# Aberdeen City Council

# Energy from Waste Business Case

Technical Report


AMEC Environment & Infrastructure UK Limited

November 2013

Confidential

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# Aberdeen City Council

# Energy from Waste Business Case

## Technical Report

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# Glossary of terms

| | |
|---|---|
| ACC | Aberdeen City Council |
| ALDP | Aberdeen Local Development Plan |
| BMW | Biodegradable Municipal Waste |
| CA | Civic Amenity site |
| CCL | Climate Change Levy |
| CD | Competitive Dialogue |
| CfD | Contracts for Difference |
| CHP | Combined Heat and Power |
| CHPQA | Combined Heat and Power Quality Assurance |
| CIWM | Chartered Institute of Wastes Management |
| CV | Calorific Value |
| DBFO | Design, Build, Finance, Operate |
| DBO | Design, Build, Operate |
| EfW | Energy from Waste |
| EU | European Union |
| FiT | Feed in Tariff |
| HHW | Household Waste |
| LAS | Landfill Allowance Scheme |
| LEC | Levy Exemption Certificate |
| MBT | Mechanical and Biological Treatment |
| MRF | Materials Recovery Facility |
| MSW | Municipal Solid Waste |
| MT | Mechanical Treatment |
| OM | Operate & Maintain |
| NPC | Net Present Cost |
| NPV | Net Present Value |
| NWMP | National Waste Management Plan |
| OBC | Outline Business Case |
| PPiP | Planning Permission in Principle |
| PWLB | Public Works Loans Board |
| QPO | Qualifying Power Output |
| RDF | Refused Derived Fuel |

| | |
|---|---|
| RO | Renewables Obligation |
| RP | Restricted Procedure |
| ROCs | Renewable Obligation Certificates |
| RHI | Renewable Heat Incentive |
| rWFD | Revised Waste Framework Directive 2008/98/EC |
| SDP | Strategic Development Plan |
| SEPA | Scottish Environmental Protection Agency |
| SPV | Special Purpose Vehicle |
| TFS | Transfrontier Shipment |
| Tpa | tonne per annum |
| TPO | Total Power Output |
| VFM | Value for Money |
| WSR | Waste (Scotland) Regulations 2012 |
| ZWP | Zero Waste Plan for Scotland |
| ZWS | Zero Waste Scotland |

# Executive Summary

This report has been produced for the purpose of considering whether the Council should pursue the procurement, construction and operation of a locally based thermal treatment solution for the City's waste (with or without joint working with other public authorities) or rely on third party/merchant facilities within the UK or elsewhere to treat waste in the long term.

The Council has a contract in place with SITA for management and disposal of all the collected waste. The Council contracted with SITA in 2000 for a 25 year term, the focus of which was the proposed development of recycling and energy recovery facilities at Altens. The original intention was for the facilities to be constructed to coincide with the closure of the Council's landfill in 2006. However SITA's planning application to the Council was refused and this requirement of the contract has never been fulfilled and the Council can procure its own energy from waste facility if required.

In parallel to this project the Council is undertaking contract variation negotiations with SITA to explore potential interim treatment options, focusing on SITA preparing the waste as a refuse derived fuel for export to Europe until such time as a long-term alternative option is available.

This report revisits the options appraisal process undertaken for the 2012 Outline Business Case by providing a greater level of detail on five options, and should be read in conjunction with the OBC. It tests and compares these options in terms of technical feasibility, financial appraisal and practicality for the Council. The five options are:

- **Option One (Small EfW, Council financed)**: To develop a facility on a site identified within the Council's boundary with the purpose of treating Aberdeen's residual waste arisings (assumed to be 60,000 tonnes per annum). This would include front end mechanical treatment (MT) to remove plastics and metals as preparation for an Energy from Waste (EfW) facility in line with Scottish Government requirements. The capital investment to provide this facility would be funded directly by the Council, and a partner waste contractor engaged to manage the facility's operational activities on the Council's behalf. It offers the potential benefit of renewable energy generation within the City;

- **Option Two (Small EfW, PPP financed):** As option 1, but assumes all capital investment for the facility is funded by the private sector under a Public-Private Partnership (PPP) arrangement. The Council pays a higher gate fee on operations under this model, as it will include recovery of capital financing costs;

- **Option Three (Large EfW, Council financed):** As option 1, with a larger EfW facility that is sized to take other residual waste. This other waste could be sourced from other public sector bodies or commercial and industrial wastes. With this option the MT facility need not be co-located with the EfW, as this could take place at the waste source, with the EfW being constructed at a suitable central site. The capital investment to provide this facility would be funded directly by the Council and a partner waste contractor engaged to manage operations;

- **Option Four (Large EfW, PPP financed):** As option 3, but assumes all capital investment for the facility is funded by the private sector under a Public-Private Partnership (PPP) arrangement, and consequently with a higher gate fee on operations to include recovery of capital financing costs

- **Option Five (RDF offtake):** The Council is currently progressing an interim treatment solution comprising the preparation of waste as Refuse Derived Fuel (RDF) prior to export to European EfW facilities. This business case considers this waste treatment option also as a long term solution, assessing whether the cost of this waste management practice would provide better value for money.

The Options Appraisal comprised mass flow modelling undertaken by AMEC, and was based on the Council's in-house waste flow model (WFM) used to inform the development of the OBC review. The model was subsequently updated with 2012 data to account for the Council's intention to move towards a full co-mingled collection for dry recyclables and the associated impact upon the remaining waste quantities available for treatment. Assumptions were made regarding waste growth rates, waste composition and the performance of mechanical treatment equipment. The recycling and composting systems are modelled to reach 54%, and additional recycling has been assumed through the mechanical treatment of the residual waste stream which meets the Council target of 56% by 2025. The tonnage of residual waste sent to thermal treatment is 38% of arisings, and therefore meets the Council target of a maximum 40% residual waste treatment capacity, and landfill is just within the maximum target of 5%.

The required EfW facility size for Option 1 and 2 is **47,000** tonnes per year, and a similar tonnage requires RDF offtake in Option 5. For Options 3 and 4 detailed data from other potential partners has not been obtained so a generic estimate of additional residual arisings has been calculated that results in a modelled additional input of 62,000 tonnes per year, resulting in a total EfW facility size of **109,000** tonnes per year.

Comparative reference plants are considered which indicate that for Options 1and 2 a site of minimum 1.5 hectares, and ideally 2 hectares would be required for a traditional EfW technology, excluding the MT plant. Options 3 and 4 would require 2 to 3 hectares. An MT plant could require a further 0.5 to 1 hectare depending on whether it is co-located or not.

The timing assumptions for the options are as follows:

- Whilst SITA are contracted to provide services until 2025 the Council has option to take out residual waste at any time. Purely for the purposes of this assessment all options have been assumed to commence full operations in the year 2020, and have been assessed over a 25 year period to 2045;

- Options 1 to 4 – MT plant operational in 2015. Interim export of RDF under existing contract. New EfW procured and constructed by 2020;

- Option 5 – RDF preparation plant operational in 2015. Long term export of RDF from 2015. It is assumed that a new offtake contract would be entered into in either 2020 or 2025 on equivalent terms.

Ernst and Young was appointed by the Council to undertake financial modelling, based on the mass flow and cost assumptions provided by AMEC.

Two funding options were analysed for the EfW facility, one being based on the Authority borrowing funds itself to pay for required construction works (termed 'Authority Build'), and the other a private-public partnership (PPP), where a contractor obtains funding at commercial borrowing rates. The local authority funded options (Options 1 and 3) are based on borrowing from the Public Works Loans Board (PWLB) which is typically at lower rates than commercially available funding arrangements. Higher borrowing rates are generally associated to privately funded options as they reflect the higher level of risk the partner accepts by agreeing to provision of the funding.

The two PPP options (Options 2 and 4) were based on a generic Special Purpose Vehicle (SPV) financial model provided by Ernst & Young drawn from currently available market funding structures and terms for similar projects. The Authority Build modelling was based on the Council sourcing the funds for the initial capital investment, and the partner waste contractor applying a gate fee to recover operational costs.

The options were first analysed without the capex and opex associated with the MT plant. This is because the technical requirements, costs and impact of interim arrangements remain unclear at this time. The MT costs were separately analysed to allow them to be included as a sensitivity test.

The headline outcomes from the financial modelling exercise is compared below (exclusive of MT costs), with the options ordered by NPV from lowest to highest. The total net present value (NPV) of each option uses a standard 3.5% discount rate

**Financial Model Results (excluding pre-treatment)**

| Option | Base Price £k | Net Present Value (NPV) £k | Nominal Price £/t 2020-21 | Nominal Price / t 2030-31 | Nominal Price / t 2040-41 | Nominal Price / t 2044-45 |
|---|---|---|---|---|---|---|
| Option 3: Large EfW, Council funded | 123,085 | 39,826 | 132.8 | 141.2 | 152.5 | 71.0 |
| Option 4: Large EfW, PPP funded | 163,771 | 48,170 | 166.1 | 176.1 | 189.2 | 184.3 |
| Option 5: RDF export | 196,137 | 52,666 | 147.7 | 194.8 | 260.0 | 271.0 |
| Option 1: Small EfW, Council funded | 198,547 | 62,838 | 187.4 | 207.2 | 231.7 | 135.4 |
| Option 2: Small EfW, PPP funded | 258,703 | 74,372 | 215.9 | 247.6 | 283.5 | 279.1 |

Overall, the financial assessment of options indicates that a larger EFW that caters for waste from other parties (e.g. public authorities or commercial/industrial wastes) would provide the best value for money solution in the long term as it can achieve better economies of scale than a small facility sized purely for Aberdeen City Council. However this option has two key deliverability issues that need to be considered over the next year in order for it to be progressed further.

Firstly it would require a partner(s) to also commit their residual waste to a new procurement. Any joint procurement with another public authority would require detailed discussions and preparations.

Secondly at present there are no strategic sites identified or secured for locating a new Energy from Waste facility. The Local Development Plan Team has started to review the adopted Local Development Plan and work towards the publication of the next Plan, which will need to be prepared in the context of the emerging Aberdeen City and Shire Strategic Development Plan (SDP), which is scheduled for adoption in 2014 and will replace the adopted Structure Plan. It is vital that this plan identifies a site for a new EfW. Detailed site suitability assessments and spatial designs will also be required by the Council in preparation for any procurement to take account of local constraints. Seeking approval for in-principle planning use for an EfW facility would partially mitigate key planning risks.

At a local level the Council's waste strategy, published in 2010, will hold significant influence over the decision to proceed, or not, with a local solution. Many of the aims of the Council's strategy clearly places emphasis upon the importance of treating waste as close to the point of generation as possible (proximity principle) but, crucially, enjoying the potential benefits (social, economic, and environmental) that a local solution may bring. Given the Council's requirement to demonstrate Best Value however these benefits need to be considered against ongoing budgetary pressures.

Aberdeen is considered the 'energy capital' of Europe, influenced by the Oil & Gas industry presence within the City, and as such the Council's strategy recognises that the potential for renewable energy production in the City can positively influence sustainability, environmental impact and socio-economic issues within the City. This opportunity is lost if the energy recovery benefits are realised elsewhere within the UK or Europe. A Combined Heat and Power scheme would maximise benefits to the City, and could attract additional revenues from government incentive schemes. The Council has already established a district heating network and should be well placed to exploit the benefits of a Combined Heat and Power (CHP) EfW solution, should this be proposed.

In the event that a larger EfW was not deemed deliverable either next year or at a future point during the procurement, the next preferred option is for medium term offtake of RDF. RDF export is a competitive option for the Council in the short to medium term based on current market price indications. There is however an unquantifiable risk of future increases in European EfW gate fees as more waste producers seek to access a fixed number of outlets. This may be mitigated by securing longer term offtake contracts either directly with a plant or via a broker who can regularly search for the best deal.

The long term viability of RDF export is currently unknown beyond 5-10 years and therefore the risk profile of this option is completely different to that of a domestic facility. The assumed RDF offtake price and the future inflation assumptions have a key influence on the cross over point between the options. The assumed RDF gate fee (£80/tonne in current terms) has not been subject to any formal benchmarking or negotiation with potential offtakers. Results of SITA negotiations are not expected until later in 2013 and can inform further consideration of the competitiveness of RDF offtake.

A smaller scale EfW facility would be the most expensive option, but if Authority funding was available it could become very competitive in the very long term (e.g. post 2042). This is because once the borrowing has been re-paid the facility would benefit from a step-down in the price per tonne (this applies to both Option 1 and 2). The Council would be in ownership of a strategic EfW asset which could offer a continued service at much reduced rates, in a similar way that other UK authorities are currently benefiting from operating older EfW facilities. It is worth noting that some of the RDF export prices are currently low due to the same reasons (e.g. use of older facilities where capital investment has been repaid).

It is noted that as currently modelled, the MT plant required high capital expenditure to achieve a relatively modest increase in recycling rates. The value for money of this, and alternative configurations would benefit from further exploration.

Should Options 3 or 4 be progressed then the Competitive Dialogue procurement route would be most appropriate. There are no firm conclusions regarding the funding route at this stage except that Authority funding would reduce net costs, subject to further investigation.

A number of critical documents will emerge during any procurement this could impact upon final designs and costs of the new EfW, including EU Best Available Techniques reference documents due in 2016. The legislation and guidance controlling the pre-treatment and export of RDF is also likely to evolve over coming years. Finally any future introduction of EU incineration taxes or other changes in law could impact upon the deliverability and costs of each option.

Based on the timetables achieved by other Councils for procuring a new EfW facility a total period of around 8 years is considered appropriate before a new EfW facility is operational. This includes 1 year for pre-procurement discussions with partners and identifying suitable sites, a three year procurement period (including preparatory planning activities) and 4 years post-contract award, but may be subject to delays outside the Councils control.

Procurement of medium term RDF offtake solution could be in place within 1 to 2 years. A new RDF preparation building may require 1 to 2 years for planning application, procurement and construction.

The recommendations arising from this study are grouped under five key themes, as outlined below and further expanded in this report.

- 1. Secure support for a Large EfW
- 2. Secure site for new EfW
- 3. Develop procurement strategy
- 4. Research and develop RDF contingency arrangements
- 5. Keep watching brief on potential changes in law and policy

# Contents

# 1. Introduction & Background

## 1.1 Purpose of this Report

In 2012, Aberdeen City Council (the Council) commissioned consultants to prepare an Outline Business Case (OBC) for the long term treatment of residual municipal waste. This document identified that a local thermal treatment plant, to be located in Aberdeen, was likely to be the best long term solution but was based a high level analysis of the options.

AMEC Environment & Infrastructure UK Ltd (AMEC) has now been engaged to consider whether the Council should pursue the procurement, construction and operation of a locally based thermal treatment solution for the City's waste (with or without waste supply from other partners) or rely on third party/merchant facilities within the UK or elsewhere to treat waste in the long term.

In order to inform this decision, AMEC has developed detailed, fully costed options in order to demonstrate which option will allow the Council to meet future legislative targets and provide the Best Value solution for residual waste treatment in the long term, manage risks and deliver the best opportunity to contribute to the success of Aberdeen. This document discusses each of the options available, the Council's strategic waste management objectives, potential contractual models, the economic case for each option (linked to the modelling exercise), and the procurement options available to the Council. It concludes with a comparative assessment between the options. This report should be read in conjunction with the 2012 Outline Business Case (OBC).

## 1.2 Background

The City of Aberdeen comprises approximately 112,000 households of which around 60,000 are high density/flatted properties. In 2010/11 the Council collected 118,049 tonnes of municipal solid waste (MSW), of which 42,143 tonnes was recycled and the remainder disposed of to landfill. The Council has an aspiration to achieve 56% source segregated recycling and composting by 2025 and municipal residual waste treatment capacity should be below 40% by 2025.

The Council has a contract in place with SITA for management and disposal of all the collected waste. The Council contracted with SITA in 2000 for a 25 year term, the focus of which was the proposed development of recycling and energy recovery facilities at Altens. The original intention was for the facilities to be constructed to coincide with the closure of the Council's landfill in 2006. However SITA's planning application to the Council was refused and this requirement of the contract has never been fulfilled and the Council can procure its own energy from waste facility if required.

In parallel to this project the Council is undertaking contract variation negotiations with SITA to explore potential interim treatment options, focusing on SITA preparing the waste as Refused Derived Fuel (RDF) for export to Europe until the end of their contract or until such time as a long-term alternative option is available.

# 2. Policy Drivers and Objectives

## 2.1 Aberdeen Waste Strategy 2010

In April 2010 the Council published its waste strategy within which it set out the key requirements and considerations for waste policy, infrastructure and services for the City up to 2025. The strategy was finalised and published following extensive consultation and engagement with a wide range of stakeholders.

The Council has committed to seeking to achieve recycling and composting targets which could be considered as challenging when accounting for the high proportion of flatted, and therefore more difficult to engage with, properties. Aligned with the local strategy specific target to limit residual waste treatment capacity, the Council's strategy clearly commits them to maximising 'front end'[1] recycling.

The key themes set out within the strategy are:

- Waste is viewed as a resource, not a problem;
- There is an aspiration to gain value from waste at all stages of treatment;
- Our resource, our solution;
- The proximity principle;
- The waste hierarchy; and
- Pragmatic, value for money solution but challenging.

The strategy also sets out the following targets:

- Target 1 Waste growth will be eliminated by 2015 (in tonnage terms);
- Target 2 Source segregated municipal waste recycling and organic waste treatment targets are:
  - 45% by 2013;
  - 50% by 2020; and
  - 56% by 2025.
- Target 3 Introduce organic waste collections for all households and develop treatment facilities within the Aberdeen area by 2013;

[1] For the purposes of this business case front end recycling is material collected at the kerbside and recovered from the primary treatment stage (mechanical treatment) for residual waste.

- Target 4 Municipal residual waste treatment capacity (including Energy from Waste) should not exceed 45% by 2020 and 40% by 2025;
- Target 5 No more than 5% of municipal waste should be landfilled by 2025.

Finally, the strategy also makes the following commitments in respect of infrastructure delivery:

- Develop commingled Materials Recycling Facility;
- Develop organic waste treatment facilities in Aberdeen; and
- Develop residual treatment capacity in Aberdeen.

The recycling and organic waste treatment facilities are both being progressed within contract variation negotiations with SITA. The feasibility of delivering the final commitment; residual treatment capacity in Aberdeen, is considered in this report.

Each of the themes identified within the strategy needs to be carefully considered alongside the potential treatment solutions to ensure the recommended option aligns with the objectives of the Council's strategy. The Council's strategy also creates an emphasis upon wider Council policies and impacts that may be influenced by the recommendations within this document. Aberdeen is considered the 'energy capital' of Europe, influenced by the Oil & Gas industry presence within the City, and as such the Council's strategy recognises that the potential for renewable energy production in the City can positively influence sustainability, environmental impact and socio-economic issues within the City. This opportunity is lost if the energy recovery benefits are realised elsewhere within the UK or Europe. The Council has also established a district heating network and should be well placed to exploit the benefits of a Combined Heat and Power (CHP) EfW solution, should this be proposed."

## 2.2 Local Planning policy

The Aberdeen Local Development Plan (ALDP) was adopted on 29 February 2012. It replaced the Aberdeen Local Plan (2008) and was the first Development Plan of its kind in Scotland. Statute requires that Development Plans are reviewed every five years, and so the Local Development Plan Team has started to review the adopted Local Development Plan and work towards the publication of the next Plan.

The adopted Local Development Plan identifies the detailed policies and sites required to deliver the current Aberdeen City and Shire Structure Plan (2009). The next Local Development Plan must however be prepared in the context of the emerging Aberdeen City and Shire Strategic Development Plan (SDP), which is scheduled for adoption in 2014 and will replace the adopted Structure Plan.

The Local Development Plan is a vital public document which shapes the future of Aberdeen, and influences significant public and private investment in homes, businesses, shops, infrastructure and facilities.

The review of the Local Development Plan started with a non-statutory Pre-Main Issues Report consultation period that ran from 15 April – 14 June 2013. Officers are now using the comments to help prepare the Main Issues Report and associated supporting documents such as the Strategic Environmental Assessment. It is understood these will be presented to the Enterprise, Planning and Infrastructure Committee in November 2013. The development of a new Local Development Plan presents an opportunity to select and appraise new site for waste treatment infrastructure.

The Proposed Strategic Development Plan (without modifications) has been submitted to Scottish Ministers for approval. The current development plan scheme (2013/14) indicates that the plan is likely to be approved by Scottish Ministers (with or without modifications) in the first few months of 2014. At that point it will replace the current Aberdeen City and Shire Structure Plan (2009).

Current policy in the Aberdeen Local Development Plan (2012) regarding waste facilities is reproduced below. The plan stated that "More detailed guidance on the location for strategic waste facilities will be produced by the Strategic Development Planning Authority which is preparing Supplementary Guidance on regional waste facilities." At present there are no strategic sites identified for locating a new Energy from Waste facility, which is a key deliverability constraint.

**Policy R3 - New Waste Management Facilities**

Proposals for waste management facilities within the City must comply with the waste hierarchy. Applications for waste management facilities will be supported provided they:

1. conform to the Zero Waste Plan and Aberdeen Waste Strategy;
2. meet a clear need for the development to serve local and/or regional requirements for the management of waste;
3. represent the Best Practicable Environmental Option for that waste stream;
4. will not compromise health and safety;
5. minimizes the transport of waste from its source; and

Applicants must submit:-

a) sufficient information with the application to enable a full assessment to be made of the likely effects of the development, together with proposals for appropriate control, mitigation and monitoring; and
b) a design statement in support of the application, where the development would have more than a local visual impact; and
c) land restoration, after-care and after-use details (including the submission of bonds or a commitment to negotiating a legally binding method for dealing with these details).

Waste management facilities that are proposed on Business and Industrial Land (BI1) will normally require to be located in a building. This will depend upon the nature of the operations involved.

Inappropriate neighbouring developments that may compromise the operation of waste management facilities including those listed in Policy R4 will not be approved.

**Policy R4 - Sites for New Waste Management Facilities**

The following sites will be safeguarded for waste related uses:

Altens East/Doonies (OP70) - materials recycling facility/an anaerobic digestion or in-vessel composting facility/and or a transfer station.

Sclattie Quarry, Bucksburn – transfer station (planning permission granted).

Denmore Road, Bridge of Don (OP5) - a recycling centre to replace the facility on Scotstown Road. The Scotstown Road facility should be turned over to urban green space in order to replace that lost on Denmore Road.

Grove Nursery at Hazlehead Park (OP67) – recycling centre to serve the west of the city.

**Policy R5 - Energy from Waste**

Applications for energy from waste recovery facilities should be accompanied by an environmental assessment in terms of the Environmental Impact Assessment (Scotland) Regulations 1999. This should set out, amongst other things, whether the proposal complies with Policy R3. Consideration should also be given to:

1. The treatment of residues from any plant;
2. SEPA's Thermal Treatment of Waste Guidelines;
3. Connection to the electricity grid and the ability to provide heat and power to neighbouring uses; and
4. Supplementary guidance on Regional Waste Facilities.

Industrial sites with the potential for connection to the electricity grid and with potential users of heat or power are likely to be suitable locations for energy from waste.

## 2.3 Revised Waste Framework Directive

The European Union (EU) sought to harmonise waste management and disposal policies across Member States through the Revised Waste Framework Directive (rWFD) 2008/98/EC on waste. The purpose of the rWFD is to encourage a shift within the EU closer towards a recycling society – where waste generation is avoided and waste is viewed, and used as a resource. The rWFD places priority upon extraction of the maximum practical benefits from resources and therefore reducing the amount of waste requiring to be sent for disposal. One of the requirements of the rWFD is for Member States to have in place a National Waste Management Plan (NWMP).

## 2.4 Zero Waste Plan

The Scottish Government's Zero Waste Plan (ZWP), published in 2010, is Scotland's NWMP and sets out the national policy structure to implement to requirements of the rWFD in Scotland.

The ZWP aims to bring about a cultural shift by moving from 'waste management' towards 'resource management' and in doing so linking climate change, sustainable economic growth, achievement of renewable energy targets and waste management more closely. The ZWP encourages focus towards driving the management of waste up the waste hierarchy. The long term target set out within the ZWP is to achieve 70% recycling, composting and the preparing for reuse of all waste streams by 2025.

## 2.5 Waste (Scotland) Regulations 2012

The Waste (Scotland) Regulations 2012 (WSR) underpin the policy objectives set out within the ZWP and constitute the regulatory framework designed to achieve Scotland's ambitions. The WSR is also the tool by which the rWFD is transposed into Scottish law.

A number of the duties within the WSR are applicable for consideration within this business case. Residual waste must be pre-treated to remove key recyclables (metals and hard plastics) prior to thermal treatment and as such this business case models a Mechanical Treatment (MT) front end plant with Energy from Waste (EfW) as the secondary treatment.

## 2.6 Climate Change (Scotland) Act 2009

The Climate Change (Scotland) Act 2009 set a target to reduce greenhouse gas emissions by at least 80% by 2050 and an interim reduction target of at least 42% by 2020. The Act introduces a new duty for all public bodies to exercise their functions in a way that is best calculated to contribute towards toward the targets.

The diversion of waste from landfill to energy recovery will contribute towards reduced greenhouse gas emissions. Where waste is treated in more modern energy efficient facilities, or those with combined heat and power offtake this will further improve performance.

## 2.7 Thermal Treatment of Waste Guidelines 2009/2013

As part of a suite of mechanisms to help deliver against the Zero Waste Plan targets, SEPA issued a consultation on revised Thermal Treatment of Waste Guidelines (April 2013), with one of the priorities being to ensure that the recovery of energy takes place with a high degree of energy efficiency.

The guidelines describe what is expected from developers and other key stakeholders in order to comply with SEPA's planning objectives and the Scottish Government's policies on waste. It also provides advice on the information SEPA requires in relation to energy recovery when determining a permit application for such a facility. Applying to all thermal treatment plants that recover energy from municipal waste and/or commercial and industrial waste, the practical implications of the guidelines are that plants should:

- Only treat residual waste (i.e. waste remaining after all efforts have been made to extract recyclable materials, either prior to or after delivery to the plant) in order not to impede recycling and waste prevention efforts;
- Be part of an integrated network of recycling and composting and other waste management facilities; and

- Recover and use the energy derived from waste efficiently.

The Thermal Treatment of Waste Guidelines apply (without excluding other potential thermal recovery technologies) to the treatment of waste by incineration, gasification, pyrolysis, plasma systems, and anaerobic digestion (gas use phase only).

In line with the SEPA Thermal Treatment Guidelines (2009), a Heat and Power Plan is also required to be submitted as part of the Environmental Permit application. This shows the strong emphasis that is being placed on Combined Heat and Power (CHP) EfW solutions that can demonstrate a viable local heat network.

## 2.8 Financial Support Mechanisms for EfW/CHP

### 2.8.1 Introduction

Various financial support mechanisms exist that are available to support low carbon energy projects and potentially add an additional revenue source to projects that can be considered renewable or low carbon. In particular, applicable to EfW plants are Renewable Obligation Certificates (ROCs), Renewable Heat Incentive (RHI), and Climate Change Levy Exemption Certificates (LECs). The RDF-EfW plant is eligible for these revenue streams as a result of the waste stream containing a proportion of biomass material which is considered a renewable fuel source. Consideration needs to be given to the proportion of biomass remaining in the MSW stream after mechanical pre-treatment, as if it falls lower than 50% this may impact on the financial support which is accessible.

### 2.8.2 Renewables Obligation

The Renewables Obligation (RO) was introduced in 2002 and is proposed to remain open to new plants commissioning before April 2017. New generation which is accredited under RO before this date, will continue to receive its full lifetime of support in the “vintaged” scheme after 2017. The scheme will finally close in 2037. It would not be available to a new facility in Aberdeen City.

Energy from Waste plants are currently eligible for ROCs, providing they meet quality assurance standards known as ‘Good Quality’ CHP which requires the plant to meet minimum levels of thermal and electrical efficiency; effectively setting minimum levels of heat and electricity export on an annual basis. This is administered by the Combined Heat and Power Quality Assurance (CHPQA) scheme set up by Defra and regulated by OFGEM (see www.chpqa.com for more information).

### 2.8.3 Feed in Tariff with Contracts for Difference

The banding review also proposes that there would be a one off choice for CHP generating stations to take the 0.5 ROC/MWh CHP ROC uplift under the RO or get support for the heat element under the RHI until. After 1 April 2015it is proposed that any new generating stations would only be able to receive support for the heat element under the RHI and there would no longer be support by way of the CHP uplift under the RO.

## Renewable Heat Incentive

The Renewable Heat Incentive (RHI) provides support to non-domestic renewable heat generators (support for domestic renewable heat generators is expected to start in summer 2013). Energy from Waste technologies are eligible for the scheme, but like ROCs it covers only the heat derived from the biodegradeable element of the waste, i.e. currently 50% of total heat used for 'eligible purposes'.

The RHI aims to provide compensation for the additional cost of renewable heating technology compared with the cost of conventional fossil fuel equivalents. The RHI therefore intends to remove the barrier of the additional cost, helping to create a level playing field between renewable and conventional heating technologies and widen the choice of heating options.

The Government set out in the EMR White Paper in July 2011 its decision to provide increased revenue certainty to low-carbon generation through use of a Feed-in Tariff following the structure of a Contract for Difference (CfDs).

## How the CfD works – the strike price

Generators with a CfD will sell their electricity into the market in the normal way, and remain active participants in the wholesale electricity market. The CfD then pays the difference between an estimate of the market price for electricity and an estimate of the long term price needed to bring forward investment in a given technology (the 'strike price').

This means that when a generator sells its power, if the market price is lower than needed to reward investment, the CfD pays a 'top-up'. However, if the market price is higher than needed to reward investment, the contract obliges the generator to pay the difference back.

In this way, CfDs stabilise returns for generators at a fixed level, over the duration of the contract. This removes the generator's long term exposure to electricity price volatility, substantially reducing the commercial risks faced by these projects. As commercial risks are lower under the CfD, this lowers the cost of raising finance, and, ultimately, encourages investment in low-carbon generation at least cost to consumers.

The CfDs will take the form of long-term, private law contracts, providing generators with a clear set of rights and obligations, and recourse to arbitration processes to resolve disputes. This structure supports investor confidence in the arrangements and reduces the risk that the support payments might be reduced or removed in future; further reducing risk to investing and therefore costs to consumers.

## RHI Tariff

The level of support varies depending on the type and size of technology. The current tariffs (from 1st April 2012) that may apply are shown below:

**Table 2.1 RHI Tariffs (MSW)**

| Tariff Name | Eligible Sizes | Tier | Tariff (p/kWhth) |
|---|---|---|---|
| Small Commercial | Less than 200kWhth | 1 | 8.3 |
| | | 2 | 2.1 |
| Medium Commercial | 200kWhth and above; <1000kWhth | 1 | 5.1 |
| | | 2 | 2.1 |
| Large Commercial | 1000kWhth and above | N/A | 1.0 |

A CHP plant will not be eligible for the RHI where it is accredited under the Renewables Obligation and has at any point since receiving that accreditation, been a 'qualifying CHP' generating station within the meaning of the Renewables Obligation Order. A 'qualifying combined heat and power generating station' is defined in the RO Order as a combined heat and power generating station that has received accreditation under the Combined Heat and Power Quality Assurance (CHPQA) Standard and CHPQA Guidance Note 44.

A local Combined Heat and Power (CHP) EfW solution in Aberdeen City should qualify for the Large Commercial RHI tariff.

### 2.8.4 Levy Exemption Certificates (LECs)

In addition to ROCs revenue, Climate Change Levy Exemption Certificates, or LECs, were a small benefit also attributable to the electricity generated from EfW plants (only the proportion of the waste deemed biodegradable) *whether or not they have CHP*. This is a further small benefit that could be gained by the generator, valued at around £4 per MWh of the eligible renewable component of the electricity.

ROCs and LECs are both available through electricity sales to the grid or to private wires networks. The CHP LEC (CCL) scheme closed in March 2013.

### 2.8.5 RHI interaction with publicly funded grants

In terms of RHI support for public sector projects the Regulations state that:

- RHI support will only be available for an eligible installation if no other grant from public funds has been paid or will be paid in respect of any of the costs of purchasing or installing the eligible installation. AMEC believes that Prudential Borrowing would not be considered as a form of grant, but this would require formal confirmation with Ofgem.

- Installations that apply under the biomass contained in municipal waste category can only use municipal waste as their fuel source. If the installation is to be eligible for the RHI on the basis that heat is being generated from solid biomass contained in municipal waste, fuels that are not classed as municipal waste by the Regulations (e.g. other wastes, or solid biomass) cannot be used at the plant.

The use of other fuels at the plant would mean that the solid biomass in municipal waste provisions in the scheme could not be utilised.

- Only a portion of the residual municipal waste feedstock is deemed eligible, related to assumptions on the biogenic content. This is assumed to be 50% at present.

Draft guidance published by Ofgem provides more detail regarding the definition of municipal waste[2]. Specifically that it is defined as in section 21 of the Waste and Emissions Trading Act 2003 (WSET). This could mean that a facility accepting commercial and industrial wastes would not have the opportunity for RHI support. AMEC believes that liaison between the waste industry and Ofgem is ongoing on this important issue.

While eligibility is assessed on a case by case basis, waste streams likely to be ineligible for RHI support are listed below;

| **Waste Stream** | **Description** |
|---|---|
| Code 02 01 – Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing | Sludges from washing and cleaning<br>Wastes from forestry |
| Code 03 01 – Wastes from wood processing and the production of panels and furniture | Sawdust, shavings, wood, particle board and veneer |
| Code 15 01 03 | Wooden packaging |
| Code 17 01 – Concrete, bricks, tiles and ceramics | Concrete<br>Bricks<br>Tiles and ceramics |
| Code 19 07 – landfill leachate | Landfill leachate |

Eligible waste streams are likely to include;

| **Waste Stream** | **Description** |
|---|---|
| Chapter 20 – Municipal wastes | Paper and cardboard<br>Biodegradable kitchen and canteen waste<br>Glass<br>Textiles<br>Plastics<br>Metals<br>Garden and park waste |
| Code 19 05 - Wastes from aerobic treatment of solid wastes | Non-composted fraction of municipal and similar wastes<br>Non-composted fraction of animal and vegetable waste |
| Code 19 06 – Wastes from anaerobic treatment of waste | Digestate from anaerobic treatment of municipal waste<br>Digestate from anaerobic treatment of animal and vegetable waste |
| Code 19 12 – Wastes from the mechanical treatment of waste | Paper and cardboard |

[2] https://www.ofgem.gov.uk/ofgem-publications/83036/rhiguidancedocumentvolonesept2013edits-consultationver.pdf

| **Waste Stream** | **Description** |
|---|---|
| (for example sorting, crushing, compacting, pelletising) not otherwise specified | Ferrous metal<br>Wood<br>Combustible waste (refuse derived fuel) |
| Code 15 01 01 | Paper and cardboard packaging |
| Code 15 01 02 | Plastic packaging |
| Codes 15 01 05 – 15 01 09 | Mixed packaging<br>Textile packaging |

# 3. OBC Review

## 3.1 Introduction

The 2012 OBC considered a range of options available to the Council in improving performance and delivering a long term sustainable waste management service. It considered the opportunities across the whole waste management service in terms of collection, recycling, treatment and energy recovery and how each option might deliver against the statutory and political drivers for change. These options were:

**Table 3.1 OBC Options**

| Reference | Description |
|---|---|
| Green Waste | |
| G1 | Merchant solution, Aberdeenshire, open windrow composting |
| G2 | New local windrow composting facility, delivered by SITA |
| G3 | New local windrow composting facility, open market procurement |
| Food Waste | |
| F1 | Merchant solution, Aberdeenshire IVC composting |
| F2 | New local food IVC plant, delivered by SITA |
| F3 | New local food IVC plant, open market procurement |
| F4 | Merchant solution, Perthshire AD plant |
| Recyclables | |
| RC1 | Merchant solution, Central Belt MRF inc glass |
| RC2 | New local glass-capable MRF, delivered by SITA |
| RC3 | New local glass-capable MRF, open market procurement |
| Residual Waste | |
| R1 | Merchant solution, export of raw waste by road for processing in UK |
| R2 | Merchant solution, export of RDF by sea for processing in Europe |
| R3 | New local EfW/CHP plant in Aberdeen from 2020 |
| R4 | Interim export of raw waste via SITA, then local EfW/CHP plant from 2020 |
| R5 | Interim export of RDF via SITA, then local EfW/CHP plant from 2020 |

Each option was subjected to a technical and financial appraisal which concluded that the most appropriate options for the Council (the reference case) were as follows:

- New local windrow composting facility, delivered by SITA;

- New local food IVC plant, delivered by SITA;
- New local glass-capable MRF, delivered by SITA;
- Interim export of RDF via SITA, then local EfW/CHP plant from 2020 onwards.

The solutions to be delivered by SITA have now been formalised and are being discussed under variations to the existing contract. The delivery of the local EfW/CHP plant is the subject of this project.

## 3.2 OBC approach to EfW/CHP options

In terms of the delivery of the EfW/CHP project, the OBC recognised its restrictions and provided a caveat as follows:

> *Although a reference case is identified, it is recognised that the cost estimates for an EfW plant (based on gate fees) would benefit from more detailed review, particularly a detailed, "bottom up" costing based on construction and operational costs for a specific plant located in Aberdeen.*
>
> *This is beyond the scope of this outline case, and should be developed as part of the next stage of project, to further validate the business case for this waste stream before progressing to procurement of an EfW facility.*

The OBC cost analysis which was undertaken was based upon developing a gate fee for each option. The model considered:

- Changes in waste arisings and stream profile shifts (more recycling);
- Collection, transport, processing and disposal costs;
- Overheads, management costs, procurement costs and income;
- Capital investment (where required for site acquisition & access);
- Inflation and other cost pressures.

The cost model included projections over 20 years but did not include captial investment in process plant since this was assumed to be incldued in the all-in gate fees used to cost each process.

For the EfW options, an estimate of the likely power income (to offset capital and operational expenditure) was developed based on low estimates of power output per tonne, and on 2012 wholesale prices for electricity. An allowance was also made for grant income from the renewable obligations certificates scheme (ROCs) operated by the Department for Environment and Climate Change (DECC). No income was assumed for any heat offtake.

# 4. Options Review

## 4.1 Introduction

This section revisits the options appraisal process undertaken for the 2012 OBC by providing a greater level of detail on five options, and should be read in conjunction with the OBC. The five options are:

- **Option One (Small EfW, Council financed)**: To develop a facility on a site identified within the Council's boundary with the purpose of treating Aberdeen's residual waste arisings (assumed to be 60,000 tonnes per annum). This would include front end mechanical treatment (MT) to remove plastics and metals as preparation for an Energy from Waste (EfW) facility in line with Scottish Government requirements. The capital investment to provide this facility would be funded directly by the Council, and a partner waste contractor engaged to manage the facility's operational activities on the Council's behalf. It offers the potential benefit of renewable energy generation within the City;

- **Option Two (Small EfW, PPP financed):** As option 1, but assumes all capital investment for the facility is funded by the private sector under a Public-Private Partnership (PPP) arrangement. The Council pays a higher gate fee on operations under this model, as it will include recovery of capital financing costs;

- **Option Three (Large EfW, Council financed):** As option 1, with a larger EfW facility that is sized to take other residual waste. This other waste could be sourced from other public sector bodies or commercial and industrial wastes. With this option the MT facility need not be co-located with the EfW, as this could take place at the waste source, with the EfW being constructed at a suitable central site. The capital investment to provide this facility would be funded directly by the Council and a partner waste contractor engaged to manage operations;

- **Option Four (Large EfW, PPP financed):** As option 3, but assumes all capital investment for the facility is funded by the private sector under a Public-Private Partnership (PPP) arrangement, and consequently with a higher gate fee on operations to include recovery of capital financing costs

- **Option Five (RDF offtake):** The Council is currently progressing an interim treatment solution comprising the preparation of waste as Refuse Derived Fuel (RDF) prior to export to European EfW facilities. This business case considers this waste treatment option also as a long term solution, assessing whether the cost of this waste management practice would provide better value for money.

## 4.2 Technical Considerations

### 4.2.1 Waste Flow Modelling

In order to test the size of the facility required for each of the Options it is necessary to consider the flows of material in advance of any residual treatment plant. A full technical note on the underlying modelling assumptions has been separately provided (see **Appendix 1**), and a summary of key inputs is provided below.

## All Options

AMEC was supplied with the Council's in-house waste flow model (WFM) used to inform the development of the OBC review. The model was subsequently updated with 2012 data to account for the Council's intention to move towards a full co-mingled collection for dry recyclables and the associated impact upon the remaining waste quantities available for treatment.

Using this data as a guide, AMEC populated its in-house waste flow model that has been designed and used on a large number of similar projects to determine requirements for waste contract procurements. The model considers each material individually e.g. paper, cardboard, green glass, clear glass etc. from collection through to final destination but relies on assumptions around arisings and composition in order to reach meaningful conclusions. The key assumptions included were:

- Limited total waste growth until 2025 related to new housing and increasing trade waste tonnages, with no growth after 2025 (e.g. waste minimisation efforts would need to counteract any future housing growth);

- As is the case with many Local Authorities, the Council lacked up to date data on waste composition. To overcome this, AMEC used recent data (2011) from Edinburgh City Council with slight adaptations. Although larger than Aberdeen, Edinburgh has a similar proportion of high density/flatted properties as Aberdeen and was considered to be a more reasonable reference case than national composition data.

The model outputs were designed to give similar results to those developed by the Council, giving a profile of waste flows as shown in Table 4.1 below.

**Table 4.1 Aberdeen Waste Flow Outputs 2017 - 2045**

| | Total Arisings | Recycling/Composting | Residual |
|---|---|---|---|
| Tonnes | 121,192 | 65,459 | 55,733 |
| % arisings | 100% | 54% | 46% |

The recycling and composting systems are modelled to reach 54%, which is just below the Council target of 56% by 2025. Additional recycling has been assumed through the mechanical treatment of the residual waste stream as shown in Table 4.2 below, and therefore meets the Council target. The tonnage of RDF is 38% of arisings, and therefore meets the Council target of a maximum 40% residual waste treatment capacity, and landfill is just within the target of 5% maximum. The required EfW facility size for Option 1 and 2 is therefore **47,000** tonnes per year, and a similar tonnage requires RDF offtake in Option 5.

**Table 4.2 Processing of Residual Waste Stream 2017-2045**

| | Total Residual | Recycling/Composting | RDF | Rejects to landfill |
|---|---|---|---|---|
| Tonnes | 55,733 | 3,420 | 46,452 | 5841 |
| % arisings | | 2.8% | 38% | 4.8% |

The assumed capture rates for materials sorted by an MT plant are set out in Table 4.3. For Option 5, it is assumed that a similar level of mechanical treatment is undertaken to produce an RDF suitable for export, although in practise some market outlets may require less intensive sorting.

**Table 4.3 Assumptions on Performance of Residual Mechanical Treatment**

| Recyclate Targeted | Capture |
|---|---|
| Plastic Bottles | 80% |
| Other Dense Plastic Packaging | 50% |
| Other Dense Plastic | 50% |
| Ferrous Metals | 88% |
| Non Ferrous | 80% |

The calorific value of the residual waste stream rather than the tonnage input is the factor that determines the size of energy recovery plant required. From the residual waste composition above it has been calculated that the CV of the input waste is likely to be around 8.5 to 9 MJ/kg. The EfW facility costings have been progressed on a conservative estimate of 8.5MJ/Kg.

## Options 3 and 4

Should other residual waste arisings be available in addition to the City's municipal wastes, then a larger EfW facility would need to be sized to meet the combined requirements. At this stage, detailed data from other potential partners has not been obtained so a generic estimate of additional residual arisings has been calculated as follows:

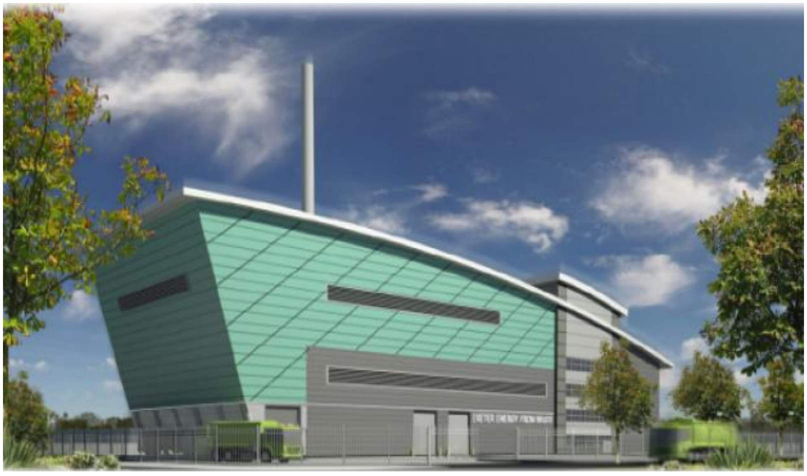
- Arisings of ~150,000 tonnes;
- 0% waste growth (as assumed for Aberdeen) is deemed prudent;
- Waste composition and resultant calorific value are considered to be the same as Aberdeen City;
- Assuming 60% can be diverted through other services and pre-treatment, the partner(s) would require residual treatment for around 60,000 tonnes per annum;

- Including a buffer of at least 3% to allow for uncertainty and limited flexibility for seasonal peaks in arisings results in a modelled additional input of 62,000 tonnes per year, resulting in a total EfW facility size of **109,000** tonnes per year.

### 4.2.2 Technology Requirements for Options 1 to 4

There are a number of EfW plants designed to operate with an input of around 40,000 to 60,000 tonnes a year based upon traditional grate technology but also advanced thermal treatment processes. There are more however designed to accept around 110,000 tonnes a year which would be required for Option 2 of this appraisal. Details of a range of suitable facilities are provided below. Each has been chosen due to its track record of development in the UK and capability to accept MSW arisings of a nature similar to that generated within Aberdeen City Council.

#### Exeter EfW



One of the most comparable reference facilities is currently under construction in Exeter. Devon County Council awarded a 25 years contract to Viridor which includes the operation of a new 60,000 tonne per annum facility at Marsh Barton near Exeter airport. This £45 Million facility will be built by TIRU/Cyclerval but Viridor will take over operation of the plant after 5 years. The facility is expected to generate 6MWe for export to the National Grid and around 17 MWth linked to 34km of District Heating network serving around 3,000 homes and a business park. These outputs are dependent on the district heating network being established separately.

## Newlincs EfW

The second relevant case study is a 56,000 tpa facility developed by Newlincs, located between Grimsby and Immingham. The facility, which had a capital cost of £49 million, accepts up to 56,000 tpa of MSW which is burned in a single incineration line with a Cyclerval oscillating kiln. The facility operates as Combined Heat and Power plant with a gross energy output of 3.45 MW. 2.2 MWe and 0.2 MWth are supplied to an adjacent factory. The thermal output was intended to be a larger portion of the CHP output but due to low customer demand, it is around 0.2 MWth. The facility has been operational since 2004 and is operated by Grimsby Operations Limited (a subsidiary of French company TIRU).

## Isle of Man EFW

The Isle of Man facility operated by SITA can accept around 65,000 tonnes per annum (includes 5,000 tonnes clinical in separate line). The capital cost of the plant was around £44 million which has a Babcock designed moving grate and boiler. The plant has an energy output in the form of electricity of around 4MWe.

## Energos Gasification Plants

Energos' gasification process has a proven track record in Norway, within one operational plant in the UK (Isle of Wight) and 6 others facility in development (including Irvine and Glasgow in Scotland). Energos offer a one line gasifier capable of accepting around 46,000 tpa (proposed for Irvine) and a two line of around 115,000 tpa (proposed for Glasgow and Milton Keynes). Typical capital costs are between £30-50 million depending on the number of lines selected. The facilities generate an electrical output of 3 or 7 MWe or can CHP mode depending on local requirements. The one line Sarpsborg facility in Norway provides around 32 MWth of steam to an adjacent industrial facility.

## Peterborough City Council

In February 2013, Peterborough City Council awarded Viridor a 25 year contract to provide 82,000 tpa EfW facility. The £76 million solution is a Babcock and Wilcox Volund (BWV) moving grate design to be provided by 2015. The plant will export around 7MW of electricity to the National Grid.

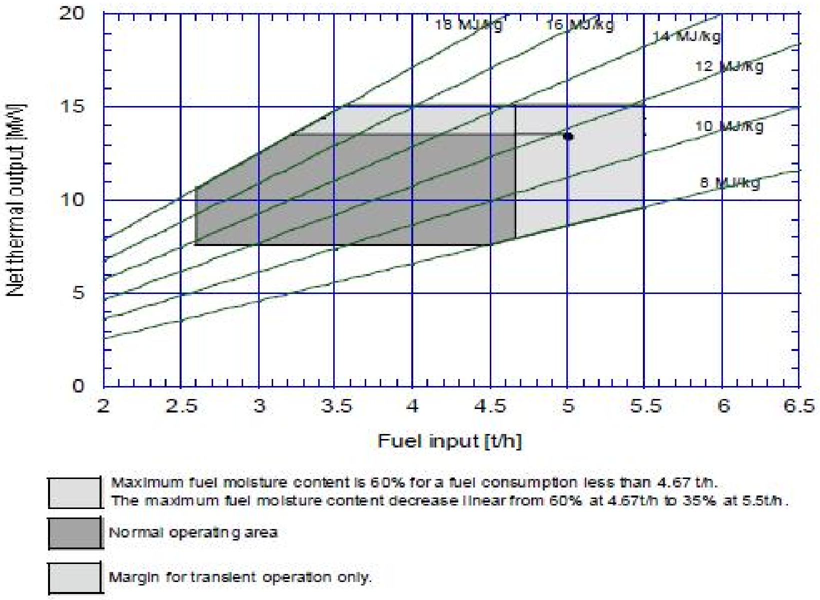
## Chineham ERF, Hampshire

Chineham ERF (Energy Recovery Facility) was the first of three EfW facilities developed to serve the Project Integra contract led by Hampshire County Council. Chineham, with a capital value of around £73 million accepts around 90,000 tonnes of municipal waste per year and has been operational since 2003. It has a CNIM designed moving grate and boiler system and produces an energy output of around 8MW of which around 6MW is delivered to the National Grid.

### 4.2.3 Technology Flexibility

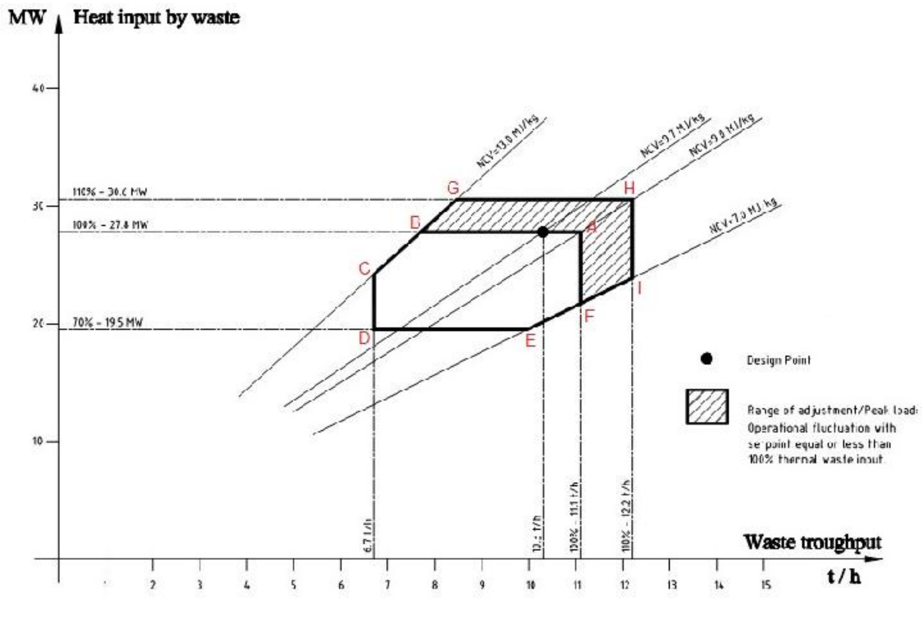
As stated in the introduction, each of the above facilities has been contracted to accept MSW waste for 25 years through local authority contracts. In this regard, they have all been scrutinised through due diligence by the procuring authorities and considered suitable for use. In terms of flexibility, at small scale, flexibility is limited in terms of amendments to plant size although all can be provided on a modular basis. In terms of flexibility to cope with changes to waste composition, each plant has a "design point" at which it operates at its optimum which is a factor of calorific value and Megawatt output as shown in the following firing diagram:

**Figure 4.1 Energos Type 41 Firing Diagram**




This example firing diagram indicates that although the design point is for waste with a calorific value of 11.8MJ/kg which gives a throughput of 5 tonnes per hour (around 43,000 tpa) and an thermal output of 13.5 MW, the normal operating window is much wider accepting waste with a CV of between 8MJ/kg and 18 MJ/kg. Each firing diagram is specific to the plant being designed. For comparison the following diagram is for the Peterborough City Council plant. It shows a plant designed for a lower CV range than the Energos one above.

**Figure 4.2 Peterborough City Council EfW Firing Diagram**



### 4.2.4 Technology Requirements for Option 5

Although no local energy recovery facility is required should residual waste be exported, it is required to be processed into a Refuse Derived Fuel (RDF) prior to shipping in order to satisfy Transfrontier Shipment (TFS) requirements. There is no technical specification for RDF but a basic level of physical processing is required to remove readily available recyclates such as metals plus a shredding or screening process to enable the material to be shaped and wrapped into 1 tonne bales. For the purpose of this appraisal, it is assumed that since Option 5 constitutes a continuation of a service to be undertaken by SITA in the short term, that suitable facilities for preparation and dockside storage will be available at no additional capital cost.

According to the recently published CIWM RDF Exports Research, there is capacity within mainland and northern Europe facilities that are capable of accepting RDF from Aberdeen. The Netherlands and Sweden are the most popular destinations from the UK with gate fees known to be around £40-£50 per tonne. The capacity is mainly within large scale facilities with high levels of efficiency (due to their use of the waste to produce heat) with additional facilities becoming available. There are other cost elements to consider such as Transfrontier Shipment (TFS) fees, transport, loading and offloading. Overall the cost of shipping and recovery within a European plant is around £80 per tonne.

### 4.2.5 Site Requirements

Each of the local technology options above have a minimum size requirement in terms of building footprint and surrounding infrastructure which will determine the size of site required. The other significant consideration (in planning terms) is the height of the stack. In general gasification plants have a smaller plant footprint, lower building roof height and lower stack than a more traditional grate technology and in theory should be more amendable to planners than a large more traditional facility. Design details for the facilities described above are provided in Table 4.3 below:

**Table 4.4 Facility Profiles**

| Facility | Annual throughput (tonnes per annum) | Building Footprint | Building height (Max) | Site Size | Stack Height |
|---|---|---|---|---|---|
| Newlincs | 56,000 | 4,635 m2 | | 1.7 hectares | |
| Exeter | 60,000 | 3,500,m2 | 27.5 metres | | 65m |
| Isle of Man | 66,000 | 10,000 m2 | 35 metres | | 70 metres |
| Energos gasifier | 46-115,000 | 1,800 or 2,400 m2 | 20 metres | 0.6 or 0.9 hectares | 45 metres |
| Peterborough | 82,000 | 5,390 m2 | 33 metres | 1.9 hectares | 60 metres |
| Chineham | 90,000 | 5,850 m2 | 37 metres | | 65 metres |

Smaller EfW plants do not necessarily result in proportionate decreases in site size due to minimum space requirements for site access, weighbridges, and some process plant. AMEC estimates that for Options 1and 2 a site of minimum 1.5 hectares, and ideally 2 hectares would be required for a traditional EfW technology, excluding the MT plant. Options 3 and 4 would require 2 to 3 hectares excluding MT. Advanced thermal technologies could have smaller footprint requirements. More detailed spatial planning would be required in event any sites are identified to take account of local constraints. An MT plant could require a further 0.5 to 1 hectares depending on whether it is co-located with the EfW or not.

The other important consideration in terms of site selection is the location of premises that could benefit from the outputs of the plant either as electricity, steam or heat. For maximum plant efficiency, these need to be within 5km of the EfW facility with "anchor" customers identified who will accept the majority of the outputs.

Exporting RDF for energy recovery in mainland or northern Europe requires the material to be prepared and stored prior to export. A shipment comprises around 2,500 tonnes of material which takes a period of time to accumulate so requires storage, preferably within a contained space or building. As discussed above, this Option 5 is the continuation of SITA's short term solution so facilities may already be available, presumed likely to be at Aberdeen City's Port or at the Port of Montrose. This could reduce the capital cost likely to be required in addition to that provided in advance for SITA but there will be an ongoing operational expense in any event.

### 4.2.6 Project Timescales

The project timescales will be driven by 4 principal drivers:

- The Waste (Scotland) Regulations 2012 requirement banning biodegradable waste going directly to landfill from 2020;
- The level and capability of resourcing within the Council's project team and governance structure;
- The programme and timescales set out for the procurement process; and
- The time taken to physically deliver each option. The highest uncertainty and risk is associated with construction of a new EfW.

The timing assumptions for the options are:

- Whilst SITA are contracted to provide services until 2025 the Council has option to take out residual waste at any time. Purely for the purposes of this assessment all options have been assumed to commence full operations in the year 2020, and have been assessed over a 25 year period to 2045;
- Options 1 to 4 – MT plant operational in 2015. Interim export of RDF under existing contract. New EfW procured and constructed by 2020;
- Option 5 – RDF preparation plant operational in 2015. Long term export of RDF from 2015. It is assumed that a new offtake contract would be entered into in either 2020 or 2025 on equivalent terms.

### 4.2.7 Opportunities surrounding Combined Heat and Power (CHP)

There are a number of EfW technologies available for the size of facility required by Aberdeen City Council. Each can be developed to operate in Combined Heat and Power (CHP) mode geared towards local needs. In CHP plants, the residual heat that is produced as a by-product of the electricity generation is captured and used instead of being discarded. This results in a highly efficient use of fuel and a significantly reduced level of CO2 emissions when compared to the separate generation of electricity and heat in power stations and heat-only boilers. It also has the potential for additional funding support through the Renewable Heat Incentives (RHIs).

The best CHP systems can increase the overall efficiency of an EfW plant from 20-25% to up to 60-70%. Therefore, the addition of CHP significantly increases the displacement of other fuels compared to electricity-only EfW.

District heating offers excellent opportunities for achieving the twin goals of saving energy and reducing environmental pollution. It is an extremely flexible technology which can make use of the utilisation of waste energy, renewables and, most significantly, the application of combined heat and power (CHP). It is by means of these integrated solutions that very substantial progress towards environmental targets, such as those emerging from the Kyoto commitment, can be made.

Points to note are:

- A CHP plant is more efficient than a simple power plant when the heat output is used effectively. Where CHP power generation produces heat that subsequently remains unused, the plant is effectively operating in the open cycle mode and therefore, probably, at a lower efficiency than the competing external power station;

- The plant will operate at its greatest energy efficiency, thereby maximising savings, when it is maintained as close as possible to its maximum load – as long as all the output is used;

- Economies of scale do exist. As the size of a CHP plant increases, capital and installation costs, expressed as £/kW, both fall. Operating and maintenance costs are also significant factors, especially for reciprocating-engine-based systems;

- It can be a challenge to find and secure end-users for heat offtake, particularly those able to enter in longer term contractual arrangements that can be needed to secure funding.

- Although a plant sized to meet maximum electrical demand will produce the greatest savings in purchased electricity, it may end up operating at part load – and thus less efficiently and economically – for a greater part of the time;

- Although electricity can be exported to the national grid during periods of surplus, these surpluses are most likely to arise at night when selling prices are at their lowest;

- The proposed EFW may be required to have two planned shutdowns (short & long) each year at roughly six-month intervals, in addition to unplanned shutdowns. These are dictated by the maintenance requirements of the air cooled condensers and in particular the legionella regulations. During these shutdowns, the energy demand of any district heating network would not be met by the

EFW. It is not considered likely that these shutdowns can be changed significantly due to the overriding regulations;

- The heat demand may show a clear seasonal pattern, with the majority of the energy use in the six months over the winter period, and reduced use over the summer periods. CHP is most economic when there is a continuous heat demand, such as on industrial sites in continual operation or in mixed-use community developments consisting of offices, retail space and homes. Domestic only schemes tend to suffer most from seasonable fluctuations in demand. Some European schemes incorporate thermal stores to overcome demand peaks/troughs or outages for maintenance, but this requires higher capital costs;

- In addition to the energy use pattern of the council demand (e.g. Town House etc), there is a further degree of finesse with the buildings only being occupied generally during office working hours. This pattern is repeated at nearly all commercial premises and schools. This suggests that a varied heat demand will exist for any district heating system, and that the overall load factor on the system is likely to be around 30 – 40% of the theoretical maximum capacity. The existing District Heating Schemes in Aberdeen will be a good source of information.

In addition to the above, there are some additional uncertainties associated with developing a wider district heating scheme in Aberdeen, especially in supplying large users that need to be considered/overcome at a design stage.

These include:

- Energy demand uncertainty – information on current demand should be available, however future demand information may be unavailable or not guaranteed;

- The condition and age of existing equipment on each site– owners are unlikely to replace brand new high efficiency condensing gas boilers and therefore the timing of any new scheme will have to consider the “cost” of integrating users into the district heating scheme.

- Existing infrastructure and whether it is compatible with a district heating scheme;

- Energy management initiatives already in place;

- The costs of providing additional back-up heat (as the EFW is unable to provide heat more than around 90% of the time);

- Commercial restrictions from long term (or centralised) utility purchasing schemes with potential for breakage costs;

- Long term development and energy efficiency plans at each site; and

- Any site specific development restrictions.

At this stage, the business case does not consider local electricity or heat demand and therefore assumptions have to been built into the financial model. Should the outcome of this appraisal favour a local solution, then a further Heat Study is required to determine the market size, potential routes and operating parameters for any heat network. This is also a statutory SEPA requirement for any new EfW permit applications.

# 5. Financial Appraisal

## 5.1 Introduction

The cost of providing an EfW facility for Aberdeen City's needs and the cost of RDF export were considered in the 2012 OBC. After considering a range of factors the OBC concluded that a local EfW solution (together with a short-term waste export arrangement seems to offer a better solution than either the "do-nothing" or long term RDF export options.

As described in Section 3 above, the OBC costs were calculated on a gate fee basis, with best estimates of underlying costs included elsewhere in the cost model.

This section considers each of the Options in more detail using the outputs from mass flow modelling and updated costings to inform an outline financial appraisal.

## 5.2 Revised Technical Cost Assumptions

For all Options it is assumed that mechanical treatment of the residual waste stream will be utilised to extract additional recyclates prior to energy recovery. The design and cost assumptions are set out in Table 5.1. Options 3 and 4 exclude any costs associated with pre-treatment of any non-council wastes, which it is assumed would take place prior to delivery to Aberdeen.

**Table 5.1 Assumptions on Residual Mechanical Treatment**

| Item | Assumptions |
|---|---|
| Long term Residual Waste throughput (Tonnes) | 55,700 |
| Design Throughput of Facility | 56,000 |
| Materials Captured via pre-treatment | Metals, Plastic |
| Capital Expenditure | £11,760,000 |
| Lifecycle Maintenance per annum | £8.40 per tonne |
| Operating Cost Variable per annum | £2 per tonne |
| Operating Cost Fixed per annum | £18 per tonne |

Note: Costs are quoted at 2013 prices (e.g. excluding future inflation), and represent underlying inputs to the financial modelling

For the purposes of appraisal, AMEC has assumed for Option 5 (RDF) that Aberdeen would enter into a direct contract agreement with a generic plant in Sweden. This route is popular with other exporters and is feasible from Aberdeen's port options. Swedish port handling costs and gate fees are known to be slightly higher than export to Netherlands but at this stage this is considered to be as feasible as the Netherlands option.

The design and cost assumptions regarding the subsequent EfW or RDF export outlet are set out in Table 5.2. .

**Table 5.2 Key EfW Input Assumptions**

| Item | Assumption |
|---|---|
| **Option 1 & 2 - Small EfW** | |
| Long term residual Waste throughput (Tonnes) | 46,500 |
| Design Throughput of Facility (Tonnes) | 47,000 |
| Capital Expenditure | £46,304,000 (excludes inflation and financing costs) |
| Maintenance per annum | £3.44 per tonne |
| Operating Cost Variable per annum | £10 per tonne |
| Operating Cost Fixed per annum | £26 per tonne |
| Calorific value of RDF | 8.5 MJ/kg |
| **Option 3 & 4 - Large EfW** | |
| Maximum residual Waste (Tonnes) | 108,452 |
| Design Throughput of Facility (Tonnes) | 109,000 |
| Capital Expenditure | £75,484,000 (excludes inflation and financing costs) |
| Maintenance per annum | £2.42 per tonne |
| Operating Cost Variable per annum | £10 per tonne |
| Operating Cost Fixed per annum | £11.77 per tonne |
| Calorific value of RDF | 8.5 MJ/kg |
| **Option 5 – RDF offtake** | |
| Capital Expenditure (RDF Mechanical Treatment plant) | £11,760,000 (excludes inflation and financing costs) |
| Baling and Wrapping | £10 per tonne |
| Gate Fee at Swedish plant | £50 per tonne |
| Sea transport & handling | £20 per tonne (assumes no backload available for free) |
| Licensing (TFS) | £4,000 per year |

Note: Costs are quoted at 2013 prices (e.g. excluding future inflation), and represent underlying inputs to the financial modelling

There are also a number of “one off” costs that could also apply to Options 1 and 2 relating use of any particular site. Since no site has been identified at present, it has been assumed that the grid connection and site preparation costs are similar to other UK plants within AMECs cost database, and are therefore included in the modelling. No costs for a CHP pipeline have been included in the modelling as any additional capital expenditure would typically be expected to be covered by extra heat income. Heat Pipeline can cost around £1,000 per metre including installation. By way of example a 7.5 km of pipeline to link to the Aberdeen Heat and Power network would cost ~£7.5M.

## 5.3 Financial model assumptions

Ernst and Young was appointed by the Council to undertake financial modelling, based on the mass flow and cost assumptions provided by AMEC.

Two funding options were analysed for the EfW facility, one being based on the Authority borrowing funds itself to pay for required construction works, and the other a private-public partnership (PPP), where a contractor obtains funding at commercial borrowing rates. The local authority funded options (Options 1 and 3) are based on borrowing from the Public Works Loans Board (PWLB) which is typically at lower rates than commercially available funding arrangements. Higher borrowing rates are generally associated to privately funded options as they reflect the higher level of risk the partner accepts by agreeing to provision of the funding.

The two PPP options (Options 2 and 4) were based on a generic Special Purpose Vehicle (SPV) financial model provided by Ernst & Young drawn from currently available market funding structures and terms for similar projects. The Authority Build modelling was based on the Council sourcing the funds for the initial capital investment, and the partner waste contractor applying a gate fee to recover operational costs.

The options were first analysed without the capex and opex associated with the MT plant. This is because the technical requirements, costs and impact of interim arrangements remain unclear at this time. The MT costs were separately analysed to allow them to be included as a sensitivity test.

Key assumptions on TPI are:

- Third party Waste has been priced at £80/t in the two oversized facilities. This is a considered to be a lower mid-point on current alternative export prices;
- Electricity has been priced at £50/MWh and indexed at 3.5%. This is slightly more aggressive than typical bank funding but comfortable for the current market placement on power price.

Key assumptions on indexation and funding terms are:

- Treasury Green Book advice has been applied where appropriate
- The project has been costed on a operating life of 25 years, in line with other waste project financial models currently in the market
- Inflation at 2.5% in line with Treasury Green Book, unless specific aspects of the project suggest using a higher rate e.g. transport costs, capital costs at 4.5%
- Risk / Optimism Bias has been based on the financial consultants experience with similar waste related projects, including;
    - Capital Expenditure +25%, Operational Expenditure+ 5%
    - Power and Heat minus 20% (as the market for Feed in Tarrifs is subject to change as detailed earlier in this report)

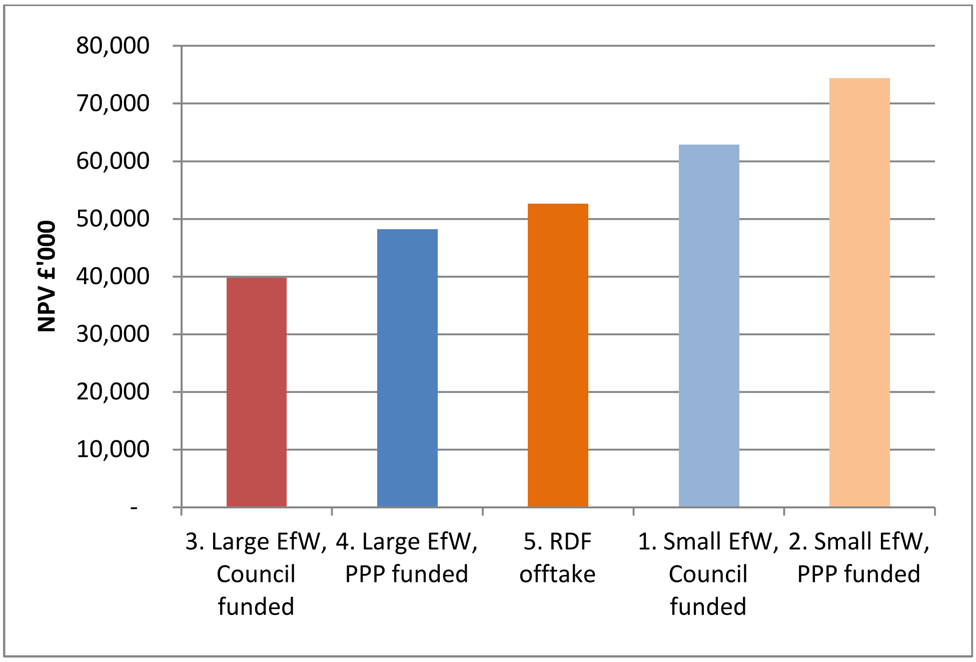
## 5.4 Financial Model Results

A working financial model has been provided to the Council. The headline data from the financial modelling exercise is compared in Table 5.6 below (exclusive of MT costs), with the options ordered by NPV from lowest to highest. The total net present value (NPV) of each option uses a standard 3.5% discount rate and is shown graphically in Figure 5.7.

**Table 5.3 Financial Model Results (excluding pre-treatment)**

| Option | Base Price £k | Net Present Value (NPV) £k | Nominal Price £/t 2020-21 | Nominal Price / t 2030-31 | Nominal Price / t 2040-41 | Nominal Price / t 2044-45 |
|---|---|---|---|---|---|---|
| Option 3: Large EfW, Council funded | 123,085 | 39,826 | 132.8 | 141.2 | 152.5 | 71.0 |
| Option 4: Large EfW, PPP funded | 163,771 | 48,170 | 166.1 | 176.1 | 189.2 | 184.3 |
| Option 5: RDF export | 196,137 | 52,666 | 147.7 | 194.8 | 260.0 | 271.0 |
| Option 1: Small EfW, Council funded | 198,547 | 62,838 | 187.4 | 207.2 | 231.7 | 135.4 |
| Option 2: Small EfW, PPP funded | 258,703 | 74,372 | 215.9 | 247.6 | 283.5 | 279.1 |

**Figure 5.1 Financial Model Results**




Option 3 (Large EfW, Council funded ) has the lowest overall NPV. The analysis broadly follows the expected convention that a larger EfW facility gives a lower cost per tonne, with Option 3 and 4 having a 35%-37% lower NPV than Option 1 and 2, based on stated indexation and third party revenue assumptions. However this option has deliverability issues as it would require other guaranteed sources of waste in order to achieve the economies of

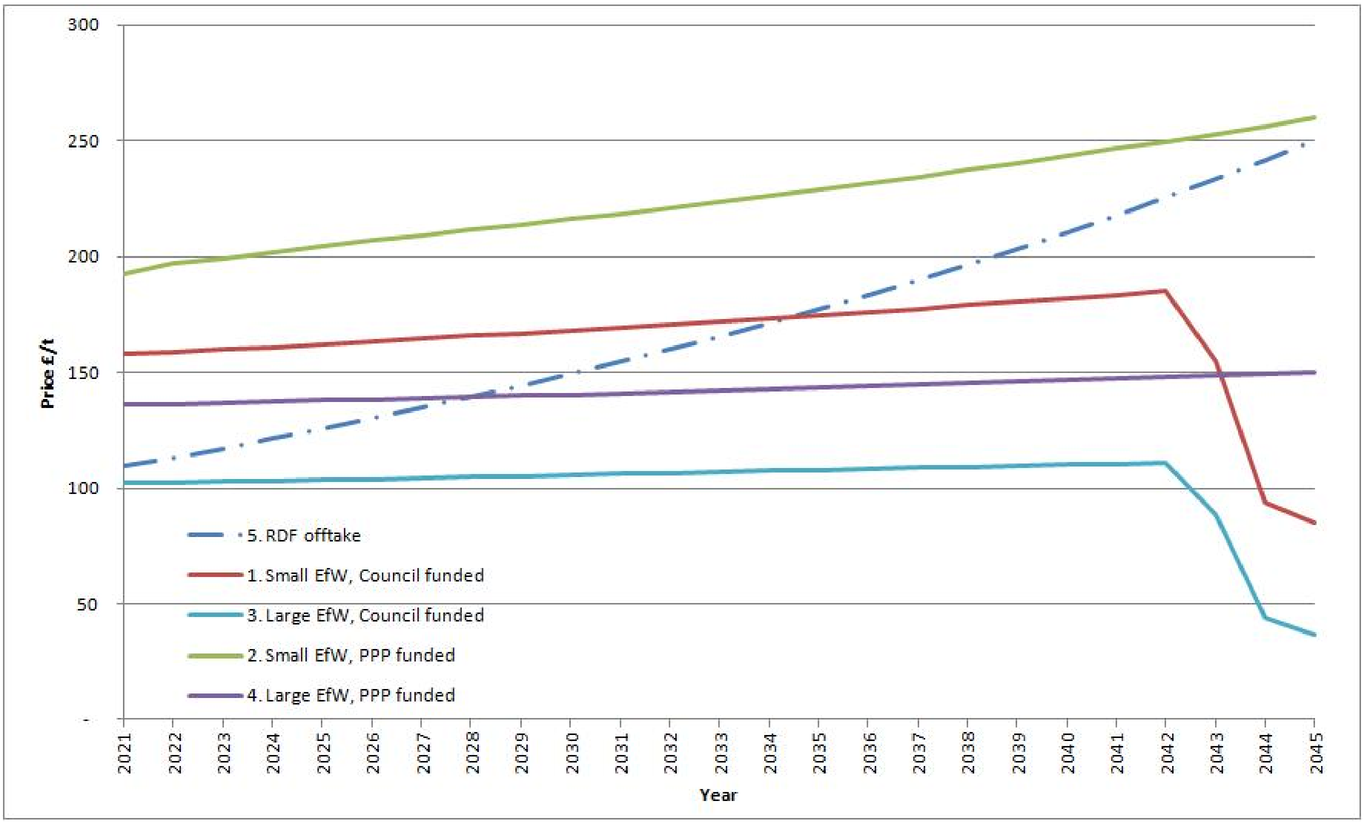
scale, or for the Council to oversize the facility and take some risk on sourcing third party wastes itself. In both cases higher investment would be needed, which increases risk of project delays in obtaining funding. Wider issues are discussed in section 8 of this report.

In NPV terms there is a moderate difference between the risk adjusted Council funded and the PPP funded cases (16% to 19% difference), and a more detailed review of the risks and project specific risk/OB adjustments may clarify which funding option would be best value for money.

This updated analysis concurs with the 2012 OBC that Option 5 RDF offtake could be competitive in the medium term compared to a small EfW in Options 1 and 2, having a 16%-29% lower NPV. It does not compete so well with a large EFW, with the total NPV of Option 5 is 9% to 32% higher than Options 3 and 4. However the assumed RDF offtake price and higher 3.5% inflation rate have a key influence on the cross over point between the options. The assumed RDF baseline gatefee (£80/tonne in current terms) and possible future inflation rates have not been subject to any formal benchmarking or negotiation with potential offtakers. Results of SITA negotiations are not expected until early 2014.

The 25 year NPV of the options tends to hide the relative changes in future costs, due to discounting effects on payments in later years. In those later years the budgetary impacts of high prices could place added financial burdens on the Council, albeit the overall 25 year project cost is still value for money. The annual nominal price per tonne of each option are shown in Figure 5.2 below. This shows that based on current modelling the price per tonne of Option 1 (small EfW, Council funded) could become lower than Option 5 (RDF offtake) in the medium term (between years 2030 to 2036 depending on funding route and inflation assumptions). RDF offtake could also be lower than Option 44 large EfW, PPP funded) until about 2027, again critically depending on future inflation rates.

**Figure 5.2 Annual nominal prices per tonne of each Option (excluding pre-treatment)**



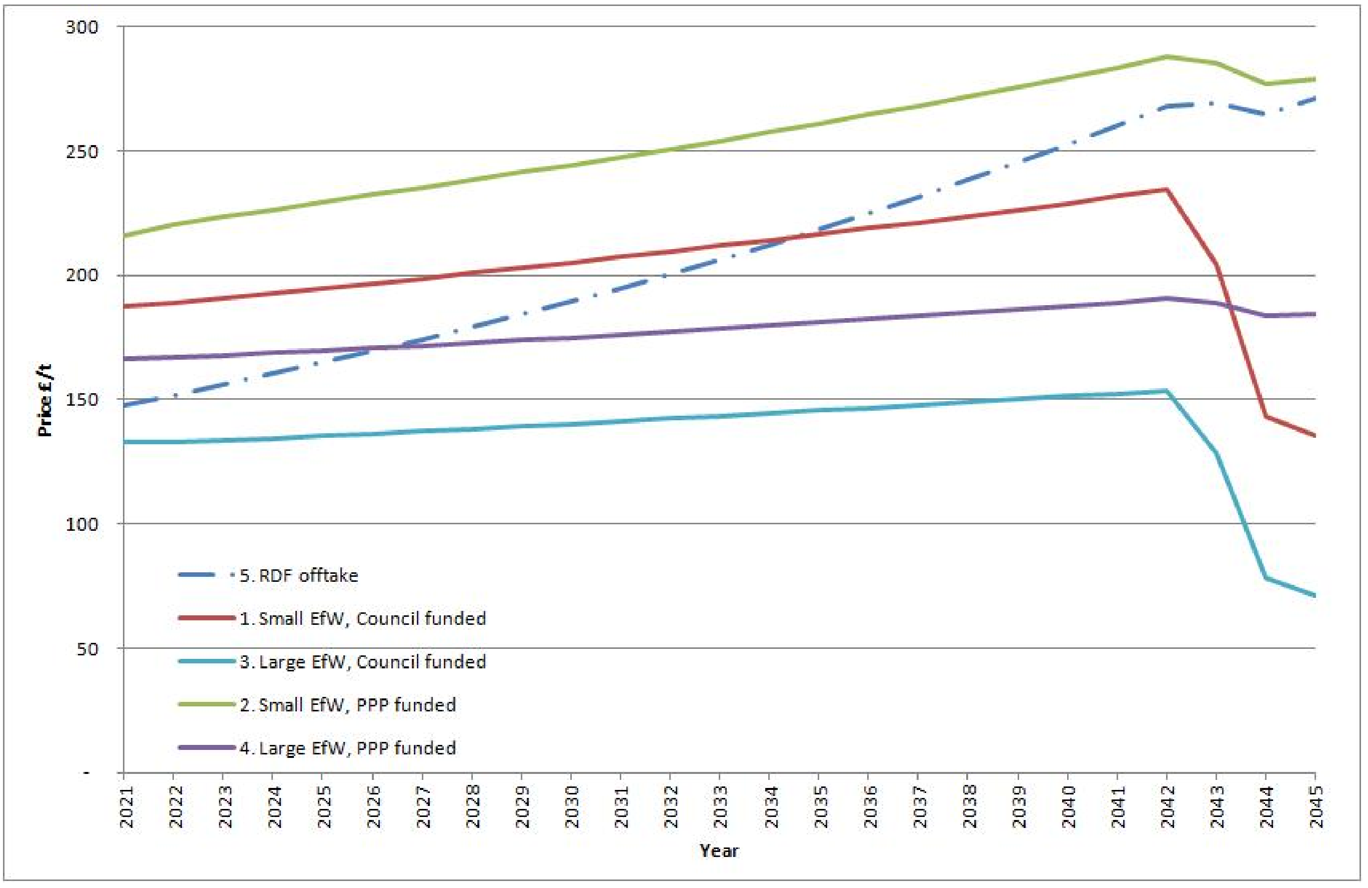

## 5.5 Requirement for Mechanical Treatment

Ernst & Young modelled the total cost of the project, inclusive of Mechanical Treatment. Whilst the requirement for Mechanical Treatment is understood in terms of the Scottish Government requirements for pre-treatment prior to domestic energy recovery, there is no such requirement prior to export. There is however a requirement to perform a basic pre-treatment in order to ensure that a Refuse Derived Fuel (RDF) rather than a raw waste is exported (in accordance with the UK Transfrontier Shipment Regulations). The extraction of metals and plastic also ensures that Aberdeen's resources are maintained within Scotland and not exported.

The level of treatment required to produce RDF is basic and cheaper than the domestic requirements, however there is much discussion at present around a formal RDF specification. It is AMEC's view that within the next few years, the domestic requirement will be adopted by SEPA for RDF exports, and therefore similar MT costs have been applied to Option 5.

The difference in cost, attributed to the MT requirement is around £40 per tonne and is considered by AMEC, in comparison to other business cases, to be a reasonable estimate. The effect of the MT costs is to increase the NPV for all options, but does not change their comparative rankings. It brings forward the potential cross over point with Option 5 RDF, as shown in Figure 5.3 below.

**Figure 5.3 Annual nominal prices per tonne of each Option (including pre-treatment)**




## 5.6 CHP Outputs

The financial modelling above assumes a revenue from an electricity only output i.e. the Council would not elect to make use of heat produced from any EfW plant by feeding it to a CHP. The benefits of CHP are discussed earlier in this document and therefore the implications for heat use, based upon a scheme similar to that proposed for the Exeter EfW project have been considered further in this section.

The extraction of both heat and electricity from an EfW facility has an impact on the subsequent amount of electricity that can be produced. The degree to which this occurs is influenced by three main factors:

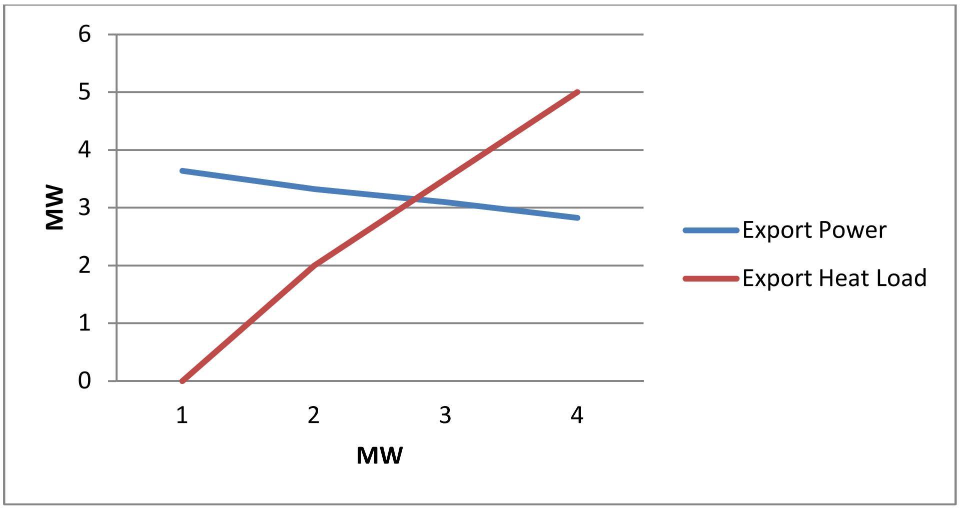
1. The CHP supply conditions i.e. low quality heat or high quality heat. Low quality heat (low temp., low pressure) can, depending upon the heat supply conditions, be taken from the back end of the turbine with much less impact on power generation. High quality heat (medium temp. Medium pressure) needs to be taken at a design optimised inter-stage point and consequently has greater impact upon power output.

2. The heat requirements i.e. total heat capacity required at off-take (MWth)

3. The nature of heat supply i.e. continuous, part daily, monthly, seasonal cycles etc.

Assuming a scheme similar to Exeter whereby low grade heat would be required by local users, or be fed into the existing Aberdeen Heat and Power network, indicative effects on heat versus electrical load are shown in Figure 5.4.

**Figure 5.4 Exeter CHP versus Electricity Only Output**




Early modelling for Option 1 indicated that around 16,000 MWh of electricity would be available for export from the plant which is equivalent to around 2.4 MW (e) (the final numbers are different, but the same principles apply). Using the Exeter data above as a guide, Table 5.5 indicates the balance of electricity versus heat output from an Aberdeen facility.

**Table 5.4 Electricity versus thermal outputs**

| CHP Option | Output |
|---|---|
| Electricity only | 16,000MWh |
| 1.78 MW (e) | 14,000 MWh (e) |
| Plus 2 MW (th) | 16,000 MWh (th) |
| 1.28 MW (e) | 10,000 MWh (e) |
| Plus 5 MW (th) | 40,000 MWh (th) |

E= electricity output, th =thermal output

To show the potential revenues that could be gained from operating in CHP mode versus electricity only, it has been assumed that the market price for heat is around one third of the market price for electricity, and a conservative value on electricity revenues has been used of £35/MWh (more conservative than E&Y's assumptions above). This is in line with fossil fuel pricing for electricity versus natural gas. The outputs are shown in Table 5.6 below.

**Table 5.5 Example effect of CHP on Revenues**

| CHP Option | Output | Revenue over 25 years |
|---|---|---|
| Electricity only | 16,000MWh (e) @ £35 MWh | £14,000,000 |
| 1.78 MW (e) | 14,000 MWh (e) @ £35 MWh | £12,250,000 |
| Plus 2 MW (th) | 16,000 MWh (th) @ £10 MWh | £4,000,000 |
| 1.28 MW (e) | 10,000 MWh (e) @ £35 MWh | £8,750,000 |
| Plus 5 MW (th) | 40,000 MWh (th) @ £10 per MWh | £10,000,000 |

Option 5 would not provide any opportunity for local electricity generation. Unlike Options 1 to 4 it would also not provide the potential for development of a district heating network associated with a local waste facility.

## 5.7 Sensitivity Analysis

There are many assumptions and variables associated with the above financial modelling, most of which are subject to change/fluctuation. At this stage, detailed sensitivity analysis has not been undertaken, however the factor most likely to influence the finance of a project is capital expenditure. Relatively small increases (<10%) in capital expenditure or changes to timings can have significant effect on the resulting price per tonne paid over the period of a contract. Since capital is subject to a number of market forces, quotations from the market should be gained through soft market test in advance of any procurement.

## 5.8 Conclusions from Financial Modelling

The financial assessment of options has shown that a large EFW (Options 3 and 4) with one or more other partners would provide the best value for money solution in the long term. This option is subject to a number of deliverability constraints as explored later in the report.

RDF export (Option 5) is a competitive option for the Council in the short to medium term based on current market price indications. This is not surprising since a similar conclusion has been made by a number of Scottish and UK Councils and waste companies in recent years, and has already been selected by the Council for the short term through the existing SITA contract. The long term viability of RDF export is currently unknown beyond 5-10 years and therefore the risk profile of this option is completely different to that of a domestic facility. These risks are further discussed in Section 6 and 8.

A smaller scale EfW facility (Options 1 and 2) would be the most expensive option but if Authority funding were available it could become very competitive in the very long term (e.g. post 2042). This is because, with both Options 1 and 3, once the borrowing has been re-paid the facility would benefit from a step-down in the price per tonne on continuing operations. The Council would be in ownership of a strategic EfW asset which could offer a continued service at much reduced rates, in a similar way that other UK authorities are currently benefiting from operating older EfW facilities. It is worth noting that some of the RDF export prices are currently low due to the same reasons (e.g. use of older facilities where capital investment has been repaid).

# 6. Risk Management

## 6.1 Introduction

There are a number of risks inherent, and unavoidable, with a waste infrastructure project of this type and they therefore need to be identified and managed from the outset of the project. An optimal apportionment of risks needs to be balanced between the council and the private sector to achieve a successful project and one that demonstrates value for money. Risk should be borne by the party, whether council or private sector, best placed to manage it.

As a minimum the risks associated with delivery of the project should be considered separately in respect of project risks and procurement risks, and ideally separately consider risks related to planning, legislation, market offtake, competition, timetable, and cost.

At an early stage the council should develop a risk register and allocate responsibility of the risk register to a key member of the project team, the Project Manager. The Project Manager is responsible for updating and amending the register as the project continually evolves. Best practice suggests the register should be updated at/following each project team meeting and reported to the project board on a regular basis.

## 6.2 Options 1 and 2 - Small EfW

There are significant risks associated with the delivering of a local EfW solution in Aberdeen but a number of ways in which risk can be managed and mitigated:

- The project scope should be clearly defined from the outset of the procurement process;
- Realistic and deliverable timetable for procurement;
- Clear selection and evaluation criteria;
- Adequate, valid data and supporting information available to bidders at an early stage to help inform outline and detailed solutions;
- Land and planning issues being resolved at as early a stage as possible. This has particular relevance with past experience in SITA's previous planning application; and
- Good resourcing of the project team to ensure to quick and effective response to bidders.

### 6.2.1 Planning risk

There is substantial risk associated with development of the local EfW option, given the contentious nature of waste treatment facilities. Previous experience through the SITA contract and inability to secure planning permission for a treatment facility at Altens Industrial Estate in 2004 demonstrates the difficulties associated with delivering planning permission.

Commencing the procurement process with a site identified in the Local Development Plan, acquired and Planning Permission in Principle (PPiP) achieved will encourage interest and increase competition in the project. This will be a particularly important issue given that SITA holds contracts with both Aberdeen and Aberdeenshire and has a site at Stoneyhill that has previously been subject to waste treatment proposals which have since been withdrawn.

Usual procurement practise is that the risk of gaining full Planning Permission, and compliance with any planning conditions, and associated permits to operate the facility is borne by the preferred bidder/contractor rather than the public authority.

### 6.2.2 Timetable risk

The project timetable must be realistic. Competitive Dialogue procurements have been successfully delivered in 18 months, not inclusive of pre-procurement preparation. Despite all good intentions, this process can take up to 5 + years to complete. The key is to for the procuring authority to be clear at the outset of the process about what it will accept and sign up to and what it will not. Whilst competitive dialogue allows the Authority to discuss and amend its requirements through dialogue, it requires the Procurement officers to have a level of Authority on behalf of the Council otherwise any Dialogue is required to be approved by a Project Board.

A reasonable construction and commissioning period is also key to ensure the service operates as planned from day 1. Typically, the development of an EfW facility can take 3 years to complete, depending on the site and any ground conditions that need to be dealt with. An additional 1 year should be allowed for the determination of the planning application and environmental permit with a 6 month preparation time for each. Overall, a period of 5 years post contract award is advisable.

## 6.3 Options 3 and 4 - Large EfW

With this option many, if not all, of the same risks exist as if Aberdeen were procuring a plant to meet their needs alone however there are additional risks in respect of ensuring all partners are fully committed to delivering the project. Full commitment from all parties can also increase confidence within the market to bid for the project. In the case of local authorities a clear mandate from the Chief Executives will give confidence to the market that the project is fully supported. This should be sought and confirmed at the earliest stage possible. Many ‘shared services’ or joint projects have failed at this point and the challenges of joint working should not be underestimated.

There is an additional public perception risk associated with the concept of ‘importing’ waste into Aberdeen, albeit this may come from within the wider region.

The identified Project Manager should be empowered and supported by all participating councils to enable effective delivery of the project.

## 6.4 Option 5 - RDF Export

The main risks with the long term option to continue to export RDF can be considered to be market based – ongoing demand from Europe and elsewhere for material; legislative – whether tighter controls are introduced in respect of quality standards, legislative controls around handling, storage and shipping; and financial risks – substantial increases in European EfW gate fees potentially driven by incineration taxes and the unknown cost of long term transportation.

### 6.4.1 Market based risks

The Chartered Institute of Wastes Management (CIWM) report into RDF exports to the EU[3], written by AMEC, suggests that long term reliance on European RDF markets could expose councils to volatile markets, given that a number of near-EU countries will be required to improve landfill diversion performance. As such the European RDF market may therefore become more expensive, as more producers seek to access a fixed number of outlets. Mitigation of this risk may be achieved through security of a long term contract with a facility. Many contacts are short term at present (2-3 years) but contracts up to 10 years in length are now available, which ensures capacity beyond 2020 (the most rigorous EU landfill diversion target date).

A number of EfW facilities designed to accept RDF are currently being developed in the UK. It is generally expected that further capacity will become available in the UK in the future, if considered commercially viable, and that European facilities will continue to offer spare capacity. The timing and level of competition for this spare capacity, and the applicable gate fees in the UK and Europe, are major uncertainties that will determine the technical deliverability of this option.

There are a range of public and private projections on how and whether there will be over capacity or under capacity in UK treatment facilities in the future. This relates to the amount exported, success rates in gaining planning permissions and funding for new facilities, future rates of waste growth and recycling and other commercial drivers. Increasing drivers for treatment of commercial and industrial wastes, arising in part from ongoing environmental policy developments and landfill tax, may also lead to increased competition for UK spare capacity with municipally collected wastes.

There is ongoing debate on the effect the more recent EU accession countries in Eastern Europe, like Poland and Romania, will have on demand for existing spare capacity at waste treatment facilities. They may develop with their own infrastructure or export waste to other countries. It is also unclear whether the current economic climate in Europe is leading to a peak in RDF market demand as waste growth has been temporarily suppressed, and there is therefore more spare capacity than originally anticipated. Demand for this market capacity may reduce as ‘home’ UK demand for input into EfW plants grows with an economic recovery.

[3] http://www.ciwm.co.uk/CIWM/MediaCentre/Current_pressreleases/Press_Releases_2013/ciwm_news_310713.aspx

### 6.4.2 Financial risks

Linked to the market based risks, financial risks may largely be driven by increased competition in the market place as outlined in 6.4.1 but may also be influenced by any changes in or introduction of incineration tax levels in individual Member States. Few Member States have an active incineration tax policy and many that do, the Netherlands and France for example, set the tax level so low that it is still a cost effective treatment option. This risk can be mitigated through the Project Agreement.

The cost of long term transportation is also an issue. Most of the companies involved in RDF export take advantage of backloading, whereby a boat has brought goods to the UK and would be returning empty. This option offers great value in that the cost of shipping has been met and the backload is accepted for a minimal fee (close to zero). This relies on the intended port being a receiver of raw goods, which is not necessarily the case for Aberdeen. The majority of port traffic is associated with the Oil and Gas Industry and therefore opportunities for backloads to Europe will be limited. The potential for this will need to be explored and in some respects, the risk can be quantified by SITA during their initial period of export. Whilst it is considered theoretically possible to eliminate financial risks over a period to 2025, such a contract has not been seen AMEC to date. It may be prudent to incorporate price break/review points into the latter stages of such deals to avoid being locked into uncompetitive contracts.

### 6.4.3 Legislative risks

There is currently no recognised standard for RDF, unlike SRF, and is a source of concern amongst the UK regulators hence the recent release of statements from each. The quality of RDF acceptable at receiving plants varies but there is no preference for an input of high quality given that the main feedstock in the plants is largely mixed domestic waste. The main risks in legislative terms are therefore likely to be at the 'UK end' in respect of tighter control or definition of what constitutes pre-treatment of waste and tighter controls on handling, storage and export of material. These risks cannot be quantified but if realised might potentially lead to additional capital costs in respect of the preparation plant and increased revenue costs for individual export loads.

# 7. Contractual & Procurement Models

## 7.1 Introduction

Assuming that the Council wishes to continue consideration of a local solution, this section provides details of a number of contractual models and procurement options that could be followed.

There are a wider range of factors that impact procurement activities to consider.

- Procurement Route;
- Procurement Timescale;
- Soft market testing;
- Contract length;
- Contract type;
- Specification requirements;
- Funding solutions;
- Site provision;
- Internal procurement and bid evaluation arrangements;
- Third party waste usage (commercial waste);
- Revenue sharing arrangements;
- Interim contract arrangements;
- Current workforce / TUPE considerations;
- Packaging of service areas;
- Approach to Variant Bids;
- Financial considerations – taxation, indexation, currency exchange risk, bonds, guarantees and insurances;
- Planning and Permitting;
- PR and stakeholder engagement.

Each option would require varying amounts of time and effort spend on these activities. The nature of the bid offers from the market would also directly influence the level of preparation, negotiation and contractual drafting that would be required to reach mutually acceptable tenders.

## 7.2 Contractual Models

### 7.2.1 Introduction

There are a number of contractual models the Council can consider for the development of a local EfW. Each of the contractual models is considered in the following sections. Some of these may be less relevant to Option 5 where less infrastructure is required, but the contractual route for constructing a local RDF preparation plant would need consideration.

### 7.2.2 Design, Build, Finance, Operate (DBFO)

With this contractual model a single contractor is generally appointed to design, build and operate the facility for a defined period of time, typically 25 – 30 years for this type of project. The contractor also finances the facility and effectively leases it to the Council. Following expiry of the contract duration the asset reverts to the client (in this case the Council). This approach essentially follows the Public Private Partnership (PPP) model and has an extensive track record in delivering waste projects on time and on budget whilst demonstrating Value for Money. The PPP model binds the contractor to a long term maintenance contract whilst also requiring the contractor to accept the risk on the quality of work that they do. The type of risks inherent in a project requiring major investment, such as the risk of the plant not doing what it is designed to do, are borne by the party best placed to manage them – the private sector.

The main objectives of a DBFO contractual model are to:

- Ensure that the project deliverable (the facility) is designed, maintained and operated safely and satisfactorily;
- Transfer the appropriate level of risk to the private sector;
- Promote innovation, not only in technical and operational matters, but also in financial and commercial arrangements; and
- Minimise the financial contribution required from the public sector.

The key principals behind a PPP DBFO contract structure are set out below.

#### The transfer of risk

The allocation of risk and reward between the contracting parties should be clearly defined and private sector returns should be genuinely subject to risk. The contractor will be expected to assume the majority of the risks associated with the design, construction, maintenance, operation and financing of the project. These risks will include the risks of construction and maintenance to time and to budget and making “whole life” cost judgements, i.e. judgements that consider the full contract duration.

### Value for money

The client establishes whether the proposed levels of payment are justified by the benefits of the DBFO project. To assess whether a project constituted value for money a public sector comparator can be used, which makes allowance for risk transferred. This is calculated by costing out what the public sector would have had to pay to procure the construction of the facility and to operate and maintain the facility over the facility lifespan by traditional means. The calculation includes an assessment of the risk resting with the client under conventional procurement.

An assessment of the net present value of the public sector comparator can be prepared and compared with the net present value of the projected payment under the DBFO contract. This can take into account other value for money considerations which may not be quantifiable but may be significant, for example, environmental considerations or other policy objectives such as those specific to Aberdeen.

### Managerial responsibility

The managerial, operational and maintenance responsibility for the facility is undertaken by the private contractor.

### Payment for service

The client makes payment in relation to the receipt of a service, and may adjust payments to reflect the satisfaction of certain performance criteria.

## 7.2.3 Design, Build, Operate (DBO)

Similar to the DBFO option a contractor is appointed to design, build and operate the facility, typically over a 25 – 30 year duration. The key difference however is that the appointed contractor is not expected to finance the facility, the Council can either directly finance themselves or seek alternative funding routes.

With this option largely the same risks are transferred to the contractor whilst the responsibility of securing financing rests with the Council. As a result of avoiding involvement of external funding bodies this contractual model focuses upon design, construction and operation and the balance of risk shared between the Council and its appointed contractor. With this approach however there are significant risks that cannot be passed over to the private sector and therefore remain with the Council. The Council has to assume all of the funding risk and the associated technology risk.

It is common for waste sector DBO contracts to also include maintenance of facilities and infrastructure necessary for the contract. This avoids the risk of operators installing maintenance intensive equipment and passing costs back to the Council. In some contracts, where an operator is using a council asset (e.g. office) or only using part of a site, the Council may arrange for separate maintenance contracts.

### 7.2.4 Separate Design and Built (D&B) and Operate & Maintain (OM) contracts

With this contractual model the Council themselves provide the finance for the facility, separately procures its design and construction and then appoint a contractor to operate the facility and maintain it for a defined period. The Council may appoint independent advisors to design and oversee the construction of the facility but essentially takes all of the design and technology risk throughout the contract period. This option has been used where Authorities have a clear facility specification and are willing to take more of the construction related risks. It does present an interface risk over the cause of any future operational difficulties, as operators may claim it is due to underlying design or construction issues and try to pass related cost risks back to the Council.

## 7.3 Procurement options

### 7.3.1 Introduction

The Public Contracts (Scotland) Regulations 2012 replaced those which came into force in 2006. The Regulations allow for four types of contract award route:

- Open procedure;
- Restricted procedure;
- Negotiated procedure; and
- Competitive Dialogue procedure.

The adoption and use of the Open and Restricted procedures are unrestricted whilst the Negotiated and Competitive Dialogue procedures can only be employed in certain circumstances. The Negotiated Procedure can only be used in very limited circumstances and those circumstances do not apply to the Council in this case. The Competitive Dialogue procedure is generally used on complex projects such as those enveloped within PPP/PFI. This process is reserved for complex projects recognising a need for dialogue with bidders to develop the final solution that meets the Council's procurement objectives.

### 7.3.2 Restricted Procedure

The Restricted Procedure (RP) requires bidders to pre-qualify in order that they can demonstrate appropriate levels of financial standing and track record/experience in delivering projects of a similar nature. Those bidders, a minimum of five where five are capable, that are invited through prepare their bid against a strict specification prepared by the Council. The RP route does not allow the Council to opportunity to 'dialogue' solutions with bidders and may therefore limit opportunities for innovation. The Council should therefore be able to specify the entire requirement of the contract to the extent that bidders can submit a fully priced bid without the need for any negotiations on receipt of the bid.

Use of the RP on waste projects would be typically limited, in Aberdeen's case, to contracts such as seeking an interim solution for waste treatment (preparation and export of RDF) or acceptance and processing of collected dry recyclables. Both of these examples are being progressed in parallel to this business case through contract variation negotiations with SITA.

### 7.3.3 Competitive Dialogue

The Competitive Dialogue (CD) process is reserved for use in particularly complex supplies, services and works contracts where it is not possible to use the Open or Restricted procedures or the circumstances do not permit use of Negotiated procedures. The CD process is most appropriate where the buyer, in this case the Council, needs the expertise of the market to design a feasible 'fit for purpose' solution. The CD process has been extensively used to deliver waste treatment infrastructure.

The use of the CD process is expected on projects where the client is able to state its requirement at the outset, but either cannot or does not want to define what the solution should be. This need to keep options open can stem from technical, legal or financial issues such as alternative design solutions and risk allocation arrangements.

The CD process is designed to encourage authorities to bring a well structured and appropriately resourced project to the market. The dialogue element is then used to refine and enhance the preferred solution. The process of dialogue is designed to be constructive, open and competitive to ensure bidders contribute to the development of the final solution for the Council. There is flexibility within this process to allow dialogue on all elements of the solution.

#### Competitive Dialogue - Lessons Learned

A number of projects, not exclusive to waste treatment infrastructure, have been delivered using the CD process and a number of lessons learned. The key issues for local authorities having used the CD process are:

- The attractiveness of the project in physical (design) and deliverability terms;
- Level of pre-procurement preparation. The Output Specification, Payment Mechanism and Project Agreement should be in place at the commencement of the CD stage to retain bidder interest;
- A good Project Director is critical to develop a strong relationship with bidders;
- No more than three bidders should be selected following evaluation of the Invitation to Submit Outline Solutions (ISOS) stage;
- Detailed and robust evaluation criteria should be developed prior to opening the CD stage;
- Dealing with the development of variant and innovative solutions; and

- Knowing when to close dialogue and Call for Final Tenders (CFT).

## Benefits of Competitive Dialogue

The dialogue process allows, and encourages, detailed testing of each bidder's preferred proposal. This is the primary benefit for the Council given that it provides confidence that the solution developed is robust, deliverable and value for money. Experience of the CD process highlights the following benefits:

- Both the bidding party and the Council can have confidence in the developed or final solution as it has been tested throughout the dialogue process;
- The process allows for added value in project delivery through the generation of alternative design proposals; and
- The iterative process of solution development complements the development of solutions for complex delivery projects.

## Competitive Dialogue Timescales

The time to deliver projects via the CD process can vary significantly, typically from 18 to 36 months from publication of contract notice to contract signature, but is exclusive of time spent by the Council in pre-procurement phases. Timescale can vary as a result of the number of stages the Council wishes to use and the length of each dialogue phase. The key phases are:

- Pre-Qualification Questionnaire (PQQ);
- Invitation to Submit Outline Solutions (ISOS);
- Invitation to Submit Detailed Solutions (ISDS); and
- Call for Final Tenders (CFT).

Some Councils also adopt a stage for refined solutions (ISRS) following and preceding the CFT stage.

# 8. Discussion and Recommendations

## 8.1 Comparative performance of the Options

This report has revisited the options appraisal process undertaken for the OBC in a greater level of detail, and has considered five options;

- **Option One (Small EfW, Council financed)**: To develop a facility on a site identified within the Council’s boundary with the purpose of treating Aberdeen’s residual waste arisings (assumed to be 60,000 tonnes per annum). This would include front end mechanical treatment (MT) to remove plastics and metals as preparation for an Energy from Waste (EfW) facility in line with Scottish Government requirements. The capital investment to provide this facility would be funded directly by the Council, and a partner waste contractor engaged to manage the facility’s operational activities on the Council’s behalf. It offers the potential benefit of renewable energy generation within the City;

- **Option Two (Small EfW, PPP financed):** As option 1, but assumes all capital investment for the facility is funded by the private sector under a Public-Private Partnership (PPP) arrangement. The Council pays a higher gate fee on operations under this model, as it will include recovery of capital financing costs;

- **Option Three (Large EfW, Council financed):** As option 1, with a larger EfW facility that is sized to take other residual waste. This other waste could be sourced from other public sector bodies or commercial and industrial wastes. With this option the MT facility need not be co-located with the EfW, as this could take place at the waste source, with the EfW being constructed at a suitable central site. The capital investment to provide this facility would be funded directly by the Council and a partner waste contractor engaged to manage operations;

- **Option Four (Large EfW, PPP financed):** As option 3, but assumes all capital investment for the facility is funded by the private sector under a Public-Private Partnership (PPP) arrangement, and consequently with a higher gate fee on operations to include recovery of capital financing costs

- **Option Five (RDF offtake):** The Council is currently progressing an interim treatment solution comprising the preparation of waste as Refuse Derived Fuel (RDF) prior to export to European EfW facilities. This business case considers this waste treatment option also as a long term solution, assessing whether the cost of this waste management practice would provide better value for money.

The table below discusses the performance of each option against a range of topics.

**Table 8.1 Comparative performance of the options**

| Topic | Option 1 & 2 – Small EfW | Option 3 & 4- Large EfW | Option 5 – RDF offtake |
|---|---|---|---|
| **Key facility assumptions** | 56,000 tonnes per year Mechanical Treatment (plastics, metals).<br>**47,000 tonnes** per year Energy from Waste facility. | 56,000 tonnes per year Mechanical Treatment (plastics, metals).<br>**109,000 tonnes** per year Energy from Waste facility (including ~62,000 from other public authorities/businesses). | No major new development – new transfer and RDF preparation building needed for 56,000 tonnes per year (metals extraction only).<br>**Export of ~47,000** tonnes per year RDF (modelled as shipped to Sweden). |
| **Technology risk** | Established technology. Throughput at lower end of optimum size, but some reference plants in UK.<br>Risks related to design and construction of a new facility would be passed to private sector.<br>The use of MT technology does have an increased chance of breakdown due to the increased use of mechanical handling, but this is usually mitigated by use of multiple lines, spare capacity, appropriate maintenance and the ability to bypass individual elements of the process train | As option 1. Larger facility size with number of reference plants in UK. | Low risk as utilises simple waste transfer and processing equipment.<br>Low risk as export utilises existing and proven EfW facilities. The reliability of these outlets depends on the specific facility utilised, but is generally good. |
| **Flexibility** | EfW facilities have an optimum design throughput, with limited flexibility for changes in tonnages (up or down) without impacting on costs.<br>Risk that increased recycling rates beyond those modelled lead to surplus capacity within facility. Could be mitigated by setting appropriate guaranteed minimum tonnage limits and managing commercial wastes through the facility.<br>Use of MT facility gives reasonable flexibility to extract further recyclables and refine the output properties if required.<br>May be deemed prudent to slightly oversize facilities to allow for fluctuations in arisings and recycling rates. | As option 1. The joint parties would need to agree the consequences of any relative changes in waste arisings, and the impacts of various risk events. | Limited ability to extract further recyclables without development of more extensive MT prcocess. Use of MT facility gives reasonable flexibility to extract further recyclables and refine the output properties if required.<br>Reliant on merchant market for offtake of RDF. These facilities do require minimum feedstock quantities and qualities of in order to operate efficiently. The contractual consequences of lower arisings of RDF would need careful consideration.<br>Option is flexible to deal with unexpected increases in arisings. Depending on the nature of the RDF contracts, changes can be managed through variations to existing arrangements or relatively simple procurement of additional offtake contracts.<br>The nature of many third party treatment contracts in a competitive environment means that the Council may have limited recourse for passing over all risk related to non-availability events at the EfW plant. |
| **Waste Policy** | Option assumes 54% recycling at kerbside/HWRC, based on Council modelling. With additional recycling from MT this meets Aberdeen Waste Strategy 2010 target of 56% recycling target by 2025. Also meets maximum cap of 40% residual waste treatment capacity.<br>Does not meet Zero Waste plan target 70% for recycling/composting. However this applies to all wastes and it is currently assumed the municipal fraction may perform lower than commercial wastes.<br>Meets Waste (Scotland) Regulations (WSR) | As option 1. | Modelling based on same waste flows as option 1. However the MT plant may not be required to extract plastics which would slightly reduce the modelled overall recycling rate. This would change the RDF tonnage, but as noted in flexibility topic the offtake contract may be capable of being varied to deal with changes in recycling and volume.<br>The application of thermal treatment requirements for pre-treatment of RDF export has not been subject to detailed |

| Topic | Option 1 & 2 – Small EfW | Option 3 & 4- Large EfW | Option 5 – RDF offtake |
|---|---|---|---|
| | 2012 that Residual waste must be pre-treated to remove key recyclables (non-ferrous metals and hard plastics) prior to EfW treatment. | | guidance, and could change. |
| **Energy generation** | ~19,800MWh of local electricity generation. | ~46,200MWh of local electricity generation. | No local electrical generation. Represents loss of ~19,800MWh of electricity.<br>However RDF may be taken to high efficiency plant elsewhere and therefore contribute to global carbon savings. |
| **CHP opportunity** | Opportunities for local heat network, improving sustainability and financial performance of the option.<br>The supply of heat to a dedicated energy network (DEN) may require additional plant and backup boilers on the site, subject to the terms of the contracts entered into. | Enhanced CHP opportunity, but unlikely to be sufficient offtakers for all potential heat. | Unlike Options 1 and 2, the offtake of RDF does not allow the potential for development of a local district heating network associated with a local waste facility.<br>However the RDF may be taken to high efficiency CHP plant elsewhere and therefore contribute to global carbon savings. |
| **Planning risk** | There are general planning policies regarding development of new energy from waste facilities in the City, and it is envisaged these could be met.<br>There remains substantial planning risk associated with development of the local EfW option, given the contentious nature of waste treatment facilities and previous withdraw of planning by SITA.<br>Commencing the procurement process with a site already identified, acquired and Planning Permission in Principle (PPiP) achieved will encourage interest and increased competition in the project<br>It is usual practise that the risk of gaining full Planning Permission and associated permits to operate the facility is borne by the preferred bidder/contractor rather than the council.<br>Heat and Power Plan required to be submitted as part of the Environmental Permit application. | As option 1.<br>There are currently no planning policy restrictions on import of waste from outside city to a local EfW facility. | There are currently no planning policy restrictions on export of waste outside of Scotland.<br>Requires planning and permit for new waste transfer and RDF preparation building. Depending on the site location this should be relatively straightforward. |
| **Site risk** | New site required ~1.5 to 2 hectares.<br>Ground condition and other site surveys would need investigation to check suitability of any site. The Council may need to bear some risk on contaminated land.<br>At present there are no strategic sites identified for locating a new Energy from Waste facility, which is a key deliverability constraint. The Local Development Plan Team has started to review the adopted Local Development Plan and work toward the publication of the next Plan.<br>Obtaining a new site will be a particularly important issue given that SITA holds contracts with both Aberdeen and Aberdeenshire and has a site at Stoneyhill that has previously been subject to waste treatment proposals which have since been withdrawn. | As option 1, with slightly larger footprint ~ 2-3 hectares.<br>The MT facility need not be co-located with the EfW, for example the partner(s) may develop MT facilities for their own waste arisings. | Requires new waste transfer and RDF preparation building. Subject to detailed scoping this may be capable of being accommodated at existing sites.<br>An MT plant could require a further 0.5 to 1 hectares depending on whether it is co-located with the EfW or not. |
| **Costs (excl MT)** | Option 1 25-year NPV. ~ **£63M** (council funded) | Option 3 25-year NPV. ~ **£40M** (council funded) | Option 5 25-year NPV. ~ **£53M**<br>Net gate fee **£XX** per tonne (net RDF plant |

| **Topic** | **Option 1 & 2 – Small EfW** | **Option 3 & 4- Large EfW** | **Option 5 – RDF offtake** |
|---|---|---|---|
| | Option 2 25-year NPV. ~ **£74M** (PPP funded)<br><br>It is noted that as currently modelled the MT plant required high capital expenditure to achieve a relatively modest increase in recycling rates. The value for money of this, and alternative configurations would benefit from further exploration. | Option 4 25-year NPV. ~ **£48M** (PPP funded) | capex plus third party offtake). |
| **Financial risk** | Capital funding of **~£46M** required for EfW and **£11M** for MT plant (2013 prices). New facilities are predicated on obtaining substantial private funding, and in the currently prevailing economic circumstances this may be challenging.<br>Council may seek to mitigate this risk through directly funding all or part of the capital cost. Detailed consideration needed on alternative / innovative operating and funding mechanisms and the resulting risks to the Council, and any consequent impacts on the procurement process.<br>Capital costs will be exposed to foreign exchange risks as much of the equipment is typically sourced overseas.<br>The future tren*d* in electricity prices will depend on factors such as fossil fuel availability and prices, the availability of alternative sustainable fuels and the changes in demand arising through energy efficiency or economic performance.<br>The continued availability and price impacts of "green" tariffs and incentives (e.g. RHI, CFD) and "green" taxes (e.g. carbon price support) are subject to great uncertainty, and result in wide ranges in the financial costs of the options.<br>Financial risk from any future introduction of UK incineration taxes. | As option 1. Capital funding of **~£78M** required for EfW and **£11M** for MT plant, which present higher risk of failure to secure funding. | Capital funding **of ~£4-£11M** required for RDF preparation plant.<br>Risk of future increases in European EfW gate fees as more waste producers seek to access a fixed number of outlets. May be mitigated by securing longer term offtake contracts.<br>The Council may be exposed to foreign exchange risks if the RDF is sent to European facilities. There are some mechanisms to mitigate this.<br>Greater exposure to changes in transport costs, which are subject to international oil prices.<br>Financial risk from any future introduction of EU incineration taxes, or change in law. |
| **Contractual models** | There are a number of contractual models the Council could consider for the development of a local EfW. Detailed consideration of the availability and risks of different funding sources (public/private) would be needed . The Council would then need to consider whether to separate the construction and operational contracts. Detailed risk assessments would be required. | As option 1. Assessment of preferred model may take longer due to involvement of a partner public authority(s). | Simple offtake contract, effectively passing all funding, construction, operational and maintenance risks to private sector. |
| **Procurement models** | Controlled by the Public Contracts (Scotland) Regulations 2012<br>Likely to require use of Competitive Dialogue procurement route, which is resource intensive and can require more officer time and external support.<br>Requires the Procurement officers to have a level of delegated authority on behalf of the Council otherwise any Dialogue is required to be approved by a Project Board | As Option 1, but increased risk of delays due to need to go through decision making processes in two councils.<br>Would need to ensure both councils are fully committed to delivering the project in partnership.<br>Project Manager should be empowered and | Controlled by the Public Contracts (Scotland) Regulations 2012.<br>Could use Restricted Procedure which would be simpler and less expensive in terms of officer time and external support than other options. Note that this route would not allow the Council to opportunity to 'dialogue' solutions with bidders and may therefore limit opportunities for innovation or discussion on cost saving mechanisms.<br>Competitive Dialogue procurement route could also be used, and would be quicker |

| **Topic** | **Option 1 & 2 – Small EfW** | **Option 3 & 4- Large EfW** | **Option 5 – RDF offtake** |
|---|---|---|---|
| | | supported by both councils to enable effective delivery of the project. | than other options as does not require dialogue on capital intensive EfW asset. |
| **Amenity risks** | Pre-treatment of waste has the potential to generate some odour and dust nuisance, and also noise nuisance from the operation of equipment. These can be assessed and mitigated in the design stage. Any ash processing operations would similarly need controls.<br>Risk of odour impacts from EfW is managed using tried and tested methods e.g. housing waste indoors, negative air pressure for delivery areas, use of air in the combustion process, and managing storage times. Turbine generators are high noise & vibration equipment and specially designed buildings etc are successfully used to control impacts.<br>Traffic movements are typically the main cause of noise and amenity impacts, and a detailed transport assessment of the site would be needed. | As Option 1. | Shredding of waste has the potential to generate some odour and dust nuisance from the storage and treatment of waste and also noise nuisance from the operation of equipment. These can be assessed and mitigated in the design stage.<br>May be increased traffic movements associated with the movement of RDF to port, with associated risk of traffic derived nuisance. |
| **Timetable risk** | A new EfW facility is not likely to be available until 2020 at the earliest.<br>Requires Competitive Dialogue procurement, which can vary in length from 18 months to 5 years. An average of 3yrs is appropriate benchmark.<br>An additional 1 year should be allowed for the determination of the planning application and environmental permit (PPC) with a 6 month preparation time for each.<br>Typically, the construction of an EfW facility can take 3 years to complete, depending on the site and any ground conditions that need to be dealt with.<br>Overall, a period of 3 years pre-, and 4 years post-contract award is typically advisable, but may be subject to delays outside the Councils control. | As Option 1. | Low risk as shorter procurement time and limited construction activities.<br>Procurement of medium term RDF offtake solution could be undertaken within 1 to 2 years.<br>A new RDF preparation building may require 1 to 2 years for planning application, procurement and construction. |
| **Market risks** | **Recyclables** - Requires outlet for more contaminated recyclables sorted from residual waste through MT. There will remain some uncertainty on the quality and market appetite for processing the plastic streams and the operator or Council will need to bear some risk on market availability and income levels, facility diversion targets and disposing of any rejected materials. Extraction of a wider range of materials (e.g. glass/aggregate and bulky wastes) would need further consideration on market risks.<br>**Residues–** Requires processing and disposal outlets for ash products. Established markets.<br>**Electricity -** secure long term market, but the principle risk issue lies in the estimation of the future price of electricity | As Option 1. | **Recyclables** - Recyclables risk from MT plant as per Option1. If no plastics included then lower risk as established market for extracted during RDF production.<br>**RDF -** market risks borne by the off-taker using already established outlets. This includes residues, electricity and any heat.<br>The production of lower quality RDF may limit access to some UK and European facilities which are designed for SRF off-take of a particular specification, but the RDF would be capable of being combusted in a range of conventional EfW facilities designed around the combustion of untreated residual waste.<br>The timing at which older RDF offtake facilities will go off-line, and the impact of |

| Topic | Option 1 & 2 – Small EfW | Option 3 & 4- Large EfW | Option 5 – RDF offtake |
|---|---|---|---|
| | **Heat** –Heat sales will depend upon new district heating and steam supply networks being installed. Establishing a District Energy Network (DEN) and associated business model in order to utilise heat from thermal processes (hot water and/or steam) is technically feasible but commercially complex, and requires off-site planning permissions, appropriate customer demand and appropriate commercial frameworks. There could be ongoing risks on certainty of off-take as many smaller customers tend to prefer the flexibility associated with shorter term contracts, however the existence of Aberdeen Heat & Power could provide a starting point. | | such closures on the market remains unclear. |
| **Legislative risk** | EfW air pollution control residues (APCR) require specialist management before disposal. These residues may require further treatment in the future priori to disposal. It is anticipated the market would adapt to such changes as there is demand from all EfW plants and a number of alternatives are under development. The relative cost of these to existing outlets is unclear.<br>Updates to EU Best Available Techniques reference documents are due in 2016. These may require more stringent air emissions levels and control systems for EfW plants. Depending on the phase of the project, this could impact upon final designs and costs of the new EfW. | As Option 1 | Risks related to any future tighter control or definition of what constitutes pre-treatment of waste, and tighter controls on handling, storage and export of material. These risks cannot be quantified but if realised might potentially lead to additional capital costs in respect of the preparation plant and increased revenue costs for individual export loads. |

## 8.2 Conclusions and Recommendations

### 8.2.1 Conclusions

The financial assessment of options indicates that a larger EFW that caters for waste from other parties (e.g. public authorities or commercial/industrial wastes) would provide the best value for money solution in the long term as it can achieve better economies of scale than a small facility sized purely for Aberdeen City Council. However this option has two key deliverability issues that need to be considered over the next year in order for it to be progressed further.

Firstly it would require a partner(s) to also commit their residual waste to a new procurement. Any joint procurement with another public authority would require detailed discussions and preparations.

Secondly at present there are no strategic sites identified or secured for locating a new Energy from Waste facility. The Local Development Plan Team has started to review the adopted Local Development Plan and work towards the publication of the next Plan, which will need to be prepared in the context of the emerging Aberdeen City and Shire Strategic Development Plan (SDP), which is scheduled for adoption in 2014 and will replace the adopted Structure Plan. It is vital that this plan identifies a site for a new EfW. Detailed site suitability assessments and spatial designs will also be required by the Council in preparation for any procurement to take account of local constraints. Seeking approval for in-principle planning use for an EfW facility would partially mitigate key planning risks.

At a local level the Council's waste strategy, published in 2010, will hold significant influence over the decision to proceed, or not, with a local solution. Many of the aims of the Council's strategy clearly places emphasis upon the importance of treating waste as close to the point of generation as possible (proximity principle) but, crucially, enjoying the potential benefits (social, economic, and environmental) that a local solution may bring. Given the Council's requirement to demonstrate Best Value however these benefits need to be considered against ongoing budgetary pressures.

Aberdeen is considered the 'energy capital' of Europe, influenced by the Oil & Gas industry presence within the City, and as such the Council's strategy recognises that the potential for renewable energy production in the City can positively influence sustainability, environmental impact and socio-economic issues within the City. This opportunity is lost if the energy recovery benefits are realised elsewhere within the UK or Europe. A Combined Heat and Power scheme would maximise benefits to the City, and could attract additional revenues from government incentive schemes. The Council has already established a district heating network and should be well placed to exploit the benefits of a Combined Heat and Power (CHP) EfW solution, should this be proposed.

In the event that a larger EfW was not deemed deliverable either next year or at a future point during the procurement, the next preferred option is for medium term offtake of RDF. RDF export is a competitive option for the Council in the short to medium term based on current market price indications. There is however an unquantifiable risk of future increases in European EfW gate fees as more waste producers seek to access a fixed number of outlets. This may be mitigated by securing longer term offtake contracts either directly with a plant or via a broker who can regularly search for the best deal.

The long term viability of RDF export is currently unknown beyond 5-10 years and therefore the risk profile of this option is completely different to that of a domestic facility. The assumed RDF offtake price and the future inflation assumptions have a key influence on the cross over point between the options. The assumed RDF gate fee (£80/tonne in current terms) has not been subject to any formal benchmarking or negotiation with potential offtakers. Results of SITA negotiations are not expected until later in 2013 and can inform further consideration of the competitiveness of RDF offtake.

A smaller scale EfW facility would be the most expensive option, but if Authority funding was available it could become very competitive in the very long term (e.g. post 2042). This is because once the borrowing has been re-paid the facility would benefit from a step-down in the price per tonne (this applies to both Option 1 and 2). The Council would be in ownership of a strategic EfW asset which could offer a continued service at much reduced rates, in a similar way that other UK authorities are currently benefiting from operating older EfW facilities. It is worth noting that some of the RDF export prices are currently low due to the same reasons (e.g. use of older facilities where capital investment has been repaid).

It is noted that as currently modelled, the MT plant required high capital expenditure to achieve a relatively modest increase in recycling rates. The value for money of this, and alternative configurations would benefit from further exploration.

Should Option 2 be progressed then the Competitive Dialogue procurement route would be most appropriate. There are no firm conclusions regarding the funding route at this stage except that Authority funding would reduce net costs, subject to further investigation.

A number of critical documents will emerge during any procurement this could impact upon final designs and costs of the new EfW, including EU Best Available Techniques reference documents due in 2016. The legislation and guidance controlling the pre-treatment and export of RDF is also likely to evolve over coming years. Finally any future introduction of EU incineration taxes or other changes in law could impact upon the deliverability and costs of each option.

Based on the timetables achieved by other Councils for procuring a new EfW facility a total period of around 8 years is considered appropriate before a new EfW facility is operational. This includes 1 year for pre-procurement discussions with partners and identifying suitable sites, a three year procurement period (including preparatory planning activities) and 4 years post-contract award, but may be subject to delays outside the Councils control.

Procurement of medium term RDF offtake solution could be in place within 1 to 2 years. A new RDF preparation building may require 1 to 2 years for planning application, procurement and construction.

### 8.2.2 Recommendations

The recommendations arising from this study are grouped under five key themes, as outlined below.

#### 1. Secure support for a Large EfW

- Seek appropriate partners for a long-term domestic solution for waste management.
- Consider in-principle financial support for a domestic facility through the Strategic Investment Plan. Detailed consideration needed on alternative / innovative operating and funding mechanisms and the resulting risks to the Council, and any consequent impacts on the procurement process.
- Undertake detailed discussions and preparations with regional public authorities, and explore options with any other suitable partners. Typical issues which will need consideration are:
    - Assessment of preferred procurement model, including further refinements to options appraisal as required.
    - Tonnage profile and properties of available residual waste
    - Delivery arrangements
    - Minimum tonnage guarantees
    - Ownership of assets and liability for changes in law
    - Management of decision making processes in multiple councils.
- Ensure all partners are fully committed to delivering the project in partnership, including senior management and political support.
- Refresh the financial model in this business case in 12-18 months time, or such other time(s) as seem appropriate once the above detailed work is underway, or completed.

#### 2. Secure site for new EfW

- Where appropriate, liaise with the planning authority regarding the timings and assessment criteria being used to identify sites suitable for EfW in the new Local Development Plan. A site of minimum 3 hectares, and with prospects for CHP is recommended.
- Undertake detailed site suitability assessments in preparation for any procurement, including baseline and scoping studies for planning permission, CHP studies and outline design layouts.
- Prepare detailed scope of works and secure appropriate consultancy support to apply for in-principle planning use for an EfW facility.

## 3. Develop procurement strategy

- Ensure the Project Manager is empowered and supported by all partners to enable effective delivery of the project.
- Prepare procurement strategy for an EfW facility, addressing key topics such as:
  - Contract Length
  - Specification Requirements
  - Funding Route (e.g. public or private funding options and related risks)
  - Contract Type (e.g whether to separate the construction and operational contracts)
  - Detailed Risk Assessments (covering risk categories such as Regulatory, Political, Stakeholders, Procurement, Sites, Planning, Programme, Waste Supply, Facility performance, Construction, Operations, Offtake, Price)
  - Approach to Contractual Risks (including approach to deal with foreign exchange risk)
  - Approach to Variant Bids
  - Procurement Route
  - Procurement Timescale (including potential interactions with the election cycle)
- Refine mass flow and financial modelling in order to generate a Reference Case.
- Following agreement on the preferred procurement strategy, prepare a detailed procurement plan for the EfW facility, addressing key topics such as:
  - Project Definition
  - Formal Business Case
  - Procurement Budget
  - Project Organisation Structure
  - Project Quality Plan
  - Project risk register
  - Detailed Schedule of Tasks
  - Communications Plan
  - Data room arrangements

In terms of timetables for progressing Option 3 or 4, and for developing Option 5 as a contingency, an indicative timetable is set out in Table 8.1 below. It is recommended that a detailed plan, with appropriate sensitivity scenarios is developed.

**Table 8.1 Indicative timetable**

| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|
| **Interim RDF offtake** | SITA arrange RDF sub-contract(s) and develop<br>Transfer/pre-treatment infrastructure. | RDF offtake contract (s) | | | | | | | Possible contract extensions if EfW delayed |
| **Options 3 or 4 – Large EfW** | Discussions and OBC development with partner(s), including financial support mechanisms<br>Identification of suitable site(s) in Local Development Plan.<br>Site suitability assessments | Procurement.<br><br>Secure Planning in-Principle for new EfW. | | | Planning permission granted.<br>Notice to proceed. | Construction | | | New EfW operational |
| **Contingency – Option 5 RDF offtake** | In-principle discussions with RDF offtakers | Development of procurement and negotiation approach. Ongoing monitoring of market trends.<br>Regular reviews of OBC for local EfW facility. | | | | | Procurement (if required) | | Further RDF offtake contract (s) |

## 4. Research and develop RDF contingency arrangements

As at this stage the viability of a large EFW is unclear, as no potential partners have been identified. It is recommended that a twin-track approach is taken over the next year to further explore RDF opportunities, including;

- Finalise interim RDF arrangements, the terms and costs of which will inform considerations on contingency options
- Confirm the planning and licensing requirements for transferring waste via the dockyards.
- Seek approval for Council officers to be allowed go abroad to discuss potential contractual arrangement and thereby adequately plan contingency arrangements. Ideally this should include in principle discussions with at least 3 offtakers (within UK and/or abroad) in order to get indication of likely gatefees over different contract period and contractual issues.

If it subsequently became clear that a EfW facility was not deliverable in the envisaged timeframes, then RDF option should be pursued after cessation of the current contact. It is recommended that preparation of a contingency plan is progressed, including;

- Regular reviews of the deliverability and outline business case for delivering a local EFW facility (both small and large scale).

- Explore longer term requirements for a new transfer and pre-treatment facility at the end of the current SITA contract.

- Explore the potential for backloads of RDF to Europe in order to reduce transport costs, drawing on experiences of SITA during their initial period of export.

- Research timings at which older RDF offtake facilities may go off-line and seek wider market views on the potential impact of such closures on the RDF contracts.

- Give consideration to the Councils approach to a number of negotiation topics should they pursue any further RDF contracts after the SITA contract. Example topics include;

    - At what level to set any GMT requirements, and the contractual consequences of lower arisings of RDF. How to vary RDF tonnages if recycling rates are higher. How any excess would be dealt with if recycling rates are lower or waste growth is high;

    - Managing transport fuel cost risks and what aspect of the service the contractor is allowed to market test;

    - Excess profit clauses or gain share mechanisms if RDF offtake costs decrease over time;

    - Any Council restrictions on where Contractor is allowed to take RDF? E.g. minimum R1 rating/ CHP status/transport modes ; and

    - Carbon reporting mechanism.

## 5. Keep watching brief on potential changes in law and policy

- Develop a proactive and systematic method to keep track of developing discussions, guidance and legislation on a local, domestic and European level. In particular this should cover any emerging issues which could impact upon;

    - Procurement and funding options;

    - Emission standards for EfW facilities;

    - Pre-treatment requirements for EfW and RDF;

    - Export controls on RDF; and

    - Environmental or green taxes or tariffs.

# Appendix A
# Technical Modelling Note

*[See separate file]*