7.0 CONCLUSIONS

Task 1: Assessment of Existing Waste Recovery Technologies

Conclusion 1

The generation rate and composition estimates were used to make projections of waste generation and composition over the period from 2020 to 2050. The overall waste generation rate was estimated to increase from about 41 ktpa to in 2020 to 46 ktpa in 2050, with the increase seen to be driven primarily by population growth. Two diversion scenarios were examined: A - if the diversion rate presently achieved stayed the same, and B – the capture rate for recyclables, food, and yard waste increased to 100% by 2050.

Conclusion 2

A broad range of waste treatment technologies that could manage OC's projected waste stream were reviewed. These can be classified into four broad classes: MRFs, MBT, biological treatment (composting or anaerobic digestion), and thermal treatment (conventional combustion or advanced treatment including gasification and pyrolysis).

Conclusion 3

Conventional combustion WtE is generally not viable at throughputs of less than 40 ktpa – 60 ktpa, and is therefore likely not viable for OC's waste stream on its own.

Conclusion 4

Advanced thermal treatment technologies such as gasification/pyrolysis are generally not viable below a throughput of 5ktpa to 10ktpa, and may therefore be viable for OC's projected waste stream, depending upon the waste generation scenario considered.

Conclusion 5

'Complex' MRF technologies are not generally not viable below throughputs of 15kpta to 25ktpa etc., and may therefore be viable for OC's projected waste stream, depending upon the waste generation scenario considered.

Conclusion 6

Ultimately the viability of any given technology class depends on jurisdiction-specific factors including land cost, energy prices, renewable tariffs, landfill prices, etc.

Conclusion 7

A list of potential providers for each technology type was compiled. All of the firms listed were known to have operations, manufacturing, or at least registered offices in North America (w/ some specific exceptions), and all had one or more operational reference facilities (although these may not be in North America).

Conclusion 8

Seven scenarios were developed, consisting of different types and combinations of technology that are considered appropriate for OC, as follows:

- **Scenario 1**: MRF recovering recyclables and organics, with the recovered organics to be bulked and transferred outside of OC for further processing at a wet anaerobic digestion (AD) plant, and the non-recyclable material to be disposed to landfill;
- **Scenario 2**: MRF recovering recyclables and producing refuse derived fuel (RDF) for thermal treatment outside of OC;
- **Scenario 3**: MBT, i.e. Scenario 1 above plus a wet AD processing stage in OC;
- **Scenario 4**: MBT, i.e. Scenario 1 above plus a dry AD processing stage in OC;
- **Scenario 5**: MBT, i.e. Scenario 1 above plus an organics composting stage in OC;
- **Scenario 6**: Basic MRF to recovering inert construction and demolition material, and producing RDF for thermal treatment outside of OC; and
- **Scenario 7**: MRF recovering recyclables and producing RDF for gasification at a new facility in OC.

Conclusion 9

OC provided SLR with a template for the Multi-Criteria Assessment (MCA) tool to assist with the review and evaluation of the seven Scenarios. The MCA tool includes four categories of criteria: Community, Economy, Environment, and Implementation. The criteria in the MCA were adapted to make the tool relevant to assessing the technology scenarios.

Conclusion 10

The MCA assessment resulted in Scenarios 3, 2, and 4 being ranked 1^{st}, 2^{nd}, and 3^{rd}, respectively.

Conclusion 11

The separation between the lowest and highest ranked scenarios represents only 8% of the potential total points available. This indicates that the range of performance of the scenarios under consideration is relatively limited and, although there are significant differences between scoring for certain criteria groupings for some scenarios, there are not substantial overall differences between them.

Conclusion 12

There is no one specific scenario aspect which is clearly visible in the lower or higher ranked scenarios. For example scenarios involving some treatment outside OC are ranked between 2^{nd} and 7^{th}, while scenarios involving thermal treatment display the same broad range.

Conclusion 13

There are inherent limits to the rigour with which the scenarios can be evaluated in an exercise of this nature. These can be summarized as follows:

- The evaluation of scoring for some of the criteria is based upon subjective opinion, albeit this is based upon professional judgement from a team with broad experience of the technologies under consideration;
- It is difficult to get hold of full data sets regarding costs for all technology types in directly comparable formats;
- The GHG Calculator tool uses certain assumptions about the average performance of different technologies which may not fully reflect the range of performance achieved by some technology categories; and
- Alternative criteria weightings may give different results in terms of the rankings of the scenarios.

Task 2: Case Studies of Implemented Technologies

Conclusion 14

It is important to characterise the waste stream accurately to serve as the facility design basis. An unexpected waste stream composition will lead to a poorly specified and designed facility.

Conclusion 15

An awareness of the general direction of federal/provincial level legislation relating to waste treatment is also valuable as future changes to these may influence the process inputs or target outputs. This is also an element of future-proofing the facility.

Task 3: Review of New and Emerging Technologies

Conclusion 16

Trends in the waste treatment technology industry include:

- the speed and accuracy of methods used to segregate recyclable plastics in MRFs, such as near infra red detectors and air knives;
- options for management of air pollution control residues, including using fly ash using it in the production of an aggregate material which stabilizes and locks-up heavy metals and other contaminants; and
- increased efficiency of the AD digestion process and upgrading biogas to biomethane.

Conclusion 17

An emerging practise is to use existing waste water treatment plant facilities to treat the organic fraction of MSW.

Conclusion 18

An important aspect for any AD plant is where and how the digestate will be utilised. As a rule of thumb, for every 100 tonnes of input about 75-80 tonnes of digestate is produced. Key to the successful utilization of digestate is the regulations surrounding its application to land.

Conclusion 19

Existing regulations are not expressly explicit with regard to compost created from AD digestate or in respect of the acceptability of biological contaminants.

Task 4: Relationship of EPR and Resource Recovery with Current Waste Stream

Conclusion 20

Five major action areas were identified to support Oxford County and the province of Ontario's move towards a zero waste future:

- transitioning existing waste diversion programs to a new producer responsibility framework;
- amend the 3 Rs regulations to increase resource recovery from all sources (including IC&I);
- food and organics diversions actions;
- designating new materials for diversion; and
- implementing disposal bans to support these efforts.

Task 5: Economic Potential of Full Resource Recovery

Conclusion 21

The economics of Scenario 2 (20ktpa MRF plant producing recyclables and RDF for thermal treatment outside OC) were estimated as follows

- CAPEX estimated as **CAN $6.6M - $6.9M**;
- OPEX estimated on the order of **$26 - $31/te**;
- Potential annual revenue of **$0.6M.**

Conclusion 22

The economics of Scenario 3 (20ktpa MBT plant using a wet AD to process generating electricity and hot water) were estimated as follows:

- CAPEX estimated as **CAN $7.7M - $9M**;
- OPEX estimated on the order of **$64 – $79/te**;
- Potential annual revenue of **$1.1M.**

Conclusion 23

A simple payback calculation based on the initial high level assessment suggests:

- Scenario 2: estimated OPEX $26 - $31/te and annual revenue of $0.598M gives a net income of **$(-)22k to $78k**.
- Scenario 3: estimated OPEX of $64 – $79/te and annual revenue of $1.104M gives a net income of **$(-)176k to $(-)476k**.

On this basis only Scenario 2 could provide a small positive net income and results in a simple payback period of approx. 80 years.

Conclusion 24

The simple payback assessment is very sensitive to the CAPEX/OPEX and revenue assumptions and that modest changes in these values could have a significant impact on the final results.

Conclusion 25

It is important to use the high-level economic analysis primarily as an indicator of the potential relative difference between Scenarios 2 and 3, and not as absolute ‘project costs’. A more detailed assessment of the top two potential technology options and associated costs/revenues is needed to obtain a more accurate result.