

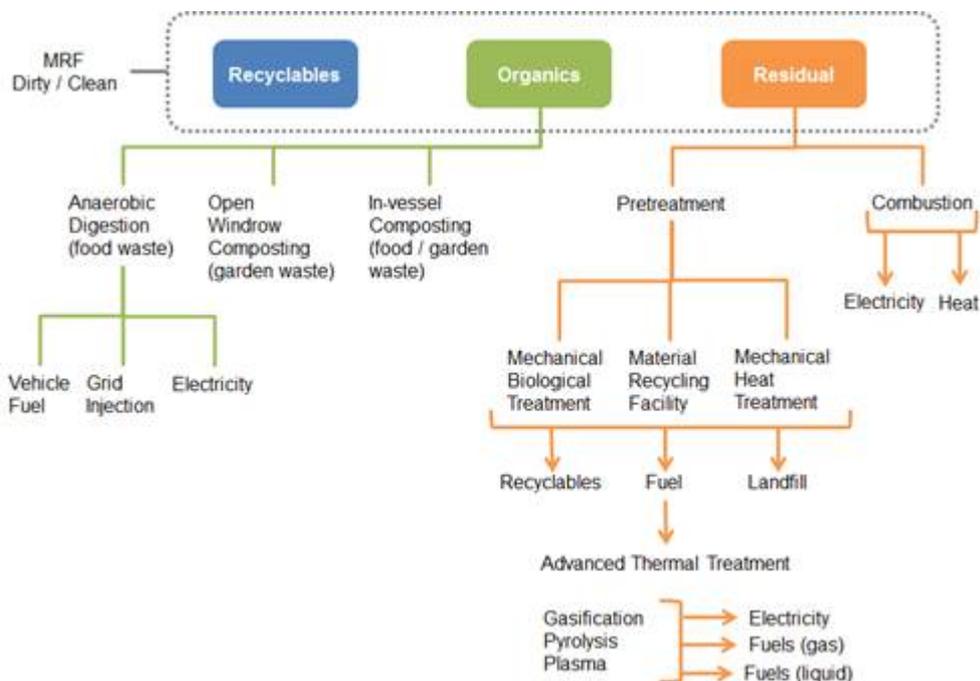
**APPENDIX A**  
**Waste Treatment Technology Descriptions**  
Final Study Report  
Oxford County  
SLR Project No.: 209.40447.00000

# WASTE TREATMENT TECHNOLOGY DESCRIPTIONS

## 1. OVERVIEW

Waste treatment technologies comprise a wide range of largely mechanical and electrical equipment components configured to undertake particular processes.

The schematic below illustrates the range of technologies used typical in waste treatment processes.



Following is a brief description of the key components and processes involved in the main technologies based on biological and thermal treatment.

## 2. MATERIALS RECOVERY FACILITY (MRF)

An MRF is a set of primarily mechanical equipment used to separate the different materials in waste collected for recycling. If the waste is not separated at source and contains wet organic wastes the MRF is termed a 'dirty' MRF, as distinct from an MRF treating dry wastes that is termed a 'clean' MRF. The only difference in the two types of MRF is the separation equipment used and degree of separation of the materials and their degree of contamination.

### Process Description

An MRF facility comprises an enclosed building in which the waste is processed and which allows the control of any potential odours when treating food wastes.

The building contains a range of mechanical/electrical equipment so arranged to assist the identification and removal of specified materials for subsequent recycling or to produce refuse derived fuel (RDF) or solid recovered fuel (SRF) for use in an energy production process<sup>1</sup>.

The equipment and process configuration will depend on whether the waste is mixed or pre-segregated but typically will comprise a bag opener, ferrous/non-ferrous metal magnets, size reduction/shredder, separation of heavies/lights, separation of paper/card and plastics and optical sorting of the different types of plastic. Most systems will also include a manual element, occasionally for primary sorting of some material types and more frequently as a QA control.

Further refining of the separated materials into specific types/categories may also be applied. The separated materials produced by a 'dirty' MRF will be of lower quality than a 'clean' MRF and command lower market prices, with the residual materials often used to produce RDF/SRF.

### **Outputs**

The output is the different types of separated materials with varying degrees of purity depending on the particular process configuration applied and whether a 'dirty/clean' MRF.

### **Pros**

- produces materials suitable for recycling;
- materials not suitable for recycling can be used to produce RDF/SRF;
- reduces quantity of waste sent to landfill.

### **Cons**

- separated materials may be contaminated and of poor quality;
- recycle material price subsequently achieved may be lower than expected.

## **3. MECHANICAL BIOLOGICAL TREATMENT (MBT)**

MBT is a hybrid process that uses mechanical treatment processes similar to those in an MRF to separate the organic fraction of the waste from the recyclable material fractions. MBT is used for mixed waste collections that include both food wastes and recyclable materials.

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<sup>1</sup> 'RDF' describes waste that has a relatively high calorific value but where the compositional quality and environmental parameters are not described in a standardized way. 'SRF' is a term used to describe a fuel produced from non-hazardous waste in compliance with European Standard EN 15359, and classifies the calorific value, ash, chlorine, as well as mercury and other heavy metals in the fuel.

The recovered organic fraction can be composted or used in an AD plant to produce biogas. The recovered materials are often of a low quality due to contamination with the organic fraction and often the materials are used to produce RDF/SRF.

### **Pros**

- recovers the organic fraction of mixed wastes for other uses e.g. AD;
- avoids landfilling of the organic content of the mixed waste;
- produces materials that may be suitable for recycling e.g. metals;
- materials not suitable for recycling can be used to produce RDF/SRF;
- reduces the overall quantity of waste sent to landfill.

### **Cons**

- separated materials may be contaminated, of poor quality and command low prices as recyclates;
- digestate produce from non-source separated organics may face regulatory issues regarding suitability for application to agricultural land.

## **4. BIOLOGICAL TREATMENT**

Two types of treatment are commonly used, based on the presence of air, aerobic i.e. composting and the absence of air, anaerobic i.e. anaerobic digestion (AD).

### **4.1. COMPOSTING**

Composting is a biochemical process during which the organic carbon in a material is broken down in the presence of oxygen by various types of microorganisms. Composting is a well proven commercially available technology used to process both green wastes and also food wastes.

The products are carbon dioxide (CO<sub>2</sub>) and water vapour. Composting can be undertaken in the open e.g. windrows, or in enclosed vessels. The material is turned on a regular basis (i.e. every 2-3 weeks), to ensure oxygen reaches the interior of the windrow to enable the microorganisms to function and provide the heat that sterilises the solid matter. In enclosed systems air is blown into the pile using underfloor vents.

The output is a compost material that can be used as a soil conditioner and contains nitrogen, potassium and phosphorus, depending on the feedstocks used.

Both green wastes and food wastes can be composted but composting food waste is usually undertaken in an enclosed vessel, to provide conditions to control vermin access, ensure sterilisation of the compost, and provide the ability to control odours.

### **Process Description**

The delivered green wastes are shredded to provide a uniform particle size and mixed to ensure a consistent proportion of green and woody materials, with the latter essential to

provide the porosity in the mixture to allow the ingress of oxygen to enable aerobic conditions to be maintained.

The mixture can be either formed into static windrows or placed in an enclosed vessel. Static windrows are turned every few weeks to ensure all of the composting mixture has access to oxygen. During the composting phase the temperature in the pile increases to approximately 60°C and once the active phase is completed the temperature reduces back to ambient over a period of a week or so as the composted organic material is stabilized. Following this stage a period of maturation<sup>2</sup> (or curing) is required in order to ensure that composted material does not damage plant health.

Material can also be placed in an enclosed vessel through which a controlled flow of air is either forced or drawn into the pile via under floor vents. After a number of days treatment the enclosed vessel is opened and the contents transferred to another vessel where the aeration process re-commences for another period of treatment to stabilise the composted organics.

Enclosed composting is used for food wastes to control both potential odour issues and access by vermin. The wet food wastes are mixed with sufficient woody green waste to provide the necessary porosity in the mixture to allow the movement of air through the pile. Forced aeration reduces the composting time significantly. Again, a suitable period of maturation is required.

## **Output**

The output of composting organic wastes is a stabilized material that will not undergo any further degradation. The benefits of compost as an additive to soil are to improve the soil's physical structure, enhance the soil chemistry and soil biology, clean up contaminants and binds heavy metals to prevent them being taken up by plants.

## **Pros**

- simple process that can be used to deal with large quantities of material;
- open windrows used for green wastes and enclosed composting for food wastes;
- variations exist with partly and fully covered windrows;
- subject to the treatment process applied the compost can be made suitable for application to agricultural or domestic land.

## **Cons**

- odour and vermin can be operational issues;
- some pre-processing of the waste is required e.g. shredding woody material and bag opening of food waste etc.;
- overall composting is a net energy user.

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<sup>2</sup> CCME PN1340 2005 includes guidelines for determining compost maturity, which will typically involve at least 3 weeks further aeration.

## 4.2. ANAEROBIC DIGESTION (AD)

Anaerobic digestion (AD) is a biochemical process during which complex organic matter is decomposed in the absence of oxygen by various types of anaerobic microorganisms. AD is a commercially well-proven technology, used widely for treating high moisture content organic wastes. As well as treating agricultural wastes such as animal manure, slurries and energy crops, AD can be utilised to treat waste-water and the organic fraction of municipal solid waste (MSW).

The main products of the process are a) biogas, a mixture of mainly methane (50-65%), carbon dioxide, water vapour and small quantities of other gases, such as hydrogen sulphide and b) digestate, which is the residual decomposed solid substrate which contains many nutrients and can be used as a synthetic fertiliser substitute.

Biogas is a combustible gas and can be used directly in a gas engine generator or turbine to produce heat and electricity. It can also be upgraded to a higher methane content by removal of CO<sub>2</sub>, hydrogen sulphide etc. for injection into the natural gas network and used for the same purposes as natural gas, or it can be compressed or liquefied and used as a vehicle fuel.

The energy content of biogas from AD derives from the methane and the composition and properties of biogas vary depending on the feedstock and type of digester, while the quantity of biogas produced depends on the digestion process (i.e. mesophilic [30-40°C] or thermophilic [50-60°C] and the residence time in the digester/fermenter). Biogas with 50% methane content has a heating value of 5kWh/Nm<sup>3</sup> and density similar to air i.e. 1.20 kg/Nm<sup>3</sup>.

The digested substrate, termed digestate, is a soil fertiliser, with moderate levels of nitrogen, phosphorus, potassium and micronutrients, subject to the feedstocks processed.

### Process Description

An AD plant comprises a variety of elements with the layout of a plant dependent on the types and amounts of feedstock to be processed. As many different types of feedstock are suitable for digestion, there are correspondingly different techniques for pre-treating feedstocks and different digester designs and systems of operation. Depending on the type, size and operational conditions of a biogas plant, a range of technologies are used for conditioning, storing and utilizing the biogas.

The main process stages involved in a biogas plant comprise elements of the following list:

- Feedstock
  - delivery
  - storage
- Feedstock preparation
  - crushing
  - maceration

- sorting
- pasteurization (can be pre or post digestion)
- mixing
- Digestion technology
  - wet digestion
  - dry digestion
- Biogas processing
  - desulphurisation
  - drying
  - upgrading to biomethane
  - gas storage
- Gas utilisation
  - power
  - heat
  - CHP (electricity and heat)
  - gas grid injection
  - vehicle fuel
- Digestate
  - dewatering
  - solid/liquid storage
  - land application as fertiliser and soil conditioner.

A wide range of different biomass types can be used as substrates/feedstocks for production of biogas from AD. The most common categories are:

- animal manures and slurries;
- agricultural residues and by-products;
- post production organic wastes from food and agro industries (i.e. vegetable and animal origin);
- organic fraction of municipal waste and from catering (i.e. vegetable and animal origin);
- sewage sludge;
- energy crops (e.g. maize, rye, sorghum, clover etc.).

## Outputs

The two outputs from AD plants are biogas and digestate that can be utilized as follows:

- biogas: used to generate electricity and heat in a combined heat and power (CHP) unit;
- biomethane: upgrading biogas to biomethane using various technologies and grid injection;
- compressed/liquefied biomethane: upgraded biogas for use as a vehicle fuel;
- carbon dioxide: recovered from upgrading to biomethane for use in food/manufacturing industry;

- digestate: solid and liquid fractions used as a fertiliser/soil conditioner on agricultural land in lieu of chemical fertilisers.

### **Pros**

- able to treat locally generated food wastes to produce power/heat;
- can treat manures and agricultural residues with added food waste;
- can add energy crops or I,C&I organic wastes to boost biogas output;
- biogas can be utilised in gas engines, gas turbines, fuel cells;
- biogas can be upgraded to a natural gas quality fuel for grid injection;
- overall a net energy producer while still producing a soil conditioner/fertiliser;
- solid digestate fraction is a source of slow release nitrogen and the liquid digestate a source of fast release nitrogen.

### **Cons**

- subject to the feedstock source, pre-preparation of the feedstock may be needed;
- subject to local regulations, pasteurization of food waste derived digestate may be required before application to land.

## **5. THERMAL TREATMENT TECHNOLOGIES**

Thermal treatment encompasses both combustion that is undertaken in the presence of oxygen and Advanced Thermal Treatment (ATT) technologies that are undertaken using limited (i.e. gasification) or no oxygen (i.e. pyrolysis).

These technologies offer the option to treat residual carbon-containing wastes and to recover the intrinsic energy contained in the carbon present in the waste. The technologies differ in how the energy is liberated for recovery. Combustion releases the energy in the waste directly by oxidising the carbon to produce a mixture of mostly 'hot' carbon dioxide and nitrogen, whereas both gasification and pyrolysis thermally treat the waste to generate a synthetic gas (syngas) and varying amounts of liquids (tars/oils) and solid (char), from which energy can be generated by combustion.

Thermal plants with energy recovery are known as both wastes to energy (WtE) and energy from waste (EfW) plants.

### **5.1. COMBUSTION**

In a combustion plant the waste is burnt on a grate to produce hot combustion gases that pass to a boiler to capture the heat and convert the heat into steam for use in a steam turbine, or to heat hot oil for use in an organic Rankine cycle (ORC) unit to produce electricity and steam.

The combustion exhaust gases undergo treatment in an air pollution control system to remove particulates and unwanted gaseous compounds to meet regulatory emission limits before release to atmosphere via the exhaust stack.

The waste feedstock can be either raw, untreated MSW, IC&I wastes, residual MSW after recovery/removal of recyclates, or a pre-treated feedstock such as RDF or an SRF. SRF is an RDF fuel produced to specified levels of CV, ash, heavy metals and chlorine content etc.

Raw MSW typically has an energy content or calorific value (CV) of 8-11MJ/kg, whereas RDF and SRF typically are 12-35 MJ/kg. Where raw MSW is processed into RDF the increase in energy content of the RDF is achieved primarily due to drying of the waste (i.e. removal of water) and removal of recyclates (e.g. glass, metals, plastics etc.) and inert materials (stones etc.) that do not contribute to the waste's calorific value CV. The remaining waste going into RDF/SRF comprises wastes with a significant CV (i.e. plastics, dried biodegradable materials, textiles etc.). RDF/SRF produced from source-separated MSW wastes and commercial wastes will have a greater CV than from raw MSW.

To allow complete combustion to take place sufficient oxygen is required to oxidise fully the carbon in the waste. Combustion plant temperatures are typically 850°C and the waste is converted into primarily carbon dioxide, water and ash, together with the inert nitrogen present in the combustion air. Non-combustible materials (e.g. metals, glass, stones etc.), remain on the combustion grate as a solid, known as bottom ash, which contains a small amount of residual carbon, usually <3% by mass. Particulates removed from the exhaust gases are termed air pollution control residues (APCR) and contain the majority of the heavy metal contaminants present in the waste.

Combustion technology is a well-proven, robust technology, able to treat a wide range of solid wastes.

## **Process Description**

The design and configuration of a combustion EfW plants differ between technology providers but any plant will comprise the following key elements:

- waste reception and handling;
- combustion furnace;
- energy recovery plant;
- exhaust gas clean-up;
- emissions monitoring of exhaust combustion gases;
- bottom ash and APCR handling.

### Waste reception and Handling

Waste is normally delivered via a waste collection vehicle and tipped into a bunker where it is mixed to blend the incoming wastes to ensure a consistent CV of the waste fed to the combustion chamber and to remove any gross contaminants (i.e. engine blocks, metal beams etc.).

### Combustion Chamber

Four main types of combustion technology are employed to burn MSW/RDF/SRF:

1. Moving Grate
  - a. roller grate;
  - b. stepped inclined grate;
  - c. inclined counter rotating grates.
2. Fixed Grate
3. Fluidised Bed (FB)
  - a. bubbling FB;
  - b. circulating FB.
4. Rotary Kiln.

### Energy Recovery

The standard approach to recovery of energy from the combustion of wastes is to use the heat produced and collected by a boiler to produce steam. Of the total available energy in the waste up to 80% can be retrieved in the boiler to produce steam. The steam can then be used for power generation via a steam turbine and/or used for heating. Energy recovery producing both heat and power (i.e. combined heat and power, or CHP), is the most efficient option for utilizing recovered energy from waste via a steam boiler.

Combustion plant producing exclusively heat can have a thermal efficiency c.80% and when used to raise steam for generating electricity the overall gross efficiency of energy conversion in an EfW plant is approximately 17-25%.

Combustion EfW plants will have a similar net electrical and thermal efficiency to most ATT processes generating steam for power generation, due mainly to the energy required to sustain the gasification/pyrolysis process and the scale of the plant.

### Emission control for releases to atmosphere

To meet the emissions limits the combustion process must be correctly controlled and the flue gases cleaned prior to release to atmosphere.

A common approach to control emissions involves the following:

- ammonia injection into the hot flue gases for control of NO<sub>x</sub> emissions;
- lime/sodium bicarbonate injection for control of SO<sub>2</sub> and HCl emissions;
- carbon injection for capture of heavy metals;
- bag filter system for removal of fly ash and other solids (unused lime/bicarbonate reagents).

The control of the concentrations of CO, VOCs and dioxins is achieved primarily through correct combustion conditions being maintained and removal of plastics containing chlorine e.g. PVC.

Clean-up of the flue gases produces APC residues comprising fly ash, lime/bicarbonate reagents and carbon. Typically the weight of APC will be approximately 2 – 6% of the weight of waste entering the combustion plant.

### Bottom ash handling

The main residual material from combustion of solid waste is termed “bottom ash”, consisting of the non-combustible constituents of the waste. Bottom ash typically represents approximately 20-30% by weight of the waste feed and 10% by volume. Bottom ash is discharged continually from the bottom of the combustion grate and quenched in a water bath. The amount of ash will depend on the level of any waste pre-treatment prior combustion and will contain some metals that can be recovered for recycling.

### **Feedstocks**

Feedstocks suitable for a combustion process are primarily solid wastes but both semi-solid and liquid wastes can be treated if suitable waste feeding systems are provided.

- raw and residual MSW;
- C&I wastes;
- RDF and SRF.

### **Outputs**

The primary outputs from combustion plants are:

- electricity and/or Heat;
- bottom ash;
- fly ash;
- metals.

### **Pros**

- can handle a wide range of waste types without any pre-processing;
- proven and robust technology;
- uses relatively simple mechanical components;
- can be applied to mid/large scale waste combustion;
- bottom ash can be recycled as a secondary aggregate;
- APCR can be processed for use as a sand replacement material.

### **Cons**

- usually involves a large building and high chimney;
- produces oxidised combustion products suitable only for energy conversion using a steam turbine or hot oil, ORC turbine;
- untreated APCR is a hazardous waste.

## **5.2. ADVANCED THERMAL TREATMENT**

Gasification and pyrolysis are referred to as ATT' (Advanced Thermal Treatment) processes. Gasification and pyrolysis plants thermally treat waste without allowing any or sufficient oxygen for complete combustion.

A brief description of the two processes is presented following.

### **5.2.1. ADVANCED THERMAL TREATMENT – PYROLYSIS**

In contrast to combustion, pyrolysis is a form of thermal treatment that chemically decomposes organic materials by heat in the absence of oxygen. The process requires an external heat source to maintain the temperature required, typically between 300°C - 850°C for materials such as MSW.

There is a degree of misunderstanding concerning the difference between pyrolysis and gasification. True pyrolysis is a low temperature thermal conversion technology that operates in an oxygen-free environment and produces a primary liquid product plus gaseous and solid phase products. If pyrolysis is operated at >800°C the primary product becomes syngas, with the process also producing liquid and solid phase products in lesser amounts.

Raw MSW is not usually appropriate for pyrolysis and typically would require some mechanical preparation and separation of glass, metals and inert materials prior to processing the remaining waste. In general pyrolysis processes tend to prefer consistent feedstocks and have a very limited track record at accepting MSW derived wastes at a commercial scale around the world. The products produced from pyrolysing materials are a solid residue and synthesis gas (syngas). The solid residue (sometimes termed char) is a combination of non-combustible materials and carbon.

Syngas is a mixture of combustible gases including carbon monoxide, hydrogen, methane and a broad range of other VOCs. A proportion of these can be condensed to produce oils, waxes and tars. Syngas typically has a net CV between 10–20 MJ/Nm<sup>3</sup>. If required the condensable fraction can be collected by cooling the syngas, potentially for use as a liquid fuel. One key issue for using syngas in energy recovery technologies is the problems related to tarring. The deposition of tars can cause blockages and other operational problems and has been associated with plant failures and inefficiencies at a number of pilot and commercial scale facilities.

#### **Feedstocks**

Typical feedstocks suitable for pyrolysis are:

- Commercial & Industrial wastes (C&I);
- RDF/SRF;
- non-waste fuels e.g. wood/other forms of biomass.

## Outputs

Primary outputs from pyrolysis are

- electricity and/or Heat – both together if a Combined Heat and Power Plant (CHP);
- syngas that can be purified to produce “biomethane”, biofuels, chemicals or hydrogen;
- pyrolysis oils – these can be used to fuel engines, or turned into diesel substitute;
- feedstocks for the chemical industry e.g. allowing biomass to substitute for oil in the production of plastics;
- bottom ash, char, or slag – by products which can be used for beneficial purposes such as aggregates or road bed material.

## Pros

- more compact plant than the equivalent capacity combustion plant;
- if syngas can be used as an engine fuel, higher energy conversion efficiencies are achieved.

## Cons

- technically more complex than a combustion plant;
- requires an external heating source;
- higher capital cost/t waste than equivalent capacity combustion plant;
- low temperature pyrolysis produces primarily a liquid (carcinogenic) and char;
- high temperature pyrolysis produces syngas but clean-up to an engine grade fuel is complicated and prone to reliability issues;
- char requires burning to recover the energy content;
- conversion to higher grade products such as methane or bioethanol is costly.

### 5.2.2. ADVANCED THERMAL TREATMENT - GASIFICATION

Gasification is a partial oxidation process in which the majority of the carbon and hydrogen in the waste is converted into a gaseous form (syngas), leaving a solid residue (ash or char).

There are many different designs of the core gasification reactor such as fluidised bed, rotary kiln, updraft and downdraft reactors, each of which is tailored to give certain benefits when gasifying various types of wastes.

The organic content of the waste is converted mainly to carbon monoxide, hydrogen and lower amounts of methane, although the syngas is generally contaminated by undesired products such as particulate, tar, alkali metals, chloride and sulphide.

Relatively high temperatures are employed, usually 600°C for the most widely used technology using air gasification and 1,000-1,400°C using oxygen. Air gasification is cheaper but results in a relatively low energy syngas, containing up to 60% nitrogen,

with a CV of 2-6 MJ/Nm<sup>3</sup>. Oxygen gasification gives a higher heating value syngas with a CV of 10-18 MJ/Nm<sup>3</sup> but requires an oxygen supply. High temperature gasification also has the benefit of melting the ash to produce a slag that is inert. The high temperature necessary to melt the ash is produced either by oxygen injection or gas plasma to provide the necessary heat input.

Gasification is a process between pyrolysis and combustion, in that it involves partial oxidation of a substance, by adding oxygen in amounts insufficient to allow the fuel to be oxidised completely or full combustion to occur. The process is largely exothermic but some heat may be required to initialise and sustain the gasification process. Raw MSW is usually not appropriate for gasification and would typically require some mechanical preparation and separation of glass, metals and inert materials prior to processing the remaining waste. The main product is syngas containing carbon monoxide, hydrogen and methane, with typically a net CV of 4-10MJ/Nm<sup>3</sup>, together with the nitrogen content of the gasification air used.

With gasification the energy content of the waste is transferred into the gas phase as both chemical and thermal energy, with the chemical energy making it possible to store and utilise the syngas at a later time, or elsewhere, for power generation, or via additional processing for use as a chemical feedstock.

Gasification of a solid waste includes a sequence of successive, endothermic and exothermic steps:

Typical feedstocks suitable for pyrolysis are:

- MSW;
- Commercial & Industrial Waste (C&I);
- RDF/SRF;
- (non-waste fuels, e.g. wood/other forms of biomass).

### **Outputs**

Primary outputs from gasification are:

- electricity and/or heat;
- syngas that can be purified to produce “biomethane”, biofuels, chemicals or hydrogen;
- feedstocks for the chemical industry;
- bottom ash, char, or slag by products that can be used for beneficial purposes e.g. secondary aggregate or land remediation material.

### **Pros**

- more compact plant than the equivalent capacity combustion plant;
- if syngas can be used as an engine fuel a higher energy conversion efficiency is achieved.

## **Cons**

- technically more complex than a combustion plant;
- higher capital cost/te waste than equivalent capacity combustion plant;
- syngas clean-up to engine grade fuel is complicated and prone to reliability issues;
- conversion to higher grade products such as methane or bioethanol is costly.

**APPENDIX B**  
**Waste Composition and Energy Mix Assumptions**  
Final Study Report  
Oxford County  
SLR Project No.: 209.40447.00000

## B-1 Waste Composition Assumptions

<b>Material Component</b>	<b>Composition % (2012/13)<sup>1</sup></b>	<b>Composition % (2017)<sup>2</sup></b>
Non-acceptable materials	28%	21%
Organics	31%	31%
Glass	4%	4%
Metals	3%	4%
Plastics	7%	13%
Paper / Packaging	11%	28%
Paper	16%	-
<b>Total</b>	<b>100%</b>	<b>100%</b>

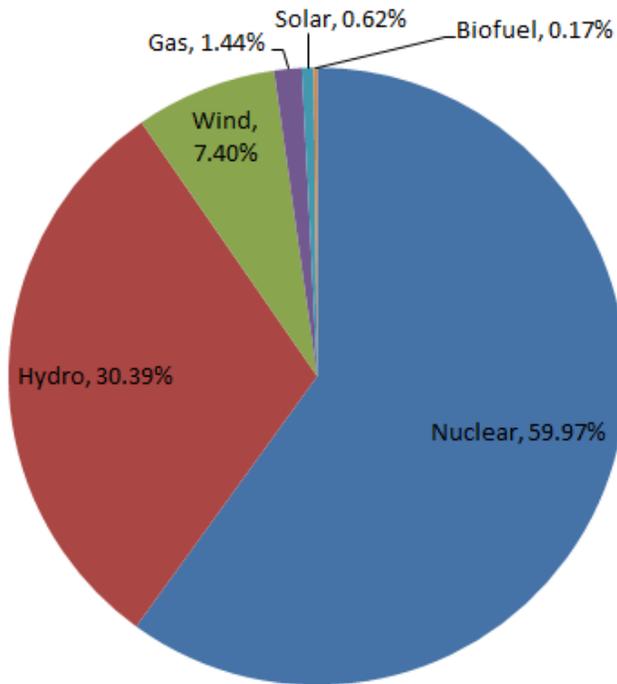
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<sup>1</sup> Derived from Ontario data provided by AET, as set out in TM1A.

<sup>2</sup> Derived from AET survey data collected in April 2017.

## B-2 Energy Mix Assumptions

Source	Electricity Generated (MW) <sup>3</sup>	Proportion (%)
Nuclear	9,383	59.97
Hydro	4,754	30.39
Wind	1,158	7.40
Gas	226	1.44
Solar	97	0.62
Biofuel	27	0.17
<b>Total</b>	<b>15,645</b>	<b>100.00</b>

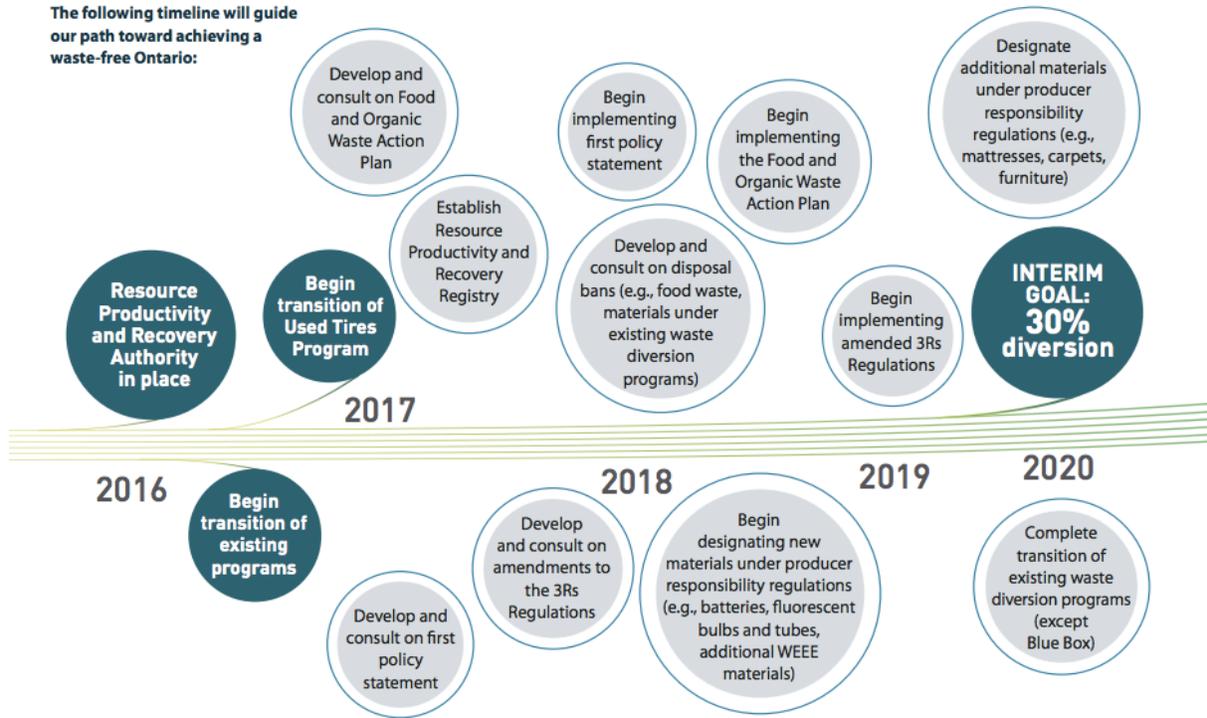


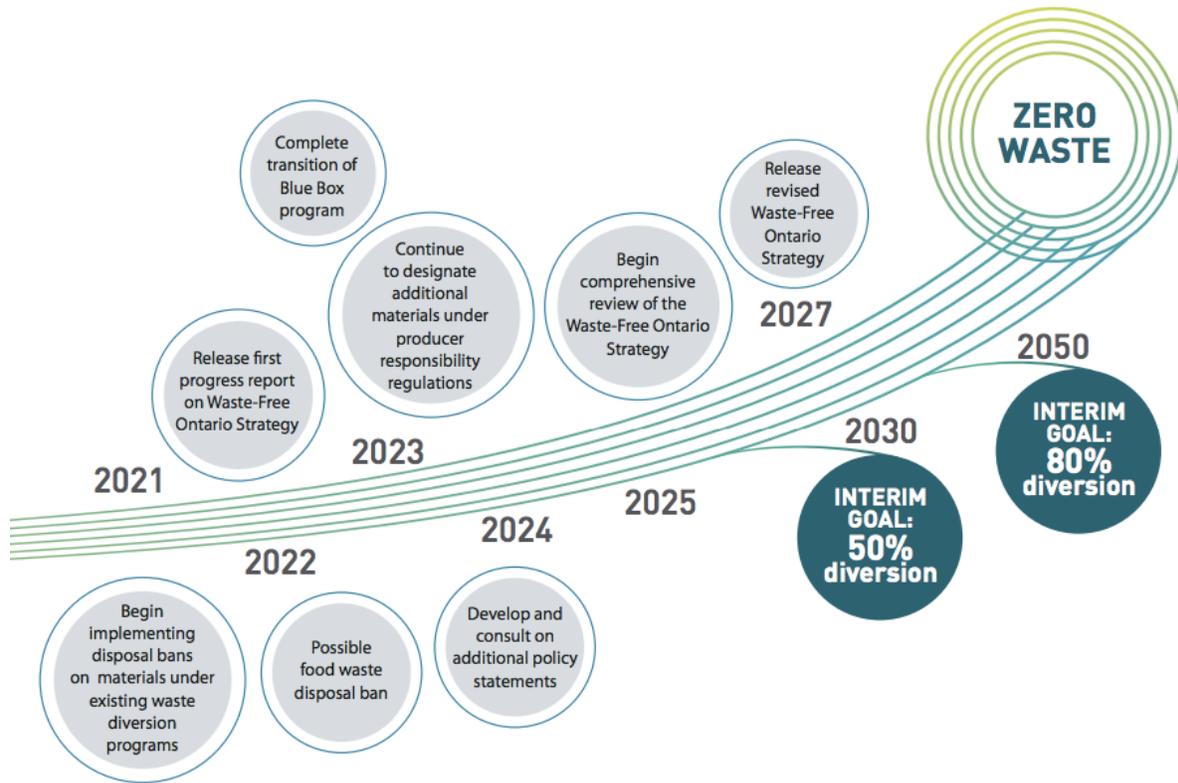
<sup>3</sup> Electricity Generated in Ontario – May 2017

**APPENDIX C**  
**Pages 12-13 from Waste Free Ontario Act**  
Final Study Report  
Oxford County  
SLR Project No.: 209.40447.00000

## Transforming Ontario into a Leader

The following timeline will guide our path toward achieving a waste-free Ontario:







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