National Assembly for Wales

Energy from Waste
April 2012

The Landfill Directive and Waste Framework Directive place statutory limits on the proportion of waste that EU Member States can send to landfill. The waste hierarchy contained in this legislation states that energy from waste is a preferable waste treatment method to landfill.

This paper examines the policies that guide energy from waste in Wales, such as *Towards Zero Waste* and the *Bioenergy Action Plan* and compares them to equivalent policies in England, Scotland and Northern Ireland. There is a brief comparison between the UK and other EU Member States.

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Energy from Waste
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Lawrence Davies

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Research Service

Summary

Historically, Wales and the UK have sent the majority of waste to landfill. The *Landfill Directive 1999* and the *Waste Framework Directive 2008* (WFD) require EU Member States to limit the amount of waste sent to landfill. The waste hierarchy within the WFD sets out the preferred methods of sustainable waste management. Under the waste hierarchy, energy from waste (EfW) is a preferable waste treatment method to landfilling.

EfW refers to the production of heat and/or electricity from waste. A number of techniques are currently in use, including anaerobic digestion (AD), incineration with energy recovery, gasification/pyrolysis and Mechanical Biological Treatment (MBT). *Towards Zero Waste* and the *Bioenergy Action Plan* set out the Welsh Government's policy on EfW treatment facilities. Wales has set a 30 per cent cap on the proportion of waste to be sent for energy recovery by 2024/25. The Welsh Government favours AD as the preferred EfW technology for food waste as the biogas produced can be used directly for heat and electricity and the residual nitrogen-rich digestate can be used as a soil conditioner or crop fertiliser. The Welsh Government favours incineration with combined heat and power (CHP) for residual waste which cannot be recycled or composted.

Waste management policies in England, Scotland and Northern Ireland also support the use of EfW treatment technologies. England and Scotland are in support of AD of food waste and incineration with CHP for residual waste. The Northern Ireland Executive also acknowledges the importance of AD in moving towards sustainable waste management and a number of MBT plants are in place.

EU Member States favour incineration with energy recovery as the most commonly used EfW technology. The average proportion of waste sent to incineration facilities in EU Member States is approximately double that of the UK average.

Contents

1. Energy from Waste

The term **Energy from Waste (EfW) refers to the recovery of heat and/or electricity from waste**. If both electricity and heat is recovered from waste, the plant is known as combined heat and power (CHP). The energy recovered can be supplied direct to the National Grid where it is transported to houses or factories. The principal arguments set out in favour of EfW techniques are[1]:

- The amount of waste sent to landfill is reduced;
- The reliance on fossil fuels is reduced; and
- The energy produced from most techniques is classified as renewable.

Wales produces over 1.6 million tonnes of municipal solid waste per annum[2]. Waste is divided into source-segregated and non-source segregated waste. Source-segregated waste is waste that has been separated, for example, plastics, glass, paper, and metals for recycling, and food and garden waste for composting. Non-source segregated waste is the mixed-waste that remains in black bins, and is typically disposed of by landfill.

Several limitations have been identified with landfill as a waste management method, including a lack of additional suitable sites and the emission of greenhouse gases carbon dioxide (CO_2) and methane into the atmosphere[3]. EfW is a preferred waste management method over landfill. EfW can refer to several techniques, however, the most common are **anaerobic digestion, mechanical biological treatment, incineration with energy recovery and gasification/pyrolysis**.

1.1. Anaerobic Digestion

Anaerobic digestion (AD) refers to the natural biological process in which microorganisms indigenous to waste break down organic matter in the absence of oxygen (anaerobically) (Fig. 1)[4]. The **organic matter is broken down into a biogas made up of both CO_2 and methane**. The biogas produced can be used directly in engines for CHP, cleaned and used as natural gas or fuel, or burned to produce heat[5]. **Nitrogen-rich digestate is also produced**, **which can be used as a crop fertiliser or soil conditioner**. All energy produced from AD is classified as renewable.

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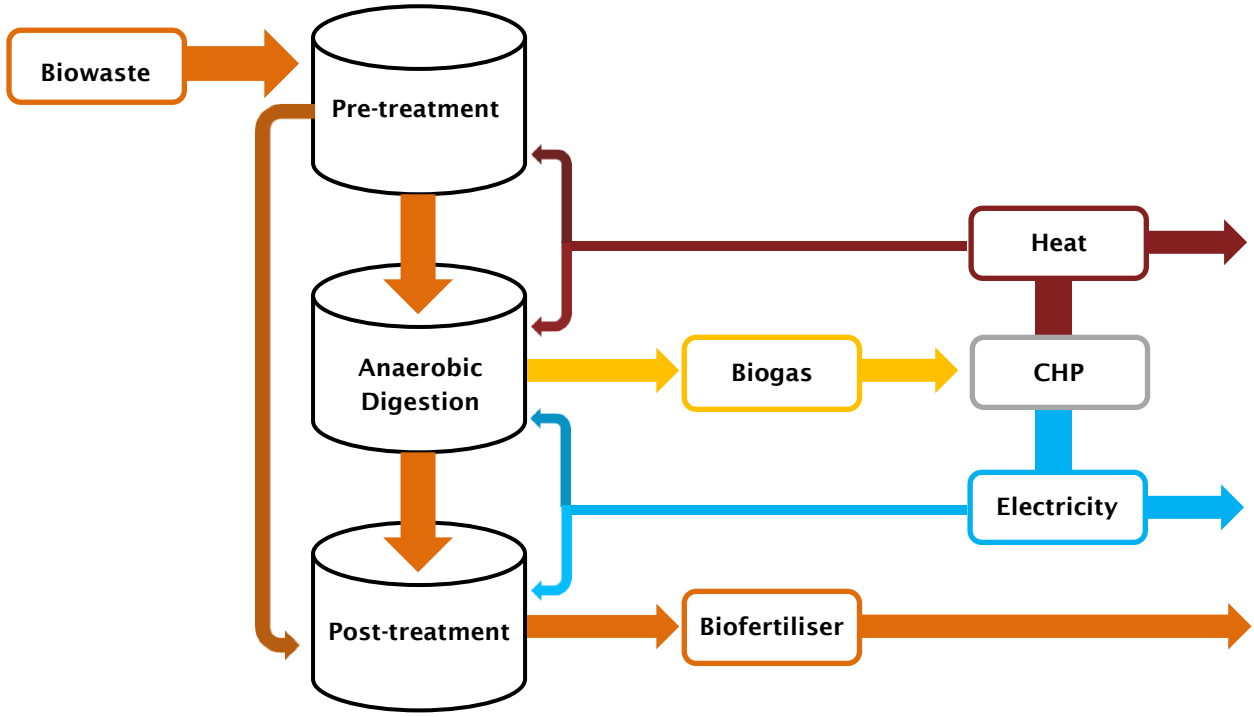
[1] Department for Environment, Food and Rural Affairs, **Anaerobic digestion strategy and action plan 2011: A commitment to increasing energy from waste through anaerobic digestion.** [accessed on 06 February 2012]
[2] Welsh Government, **Towards zero waste: The overarching waste strategy document for Wales 2010**. [accessed on 07 February 2012].
[3] **OJ L 182 , 16.07.1999**
[4] **The Wales Centre of Excellence for Anaerobic Digestion**. [accessed on 06 February 2012]
[5] ibid

Fig. 1: Schematic showing the process and products of anaerobic digestion.



Source: Defra[6]

AD has been used in the UK for over 100 years to treat sewage sludge[7]. Recently, AD has been applied to farm waste[8]. Manures and slurries are often recycled onto agricultural land as they are a rich source of nitrogen. The manures and slurries are often required to be stored due to restrictions on the period of application e.g. land that drains into water polluted by nitrate (Nitrate Vulnerable Zones) has restrictions on the timing and amount of nitrogen that can be applied to land[9]. However, by leaving storage tanks un-covered, there is an emission of methane, a greenhouse gas 23-times more potent than CO_2. Recently, AD has been applied to minimise the emission of methane during storage[10]. The Welsh Government considers that AD is the preferred technique for treating source-segregated food waste in Wales[11].

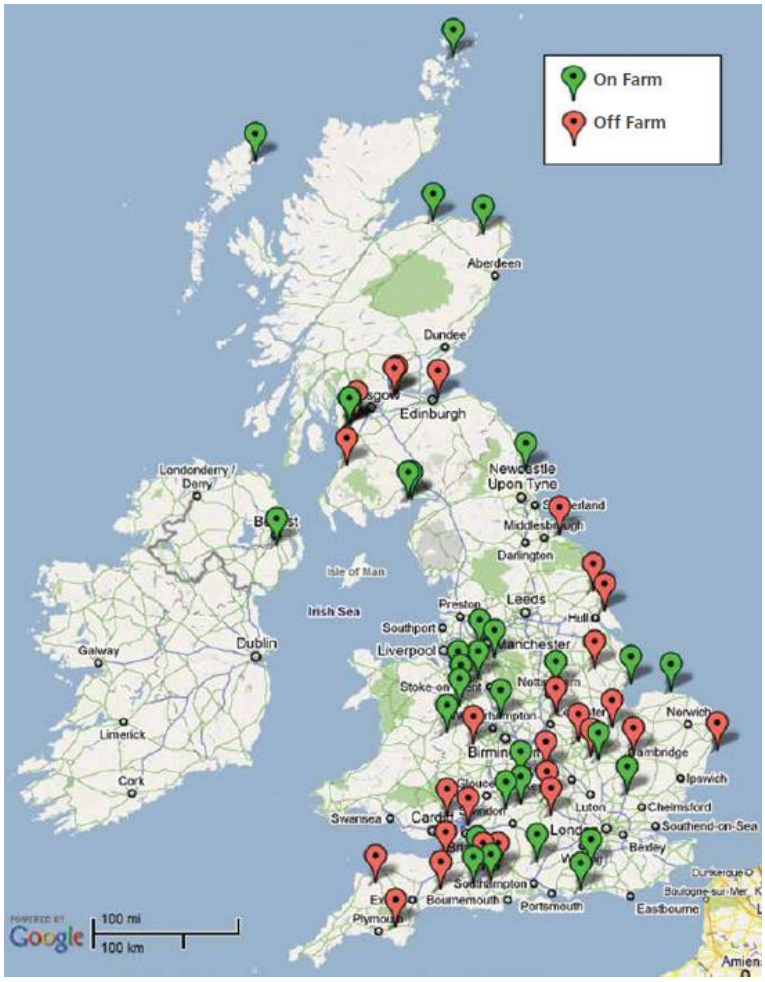
[6] Department for Environment, Food and Rural Affairs, Anaerobic digestion strategy and action plan 2011: A commitment to increasing energy from waste through anaerobic digestion. [accessed on 06 February 2012]
[7] ibid
[8] ibid
[9] Nitrate pollution prevention (Wales) (Amendment) regulations. SI 2010/489 (W.55). [accessed on 24 February 2012]
[10] Department for Environment, Food and Rural Affairs, Anaerobic digestion strategy and action plan 2011: A commitment to increasing energy from waste through anaerobic digestion. [accessed on 06 February 2012]
[11] Welsh Government, Towards zero waste: The overarching waste strategy document for Wales 2010. [accessed on 07 February 2012].

The Welsh Government's Consultation on a Bioenergy Action Plan for Wales 2009 estimates that there is potential for AD in Wales to treat[12]:

- 340 000 tonnes of food waste;
- 250 000 tonnes of agricultural slurry and food waste; and
- 37 000 tonnes of sewage sludge.

The Department for Environment, Food and Rural Affairs (Defra) has mapped the location of AD-plants in the UK that produce biogas (Fig 2)[13]. Currently, there is an operational plant in Newport, and two plants near the Welsh-English border[14].

Fig. 2: Anaerobic digestion facilities in the UK producing biogas as of 2011 (excluding sewage sludge plants and plants only used to treat farm waste).



Source: Defra[15]

[12] Welsh Government, **Consultation on a bioenergy action plan for Wales 2009**. [accessed on 13 February 2012]
[13] Department for Environment, Food and Rural Affairs, **Anaerobic digestion strategy and action plan 2011: A commitment to increasing energy from waste through anaerobic digestion.** [accessed on 06 February 2012]
[14] ibid
[15] ibid

1.2. Mechanical Biological Treatment

Mechanical Biological Treatment (MBT) refers to a group of technologies. MBT involves mechanically sorting the waste into individual components and some form of biological treatment, such as composting or AD with biogas production[16]. Approximately 60 per cent of waste remains as residue. The residual waste can be used as a low quality soil in land reclamation or sent to landfill, a process known as biostabilisation. Alternatively, the residual waste can be used to create refuse derived fuel, a process termed biodrying, which can be burned to produce energy[17].

1.3. Incineration with Energy Recovery

Incineration refers to the complete combustion of waste, creating steam which is used for CHP by powering a steam turbine[18]. Polyurethane plastics present in residual waste aid the incineration of other components without the need for additional fuel[19]. The polyurethane waste is reduced to approximately 1 per cent of its initial volume. This reduces the amount of waste to be sent to landfill. Dioxins and acid pollutants are treated and particulate matter is filtered before gases are emitted into the atmosphere[20]. **The energy produced from incineration with energy recovery is not always classified as renewable**.

1.4. Gasification/Pyrolysis

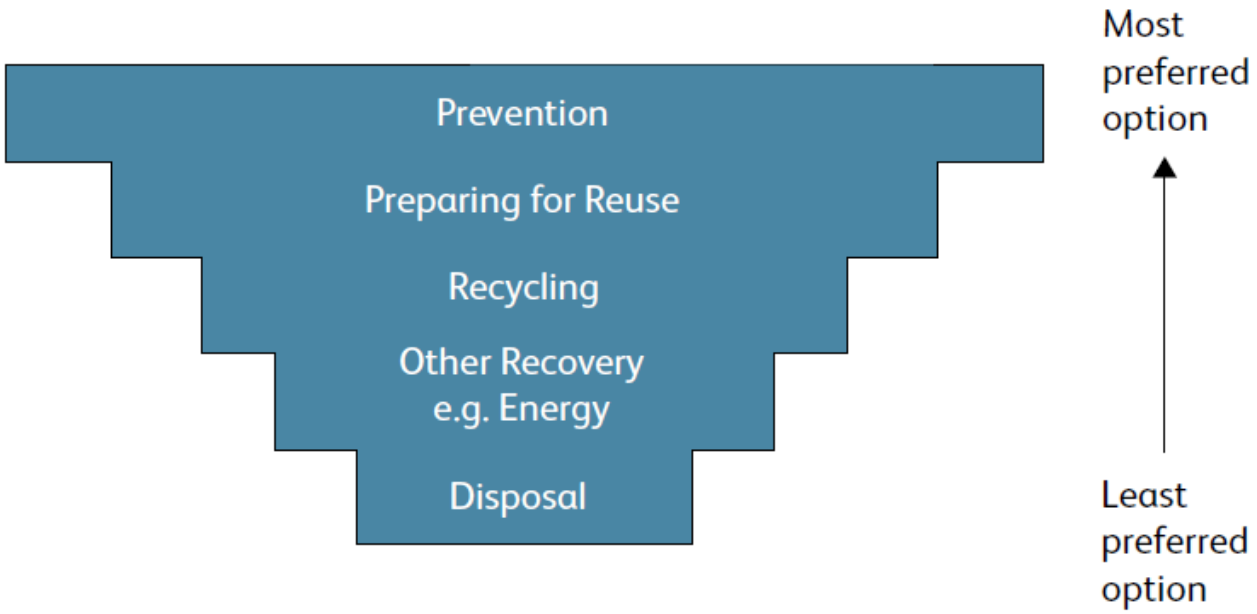
Gasification and pyrolysis differ from incineration in that the material is heated to a lower temperature and combustion does not take place, rather intermediates are created[21]. The two techniques differ in that pyrolysis refers to the anaerobic degradation of waste, whereas oxygen is present during gasification, although not enough to cause combustion. The main product of both techniques is syngas which is primarily composed of carbon monoxide and hydrogen (85 per cent), as well as CO_2, nitrogen, methane, and other hydrocarbon gases. The syngas is used to generate steam or electricity or as a feedstock in petrochemical and refining industries.

[16] Friends of the Earth, **Mechanical and biological treatment**. [accessed on 24 February 2012]
[17] ibid
[18] Prosiect Gwyrdd, **A partnership for sustainable waste management in Wales**. [accessed on 24 February 2012]
[19] The Environment Agency, **Energy from waste incineration**. [accessed on 06 February 2012]
[20] ibid
[21] Friends of the Earth, **Pyrolysis, gasification and plasma** 2009. [accessed on 24 February 2012]

2. Waste Management Directives and Legislation

There are several pieces of EU legislation that regulate waste management policies in Wales, including EfW. The *Waste Framework Directive* (2008/98/EC) (WFD)[22] is the European legislation designed to minimise the adverse effects of waste on human health and the environment. The WFD was transposed into law in Wales by the *Waste (England and Wales) Regulations 2011*[23] *(S.I. 2011 No. 988)*. **The WFD enshrines the waste hierarchy (Fig. 3) in EU law. The hierarchy ranks the preferred methods of waste management**[24]; preventing i.e. reducing waste, re-using and recycling being the most favourable methods. EfW is classified as 'other recovery', which is preferred over disposal to landfills (Fig. 3).

Fig 3: The waste hierarchy ranks the preferred method of waste management under EU legislation



Source: Welsh Government[25]

Waste management policies in Wales must also comply with the *Landfill Directive* (1999/31/EC)[26] which states that by 2020:

- Biodegradable waste must be reduced to 35 per cent of 1995 levels;
- All waste must be treated prior to landfill.

[22] OJ L 312, 22.11.2008
[23] The Waste (England and Wales) Regulations. SI 2011/988. [accessed on 16 March 2012]
[24] OJ L 312, 22.11.2008
[25] Welsh Government, Towards zero waste: The overarching waste strategy document for Wales 2010. [accessed on 07 February 2012].
[26] OJ L 182 , 16.07.1999

In addition, The *Packaging and Packaging Waste Directive* (94/62/EC)[27] must also be adhered to which sets out targets of 60 per cent recovery, 55 per cent recycling and 15-60 per cent recycling of each material.

3. Consent for Energy from Waste Facilities

EfW is covered by the EU *Waste Incineration Directive 2000/76/EC*[28]. The Directive has been transposed in England and Wales through the *Environmental Permitting (England and Wales) Regulations 2007*[29]. These regulations mean that thermal plants must have a permit from the Environment Agency to operate. The Environment Agency will only grant a permit for a plant to operate if it is:

> "…sure that the plant will be designed, constructed and operated in a way that will not significantly pollute the environment or harm human health".[30]

In addition to an environmental permit from the Environment Agency, EfW plants require planning permission. Even if a permit is granted, planning permission may not be. The Local Planning Authorities in Wales deal with planning applications for EfW plants that have a generating capacity of up to 50 Megawatts. Local authorities considering applications for EfW plants will be guided by the Welsh Government's national planning policy, *Planning Policy Wales*[31] which is supplemented with Technical Advice Note 8 on renewable energy[32]. Technical Advice Note 21 (Waste) sets out relevant national policies for waste management facilities, including location criteria to inform local planning policy and planning decisions[33].

The *Planning Act 2008*[34], as amended by the *Localism Act 2011*[35] requires any EfW projects above the 50 Megawatt threshold to be considered as Nationally Significant Infrastructure Projects and therefore applications for consent are considered under the UK Government's infrastructure planning process.

For projects above 50 Megawatts, the primary source of 'planning' guidance is the Department of Energy and Climate Change's Energy National Policy Statements[36]. Decisions on these larger EfW applications are made by the Infrastructure Planning Commission (IPC). From April 2012 they will be made by the DECC Secretary of

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[27] OJ L 365, 31.12.1994
[28] OJ L 332/91. 28.12.2000
[29] The environmental permitting (England and Wales) regulations. SI 2007/3538. [accessed on 24 February 2012]
[30] Environment Agency, Energy from waste – regulation. [accessed on 24 February 2012]
[31] Welsh Government, Planning Policy Wales edition 4. 2011. [accessed on 08 February 2012]
[32] Welsh Government, Technical Advice Note 8 – Renewable Energy 2005. [accessed on 08 February 2012]
[33] Welsh Government. Technical Advice Note 21 – waste. [accessed on 16 March 2012]
[34] Planning Act 2008. (Chapter 29). [accessed on 24 February 2012]
[35] Localism Act 2011. (Chapter 20). [accessed on 24 February 2012]
[36] Department of Energy and Climate Change, National policy statements for energy infrastructure. [accessed on 24 February 2012]

State, based on a recommendation by the National Infrastructure Directorate of the Planning Inspectorate (replacing the IPC).

National Policy Statement for *Renewable Energy Infrastructure (EN-3)*[37] covers any energy from biomass and/or waste over 50 Megawatts. *EN-3* states that AD is not expected to have an energy generating capacity over 50 Megawatts, and is therefore not covered separately under the policy statement. However, a range of waste and biomass combustion technologies are covered by *EN-3* including gasification, pyrolysis, grate combustion and fluidised bed combustion. *EN-3* sets out the technical considerations for the IPC to consider when processing applications for biomass/waste combustion plants[38]. This includes the applicant's assessment, IPC's decision making process and mitigation measures for air quality and emissions, landscape and visual, noise and vibration, odour, insect and vermin infestation, waste management, residue management, and water quality and resources[39].

4. Welsh Government Policy on Energy from Waste

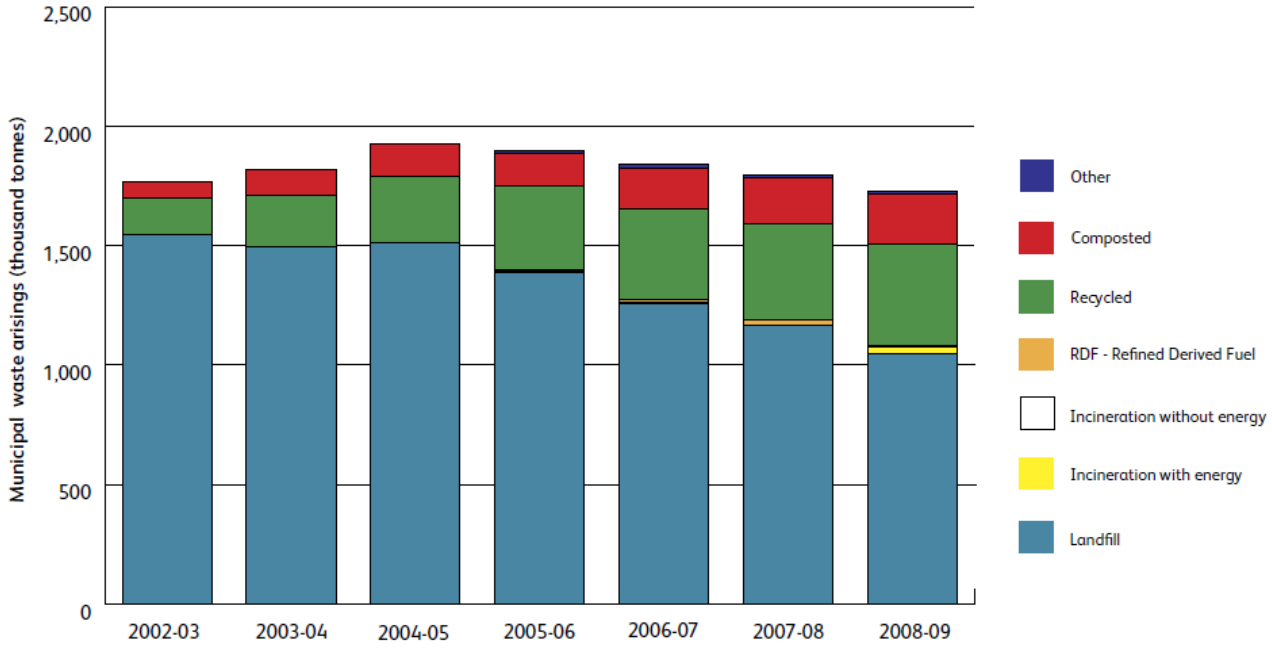
The Welsh Government has produced a number of policies and programmes on EfW, which are set out below.

4.1. Towards Zero Waste 2010

The Welsh Government published a Strategy for waste management, *Towards Zero Waste*[40] in 2010. The Strategy sets out the long-term framework for waste management and resource use efficiency in Wales until 2050. *Towards Zero Waste* states that by 2050, Wales aims to re-use or recycle all waste, without the need for any landfill or energy recovery, or as a minimum, reduce waste to 65 per cent of current levels[41]. Although it is specifically stated that in an ideal scenario EfW would not be implemented, ***Towards Zero Waste* also recognises the role of EfW techniques in the short to medium term plans for sustainable waste management in Wales**[42]. Fig. 4 shows there was a gradual increase in recycling and composting in Wales over time, however, by 2008/09 there is the start of the the use of EfW techniques (incineration with energy recovery) in waste management.

[37] Department of Energy and Climate Change, **National policy statement for renewable energy infrastructure (EN-3) 2011**. [accessed on 16 February 2012]
[38] ibid
[39] ibid
[40] Welsh Government, **Towards zero waste: The overarching waste strategy document for Wales 2010**. [accessed on 07 February 2012].
[41] ibid
[42] ibid

Fig 4: Waste management in Wales over time



Source: Welsh Government[43].

Towards Zero Waste states that Wales should recycle or compost 70 per cent of waste by 2025 and the remaining 30 per cent of waste should be treated through high-efficiency EfW treatment facilities[44]. **AD is the Welsh Government's preferred technology for the treatment of food waste[45], and incineration with CHP is preferred for the treatment of residual waste which cannot be recycled or composted**[46]. The Strategy quotes the Committee on Climate Change's view on AD which states that:

> "anaerobic digestion has significant potential to reduce greenhouse gas emissions" and "the use of AD is strongly recommended for source-segregated food waste.[47]"

The Strategy outlines the **Welsh Government's aim to work closely with businesses to create a market for the resultant digestate produced by AD**. This will reduce the production of nitrogen-based fertiliser, which is an energy intensive process. In line with the requirement for the Welsh Government to follow the waste hierarchy (Fig. 3), **the Strategy states that there should be a gradual reduction in the amount of municipal waste to be diverted to EfW facilities**

[43] Welsh Government, Towards zero waste: The overarching waste strategy document for Wales 2010. [accessed on 07 February 2012].
[44] ibid
[45] Welsh Government website, Food Waste Treatment Programme [accessed on 17 October 2012].
[46] Welsh Government website, Residual Waste Treatment Programme [accessed on 17 October 2012].
[47] Welsh Government, Towards zero waste: The overarching waste strategy document for Wales 2010. [accessed on 07 February 2012].

over time, from 42 per cent in 2015/16 to only 30 per cent in 2024/25, with the aim of phasing out all residual waste by 2050[48].

The Welsh Government's annual report on Sustainable Development 2010-2011[49] re-emphasises the aims set out in *Towards Zero Waste* in relation to EfW. The report outlines an increase in the *Sustainable Waste Management* grant from £59 million in 2009/10 to £72 million in 2010/11[50]. This funding was used to **focus on increasing the provision of a separate food waste collection by local authorities**. The collection of source-segregated food waste is considered to be an important step as the volume of food waste present in residual waste will be reduced and this waste can be processed in an AD facility.

4.2. Bioenergy Action Plan for Wales 2010

The *Bioenergy Action Plan*[51] sets out aims for the production of sustainable bioenergy and highlights the importance of EfW within this framework. The *Action Plan* explains the importance of EfW in the Welsh Government's proposals for tackling climate change, improving the local environment, the production and consumption of sustainable energy, and supporting rural development[52]. The report also sets out the **importance of supporting AD of biological waste in the shift towards bioenergy production**. Several of the Action Plan's targets relate to AD. These include:

- Supporting the establishment of AD facilities in Wales;
- Increasing farmers' awareness of the benefits of AD plants;
- The provision of centralised facilities; and
- Working with local authorities to educate communities on the benefits of EfW[53].

The Action Plan also sets out the Welsh Government's criteria for the use of EfW incineration with energy recovery facilities, stating their use is only acceptable provided[54]:

- Energy is only recovered from the residual waste that remains after as much
- compostable and recyclable material as possible has been removed;

[48] ibid
[49] Welsh Government, **One Wales: One planet - The sustainable development annual report 2010-2011**. [accessed on 07 February 2012]
[50] ibid
[51] Welsh Government, **Bioenergy action plan for Wales progress report 2010**. [accessed 07 February 2012]
[52] ibid
[53] ibid
[54] ibid

- It represents the best practicable environment option for residual waste; and
- It includes CHP and is consistent with the regional waste plan.

The Action Plan states that over the next ten years, local authorities waste processing facilities in Wales will be replaced with new facilities. It also highlights that funding has been allocated by the Welsh Government to support the treatment of food and garden waste[55]. Funding is also allocated for a parallel programme to treat residual waste which cannot by recycled or composted[56].

The Welsh Government's *Energy Policy Statement 2010*[57] sets out aims to deliver up to 6 kilowatt hours per day per person (kWh/d/p) of electricity or 2-2.5 kWh/d/p of heat from Biomass[58]. It is important to note that this includes energy from biomass crops in addition to waste, and it is expected that 50 per cent of the biomass will be imported. The Glastir[59] scheme supports several forms of renewable energy in Wales, including AD, through the Agricultural Carbon Reduction and Efficency Scheme (ACRES). The Scheme provides £5 million of capital funding per annum to selected farms in the Glastir scheme for projects that encourage renewable energy and energy efficiency on farms[60]

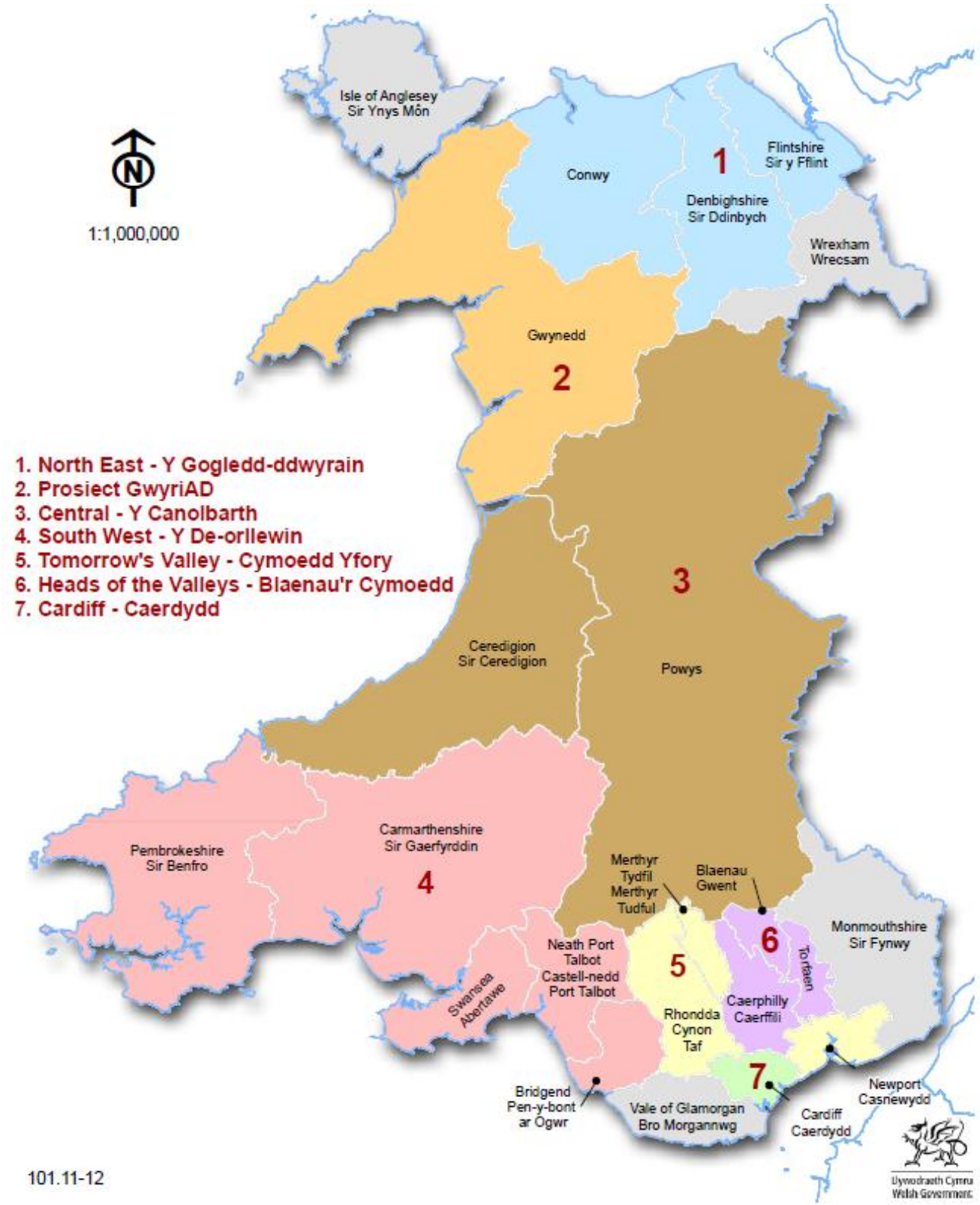
4.3. Waste Infrastructure Procurement Programme 2011

The Welsh Government's *Waste Infrastructure Procurement Programme*[61] is made up of the *Food Waste Treatment Programme* [62]and the *Residual Waste Treatment Programme*[63]. The two programmes aim to provide local authorities with advice and funding to develop new waste treatment facilities, including the AD of food waste and incineration with CHP of residual waste.

Local authorities in Wales are working together in groups to procure food waste and residual waste treatment infrastructure. The *Food Waste Treatment Programme* will see seven 'hubs' setup across Wales for the AD of food waste (Fig. 5). The *Residual Waste Treatment Programme* will run in parallel, with six 'hubs' across Wales. Incineration with CHP is considered by the Welsh Government as the technology with the greatest potential to process residual waste[64] (Fig. 6).

[55] Welsh Government, **Bioenergy action plan for Wales progress report 2010**. [accessed 07 February 2012]
[56] Welsh Government, **Residual waste treatment programme**. [accessed on 24 February 2012]
[57] Welsh Government, **A low Carbon revolution – The Welsh Assembly Government energy policy statement 2010**. [accessed on 14 February 2012].
[58] ibid
[59] Glastir is the Welsh Government's agri-environment scheme.
[60] Welsh Government, **Agricultural carbon reduction and efficiency scheme**. [accessed on 14 February 2012]
[61] Welsh Government, **Waste infrastructure procurement programme**. [accessed on 07 February 2012].
[62] Welsh Government, **Food waste treatment programme**. [accessed on 24 February 2012]
[63] Welsh Government, **Residual waste treatment programme**. [accessed on 24 February 2012]
[64] Welsh Government, **Residual waste treatment procurement consortia configuration**. [accessed on 24 February 2012]

Fig 5: Planned food waste treatment hubs in Wales



Source: Welsh Government[65]

[65] Welsh Government, **Waste infrastructure procurement programme – Food and organics waste treatment programme**. [accessed on 07 February 2012].

Fig 6: Planned residual waste treatment hubs in Wales

Source: Welsh Government[66]

[66] Welsh Government, **Residual waste treatment programme**. [accessed on 24 February 2012

5. Energy from Waste Policy in the UK and EU Member States

This section compares Welsh EfW policy to equivalent policies in England, Scotland and Northern Ireland, and compares the use of EfW in the UK to other EU Member States.

5.1. UK Government Review of Waste Policy in England 2011

The UK Government Review states that the waste hierarchy (Fig. 3) will direct England's waste policy. In relation to EfW the review states:

> "to get the most energy out of genuinely residual waste, not to get the most waste into energy recovery[67]."

Similar to the policy in Wales, the Review states that **AD is England's preferred technology to process food waste and incineration with CHP is highlighted as a potential for residual waste which cannot be recycled or composted**. Defra has published a separate Action Plan on AD technology[68]. The Strategy and Action Plan highlights important areas for further research in order to fulfil AD's potential in waste management and provision of CHP. In addition, the Strategy states that although Wales, Scotland and Northern Ireland are responsible for their own waste policies, the devolved administrations were consulted during the preparation of the Action Plan as AD is shared among the administrations as the EfW strategy of preference[69]. The Action Plan suggests that there is the potential for **5 million tonnes of food waste and 40 million tonnes of manures in England to be treated by AD facilities**, which could produce 3.5 TWh of electricity or **enough to supply over 900 000 households**[70]

5.2. Zero Waste Plan in Scotland 2010

The *Renewable Heat Action Plan*[71] for Scotland identifies EfW as having an essential role in providing sustainable energy generation and waste treatment. Similar to Wales and England, the Action Plan prioritises reducing, re-using and recycling waste, rather than EfW technologies[72]. The ***Zero Waste Plan***[73] **sets out the direction of waste policy in Scotland and has similar aims to the Welsh**

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[67] Department for Environment, Food and Rural Affairs, Government review of waste policy in England 2011. [accessed on 07 February 2012]
[68] Department for Environment, Food and Rural Affairs, Anaerobic digestion strategy and action plan for England 2011. [accessed on 07 February 2012]
[69] ibid
[70] ibid
[71] Scottish Government, Renewable heat action plan for Scotland – A plan for the promotion of the use of heat from renewable energy sources 2009
[72] ibid
[73] Scottish Government, Scotland's zero waste plan 2010. [accessed on 07 February 2012]

Strategy *Towards Zero Waste*[74], namely 70 per cent of waste is to be recycled and a **cap set for a maximum of 25 per cent of municipal waste to be diverted to EfW facilities** by 2025[75] (the cap in Wales is 30 per cent). However, the overall aim is to prevent residual waste altogether. The Action Plan also highlights the importance of using source-segregated food waste in AD facilities. The Sustainable Development Commission Scotland has produced a report on the *Energy from Waste Potential* in Scotland[76]. Assuming a 25 per cent cap on the proportion of waste diverted to EfW technologies, it was estimated that **3 per cent of Scotland's total heat and electricity demand could be derived from EfW**. Incineration with energy recovery and AD with biogas capture are the two techniques considered by the report as they can supply the greatest energy outputs. The report also highlights that, unlike energy derived from AD, not all of the energy produced by incineration can be considered renewable[77].

5.3. Bioenergy Action Plan for Northern Ireland 2010-2015

Waste policies from the Northern Ireland Executive also reference the methods proposed by the waste hierarchy (Fig. 3). ***Towards Resource Management*** [78] **is Northern Ireland's waste management strategy and it discusses the role of AD, incineration with energy recovery, pyrolysis and gasification in relation to EfW. The *Bioenergy Action Plan*[79] states that in Northern Ireland there is a wide network of MBT plants producing refuse derived fuel** and that thermal energy facilities are available to recover energy from refuse derived fuel. The Action Plan does not provide specific support for the priority of any individual EfW technique; however, it states that it is likely to be a mix of incineration with energy recovery, gasification, pyrolysis, AD and in-vessel composting. The Action Plan also states that

> "AD is not a known technology in NI and with current financial climate, funding of such projects is even more difficult."

However, there is also mention of **an increase in support for AD and advanced plans and support for an AD site** at Granville, Dungannon.

[74] Welsh Government, Towards zero waste: The overarching waste strategy document for Wales 2010. [accessed on 07 February 2012].
[75] Scottish Government, Scotland's zero waste plan 2010. [accessed on 07 February 2012]
[76] Sustainable Development Commission Scotland, Energy from waste potential in Scotland - quantifying the contribution energy from waste could make to Scotland's energy needs 2010. [accessed on 07 February 2012]
[77] ibid
[78] Department of the Environment, Towards resource management – The Northern Ireland waste management strategy 2006-2020. [accessed on 07 February 2012]
[79] Department of Enterprise, Trade and Investment, Bioenergy action plan for Northern Ireland 2010-2015. [accessed on 07 February 2012]

5.4. EU Member States

There are 420 EfW facilities across EU Member States[80]. **Incineration with energy recovery is the most common treatment method** and therefore only around 50 per cent of the energy produced can be classified as renewable[81]. The Consultants Coffey[82] have shown that approximately 30 TWh of electricity was produced from EfW treatment in 2009 supplying around 8 million households, in addition to 55 TWh heat[83].

Table 1 shows that in 2010 an average of 21.41 per cent of EU waste was incinerated, with 16.66 and 4.75 per cent incinerated with and without energy recovery, respectively. Incineration in the UK is approximately half that of the EU27 average with 11.56 per cent of municipal waste incinerated with energy recovery. However, Eurostat data shows that recycling in the UK is approximately equal to the EU27 average of 25 per cent[84]. Northern Europe has the most widespread adoption of incineration with Denmark, Norway and Sweden in addition to Switzerland treating approximately 50 per cent of municipal waste using incineration with energy recovery. There are several Eastern and Southern European countries where less than 1 per cent of waste is incinerated such as Bulgaria, Bosnia and Herzegovina, Estonia, Poland Greece, Latvia, Lithuania, Malta, and Romania. Germany is the only EU Member State where a greater proportion of incineration is without energy recovery, with 23.44 and 14.34 per cent of waste incinerated without and with energy recovery, respectively.

[80] Coffey International limited, **Energy from waste across Europe - Current statistics and trends**. [accessed on 07 February 2012]
[81] ibid
[82] Coffey is an international consultancy service specialising in geosciences, international development and technical analysis.
[83] Coffey International limited, **Energy from waste across Europe - Current statistics and trends.** [accessed on 07 February 2012]
[84] Eurostat, **Municipal waste generation and treatment, by type of treatment method 2010**. [accessed on 24 February 2012]

Table 1: Use of incineration with and without energy recovery in EU countries, EU candidate countries and EFTA countries (2010)

Country	Total waste (1000's tonnes)	Incineration with and without energy recovery (per cent)	Incineration with energy recovery (per cent)	Incineration without energy recovery (per cent)
EU27 average	**252, 095**	**21.41**	**16.66**	**4.75**
Belgium	5,074	34.41	34.35	0.06
Bulgaria	3,091	0.00	0.00	0.00
Czech Republic	3,334	14.91	14.85	0.06
Denmark	3,732	54.26	54.26	0.00
Germany	47,691	37.78	14.34	23.44
Estonia	417	0.00	0.00	0.00
Ireland	2,846	3.83	3.79	0.04
Greece	5,175	0.00	0.00	0.00
Spain	24,664	9.07	9.07	0.00
France	34,535	33.97	32.43	1.53
Italy	32,090	14.35	14.30	0.05
Cyprus	611	0.00	0.00	0.00
Latvia	680	0.00	0.00	0.00
Lithuania	1,253	0.08	0.08	0.00
Luxembourg	344	35.47	35.47	0.00
Hungary	4,129	9.83	9.83	0.00
Malta	246	0.00	0.00	0.00
Netherlands	9,887	32.66	32.66	0.00
Austria	4,960	29.54	29.54	0.00
Poland	12,038	0.85	0.00	0.85
Portugal	5,464	19.36	19.36	0.00
Romania	7,830	0.00	0.00	0.00
Slovenia	864	1.16	1.04	0.12
Slovakia	1,809	10.12	9.45	0.66
Finland	2,519	22.07	17.51	4.57

Country	Total waste (1000's tonnes)	Incineration with and without energy recovery (per cent)	Incineration with energy recovery (per cent)	Incineration without energy recovery (per cent)
Sweden	4,364	48.67	48.67	0.00
United Kingdom	32,450	11.56	11.54	0.02
Iceland	182	10.44	10.44	0.00
Norway	2,295	50.28	50.28	0.00
Switzerland	5,560	49.64	49.64	0.00
Croatia	1,630	0.00	0.00	0.00
Former Yugoslav Republic of Macedonia,	721	0.00	0.00	0.00
Turkey	29,733	0.00	0.00	0.00
Bosnia and Herzegovina	1,550	0.00	0.00	0.00

Source: Eurostat[85]

[85] Eurostat, **Municipal Waste**. [accessed on 19 March 2012]