrastructure at 2012

In 2007, Austria generated about 58 million tonnes of solid waste. Approximately 10% of this waste was thermally treated or incinerated in the 11 WtE facilities in the country, which have a total thermal capacity exceeding 800 MW.

## BELGIUM

### Background

As a founding member of the EU, Belgium has mandatory targets in common with the rest of the EU relating to waste minimisation, minimising disposal to landfill and increasing recycling and recovery rates. In 2000, the Federal Government of Belgium adopted the Federal Plan for Sustainable Development, which is targeted

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<sup>36</sup> Stantec (2011) Waste to Energy: A Technical Review of Municipal Solid Waste Thermal Treatment Practices: Final Report

<sup>37</sup> [http://www.dlapiperrealworld.com/country\\_profile/questions-search?queries\\_country\\_query=Austria&queries\\_topic\\_area\\_query=Planning/Zoning](http://www.dlapiperrealworld.com/country_profile/questions-search?queries_country_query=Austria&queries_topic_area_query=Planning/Zoning)



towards the use of natural resources. However, the actions in the plan may have long term effects on waste arisings and quality. In 2009 there were 15 operational WtE facilities in Belgium<sup>38</sup>.

Belgium comprises three geographical regions namely; Flanders, Walloon and Brussels and Belgian waste policies are under the jurisdiction of these three regions. Each region has its own waste management legislation and policy and is responsible for the regulation and public administration of the Waste Management System in Belgium.

## Policy

### Fiscal Drivers

A Landfill tax is in place to incentivise the diversion of waste from landfill disposal.

Implementation of a 'Pay As You Throw' (PAYT) system in Flanders which acts as an incentive to decrease the amount of bio-waste collected. This system is encouraged by the provision of composting support for households such as subsidised composting tools.

**Table 9: Cost of disposal and taxes for LACW in Belgium**

	Flanders	Brussels	Wallonia
Incineration inc. Levies €/Tonne	>100	>100	depends on contract structure of inter-municipal partnership
Landfill Cost LACW €/tonne exc. vat	50	No Landfill	Up to 90
Environmental Tax LACW €/Tonne	7-80*	No Landfill	3-60*

\* highest rates for combustible waste to be landfilled, lower for incineration

## Regulatory Framework

The key pieces of legislation primarily related to the implementation of the waste related EU directives are described in this section.

### Waste Framework Directive

All three regions have in place various measures to prevent the generation of waste, such as the network of reuse shops and centres, promotion of home composting and the 'please no publicity' campaign (initiative to prevent distribution of unsolicited publications).

Since 1992, the Brussels region has adopted a Waste Prevention and Management Plan on a five yearly basis which was a requirement based on the Brussels Ordinance on waste prevention and management. The fourth and most recent waste plan adopted in 2010, implements the EU Waste Framework Directive (Directive 2008/98/EC). The plan sets out the order of priority (waste hierarchy) for the waste policy and aims to achieve measurable prevention targets for specific waste streams by 2020.

In the Flanders region of Belgium in 1981, a decree on the prevention and management of waste streams was made. The implementation of this decree was the responsibility of the Flemish waste Agency. The Agency

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[http://www.cewep.eu/media/www.cewep.eu/org/med\\_568/606\\_belgium\\_country\\_report\\_cewep\\_congress\\_antwerp\\_2010\\_updated\\_10\\_03\\_2011.pdf](http://www.cewep.eu/media/www.cewep.eu/org/med_568/606_belgium_country_report_cewep_congress_antwerp_2010_updated_10_03_2011.pdf)

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issued an environmental Policy Plan for household waste for the years, 2003 to 2007, with the European waste hierarchy as its core focus. The plan had the following targets:

- To obtain 13% prevention of household waste in 2007 as compared to 2000.
- To collect and recycle or compost 69% of household waste.
- To progressively reduce residual household waste to 180 kg/capita in 2003, 165 kg/capita in 2005 and 150 kg/capita in 2007.
- To allow landfill disposal of only waste which that cannot be incinerated from 2005.

In 2009, a new Strategic Policy Plan for 2010 - 2015 on Waste, Materials and Soil Management was adopted with the following principles being taken up in its strategies:

- Minimum use of finite resources
- Optimal use of renewable resources
- Maximum prevention of the generation of waste
- Maximum use of waste as secondary resource
- Minimum environmental impact when treating waste

The Walloon region has the waste management law which since 1996 has been regularly updated to keep up to date with the EU regulations. This law provides the foundation for ordinances on waste handling and treatment and requires the regional government to make available waste management plans.

In 1998, a Waste Management plan for Wallonia was presented by its Ministry of the Environment, Natural Resources and Agriculture. The Wallonian regional government is in the process of preparing a new Waste Plan 2020. This plan will be a means of reducing greenhouse gas emissions and environmental impact of waste generation and treatment.

#### Landfill Directive

To achieve a maximum level of recycling in Belgium, certain separately collected items are banned from being sent for landfill disposal and incinerated. Landfill disposal is seen only as a final treatment option and as a result there is also a ban on landfill disposal of combustible residual wastes.

As there is no landfill disposal of household waste in the Brussels region the Landfill Directive is not relevant.

The Flanders region's targets in the 2003 - 2007 Environmental Policy Plan for household waste only allows landfill disposal of waste that cannot be incinerated.

The region of Wallonia transposes the Landfill Directive through a number of implementing Acts.

#### Waste Incineration Directive

The key legislation governing the operation of WtE facilities in Belgium (planned and existing) is the Waste Incineration Directive. The country adopts the emission limits laid out in WID without amendment.

## BULGARIA

### Background

Bulgaria joined the EU in 2007 and accepted the mandatory targets in common with the rest of the EU relating to minimising disposal to landfill and increasing recycling and recovery rates. Unfortunately Bulgaria has been slow in transposing these directives into its national legislation. Waste management planning in Bulgaria began

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in 1998 with the adoption of the five year national waste management program by the Council of Ministers of the Republic of Bulgaria which is in its third iteration (2009-2013).<sup>39</sup>

## Policy

### Fiscal Drivers

There is a tax of €3 per tonne for waste sent for landfill disposal. The Sofia municipality has in place a 'Garbage Tax' which is collected based on the property's taxable value.

## Regulatory Framework

### Waste Framework Directive

Bulgaria is yet to adopt its Waste Management Act which was promulgated in 2003. This Act is an important step in implementing the EU WFD into national legislation. Bulgaria's failure to meet the December 2010 deadline resulted in proceedings by the EU Court of Justice and faces having to pay fines for non-compliance<sup>40</sup>.

### Landfill Directive

Bulgaria was one of the EU Member States that landfilled more than 80% of the waste in 1995 and was therefore allowed a derogation period not exceeding four years to comply with the EU landfill directive. In 2004, Bulgaria's Ministry of Environment and Water released a regulation stipulating requirements and guidelines to which waste treatment facilities must adhere<sup>41</sup>.

In 2010, a national strategic plan for diversion of biodegradable waste going to landfill for a ten year period (2010-2020) was put in place<sup>42</sup>.

### Waste Incineration Directive

Although there are currently no incineration facilities for treating MSW operating in the country<sup>43</sup>, the Bulgarian Ministry of Environment and Water in 2004 released a regulation, which stipulates the conditions and the requirements for the construction and operation of installations for incineration and co-incineration<sup>44</sup>. This regulation is a direct transposition of the EU WID as it imposes the same daily air ELVs for incinerators required in the directive.

### Waste to Energy Infrastructure

There are currently no incineration facilities operating in Bulgaria; however an incineration facility is being planned for waste generated in the capital, Sofia.

## DENMARK

### Background

Danish environment policies have been characterised by the use of a wide variety of policy instruments. Traditionally, environment policy was mainly based on regulation, but in the last two decades this has been supplemented with an increasing use of economic instruments and a range of other measures, including

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<sup>39</sup> <http://www.compostnetwork.info/country-report-of-bulgaria.html>

<sup>40</sup> <http://www.wtert.de/default.asp?Menu=26&NewsPPV=11501>

<sup>41</sup> Bulgarian Ministry of Environment and Water (2004), Regulation No. 7

<sup>42</sup> <http://www.compostnetwork.info/country-report-of-bulgaria.html>

<sup>43</sup> <http://www.iwwaterwiki.org/xwiki/bin/view/Articles/Bulgaria#HIncinerationOption>

<sup>44</sup> Bulgarian Ministry of Environment and Water (2004), Regulation No. 6

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awareness raising campaigns and voluntary agreements. Awareness raising is targeted towards citizens in general and key stakeholders, e.g. specific industries or companies<sup>45</sup>.

## Policy

Denmark has a Waste Strategy for the years 2009-2012 which by 2012, aims to increase recycling of waste generated to 65% and reduce total waste sent for landfill disposal to 6%. The strategy has two new important activity areas; waste prevention and innovation of waste treatment technology such as recycling and recovery<sup>46</sup>.

## Fiscal Drivers

The waste tax on landfill and incineration was introduced in 1987 with the purpose of incentivising recycling of waste. Though applicable to incineration and landfill, the tax was designed to make landfill more expensive than incineration and incineration with energy recovery cheaper than incineration without energy recovery<sup>47</sup>.

In addition to fiscal measures, Denmark was the first EU Member State to introduce a landfill ban on combustible waste suitable for incineration which has been in place since 1997<sup>48</sup>.

## Regulatory Framework

The main elements of Danish legislation in relation to WtE primarily relate to the implementation of EU directives. In addition there are national acts of legislation that influence the treatment of waste.

The key acts of Danish legislation relating to waste are described in this section:

- Environmental Protection Act Consolidated Act No. 753 of 25 August 2001 (as amended).
- Statutory Order No 619 of 27 June 2000 on Waste (as amended).

## Waste Framework Directive

The Danish Environmental Protection Act and the Waste Statutory Order (2009/2010) has ensued transposition of new waste definitions and terminology based on the 2008 Waste Framework Directive into Danish legislation.<sup>49</sup>

## Landfill Directive

The EU Landfill Directive is transposed into Danish legislation through the following Acts and Statutory Order:

- Environmental Protection Act, Consolidated Act No. 753 of 25 August 2001 (as amended)
- Statutory Order No 650 of 29 June 2001 on Landfill facilities to the Commission proposal on harmonisation of the annexes to the Directive on the landfill of waste.
- Statutory Order No 647 of 29 June 2001 on training of operations managers and personnel employed at landfill sites.
- Statutory Order No 619 of 27 June 2000 on Waste (as amended).

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<sup>45</sup> [www.eea.europa.eu/themes/.../denmark-country-profile-on-resource](http://www.eea.europa.eu/themes/.../denmark-country-profile-on-resource)

<sup>46</sup> [http://www.mst.dk/English/Waste\\_Soil/waste\\_strategy\\_and\\_waste\\_prevention/waste\\_strategy\\_and\\_waste\\_prevention.htm](http://www.mst.dk/English/Waste_Soil/waste_strategy_and_waste_prevention/waste_strategy_and_waste_prevention.htm)

<sup>47</sup> [http://scp.eionet.europa.eu/facts/factsheets\\_waste/2006\\_edition/Denmark](http://scp.eionet.europa.eu/facts/factsheets_waste/2006_edition/Denmark)

<sup>48</sup> Ramboll (2006): WtE in Denmark

<sup>49</sup> Anne-Marie Rasmussen (2010) Presentation on The Danish Implementation of the Waste Directive (2008/98/EC)

- Statutory Order No 648 of 29 June 2001 on the revision of Statutory Order No 619 of 27 June 2000 on Waste.
- Denmark is one of the few EU Member States that have already achieved the 2016 reduction target for landfilling of biodegradable waste<sup>50</sup>.

#### Waste Incineration Directive (WID)

The Order on Incineration of Waste issued by the Ministry of the Environment (No. 162 of 11 March 2003) transposes the WID into Danish legislation. The ELVs for permitted incinerators in the Statutory Order are exactly as stipulated by the EU Waste Incineration Directive<sup>51</sup>.

#### WtE Infrastructure

In 2008, there were 29 WtE facilities treating 3.59 million tonnes of waste in Denmark annually; these facilities produced 1.87 million MWh of electricity and 7.03 million MWh of heat. The development of an additional 100,000 tonnes of WtE capacity was planned to come online between 2009 and 2011, while an additional capacity of 950,000 tonnes including a new plant was planned between 2012 and 2016<sup>52</sup>.

## FINLAND

### Background

Finland has had specialised waste legislation (Waste Management Act 673/1978) which was similar to EU legislation since the 1970's before joining the EU in 1995. After the EEA agreement, effort has been made to harmonise the Finnish waste legislation to match the EU legislation<sup>53</sup>. There are a number of national acts of legislation that influence the treatment of waste.

### Policy

The first Finnish National Waste Plan prepared by the Ministry of Environment came into force in 1996 until 2002, when it was revised. This plan remained in force until a new plan was drafted in 2006 which is to remain until 2016.<sup>54</sup>

#### Fiscal Drivers

Landfill tax was first introduced in 1996 through the Waste Tax Act 1997-2010, while the second Act came into force in 2011.<sup>55</sup> The Act was introduced to encourage waste prevention and increase recovery. The scope of the new Act (2011) covers any waste that has an alternative possibility for recovery; as a result, the tax does not apply to any waste that cannot be recovered or disposed of other than through landfill (such as some hazardous waste).

<sup>50</sup> <http://www.slideserve.com/brooks/the-landfill-directive-council-directive-1999>

<sup>51</sup> <https://www.retsinformation.dk/Forms/R0710.aspx?id=12614>

<sup>52</sup> RenoSam (2010): CEWEP Country Report 2010 Denmark

<sup>53</sup> [http://scp.eionet.europa.eu/facts/factsheets\\_waste/2009\\_edition/factsheet?country=FI](http://scp.eionet.europa.eu/facts/factsheets_waste/2009_edition/factsheet?country=FI)

<sup>54</sup> [http://scp.eionet.europa.eu/facts/factsheets\\_waste/2009\\_edition/factsheet?country=FI](http://scp.eionet.europa.eu/facts/factsheets_waste/2009_edition/factsheet?country=FI)

<sup>55</sup> European Topic Centre on Sustainable Consumption and Production (2012): Overview of the use of landfill taxes in Europe

**Table 10: Increase in tax rate since its introduction**

	1996	2003	2005	2011	2013 (planned)
Landfill Tax (€/tonne)	15.15	23	30	40	50

A Decree for landfill ban is in preparation: for all organic (biodegradable + plastics) waste (TOC or LOI < 10 %, for ashes and slags DOC < 800 mg/kg + some exemptions.

## Regulatory Framework

### Waste Framework Directive (WFD)

The Finnish Waste Act (1072/1993) and Waste Decree (1390/1993) implemented the provisions of Council Directives on waste (75/442/EEC), on hazardous waste (91/689/EEC) and the Regulation of the European Parliament and of the Council on shipments of waste (No 1013/2006). Finnish legislation is being updated to implement the Waste Framework Directive 2008/98/EC and the current legislation puts more emphasis on waste prevention and recovery<sup>56</sup>.

### Landfill Directive

The Finnish Government Decision on Landfills (861/1997) transposes the EU Landfill Directive into Finnish legislation. Although the Finnish legislation has imposed a deadline four years closer than that of the EU to achieve diversion of Biodegradable Municipal Waste allowed from landfill<sup>57</sup>.

### Waste Incineration Directive

The EU Waste Incineration Directive is transposed into Finnish legislation through the Government Decree on incineration of waste (362/2003) prepared by the Ministry of Environment.<sup>58</sup>

### WtE Infrastructure

In 2009, 0.274 million tonnes of waste was incinerated in the three WtE plants and 0.7 million tonnes of RDF was incinerated in plants permitted for co-incineration of RDF. An additional capacity of 790,000 tonnes for WtE and 250,000 tonnes for RDF (new facility) has been planned within 2012 and 2016.<sup>59</sup>

## FRANCE

### Background

France has mandatory targets in common with the rest of the EU relating to minimising disposal to landfill and increasing recycling and recovery rates, and several key pieces of legislation primarily relate to the implementation of EU directives. French policy on waste similar to its environmental policy is strongly influenced by Community policy.

French national regulatory framework on waste is based on Act n. 633 of the 15 July 1975, as modified by Act n. 646 of the 13 July 1992, implementing the EU Waste Framework Directive (75/442/EEC). The main objectives of French policy on waste established by this law were: to implement a waste hierarchy (prevention,

<sup>56</sup> [http://scp.eionet.europa.eu/facts/factsheets\\_waste/2009\\_edition/factsheet?country=FI](http://scp.eionet.europa.eu/facts/factsheets_waste/2009_edition/factsheet?country=FI)

<sup>57</sup> Tehri Lensu and Eija Alakangas (2007) The Role of Bioenergy in the National Legislation and Implementing EU Directives

<sup>58</sup> Tehri Lensu and Eija Alakangas (2007) The Role of Bioenergy in the National Legislation and Implementing EU Directives

<sup>59</sup> CEWEP (2010): Country Report 2010 Finland

recovery, treatment and disposal), enhance recovery, limit waste transportation and waste planning at a regional level<sup>60</sup>.

## Policy

France has a national strategy for the reduction of biodegradable waste going to landfill, in line with the EU Landfill Directive.

### Fiscal Drivers

France has a number of waste related economic instruments such as:

- Landfill Tax: This tax was initially introduced in 1992 to promote waste minimisation and recycling and other waste management options other than incineration without energy recovery and landfill. In 2011, this tax varied depending on the type of landfill and was set to increase at the beginning of every year<sup>61</sup>;
- An incineration tax of €7 has been in place since 2009 which is expected to double by 2013. An incinerator is entitled to a 70% discount if the facility has two of the three qualities: an ISO 14001 environmental certification, an energy efficiency ratio similar to the R1 formula, NOx emissions below 80 mg/Nm<sup>3</sup><sup>62</sup>;
- MSW Service fee (REOM: Redevance d'Enlèvement des Ordures Ménagères), this is a fee charged by municipal authorities and was implemented to promote waste reduction using the 'polluter-pays' principle.
- Reduction of VAT on waste management services: To encourage local authorities to implement separate collection schemes and promote recycling.

**Table 11: Landfill tax costs France**

Type of landfill	Non-authorised landfills	Authorised landfills	Authorised & ISO 14001 landfills	Landfills with energy recovery
Landfill tax 2011 (€)	70	20	17	11
Projected Landfill tax 2015 (€)	150	40	32	20

## Regulatory Framework

### Waste Framework Directive

France has shown its commitment to the EU Waste Framework Directive through its draft law resulting from the Environment Round table, adopted in 2008. This law set guidelines on implementing the principles of the Waste Framework Directive (waste hierarchy) for the period 2009-2014.<sup>63</sup>

The Grenelle de l'environnement Grenelle (Environment Round Table) meetings instigated in 2007 by the French president led to the Grenelle Acts. The Grenelle 1 Act of 2009 set the main principles of Grenelle and the framework for major upcoming developments. The Grenelle 2 Act of July 2010 is the law on the national commitment to the environment which created measures to implement the objectives adopted by Grenelle 1.

<sup>60</sup> International Law Office, (2011). Recent developments in waste law management  
<http://www.internationallawoffice.com/newsletters/detail.aspx?g=b96d41fb-4c53> CEWEP (2011) Landfill taxes & bans.-4af0-9c79-d127bf54b512&redir=1

<sup>61</sup> CEWEP (2011) Landfill taxes & bans

<sup>62</sup> CEWEP (2010) Country Report France

<sup>63</sup> [http://www.eea.europa.eu/soer/countries/fr/soertopic\\_view?topic=waste](http://www.eea.europa.eu/soer/countries/fr/soertopic_view?topic=waste)

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The adopted measures enabled France to catch up with the actions of other EU Member States.<sup>64</sup> This law implements many of the actions proposed by the EU Waste Framework Directive.

#### Landfill Directive

Regulations 31 December 2001, 3 April 2002 and 19 January 2006 amended regulation 9 September 1997 in order to transpose European Directive 1999/31/CE into French legislation. There have been a number of modifications to national rules concerning landfill, such as: landfill definition, admission criteria and procedures & the requirement for a landfill operator to prepare and present a conditioning plan<sup>65</sup>.

#### Waste Incineration Directive

French and European regulations on incineration have been harmonised since the introduction of the EU Waste Incineration Directive.

A regulation issued by the French Ministry of Ecology in March 2005 defined the requirements and emission standards to be met by WtE plants. Every plant is required to report its emissions annually to a DREAL (Regional Directorates of Environment, Physical Planning and Housing) which represents the French Ministry of Ecology.<sup>66</sup> The official French upper limit for mercury and heavy metal emission is the same as the European limit, it has been assumed that the official French limit for other pollutants are the same as the European limit.<sup>67</sup>

#### Industrial Emissions Directive

The French parliament has passed legislative order No. 2012-7 which implements the Industrial Emissions Directive into French law. Under the order, environmental permit conditions will be based on best available techniques. The order will be implemented by a decree which is yet to be passed.<sup>68</sup>

#### WtE Infrastructure

France has approximately 130 operational incinerators (110 WtE facilities) all of which meet the national and European emission standards for particulates, heavy metals and dioxins/furans, with the exception of NOx where average emissions from WtE plants was 20% higher than the EU standard in 2006<sup>69</sup>. As of 2009, the average dioxin/furan emission from all WtE facilities in France was less than half of the WID emission limit value.

## ITALY

### Background

Italy's national framework legislation is contained in the 'Environmental Act', Decree 152/06, which contains all the prescriptions necessary for the management of waste. The different regions in the country are responsible for preparing waste management plans which integrate waste collection, treatment and disposal.

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<sup>64</sup> International Law Office, (2011). Government finally adopts Grenelle Environment Project  
<http://www.internationallawoffice.com/newsletters/Detail.aspx?q=4a8e0b73-fd44-4710-843f-88645e55c83b&redir=1>

<sup>65</sup> [http://scp.eionet.europa.eu/facts/factsheets\\_waste/2006\\_edition/France](http://scp.eionet.europa.eu/facts/factsheets_waste/2006_edition/France)

<sup>66</sup> Yohann Benhamou (2010) Comparison of environmental performance of WtE (WTE) plants in France with Denmark and Germany

<sup>67</sup> Yohann Benhamou (2010) Comparison of environmental performance of WtE (WTE) plants in France with Denmark and Germany

<sup>68</sup> Freshfields Bruckhaus Deringer (2012) Environment, Planning and Regulatory News

<sup>69</sup> Yohann Benhamou (2010) Comparison of environmental performance of waste-to-energy (WTE) plants in France with Denmark and Germany



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## Policy

There is a ban on combustible waste with a calorific value >13MJ/kg being sent to landfill which came into force on 1 January 2012.

### Fiscal Drivers

Italy, like many EU Member States, also has a landfill tax in place, €1–10 for inert waste, €5–10 other waste (MSW excluded) and €10–25 for MSW, depending on the region.

## Regulatory Framework

### Waste Framework Directive

In line with implementing the WFD, Italy has developed regional waste management plans to cover specific waste streams, although these plans do not concern mixed municipal waste.<sup>70</sup>

### Landfill Directive

The Landfill Directive was transposed into Italian law through the implementation of Legislative Decree 13/01/2003 n° 36.<sup>71</sup> The Italian decree has set targets for the maximum allowable quantity of Biodegradable Municipal Waste (BMW kg/year) to be generated per capita as: 173 kg/year by March 2008;<sup>72</sup> 115 kg/year by March 2011 and; 81 kg/year by March 2018<sup>73</sup>. This approach is different from the percentage based target set out in the Landfill Directive due to lack of reliable data of BMW sent for landfill disposal in 1995.

### Waste Incineration Directive

The EU WID was transposed into Italian law with the Legislative Decree 11 n. 133 of May 2005, which established the technical and operational provisions for waste incineration<sup>74</sup>. The transposition of the IPPC Directive was undertaken through the Legislative Decree n. 59 of 18 February 2005.

### WtE Infrastructure

As of 2005, there were 50 operational incinerators in Italy treating about 4.3 million tonnes of a mixture of municipal solid waste, RDF and biomass<sup>75</sup>. The Ministerial Decree of 29th January 2007 implemented national guidelines with best available technique (BAT) for waste treatment plants; as a result most incinerators in Italy have already adopted BAT.

## POLAND

### Background

Waste management in Poland is considered as a one of the priorities in the ecological policy. Waste policy should aim at reducing the use of resources, and favour the practical application of the waste hierarchy (prevention, preparing for reuse, recycling, other recovery, e.g. energy recovery and final disposal). Increasing

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<sup>70</sup> Institute of European Environmental Policy (2009): A Report on the Implementation of Directive 75/442/EEC on Waste

<sup>71</sup> Policy Department European Parliament (2006), Status of Implementation of EU Environmental Laws in Italy

<sup>72</sup> <http://www.waste-management-world.com/index/display/article-display/314942/articles/waste-management-world/volume-8/issue-6/features/italian-peaks.html>

<sup>73</sup> European Environment Agency (2009), Diverting Waste from Landfill Report

<sup>74</sup> European Parliament (2006): Status of Implementation of EU Environmental Laws in Italy

<sup>75</sup> European Topic Centre on Resource and Waste Management (2008): Evaluation of effectiveness of waste policies related to the Landfill Directive Italy

the recovery share (especially recycling of glass, metals, plastics and paper, also energy recovery) and minimising storage of wastes are the main objectives adopted in the 2014 National Waste Management Plan<sup>76</sup>.

## Policy

### Fiscal Drivers

There is a landfill tax on wastes which varies depending on the category of waste landfilled. The tax is higher for hazardous and biodegradable waste than for inert waste<sup>77</sup>.

**Table 12: Polish Landfill Tax Rates**

Category of waste	2012 (€)
Concrete, bricks and Wastes from mineral non-metalliferous excavation	2.79
Wastes from mineral metalliferous excavation	4.32
De-inking sludges from paper recycling	13.86
All types of packaging waste and Municipal waste	26.6
Acid tars from the pyrolytic treatment of coal	36.4
Batteries	49.5

## Regulatory Framework

The main piece of legislation dealing with waste management in Poland is the Act of 27 April 2001 on Waste. This Act is divided into 10 sections dealing with different aspects of waste; it covers general waste management rules, waste management plans, incineration and landfill disposal of waste among others.<sup>78</sup>

### Waste Framework Directive

Poland has missed the 2010 deadline for the transposition of the Waste Framework Directive, although the Act on Waste is expected to be replaced by a new one in order to incorporate the new elements of the WFD<sup>79</sup>.

The current Polish National Waste Management Plan was written in 2006 based on the obligation set by the Polish Act on Waste, to be implemented between 2007 and 2010<sup>80</sup>.

A new law was passed by the Polish parliament in January 2012 which makes local authorities responsible for managing municipal waste including improving infrastructure for waste collection and recovery. The law was passed to help Poland meet the objectives of the EU Waste Framework Directive and it would allow local authorities to tender contracts to private companies for collection and treatment of waste.<sup>81</sup> This new law is also expected to promote recycling and incineration as the local authorities would have the legal power to enforce EU directives, making waste operators more responsible in adopting waste treatment options.<sup>82</sup>

<sup>76</sup> [www.eea.europa.eu/.../poland-2014-resource-efficiency-policies](http://www.eea.europa.eu/.../poland-2014-resource-efficiency-policies)

<sup>77</sup> European Topic Centre (2012) Overview of the use of landfill taxes in Europe

<sup>78</sup> [http://www.eea.europa.eu/soer/countries/pl/soertopic\\_view?topic=waste](http://www.eea.europa.eu/soer/countries/pl/soertopic_view?topic=waste)

<sup>79</sup> European Commission (2011) Assessment and Guidance for the Implementation of EU waste legislation in Member States

<sup>80</sup> [http://scp.eionet.europa.eu/facts/factsheets\\_waste/2009\\_edition/factsheet?country=PL](http://scp.eionet.europa.eu/facts/factsheets_waste/2009_edition/factsheet?country=PL)

<sup>81</sup> [http://www.waste-management-world.com/index/display/article-display/8236269644/articles/waste-management-world/markets-policy-finance/2011/05/New\\_Waste\\_Management\\_Law\\_to\\_Boost\\_Infrastructure\\_Investment\\_in\\_Poland.html](http://www.waste-management-world.com/index/display/article-display/8236269644/articles/waste-management-world/markets-policy-finance/2011/05/New_Waste_Management_Law_to_Boost_Infrastructure_Investment_in_Poland.html)

<sup>82</sup> <http://www.cleantechpoland.com/en/renewables/new-waste-law-promotes-recycling-incineration/>

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### Landfill Directive

The Polish Act of 27 April 2001 on Waste transposes the EU Landfill directive into Polish law. Poland being one of the EU countries with a large dependency on landfill, was given a four-year derogation period to divert the required percentage of biodegradable municipal waste going to landfill. Poland was also given extended deadlines with annual decreasing targets for the amount of waste deposited in a number of non-compliant landfill.<sup>83</sup>

### WtE Infrastructure

Poland does not have significant WtE infrastructure. In 2005, there was only one incineration plant for municipal waste, although by 2008 12 incinerators have been proposed for various parts of the country.<sup>84</sup>

## ROMANIA

### Background

Romania joined the EU in 2007 and is developing its domestic legislation in accordance with the requirements of the key EU waste related Directives.

### Policy

Romania has a national waste management strategy and national waste management plan approved by Governmental Decision 1470/2004<sup>85</sup>. The plan is based on EU regulations and is expected to be reviewed every five years.

### Regulatory Framework

#### Waste Framework Directive

In the first quarter of 2011, Romania was still in the process of revising its legislation to transpose the 2008 EU Waste Framework Directive.<sup>86</sup> Although the 2006/12/EC EU Directive on waste had been transposed through the Emergency Ordinance No. 78/2000 on waste regime, modified and approved by Law No. 426/2001, modified by Emergency Ordinance 61/2006, approved by Law 27/2007.<sup>87</sup>

#### Landfill Directive

Romania transposed the Landfill Directive into its legislation through Governmental Decision No. 349/2005. The Ministerial Order No 95/2005 transposes the European Council decision 2003/33/EC for the approval of waste acceptance criteria and national lists of waste accepted in each landfill class. Ministerial Order No. 757/2004 for the approval of Technical norms regarding waste landfilling.<sup>88</sup>

In addition to the WFD and Landfill Directive the following acts have an impact on residual solid waste composition in Romania:

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<sup>83</sup> <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1154>

<sup>84</sup> CEE Bankwatch Network (2009) Explanatory Comments on the Polish Incinerator Project Awarded with the RegioScars Award 2009

<sup>85</sup> [http://scp.eionet.europa.eu/facts/factsheets\\_waste/2009\\_edition/factsheet?country=RO](http://scp.eionet.europa.eu/facts/factsheets_waste/2009_edition/factsheet?country=RO)

<sup>86</sup> Larive Romania IBD SRL (2011): Waste Management Research in Romania

<sup>87</sup> [http://scp.eionet.europa.eu/facts/factsheets\\_waste/2009\\_edition/factsheet?country=RO](http://scp.eionet.europa.eu/facts/factsheets_waste/2009_edition/factsheet?country=RO)

<sup>88</sup> Institute for European Environmental Policy (2009): A Report on the Implementation of Directive 1999/31/EC on the Landfill of Waste

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Governmental Decision No. 621/2005 on packaging and packaging waste management, modified by Governmental Decision 1872/2006 Ministerial Order No. 927/2005 regarding reporting procedure for packaging and packaging waste.<sup>89</sup>

### Waste Incineration Directive

The EU Waste Incineration Directive is transposed into Romanian law by the Governmental Decision No. 128/2002 on incineration of waste, modified and completed by Governmental Decision 268/2005 and Order of the Ministry of Wasters and Environment Protection no. 1215 of 10 January 2003 on approving the Technical Norms on waste incineration.<sup>90</sup>

### WtE Infrastructure

There is no municipal waste incinerator in Romania, although there are plans to build one as part of the integrated waste management system in Bucharest and Brasov.<sup>91</sup>

## SPAIN

### Background

Spain, like other Member States, has mandatory targets similar to the rest of the EU relating to minimising disposal to landfill and increasing recycling and recovery rates. A number of Spanish legislative mechanisms exist to implement these EU directives alongside acts of legislation that influence the treatment of waste.

### Policy

Spain has an integrated national waste plan for 2008-2015 approved by the Minister's Council, which were written based on Spanish legislation transposing the EU Directives on packaging waste, landfill and Incineration.<sup>92</sup>

### Fiscal Drivers

There is no national landfill tax although the Spanish Waste Act allows waste authorities to introduce fiscal measures, such as landfill and incineration taxes, to promote waste prevention. Several regions have introduced such taxes, such as a landfill and incineration tax in Catalonia for municipal waste and landfill tax in Andalusia, Cantabria, Madrid and Murcia for industrial waste.<sup>93</sup>

### Regulatory Framework

#### Waste Framework Directive

The National Law 22/2011 transposed the WFD into Spanish legislation. This law changed the legal framework in Spain and established a new logic in the regulation of waste.<sup>94</sup> To comply with the new law, the state and the 17 regions will have to develop framework waste management plans. Local agencies are then expected to prepare waste management programs to conform to the state and regional management plans before 12 December 2013.

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<sup>89</sup> [http://scp.eionet.europa.eu/facts/factsheets\\_waste/2009\\_edition/factsheet?country=RO](http://scp.eionet.europa.eu/facts/factsheets_waste/2009_edition/factsheet?country=RO)

<sup>90</sup> Institute for European Environmental Policy (2009): A Report on the Implementation of Directive 1999/31/EC on the Landfill of Waste

<sup>91</sup> Larive Romania IBD SRL (2011): Waste Management Research in Romania

<sup>92</sup> European Network of Environmental Law Organisations (2011): Waste Management Planning

<sup>93</sup> European Topic Centre on Sustainable Consumption and Production (2012) Overview of the use of landfill taxes in Europe

<sup>94</sup> European Network of Environmental Law Organisations (2011): Waste Management Planning

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### Landfill Directive

The Royal Decree 1481/2001 on landfill transposed the EU Landfill Directive in December 2001. As of 2006, a large number of landfills were closed down due to a lack of compliance with the Royal Decree, however a significant number of landfills are still operational.

### Waste Incineration Directive

The Royal Decree 653/2003, of 30th May, on Incineration of Waste transposes the 2000 EU Waste Incineration Directive. This legislation came into force in December 2005 and has led to a significant reduction in the ELVs for incinerators in Spain.<sup>95</sup> The new limit values defined by the Royal Decree 653/2003 match those set by the EU Waste incineration Directive.<sup>96</sup>

### WtE Infrastructure

In 2007, there were ten WtE plants operational in Spain incinerating 2.1 million tonnes of waste. An additional capacity of 360,000 tonnes was expected by the end of 2010.<sup>97</sup>

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<sup>95</sup> <http://www.plantabrossa-maresme.com/infocaps.php?id=1255>

<sup>96</sup> <http://www.plantabrossa-maresme.com/emissions2.php>

<sup>97</sup> CEWEP (2008): Country Report: Spain

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## 4 Japan

### 4.1 Introduction

This section presents a summary of how WtE plants are regulated in Japan at central government, prefecture and municipality level. It was undertaken by waste experts and based on a combination of their knowledge, experience, communication with Japanese technology providers and desktop research.

### 4.2 Policy and Legislation

Over the last decade, Japan has shifted from a waste management policy to an integrated waste and material management approach that promotes de-materialisation and resource efficiency. Landfill shortage and dependency on natural resources imports have been key drivers of these changes.<sup>98</sup>

#### Fiscal Drivers

There is no national landfill tax. Historically, incineration has been the primary disposal route for waste in Japan due to a lack of space for landfills and the requirement for waste to be disposed of locally, so there is no strong driver to reduce landfill dependence in a country that has limited existing capacity and little potential for future capacity.

Additionally, the recycling laws prevent much commercial biodegradable waste from entering landfills.

#### **Regulatory Framework**

Waste management in Japan is a responsibility of the Ministry of the Environment. The fundamental principles governing environmental protection are set out in the Basic Environmental Law (1994). Japan has three levels of governance:

- Central government;
- Prefectures; and
- Municipalities.

Each level has different responsibilities relating to waste management. Central government oversees waste management with a duty to collect waste information, promote waste management technology development and provide funding to the prefectures and municipalities to allow them to carry out their duties. The prefectures formalise waste plans and grant licences for waste disposal facilities, and also have the power to set emissions limits. It is then for the individual municipalities within the prefecture to oversee the development of waste infrastructure.

Prior to the 1990s, waste regulation in Japan focussed on disposal and energy recovery whilst recycling was not prioritised. Incineration has historically been the primary disposal route for waste due to limitations on space for landfill in proximity to urban areas as a result of the country's geography. However, the introduction of a raft of new legislation in the late 1990s and early 2000s saw a major shift in policy to increase the recycling rate substantially as well as substantially improving the environmental performance of incineration and WtE facilities.

Permits are issued by the Prefectural Governments and Planning Control is the responsibility of the municipalities.

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<sup>98</sup> OECD (2010), 'Waste Management and the 3Rs (Reduce, Reuse, Recycle)', in OECD, OECD Environmental Performance Reviews: Japan 2010, OECD Publishing. doi: 10.1787/9789264087873-7-en

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## Modern Waste Regulation in Japan

### Basic Law for Promoting the Creation of a Recycling-Oriented Society (2000)<sup>99</sup>

The basic framework law governing waste and resources is the Basic Law for Promoting the Creation of a Recycling-Oriented Society (2000), which came into force in January 2001. This law establishes the basic principles of waste management and sets out roles and responsibilities for national and local government with respect to the management, recovery and disposal of waste. At its core is the promotion of the 3Rs; Reduce, Reuse and Recycle. The law seeks to create a recycling-oriented society, promoting the following:

- Creation of a sustainable society with minimal impact on the environment;
- Promoting measures in the following priority order (the equivalent of the waste hierarchy in the EU Waste Framework Directive):
  1. Reduction of waste generation;
  2. Reuse of parts;
  3. Material recycling;
  4. Thermal recycling; and
  5. Proper disposal.
- Achieving close liaison with measures to ensure proper circulation of substances in the natural world. To support this, the Basic Plan for Promoting the Creation of a Recycling-oriented Society was developed to implement and realise the goals set out in the Basic Law.

There are two key pieces of waste management legislation that sit under the Framework Law; the Law for Promotion of the Effective Utilisation of Resources covers promotion of the 3Rs, and the Waste Management and Public Cleansing Law covers proper management of those materials that require disposal.

### Waste Management and Public Cleansing Law (2001)

The law was first enforced in 1970 and has been updated numerous times. It is solely applicable to the final disposal of waste, covering the following:

- Proper waste disposal;
- Regulations for setting up waste disposal facilities;
- Regulations on waste disposal businesses;
- Establishment of criteria for waste disposal;
- Measures to control improper disposal; and
- Development of facilities through participation of the public sector.

Of note is that the incineration of waste without thermal energy recovery is considered a disposal operation. As such this law was relevant to many incineration plants prior to the introduction of the Basic Law for Promoting the Creation of a Recycling-Oriented Society, as the emphasis was strongly on incineration as a volume reduction and disposal process rather than an energy recovery operation. Many plants were small scale serving individual municipalities and the generation of electricity or recovery of heat was uneconomic. However, given the increasing emphasis on recycling and recovery, modern WtE plants are incentivised to recover energy (as well as recycling ash) an activity classed as 'thermal recycling', particularly the use of

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<sup>99</sup> Also known as the Fundamental Law for Establishing a Sound Material-Cycle Society;  
<http://www.meti.go.jp/english/information/downloadfiles/cRecycle3R20403e.pdf>



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plasma melters to vitrify the bottom and fly ash from incineration plants to be recycled into construction applications. Hence modern WtE is not considered to be a disposal activity and this law therefore does not apply to WtE.

### Law for Promotion of the Effective Utilisation of Resources (2001)

The law was first enforced in 2001 and covers the following:

- Prevention and recycling of by-products;
- Utilisation of recycled resources and parts;
- Product designing and manufacturing in consideration of the 3Rs;
- Product labelling for selected collection of waste;
- Self-collection and recycling of used products; and
- Promotion of effective utilisation of by-products.

The law is essentially a framework providing guidance to ensure minimisation, re-use and recycling of waste. Supporting the Law for Promotion of the Effective Utilisation of Resources are a number of more specific laws governing the management of specific products:

- Containers and Packaging Recycling Law (1995).
- Home Appliance Recycling Law (1998).
- Food Recycling Law (2000).
- Construction Materials Recycling Law (2000).
- End of Life Vehicle Recycling Law (2002).

Finally, in order to encourage markets for the recovered products the Green Purchasing Law was brought in, which requires the national government to promote the procurement of recycled products.

### WtE Regulatory Framework

The regulatory regime governing environmental impacts from WtE plants in Japan is set out in the Japan Environmental Governing Standards (JEGS) 2010.

There are a number of important definitions in the JEGS, and in many cases the definitions differ from the equivalent term in the EU and other regions:

- Municipal Solid Waste – includes ‘any household, commercial/retail or institutional waste’.
- Commercial and Industrial Solid Waste – limited to industrial wastes such as waste oils, sludges, construction and demolition residues etc.

The differences are important as there are different emissions limits depending on the type of feedstock being treated.

### Air Emissions Limits

National air emissions limits are provided in Chapter 2 of the JEGS and are also available on the Ministry of the Environment website.<sup>100</sup> These standards set out the minimum emissions levels that all new and existing

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<sup>100</sup> <http://www.env.go.jp/en/air/qa/air.html>

incineration plant (and other industrial facilities) must achieve. There is no legislation that applies specifically to incineration as there is in the EU. Certain emissions limits vary depending on a range of factors, including:

- Age of the plant;
- Feedstock (in particular whether the plant treats Municipal Solid waste or Commercial and Industrial Solid waste);
- Treatment capacity; and
- Technology type.

To enable comparison of JEGS emission limit values with EU WID, the values from JEGS (expressed as parts per million) have been converted to mg/Nm<sup>3</sup> and all concentrations normalised to an 11% oxygen basis. A summary is provided in Tables 13, 14 and 15.

**Table 13: Air Emission Limit Values**

Incinerator Type		Existing Municipal Waste Combustion Plant		New or substantially modified Municipal Waste Combustion Plant		Commercial and Industrial Waste Incineration Plant
Rated Capacity	Units	35-250 tpd	>250 tpd	35-250 tpd	>250 tpd	All units
Particulate	mg/Nm <sup>3</sup>	50	19	17	17	50
Opacity		10%	10%	10%	10%	10%
NOx (expressed as NO <sub>2</sub> )	mg/Nm <sup>3</sup>	None	Depends on technology	723	217	561
SO <sub>2</sub>	mg/Nm <sup>3</sup>	155	58	60	60	40
Dioxins/Furans	ng/Nm <sup>3</sup>	89.0	21.4	9.3	9.3	0.3
Cadmium	mg/Nm <sup>3</sup>	0.07	0.03	0.01	0.01	0.00
Lead	mg/Nm <sup>3</sup>	1.14	0.31	0.14	0.14	0.03
Mercury	mg/Nm <sup>3</sup>	0.06	0.06	0.06	0.06	0.33
HCl	mg/Nm <sup>3</sup>	287	33	34	29	71

**Table 14 Carbon Monoxide Emission Limit Values**

Incinerator Type		Existing Municipal Waste Combustion Plant		New or substantially modified Municipal Waste Combustion Plant		Commercial and Industrial Waste Incineration Plant
Rated Capacity	Units	35-250 tpd	>250 tpd	35-250 tpd	>250 tpd	All units
Fluidised Bed	mg/Nm <sup>3</sup>	137				214
Fluidised Bed, mixed Fuel (wood/RDF)	mg/Nm <sup>3</sup>	274		274	137	
Mass burn rotary refractory	mg/Nm <sup>3</sup>	137		137		
Mass burn rotary waterfall	mg/Nm <sup>3</sup>	342				
Mass burn waterfall and refractory	mg/Nm <sup>3</sup>	137		137		
Mixed fuel fired (pulverized coal/RDF)	mg/Nm <sup>3</sup>	205		205		
Modular starved-air and excess air	mg/Nm <sup>3</sup>	68		68		
Spreader stoker, mixed fuel fired (coal/RDF)	mg/Nm <sup>3</sup>	274		205		
Stoker, RDF	mg/Nm <sup>3</sup>					

**Table 15: Dioxin Emission Limit Values**

Capacity (tonnes per hr)	Units	New	Existing
=>4	ng TEQ/Nm <sup>3</sup>	0.1	0.7
2-4	ng TEQ/Nm <sup>3</sup>	0.7	3.6
<2	ng TEQ/Nm <sup>3</sup>	3.6	7.1

A full version of the JEGS emission limit values for air and water is provided in Appendix C.

It is noteworthy that the national emissions limits are in many cases substantially less stringent than for WID. For example small plants can emit 50 times the level of dioxins/furans than an equivalent plant in the EU. For 'existing' plants the dioxin/furan limits are higher still (note 'existing' plants are defined in the JEGS as those plants constructed prior to December 1997, 'new' plants are those constructed after this date).

The JEGS include two emissions limits tables specifically apply to incineration plant. However, plants must also comply with other emissions limits in a range of other tables, leading in many cases to several emissions limits for the same pollutant. It is assumed that the figures in the incineration-specific tables take precedence.

However, the JEGS allow Prefectural Governments who plan to construct waste treatment facilities to decide on emissions limits in accordance with emission regulation of local government and/or agreement with communities.

### Air Emissions Limits - Regional

The national emissions limits are a baseline minimum in the absence of more specific limits that may be set at a regional level. Prefectural governments are free to set their own, more stringent limits specific to their

jurisdiction. This results in significant differences across the country, with more heavily urbanised areas typically setting stricter limits than more rural prefectures. For example, predominantly urban Saitama Prefecture has a very strict dioxin limit, 50 times lower than the much more rural Aomori Prefecture. An implication of this is that certain WtE technologies may be appropriate in one prefecture but not in another due to an inability to comply with the emissions standards.

The differences between emissions limits in each prefecture results in a complex picture nationwide. Data for all 47 prefectures could not be obtained, but a sample of emission limits in four prefectures is provided in Table 16.

**Table 16: Example of Emission Limit Variation by Prefecture**

Pollutant	Unit	Prefecture			
		Kanagawa	Saitama	Miyagi	Aomori
Dust	g/Nm <sup>3</sup>	0.005	0.02	0.02	0.01
SOx	ppm	10	10	50	20
NOx	ppm	30	50	60	150
HCl	ppm	10	10	50	50
CO	ppm	30 (4hr average)	30 (4hr average)	30 (4hr average)	30 (4hr average)
Dioxins	ng/TEQ/m <sup>3</sup> N	0.05	0.005	0.01	0.1
Capacity of plant	tonnes/day	525	265	230	60

## Effluent Discharge

National limits apply on effluent discharge to waste water (see Appendix C). Similarly to air emissions, individual prefectures can specify more stringent limits.

## Municipal Solid Waste - Local Government Responsibility

Incineration has historically been used to dispose of a far greater proportion of waste than in most countries. In 2008, 74% of all waste produced in Japan was thermally treated, with just 2% sent to landfill. This is primarily a result of a lack of available land for landfills near urban areas (a high population in a relatively small habitable area). Municipalities are required to dispose of their waste within their own boundaries where possible, though several neighbouring municipalities may partner to develop a common waste treatment plant if there are insufficient waste arisings.

The requirement to treat waste at a local municipality level (i.e. individual cities, towns and villages) has resulted in the construction of a very large number of relatively small scale incineration plants, typically based on grate combustion technology. In 2008 Japan had 1,269 waste incineration plants for the treatment of 35.7 million tonnes of Municipal Solid Waste<sup>101</sup>, the average size of which is well below that of the average Europe plant (less than 30,000 tonnes per year). Japan is one of the few countries with an overcapacity of incineration plant as recycling rates have increased substantially since the turn of the century.

Historically energy recovery was not a high priority for incineration plant in Japan. Only relatively recently has the focused changed from waste disposal (volume reduction) to energy recovery (or 'thermal recycling').

<sup>101</sup> High Efficiency Wte Power Plant Using High-Temperature Gasifying And Direct Melting Furnace, JFE 2011

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## Recycling and Impact on Feedstock for MSW

Over the previous decade there has been a considerable push to increase recycling by requiring households to sort waste into various fractions. Individual municipalities are free to establish sorting guidelines, so the level of separation varies quite widely. Waste is typically sorted into around eight fractions, though some municipalities require waste to be sorted into as many as 44 different categories. This leads to variations in the residual waste stream that may be treated via WtE as the recycling rate varies by municipality.

## Industrial Waste – Waste Producer Responsibility

The ‘polluter pays’ principle has been adopted for the management of industrial waste (Extended Producer Responsibility, which requires Life Cycle Assessments to be undertaken). Producers of waste must pay to dispose; they remain liable for the appropriate disposal even if they then employ a subcontractor to handle and dispose of it on their behalf. Reuse and recycling of waste is strongly incentivised as a result. Note that the definition of industrial waste differs to the EU interpretation in that it does not include commercial and industrial arising with similar characteristics to municipal waste. Only residues such as construction and demolition waste and industrial effluent are considered in this category.

## WtE Infrastructure in Japan

Japan currently has a surplus of thermal waste treatment capacity. This is a result of two main factors:

- the long-term reliance on incineration for waste disposal; and
- a recent decrease in the volumes of residual waste due to the substantial increase in recycling levels over the previous 10 years.

Many existing incineration plants are small, aging and inefficient. The average size of existing plant is less than 30,000 tonnes per year, and at this scale generation of electricity is not usually viable from a typical grate incineration plant. However, the introduction of much more stringent emissions limits (particularly dioxins/furans) has led to the development of many more advanced facilities developed in the last few years, including more than 100 waste gasification plants, a number of which include unconventional processes such as the use of syngas in gas engines (rather than the more conventional steam cycle) and ash melting.

Many modern plants employ ash melting processes in order to produce a vitrified, stable ash product that can be used as a construction material. Unlike in many other countries bottom ash from incineration cannot be used for applications such as road construction in Japan and therefore has to be melted into slag, hence the driver to develop systems that use ash melting. This reduces the landfill requirement to almost zero; the minimisation of landfill has historically been a stronger driver than maximising energy recovery in Japan. Recently some Japanese municipalities have begun mining existing landfills and processing the material in slagging gasifiers in order to recover the very valuable landfill void space asset.

It is of note that the emissions limits for older plant (pre 1998 in particular) are in many cases substantially less stringent than for new plants. This is unlike the situation in Europe where the introduction of the WID applied the same stringent limits to all plants regardless of age, effectively requiring non-compliant plant to retrofit clean-up equipment or close within a relatively short timescale. However, the proliferation of, and reliance on, incineration in Japan means it would have been highly challenging to set similar very stringent demands on all plants whilst maintaining sufficient disposal capacity.

## Future Impacts

Despite the present overcapacity, there remains considerable activity in the WtE market as existing incinerators are replaced with new, modern plants, typically at a larger scale to lower treatment costs and improve efficiency.

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## 5 United States of America

### 5.1 Introduction

This section presents a summary of how WtE plants are regulated in the US at national and state level and how this may impact established operational plants or future developments. This review was undertaken by local experts and based on a combination of their knowledge, experience and desktop research.

At a national level it describes the overall policy and regulatory framework, how this relates to WtE, specific policy instruments and fiscal drivers aimed at incentivising change.

### 5.2 National Legislation

#### Background

The United States Environmental Protection Agency (USEPA) reported that in 2010, approximately 29 million tons of MSW were combusted for energy recovery (i.e. WtE), which represented 11.7 % of the total MSW managed in the US. Between 2000 and 2010, there was a decrease in management of MSW using WtE from approximately 34 million tons to 29 million tons. The USEPA also reported that while the number of landfills in the US has decreased over time, the average landfill size has increased. At the national level, the USEPA believes that landfill capacity is sufficient, although it acknowledged that capacity is limited in certain areas.

Generally within the US, at both the federal and state level, the use of WtE technologies (not including landfill gas to energy) is viewed as a viable option to reduce the volume of MSW entering landfills across the country. This is a particularly important issue for major cities, such as New York, that have no landfill capacity and must export all of their MSW to other parts of the state or to other States. At present, there are no federal or state regulations that directly require the development of WtE facilities although there are several federal initiatives (and some state regulatory programmes) that were established to compel a reduction in landfilling (at both a state and municipal level) and a focus on better management of waste that might include the development of recycling, reuse, and WtE strategies. In addition, many States have adopted renewable portfolio standards with the goal of increasing the generation of renewable energy by electric utilities and retail electricity providers, which may include the purchase of electricity from a renewable source facility. The USEPA has indicated that MSW can be considered to be a renewable power source when it is combusted in WtE facilities to generate electricity.

Currently, WtE facilities provide approximately 0.3% of the nation's power generation. Most of the operating WtE facilities were originally constructed in the late-1980s through the mid-1990s. Environmental regulations at that time were not as well developed as they are now (in particular the federal Clean Air Act), and the facilities were perceived by the public to be a significant source of pollution including air toxics, particulates, odours, and noise. In the present day, strict regulations on air emissions, waste management, and water quality (including wastewater and storm water discharges) can present significant stumbling blocks to the siting, permitting, and construction of new WtE facilities.

#### Regulatory Framework

The regulatory framework applicable to WtE operations in the US is at best complex. At the federal level (which covers all States, territories, and protectorates), there is no single body of laws that regulate WtE siting, construction, and operation. Instead, each aspect is governed by a series of laws and regulations that must be taken into consideration during all phases of selecting a facility location, constructing the facility, operating the facility, and closing down the operation at end of life.

The USEPA has identified the potential environmental impacts having the most significance with respect to WtE facilities to include air emissions (nitrogen oxides, sulfur dioxide, CO<sub>2</sub>, and trace amounts of mercury compounds [and potentially other metals] and dioxins/furans), water use (for cooling water and steam

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generation), water discharges (cooling water, wastewater, and storm water runoff), solid waste generation (ash and other residue), and land resources (resulting from the physical location and operation of the plant and related ash landfill). There are individual federal laws that address each of these impacts and others that regulate specific aspects of facility operations such as management of the MSW fuel source and hazardous materials that may be used in the process.

Many of the federal laws require participation by the states with respect to enforcing federal regulations within each state including developing and implementing matching programs at the state level. States (many, but not all) also have promulgated laws that go well beyond the federal regulations and include stricter compliance criteria. For example, many states have passed regulations requiring the application of stricter air quality criteria to emissions than the federal government has included in the Clean Air Act. At the state level, there are also a number of additional laws that are applicable to WtE facilities to address regional issues including water use, groundwater protection, geological concerns (e.g., site stability), storage tank registration and testing, contingency planning, and emergency preparedness. Some states have developed a fairly comprehensive approach to regulation and permitting of WtE facilities and power generating facilities in general, while others have no formalised program.

In the US, there are also individual municipalities within the states that have enacted local environmental laws that would apply to and potentially further restrict WtE operations. The most significant of these municipal laws tend to be found in larger cities, such as New York (which has a robust set of environmental regulations that apply to various activities conducted within the city limits), Los Angeles, and Chicago, although many smaller cities and counties also have laws and ordinances that are applicable to WtE operations including those governing such issues as land use, water rights, occupancy permits, permits to operate, noise limits, control of odours, traffic-related impacts, water discharges, storm water impacts from construction activity, and operation of pollution control equipment. In accordance with WSP's proposal for this project, municipal laws and ordinances are not discussed further in this summary.

## Federal Laws

### National Environmental Policy Act

The National Environmental Policy Act (NEPA) was passed in 1969 and requires an environmental review to be conducted before any major federal action is undertaken. Each federal agency has developed its own program for compliance with NEPA requirements and the USEPA plays a significant role in the NEPA process both for its own activities as well as for those of other agencies. Given the wide applicability of NEPA, it has been broadly interpreted over the years and may be applicable to any project that requires federal involvement such as the licensing of a power generation facility by the Federal Energy Regulatory Commission. The NEPA process is overseen by the federal Council on Environmental Quality and involves preparation of an Environmental Assessment (EA) and, if warranted, preparation of an Environmental Impact Statement (EIS).

The purpose of the EA is to determine whether the proposed project is likely to have a significant impact on the environment. There is an opportunity for public involvement and comment during preparation and review of the EA and input is generally sought from applicable federal, state, and local agencies that have an interest in the project. Upon completion of the review, there is either a Finding of No Significant Impact or a determination that an EIS must be prepared.

The EIS involves a more detailed and rigorous evaluation of the potential environmental impacts of the proposed project and generally follows a more formal review process. It can be a lengthy process requiring the development of significant supporting studies and reports. There is an opportunity for public review and comment at both the draft and final EIS stage and participation by interested stakeholders is encouraged throughout. The final decision regarding the EIS is published in a Record of Decision (ROD) and any requirements for mitigation of potential environmental impacts are included in the ROD.



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## Resource Conservation and Recovery Act

The regulatory framework for managing solid and hazardous wastes is established by the Resource Conservation and Recovery Act (RCRA), which was originally passed in 1976 and significantly amended in 1984. Underground storage tanks are also regulated under RCRA. The implementing regulations for RCRA are found in the Code of Federal Regulations (CFR) at Title 40 Parts 239 through 259 for solid waste and Parts 260 through 279 for hazardous waste (cited as 40 CFR §239 through 259). For solid (non-hazardous) waste, which by definition includes MSW, the RCRA regulations cover:

- Requirements for state permit programmes;
- Guidelines for thermal processing of solid wastes;
- Guidelines for storage and collection of solid wastes;
- Guidelines for source separation for materials recovery;
- Procurement guideline for products containing recovered materials;
- Prior notice of citizen suits;
- Identification of regions and agencies for solid waste management;
- Guidelines for development and implementation of state solid waste management plans;
- Criteria for classification of solid waste disposal facilities and practices; and
- Criteria for MSW landfills.

Hazardous waste regulations under RCRA govern the management of hazardous wastes from 'cradle to grave,' essentially placing responsibility for all aspects of proper management and disposal of hazardous wastes on the generator. All commercial businesses (and federal, state, and local government entities) that generate, transport, treat, store, or dispose of hazardous waste must comply with applicable RCRA regulations. Even businesses that are not likely to generate wastes that meet the definition of 'hazardous' under RCRA must comply with the RCRA requirements for characterisation of individual waste streams to determine whether each is hazardous or non-hazardous. For hazardous wastes, the RCRA regulations include:

- General requirements for hazardous waste management;
- Identification and listing of hazardous waste;
- Standards applicable to generators and transporters of hazardous waste;
- Standards for owners and operators of hazardous waste treatment, storage, and disposal facilities (including Corrective Action);
- Standards for management of specific hazardous wastes and types of facilities;
- Standards for owners and operators of hazardous waste facilities operating under a standardised permit;
- Land Disposal Restrictions;
- The hazardous waste permit programme;
- Requirements for authorisation of state programmes;
- Standards for universal waste management;
- Standards for management of used oil;
- Technical standards and corrective action requirements for owners and operators of underground storage tanks; and

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- Approval of state underground storage tank programmes.

Within the RCRA regulations, there are specific requirements that govern the design and operation of both non-hazardous and hazardous waste management facilities. Individual States are encouraged by the USEPA to adopt State non-hazardous and hazardous waste management and permitting programmes that meet the minimum regulations established under RCRA. Currently, 50 States and territories have been authorised by the USEPA to implement baseline RCRA programmes.

Many States are also authorised to implement other parts of RCRA, including Corrective Action, but there is substantial variability among the States with respect to which parts of RCRA each is authorised to implement, and enforce. In cases where a State does not have an equivalent rule, the responsibility for enforcement under RCRA reverts to the federal level. As a result, it is possible to have solid waste management requirements for a site that are enforced jointly by a State regulatory agency and the USEPA.

### Clean Air Act

The Clean Air Act (CAA), originally passed in 1970, is the comprehensive federal law that regulates air emissions from stationary and mobile sources. Among other things, this law authorises the USEPA to establish National Ambient Air Quality Standards (NAAQS) to protect public health and welfare and to regulate emissions of hazardous air pollutants.

One of the goals of the CAA was to set and achieve NAAQS in every state by 1975 to address the public health risks posed by certain widespread air pollutants. The setting of these standards was coupled with directing the states to develop state implementation plans (SIPs), applicable to appropriate industrial sources in each state, to achieve these standards. The CAA was significantly amended in 1977 and 1990 primarily to set new goals (i.e., dates) for achieving attainment of NAAQS since many areas of the US had failed to meet the original deadlines.

The federal programs that are covered by the CAA include: acid rain, climate change, air pollutants, health and ecosystem protection, ozone layer protection, radiation, the clean diesel program, air pollution data sources, and the air quality data technology transfer network. The CAA regulations are viewed by many to be complicated and difficult to navigate with respect to determining applicability. The major titles of the Act include:

- Title I – Air Pollution Prevention and Control
  - Part A – Air Quality and Emission Limitations (including the National Emissions Standards for Hazardous Air Pollutants, also known as NESHAPs)
  - Part B – Ozone Layer Protection
  - Part C – Prevention of Significant Deterioration of Air Quality
  - Part D – Plan Requirements for Nonattainment Areas
- Title II – Emission Standards for Moving Sources
  - Part A – Motor Vehicle Emission and Fuel Standards
  - Part B – Aircraft Emission Standards
  - Part C – Clean Fuel Vehicles
- Title III – General Requirements
- Title IV – Acid Deposition Control
- Title V – Permits
- Title VI – Stratospheric Ozone Protection

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Within each title and part are numerous sections and implementing rules. For stationary sources, significant rules pertain to cross-State air pollution, general air pollutants, new source performance standards, new source review/prevention of significant deterioration, ozone layer protection, facility operating permits, and hazardous air pollutants (NESHAPs).

Although many sections of the CAA are potentially applicable to WtE facilities, Title I, Part A, Section 129 (added to the CAA in 1990) is specific to solid waste combustion and includes requirements pertaining to emissions standards (including numerical limits as performance standards or emission guidelines), control methods and technologies, facility monitoring, operator training, and permits. Under Section 129, the USEPA is required to establish new source performance standards (NSPS) for new units and emission guidelines (EG) for existing units pertaining to particulate matter, opacity, sulfur dioxide, hydrogen chloride, oxides of nitrogen, carbon monoxide, lead, cadmium, mercury, dioxins/furans, and dibenzofurans. Both the NSPS and EG under Section 129 use a Maximum Achievable Control Technology (MACT) approach.

The NSPS are federal regulations that apply directly to all new sources, i.e., new municipal waste combustor (MWC) units that start up after the effective date of the NSPS must comply with the federal NSPS. The EG establish requirements for limits to be included in SIPs; once the SIPs are approved by the USEPA, they become federally enforceable. In accordance with Section 129, SIPs must have emissions limits that are at least as protective as the EG, but may be more restrictive.

The rules establishing NSPS or EG potentially applicable to WtE facilities are found at 40 CFR Part 60 and include:

- Subpart Ea – NSPS for MWCs constructed after December 20, 1989 and on or before September 20, 1994
- Subpart Eb – NSPS for Large MWCs constructed after September 20, 1994
- Subpart Ca (withdrawn)
- Subpart Cb – EG and Compliance Times for Large MWCs constructed on or before September 20, 1994
- Subpart AAAA – NSPS for Small MWC Units
- Subpart BBBB – EG for Small MWC Units
- Subpart CCCC – NSPS for Commercial/Industrial Solid Waste Incinerators (CISWI) constructed after November 30, 1999
- Subpart DDDD – EG for CISWI constructed on or before November 30, 1999
- Subpart EEEE – Standards of Performance for Other Solid Waste Incineration Units for Which Construction is Commenced After December 9, 2004, or for Which Modification or Reconstruction is Commenced on or After June 16, 2006
- Subpart FFFF – EG and Compliance Times for Other Solid Waste Incineration Units That Commenced Construction on or Before December 9, 2004.

It is important to note that the USEPA initiated the rulemaking process to establish NSPS or EG for most solid waste combustor units in the mid-1990s. Many of the rules have been amended several times or stayed by judicial authority pending the outcome of litigation brought by various interested parties. For large MWCs, the most recent version of the final rule for NSPS and EG was issued in May 2006; in March 2007, the USEPA announced that it was reconsidering certain aspects of the final rule (not including the emissions limits). For small MWCs, the most recent versions of the final rules for NSPS and EG (issued separately) were issued in December 2000. For CISWI, the most recent version of the final rule for NSPS and EG was issued in March 2011; since then, the USEPA has delayed the effective dates for the rules and indicated that it is reconsidering certain aspects of the final rule. For 'other' solid waste combustor units, the final rule for NSPS and EG was issued in January 2007.

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Of recent and growing interest within the CAA are the regulatory initiatives developed to address greenhouse gas emissions from mobile and stationary sources. In 2009, the USEPA issued a finding under the CAA that six key greenhouse gases pose a threat to public health and welfare – carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. As a result, several actions were either proposed or completed by the USEPA to implement the CAA requirements for greenhouse gases for stationary sources that include: emissions reporting and establishing greenhouse gas emissions thresholds that define when permits under the New Source Review/Prevention of Significant Deterioration and Title V Operating Permit programs are required (currently subject to the final Greenhouse Gas Tailoring Rule).

## Clean Water Act

The Clean Water Act (CWA), passed in its current form in 1972, regulates discharges of pollutants into US waters and establishes surface water quality standards for various contaminants. Under the CWA, the USEPA has implemented pollution control programs that include setting wastewater standards for industrial discharges.

The CWA made it unlawful to discharge any pollutant from a point source into navigable waters of the US (a very broadly defined term), unless a permit is obtained. The USEPA's National Pollutant Discharge Elimination System (NPDES) permit program controls these discharges. Point sources are defined to mean discrete conveyances such as pipes or man-made ditches that are used to discharge wastewater or storm water from a facility. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters.

The NPDES permit programme is mostly administered through individual State programmes that have been authorised by the USEPA. Most States within the US are at least partially authorised to administer the NPDES permit programme, although four States and the District of Columbia (and most territories) are not authorised. Permits are required for construction activities, facility operations where discharges to surface water are likely (including both wastewater and storm water), and for certain specific activities (e.g., application of pesticides).

NPDES permits for storm water discharges are required for 10 categories of industrial activities. Potentially applicable to WtE facilities, Category Five includes landfills, land application sites, and open dumps with industrial wastes and Category Seven applies to steam electric power generating plants. In addition, there is a Multi-Sector General Permit program that applies to a broad group of industrial activities that may apply to certain WtE related activities including landfills and land application sites, scrap and waste recycling facilities, and steam electric generating facilities. Applicability determinations for NPDES permits are dependent on the specific activities being conducted at a site.

Within the NPDES permit program, effluent limitation guidelines and standards are set by the USEPA for various industrial categories. The guidelines are based on the degree of contaminant reduction that is attainable for a specific industrial category using pollution control technologies for existing and new sources.

The USEPA has developed effluent guidelines based on the following:

- Best conventional pollutant control technology (BPT) – for conventional pollutants; applicable to existing dischargers
- Best practicable control technology currently available (BCT) – for conventional, toxic and nonconventional pollutants; applicable to existing dischargers
- Best available technology economically achievable (BAT) – for toxic and nonconventional pollutants; applicable to existing dischargers
- NSPS – for conventional pollutants; applicable to new sources

The USEPA has established guidelines and standards for more than 50 different industrial categories. Currently, none of the industry-specific guidelines appear to be directly applicable to WtE facilities, although a

specific applicability determination would need to be performed that is consistent with specific State's programme authorisation.

The CWA also establishes certain criteria that are applicable to wastewater discharges to municipal systems. In general, these criteria take the form of wastewater pre-treatment requirements that apply to wastewater in general as well as to specific categories of industrial discharges (these are known as the categorical pre-treatment standards). The criteria include Prohibited Discharge Standards that prohibit the discharge of pollutants to a municipal treatment system that would cause an upset to the system or system bypass, and Categorical Pretreatment Standards that are specific to wastewater from particular industrial categories. In addition, there are Local Limits that are developed for specific wastewater treatment facilities and are developed in conjunction with local municipal authorities. Similar to the NPDES effluent limits, an applicability determination for wastewater discharge criteria would need to be performed taking into account specific site activities, source of wastewater discharge, and receiving unit.

In general, Prohibited Discharges include the following:

- Pollutants that create a fire or explosion hazard;
- Pollutants that cause corrosive structural damage (e.g., low pH);
- Solid or viscous pollutants in amounts which will cause obstruction to flow;
- Any pollutant which will cause interference with the treatment system;
- Heat in amounts which will inhibit biological activity;
- Petroleum oil, non-biodegradable cutting oil, or products of mineral oil origin in amounts that will cause treatment system interference or pass through;
- Pollutants which result in the presence of toxic gases, vapours, or fumes within the treatment system in a quantity that may cause acute worker health and safety problems; and
- Any trucked or hauled pollutants.

Other federal programmes under the CWA include: protection of watersheds, wastewater pre-treatment for industrial users, oil spill prevention (including development of Spill Prevention, Control and Countermeasures plans for facilities storing petroleum products), and protection of wetlands.

### Superfund Amendments and Reauthorisation Act

The Superfund Amendments and Reauthorisation Act (SARA), passed in 1986, was a significant amendment to the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; also known as Superfund). CERCLA was enacted to allow the federal government to respond directly to releases or threatened releases of hazardous substances that could endanger public health or the environment.

Of particular interest with respect to WtE facilities are the provisions of SARA Title III, which is also known as the Emergency Planning and Community Right-to-Know Act (EPCRA). Under EPCRA, there are four major sections: emergency planning, emergency release notification, community right-to-know reporting requirements, and toxic chemical release inventory reporting. The purpose of EPCRA was to provide better information to the general public about hazardous materials that are being used and stored within their communities and to assist state and local authorities in meeting their obligations in regard to responding to chemical emergencies.

Key requirements for facilities that store hazardous chemicals onsite include the following:

- Facilities must immediately notify local emergency planning committees and state emergency response committees if there is a release of a hazardous substance (exceeding a 'reportable quantity') to the

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environment; EPCRA specifies a list of extremely hazardous substances (EHSs) and hazardous chemicals that are subject to this requirement.

- Facilities that store EHSs or hazardous chemicals in an amount that exceeds the specific threshold established in the regulations are required to submit copies of material safety data sheets or a list of relevant chemicals to various local and state agencies.
- Facilities that have hazardous chemicals or EHSs present at any one time equal to or in excess of specified thresholds must submit annual chemical inventory forms (known as Tier I or Tier II Hazardous Chemical Inventory forms) to various local and state agencies.
- To support the requirement for the USEPA to establish an inventory of routine toxic chemical emissions from certain facilities, facilities subject to the reporting requirement must complete an annual Toxic Chemical Release Inventory Form (known as a Form R) to the USEPA.

### **Requirements of the Pipeline and Hazardous Materials Safety Administration (PHMSA)**

Under the US Department of Transportation, the PHMSA is responsible for protection of public health and the environment from the risks inherent in the transportation of hazardous materials, which can include by pipeline or other modes of transportation. Key regulations include the Hazardous Materials Regulations (HMR), which are found at 49 CFR Parts 100 through 185, and the Pipeline Safety Regulations, which are found at 49 CFR Parts 190 through 199. The HMR govern the packaging, labelling, documentation, and shipping of hazardous materials by all modes of transportation (i.e., ground, rail, air and water) within, to, and through the US. The Pipeline Safety Regulations govern the transportation of hazardous liquids, petroleum products, and natural gas in pipelines and tank cars.

### **Other Federal Laws and Programmes**

As stated previously, in addition to the federal laws that specifically address environmental protection, there are other federal laws and programme requirements that may be applicable, including:

- Federal Energy Regulatory Commission (licensing of projects involving interstate transmission of natural gas, oil, and electricity).
- Federal Aviation Administration Notice of Proposed Construction (height restrictions for physical facilities).
- US Coast Guard Waterway Management (protection of navigable waters of the US).
- US Army Corps of Engineers (wetlands and impoundment permitting).
- US Fish and Wildlife Service (management of endangered and protected species).
- National Historic Preservation Act (protection of significant historical and cultural resources).

### **Emission Limit Values for Air and Water**

Under the CAA, there are several sets of emissions standards that may apply for specific hazardous air pollutants. The final rules for NSPS and EG for large combustors existing and new, small combustors existing and new, and Commercial and Industrial Waste Incinerators (CISWI) all apply different limits, including general modifying criteria.

For water discharges under the CWA, there is not a single set of effluent criteria that will apply. The NPDES permit programme and industrial wastewater discharge limits are state and location-specific and are driven by the specific discharge activity and nature of the discharge.



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## 5.3 State Legislation

### California

Surprisingly, California has trailed behind many other States in the application of WtE as a solid waste management strategy, and there are a limited number of MSW-to-electricity or RDF facilities within the State. In part, this appears to be due to concerns that WtE facilities would undermine the State's recycling efforts and would contribute to greater levels of air pollution. One facility in Long Beach, was built in 1988 and consumes approximately 1,550 tons of MSW per day and generates up to 36 MW of power (one of only three WtE facilities in California). The ash from the facility is used to pave roads at the county landfill.

A 2011 report commissioned by the California Council on Science and Technology (CCST) indicates that California has embraced a waste management hierarchy (consistent with the USEPA) that includes waste reduction, reuse/recycling, energy recovery, and landfilling, but notes that the state has been reluctant to endorse WtE primarily due to opposition to the use of what is viewed as conventional incineration and concern about emissions. A realistic concern as California is home to a number of cities that are 'non-attainment' areas, i.e., they are unable to meet state air quality criteria and federal Clean Air Act national ambient air quality standards.

The CCST report states that there are only three WtE facilities currently operating in California, with a combined capacity of 70 MW. These facilities are reportedly almost 30 years old. New facilities that might be located in the state face three significant barriers: technology restrictions within the state's statutes, challenges in receiving appropriate permitting, and adequate financing, including difficulties in demonstrating eligibility for economic incentives. In general, the report supports exploration of the use of WtE technologies, but indicates that it is controversial. Key findings of the report also include:

- The environmental and other impacts of a WtE system are specific to the system itself. Changes to system-specific factors including location, waste composition, equipment type and configuration, operating conditions, and control techniques can affect the performance of the system and whether it results in a net positive or negative impact.
- Life-cycle analysis of various waste management options was determined to be a valuable decision-making tool, although it was noted that there was insufficient literature regarding life-cycle analysis for WtE technologies.
- Technologies exist for the conversion of MSW to energy that can meet California's rigorous environmental quality standards and review process, but indicated that there are uncertainties with new WtE technologies that make it difficult to predict whether such technologies could be uniformly successful in all regions of the State.
- Implementation of WtE systems is expensive and requires economic or policy incentives to encourage development.
- There is a possibility that WtE systems may interfere with waste recycling and reuse efforts. It is noted that current state law requires 'to the maximum extent feasible, the technology removes all recyclable materials and marketable green waste compostable materials from the solid waste stream prior to the conversion process.'

The California Energy Commission<sup>102</sup> has jurisdiction over all thermal power plant projects 50 MW or larger that are proposed to be constructed and operated in California. The commission follows a certification process that evaluates potential effects on public health as well as environmental quality and the process has been certified by the California Natural Resources Agency as functionally equivalent to a review performed in accordance with the California Environmental Quality Act.

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<sup>102</sup> [http://www.energy.ca.gov/public\\_adviser/lors\\_faq.html](http://www.energy.ca.gov/public_adviser/lors_faq.html)



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The process followed by the Energy Commission includes filing an Application for Certification, staff analysis of the application, issuance of a Scheduling Order to establish the schedule for filing documents and holding public meetings and hearings, a prehearing conference, and issuance of the decision.

The proposed facility must meet all of the federal, state, and local requirements applicable to construction and operation of power plants in the state. California has a complicated regulatory scheme that involves oversight by many agencies at the state and regional level. These include the:

- California Environmental Protection Agency (Cal/EPA);
- Cal/EPA Air Resources Board;
- Department of Toxic Substances Control;
- State Water Resources Control Board;
- Regional Water Quality Control Board;
- California Department of Public Health;
- Regional Air Quality Management District or Air Pollution Control Districts; and
- California Unified Program Agencies.

In addition to applicable provisions of federal laws, thermal power plant projects in California must meet the requirements of the following State and local environmental laws and regulations (note that this list represents the major environmental regulatory requirements and is not exhaustive):

- Air Quality
  - California State Health and Safety Code – regulation of discharges that might cause harm to public health.
  - Air Resources Board – establishes state-level ambient air quality standards, which may in many cases be more stringent than the national ambient air quality standards.
  - Regional Air Quality Management District regulations, including implementation of the federal PSD requirements, Best Available Control Technology, offsets, emissions calculation procedures to estimate emission reduction credits and requirements for the federal acid rain programme.
- Biological Resources
  - California Endangered Species Act and other regulations that protect ecological resources.
  - County general plans applicable to land use, open space, and conservation.
- Hazardous Materials Management
  - California Health and Safety Code – requires development of a Risk Management Plan.
  - Title 8, California Code of Regulations – requires development of safety management plans for large quantities of hazardous materials.
  - California Government Code – restricts issuance of an occupancy permit until a covered facility submits a Risk Management Plan.
- Land Use
  - California Coastal Act – governs land use along the California coast.
  - Delta Protection Act – long term management of resources within the Delta Primary Zone.
- County general plans, area-specific plans, zoning ordinances.

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## ■ Waste Management

- California Health and Safety Code – establishes regulatory framework for management of hazardous wastes.
- Title 14, California Code of Regulations – sets minimum standards for solid waste handling and disposal and conformance of solid waste management facilities with county solid waste management plans.
- Title 22, California Code of Regulations – establishes requirements for generators of hazardous waste.

## ■ Soil and Water Resources

- State Water Resources Control Board – storm water discharge permits for facility construction and operation, and requirements for water quality protection.
- Water Quality Control Act – prohibits use of water suitable for potable use for non-potable uses, including industrial use, if suitable recycled water is available.
- Local wastewater ordinances.

In addition, there are State and local regulations covering specific aspects of facility design, geological and paleontological resources, noise, public health, cultural resources, socioeconomics, traffic and transportation, visual resources, and power plant reliability.

## Florida

Information available from the Florida Department of Environmental Protection (FDEP) through its WtE web page ([http://www.dep.state.fl.us/waste/categories/solid\\_waste/pages/wte.htm](http://www.dep.state.fl.us/waste/categories/solid_waste/pages/wte.htm)) indicates that as of 2011, there were 11 operating WtE plants in the state (all are facilities that combust MSW or RDF to produce electricity), up from a single plant in 1982.

The Power Plant Siting Act (PPSA) is the state of Florida's centralised process for licensing large power plants, which includes WtE facilities. Under the PPSA, the State issues a single license, called a certification, in place of numerous state and local permits, although the requirements of those permits are incorporated into the single certification. As a result, the certification addresses permitting, land use and zoning, and property issues. The certification does not cover permitting or licensing that is required by the federal government; these must still be obtained in addition to the certification. The PPSA applies to electrical generating facilities that generate 75 megawatts or more, and to applications that occurred after July 1, 1973. Certifications are issued by the state Siting Board or the Secretary of the FDEP.

The terms of the certification for a facility are set forth in the Conditions of Certification for each facility. For example, in March 2010, the FDEP issued its Conditions of Certification for the Lee County Solid Waste Energy Recovery Facility. The Lee County facility was planned to combust 1,800 tons of MSW per day using three mass burn waterwall combustion systems located on a 155 acre site. The Conditions Certification for the facility includes information pertaining to:

- Design and performance criteria;
- Construction practices (including for mitigation of environmental impacts);
- Federal and state permit requirements;
- Post-certification requirements;
- Environmental impacts;
- Operational requirements established by the FDEP for emissions, cooling water, wastewater, solid and hazardous waste, and transmission lines;

- Conditions imposed by the South Florida Water Management District;
- Conditions established by other regional authorities including the Department of Community Affairs, Regional Planning Council, Department of Transportation, Fish and Wildlife Conservation Commission, and State Division of Historical Resources; and
- Attachments include a survey map of the area, mitigation plan, air permits for construction, and the facility's Title V air operation permit.

Recently (February 2012), the State enacted a WtE Ash Management Rule under which ash from WtE facilities must no longer be managed as hazardous waste, but is required to be disposed of in lined MSW landfills or a lined ash monofill. This will be considered within the PPSA going forward.

Facilities that are not covered by the PPSA do not benefit from the centralised licensing process and must comply with the requirements of the individual state (and where applicable federal) environmental laws including with respect to air permits, solid waste management, wildlife protection, coastal protection and management, environmental resource permits, storm water permits, groundwater protection, wastewater and storm water discharge, storage tank registration and management, and underground injection control.

## Minnesota

In a 2006 policy statement, the Minnesota Pollution Control Agency (MPCA) stated that it supports WtE as 'an important part of the Waste Management System, with the understanding that each facility must satisfy the requirements of environmental review and the permitting process.' That being said, the MPCA has also stated that every application for a WtE facility must undergo a thorough environmental review and cautioned that facility operators must be 'aware that their financial obligations will extend for decades.'

Minnesota's hierarchy of solid waste management practices includes WtE (included in the broader category of resource recovery) as one of six preferred practices. As of 2010 (the most current data available), WtE comprised 18.4% of MSW management/disposal options in Minnesota; state wide this represents a decrease over 2009. The Minnesota Resource Recovery Association (<http://www.mnresourcerecovery.com/>) reports that there are nine WtE facilities currently operating in Minnesota.

The 2009 Integrated Solid Waste Management Stakeholder Process was developed by the Minnesota Environmental Initiative (MEI) and funded by the MPCA to reduce greenhouse gas emissions through changes in the way solid waste is managed. The process focusses on four primary metropolitan areas within the state. Interestingly, the MEI did not support the development of new WtE capacity, but instead recommended a strategy based on increasing the existing capacity, with the goal of achieving full cost-effective utilisation of existing WtE facilities in accordance with permit conditions.

The MPCA does not have a comprehensive approach to permitting and regulating WtE facilities; it is managed through the state's solid waste program and WtE facilities must comply with all applicable requirements of the individual state environmental laws applicable to construction and operation of a solid waste management facility. Most significant would be the need to obtain an air emission permit from MPCA; the state law imposes stricter emissions limits than the federal law and also includes requirements for emissions monitoring and testing and annual training for facility operators. Ash is required to be managed as a non-hazardous waste in an industrial waste landfill.

The Minnesota Environmental Policy Act requires the completion of an environmental review process for large projects within the state before permits and approvals are issued. The review process must be conducted in accordance with rules established by the Minnesota Environmental Quality Board and includes reviews by both state and local government agencies, such as the MPCA. Projects commonly reviewed by the MPCA include industrial projects, feedlots, wastewater systems, and solid waste management facilities, such as WtE facilities. The review process includes preparation of an Environmental Assessment Worksheet (EAW); a detailed description of the project must be provided in the worksheet. The worksheet also includes information

pertaining to land use and habitat, storm water and wastewater, air emissions, traffic, and historical or archaeological resources. Based on the outcome of the EAW review, a more detailed Environmental Impact Statement (EIS) may be required, typically for the largest projects, which may include siting or expansion of a WtE facility. Public review and comment periods are included in both the EAW and EIS processes. Permits cannot be issued for any facility until the environmental review process is complete. It is a lengthy process, requiring several months for the simplest facilities and can take well over a year for more complex facilities.

New facilities must complete an application for a Solid Waste Permit. The permit application requires submittal of the following (note that only major regulatory requirements are included below):

- Industrial solid waste management plan.
- Description of security procedures and equipment.
- Contingency Plan.
- Description of procedures, structures or equipment to prevent operational hazards.
- Description of procedures, structures or equipment to prevent run-off, run-on.
- Description of procedures, structures or equipment to prevent ground and surface water contamination.
- Description of procedures, structures or equipment to mitigate effects of equipment failure.
- Description of precautions to prevent ignition or explosions and emergency response plan.
- Closure and Post-closure Plan.
- Closure cost estimates and evidence of financial assurance.
- Post closure cost estimates and evidence of financial assurance.
- Corrective action cost estimates and evidence of financial assurance.

In addition to the Solid Waste Permit, WtE facilities are required to obtain an air emissions permit, wastewater discharge permit (state and local municipality), and a storm water discharge permit. Additional permits may be required if unusual water, wastewater, or storm water management processes are proposed.

Operating WtE facilities are required to submit an Annual Report including:

- Quality of waste received and method of handling.
- Quantity of waste recycled and method of handling.
- Average price charged at facility gate.
- Evaluation reports – including amendments to closure, post-closure, and contingency plans, and evaluation of the facility's Industrial Solid Waste Management Plan.
- Counties served.

### New York

The website for the New York State Department of Environmental Conservation (NYSDEC; <http://www.dec.ny.gov/chemical/23683.html>) notes that as of February 2012, there were 10 active municipal waste combustion facilities in the state. The state follows a strict programme of emission controls and prohibits certain wastes (e.g., batteries and fluorescent light bulbs) from entering the WtE facilities to reduce pollutants in facility emissions.

New York has enacted a Uniform Procedures Act for administering NYSDEC's issuance of key environmental regulatory permits. The act provides specific time frames for NYSDEC response to permit applications, and standardised procedures for filing and reviewing applications, providing public notice and holding public

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hearings, and final agency decisions. The purpose of the act is to ensure a fair, timely, and thorough review of permit applications, eliminate inconsistency between permit programs and regional offices, and encourage public participation in the permitting process.

Permits and regulatory programs that may be applicable to WtE facilities in New York include:

- Air Pollution Control Permit – required for owners and operators of air contamination sources; type of permit and permit limits are based on the location (i.e., region) and types of sources. This covers Title V Permits (issued in coordination with the USEPA under the federal Clean Air Act), State Facility Permits, or Registration for source construction or operation.
- Coastal Erosion Hazard Permits – for facilities constructed within certain lands located along designated coastal waters in the state.
- State Pollutant Discharge Elimination System – applies to discharges of water, wastewater, and storm water under various circumstances including to groundwater and surface water within the state.
- Protection of Waters – required for activities involving modification or disturbance of the bed or banks of streams or water bodies.
- Water Quality Certification – applies to any discharge into the waters of the US that may be subject to issuance of a federal permit, e.g., for discharges of dredged or fill material.
- Wetlands Permits (freshwater or tidal) – applies to activities that may result in disturbance of certain areas of wetlands.
- Solid Waste Permit (specific to the requirements for Solid Waste Incinerators, Refuse-Derived Fuel Processing Facilities, or Solid Waste Pyrolysis Units).
  - Permit to construct and operate – application must include the following: engineering report; engineering plans and specifications; comprehensive recycling analysis; proposed landfill for ash residue, downtime waste, and bypass waste; final disposition of refuse derived fuel (if appropriate); facility operation and maintenance manual; personnel training plan; facility maintenance, monitoring and inspection plan; staffing plan; waste control plan; contingency plan; and closure plan.
  - Operational requirements – facilities must operate in compliance with the following: provisions of the approved operation and maintenance manual; requirements regarding receipt and handling of solid waste; facility must have adequate drainage and be free of standing water; NYSDEC must be notified of process changes before they are implemented; unauthorised access must be restricted; required reporting must be completed; and the facility must comply with all requirements of its contingency plan and additional requirements for preparedness and prevention.
  - Ash residue requirements – apply only to facilities that receive and combust household waste and other non-hazardous wastes and include specific testing methods and procedures; and preparation of an ash residue management plan that covers generation, handling, transportation, and disposal, which may include landfill disposal, treatment, or beneficial reuse.

## Planning

In the US, the planning process for a facility such as a WtE plant generally starts at the local level. The proposed location of a WtE facility must first comply with local zoning ordinances, land use restrictions, and community development plans. Once a suitable location has been identified, the facility planning process can be initiated and will require coordination of local, state, and federal agencies as it moves forward. In general, most federal and state regulatory agencies will look for the concurrence of local agencies with respect to land use issues as part of its environmental review and permitting process for a WtE facility.

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## WtE Infrastructure at 2012

The 2010 Directory of WtE Plants prepared by the Energy Recovery Council (a national trade group) states that in 2010, there were 86 WtE plants operating in the US with a total capacity to manage more than 97,000 tons of MSW per day. The report notes that this represents an increase in WtE capacity since the directory was last published in 2007 and that additional capacity is under development. Other key findings in the report include:

- The WtE facilities in the US have the capacity to generate the equivalent of 2,790 MW of electricity.
- States with operating WtE plants include Alabama, Alaska, California, Connecticut, Florida, Hawaii, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, North Carolina, Oklahoma, Oregon, Pennsylvania, Utah, Virginia, and Washington, Wisconsin. Florida, with 11 plants, has the largest number of WtE facilities in the US.
- Between 2007 and 2010, three facilities have completed construction of expansion units; additional expansions are both planned and under construction.
- Several communities are in the process of developing greenfield WtE facilities.
- Kaplan (et al., 2009) reported that annual stack test and continuous emission monitoring data are available for all WtE facilities operating in the US. These data indicate that the actual emissions for the facilities are less than regulatory requirements. All of the WtE facilities in the US were noted to recover heat from the combustion process to power a steam turbine and electricity generator.

In June 2012, the USEPA issued its preliminary approval of the air permit for the Arecibo Renewable Energy Project in Puerto Rico. The Arecibo plant is proposed to convert 2,100 tons per day of MSW into bio fuel. The facility will include:

- MSW combustors;
- Steam turbine generator;
- Ash handling system;
- Carbon storage silo;
- Lime storage silo;
- Emergency diesel generator and fire pump;
- Ammonia distillate and fuel oil storage tanks; and
- Mechanical draft cooling tower.

Final approval of the air permit by USEPA will be a significant step forward in the final planning and construction of the facility. The company proposing to construct and operate the facility will be required to test its emissions and demonstrate it meets all established limits before it will be permitted to fully operate.

## Future impacts

The most significant future impact on siting and operation of WtE facilities in the US will be changes to the CAA (and similar state laws) with respect to emissions limits, required pollution control technologies, and requirements pertaining to greenhouse gases and other climate change initiatives.



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## 6 Review of Key Issues

### 6.1 Introduction

In their discussion paper 'Alternative Waste Treatment (AWT) Technologies Established Guidelines' published in 2010<sup>103</sup>, the Waste Management Association of Australia (WMAA) highlighted areas for further review to support the development of future best practice guidelines for Western Australia.

The scope of the WMAA report included biological technologies as well as thermal technologies and Commercial and Industrial waste as well as Municipal Solid Waste. In the context of this report the focus is on thermal energy-from-waste technology and predominantly MSW.

The WMAA report is considered to be a precursor to the production of guidelines and amongst its conclusions highlighted gaps in regulatory/policy areas, established standards and community awareness for WA to consider and that measures adopted by other jurisdictions may not be directly applicable to WA due to its geographic size, remoteness and relatively small population.

Regulation and Policy within the specified geographies were reviewed in Sections two to five of this document and this Section considers some of the key issues in relation to the development of WtE facilities and the preparation of associated best practice guidance.

### 6.2 Regulatory and Policy Impact on Waste Feedstock

Assessing the security of supply of waste feedstock is one of the main factors in the decision making process for the development of a WtE facility. This concerns not only continuity of supply but also an understanding of the consistency of composition and any factors that may significantly change this over the lifetime of the plant e.g. some of the regulatory changes specified in previous Sections.

With an ever increasing focus on the waste hierarchy, separate collection of recyclable waste and a growth in the separate collection of food and garden waste for biological treatment, the composition of what we refer to generally as MSW can be subject to change which can have an impact on the efficiency and operation of a thermal WtE facility. Any thermal WtE process (incineration, gasification and pyrolysis) must know the composition and calorific value (CV) of the waste streams it is expected to treat. Although there is a certain amount of flexibility of operation (represented by the firing diagram of the plant), major shifts in composition changes due to changes in collection and recycling strategies and policies can have a significant impact on the performance of a thermal plant.

This becomes particularly relevant for Western Australia as the National Waste Policy cites the important role of State and Territory Governments in building on their existing programs, including the need to consider the use of alternative waste treatment technologies, WtE plants and bio-digesters.

Note: The traditional definition of MSW is applied throughout this report although there is no common universally accepted definition e.g. in the EU it may also be referred to as Local Authority Collected Waste (LACW) to accommodate the element of commercial type waste collected by local authorities (LA's) in addition to MSW. Furthermore, the classification of residual MSW (RMSW) is used to describe the remaining fraction of municipal waste once the readily recyclable materials have been removed, either prior to collection by the householder or post collection via a treatment process e.g. material recovery facility.

#### Application of the waste hierarchy and waste composition

The debate regarding WtE plants diverting material viable for recycling away from recycling options is well established, however there are examples of specific policy measures to establish waste management systems

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<sup>103</sup> [http://www.wmaa.com.au/CMS/docs/ASKWM\\_AWT\\_Guide.pdf](http://www.wmaa.com.au/CMS/docs/ASKWM_AWT_Guide.pdf)



designed to ensure recycling is maximised and the residual unsuitable material is sent for energy recovery e.g. the Dutch 'Pay as you throw' system. All recyclables are separately collected and there is a financial disincentive to use the 'garbage' bag.

An example of developing policy is the 'Report on a Resource-Efficient Europe' recently published by the European Commission specifying a proposal for the phasing-out, by the end of this decade, the incineration of recyclable and compostable waste.

The Scotland Zero Waste plan will place restrictions on the input to all WtE facilities, in the past only applicable to municipal waste, therefore encouraging greater waste prevention, re-use and recycling.

By 2009 Germany had achieved 99% plus landfill diversion; approximately 64% of LACW is recycled or composted, 33% sent to WtE plants and less than 1% sent for landfill disposal). Policy set a clear objective to develop a sustainable resource efficient materials flow management system, and legislation includes a ban on landfill disposal of untreated household wastes or general waste since 2005. This has also been achieved without a fiscal driver such as landfill tax. In a best practice scenario such as this there remains disagreement upon the application of the waste hierarchy. Section 3.2 provides the example of the Federation of German Waste, Water and Raw Materials Industry Association (BDE) challenging the German Recycling Act. In summary, the BDE believes that there is a calorific value clause that could lead to large quantities of waste suitable for recycling being sent for thermal treatment.

One US study suggests the assumption that WtE plants reduce recycling is unfounded, whereby communities that have access to WtE facilities exhibit a 17.8% higher recycling rate than the US EPA average<sup>104</sup>.

Rada et al<sup>105</sup> published a paper proposing a theoretical scenario where the equilibrium balance is achieved for only recyclable material in the waste to be recycled and no recyclables are in the RMSW and makes reference to a prior study on the impact of increasing selective collection and composition of RMSW in Trentino, Italy<sup>106</sup>. It refers to a reducing organic fraction in RMSW due in part to selective collection of the organic fraction. It then considers the treatment options for processing RMSW and the potential impacts.

It discusses changes in the lower heating value (net calorific value) caused by variations in organic content due to selective collection and impact on conventional grate systems and the impact on existing Mechanical Biological Treatment (MBT) plants i.e. potential to cause inefficiencies due to low organic content. It also highlights the importance of forecasting changes to waste composition due to developing selective collection systems to ensure the design of WtE facilities can accommodate change e.g. adopting a modular design.

## R1 Criterion

Within the EU, the introduction of the R1 criterion to enable recovery status for WtE plants has increased the debate about the application of the hierarchy i.e. increasing perception that WtE diverts waste from recycling and how this could be made worse by the resulting greater activity in the cross border movement of waste, previously banned when disposal status applied to WtE.

In The Netherlands, increasing efficiency in recycling has in turn reduced the MSW available to WtE plants. The available capacity is being utilised by importing waste fuels from other EU Member States<sup>107</sup>.

The basis for the R1 criterion is also subject to challenge. A study by Grosso et al<sup>108</sup> critically appraised the R1 criterion and correlated to what they refer to as the more scientific approach based on energy efficiency. For

<sup>104</sup> Psomopoulos, Bourka and Themelis, 2009, Waste to energy: A review of the status and benefits in the USA, Waste Management, 1718-1724, Vol 29

<sup>105</sup> Rada, Istrate and Ragazzi, 2009, Trends in the management of residual municipal solid waste, Environmental Technology, 651-661, Vol. 30 no.7

<sup>106</sup> Ragazzi and Rada, Effects of recent strategies of selective collection on the design of municipal solid waste treatment plants in Italy, 4th Wessex Institute of Technology Conference on Waste Management and the Environment, Spain, 2008, pp613-620

<sup>107</sup> <http://www.letsrecycle.com/energy/blog/rdf-export-2013-a-dutch-perspective>

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WtE plants currently operating in Europe, they found some significant differences in performance, mainly related to average size and availability of a heat market (district heating). Moreover they suggest the official R1 formula contains some considerable flaws e.g. it disadvantages small installations and warmer countries. Contrary to this view there are many others that consider the R1 criterion to be a reasonable and worthwhile measure of the efficiency of thermal technologies.

## 6.3 Public Perception

### EU

In Germany waste incinerators are viewed as sources of critical air pollution by the general public though due to stringent emission control standards, dioxins/furans, dust and heavy metal emissions from waste incineration are no longer an issue. There is no general organisation in Germany that is anti-energy from waste. When a WtE facility is planned, every community and person involved can raise an objection. Key issues of objections are mainly the basic rights to life, health and property. Action against the permission is possible before the Supreme Administrative Court or the Administrative Court one month after delivery of notice. Entitled to sue are only those persons of recognised nature conservation organisations, who participated in the permitting process with their own objection. Boosting energy efficiency and optimising energy use are the central challenges faced by state-of-the-art waste incineration.

Denmark incinerates the largest amount of waste per capita (including commercial and industrial waste), namely 600 kg annually. WtE facilities have been in operation in Denmark for more than 100 years and have been widely used as a source of energy for municipal district heating. As a result, WtE has a positive perception in the eyes of the public<sup>109</sup>.

Incineration and WtE plants have a poor reputation in France even though about a third of French MSW is treated through incineration. This is due to lack of public access to information on WtE emissions; there have been long debates about the place of incineration in France and there are widely divergent positions on it<sup>110</sup>.

In Italy MBT is used to produce solid recovered fuel (SRF) which is combusted in dedicated boilers and receives 'Green Certificates' for premium priced electricity sales for the total throughput of the plant, such that the SRF is considered to be a 100% renewable fuel. The Italian public appears to accept this approach whilst still being against conventional WtE plants.

There is a drive to develop WtE schemes in Poland, however there is also strong public opposition to these schemes as perception is based on past experience with poorly performing incinerators and anxiety about negative environmental impact and particularly emissions to air<sup>111</sup>.

In the UK there is a strong anti-incineration lobby, based primarily on human health concerns but also more recently from an environmental perspective i.e. opposition to local WtE developments will often cite potential conflicts in the waste hierarchy as additional concerns. The United Kingdom Without Incineration Network (WIN)<sup>112</sup> was founded in March 2007, its role is to help individuals and groups to develop the case against incineration, and in doing so support the UK-wide movement in favour of what they consider to be more sustainable waste management.

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<sup>108</sup> Grosso, Motta and Rigamonti, 2010, Efficiency of energy recovery from waste incineration, in the light of the new Waste Framework Directive, Waste Management, 1238-1243, Vol 30

<sup>109</sup> Heron Kleis and Søren Dalager (2004): 100 Years of Waste Incineration in Denmark

<sup>110</sup> Yohann Benhamou (2010) Comparison of environmental performance of WtE (WTE) plants in France with Denmark and Germany

<sup>111</sup> The World Bank (2011): Solid Waste Management in Bulgaria, Croatia, Poland, and Romania

<sup>112</sup> <http://ukwin.org.uk/>

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## US

The operation of WtE facilities in the US is undoubtedly a controversial topic. Public opinion regarding the primary WtE technology in use in the US (combustion) was largely formed in response to the early operation of these WtE facilities that were not subject to the stringent emissions and operational controls currently placed on such facilities. As a result, the facilities were perceived in the surrounding communities to be significant causes of problems with air quality, noise, odour, and traffic congestion. Current operators of the WtE facilities must contend with this lingering negative perception despite the fact that they are demonstrating through monitoring data that the facilities are in compliance with all regulatory criteria.

As a result of 'past sins', siting a new facility in many parts of the US is difficult and requires strong support from both the federal and state environmental regulatory agencies to reassure the public that WtE facilities can be operated cleanly and present minimal risk to public health and the environment. In addition, states and local municipalities have indicated that they are concerned that new WtE projects will compete with their reduction, reuse, and recycling programme goals, which are focused on achieving 'zero waste' generated for disposal.

Siting a WtE facility also raises concerns relative to environmental justice. It has long been a concern in the US that waste management facilities (including landfills, incinerators, transfer stations and others) tend to be constructed in low income areas, where in the past, residents of these areas have been viewed as being less likely to object. Because many of the federal and state laws that apply to construction and operation of WtE facilities include significant opportunities for public participation and comment in the permitting process, environmental justice concerns have become a key focus during public hearings.

Lastly, there is a common perception in the US that there is sufficient landfill space available to enable landfilling of waste to continue well into the country's future. The regulatory and financial hurdles a community must face when considering WtE as a viable waste management option are daunting in communities that are not affected by limitations on landfill space. This will continue to be a limiting factor in the development of WtE facilities in many parts of the country.

## Japan

In the 1960s and 1970s Japan had a major problem with industrial pollution. Industrial emissions were poorly regulated, and pollution related disasters such as the Minamata disease incident (caused by mercury poisoning from contaminated water) led to the introduction of environmental pollution laws. Particularly relevant to WtE was the introduction of the Special Law on Dioxins in 2000, brought in as a result of substantial public concern around dioxin releases from the very large number of incineration plants across the country (>1300).

Over the past few years the Japanese government has given financial incentives to owners and operators of existing old plants to build new facilities based on slagging gasification rather than combustion technology because they believe this solves the dioxin problem. There are also examples where local people have accepted the development of WtE facilities in their neighbourhood in exchange for free heat to public buildings, such as hospitals, old peoples' homes and schools. The Japanese also construct plants designed to treat the quantity of waste produced by a town or group of villages to avoid the transport of waste around the road network. Consequently, there are many small scale (40 – 70 ktpa) plants in Japan.

Industry now must comply with all relevant emissions limits, but are encouraged to go further and liaise with the local community. Additionally the recycling laws have prioritised public engagement and producer and consumer responsibility, and the public are much more involved in waste management in general.

## 6.4 Western Australia Waste Strategy 2012

Strategy objectives 3b and 3c propose to review best practice systems and outcomes and develop recommendations and information on these to promote the adoption of these deemed best practice for Western Australia. The review of how policy and regulations has developed across the selected geographies informs

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this debate and could foster a more in-depth review of selected options to enable full sensitivity and scenario analysis on the implications of adoption by Western Australia.

The selection of fiscal drivers aimed primarily at diverting waste from landfill reviewed for this document exhibit a wide range of tax rates and policy related factors as to how this levy is structured. It also provides examples of how relatively short lived some initiatives are e.g. incineration tax in Norway and landfill tax in Queensland. This should inform the implementation of objectives 4a and 4b and enable further investigation of those most relevant to the Western Australian model.

From the study undertaken within Sections two to five of this report, there are potentially a number of case studies in support of objective 5d to communicate to the wider public how waste can be managed in a sustainable way whilst minimising impact on the environment. Subsequent elements of this study will in parallel present the facts and highlight cases of best practice in relation to the protection of public health.

## APPENDIX A

### Australia Ambient Air Quality NEPM National Standards

**Table A1 Australia Ambient Air Quality NEPM National Standards**

Pollutant	Averaging period	Maximum (ambient) concentration	Goal within 10 years (maximum allowable exceedances)
Carbon monoxide	8 hours	9.0 ppm	1 day a year
Nitrogen dioxide	1 hour	0.12 ppm	1 day a year
	1 year	0.03 ppm	none
Photochemical oxidants (as ozone)	1 hour	0.10 ppm	1 day a year
	4 hours	0.08 ppm	1 day a year
Sulfur dioxide	1 hour	0.20 ppm	1 day a year
	1 day	0.08 ppm	1 day a year
	1 year	0.02 ppm	none
Lead	1 year	0.50 µg/m <sup>3</sup>	none
Particles as PM <sub>10</sub>	1 day	50 µg/m <sup>3</sup>	5 days a year

The PM<sub>2.5</sub> Variation to the Air NEPM sets the following advisory reporting standards and goal for particles as PM<sub>2.5</sub>.

**Table A2**

Pollutant	Averaging period	Maximum (ambient) concentration	Goal
Particles as PM <sub>2.5</sub>	1 day 1 year	25 µg/m <sup>3</sup> 8 µg/m <sup>3</sup>	Goal is to gather sufficient data nationally to facilitate a review of the standard as part of the review of this Measure scheduled to commence in 2005.

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## APPENDIX B Exchange Rates at January 2013

**Table B1 Exchange Rates at January 2013**

	Euro	Great British Pound	Swedish Krona	Norwegian Krone	United States Dollar	Japanese Yen
1 AUD Equivalent 10 January 2013 <sup>113</sup>	0.81	0.66	6.92	5.90	1.06	93.22

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<sup>113</sup> <http://www.xe.com/currency/aud-australian-dollar>

## APPENDIX C Japanese Emission Limit Values (JEGS)

**Table C1 JEGS (2010) Air Emissions Limits - National**

Incinerator Type		Existing MWC		New or substantially modified MWC		CISWI
Rated Capacity	Units	35-250 tpd	>250 tpd	35-250 tpd	>250 tpd	All units
Particulate	mg/dscm	70	27	24	24	70
Opacity		10%	10%	10%	10%	10%
NOx	ppm	None	Varies on tech	500	150	388
SO2	ppm	77	29	30	30	20
Dioxins/Furans	ng/dscm	125	30	13	13	0.41
Cadmium	mg/dscm	0.1	0.04	0.02	0.02	0.004
Lead	mg/dscm	1.6	0.44	0.2	0.2	0.04
Mercury	mg/dscm	0.08	0.08	0.08	0.08	0.47
HCl	ppm	250	29	30	25	62
Fugitive Ash		5%	5%	5%	5%	5%

Dscm = dry standard cubic metre

Tpd = tonnes per day

**Table C2**

Incinerator Type		Existing MWC units		New or substantially modified MWC		CISWI
Rated Capacity	Units	35-250 tpd	>250 tpd	35-250 tpd	>250 tpd	All units
Fluidised Bed	ppm	100 (4hr av)				157
Fluidised Bed, mixed Fuel (wood/RDF)	ppm	200 (24hr av)		200 (24hr av)	100 (4hr av)	
Mass burn rotary refractory	ppm	100 (4hr av)		100 (24hr av)		
Mass burn rotary waterfall	ppm	250 (24hr av)				
Mass burn waterfall and refractory	ppm	100 (4hr av)		100 (4hr av)		
Mixed fuel fired (pulverized coal/RDF)	ppm	150 (4hr av)		150 (4hr av)		
Modular starved-air and excess air	ppm	50 (4hr av)		50 (4hr av)		
Spreader stoker, mixed fuel fired (coal/RDF)	ppm	200 (24hr av)		150 (24hr av)		
Stoker, RDF	ppm					



**Table C3**

Capacity (tonnes per hr)	Units	New	Existing
=>4	ng TEQ/Nm3	0.1	1
2-4	ng TEQ/Nm3	1	5
<2	ng TEQ/Nm3	5	10

## National Effluent Limits

**Table C4 – Discharge to Water (National Effluent Standards)**

Toxic Substances	Permissible Limits
cadmium and its compounds	0.1 mg/l
cyanide compounds	1 mg/l
organic phosphorus compounds(parathion, methyl parathion, methyl demeton and EPN only)	1 mg/l
lead and its compounds	0.1 mg/l
sexivalent chrome compounds	0.5 mg/l
arsenic and its compounds	0.1 mg/l
total mercury	0.005 mg/l
alkyl mercury compounds	Not detectable
PCBs	0.003 mg/l
trichloroethylene	0.3 mg/l
tetrachloroethylene	0.1 mg/l
dichloromethane	0.2 mg/l
carbon tetrachloride	0.02 mg/l
1, 2-dichloro ethane	0.04 mg/l
1, 1-dichloro ethylene	1mg/l
cis-1, 2-dichloro ethylene	0.4 mg/l
1, 1, 1-trichloro ethane	3 mg/l
1, 1, 2-trichloro ethane	0.06 mg/l
1, 3-dichloropropene	0.02 mg/l
Thiram	0.06 mg/l
Simazine	0.03 mg/l
thiobencarb	0.2 mg/l
benzene	0.1 mg/l
selenium and its compounds	0.1 mg/l
boron and its compounds	Non-coastal areas 10 mg/l
	Coastal areas 230 mg/l
fluorine and its compounds	Non-coastal areas 8 mg/l
	Coastal areas 15 mg/l
ammonia, ammonium compounds, nitrate and nitrite compounds	100 mg/l (Total of ammonia,-N multiplied by 0.4, nitrate-N and nitrite-N)

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1,4-dioxane	0.5mg/l
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Tel: +44 207 7314 5883  
Fax: +44 207 7314 5005

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