



Optimized Waste Management Systems: A discussion of waste diversion programs, composting, and landfill optimization

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Abstract

- Operating a waste management system in today's market place can prove challenging given:
 - increasing level of public awareness
 - changing regulatory drivers
 - economic considerations associated with the various potential system components

Abstract (continued)

- The ability to optimise waste management systems is directly related to an entity's ability to finance new and creative waste management strategies
- There is no “cookbook” or “one model fits all” approach

Abstract (continued)

- Explore the decision making process for implementing and expanding an integrated waste management system (IWMS).
- Waste management commissions and regulators need tools to evaluate and develop available waste management systems into integrated waste management strategies that meet the needs of community

Introduction

- Integrated Solid Waste Management (ISWM) is defined as the management of non-hazardous solid waste using an overall strategy based on:
 - source reduction,
 - recycling and reuse,
 - waste processing (eg. composting or combustion),
 - final disposal of waste and/or residual waste.

Introduction (continued)

- Appears quite simple but the real world application becomes much more complex.
- Each system and/or sub-system that comprise the ISWM system must be balanced and compatible to meet the objectives for the Community.

Introduction (continued)

- Consider the specific 'Waste Stream' in combination with the 'Economies of Scale'
- Include risk management in the process of developing an IWMS.

Introduction (continued)

➤ Source Reduction

- Reduce the amount and/or toxicity of the wastes
- Education and/or disincentives such as bag limits per household and/or some form of direct charge based on quantity/mass.

Introduction (continued)

➤ **Source Reduction (con't)**

- Forward-looking projections for changes to the future waste streams can have a direct bearing on the selection of the appropriate ISWM approach.
- Some waste management technologies sensitive to changes in the waste character and/or waste quantity profiles.

Introduction (continued)

- **Reuse and Recycling**
 - The most positively perceived of all the waste management systems. This involves the separation and removal of materials from the waste stream and the subsequent reuse.
 - Highly market sensitive and constantly changing over time

Introduction (continued)

- **Composting and Other Forms of Waste Processing/Transformation**
 - Composting and anaerobic waste processing involves the controlled biological decomposition of organic materials
 - Feedstock for these systems can range from unsorted MSW to segregated source-separated organics (SSO)
 - SSO streams typically require infrastructure changes

Introduction (continued)

- **Composting and Other Forms of Waste Processing/Transformation** (con't)
- Thermal waste transformation involves the physical alteration of wastes to reduce quantities and produce end products such as various forms of fuel and conversion into various forms of energy etc. with some residual end products.
- The application of these technologies is highly sensitive to the nature of the waste stream and requires sustained feedstock

Introduction (continued)

- **Waste or Residual Disposal (Landfills)**
- A landfill is a pre-requisite for any waste management system.
 - Must, at a minimum, receive the materials that can not be diverted through source reduction, recycling and composting, and waste transformation
 - Residual wastes disposal after sorting at material recovery facilities, after the recovery of conversion products or energy, and off-spec compost.

Waste Processing, Diversion Programs, and Costs

- Many possible combinations of systems and sub-systems available
- Must meet the regulatory and community driven needs and goals, as well as economic drivers.

Waste Processing, Diversion Programs, and Costs

- the cost of landfill capacity can range from \$250,000 to more than \$1,000,000/hectare or between \$3 and \$10 per tonne of waste.
- Composting in windrows can cost between \$10 and \$20 per tonne for leaf and yard waste.
- Composting or anaerobic waste processing can cost between \$90 and \$160 per tonne.

Waste Processing, Diversion Programs, and Costs (Continued)

- Material Recovery Facilities (MRFs) will start with a capital investment of between \$2 to \$4 million and can go up to \$5 to \$10 million depending upon quantity/characteristics of waste and the performance criteria for the products.

Waste Processing, Diversion Programs, and Costs (Continued)

- Thermal processing facilities for a mid size facility will start at more than \$5 million and can exceed \$20 million or more for a full processing system with a capacity of 100,000 tonnes per year with a minimum processing cost starting at \$100/tonne

Waste Processing, Diversion Programs, and Costs (Continued)

- LFG collection and treatment play an integral role in an ISWM. Done correctly, it will address LFG emission issues from existing and proposed landfills, but also has the potential to yield revenue from the emission reductions .
- Most of emission reductions over the near term will be from existing waste

Waste Processing, Diversion Programs, and Costs (Continued)

- Typical costs for LFG collection and treatment (i.e., flaring) systems start in the range of \$1,000,000 for an initial phase
- Would collect enough gas to yield the equivalent of about 40,000 tonnes per year of carbon dioxide emission reductions
- Would have the capacity to produce electricity approx 1 MW of electricity

Waste Management Systems

Assessing Existing and Proposed

- Each community is unique so the appropriate ISWM system will be unique to each community.
 - community size and location;
 - regulatory policies;
 - costs and available budgets;
 - innovative solutions; and
 - available markets.
- The end goal of developing an ISWM system is to improve current practices.

Establishing Objectives for ISWM Program

- The local/regional representatives will need to consider:
 - the waste stream and associated goals;
 - identify options and environmental risks;
 - long-term requirements;
 - the costs associated with each waste management option;
 - the volatility of proposed recyclable markets;
 - permitting requirements and scheduling; and
 - local versus regional approaches.

Establishing Objectives for ISWM Program (continued)

- Communities will need to consider many goals as identified in the 'FCM Guide to Sustainable Communities':
 - decreasing waste management costs;
 - shifting responsibility from the tax base to the consumer and industry;
 - encouraging industry to change product designs to be more environmentally friendly;
 - decreasing waste generation and increasing diversion from landfills;
 - increasing business opportunities from local recycling
 - increasing revenue from recycling.

Resources to Assist Development of ISWM

- The Federation of Canadian Municipalities (FCM) has developed a 'Guide for Sustainable Communities' to assist with the development of solid waste management systems:

http://www.sustainablecommunities.ca/Capacity_Building/Waste/Solid_Waste_as_a_Resource.asp

Program Development Considerations

- Communities may have conflicting goals and objectives between certain policy initiatives and revenue/cost considerations
- Life Cycle operating and cost considerations

Program Development Considerations (continued)

- **LFG Management**
 - implement a LFG Management System to divert and reduce LFG emissions from landfilling operations.
- **SSO Facility**
 - increase waste diversion rates to > 50% and reduce dependency on landfilling.

Program Development

Considerations (continued)

➤ LFG Management

- LFG and utilization assessment;
- design and permitting costs;
- capital and operation & maintenance costs;
- the potential for CERs from the destruction of LFG through flaring and/or utilization; and
- the potential for revenue associated with the utilization of the LFG resource.

Program Development Considerations (continued)

➤ SSO Facility

- potential organic waste quantities;
- potential tipping fees for SSO versus real tipping fees at local/regional landfill facilities;
- capital and operation & maintenance costs;
- the potential for emission reductions;
- the potential for revenue associated with the utilization of the biogas resource and
- design and permitting costs.

Program Development Considerations (continued)

- A solid waste entity that has been operating for 20 years with an average annual disposal rate of 50,000 tonnes, is faced with the regulatory goal of achieving and exceeding a 50 percent diversion.
- the solid waste entity is expected to implement a LFG Management System to divert and reduce LFG emissions from landfilling operations.

Program Development

Considerations (continued)

- Typically an SSO plant capacity must be 30,000 tonnes/year or more to represent the critical mass for a minimum plant capacity
- A site with one million tonnes of waste in place is enough to warrant a LFG collection and treatment system

Program Development Considerations (continued)

- Given the annual waste quantities assumed for this example, there does not appear to be a sufficient quantity of organics to warrant the development of a state of the art aerobic or anaerobic processing facility for the SSO stream.
- A modern landfill with an effective LFG Management System can provide the community with cost effective and environmentally responsible management of these SSO materials

Program Development

Considerations (continued)

- Maximizing waste diversion can be a function of many factors. Home composting of yard wastes and other suitable materials and diversion efforts will reduce the quantity of materials that must be landfilled.
- Revenue from a LFG Management System may enable the waste management entity to embark on new and innovative approaches to managing inert waste streams.

Conclusion

- Establishing a ISWM system in a community can be a complicated effort;
- parties must consider the net fiscal costs as well as the net environmental benefits
- Considering regional approaches may offset the disadvantages and limitations associated with the critical mass concept and economies of scale.