

1.0 THE HARRISON GRIERSON STANDPOINT

The draft report on the low-emissions economy summarises the state of play on New Zealand’s waste emissions resulting from solid waste disposal very well. Harrison Grierson is an engineering and design consultancy operating from a regional base across New Zealand. We are passionate about New Zealand’s economy and our environment with one of our three company visions being; “Supporting Better Environments”. We have a diverse organisation with several engineers who have been brought up in Europe and Japan and have experienced mature and well developed waste management practises.

2.0 NEW ZEALAND VS. OECD COUNTRIES

Figure 14.4 shows New Zealand as the top OECD laggard on waste emissions, around 9 times worse than those of Switzerland. Having lived in Switzerland lately for a number of years, I will refer back to their practises throughout this submission.

While the draft report has acknowledged New Zealand’s emission position, the main contributor was identified as our uncontrolled landfill sites. While uncontrolled landfills are a real problem in New Zealand, New Zealand’s landfill practices are not on par with those in Europe. Our landfills still have a significant amount of methane leakage, resulting in our landfills being net carbon contributors. New Zealand’s waste management practices do allow for the disposal of batteries (a valuable resource) and do not control the disposal of e-waste (another valuable resource) to landfill. These contributors are major contaminators and will leave a lasting “legacy” for future generations. With clay and plastic landfill liners as well as landfill covers breaking up over decades, our streams, our land, and our air will be contaminated.

3.0 WASTE MANAGEMENT PRACTICES IN SWITZERLAND

Switzerland has 26 self-governing states (cantons), where each state is responsible for its own waste management. This harnesses a wealth of potential lessons in this sector. The most common denominators are:

- Waste fees are charged by volume for individual households, encouraging source recycling.
- Source recycling is made easy with the supply of recycling stations in close proximity e.g. supermarkets, town centres, petrol stations, residential streets etc.
- Product stewardship is underpinned by laws and regulations to support industries.
- Separate fees are charged for some plastic and glass bottles.
- Full diversion of organic waste from residual waste and point of source.

- Large penalties on illegal dumping and unconsented storage of rubbish, which is state enforced.

With these actions source recycling has been successfully practised and residual waste volumes have been reduced to a minimum. Even though this has been practised for decades now, a zero waste economy has not been reached. Residual waste is treated in Energy from Waste and Anaerobic Digestion plants, recovering energy, process heat and gas and producing high grade fertiliser.

3.1 USE OF EXISTING TECHNOLOGIES TO TACKLE THE PROBLEM

As eluded to in the draft report, existing technologies are available to tackle the waste problem. Functioning technologies i.e. Energy from Waste and Anaerobic Digestion plants are successfully used in Switzerland and throughout Europe.

4.0 LESSONS FROM OVERSEAS

The draft report does mention that public perception and acceptance of Energy from Waste plants could be a potential issue in New Zealand. In Europe rules around the flue gas treatment of any waste treatment technology are governed by the European Waste Directive 2008/98/EC. This document sets out emission parameters amongst other rules. As such plant emissions are lower than those of the transportation sector. Effectively co-generation of electricity and heat make these technologies a carbon sink, rather than an emitter, generating an income through the Emissions Trading Scheme (ETS).

5.0 SOLUTIONS AND ACTIONS

1. For New Zealand the only viable low emission residual waste treatment technologies are those, which recover energy and heat concurrently. The most likely plant locations are close to process industries where process heat is required, such as dairy or meat processing. This would provide a win-win on reducing New Zealand industrial emissions, displacing coal fired boilers without stringent flue gas treatments. Future larger housing developments could be supplemented with district heating, as heating represents New Zealand's number 1 household energy usage (BRANZ Study Report No. SR 155 (2006)).
2. A government special focus group could be created to investigate and implement European waste management practices. This may mean the introduction of waste levies or legislative interventions. New Zealand can emulate existing technology and systems that have been proven successful internationally.
3. The current focus on waste reduction, re-use and recycling must remain a top priority.
4. Introduce e-waste recycling.
5. The European directive 2008/98/EC should be implemented into the New Zealand context.
6. Increase carbon price to international levels to invigorate the New Zealand ETS again.
7. Iwi must be consulted and integrated into this process from the very start as our country's heritage is built on Māori kaitiakitanga.

5.1 ENCLOSURES:

European Directive 2008/98/EC and interpretation

Branz Study Report SR 155 (2006), Energy Use in New Zealand Households

DIRECTIVES

DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 19 November 2008

on waste and repealing certain Directives

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof,

Having regard to the proposal from the Commission,

Having regard to the opinion of the European Economic and Social Committee ⁽¹⁾,

Having regard to the opinion of the Committee of the Regions ⁽²⁾,

Acting in accordance with the procedure laid down in Article 251 of the Treaty ⁽³⁾,

Whereas:

(1) Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste ⁽⁴⁾ establishes the legislative framework for the handling of waste in the Community. It defines key concepts such as waste, recovery and disposal and puts in place the essential requirements for the management of waste, notably an obligation for an establishment or undertaking carrying out waste management operations to have a permit or to be registered and an obligation for the Member States to

draw up waste management plans. It also establishes major principles such as an obligation to handle waste in a way that does not have a negative impact on the environment or human health, an encouragement to apply the waste hierarchy and, in accordance with the polluter-pays principle, a requirement that the costs of disposing of waste must be borne by the holder of waste, by previous holders or by the producers of the product from which the waste came.

(2) Decision No 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme ⁽⁵⁾ calls for the development or revision of the legislation on waste, including a clarification of the distinction between waste and non-waste, and for the development of measures regarding waste prevention and management, including the setting of targets.

(3) The Commission communication of 27 May 2003 towards a Thematic Strategy on the prevention and recycling of waste noted the need to assess the existing definitions of recovery and disposal, the need for a generally applicable definition of recycling and a debate on the definition of waste.

(4) In its resolution of 20 April 2004 on the abovementioned communication ⁽⁶⁾, the European Parliament called on the Commission to consider extending Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control ⁽⁷⁾ to the waste sector as a whole. It also asked the Commission to differentiate clearly between recovery and disposal and to clarify the distinction between waste and non-waste.

⁽¹⁾ OJ C 309, 16.12.2006, p. 55.

⁽²⁾ OJ C 229, 22.9.2006, p. 1.

⁽³⁾ Opinion of the European Parliament of 13 February 2007 (OJ C 287 E, 29.11.2007, p. 135), Council Common Position of 20 December 2007 (OJ C 71 E, 18.3.2008, p. 16) and Position of the European Parliament of 17 June 2008 (not yet published in the Official Journal). Council Decision of 20 October 2008.

⁽⁴⁾ OJ L 114, 27.4.2006, p. 9.

⁽⁵⁾ OJ L 242, 10.9.2002, p. 1.

⁽⁶⁾ OJ C 104 E, 30.4.2004, p. 401.

⁽⁷⁾ OJ L 257, 10.10.1996, p. 26. Directive replaced by Directive 2008/1/EC of the European Parliament and of the Council (OJ L 24, 29.1.2008, p. 8).

- (5) In its conclusions of 1 July 2004, the Council called on the Commission to bring forward a proposal for the revision of certain aspects of Directive 75/442/EEC, repealed and replaced by Directive 2006/12/EC, in order to clarify the distinction between waste and non-waste and that between recovery and disposal.
- (6) The first objective of any waste policy should be to minimise the negative effects of the generation and management of waste on human health and the environment. Waste policy should also aim at reducing the use of resources, and favour the practical application of the waste hierarchy.
- (7) In its Resolution of 24 February 1997 on a Community strategy for waste management ⁽¹⁾, the Council confirmed that waste prevention should be the first priority of waste management, and that re-use and material recycling should be preferred to energy recovery from waste, where and insofar as they are the best ecological options.
- (8) It is therefore necessary to revise Directive 2006/12/EC in order to clarify key concepts such as the definitions of waste, recovery and disposal, to strengthen the measures that must be taken in regard to waste prevention, to introduce an approach that takes into account the whole life-cycle of products and materials and not only the waste phase, and to focus on reducing the environmental impacts of waste generation and waste management, thereby strengthening the economic value of waste. Furthermore, the recovery of waste and the use of recovered materials should be encouraged in order to conserve natural resources. In the interests of clarity and readability, Directive 2006/12/EC should be repealed and replaced by a new directive.
- (9) Since most significant waste management operations are now covered by Community legislation in the field of environment, it is important that this Directive be adapted to that approach. An emphasis on the environmental objectives laid down in Article 174 of the Treaty would bring the environmental impacts of waste generation and waste management more sharply into focus throughout the life-cycle of resources. Consequently, the legal basis for this Directive should be Article 175.
- (10) Effective and consistent rules on waste treatment should be applied, subject to certain exceptions, to movable property which the holder discards or intends or is required to discard.
- (11) The waste status of uncontaminated excavated soils and other naturally occurring material which are used on sites other than the one from which they were excavated should be considered in accordance with the definition of waste and the provisions on by-products or on the end of waste status under this Directive.
- (12) Regulation (EC) No 1774/2002 of the European Parliament and of the Council of 3 October 2002 laying down health rules concerning animal by-products not intended for human consumption ⁽²⁾ provides, inter alia, for proportionate controls as regards the collection, transport, processing, use and disposal of all animal by-products including waste of animal origin, preventing it from presenting a risk to animal and public health. It is therefore necessary to clarify the link with that Regulation, avoiding duplication of rules by excluding from the scope of this Directive animal by-products where they are intended for uses that are not considered waste operations.
- (13) In the light of the experience gained in applying Regulation (EC) No 1774/2002, it is appropriate to clarify the scope of waste legislation and of its provisions on hazardous waste as regards animal by-products regulated by Regulation (EC) No 1774/2002. Where animal by-products pose potential health risks, the appropriate legal instrument to address these risks is Regulation (EC) No 1774/2002 and unnecessary overlaps with waste legislation should be avoided.
- (14) The classification of waste as hazardous waste should be based, inter alia, on the Community legislation on chemicals, in particular concerning the classification of preparations as hazardous, including concentration limit values used for that purpose. Hazardous waste should be regulated under strict specifications in order to prevent or limit, as far as possible, the potential negative effects on the environment and on human health due to inappropriate management. Furthermore, it is necessary to maintain the system by which waste and hazardous waste have been classified in accordance with the list of the types of waste as last established by Commission Decision 2000/532/EC ⁽³⁾, in order to encourage a harmonised classification of waste and ensure the harmonised determination of hazardous waste within the Community.

⁽¹⁾ OJ C 76, 11.3.1997, p. 1.

⁽²⁾ OJ L 273, 10.10.2002, p. 1.

⁽³⁾ Decision 2000/532/EC of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste (OJ L 226, 6.9.2000, p. 3).

- (15) It is necessary to distinguish between the preliminary storage of waste pending its collection, the collection of waste and the storage of waste pending treatment. Establishments or undertakings that produce waste in the course of their activities should not be regarded as engaged in waste management and subject to authorisation for the storage of their waste pending its collection.
- (16) Preliminary storage of waste within the definition of collection is understood as a storage activity pending its collection in facilities where waste is unloaded in order to permit its preparation for further transport for recovery or disposal elsewhere. The distinction between preliminary storage of waste pending collection and the storage of waste pending treatment should be made, in view of the objective of this Directive, according to the type of waste, the size and time period of storage and the objective of the collection. This distinction should be made by the Member States. The storage of waste prior to recovery for a period of three years or longer and the storage of waste prior to disposal for a period of one year or longer is subject to Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste ⁽¹⁾.
- (17) Waste collection schemes which are not conducted on a professional basis should not be subject to registration as they present a lower risk and contribute to the separate collection of waste. Examples of such schemes are waste medicines collected by pharmacies, take-back schemes in shops for consumer goods and community schemes in schools.
- (18) Definitions of prevention, re-use, preparing for re-use, treatment and recycling should be included in this Directive, in order to clarify the scope of these concepts.
- (19) The definitions of recovery and disposal need to be modified in order to ensure a clear distinction between the two concepts, based on a genuine difference in environmental impact through the substitution of natural resources in the economy and recognising the potential benefits to the environment and human health of using waste as a resource. In addition, guidelines may be developed in order to clarify cases where this distinction is difficult to apply in practice or where the classification of the activity as recovery does not match the real environmental impact of the operation.
- (20) This Directive should also clarify when the incineration of municipal solid waste is energy-efficient and may be considered a recovery operation.
- (21) Disposal operations consisting of release to seas and oceans including sea bed insertion are also regulated by international conventions, in particular the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, done at London on 13 November 1972, and the 1996 Protocol thereto as amended in 2006.
- (22) There should be no confusion between the various aspects of the waste definition, and appropriate procedures should be applied, where necessary, to by-products that are not waste, on the one hand, or to waste that ceases to be waste, on the other hand. In order to specify certain aspects of the definition of waste, this Directive should clarify:
- when substances or objects resulting from a production process not primarily aimed at producing such substances or objects are by-products and not waste. The decision that a substance is not waste can be taken only on the basis of a coordinated approach, to be regularly updated, and where this is consistent with the protection of the environment and human health. If the use of a by-product is allowed under an environmental licence or general environmental rules, this can be used by Member States as a tool to decide that no overall adverse environmental or human health impacts are expected to occur; an object or substance should be regarded as being a by-product only when certain conditions are met. Since by-products fall into the category of products, exports of by-products should meet the requirements of the relevant Community legislation; and
 - when certain waste ceases to be waste, laying down end-of-waste criteria that provide a high level of environmental protection and an environmental and economic benefit; possible categories of waste for which 'end-of-waste' specifications and criteria should be developed are, among others, construction and demolition waste, some ashes and slags, scrap metals, aggregates, tyres, textiles, compost, waste paper and glass. For the purposes of reaching end-of-waste status, a recovery operation may be as simple as the checking of waste to verify that it fulfils the end-of-waste criteria.
- (23) In order to verify or calculate if the recycling and recovery targets set in European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste ⁽²⁾, Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life

⁽¹⁾ OJ L 182, 16.7.1999, p. 1.

⁽²⁾ OJ L 365, 31.12.1994, p. 10.

- vehicles ⁽¹⁾, Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE) ⁽²⁾ and Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators ⁽³⁾ as well as other relevant Community legislation are met, the amounts of waste which have ceased to be waste should be accounted for as recycled and recovered waste when the recycling or recovery requirements of that legislation are satisfied.
- (24) On the basis of the definition of waste, in order to promote certainty and consistency, the Commission may adopt guidelines to specify in certain cases when substances or objects become waste. Such guidelines may be developed *inter alia* for electrical and electronic equipment and vehicles.
- (25) It is appropriate that costs be allocated in such a way as to reflect the real costs to the environment of the generation and management of waste.
- (26) The polluter-pays principle is a guiding principle at European and international levels. The waste producer and the waste holder should manage the waste in a way that guarantees a high level of protection of the environment and human health.
- (27) The introduction of extended producer responsibility in this Directive is one of the means to support the design and production of goods which take into full account and facilitate the efficient use of resources during their whole life-cycle including their repair, re-use, disassembly and recycling without compromising the free circulation of goods on the internal market.
- (28) This Directive should help move the EU closer to a 'recycling society', seeking to avoid waste generation and to use waste as a resource. In particular, the Sixth Community Environment Action Programme calls for measures aimed at ensuring the source separation, collection and recycling of priority waste streams. In line with that objective and as a means to facilitating or improving its recovery potential, waste should be separately collected if technically, environmentally and economically practicable, before undergoing recovery operations that deliver the best overall environmental outcome. Member States should encourage the separation of hazardous compounds from waste streams if necessary to achieve environmentally sound management.
- (29) Member States should support the use of recyclates, such as recovered paper, in line with the waste hierarchy and with the aim of a recycling society, and should not support the landfilling or incineration of such recyclates whenever possible.
- (30) In order to implement the precautionary principle and the principle of preventive action enshrined in Article 174(2) of the Treaty, it is necessary to set general environmental objectives for the management of waste within the Community. By virtue of those principles, it is for the Community and the Member States to establish a framework to prevent, reduce and, in so far as is possible, eliminate from the outset the sources of pollution or nuisance by adopting measures whereby recognised risks are eliminated.
- (31) The waste hierarchy generally lays down a priority order of what constitutes the best overall environmental option in waste legislation and policy, while departing from such hierarchy may be necessary for specific waste streams when justified for reasons of, *inter alia*, technical feasibility, economic viability and environmental protection.
- (32) It is necessary, in order to enable the Community as a whole to become self-sufficient in waste disposal and in the recovery of mixed municipal waste collected from private households and to enable the Member States to move towards that aim individually, to make provision for a network of cooperation as regards disposal installations and installations for the recovery of mixed municipal waste collected from private households, taking into account geographical circumstances and the need for specialised installations for certain types of waste.
- (33) For the purposes of applying Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste ⁽⁴⁾, mixed municipal waste as referred to in Article 3(5) of that Regulation remains mixed municipal waste even when it has been subject to a waste treatment operation that has not substantially altered its properties.
- (34) It is important that hazardous waste be labelled in accordance with international and Community standards. However, where such waste is collected separately from households, this should not result in householders being obliged to complete the requisite documentation.

⁽¹⁾ OJ L 269, 21.10.2000, p. 34.

⁽²⁾ OJ L 37, 13.2.2003, p. 24.

⁽³⁾ OJ L 266, 26.9.2006, p. 1.

⁽⁴⁾ OJ L 190, 12.7.2006, p. 1.

- (35) It is important, in accordance with the waste hierarchy, and for the purpose of reduction of greenhouse gas emissions originating from waste disposal on landfills, to facilitate the separate collection and proper treatment of bio-waste in order to produce environmentally safe compost and other bio-waste based materials. The Commission, after an assessment on the management of bio-waste, will submit proposals for legislative measures, if appropriate.
- (36) Technical minimum standards concerning waste treatment activities not covered by Directive 96/61/EC may be adopted where there is evidence that a benefit would be gained in terms of protecting human health and the environment and where a coordinated approach to the implementation of this Directive would ensure the protection of human health and the environment.
- (37) It is necessary to specify further the scope and content of the waste management planning obligation, and to integrate into the process of developing or revising waste management plans the need to take into account the environmental impacts of the generation and management of waste. Account should also be taken, where appropriate, of the waste planning requirements laid down in Article 14 of Directive 94/62/EC and of the strategy for the reduction of biodegradable waste going to landfills, referred to in Article 5 of Directive 1999/31/EC.
- (38) Member States may apply environmental authorisations or general environmental rules to certain waste producers without compromising the proper functioning of the internal market.
- (39) According to Regulation (EC) No 1013/2006, Member States may take the measures necessary to prevent shipments of waste which are not in accordance with their waste management plans. By way of derogation from that Regulation, Member States should be allowed to limit incoming shipments to incinerators classified as recovery, where it has been established that national waste would have to be disposed of or that waste would have to be treated in a way that is not consistent with their waste management plans. It is recognised that certain Member States may not be able to provide a network comprising the full range of final recovery facilities within their territory.
- (40) In order to improve the way in which waste prevention actions are taken forward in the Member States and to facilitate the circulation of best practice in this area, it is necessary to strengthen the provisions relating to waste prevention and to introduce a requirement for the Member States to develop waste prevention programmes concentrating on the key environmental impacts and taking into account the whole life-cycle of products and materials. Such measures should pursue the objective of breaking the link between economic growth and the environmental impacts associated with the generation of waste. Stakeholders, as well as the general public, should have the opportunity to participate in the drawing up of the programmes, and should have access to them once drawn up, in line with Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment⁽¹⁾. Waste prevention and decoupling objectives should be developed covering, as appropriate, the reduction of the adverse impacts of waste and of the amounts of waste generated.
- (41) In order to move towards a European recycling society with a high level of resource efficiency, targets for preparing for re-use and recycling of waste should be set. Member States maintain different approaches to the collection of household wastes and wastes of a similar nature and composition. It is therefore appropriate that such targets take account of the different collection systems in different Member States. Waste streams from other origins similar to household waste include waste referred to in entry 20 of the list established by Commission Decision 2000/532/EC.
- (42) Economic instruments can play a crucial role in the achievement of waste prevention and management objectives. Waste often has value as a resource, and the further application of economic instruments may maximise environmental benefits. The use of such instruments at the appropriate level should therefore be encouraged while stressing that individual Member States can decide on their use.
- (43) Certain provisions on the handling of waste, laid down in Council Directive 91/689/EEC of 12 December 1991 on hazardous waste⁽²⁾, should be amended in order to remove obsolete provisions and to improve the clarity of the text. In the interests of simplifying Community legislation, they should be integrated into this Directive. In order to clarify the operation of the mixing ban laid down in Directive 91/689/EEC, and to protect the environment and human health, the exemptions to the mixing ban should additionally comply with best available techniques as defined in Directive 96/61/EC. Directive 91/689/EEC should therefore be repealed.

⁽¹⁾ OJ L 156, 25.6.2003, p. 17.

⁽²⁾ OJ L 377, 31.12.1991, p. 20.

- (44) In the interests of the simplification of Community legislation and the reflection of environmental benefits, the relevant provisions of Council Directive 75/439/EEC of 16 June 1975 on the disposal of waste oils ⁽¹⁾ should be integrated into this Directive. Directive 75/439/EEC should therefore be repealed. The management of waste oils should be conducted in accordance with the priority order of the waste hierarchy, and preference should be given to options that deliver the best overall environmental outcome. The separate collection of waste oils remains crucial to their proper management and the prevention of damage to the environment from their improper disposal.
- (45) Member States should provide for effective, proportionate and dissuasive penalties to be imposed on natural and legal persons responsible for waste management, such as waste producers, holders, brokers, dealers, transporters and collectors, establishments or undertakings which carry out waste treatment operations and waste management schemes, in cases where they infringe the provisions of this Directive. Member States may also take action to recover the costs of non-compliance and remedial measures, without prejudice to Directive 2004/35/EC of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage ⁽²⁾.
- (46) The measures necessary for the implementation of this Directive should be adopted in accordance with Council Decision 1999/468/EC of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission ⁽³⁾.
- (47) In particular, the Commission should be empowered to establish criteria regarding a number of issues such as the conditions under which an object is to be considered a by-product, the end-of-waste status and the determination of waste which is considered as hazardous, as well as to establish detailed rules on the application and calculation methods for verifying compliance with the recycling targets set out in this Directive. Furthermore, the Commission should be empowered to adapt the annexes to technical and scientific progress and to specify the application of the formula for incineration facilities referred to in Annex II, R1. Since those measures are of general scope and are designed to amend non-essential elements of this Directive, by supplementing it with new non-essential elements, they must be adopted in accordance with the regulatory procedure with scrutiny provided for in Article 5a of Decision 1999/468/EC.

⁽¹⁾ OJ L 194, 25.7.1975, p. 23.

⁽²⁾ OJ L 143, 30.4.2004, p. 56.

⁽³⁾ OJ L 184, 17.7.1999, p. 23.

- (48) In accordance with paragraph 34 of the interinstitutional agreement on better law-making ⁽⁴⁾, Member States are encouraged to draw up, for themselves and in the interest of the Community, their own tables, illustrating, as far as possible, the correlation between this Directive and the transposition measures and to make them public.
- (49) Since the objective of this Directive, namely the protection of the environment and human health, cannot be sufficiently achieved by the Member States and can therefore, by reasons of the scale or effects of the Directive, be better achieved at Community level, the Community may adopt measures, in accordance with the principle of subsidiarity as set out in Article 5 of the Treaty. In accordance with the principle of proportionality, as set out in that Article, this Directive does not go beyond what is necessary in order to achieve that objective,

HAVE ADOPTED THIS DIRECTIVE:

CHAPTER I

SUBJECT MATTER, SCOPE AND DEFINITIONS

Article 1

Subject matter and scope

This Directive lays down measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use.

Article 2

Exclusions from the scope

1. The following shall be excluded from the scope of this Directive:
- (a) gaseous effluents emitted into the atmosphere;
 - (b) land (in situ) including unexcavated contaminated soil and buildings permanently connected with land;
 - (c) uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated;

⁽⁴⁾ OJ C 321, 31.12.2003, p. 1.

(d) radioactive waste;

(e) decommissioned explosives;

(f) faecal matter, if not covered by paragraph 2(b), straw and other natural non-hazardous agricultural or forestry material used in farming, forestry or for the production of energy from such biomass through processes or methods which do not harm the environment or endanger human health.

2. The following shall be excluded from the scope of this Directive to the extent that they are covered by other Community legislation:

(a) waste waters;

(b) animal by-products including processed products covered by Regulation (EC) No 1774/2002, except those which are destined for incineration, landfilling or use in a biogas or composting plant;

(c) carcasses of animals that have died other than by being slaughtered, including animals killed to eradicate epizootic diseases, and that are disposed of in accordance with Regulation (EC) No 1774/2002;

(d) waste resulting from prospecting, extraction, treatment and storage of mineral resources and the working of quarries covered by Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries ⁽¹⁾.

3. Without prejudice to obligations under other relevant Community legislation, sediments relocated inside surface waters for the purpose of managing waters and waterways or of preventing floods or mitigating the effects of floods and droughts or land reclamation shall be excluded from the scope of this Directive if it is proved that the sediments are non-hazardous.

4. Specific rules for particular instances, or supplementing those of this Directive, on the management of particular categories of waste, may be laid down by means of individual Directives.

Article 3

Definitions

For the purposes of this Directive, the following definitions shall apply:

1. 'waste' means any substance or object which the holder discards or intends or is required to discard;

2. 'hazardous waste' means waste which displays one or more of the hazardous properties listed in Annex III;

3. 'waste oils' means any mineral or synthetic lubrication or industrial oils which have become unfit for the use for which they were originally intended, such as used combustion engine oils and gearbox oils, lubricating oils, oils for turbines and hydraulic oils;

4. 'bio-waste' means biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises and comparable waste from food processing plants;

5. 'waste producer' means anyone whose activities produce waste (original waste producer) or anyone who carries out pre-processing, mixing or other operations resulting in a change in the nature or composition of this waste;

6. 'waste holder' means the waste producer or the natural or legal person who is in possession of the waste;

7. 'dealer' means any undertaking which acts in the role of principal to purchase and subsequently sell waste, including such dealers who do not take physical possession of the waste;

8. 'broker' means any undertaking arranging the recovery or disposal of waste on behalf of others, including such brokers who do not take physical possession of the waste;

9. 'waste management' means the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker;

10. 'collection' means the gathering of waste, including the preliminary sorting and preliminary storage of waste for the purposes of transport to a waste treatment facility;

⁽¹⁾ OJ L 102, 11.4.2006, p. 15.

11. 'separate collection' means the collection where a waste stream is kept separately by type and nature so as to facilitate a specific treatment;
12. 'prevention' means measures taken before a substance, material or product has become waste, that reduce:
- the quantity of waste, including through the re-use of products or the extension of the life span of products;
 - the adverse impacts of the generated waste on the environment and human health; or
 - the content of harmful substances in materials and products;
13. 're-use' means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived;
14. 'treatment' means recovery or disposal operations, including preparation prior to recovery or disposal;
15. 'recovery' means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy. Annex II sets out a non-exhaustive list of recovery operations;
16. 'preparing for re-use' means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing;
17. 'recycling' means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations;
18. 'regeneration of waste oils' means any recycling operation whereby base oils can be produced by refining waste oils, in particular by removing the contaminants, the oxidation products and the additives contained in such oils;
19. 'disposal' means any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy. Annex I sets out a non-exhaustive list of disposal operations;
20. 'best available techniques' means best available techniques as defined in Article 2(11) of Directive 96/61/EC.

Article 4

Waste hierarchy

1. The following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy:

- prevention;
- preparing for re-use;
- recycling;
- other recovery, e.g. energy recovery; and
- disposal.

2. When applying the waste hierarchy referred to in paragraph 1, Member States shall take measures to encourage the options that deliver the best overall environmental outcome. This may require specific waste streams departing from the hierarchy where this is justified by life-cycle thinking on the overall impacts of the generation and management of such waste.

Member States shall ensure that the development of waste legislation and policy is a fully transparent process, observing existing national rules about the consultation and involvement of citizens and stakeholders.

Member States shall take into account the general environmental protection principles of precaution and sustainability, technical feasibility and economic viability, protection of resources as well as the overall environmental, human health, economic and social impacts, in accordance with Articles 1 and 13.

*Article 5***By-products**

1. A substance or object, resulting from a production process, the primary aim of which is not the production of that item, may be regarded as not being waste referred to in point (1) of Article 3 but as being a by-product only if the following conditions are met:

- (a) further use of the substance or object is certain;
- (b) the substance or object can be used directly without any further processing other than normal industrial practice;
- (c) the substance or object is produced as an integral part of a production process; and
- (d) 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.

2. On the basis of the conditions laid down in paragraph 1, measures may be adopted to determine the criteria to be met for specific substances or objects to be regarded as a by-product and not as waste referred to in point (1) of Article 3. Those measures, designed to amend non-essential elements of this Directive by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 39(2).

*Article 6***End-of-waste status**

1. Certain specified waste shall cease to be waste within the meaning of point (1) of Article 3 when it has undergone a recovery, including recycling, operation and complies with specific criteria to be developed in accordance with the following conditions:

- (a) the substance or object is commonly used for specific purposes;
- (b) a market or demand exists for such a substance or object;
- (c) the substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and

- (d) the use of the substance or object will not lead to overall adverse environmental or human health impacts.

The criteria shall include limit values for pollutants where necessary and shall take into account any possible adverse environmental effects of the substance or object.

2. The measures designed to amend non-essential elements of this Directive by supplementing it relating to the adoption of the criteria set out in paragraph 1 and specifying the type of waste to which such criteria shall apply shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 39(2). End-of-waste specific criteria should be considered, among others, at least for aggregates, paper, glass, metal, tyres and textiles.

3. Waste which ceases to be waste in accordance with paragraphs 1 and 2, shall also cease to be waste for the purpose of the recovery and recycling targets set out in Directives 94/62/EC, 2000/53/EC, 2002/96/EC and 2006/66/EC and other relevant Community legislation when the recycling or recovery requirements of that legislation are satisfied.

4. Where criteria have not been set at Community level under the procedure set out in paragraphs 1 and 2, Member States may decide case by case whether certain waste has ceased to be waste taking into account the applicable case law. They shall notify the Commission of such decisions in accordance with Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations and of rules on Information Society services⁽¹⁾ where so required by that Directive.

*Article 7***List of waste**

1. The measures designed to amend non-essential elements of this Directive relating to the updating of the list of waste established by Decision 2000/532/EC shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 39(2). The list of waste shall include hazardous waste and shall take into account the origin and composition of the waste and, where necessary, the limit values of concentration of hazardous substances. The list of waste shall be binding as regards determination of the waste which is to be considered as hazardous waste. The inclusion of a substance or object in the list shall not mean that it is waste in all circumstances. A substance or object shall be considered to be waste only where the definition in point (1) of Article 3 is met.

⁽¹⁾ OJ L 204, 21.7.1998, p. 37.

2. A Member State may consider waste as hazardous waste where, even though it does not appear as such on the list of waste, it displays one or more of the properties listed in Annex III. The Member State shall notify the Commission of any such cases without delay. It shall record them in the report provided for in Article 37(1) and shall provide the Commission with all relevant information. In the light of notifications received, the list shall be reviewed in order to decide on its adaptation.

3. Where a Member State has evidence to show that specific waste that appears on the list as hazardous waste does not display any of the properties listed in Annex III, it may consider that waste as non-hazardous waste. The Member State shall notify the Commission of any such cases without delay and shall provide the Commission with the necessary evidence. In the light of notifications received, the list shall be reviewed in order to decide on its adaptation.

4. The reclassification of hazardous waste as non-hazardous waste may not be achieved by diluting or mixing the waste with the aim of lowering the initial concentrations of hazardous substances to a level below the thresholds for defining waste as hazardous.

5. The measures designed to amend non-essential elements of this Directive relating to the revision of the list in order to decide on its adaptation pursuant to paragraphs 2 and 3 shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 39(2).

6. Member States may consider waste as non-hazardous waste in accordance with the list of waste referred to in paragraph 1.

7. The Commission shall ensure that the list of waste and any review of this list adhere, as appropriate, to principles of clarity, comprehensibility and accessibility for users, particularly small and medium-sized enterprises (SMEs).

CHAPTER II

GENERAL REQUIREMENTS

Article 8

Extended producer responsibility

1. In order to strengthen the re-use and the prevention, recycling and other recovery of waste, Member States may take legislative or non-legislative measures to ensure that any natural or legal person who professionally develops, manufactures, processes, treats, sells or imports products (producer of the product) has extended producer responsibility.

Such measures may include an acceptance of returned products and of the waste that remains after those products have been used, as well as the subsequent management of the waste and financial responsibility for such activities. These measures may include the obligation to provide publicly available information as to the extent to which the product is re-usable and recyclable.

2. Member States may take appropriate measures to encourage the design of products in order to reduce their environmental impacts and the generation of waste in the course of the production and subsequent use of products, and in order to ensure that the recovery and disposal of products that have become waste take place in accordance with Articles 4 and 13.

Such measures may encourage, inter alia, the development, production and marketing of products that are suitable for multiple use, that are technically durable and that are, after having become waste, suitable for proper and safe recovery and environmentally compatible disposal.

3. When applying extended producer responsibility, Member States shall take into account the technical feasibility and economic viability and the overall environmental, human health and social impacts, respecting the need to ensure the proper functioning of the internal market.

4. The extended producer responsibility shall be applied without prejudice to the responsibility for waste management as provided for in Article 15(1) and without prejudice to existing waste stream specific and product specific legislation.

Article 9

Prevention of waste

Following the consultation of stakeholders, the Commission shall submit to the European Parliament and the Council the following reports accompanied, if appropriate, by proposals for measures required in support of the prevention activities and the implementation of the waste prevention programmes referred to in Article 29 covering:

(a) by the end of 2011, an interim report on the evolution of waste generation and the scope of waste prevention, including the formulation of a product eco-design policy addressing both the generation of waste and the presence of hazardous substances in waste, with a view to promoting technologies focusing on durable, re-usable and recyclable products;

(b) by the end of 2011, the formulation of an action plan for further support measures at European level seeking, in particular, to change current consumption patterns;

(c) by the end of 2014, the setting of waste prevention and decoupling objectives for 2020, based on best available practices including, if necessary, a revision of the indicators referred to in Article 29(4).

Article 10

Recovery

1. Member States shall take the necessary measures to ensure that waste undergoes recovery operations, in accordance with Articles 4 and 13.

2. Where necessary to comply with paragraph 1 and to facilitate or improve recovery, waste shall be collected separately if technically, environmentally and economically practicable and shall not be mixed with other waste or other material with different properties.

Article 11

Re-use and recycling

1. Member States shall take measures, as appropriate, to promote the re-use of products and preparing for re-use activities, notably by encouraging the establishment and support of re-use and repair networks, the use of economic instruments, procurement criteria, quantitative objectives or other measures.

Member States shall take measures to promote high quality recycling and, to this end, shall set up separate collections of waste where technically, environmentally and economically practicable and appropriate to meet the necessary quality standards for the relevant recycling sectors.

Subject to Article 10(2), by 2015 separate collection shall be set up for at least the following: paper, metal, plastic and glass.

2. In order to comply with the objectives of this Directive, and move towards a European recycling society with a high level of resource efficiency, Member States shall take the necessary measures designed to achieve the following targets:

(a) by 2020, the preparing for re-use and the recycling of waste materials such as at least paper, metal, plastic and glass from households and possibly from other origins as far as

these waste streams are similar to waste from households, shall be increased to a minimum of overall 50 % by weight;

(b) by 2020, the preparing for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a minimum of 70 % by weight.

3. The Commission shall establish detailed rules on the application and calculation methods for verifying compliance with the targets set out in paragraph 2 of this Article, considering Regulation (EC) No 2150/2002 of the European Parliament and of the Council of 25 November 2002 on waste statistics⁽¹⁾. These can include transition periods for Member States which, in 2008, recycled less than 5 % of either categories of waste referred to in paragraph 2. Those measures, designed to amend non-essential elements of this Directive by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 39(2) of this Directive.

4. By 31 December 2014 at the latest, the Commission shall examine the measures and the targets referred to in paragraph 2 with a view to, if necessary, reinforcing the targets and considering the setting of targets for other waste streams. The report of the Commission, accompanied by a proposal if appropriate, shall be sent to the European Parliament and the Council. In its report, the Commission shall take into account the relevant environmental, economic and social impacts of setting the targets.

5. Every three years, in accordance with Article 37, Member States shall report to the Commission on their record with regard to meeting the targets. If targets are not met, this report shall include the reasons for failure and the actions the Member State intends to take to meet those targets.

Article 12

Disposal

Member States shall ensure that, where recovery in accordance with Article 10(1) is not undertaken, waste undergoes safe disposal operations which meet the provisions of Article 13 on the protection of human health and the environment.

⁽¹⁾ OJ L 332, 9.12.2002, p. 1.

*Article 13***Protection of human health and the environment**

Member States shall take the necessary measures to ensure that waste management is carried out without endangering human health, without harming the environment and, in particular:

- (a) without risk to water, air, soil, plants or animals;
- (b) without causing a nuisance through noise or odours; and
- (c) without adversely affecting the countryside or places of special interest.

*Article 14***Costs**

1. In accordance with the polluter-pays principle, the costs of waste management shall be borne by the original waste producer or by the current or previous waste holders.
2. Member States may decide that the costs of waste management are to be borne partly or wholly by the producer of the product from which the waste came and that the distributors of such product may share these costs.

CHAPTER III

WASTE MANAGEMENT

*Article 15***Responsibility for waste management**

1. Member States shall take the necessary measures to ensure that any original waste producer or other holder carries out the treatment of waste himself or has the treatment handled by a dealer or an establishment or undertaking which carries out waste treatment operations or arranged by a private or public waste collector in accordance with Articles 4 and 13.
2. When the waste is transferred from the original producer or holder to one of the natural or legal persons referred to in paragraph 1 for preliminary treatment, the responsibility for carrying out a complete recovery or disposal operation shall not be discharged as a general rule.

Without prejudice to Regulation (EC) No 1013/2006, Member States may specify the conditions of responsibility and decide in which cases the original producer is to retain responsibility for the whole treatment chain or in which cases the responsibility of

the producer and the holder can be shared or delegated among the actors of the treatment chain.

3. Member States may decide, in accordance with Article 8, that the responsibility for arranging waste management is to be borne partly or wholly by the producer of the product from which the waste came and that distributors of such product may share this responsibility.

4. Member States shall take the necessary measures to ensure that, within their territory, the establishments or undertakings which collect or transport waste on a professional basis deliver the waste collected and transported to appropriate treatment installations respecting the provisions of Article 13.

*Article 16***Principles of self-sufficiency and proximity**

1. Member States shall take appropriate measures, in cooperation with other Member States where this is necessary or advisable, to establish an integrated and adequate network of waste disposal installations and of installations for the recovery of mixed municipal waste collected from private households, including where such collection also covers such waste from other producers, taking into account best available techniques.

By way of derogation from Regulation (EC) No 1013/2006, Member States may, in order to protect their network, limit incoming shipments of waste destined to incinerators that are classified as recovery, where it has been established that such shipments would result in national waste having to be disposed of or waste having to be treated in a way that is not consistent with their waste management plans. Member States shall notify the Commission of any such decision. Member States may also limit outgoing shipments of waste on environmental grounds as set out in Regulation (EC) No 1013/2006.

2. The network shall be designed to enable the Community as a whole to become self-sufficient in waste disposal as well as in the recovery of waste referred to in paragraph 1, and to enable Member States to move towards that aim individually, taking into account geographical circumstances or the need for specialised installations for certain types of waste.

3. The network shall enable waste to be disposed of or waste referred to in paragraph 1 to be recovered in one of the nearest appropriate installations, by means of the most appropriate methods and technologies, in order to ensure a high level of protection for the environment and public health.

4. The principles of proximity and self-sufficiency shall not mean that each Member State has to possess the full range of final recovery facilities within that Member State.

Article 17

Control of hazardous waste

Member States shall take the necessary action to ensure that the production, collection and transportation of hazardous waste, as well as its storage and treatment, are carried out in conditions providing protection for the environment and human health in order to meet the provisions of Article 13, including action to ensure traceability from production to final destination and control of hazardous waste in order to meet the requirements of Articles 35 and 36.

Article 18

Ban on the mixing of hazardous waste

1. Member States shall take the necessary measures to ensure that hazardous waste is not mixed, either with other categories of hazardous waste or with other waste, substances or materials. Mixing shall include the dilution of hazardous substances.

2. By way of derogation from paragraph 1, Member States may allow mixing provided that:

(a) the mixing operation is carried out by an establishment or undertaking which has obtained a permit in accordance with Article 23;

(b) the provisions of Article 13 are complied with and the adverse impact of the waste management on human health and the environment is not increased; and

(c) the mixing operation conforms to best available techniques.

3. Subject to technical and economic feasibility criteria, where hazardous waste has been mixed in a manner contrary to paragraph 1, separation shall be carried out where possible and necessary in order to comply with Article 13.

Article 19

Labelling of hazardous waste

1. Member States shall take the necessary measures to ensure that, in the course of collection, transport and temporary storage, hazardous waste is packaged and labelled in accordance with the international and Community standards in force.

2. Whenever hazardous waste is transferred within a Member State, it shall be accompanied by an identification document, which may be in electronic format, containing the appropriate data specified in Annex IB to Regulation (EC) No 1013/2006.

Article 20

Hazardous waste produced by households

Articles 17, 18, 19 and 35 shall not apply to mixed waste produced by households.

Articles 19 and 35 shall not apply to separate fractions of hazardous waste produced by households until they are accepted for collection, disposal or recovery by an establishment or an undertaking which has obtained a permit or has been registered in accordance with Articles 23 or 26.

Article 21

Waste oils

1. Without prejudice to the obligations related to the management of hazardous waste laid down in Articles 18 and 19, Member States shall take the necessary measures to ensure that:

(a) waste oils are collected separately, where this is technically feasible;

(b) waste oils are treated in accordance with Articles 4 and 13;

(c) where this is technically feasible and economically viable, waste oils of different characteristics are not mixed and waste oils are not mixed with other kinds of waste or substances, if such mixing impedes their treatment.

2. For the purposes of separate collection of waste oils and their proper treatment, Member States may, according to their national conditions, apply additional measures such as technical requirements, producer responsibility, economic instruments or voluntary agreements.

3. If waste oils, according to national legislation, are subject to requirements of regeneration, Member States may prescribe that such waste oils shall be regenerated if technically feasible and, where Articles 11 or 12 of Regulation (EC) No 1013/2006 apply, restrict the transboundary shipment of waste oils from their territory to incineration or co-incineration facilities in order to give priority to the regeneration of waste oils.

*Article 22***Bio-waste**

Member States shall take measures, as appropriate, and in accordance with Articles 4 and 13, to encourage:

- (a) the separate collection of bio-waste with a view to the composting and digestion of bio-waste;
- (b) the treatment of bio-waste in a way that fulfils a high level of environmental protection;
- (c) the use of environmentally safe materials produced from bio-waste.

The Commission shall carry out an assessment on the management of bio-waste with a view to submitting a proposal if appropriate. The assessment shall examine the opportunity of setting minimum requirements for bio-waste management and quality criteria for compost and digestate from bio-waste, in order to guarantee a high level of protection for human health and the environment.

CHAPTER IV

PERMITS AND REGISTRATIONS*Article 23***Issue of permits**

1. Member States shall require any establishment or undertaking intending to carry out waste treatment to obtain a permit from the competent authority.

Such permits shall specify at least the following:

- (a) the types and quantities of waste that may be treated;
- (b) for each type of operation permitted, the technical and any other requirements relevant to the site concerned;
- (c) the safety and precautionary measures to be taken;
- (d) the method to be used for each type of operation;

- (e) such monitoring and control operations as may be necessary;
- (f) such closure and after-care provisions as may be necessary.

2. Permits may be granted for a specified period and may be renewable.

3. Where the competent authority considers that the intended method of treatment is unacceptable from the point of view of environmental protection, in particular when the method is not in accordance with Article 13, it shall refuse to issue the permit.

4. It shall be a condition of any permit covering incineration or co-incineration with energy recovery that the recovery of energy take place with a high level of energy efficiency.

5. Provided that the requirements of this Article are complied with, any permit produced pursuant to other national or Community legislation may be combined with the permit required under paragraph 1 to form a single permit, where such a format obviates the unnecessary duplication of information and the repetition of work by the operator or the competent authority.

*Article 24***Exemptions from permit requirements**

Member States may exempt from the requirement laid down in Article 23(1) establishments or undertakings for the following operations:

- (a) disposal of their own non-hazardous waste at the place of production; or
- (b) recovery of waste.

*Article 25***Conditions for exemptions**

1. Where a Member State wishes to allow exemptions, as provided for in Article 24, it shall lay down, in respect of each type of activity, general rules specifying the types and quantities of waste that may be covered by an exemption, and the method of treatment to be used.

Those rules shall be designed to ensure that waste is treated in accordance with Article 13. In the case of disposal operations referred to in point (a) of Article 24 those rules should consider best available techniques.

2. In addition to the general rules provided for in paragraph 1, Member States shall lay down specific conditions for exemptions relating to hazardous waste, including types of activity, as well as any other necessary requirement for carrying out different forms of recovery and, where relevant, the limit values for the content of hazardous substances in the waste as well as the emission limit values.

3. Member States shall inform the Commission of the general rules laid down pursuant to paragraphs 1 and 2.

Article 26

Registration

Where the following are not subject to permit requirements, Member States shall ensure that the competent authority keeps a register of:

- (a) establishments or undertakings which collect or transport waste on a professional basis;
- (b) dealers or brokers; and
- (c) establishments or undertakings which are subject to exemptions from the permit requirements pursuant to Article 24.

Where possible, existing records held by the competent authority shall be used to obtain the relevant information for this registration process in order to reduce the administrative burden.

Article 27

Minimum standards

1. Technical minimum standards for treatment activities which require a permit pursuant to Article 23 may be adopted where there is evidence that a benefit in terms of the protection of human health and the environment would be gained from such minimum standards. Those measures, designed to amend non-essential elements of this Directive by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 39(2).

2. Such minimum standards shall cover only those waste treatment activities that are not covered by Directive 96/61/EC or are not appropriate for coverage by that Directive.

3. Such minimum standards shall:

- (a) be directed to the main environmental impacts of the waste treatment activity;
- (b) ensure that the waste is treated in accordance with Article 13;
- (c) take into account best available techniques; and
- (d) as appropriate, include elements regarding the quality of treatment and the process requirements.

4. Minimum standards for activities that require registration pursuant to points (a) and (b) of Article 26 shall be adopted where there is evidence that a benefit in terms of the protection of human health and the environment or in avoiding disruption to the internal market would be gained from such minimum standards, including elements regarding the technical qualification of collectors, transporters, dealers or brokers.

Those measures, designed to amend non-essential elements of this Directive by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 39(2).

CHAPTER V

PLANS AND PROGRAMMES

Article 28

Waste management plans

1. Member States shall ensure that their competent authorities establish, in accordance with Articles 1, 4, 13 and 16, one or more waste management plans.

Those plans shall, alone or in combination, cover the entire geographical territory of the Member State concerned.

2. The waste management plans shall set out an analysis of the current waste management situation in the geographical entity concerned, as well as the measures to be taken to improve environmentally sound preparing for re-use, recycling, recovery and disposal of waste and an evaluation of how the plan will support the implementation of the objectives and provisions of this Directive.

3. The waste management plans shall contain, as appropriate and taking into account the geographical level and coverage of the planning area, at least the following:

- (a) the type, quantity and source of waste generated within the territory, the waste likely to be shipped from or to the national territory, and an evaluation of the development of waste streams in the future;
- (b) existing waste collection schemes and major disposal and recovery installations, including any special arrangements for waste oils, hazardous waste or waste streams addressed by specific Community legislation;
- (c) an assessment of the need for new collection schemes, the closure of existing waste installations, additional waste installation infrastructure in accordance with Article 16, and, if necessary, the investments related thereto;
- (d) sufficient information on the location criteria for site identification and on the capacity of future disposal or major recovery installations, if necessary;
- (e) general waste management policies, including planned waste management technologies and methods, or policies for waste posing specific management problems.

4. The waste management plan may contain, taking into account the geographical level and coverage of the planning area, the following:

- (a) organisational aspects related to waste management including a description of the allocation of responsibilities between public and private actors carrying out the waste management;
- (b) an evaluation of the usefulness and suitability of the use of economic and other instruments in tackling various waste problems, taking into account the need to maintain the smooth functioning of the internal market;
- (c) the use of awareness campaigns and information provision directed at the general public or at a specific set of consumers;

(d) historical contaminated waste disposal sites and measures for their rehabilitation.

5. Waste management plans shall conform to the waste planning requirements laid down in Article 14 of Directive 94/62/EC and the strategy for the implementation of the reduction of biodegradable waste going to landfills, referred to in Article 5 of Directive 1999/31/EC.

Article 29

Waste prevention programmes

1. Member States shall establish, in accordance with Articles 1 and 4, waste prevention programmes not later than 12 December 2013.

Such programmes shall be integrated either into the waste management plans provided for in Article 28 or into other environmental policy programmes, as appropriate, or shall function as separate programmes. If any such programme is integrated into the waste management plan or into other programmes, the waste prevention measures shall be clearly identified.

2. The programmes provided for in paragraph 1 shall set out the waste prevention objectives. Member States shall describe the existing prevention measures and evaluate the usefulness of the examples of measures indicated in Annex IV or other appropriate measures.

The aim of such objectives and measures shall be to break the link between economic growth and the environmental impacts associated with the generation of waste.

3. Member States shall determine appropriate specific qualitative or quantitative benchmarks for waste prevention measures adopted in order to monitor and assess the progress of the measures and may determine specific qualitative or quantitative targets and indicators, other than those referred to in paragraph 4, for the same purpose.

4. Indicators for waste prevention measures may be adopted in accordance with the regulatory procedure referred to in Article 39(3).

5. The Commission shall create a system for sharing information on best practice regarding waste prevention and shall develop guidelines in order to assist the Member States in the preparation of the Programmes.

*Article 30***Evaluation and review of plans and programmes**

1. Member States shall ensure that the waste management plans and waste prevention programmes are evaluated at least every sixth year and revised as appropriate and, where relevant, in accordance with Articles 9 and 11.

2. The European Environment Agency is invited to include in its annual report a review of progress in the completion and implementation of waste prevention programmes.

*Article 31***Public participation**

Member States shall ensure that relevant stakeholders and authorities and the general public have the opportunity to participate in the elaboration of the waste management plans and waste prevention programmes, and have access to them once elaborated, in accordance with Directive 2003/35/EC or, if relevant, Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment⁽¹⁾. They shall place the plans and programmes on a publicly available website.

*Article 32***Cooperation**

Member States shall cooperate as appropriate with the other Member States concerned and the Commission to draw up the waste management plans and the waste prevention programmes in accordance with Articles 28 and 29.

*Article 33***Information to be submitted to the Commission**

1. Member States shall inform the Commission of the waste management plans and waste prevention programmes referred to in Articles 28 and 29, once adopted, and of any substantial revisions to the plans and programmes.

2. The format for notifying the information on the adoption and substantial revisions of those plans and programmes shall be adopted in accordance with the regulatory procedure referred to in Article 39(3).

CHAPTER VI

INSPECTIONS AND RECORDS*Article 34***Inspections**

1. Establishments or undertakings which carry out waste treatment operations, establishments or undertakings which collect or transport waste on a professional basis, brokers and dealers, and establishments or undertakings which produce hazardous waste shall be subject to appropriate periodic inspections by the competent authorities.

2. Inspections concerning collection and transport operations shall cover the origin, nature, quantity and destination of the waste collected and transported.

3. Member States may take account of registrations obtained under the Community Eco-Management and Audit Scheme (EMAS), in particular regarding the frequency and intensity of inspections.

*Article 35***Record keeping**

1. The establishments or undertakings referred to in Article 23(1), the producers of hazardous waste and the establishments and undertakings which collect or transport hazardous waste on a professional basis, or act as dealers and brokers of hazardous waste, shall keep a chronological record of the quantity, nature and origin of the waste, and, where relevant, the destination, frequency of collection, mode of transport and treatment method foreseen in respect of the waste, and shall make that information available, on request, to the competent authorities.

2. For hazardous waste, the records shall be preserved for at least three years except in the case of establishments and undertakings transporting hazardous waste which must keep such records for at least 12 months.

Documentary evidence that the management operations have been carried out shall be supplied at the request of the competent authorities or of a previous holder.

3. Member States may require the producers of non-hazardous waste to comply with paragraphs 1 and 2.

⁽¹⁾ OJ L 197, 21.7.2001, p. 30.

*Article 36***Enforcement and penalties**

1. Member States shall take the necessary measures to prohibit the abandonment, dumping or uncontrolled management of waste.

2. Member States shall lay down provisions on the penalties applicable to infringements of the provisions of this Directive and shall take all measures necessary to ensure that they are implemented. The penalties shall be effective, proportionate and dissuasive.

CHAPTER VII

FINAL PROVISIONS

*Article 37***Reporting and reviewing**

1. Every three years, Member States shall inform the Commission of the implementation of this Directive by submitting a sectoral report in an electronic form. This report shall also contain information on the management of waste oil and on the progress achieved in the implementation of the waste prevention programmes and, as appropriate, information on measures as foreseen by Article 8 on extended producer responsibility.

The report shall be drawn up on the basis of a questionnaire or outline established by the Commission in accordance with the procedure referred to in Article 6 of Council Directive 91/692/EEC of 23 December 1991 standardising and rationalising reports on the implementation of certain Directives relating to the environment⁽¹⁾. The report shall be submitted to the Commission within nine months of the end of the three year period covered by it.

2. The Commission shall send the questionnaire or outline to the Member States six months before the start of the period covered by the sectoral report.

3. The Commission shall publish a report on the implementation of this Directive within nine months of receiving the sectoral reports from the Member States in accordance with paragraph 1.

4. In the first report that intervenes by 12 December 2014, the Commission shall review the implementation of this Directive, including the energy efficiency provisions, and will present a proposal for revision if appropriate. The report shall also assess the existing Member State waste prevention

programmes, objectives and indicators and shall review the opportunity of Community level programmes, including producer responsibility schemes for specific waste streams, targets, indicators and measures related to recycling, as well as material and energy recovery operations that may contribute to fulfilling the objectives set out in Articles 1 and 4 more effectively.

*Article 38***Interpretation and adaptation to technical progress**

1. The Commission may develop guidelines for the interpretation of the definitions of recovery and disposal.

If necessary, the application of the formula for incineration facilities referred to in Annex II, R1, shall be specified. Local climatic conditions may be taken into account, such as the severity of the cold and the need for heating insofar as they influence the amounts of energy that can technically be used or produced in the form of electricity, heating, cooling or processing steam. Local conditions of the outermost regions as recognised in the fourth subparagraph of Article 299(2) of the Treaty and of the territories mentioned in Article 25 of the 1985 Act of Accession may also be taken into account. This measure, designed to amend non-essential elements of this Directive, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 39(2).

2. The Annexes may be amended in the light of scientific and technical progress. Those measures, designed to amend non-essential elements of this Directive, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 39(2).

*Article 39***Committee procedure**

1. The Commission shall be assisted by a committee.

2. Where reference is made to this paragraph, Article 5a(1) to (4) and Article 7 of Decision 1999/468/EC shall apply, having regard to the provisions of Article 8 thereof.

3. Where reference is made to this paragraph, Articles 5 and 7 of Decision 1999/468/EC shall apply, having regard to the provisions of Article 8 thereof.

The period laid down in Article 5(6) of Decision 1999/468/EC shall be set at three months.

⁽¹⁾ OJ L 377, 31.12.1991, p. 48.

Article 40

Transposition

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 12 December 2010.

When Member States adopt these measures, they shall contain a reference to this Directive or shall be accompanied by such reference on the occasion of their official publication. The methods of making such reference shall be laid down by Member States.

2. Member States shall communicate to the Commission the text of the main provisions of national law which they adopt in the field covered by this Directive.

Article 41

Repeal and transitional provisions

Directives 75/439/EEC, 91/689/EEC and 2006/12/EC are hereby repealed with effect from 12 December 2010.

However, from 12 December 2008, the following shall apply:

(a) Article 10(4) of Directive 75/439/EEC shall be replaced by the following:

‘4. The reference method of measurement to determine the PCB/PCT content of waste oils shall be fixed by the Commission. That measure, designed to amend non-essential elements of this Directive by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 18(4) of Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste (*).

(*) OJ L 114, 27.4.2006, p. 9.’;

(b) Directive 91/689/EEC is hereby amended as follows:

(i) Article 1(4) shall be replaced by the following:

‘4. For the purpose of this Directive “hazardous waste” means:

— waste classified as hazardous waste featuring on the list established by Commission Decision

2000/532/EC (*) on the basis of Annexes I and II to this Directive. This waste must have one or more of the properties listed in Annex III. The list shall take into account the origin and composition of the waste and, where necessary, limit values of concentration. This list shall be periodically reviewed and, if necessary revised. Those measures, designed to amend non-essential elements of this Directive by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 18(4) of Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste (**),

— any other waste which is considered by a Member State to display any of the properties listed in Annex III. Such cases shall be notified to the Commission and reviewed with a view to adapting the list. Those measures, designed to amend non-essential elements of this Directive by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 18(4) of Directive 2006/12/EC.

(*) OJ L 226, 6.9.2000, p. 3.

(**) OJ L 114, 27.4.2006, p. 9.’;

(ii) Article 9 shall be replaced by the following:

‘Article 9

The measures necessary for adapting the Annexes of this Directive to scientific and technical progress and for revising the list of wastes referred to in Article 1(4), designed to amend non-essential elements of this Directive, inter alia by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 18(4) of Directive 2006/12/EC.’;

(c) Directive 2006/12/EC is hereby amended as follows:

(i) Article 1(2) shall be replaced by the following:

‘2. For the purposes of paragraph 1, point (a), Commission Decision 2000/532/EC (*) featuring the list of waste belonging to the categories listed in Annex I to this Directive shall apply. This list shall be periodically reviewed and, if necessary, revised. Those measures, designed to amend non-essential elements of this Directive by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 18(4).

(*) OJ L 226, 6.9.2000, p. 3.’;

(ii) Article 17 shall be replaced by the following:

'Article 17

The measures necessary for adapting the Annexes to scientific and technical progress, designed to amend non-essential elements of this Directive, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 18(4).;

(iii) Article 18(4) shall be replaced by the following:

'4. Where reference is made to this paragraph, Article 5a(1) to (4) and Article 7 of Decision 1999/468/EC shall apply, having regard to the provisions of Article 8 thereof.'

References to the repealed Directives shall be construed as references to this Directive and shall be read in accordance with the correlation table set out in Annex V.

Article 42

Entry into force

This Directive shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

Article 43

Addressees

This Directive is addressed to the Member States.

Done at Strasbourg, 19 November 2008.

For the European Parliament

The President

H.-G. PÖTTERING

For the Council

The President

J.-P. JOUYET

ANNEX I

DISPOSAL OPERATIONS

- D 1 Deposit into or on to land (e.g. landfill, etc.)
- D 2 Land treatment (e.g. biodegradation of liquid or sludgy discards in soils, etc.)
- D 3 Deep injection (e.g. injection of pumpable discards into wells, salt domes or naturally occurring repositories, etc.)
- D 4 Surface impoundment (e.g. placement of liquid or sludgy discards into pits, ponds or lagoons, etc.)
- D 5 Specially engineered landfill (e.g. placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)
- D 6 Release into a water body except seas/oceans
- D 7 Release to seas/oceans including sea-bed insertion
- D 8 Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12
- D 9 Physico-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12 (e.g. evaporation, drying, calcination, etc.)
- D 10 Incineration on land
- D 11 Incineration at sea (*)
- D 12 Permanent storage (e.g. emplacement of containers in a mine, etc.)
- D 13 Blending or mixing prior to submission to any of the operations numbered D 1 to D 12 (**)
- D 14 Repackaging prior to submission to any of the operations numbered D 1 to D 13
- D 15 Storage pending any of the operations numbered D 1 to D 14 (excluding temporary storage, pending collection, on the site where the waste is produced) (***)

(*) This operation is prohibited by EU legislation and international conventions.

(**) If there is no other D code appropriate, this can include preliminary operations prior to disposal including pre-processing such as, inter alia, sorting, crushing, compacting, pelletising, drying, shredding, conditioning or separating prior to submission to any of the operations numbered D1 to D12.

(***) Temporary storage means preliminary storage according to point (10) of Article 3.

ANNEX II

RECOVERY OPERATIONS

- R 1 Use principally as a fuel or other means to generate energy (*)
- R 2 Solvent reclamation/regeneration
- R 3 Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes) (**)
- R 4 Recycling/reclamation of metals and metal compounds
- R 5 Recycling/reclamation of other inorganic materials (***)
- R 6 Regeneration of acids or bases
- R 7 Recovery of components used for pollution abatement
- R 8 Recovery of components from catalysts
- R 9 Oil re-refining or other reuses of oil
- R 10 Land treatment resulting in benefit to agriculture or ecological improvement
- R 11 Use of waste obtained from any of the operations numbered R 1 to R 10
- R 12 Exchange of waste for submission to any of the operations numbered R 1 to R 11 (****)
- R 13 Storage of waste pending any of the operations numbered R 1 to R 12 (excluding temporary storage, pending collection, on the site where the waste is produced) (*****)

(*) This includes incineration facilities dedicated to the processing of municipal solid waste only where their energy efficiency is equal to or above:

- 0,60 for installations in operation and permitted in accordance with applicable Community legislation before 1 January 2009,
- 0,65 for installations permitted after 31 December 2008,

using the following formula:

$$\text{Energy efficiency} = (E_p - (E_f + E_i)) / (0,97 \times (E_w + E_f))$$

In which:

E_p means annual energy produced as heat or electricity. It is calculated with energy in the form of electricity being multiplied by 2,6 and heat produced for commercial use multiplied by 1,1 (GJ/year)

E_f means annual energy input to the system from fuels contributing to the production of steam (GJ/year)

E_w means annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year)

E_i means annual energy imported excluding E_w and E_f (GJ/year)

0,97 is a factor accounting for energy losses due to bottom ash and radiation.

This formula shall be applied in accordance with the reference document on Best Available Techniques for waste incineration.

(**) This includes gasification and pyrolysis using the components as chemicals.

(***) This includes soil cleaning resulting in recovery of the soil and recycling of inorganic construction materials.

(****) If there is no other R code appropriate, this can include preliminary operations prior to recovery including pre-processing such as, inter alia, dismantling, sorting, crushing, compacting, pelletising, drying, shredding, conditioning, repackaging, separating, blending or mixing prior to submission to any of the operations numbered R1 to R11.

(*****) Temporary storage means preliminary storage according to point (10) of Article 3.

ANNEX III

PROPERTIES OF WASTE WHICH RENDER IT HAZARDOUS

- H 1 'Explosive': substances and preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene.
- H 2 'Oxidizing': substances and preparations which exhibit highly exothermic reactions when in contact with other substances, particularly flammable substances.
- H 3-A 'Highly flammable'
- liquid substances and preparations having a flash point below 21 °C (including extremely flammable liquids), or
 - substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any application of energy, or
 - solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or to be consumed after removal of the source of ignition, or
 - gaseous substances and preparations which are flammable in air at normal pressure, or
 - substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.
- H 3-B 'Flammable': liquid substances and preparations having a flash point equal to or greater than 21 °C and less than or equal to 55 °C.
- H 4 'Irritant': non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation.
- H 5 'Harmful': substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve limited health risks.
- H 6 'Toxic': substances and preparations (including very toxic substances and preparations) which, if they are inhaled or ingested or if they penetrate the skin, may involve serious, acute or chronic health risks and even death.
- H 7 'Carcinogenic': substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce cancer or increase its incidence.
- H 8 'Corrosive': substances and preparations which may destroy living tissue on contact.
- H 9 'Infectious': substances and preparations containing viable micro-organisms or their toxins which are known or reliably believed to cause disease in man or other living organisms.
- H 10 'Toxic for reproduction': substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce non-hereditary congenital malformations or increase their incidence.
- H 11 'Mutagenic': substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce hereditary genetic defects or increase their incidence.
- H 12 Waste which releases toxic or very toxic gases in contact with water, air or an acid.
- H 13 (*) 'Sensitizing': substances and preparations which, if they are inhaled or if they penetrate the skin, are capable of eliciting a reaction of hypersensitization such that on further exposure to the substance or preparation, characteristic adverse effects are produced.
- H 14 'Ecotoxic': waste which presents or may present immediate or delayed risks for one or more sectors of the environment.

(*) As far as testing methods are available.

H 15 Waste capable by any means, after disposal, of yielding another substance, e.g. a leachate, which possesses any of the characteristics listed above.

Notes

1. Attribution of the hazardous properties 'toxic' (and 'very toxic'), 'harmful', 'corrosive', 'irritant', 'carcinogenic', 'toxic to reproduction', 'mutagenic' and 'eco-toxic' is made on the basis of the criteria laid down by Annex VI, to Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances ⁽¹⁾.
2. Where relevant the limit values listed in Annex II and III to Directive 1999/45/EC of the European Parliament and of the Council of 31 May 1999 concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations ⁽²⁾ shall apply.

Test methods

The methods to be used are described in Annex V to Directive 67/548/EEC and in other relevant CEN-notes.

⁽¹⁾ OJ 196, 16.8.1967, p. 1.

⁽²⁾ OJ L 200, 30.7.1999, p. 1.

ANNEX IV

EXAMPLES OF WASTE PREVENTION MEASURES REFERRED TO IN ARTICLE 29**Measures that can affect the framework conditions related to the generation of waste**

1. The use of planning measures, or other economic instruments promoting the efficient use of resources.
2. The promotion of research and development into the area of achieving cleaner and less wasteful products and technologies and the dissemination and use of the results of such research and development.
3. The development of effective and meaningful indicators of the environmental pressures associated with the generation of waste aimed at contributing to the prevention of waste generation at all levels, from product comparisons at Community level through action by local authorities to national measures.

Measures that can affect the design and production and distribution phase

4. The promotion of eco-design (the systematic integration of environmental aspects into product design with the aim to improve the environmental performance of the product throughout its whole life cycle).
5. The provision of information on waste prevention techniques with a view to facilitating the implementation of best available techniques by industry.
6. Organise training of competent authorities as regards the insertion of waste prevention requirements in permits under this Directive and Directive 96/61/EC.
7. The inclusion of measures to prevent waste production at installations not falling under Directive 96/61/EC. Where appropriate, such measures could include waste prevention assessments or plans.
8. The use of awareness campaigns or the provision of financial, decision making or other support to businesses. Such measures are likely to be particularly effective where they are aimed at, and adapted to, small and medium sized enterprises and work through established business networks.
9. The use of voluntary agreements, consumer/producer panels or sectoral negotiations in order that the relevant businesses or industrial sectors set their own waste prevention plans or objectives or correct wasteful products or packaging.
10. The promotion of creditable environmental management systems, including EMAS and ISO 14001.

Measures that can affect the consumption and use phase

11. Economic instruments such as incentives for clean purchases or the institution of an obligatory payment by consumers for a given article or element of packaging that would otherwise be provided free of charge.
 12. The use of awareness campaigns and information provision directed at the general public or a specific set of consumers.
 13. The promotion of creditable eco-labels.
 14. Agreements with industry, such as the use of product panels such as those being carried out within the framework of Integrated Product Policies or with retailers on the availability of waste prevention information and products with a lower environmental impact.
 15. In the context of public and corporate procurement, the integration of environmental and waste prevention criteria into calls for tenders and contracts, in line with the Handbook on environmental public procurement published by the Commission on 29 October 2004.
 16. The promotion of the reuse and/or repair of appropriate discarded products or of their components, notably through the use of educational, economic, logistic or other measures such as support to or establishment of accredited repair and reuse-centres and networks especially in densely populated regions.
-

ANNEX V

CORRELATION TABLE

Directive 2006/12/EC	This Directive
Article 1(1)(a)	Article 3(1)
Article 1(1)(b)	Article 3(5)
Article 1(1)(c)	Article 3(6)
Article 1(1)(d)	Article 3(9)
Article 1(1)(e)	Article 3(19)
Article 1(1)(f)	Article 3(15)
Article 1(1)(g)	Article 3(10)
Article 1(2)	Article 7
Article 2(1)	Article 2(1)
Article 2(1)(a)	Article 2(1)(a)
Article 2(1)(b)	Article 2(2)
Article 2(1)(b)(i)	Article 2(1)(d)
Article 2(1)(b)(ii)	Article 2(2)(d)
Article 2(1)(b)(iii)	Article 2(1)(f) and (2)(c)
Article 2(1)(b)(iv)	Article 2(2)(a)
Article 2(1)(b)(v)	Article 2(1)(e)
Article 2(2)	Article 2(4)
Article 3(1)	Article 4
Article 4(1)	Article 13
Article 4(2)	Article 36(1)
Article 5	Article 16
Article 6	—
Article 7	Article 28
Article 8	Article 15
Article 9	Article 23
Article 10	Article 23
Article 11	Articles 24 and 25
Article 12	Article 26
Article 13	Article 34
Article 14	Article 35
Article 15	Article 14
Article 16	Article 37
Article 17	Article 38
Article 18(1)	Article 39(1)

Directive 2006/12/EC	This Directive
—	Article 39(2)
Article 18(2)	—
Article 18(3)	Article 39(3)
Article 19	Article 40
Article 20	—
Article 21	Article 42
Article 22	Article 43
Annex I	—
Annex IIA	Annex I
Annex IIB	Annex II

Directive 75/439/EEC	This Directive
Article 1(1)	Article 3(18)
Article 2	Articles 13 and 21
Article 3(1) and (2)	—
Article 3(3)	Article 13
Article 4	Article 13
Article 5(1)	—
Article 5(2)	—
Article 5(3)	—
Article 5(4)	Articles 26 and 34
Article 6	Article 23
Article 7(a)	Article 13
Article 7(b)	—
Article 8(1)	—
Article 8(2)(a)	—
Article 8(2)(b)	—
Article 8(3)	—
Article 9	—
Article 10(1)	Article 18
Article 10(2)	Article 13
Article 10(3) and (4)	—
Article 10(5)	Articles 19, 21, 25, 34 and 35
Article 11	—
Article 12	Article 35
Article 13(1)	Article 34

Directive 75/439/EEC	This Directive
Article 13(2)	—
Article 14	—
Article 15	—
Article 16	—
Article 17	—
Article 18	Article 37
Article 19	—
Article 20	—
Article 21	—
Article 22	—
Annex I	—

Directive 91/689/EEC	This Directive
Article 1(1)	—
Article 1(2)	—
Article 1(3)	—
Article 1(4)	Articles 3(2) and 7
Article 1(5)	Article 20
Article 2(1)	Article 23
Article 2(2)-(4)	Article 18
Article 3	Articles 24, 25 and 26
Article 4(1)	Article 34(1)
Article 4(2)(3)	Article 35
Article 5(1)	Article 19(1)
Article 5(2)	Article 34(2)
Article 5(3)	Article 19(2)
Article 6	Article 28
Article 7	—
Article 8	—
Article 9	—
Article 10	—
Article 11	—
Article 12	—
Annexes I and II	—
Annex III	Annex III



EUROPEAN COMMISSION
DIRECTORATE-GENERAL
ENVIRONMENT

GUIDELINES
ON THE INTERPRETATION OF THE R1 ENERGY EFFICIENCY FORMULA FOR
INCINERATION FACILITIES DEDICATED TO THE PROCESSING OF
MUNICIPAL SOLID WASTE ACCORDING TO ANNEX II OF
DIRECTIVE 2008/98/EC ON WASTE¹

¹ Directive 2008/98/EC on waste and repealing certain Directives – OJ L 312, 22.11.2008, p. 3.

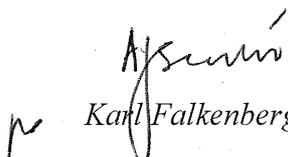
Foreword

The new Waste Framework Directive, which since 12 December 2010 has to be applied by all Member States, marks a shift away from thinking about waste as an unwanted burden to seeing it as a valued resource. The Directive establishes a straightforward five-step waste hierarchy as a priority order for Member States decisions on waste policies and legislation. Waste prevention is regarded as the most desirable option, followed by preparing waste for re-use, recycling and other recovery, including energy recovery, with disposal (such as landfill) as the last resort. When applying the waste hierarchy, EU Member States shall encourage those options that deliver the best overall environmental outcome over the whole life-cycle of products and services.

Recycling of waste by reprocessing it into new products can make the most efficient use of the resources contained in waste. Where waste recycling is not the environmentally preferable option, technically not feasible or economically not viable, waste should be used to generate energy. The new Waste Framework Directive promotes production of energy from waste. With the so-called R1 Formula², it has introduced an incentive for municipal waste incinerators to contribute to the energy supply for industries and households. Municipal waste incinerators meeting or exceeding the energy efficiency thresholds of this formula can be classified as facilities for the recovery of energy from waste according to the waste hierarchy.

This guideline is intended to help the authorities in the Member States to interpret and apply the R1 Formula. It could also be used as a reference by economic operators, as they will have to comply with the national laws transposing the Directive. The guidance has been developed together with experts from Member States, industry and NGOs. It reflects the views of the Commission, and as such is not legally binding; binding interpretation of EU legislation is the exclusive competence of the Court of Justice of the European Union. The guidance is a living document and as such may be revised according to experience with the implementation in the Member States and further development of European waste management policy.

June 2011


Karl Falkenberg

Director-General of DG Environment

² Annex II, footnote (*) of Directive 2008/98/EC

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The following abbreviations for pertinent legislation are used in this document:

Legislation/Guidance	Abbreviation
Waste Framework Directive 2008/98/EC	WFD
Directive on the incineration of waste 2000/76/EC ³	WID
Directive concerning integrated pollution prevention and control 2008/1/EC ⁴	IPPC Directive
Directive 2010/75/EU on industrial emissions ⁵	IED
Waste Shipment Regulation (EC) No 1013/2006 ⁶	WSR
Integrated Pollution Prevention and Control Reference Document on the Best Available Techniques for Waste Incineration, from August 2006 ⁷	BREF WI

³ OJ L 332, 28.12.2000, p. 91; repealed by 7 January 2014 by Directive 2010/75/EU.

⁴ OJ L 24, 29.1.2008, p. 8; repealed by 7 January 2014 by Directive 2010/75/EU.

⁵ OJ L334, 17.12.2010, p. 17.

⁶ OJ L 190, 12.7.2006, p. 1.

⁷ ftp://ftp.jrc.es/pub/eippcb/doc/wi_bref_0806.pdf.

1 Introduction

These guidelines are destined to provide legal certainty and a level playing field in the application of the energy efficiency thresholds for municipal waste incinerators in Annex II of Directive 2008/98/EC on waste (Waste Framework Directive - WFD).

The new WFD has introduced a **five-step waste hierarchy as a priority order** with waste prevention at the top followed by preparing for re-use, recycling, other recovery including energy recovery and waste disposal as the last resort. The Directive allows municipal waste incinerators to be classified as recovery operations provided they contribute to the generation of energy with high efficiency to promote the use of waste to produce energy in energy efficient municipal waste incinerators and encourage innovation in waste incineration.

In this context, it is important to note that “recovery” means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy (Art 3 (15) of the WFD).

The non-exhaustive list of recovery operations presented in Annex II of the WFD defines R1 as a recovery operation which is understood as “*Use principally as a fuel or other means to generate energy*”. It is clarified in footnote (8) that this includes incineration facilities dedicated to the processing of municipal solid waste (MSW) only where their energy efficiency is equal to or above:

- 0.60 for installations in operation and permitted in accordance with applicable Community legislation before 1 January 2009,
- 0.65 for installations permitted after 31 December 2008,

using the following formula:

$$\text{Energy efficiency} = \frac{E_p - (E_r + E_i)}{0.97 * (E_w + E_f)}$$

In which:

E_p means annual energy produced as heat or electricity. It is calculated with energy in the form of electricity being multiplied by 2.6 and heat produced for commercial use multiplied by 1.1 (GJ/year)

E_f means annual energy input to the system from fuels contributing to the production of steam (GJ/year)

E_w means annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year)

E_i means annual energy imported excluding E_w and E_f (GJ/year)

0.97 is a factor accounting for energy losses due to bottom ash and radiation

In addition, Annex II of the WFD highlights that this formula shall be applied in accordance with the Reference Document on Best Available Techniques for Waste Incineration (BREF WI).

The “R1-formula” is not strictly speaking an expression of efficiency in physics, but a performance indicator for the level of recovery of energy from waste in a plant dedicated to the incineration of municipal solid waste (MSWI). The practical impact of this provision will have to be monitored in future and the R1 formula may be revised in 2014 in accordance with the provisions of article 37(4) of the WFD, and if necessary to keep it up to date with technological progress.

For historical development of the formula and its link to the Integrated Pollution Prevention and Control Reference Document on the Best Available Techniques for Waste Incineration from August 2006 (BREF WI) see Annex 1.

For better readability, this document specifies major topics in specific thematic areas in shaded boxes and summarises the major elements of guidance in boxes at the end of each chapter.

It should be noted that this guidance only reflects the opinion of the Commission services and is not legally binding. A final binding legal interpretation of EU legislation can only be provided by the Court of Justice of the European Union. This guidance is without prejudice to the position the Commission might take should related issues arise in a procedure before the Court of Justice.

1.1 Scope of the Energy Efficiency Formula

Annex II, footnote (*) of the WFD clearly restricts the scope of the formula to “incineration facilities dedicated to the processing of municipal solid waste” (MSWI). The WFD should, pursuant to its recital 20, clarify when incineration of (MSW) is energy-efficient and may be considered as recovery operation.

Waste incinerators dedicated to the incineration of municipal waste are waste incinerators which have the permit and are technically designed in a way so that they are capable to incinerate mixed municipal solid waste.

The R1 formula does not apply to co-incineration plants and facilities dedicated to the incineration of hazardous waste, hospital waste, sewage sludge or industrial waste.

Installations shall correspond to the IPPC activity 5.2. “Installations for the incineration of municipal waste (household waste and similar commercial, industrial and institutional wastes) with a capacity exceeding 3 tonnes per hour” (it should be noted that the capacity limit in this context is not applicable in the context of the R1 formula). However, this activity description will change under the IED, Annex I, as indicated below:

5.2 Disposal or recovery of waste in waste incineration plants or in waste co-incineration plans:

- (a) for non-hazardous waste with a capacity exceeding 3 tonnes per hour;
- (b) for hazardous waste with a capacity exceeding 10 tonnes per day.

In the context of IED, installations dedicated to the incineration of municipal waste shall correspond to a sub-sector of activity 5.2 recognizing that: (1) only if the facility is dedicated to the incineration of municipal solid waste will it fall within the R1 energy efficiency thresholds of the WFD and (2) that the R1-formula does not apply to co-incinerators.

Municipal waste is classified in chapter 20 of Commission Decision 2000/532/EC on the list of waste. Usually, MSWI are installations permitted for the incineration of 'mixed municipal waste'. Mixed municipal waste is defined in Art 3(3) WFD as waste from households as well as commercial, industrial and institutional waste, which because of its nature and composition is similar to waste from households, excluding separately collected fractions of recyclable waste.

In addition, other waste streams can be accepted by MSWI if listed in the permit for the IPPC category 5.2, if applicable, or the permit according to WID. Authorization of any waste input, except for mixed municipal solid waste, shall be in line with the BREF on waste incineration and with the waste hierarchy (Art 4 WFD).

In practice, the waste input into a MSWI is made of different mixed and heterogeneous fractions which are blended before feeding the hopper in order to optimize the combustion process.

The calculation of the R1 formula shall be done on the waste composition which is actually incinerated in a facility, not only on the part of the waste which is classified as municipal waste or mixed municipal waste.

In case an incineration plant has two separate lines (one for hazardous waste and one for MSW), only the line for MSW can apply for the R1 status according to the formula.

Non-municipal wastes can be accepted as long as specified in the permit in accordance with the IPPC and WID and the BREF document, although primarily other treatment options might be preferred. Separately collected waste fractions should be managed in line with the waste hierarchy.

The calculation of the E_w as a parameter for the R1 efficiency is based on the actual waste mix incinerated.

1.2 Principles of self-sufficiency and proximity and the waste hierarchy

Together with the introduction of the R1 formula, the principles of self-sufficiency and proximity have been extended from waste disposal installations to the recovery of mixed municipal waste collected from private households, including where such collection also covers such waste from other producers.

The fact that municipal waste treated in an R1-facility is to be regarded as recovered has to be distinguished from the question of whether the recovery of a certain waste in such a facility is to be seen as a waste management option with the best environmental outcome considering the waste hierarchy and taking into account life-cycle thinking (Art 4 WFD). Certain waste streams like paper, glass, plastic, and metals can be used with higher resource efficiency when they are separately collected from other municipal wastes and recycled.

According to Art 4(2) WFD, Member States should encourage those waste management options that deliver the best overall environmental outcome. For waste streams where recycling is the preferable option, this should include appropriate measures such as introduction of separate collection schemes and other measures supporting recycling, implementing recycling targets and avoiding overcapacities for waste incinerators in waste management plans. National legislation on recycling of certain waste streams might be another option.

Hazardous waste is usually treated in the most appropriate way in incinerators specifically dedicated to the treatment of hazardous waste which are not under the scope of the R1 formula.

The principle of self-sufficiency and proximity (Art 16(1) WFD) is applied to mixed municipal waste from private households destined to incinerators that are classified as recovery. Similar waste from other producers is included when it has been collected together with mixed municipal wastes from households.

The waste hierarchy principle (Art 4 WFD) establishes a 5-step priority order with waste prevention as the most preferable solution, followed by preparation for re-use, recycling, other recovery (including energy recovery) and waste disposal as the last resort. According to Art 4(2) WFD, Member States should encourage those waste management options that deliver the best overall environmental outcome taking into account life-cycle thinking.

2 System Boundaries for application of the R1-formula

2.1 Definition of system boundaries

The definition of system boundaries has considerable implications for the calculation of the energy efficiency, because it affects the energy streams which are to be calculated as E_i , E_f and E_w , thus influencing the R1 factor.

WFD does not contain a definition of the compounds of an “incineration facility”, hence definitions in other relevant laws and guidance shall apply. In this context it is important to differentiate between “waste incineration installation” according to the IPPC Directive and “incineration facility” according to WID.

The boundaries of a **“waste incineration installation” according to the IPPC Directive** are defined by the limits of the operator’s permit. “Installation“ according to Art 2(3) of the consolidated IPPC Directive means a stationary technical unit where one or more activities listed in Annex I of this Directive are carried out, and any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions and pollution. Depending on local conditions, the “waste incineration installation” according to the IPPC Directive may simply include an “incineration facility” according to WID and its offices or other additional processes/activities, such as:

- ash processing, recovery of metals from ash, on site manufacture of products from those recovered materials,
- other waste treatment processes, such as a sorting facility, aerobic and/or anaerobic digestion facility, station for waste collection vehicles maintenance, etc.
- other activities such as sewage sludge treatment,
- classic boiler (fired with classic fuels), a complex process such as a combined cycle with gas turbine, an industrial complex.

It should be noted, however, that the IED introduces new activity descriptions for which a permit will be required. According to IED, permits issued to incinerators under IED, Annex I, activity 5.2, may also contain provisions for the other waste treatment activities listed in IED, such as Annex I, activity 5.3, given that an installation can contain more than one Annex I activity and be subject to a single permit. However, such pre and post-treatments are not included within the R1 system boundary (see section 2.2).

The **“incineration plant” according to the WID** includes the site and the entire incineration plant with all incineration lines, waste reception area, storage, on-site pre-treatment facilities, waste fuel and air supply systems, waste incineration furnace/combustion chamber(s), boiler(s), a cleaning system for incineration flue gas, and on-site facilities for treatment or storage of residues and water as well as the stack. This definition is generally the same in the IED.

In line with the description in the related BREF Document (Annex 10.4.1, figure 10.14), **the R1 system boundaries** shall comprise only the essential parts of the incineration and energy recovery process. This includes the combustion chamber(s) and boiler(s), the flue gas treatment system, energy transformation and recovery equipment such as heat exchangers and turbine generator set, as well as all electrical systems (e.g. pumps, motors, fans, compressors, trace heating, control systems, etc.) and heat consuming systems needed for their proper functioning.

The inclusion of the turbine into the R1 system boundaries is underpinned by the WID requesting combined heat and power recovery from waste to the extent possible (for more details see BREF document).

The inclusion of the flue gas cleaning system gives the incentive to use also lower temperature heat, which otherwise would be wasted.

The system boundaries for the calculation of the R1-formula are the incineration facility as defined above including incineration furnace/combustion chamber(s), the boiler(s), the incineration flue gas cleaning system and, often, energy transformation and recovery equipments such as heat exchangers feeding a District Heating (DH) or cooling network and/or a Turbine Generator (TG), see Annex 2 to this document.

In order to ensure a correct calculation of the R1-formula, measurement points have to be established at the system boundaries. A basic illustration of system boundaries and energy flows is provided in Annex 2 to this document.

2.2 Pre-treatment, post-treatment, conventional boiler and combined processes

Pre-treatment, post-treatment, conventional boiler, and combined processes shall not be included in the R1-formula system boundaries.

This is justified by the fact that pre-treatment is typically not included in the permit of the installation and is not an essential part of the incineration process. It is also not included in the plant efficiency (Pl ef) calculation formula BREF document, and apart from mixing the waste and crushing or shredding bulky wastes, in general is not essential for the incineration process in MSWI. Furthermore, it is listed as separate recovery operation (R 12) in Annex II to the WFD. R 12 operation can include preliminary waste treatment operations prior to recovery including pre-processing such as, inter alia, dismantling, sorting, crushing, compacting, pelletising, drying, shredding, conditioning, repackaging, separating, blending or mixing.

A similar approach applies to bottom ash (post)treatment, which also is not considered in the WI BREF Document and is classified in Annex II to the WFD as R 4/R 5 operation.

Classic boilers or combined processes (e.g. if the incinerator is coupled with a gas turbine) using conventional fuels included in the installation, if any, are also not included in the R1 system boundaries, even if they are connected to the incineration facility.

2.3 Processes outside the scope of the incineration facility permit

It is important to note that the R1-formula system cannot be extended outside the “incineration facility” nor the “installation” as defined by the permit, and that installations outside the responsibility of the operator are to be excluded from the R1 system boundaries, in particular because the operator has no authority there.

The technical unit used in the definition of the “incineration plant” (according to Art 3(4) WID) dedicated to the thermal treatment of wastes with recovery of the generated combustion heat, as specified in the corresponding WID permit, shall be the decisive factor as regards inclusion or exclusion of scope of a turbine for generation of electricity and their consideration in the calculation of the R1 efficiency.

Therefore, turbine generators set outside the boundary limits of the permit are excluded from the “R1-formula system”, so as are classic boilers or combined processes (e.g. if the incinerator is coupled with a gas turbine) using conventional fuels even if installed on the same site.

Existing plant permits may not be changed to include/exclude electricity production in order to reach R1 classification without corresponding plant modification.

3 Energy Flows and Single Factors of the Energy Efficiency Formula

E_w , E_f , E_i and E_{exp} must always be defined as energy flow at the system boundaries. In this context, E_w , E_f and E_i constitute the input to the system, whereas the output from the system to third parties and/or the grid is E_{exp} .

E_p as another important factor of the R1 formula is not related to system boundaries but is clearly defined by means of the formula itself.

It is important to emphasise that the R1 formula does not cover all energy flows that have to be counted for a full energy balance for the system and that the R1 formula is not calculating the boiler efficiency but is considering the part recovered and utilized from the energy generated at the boiler.

A compilation of examples of energy flows allocated to the different parameters is provided in Annex 3a to this document.

3.1 Equivalence factors

Equivalence factors as specified in the calculation formula apply to electricity and heat irrespective whether produced, imported, self-consumed or taken back into the system as

return flow or backflow. No equivalence factor applies for fuels (fuel-oil, gas ...), i.e. the factor is 1.

Electricity is to be multiplied with the equivalence factor of 2.6. The equivalence factor for heat (steam or hot water) is 1.1.

The equivalence factors for electricity and heat generation which are taken directly from the BREF WI can be explained as follows:

The factor 2.6 for electricity is based on an average European coefficient of coal plants with 38%, which means an energy demand of 2.6 kWh for the production of one kWh of electricity.

The factor 1.1 for generated heat is based on an average European coefficient of heat plants of 91%.

The factors of 1.1 and 2.6 are to be applied independently whether the energy is used outside or inside the R1 system boundary.

3.2 Energy produced - E_p

3.2.1 Definition of E_p

Annex II to the WFD defines E_p as “annual energy produced as heat or electricity”. It is calculated with energy in the form of electricity [...] and heat produced for commercial use [...].

“Produced” in this context is to be interpreted as “produced and utilized” in the meaning of the generated energy that is recovered and effectively used⁸ or the “part of the energy generated (...) reclaimed and used”⁹ (see) or “recovery of energy from waste” as stipulated in chapter 3.5.4, page 194 ff of the WI BREF document or BREF document (page 597). This is not restricted to the exported energy as in the “plant efficiency potential” or “output from the incineration facility” (PI ef)¹⁰ described in chapter 3.5.6 of the BREF, titled “data comparing energy required by, and output from, the installation”.

⁸ ECJ C-228/00, para 42.

⁹ ECJ C-458/00, para 34.

¹⁰
$$PI\ ef = \frac{(O_{exp} - (E_f + E_{tmp}))}{(E_f + E_{tmp} + E_{tre})}$$

In the BREF document (page 597) the formula is given for the total specific electricity produced in correlation to the quantity of waste incinerated: $N_{e\ sp\ prod} = (O_{e\ exp} + E_{e\ circ}) / m$.

This means that per quantity of waste the produced electricity is the sum of the total exported electricity and the circulated electricity divided by the quantity of waste. When this formula is applied for the total waste incinerated, it transforms to: $O_{e\ sp\ prod} = O_{e\ exp} + E_{e\ circ}$.

The same sort of a formula is given in the BREF document for produced heat. By combining the electricity and heat produced, the total energy produced can be calculated. This can be written as: $O_{prod} = O_{exp} + E_{circ}$ or $E_p = \text{exported} + \text{circulated energy}$.

This interpretation is confirmed by the Commission non-paper on the energy efficiency draft, issued during the negotiations of the WFD in the European Parliament and the Council, stating that “some operators suggest changing the meaning of E_p from gross amount of energy from the turbine/generator (the actual meaning in COM(2005)667) to the amount of energy actually exported to the grid“.

E_p thus includes the energy (heat and electricity) recovered from waste which is exported outside the R1 system boundary to third parties or to other uses within the installation, as well as the energy which is used inside the R1 system boundary, e.g. for heating up the flue gas before the chimney, but not including energy uses influencing the steam/heat production. This distinction is necessary to avoid double-counting of energy flows and is in accordance with table 10.98 of the BREF-WI (footnote 2-4) which is reflected in Annex 3a of this guidance. In order to be counted in E_p , operators shall prove that uses within the system boundary and within the installation are state-of-the-art and technically designed and operated in line with BAT (where relevant).

Note: To be counted in E_p , a commercial use needs to be given for heat. Exported heat shall only be counted in E_p if the operator can prove commercial use by means of valid contracts with third parties. Internal heat consumption (within the permit boundaries) shall also be regarded as commercial use, as it directly replaces primary energy which otherwise would have to be purchased (opportunity cost principle). All internal uses have to be documented in the calculation form as proof of utilisation.

In order to avoid double counting:

- The energy of the steam which is converted into electricity in the incineration facility to generate electricity which is counted as produced electricity cannot be counted as produced heat.*
- The electricity generated by a third party using the steam from the incineration facility is not to be counted as electricity but only as produced heat.*

¹¹ E_{circ} is circulated energy, energy that is produced and then circulated so that it is used in the installation.

3.2.2 Transport losses, inefficient use by third parties and transformation of heat into electricity by third parties

E_p is the energy produced by the incineration facility. The fact that energy is used inefficiently by third parties shall not be taken into account and shall have no effect on the R1 energy efficiency formula. The same applies in the case of energy losses due to transport of heat energy.

3.2.3 Backflows and return flows of generated energies

Backflows and return flows are energy flows (e.g. steam or warm water) that come back from the air- or water-cooled condensers as condensation water, from internal heat exchangers or from external customers in a closed circuit, e.g. from district heating or a power plant. Although strictly speaking not a “backflow”, fresh feed water added as make-up to compensate the blow down and water losses shall be counted with backflows.

Backflows from external sources shall be deducted from E_p as they directly lower the rate of energy recovery from waste. Backflows from internal sources shall be deducted from E_p if they origin from energy flows accounted for in E_p . Backflows from energy streams excluded from EP (see 3.2.1. para7) will not be deducted.

3.3 Fuel inputs - E_f

E_f is defined as annual energy input to the system from fuels contributing to the production of steam (GJ/year).

E_f includes only fuels. Fuels are “combustible non waste substances” (e.g. diesel, natural gas) compliant with the Fuel Quality Directive 2009/30/EC, used for start-up and shutdown of the incineration process, including fuels to maintain required temperatures $> 850^{\circ}\text{C}$ by using auxiliary burners.

Note that the energy of all waste, including RDF/SRF (Refuse Derived Fuel) or waste (exhaust) gas, is to be counted within E_w and not within E_f . This shall apply also to waste oil, although exclusively used in a burner, due to its definition as waste and the fact that it can only be used when the legally required incineration temperature has been reached.

During start-up, the period where fuel contributes to the production of steam (counting as E_f) starts when the steam generator is connected to the steam grid and lasts until the legal minimum flue gas temperature (required by the legislation and/or the permit) is reached. During shut down, it lasts until the steam generator is disconnected from the grid.

3.4 Other energy imported - E_i

E_i means annual energy imported excluding E_w and E_f (GJ/year).

E_i consists of electricity, other kinds of imported non fuel energy such as steam and hot water, and of the amounts of fuel used during start-up and shut down processes before connecting and after disconnecting to steam grid (i.e. that part which is not counted as E_f), the energy for

re-heating of the flue-gas for catalysts or after the flue gas cleaning systems (e.g. with gas or oil), as well as other energies imported for the use in the “incineration facility” plant which are not used for steam production are to be counted in E_i .

Avoid double counting: The condensate (or cold water) from the condensers or backflows returned from the export of steam (or hot water) are not counted in E_i , but are to be deducted from E_p .

Circulating heat and electricity for own uses of the incineration plant are part of E_p and are not to be counted in E_i .¹²

This aspect gives an incentive to incineration facilities to make use of the energy they produce (namely heat) and avoids that sophisticated flue gas treatment used to minimize air emissions (e.g. NO_x) would have a negative impact on the ability to reach the R1 efficiency.

In this context it has to be underlined that own energy consumption of an incineration facilities is limited by process design and that own energy consumption as well as minimum annual energy exports are clearly specified in the Waste Incineration BREF document in BAT No. 61, 62, 63, 66b and 68 which shall be taken into consideration and reflected in the corresponding plant permits (limitations for internal use and minimum export requirements set in the BATs are listed in Annex 3b).

3.5 Distinction between E_f and E_i

Distinction between E_f and E_i has to be made for fuel used by the burner for start-up and shut down. The consumption at the burner during start-up and shut down periods is roughly 50% without steam being produced (E_i) and 50 % with steam production (E_f).

Although specified separately in the calculation formula, in practice there is no need to make a distinction in imported fuel consumption between E_f and E_i because the numerator of the R1-formula requests the sum $E_f + E_i$. This corresponds to the totally imported energy for which data are readily available for operators.

The routine measurements performed by operators give direct access on the one hand to $E_w + E_f$ and on the other to $E_f + E_i$ which are the elements addressed by the R1-formula.

3.6 Energy contained in waste - E_w

Annex II of the WFD defines E_w as: “...annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year)”.

This comprises all types of waste acceptable at the MSWI plant as defined in IPPC and WID (see scope of the formula). This includes secondary fuels derived from waste as long as they have not reached their end-of-waste status (Art 6 WFD).

¹² Also circulating heat and electricity, which are excluded from the calculation of E_p (see chapter 3.2.1 and Annex 3a) shall not be counted as E_i .

E_w has to be calculated for waste entering the R1 system boundary, which means after pre-treatment, if in place.

Analysis of individual waste samples is not a feasible determination method because the amount of waste to be sampled and the frequency of sampling for a reliable outcome would be too high.

The best method for the determination of the energy content of the waste or the net calorific value (NCV) is a calculation with proven process data over longer time periods (energy balance).

The method relies on a European standard developed for the specific case of Waste-to-Energy incinerators in relevant reference documents¹³. These documents describe the detailed procedure for the Acceptance Test which is performed according to the methodology and principles of the European standard EN 12952-15 once in the course of the tests on completion of the plant and during which the efficiency of the boiler is determined.

The principle of the methods is to use energy balance on the furnace and the boiler considered together as a calorimeter¹⁴. Energy inputs equal energy outputs plus energy losses (in flue gas, in bottom ash, by convection and radiation). The main energy outputs are measured during the comprehensive “acceptance test” at the beginning of the life of the incineration facility (e.g. steam flow) and the small ones are assessed. Boiler efficiency gives the ratio between the energy output and the overall energy input.

For calculation and measurement details see annex 4 to this document.

The energy coming from the waste (E_w) is then obtained by deducting from the total energy input the energy of fuels contributing to the production of steam/hot water (E_f) used over the same period of time.

The average NCV of the waste is obtained by dividing this waste energy input by the waste flow entering the incineration furnace/combustion chamber over the corresponding period of time. E_w is equal to the NCV by the waste flow.

Alternatively, the NCV formula given in the BREF document (chapter 2.4.2.1 and Annex 10.4.2) can be used in justified cases if the formula has been adapted to the specific installation via an initial energy balance and if recalculated to standard oxygen. According to the BREF NCV is to be measured as follows: $NCV = (1.133 * (mst\ waste/m\ waste) * cst\ x + 0.008 * Tb) / 1.085$ [GJ/Mg(tonne) waste].

Although specified separately in the calculation formula, in practice there is in general no need to specifically determine E_w and NCV, because the denominator of the R1-formula requests the sum of $E_w + E_f$, which corresponds to the total energy input to the boiler that is directly calculated by the method using the boiler as a calorimeter (see above).

¹³ Acceptance Testing of Waste Incineration Plants with Grate Firing System’ Guideline Edition 04/2000 by FDBR. Available from FDBR in German and in English. Cahier des clauses techniques générales (CCTG) applicables aux marchés publics de travaux, Fascicule.’ approved by “Arrêté du 6 mars 2008” of “Ministère de l’économie, de l’industrie et de l’emploi. Available in French from Ministry of ecology:

¹⁴ The boundary limits of the system here (furnace and boiler) are different (narrower) than the R1 boundary limits considered in the other parts of the R1 guideline document.

4 Qualification Procedure and Monitoring of Compliance

Statements in this chapter are recommendations for an appropriate and harmonized procedure resulting from the discussion in the expert working group which accompanied the preparation of this guidance. Implementation and enforcement of monitoring remains the full responsibility of Member States.

The procedures for classification of municipal waste incineration facilities as either a 'Recovery operation' or a 'Disposal operation' have to ensure sufficient legal and planning security for operators.

In this context, it has to be taken into consideration that energy efficiency is largely dependent on the technical design of the facility and will only change to a limited extent during operation.

The status of a facility should be known before the waste is treated, well in advance before the treatment begins, in order to comply with the stipulations of waste management contracts.

4.1 Applicable factor for the classification as R1 operation

According to Annex II of the WFD, incineration facilities dedicated to the processing of MSW can be classified as R1 recovery operations where their energy efficiency is equal to or above:

- 0.60 for installations in operation and permitted in accordance with applicable Community legislation before 1 January 2009,
- 0.65 for installations permitted after 31 December 2008,

In this context the meaning of "installations in operation and permitted" as mentioned above shall include installations that had a permit and were in operation before January 2009.

The factor of 0.65 applies exclusively for installations permitted after 31 December 2008. It does not apply for existing plants with a modification in a part of the installation, e.g. in the combustion chamber/furnace, boiler, turbine generator set or flue gas cleaning carried out after 31 December 2008. Existing plants shall have the possibility to reach the threshold by adjusting their efficiency.

Modification is understood as any measure to increase the recovery of energy from the incinerated waste by improving the process conditions or by establishing additional uses. An increase in capacity shall not be regarded as modification in the abovementioned meaning.

4.2 Existing plants

For existing plants ("installations in operation"), the R1-formula shall be determined on the basis of practical annual performance data of the plant (see R1 calculation procedures below).

A plant having undergone constructive or contractual adjustments concerning the energy efficiency will follow the same procedures as a new facility.

4.3 New plants

For new plants, the R1 status shall initially be granted on the basis of the planning or construction specifications, considering the energy supply contracts and by determination of the general efficiency of the facility from an energetic view. This shall be achieved by means of a comprehensive “acceptance test”, determining the boiler efficiency made after commissioning, followed by a calculation on operational data made after one year in normal operation conditions on the basis of annual data.

4.4 R1 calculation procedures

According to Annex II WFD, the energy efficiency of the incineration facility is to be based on annual figures for energy production and energy consumption of the plant. This shall be understood as real practical performance and not as a theoretical maximized value which would not take into consideration periods of lower efficiency.

The calculation therefore shall be based on regular operation (including revisions) of the whole facility. The regular operation shall also include imperfect supply of electricity and heat because of lower demand.

The acquisition of data is made over a complete year. This is not necessarily a calendar year (i.e. the measuring period does not necessarily start on the 1st of January). The instruments and control equipment of the plant are maintained and controlled by the operator. Some data can be directly read from a counter as a sum, for instance fuel consumption and electricity produced. Some data require continuous computation and integration, for instance the energy of steam flows.

The R1 threshold shall be regarded as satisfied on the condition that:

- R1 calculated (with measured, assessed and corrected data);
- R1 threshold where ‘R1 threshold’ value is 0.6 for existing plants and 0.65 for new plants.

Calculation of the R1-formula on the basis of annual input and output data shall follow the exemplary calculation format provided in Annex 5 to this document.

4.5 R1 calculation procedures for multiple incineration lines

Multiple incineration lines are multiple facilities, and they can apply separately for the R1 status when the line(s) operate independently or the flows of each part of the plant can be clearly distinguished and calculated separately.

4.6 Approval of R1 calculation and allocation of R1 status

There are two different possibilities for initial calculation of the R1-formula.

- Calculation by the plant operator (with external control),

- Calculation by an external certified expert or an expert from competent authorities.

The R1-formula shall be either calculated or verified by an independent third person before it is presented to the competent authority of the EU Member State by the operator of the respective facility. In a normal operating year, the formula is calculated by the operator and submitted to the competent authority together with the details of the calculation. The competent authority shall receive the calculation sheet and, if needed, can carry out controls to verify whether the R1 formula is properly used. The competent authority can also request further information or verification by an independent expert, if needed. If the performance of an existing plant at initial application for R1 status is close to the threshold, the plant operator shall demonstrate to its competent authority that the R1 threshold was met over the past three years, using the mean value over the whole period (“gliding average” using two decimal places).

The R1 status of the plant shall be formally confirmed by the competent authority on the basis of the data required to calculate the R1 value and the R1 value calculated provided by the plant operators. When the calculated R1 value is above or equal to the threshold, the competent authority issues a certificate within three months attesting that the plant complies with the R1-formula condition.

4.7 Revision of monitoring results/ verification of R1 status

The calculation of the R1-formula and the statement of maintaining the energy efficiency level have to be presented on the basis of data of the preceding year (annual performance data as indicated above). The R1 classification of a municipal waste incinerator shall be confirmed by the competent authority to the operator for the running year in writing and in due time.

In order to guarantee smooth procedures and legal security, it is recommended that the confirmation is issued within 3 months from the date of the presentation of the operator's report. It shall be valid for the period of one year following the period for which the data has been provided. The operator shall annually report on the performance of the plant by means of a reporting form similar to the one presented in annex 5 to this document. This calculation shall be based on routine operator's monitoring results and cover the quantities of waste incinerated, quantities of fuel and imported electricity/heat consumed, electricity generated, heat used outside the incinerator facility. For the additional energy flows, lump sum data based on the previous R1-formula calculation of the plant might be used. The reporting shall be integrated into the reporting under Art 12(2)¹⁵ of the WID. The report shall be made available to the competent authority not later than one month after the calculation period agreed during the initial classification or any new classification.

Due to the fact that major features of an incineration plant do not change over time, the operator's report including annual monitoring results completed by information on any structural changes that occurred in the plant during the past year (e.g. technical modification, change of customers, etc.) allows the competent authority to conduct a routine validation and check if a comprehensive recalculation is necessary. If a new comprehensive recalculation is not necessary, the installation can keep its R1/D10 status.

¹⁵ An annual report to be provided by the operator to the competent authority on the functioning and monitoring of the plant shall be made available to the public. This report shall, as a minimum requirement, give account of the running of the process and the emissions into air and water compared with the emission standards in the WID.

A new comprehensive recalculation with external control or external expert is to be repeated after a maximum of 5 years, or in case of a substantial change of the basic conditions (modification of boiler, turbine generator, heat supply contract, the flue gas cleaning system) on which the first verification was based. If necessary, or in case of doubts, the authorities have the right to send inspectors or ask for any additional calculations/measurements they need.

4.8 Transitional periods, new application

It is the responsibility of the operator of the plant to provide sufficient certainty concerning a consistent achievement of the R1 threshold, even in case of modified circumstances for the plant's operation. Thus, an operator should aim at maintaining the energy efficiency well above the R1 threshold in order to be able to compensate for a modification in the conditions of operation. However, in case where an E-parameter changes due to circumstances which cannot be influenced by the plant operator (*force majeure*, e.g. loss of industrial heat consumer, unexpected climatic conditions, breakdowns or other outage periods) and the R1 threshold cannot be met in the annual reporting, the status of the plant will not be withdrawn immediately.

In such cases, the plant operator may – on the basis of the annual performance over the past three years – provide a justified statement why the threshold could not have been met. The plant operator will then be authorized to adjust/remediate in such a manner that the efficiency ratio complies with the thresholds again until the following year. If this result is achieved, the R1 status is maintained.

In case of a long-lasting breakdown or disturbance with significant impact on the efficiency (e.g. turbine breakdown or customer's failure), after expertise and assessment of the duration of the unavailability, the operator may: (i) give up the R1 status (and inform the competent authority thereof) and recover it as soon as the breakdown or failure is fixed (and calculate the R1 value over a year starting when the incineration facility is back to normal operation conditions); (ii) continue to try to achieve the R1 threshold.

When a plant cannot reach the R1 status or loses it due to not being able to meet the threshold in two subsequent reporting years, the operator can try again to obtain the R1 status by applying for a new test, after documentation of procedural changes or changed energy supply contracts.

4.9 Communication on R1 status in the context of transboundary shipment

The operator of a MSWI plant with R1 classification has to communicate the status of his plant to his clients by means of appropriate documentation (official certificate). In case of doubts, the competent authority can be asked for confirmation by other involved authorities and potential economic partners. A valid permit is a prerequisite for transboundary movement. The procedural requirements of the Waste Shipment Regulation should apply for MSWI with R1 classification as for any other facility.

ANNEX 1: The R1 calculation formula

The formula in the WFD is related to the plant efficiency formula (Pl ef) in the "Integrated Pollution Prevention and Control Reference Document on the Best Available Techniques for Waste Incineration", from August 2006 (hereinafter referred to as BREF document), Annex 10.4.5, as described hereinafter.

$$Pl\ ef = (O_{exp} - (E_f + E_{imp})) / (E_f + E_{imp} + E_{circ})$$

all figures as equivalents in accordance to BREF, Chapter 3.5.6

E_f = annual energy input to the system by fuels with steam production (GJ/y)

E_{imp} = annual imported energy (Note: energy from the treated waste (E_w) is not included)

E_{circ} = annual energy circulated

O_{exp} = annual exported energy (combined total of heat plus electricity as equivalents)

“If the result is higher than 1: This shows that the plant minus imported energy with steam production is exporting (BREF) or producing (ECJ C-228/00) more energy than that which is required to operate the total waste incineration process”

According to the BREF document, all amounts of energy (E_p, E_f, E_i, and E_w) are declared in GJ/a or MWh/a and equivalent values are used for heat and electricity in accordance to BREF, Chapter 3.5.6. Primary fuels are taken into account without equivalent value (i.e. with a factor of 1) because no conversion of energy is connected with it.

The R1-formula can be deduced from the energy calculation formulas presented in BREF WI (Annex 10.4.4) as follows:

The denominator of the boiler efficiency by heat/steam production in correlation to the total heat/steam producing energy input, taking into account energy losses due to bottom ash and radiation or to remaining carbon content in the residues which can technically not be avoided (factor 0.97). (BREF WI Annexes 10.4.4, page 599),

$$\eta_b(97\%) = \left(\frac{E_{h\ st\ boiler}}{0.97 * (E_f + E_w)} \right) * 100\%$$

was used to derive the denominator of the R1-formula “0.97 * (E_f + E_w)”.

The numerator of the R1 energy efficiency formula is related to the numerator of the boiler efficiency (E_{h st boiler}). However, instead of the total thermal energy (E_{h/st boiler}) generated by the boiler, only the energy (heat and or electricity) factually recovered - or in other words produced and utilized –from the waste, as the sum of the energy exported to third parties and the energy used within the installation forms the calculation basis for E_p. The numerator of the R1 energy efficiency formula can also be deduced from the numerator of the plant efficiency (Pl ef) formula Pl ef = O_{exp} – (E_f + E_{imp}). In contrast to Pl ef however, the recovery efficiency of an incineration plant according to the Formula in Annex II to the new WFD is based on the

energy in terms of heat and electricity factually utilized from the energy generated at the boiler (O_{prod}) and on the energy exported from the plant (O_{exp}). (For standardization purpose O_{prod} was changed to E_p and E_{imp} to E_i).

Energy efficiency = $O_{\text{prod}} - (E_f + E_{\text{imp}}) \Rightarrow E_p - (E_f + E_i)$. That means that the energy efficiency formula in the new WFD corresponds to the “recovery of energy from waste” as stipulated in chapter 3.5.4.1 and 3.5.4.2 (Tables 3.40 to 3.43) p. 195/196 of the WI BREF and not to the plant efficiency potential as described in chapter 3.5.6 titled “data comparing energy required by, and output from, the installation”.

The calculated R1-factor gives the relation between:

- (a) the energy recovered from waste (exported energy plus internally used energy) minus the imported energy, and*
- (b) the energy from waste plus other imported energy used for steam production.*

ANNEX 2: System Boundaries of R1-formula

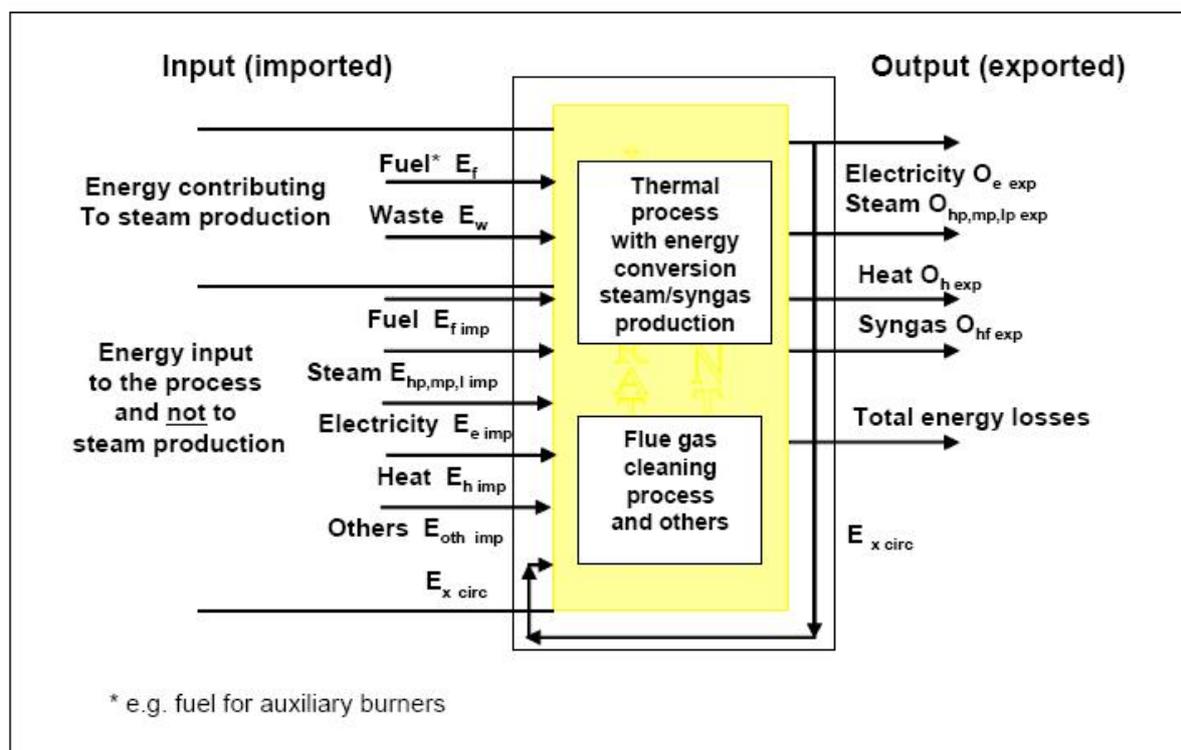


Figure 1: Energy efficiency system boundary according to BREF WI (Figure 10.14)

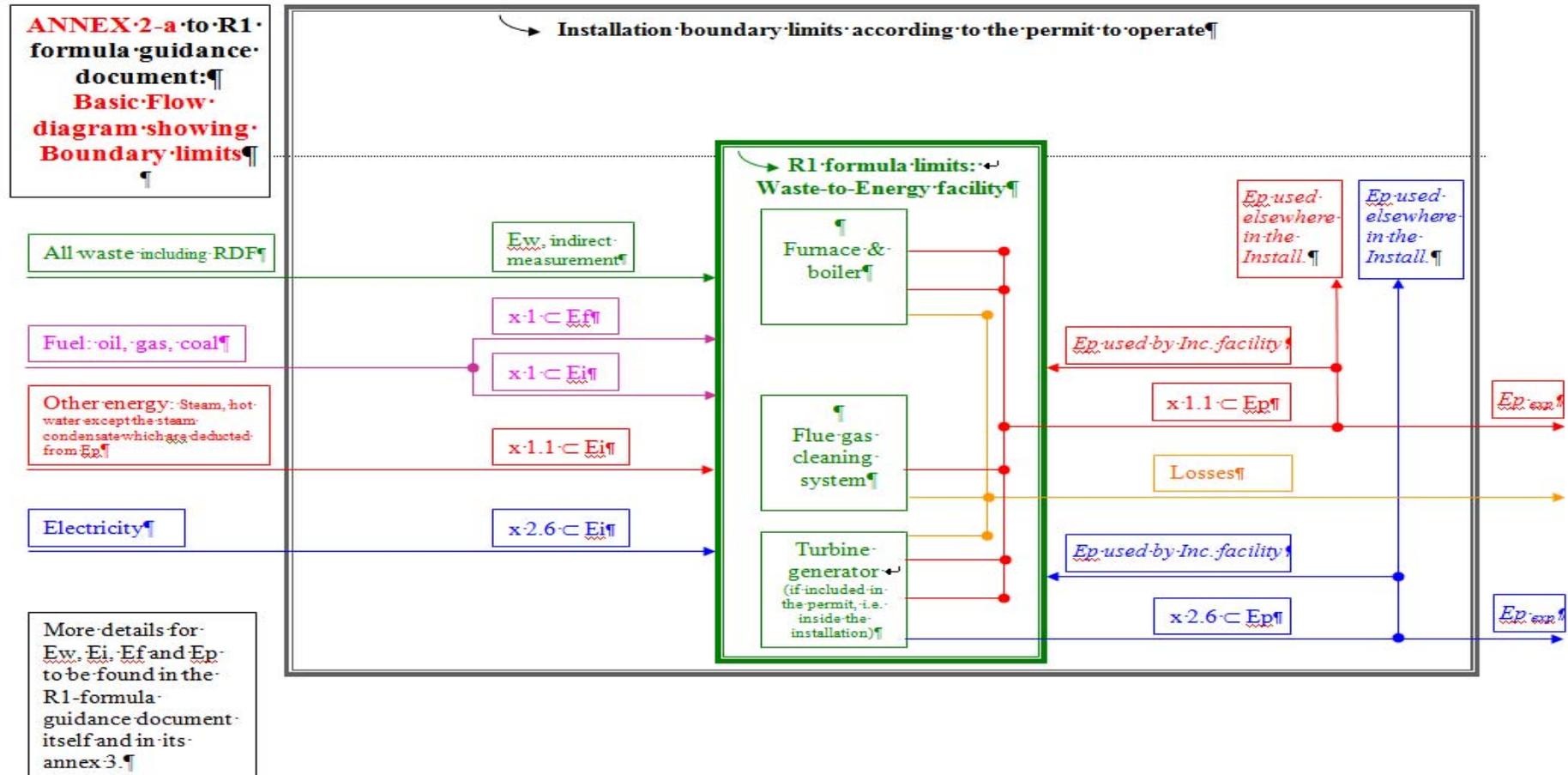


Figure 2: Distinction between R1 system boundary and permit boundary for MSWI (Source: CEWEP-ESWET-FEAD Proposal for a Guideline for the use of the R1 energy efficiency formula for incineration facilities dedicated to the processing of Municipal Solid Waste (Waste Framework Directive 2008/98/EC, Annex II, R1-formula), 30 Nov 2009.

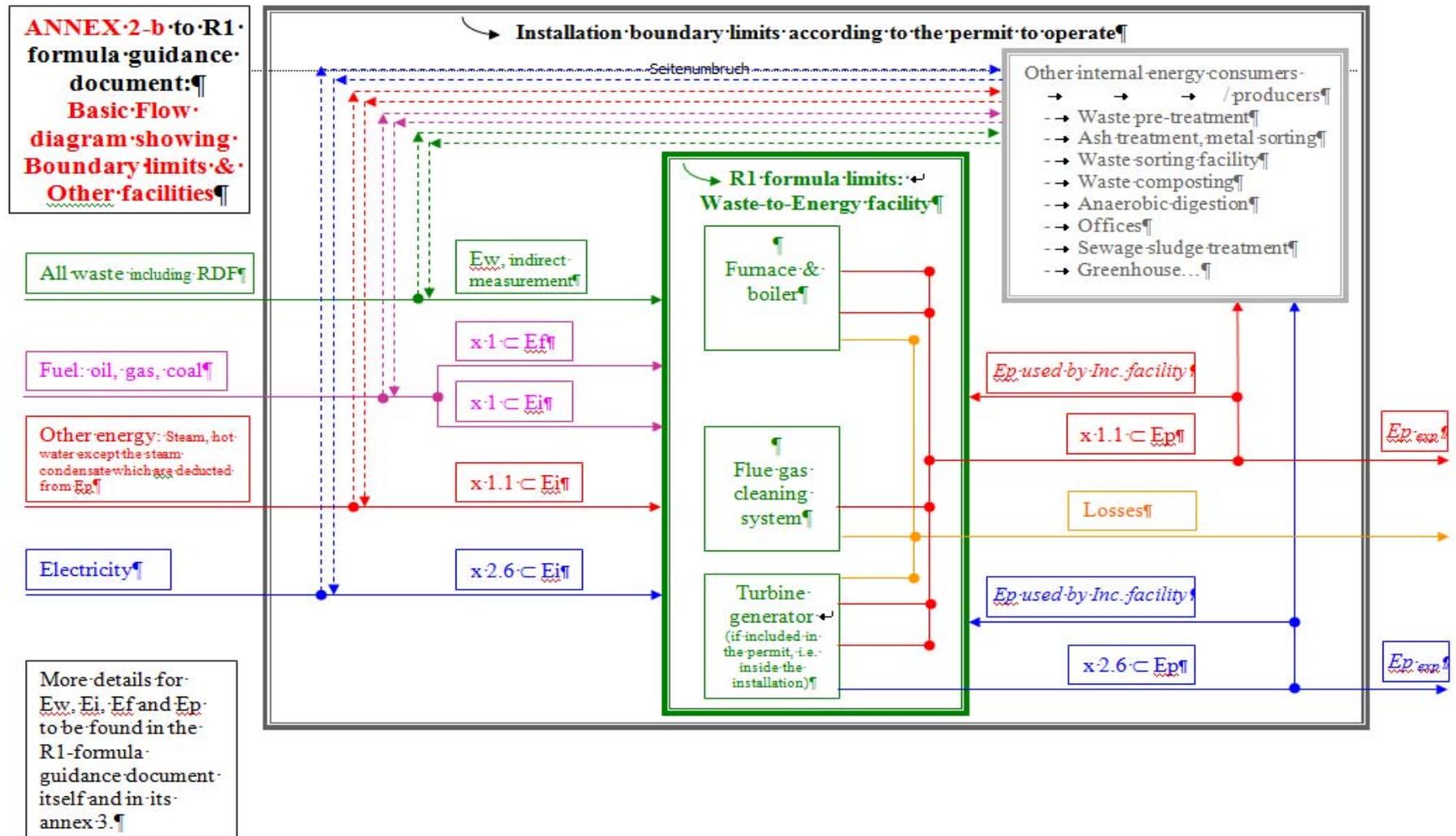


Figure 3: Other internal uses excluded from the R1 system boundary

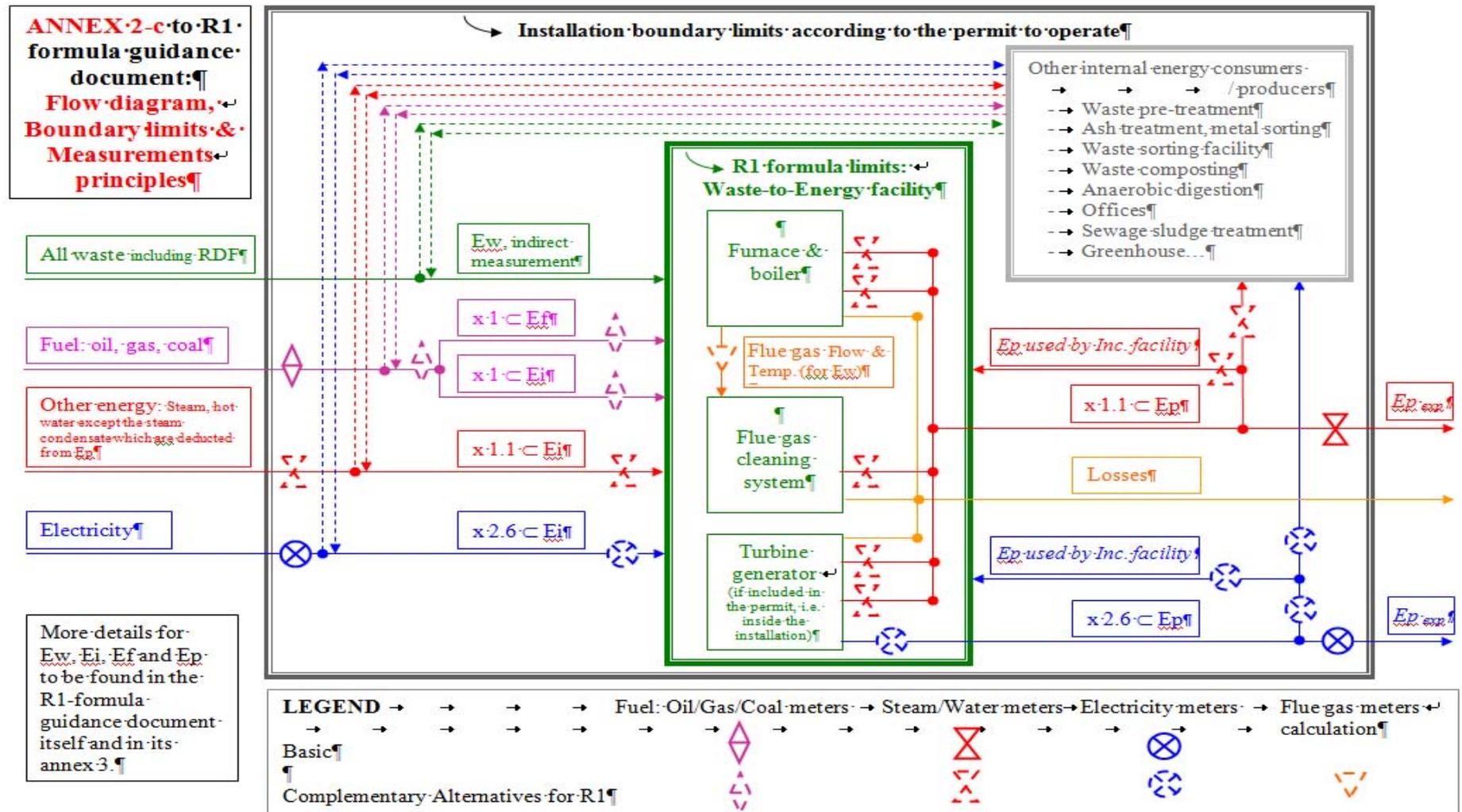


Figure 4: Position of measurement devices to determine energy flows relevant for the R1 calculation

ANNEX 3a: Energy to be counted in E_p , E_f and E_i

E_p	E_f	E_i
<ul style="list-style-type: none"> • Electricity produced (self use and delivery*) • District heating produced (self use and delivery*) • Process steam produced (self use and delivery*) • Other types of heating (local heat, mobile heat accumulator) • Incineration facility self use as electricity, steam/heat are e.g. <ul style="list-style-type: none"> - Energy used for evaporation or injection e.g. NH_4OH injection with steam, water for cleaning purpose or waste water from wet scrubbing - Energy used for soot blowers - Steam driven devices such as pumps, compressors, vacuum pumps - Energy used for steam trace heating - Electricity used for all electrical systems (pumps, motors, fans, compressors, trace heating, control systems etc.), buildings and infrastructure (e.g. illumination, air conditioning etc.) - Energy used for re-heating of flue-gas (before catalytic reactor, after scrubber, before fabric filter) - Use of condensing energy from the steam in the flue gas - Heat for concentration process (salt concentration, spray drier) - Energy used for Apparatus, silos and buildings heating incl. warm water feed (administration, social buildings, other constructions) 	<ul style="list-style-type: none"> • Support combustion with fuels for maintaining the minimal temperature/ incineration conditions • Start-up process with fuels starting when the steam generator is connected to the grid (usage of steam) • Shut-down process with fuels until decoupling of the steam generator with the grid (usage of steam) 	<ul style="list-style-type: none"> • Support combustion with fuels in the start-up- and shut-down processes without connection of steam generator with the grid. • Imported energy for re-heating of the flue gases, e.g. with in duct burner (oil, gas) before catalytic reactor (SCR) or scrubber • Import of electricity (e.g. plants without turbine)

* Energy “self use and delivery” means the energy used by the incineration facility and the energy delivered inside the installation to other users as well as the energy delivered outside of the installation.

ANNEX 3b: Relevant BAT to limit self demand and determine export minimums

Extract from: *Integrated Pollution Prevention and Control, Reference Document on the Best Available Techniques for Waste Incineration, August 2006*

Reference: 5.2 Specific BAT for municipal waste incineration

In addition to the generic measures given in Section 5.1, for municipal waste incineration BAT is in general considered to be:

61. the location of new installations so that the use of CHP and/or the heat and/or steam utilisation can be maximised, so as to generally exceed an overall total energy export level of 1.9 MWh/tonne of MSW (ref. Table 3.42), based on an average NCV of 2.9 MWh/tonne (ref. Table 2.11) 62. in situations where less than 1.9 MWh/tonne of MSW (based on an average NCV of 2.9 MWh/tonne) can be exported, the greater of:

a. the generation of an annual average of 0.4 – 0.65 MWh electricity/tonne of MSW (based on an average NCV of 2.9 MWh/tonne (ref. Table 2.11) processed (ref. Table 3.40), with additional heat/steam supply as far as practicable in the local circumstances, or

b. the generation of at least the same amount of electricity from the waste as the annual average electricity demand of the entire installation, including (where used) on-site waste pretreatment and on-site residue treatment operations (ref. Table 3.48).

63. to reduce average installation electrical demand (excluding pretreatment or residue treatment) to be generally below 0.15 MWh/tonne of MSW processed (ref. Table 3.47 and section 4.3.6) based on an average NCV of 2.9 MWh/tonne of MSW (ref. Table 2.11).

Reference: 5.3 Specific BAT for pretreated or selected municipal waste incineration

For pre-treated or selected municipal waste (including municipal refuse derived fuels) incineration BAT is in general considered to be:

66. at new and existing installations, the generation of the greater of:

a. an annual average of generally at least 0.6 – 1.0 MWh electricity/tonne of waste (based on an average NCV of 4.2 MWh/tonne), or

b. the annual average electricity demand of the entire installation, including (where used) on-site waste pretreatment and on-site residue treatment operations.

67. the location of new installations so that:

a. as well as the 0.6 – 1.0 MWh/tonne of electricity generated, the heat and/or steam can also be utilised for CHP, so that in general an additional thermal export level of 0.5 – 1.25 MWh/tonne of waste (ref. section 3.5.4.3) can be achieved (based on an average NCV of 4.2 MWh/tonne), or

b. where electricity is not generated, a thermal export level of 3 MWh/tonne of waste can be achieved (based on an average NCV of 4.2 MWh/tonne).

68. to reduce installation energy demand and to achieve an average installation electrical demand (excluding pretreatment or residue treatment) to generally below 0.2 MWh/tonne of waste processed (ref. Table 3.47 and section 4.3.6) based on an average NCV of 4.2 MWh/tonne of waste.

ANNEX 4: Determination of the Energy input ($E_w + E_f$) and of NCV

The ratio between the energy output and the energy input is the boiler efficiency and therefore:

$E_w + E_f = [(\text{Energy of steam or hot water} - \text{Energy of feedwater}) / \text{boiler efficiency}] - \text{Energy of combustion air,}$

Physical quantities required and related instruments:

- Steam or hot water flow and enthalpy (Flow meter, Pressure, Temperature) at boiler outlet (usual location; can be adapted if more favourable location elsewhere).
- Steam flows and enthalpy (F, P, T) extracted before the main steam flow meter if any, e.g. from the drum if the unit consuming it is external to the 'calorimetric system' boundary limits and if these flows cannot be calculated from design data parameters or lump sum values be agreed.
- Feedwater flow and enthalpy (Flowmeter if flow not calculated, Temperature), usually at economizer inlet.
- Sensible heat of primary and secondary combustion air. This can be taken from the Acceptance Test or a lump sum value agreed, typically 7 to 8% of ($E_w + E_f$) if primary and secondary air is pre-heated and 5 % if only primary air is pre-heated. If not possible: Flow meter, Temperature after pre-heating.

Physical quantities measurement:

- The physical quantities which are not re-calculated from other data nor taken as lump sum values are usually measured continuously.
- The corresponding energy flows can be calculated continuously by local counters or the plant CS (Control System) and averaged over the period of testing.

ANNEX 5: Example and calculation form for the determination of the R1 energy efficiency factor

	Type of energy	unit	Reporting year		
			amount [Mg(tonne)]	NCV [kJ/kg]	energy E_x [MWh]
1.1	amount of incinerated waste (without 1.2 and 1.3)		701,182	10,264	1,999,148
1.2	e.g. amount of incinerated sewage sludge		0		0
1.3	e.g. amount used activated carbon incinerated		0		0
1	E_w: energy input to the system by waste	MWh			1,999,148
2.1	E_{f1} : amount of light fuel oil for start up (after connection with the steam grid)	litre	335,834	42,000	3,370
2.2	E_{f2} : amount of light fuel oil for keeping the incineration temperature	litre	323,193	42,000	3,243
2.3	E_{f3} : amount of natural gas for start up and keeping incineration temperature	Nm ³			0
2	$S E_f$: energy input by imported energy <u>with</u> steam production	MWh			6.612
3.1	E_{i1} : amount of light fuel oil for start up/shut down (no connection with the steam grid)	litre	111,945	42,000	1,123
3.2	E_{i2} : e.g. natural gas for heating up of flue gas temperature for SCR and start up/shut down	Nm ³	0		0
3.3	E_{i3} : imported electricity (multiplied with the equivalence factor 2.6)		0		0
3.4	E_{i4} : imported heat (multiplied with the equivalence factor 1.1)		0		0
3	$S E_i$: energy input by imported energy <u>without</u> steam production	MWh			1,123
4.1	$E_{p_{el\ internal\ used}}$: electricity produced and internally used for the incineration process	MWh	-		82,807
4.2	$E_{p_{el\ exported}}$: electricity delivered to a third party	MWh	-		339,982
4	$S E_{p_{el\ produced}} = E_{p_{el\ internal\ used}} + E_{p_{el\ exported}}$	MWh			422,789
5.1	$E_{p_{heat\ exp.1}}$: steam delivered to a third party without backflow as condensate		11,750	3,023	9,867
5.2	$E_{p_{heat\ exp.2}}$: district heat delivered to a third party with backflow as condensate (hot water)				71,445
5	$S E_{p_{heat\ exported}} = E_{p_{heat\ exp.1}} + E_{p_{heat\ exp.2}}$	MWh			81,312

	Type of energy	unit	Reporting year		
			amount [Mg(tonne)]	NCV [kJ/kg]	energy E _x [MWh]
6.1	Ep _{heat int.used1} : for steam driven turbo pumps for boiler water, backflow as steam		42,831	397	4,723
6.2	Ep _{heat int.used2} : for heating up of flue gas with steam, backflow as condensate		120,404	2,225	74,416
6.3	Ep _{heat int.used4} : for concentration of liquid APC residues with steam, backflow as condensate		23,863	2,730	18,097
6.4	Ep _{heat int.used5} : for soot blowing <u>without</u> backflow as steam or condensate		38,026	2,918	30,822
6.5	Ep _{heat int.used7} : for heating purposes of buildings/instruments/silos, backflow as condensate		23,638	2,490	16,351
6.6	Ep _{heat int.used8} : for deaeration- demineralization with condensate as boiler water input		21,972	2,699	16,475
6.7	Ep _{heat int.used9} : for NH ₄ OH (water) injection <u>without</u> backflow as steam or condensate		10,517	2,918	8,525
6	S Ep_{heat int.used} = S Ep_{heat int.used1-9}	MWh			169,409
	$R1 = (Ep - (Ef + Ei)) / (0.97 * (Ew + Ef))$	[-]			
	$Ep = 2.6 * (S Ep_{el int.used} + S Ep_{el exported}) + 1.1 * (S Ep_{heat int.used} + S Ep_{heat exported})$	MWh	1,375,044.5		
	$R1 = ((2.6 * (422,789) + 1.1 * (250,721)) - (6,612 + 1,123)) / (0.97 * (1,999,148 + 6,612))$				0.703

Remarks:

- to 2.1 Amount of light fuel oil ($\rho_{foil} = 0,86$ kg/litre) during start up/shut down with steam production, determined from the light fuel oil demand during the relevant time period: connected to the steam grid but yet without release of waste into the furnace.
- to 2.2 Amount of light fuel oil ($\rho_{foil} = 0,86$ kg/litre) with steam production, during the relevant time period: keeping incineration temperature.
- to 3.1 Determined as difference out of total light fuel oil demand minus demand by 2.1 and 2.2.
- to 5.1 In this example there is no backflow of condensate, therefore difference of enthalpy equal to the enthalpy of middle pressure (mp) steam (advice: in case of backflow of condensate Dc is the difference out of enthalpy from delivered steam minus enthalpy of condensate).
- to 5.2 Amount of district heat determined from the quantity of transported hot water (deviation concerning the steam quantity about 3%).
- to 6.1 Steam driven turbo pumps for boiler water using high pressure (hp) steam, decompressing to low pressure (lp) steam; $\Delta c = 397$ kJ/kg.

- to 6.2 Heat exchangers for heating up flue gas are operated with middle (mp) pressure steam (13 bar). Depending on the fouling of the heat exchangers and throughput, so that the steam pressure is in the range of 9-12 bar. Only the difference of enthalpy, that means the enthalpy of mp steam (as average 10 bar) with backflow of the condensate into the condensate collecting tank (3.2 bar) and therefore on energy losses are taken into account (in the condensate collecting tank decompression to lp steam, which goes into the lp steam net).
- to 6.3 Liquid APC residues are treated with mp steam, condensate at 70°C flows back into the boiler (feed) water tank.
- to 6.4 Hp steam used for soot blowing with an energy demand of $\Delta c = 3,211 - 293 = 2,918$ kJ/kg. Amount of energy used for soot blowing taking part in the hp steam production was neglected.
- to 6.5 Heating of buildings e.g. administration, boiler houses and other sectors of the WtE plant as well as preparation of warm water for sanitary demand is processed by heat exchangers with lp steam. Backflow of condensate at about 70°C.
- to 6.6 Temperature of fresh water from the demineralization installation about 20°C. This energy shall only be considered, if it does not increase directly or indirectly the temperature of the feed water, used for energy generation (for details see chapter 3.2.1 of this Guidelines).
- to 6.7 NH₄OH injection with hp steam.

(Source: Based on Draft Guidance for the determination of the energy efficiency factor R1 (Waste Framework Directive 2000/98/EC, Annex II, R1-formula elaborated by ITAD in coordination with the German Environment Ministry and the Environment Agency, May 2009).

Energy Use in New Zealand Households – HEEP Year 10 Report

Authors:

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This Executive Summary provides a selection of the results from the HEEP Year 10 report – copies of the full report can be downloaded from www.branz.co.nz or purchased from the BRANZ Bookshop on the website. **Note that all the results, monitoring and analysis methodology reported here are copyright to BRANZ Ltd.** This is the 10th and final Household Energy End-use Project (HEEP) annual report. A final report to be published in 2007 will bring together (and update) earlier annual reports, providing definitive results for the future.

The goal of HEEP is to understand how, where, when and why energy is used in New Zealand homes. This knowledge is being used to develop a model of the residential energy sector to help improve energy efficiency, reduce greenhouse gas emissions and identify new energy efficiency opportunities.

The HEEP database now holds energy, temperature, social and physical house data on some 400 randomly selected houses from Invercargill to Kaikohe. Monitoring began in 1997 and was completed in 2005, with the majority of the houses (300) being monitored in the last three years. Each house was monitored for about 11 months. All fuels (natural gas, electricity, solid fuel, solar water heaters, oil and LPG) are monitored for each house. The database holds 10 minute data for each fuel, living room and master bedroom temperatures, social data on the occupants and house physical house data (floor plan, hot water system etc).

This report gives an overview of the HEEP project including: importance of collecting data; a review of energy end-uses; social impacts on solid fuel use; temperature and energy use in Māori HEEP households; fuel poverty; analysis of summer and winter indoor temperatures; standby and baseload electricity use; analysis of energy use in pre-1978 and post-1978 houses; faulty refrigeration appliances; electricity power factors; the development of the Household Energy Efficiency Resource Assessment (HEERA) model; the HEEP appliance ownership model; and a brief international comparison of domestic hot water systems.

Energy end-uses

HEEP data can now be used to provide a national breakdown of residential energy use by fuel type and end-use. Figure i provides a breakdown of energy supply by fuel type. Figure ii shows that on average, across all fuel types, space heating is the largest single end-use (34%), followed by hot water (29%), appliances (13%), refrigeration (10%), lighting (8%) and cooking (6%). The most important fuel source is electricity, while the most important space heating fuel is solid fuel (wood and coal).

Low temperature heat is the main (63%) use of household energy, providing space heat (34%) and water heat (29%).

Electricity provides three-quarters (75%) of energy used for hot water, with gas (20%) and wetback (5%) providing almost all of the rest. Seventy-seven percent of household hot water cylinders are electric – the highest proportion for any country. Combined with the high proportion of low pressure systems (72%) this creates a unique situation. The shift towards mains pressure gas hot water systems is likely to have a significant impact, not only on energy but also on water use.

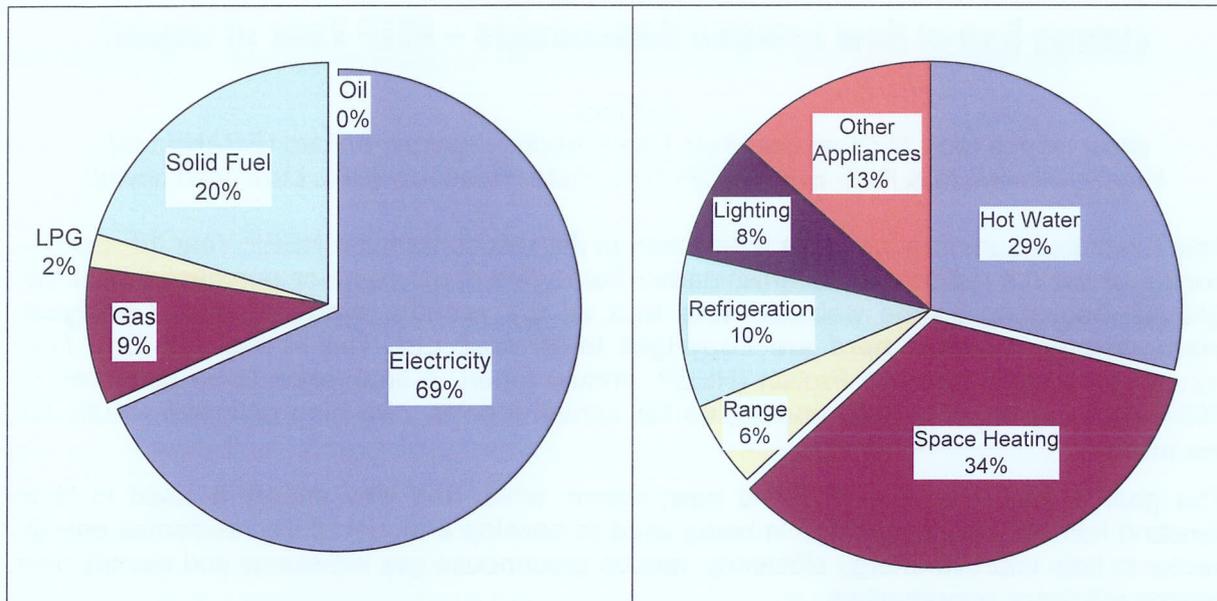


Figure i: Total energy use by fuel type

Figure ii: Total energy use by end-use

HEEP has identified solid fuel (56%) and electricity (24%) as the main space heating fuels. This has resulted in changes to the official New Zealand energy statistics (Ministry of Economic Development's (MED) Energy Data File).



Figure iii: A power station was hiding in the wood shed

The latest year report added to the national energy supply solid fuel equivalent to a 530 MW power station feeding conventional resistance heaters, or 180 MW feeding heat pumps (COP 3) (Figure iii). This increased wood from 5% to 14% of residential energy share, while reducing electricity from 82% to 69%.

The conversion of a house from one heating fuel to another is not a simple energy switch, as winter evening temperatures relate to fuel types. Houses heated by LPG or electricity tend to be the coolest, those with enclosed solid fuel heaters the warmest. The promotion of electric heating to replace solid fuel heating may have unforeseen impacts on the electricity generation, transmission and distribution system.

Other (non-low grade heat) uses are electricity dominated: appliances (13%), refrigeration (10%), range (6%) and lighting (8%) together account for 37% of total household energy use or 54% of household electricity use.

Fuel use per household	Bottom 20%		Top 20%	
	Use under kWh/yr	% of energy	Use over kWh/yr	% of energy
Electricity	4,860	10%	10,380	35%
Gas	2,580	5%	9,900	34%
Solid fuel heating	450	1%	5,740	57%
LPG heating	180	3%	1,110	50%
All fuels	6,940	9%	14,450	36%

Table i : Fuel use – top and bottom 20%

Patterns of fuel use are skewed, with large users consuming more in total than small users. Table i shows (across all fuels) the top 20% of households use over 14,450 kWh/yr or 36% of total energy use, while the bottom 20% use under 6,940 kWh/yr or 9% of energy use.

Total energy and electricity use per household appears to vary little by region, although the end-uses and the per occupant energy use differ. The report provides regional breakdowns for total, hot water and space heating energy use by fuel, and annual average energy use per house for selected end-uses. The report also provides a comparison of household electricity uses in 1971/72 with the HEEP sample.

Faulty refrigeration appliances

While installing monitoring equipment and surveying the HEEP houses, a number of old and potentially faulty refrigeration appliances were found. Visual inspection of the monitored data confirmed that a number of refrigeration appliances stayed on continuously for long periods of time. Even though insulation degrades or gets wet, coolant leaks, door seals fail, or the thermostat or controller fails, the appliance may continue to operate (i.e. make noise and keep food cool) for years. For refrigeration appliances there may be no obvious sign that the appliance is faulty and many people may not realise there is a problem.

Refrigeration appliances (refrigerators, combination fridge freezers and freezers) use, on average, (1,119±72) kWh per household per year, or approximately 15% of household electricity. About 7% of domestic refrigeration appliances are faulty, and 9% operate marginally. HEEP tested an overseas algorithm adapted to New Zealand refrigeration appliances, and it was found to reliably identify faulty refrigeration appliances.

There are also energy savings from replacement of older refrigeration appliances with modern appliances simply due to the improved energy performance. Over the past 26 years, the sales-weighted average energy use for fridge freezers has fallen by two-thirds, reflecting the impact of energy labelling and Minimum Energy Performance Standards (MEPS).

Power factors

Each year for three years electricity meters were used in three houses that reported both real and reactive power, also providing the power factor. The mean power factor varied from 0.76 to 0.97, with an overall mean of 0.86. The lower the power factor, the higher the load on the electricity system. The report provides power factor analysis for selected time periods.

Standby and baseload

Use	Load (W)
Standby	57±4
Heated towel rails	21±2
Faulty refrigeration	15±10
Minor loads	4±1
Lights left on	7±3
Remainder	8±12
Total	112±4

Table ii: Standby and baseload

The HEEP data has supported the first nation-wide statistically representative study of standby and baseload electricity use for any country. The baseload of a house is the typical lowest power consumption when everything that is usually switched off is off, while standby includes energy used by appliances while waiting to be used. On average these total (112±4) W continuous, with the breakdown given in Table ii. The 95% confidence interval is from 104 W to 121 W. Assuming 1.4 million houses, this is equivalent to about 160 MW of continuous load, or about 10% of the total