Waste to Energy Assessment Results and Recommendations

Comox Strathcona Waste Management
Select Committee Meeting
November 28, 2017

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Overview

- Project objectives
- Summary of RFI process and outcomes
- Assessment of requirements
  - Siting
  - Regulatory
- System options and costs analysis
- GHG emissions
- Constraints, risks and timelines
- Conclusion

Overall Project Objectives

- Update the previous assessment of WTE technologies, costs and GHG emissions
- Assess the current state of technologies and the market
- Compare WTE costs to the costs of the existing engineered landfill

Objectives for Request for Information (RFI)

- Assess changes in the market since the last assessment
- Gather updated cost and track record information
- Assess interest of vendors in the region
- Determine factors that could make WTE viable

RFI Submissions Received

Vendor	Technology
Eco Waste Solutions (EWS)	Traditional WTE through combustion
REDWAVE, a Division of BT-Wolfgang Binder GmbH	RDF production
SALT Canada Inc.	Aerobic landfill with subsequent mining and RDF production
Sustane Technologies Inc.	Mechanical separation, pyrolysis of plastics, fuel pellets from organics
WastAway	RDF production
WTT Netherlands BV (WTT)	Mechanical separation, AD of organics and RDF from balance

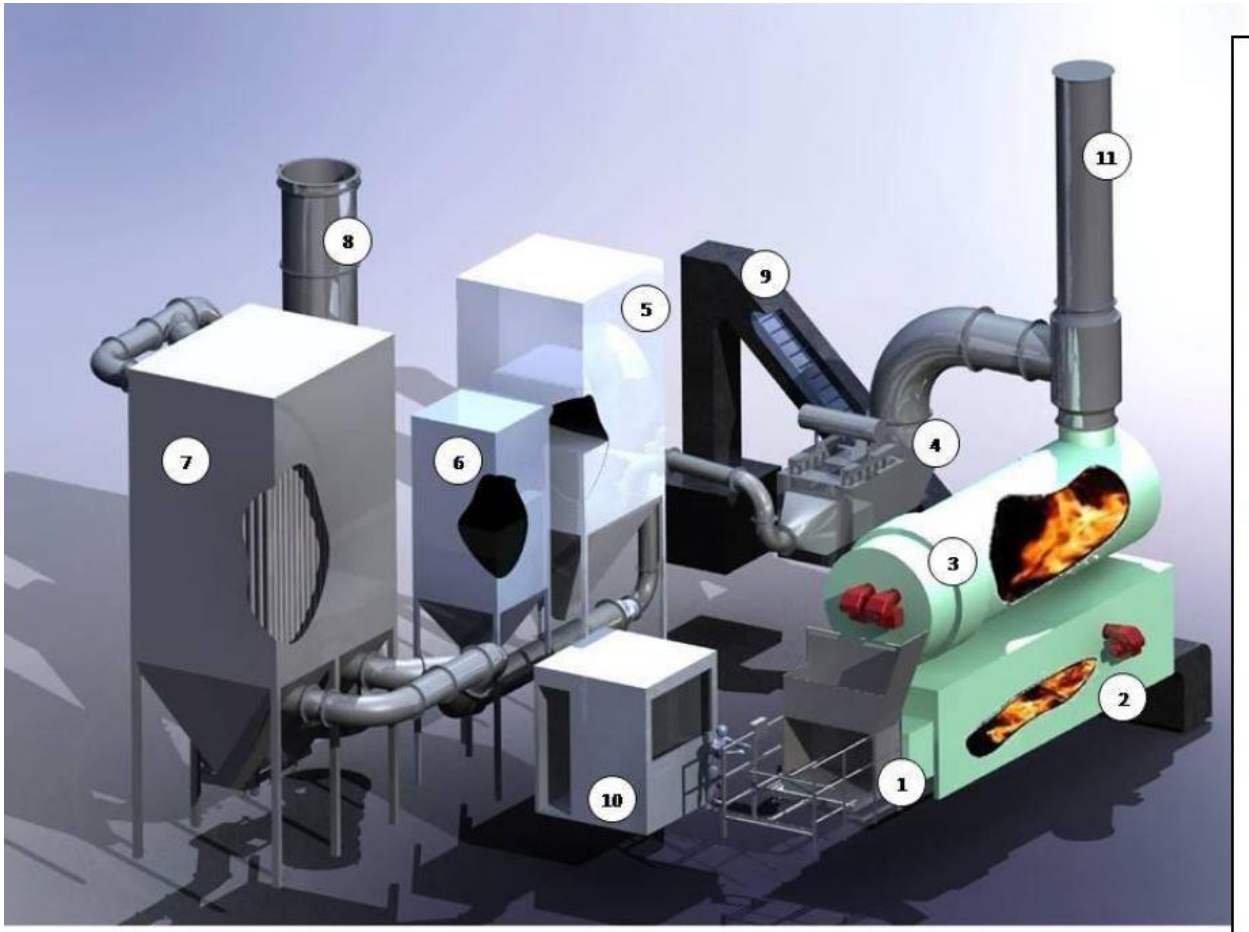
Evaluation Criteria

- Innovation
- Technology
- Environmental / social
- Economics / affordability
- Quality of submission

Evaluation Top Results

- EWS
- WTT
- Sustane

EWS - Conventional WTE



1. Continuous Loading System of Waste (following Sorting/ Recycling)
2. Primary Chamber
3. Secondary Chamber
4. Heat Exchange for Energy Recovery
5. Emission Controls – Acid Neutralization
6. Emission Controls – Metals/Organics
7. Emission Controls – Dust/Particulate
8. Exit of Clean Gaseous Emissions
9. Ash Removal-Conveyor
10. Controlling & Monitoring of Process
11. Emergency By-Pass Stack

EWS Submission Summary

- 2 modules
- 5% residue to landfill (assuming market is found for bottom ash)
- Electricity to market, plus some heat available
- Recycling of metals
- 30 jobs during operation
- Numerous reference facilities

WTT Netherlands BV – AD and RDF production

WTT Submission Summary

- Highly flexible system to mechanically and optically sort, recycle, make gas through AD and compost
- 5-15 jobs depending on manual/ automated sorting
- Recycling, bio-gas (for fuel or electricity), plus RDF
- Residuals to landfill vary depending on system configuration
- Numerous reference facilities, including Surrey Biofuel facility for AD and composting

Sustane Technologies Inc. – Separation with RDF production

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Sustane Submission Summary

- Proprietary de-bonding and separation
- Requires 20,000 litres of water per day
- Makes diesel from plastics
- Fuel pellets from organics
- About 10% residuals to landfill (inert)
- Approximately 28 staff required
- One reference facility in Spain, new project in Nova Scotia

Siting Options and Requirements

1. Comox Valley area – at Comox Valley Waste Management Centre

2. Campbell River area - the Campbell River Waste Management Centre and the former Elk Falls mill site

3. Gold River – at the former pulp mill site

Siting Options and Requirements

- Each of the four potential sites were assessed against the following siting criteria:
  - Zoning
  - Transportation
  - Proximity to feedstock sources
  - Access to utilities
  - Buffers to neighbours
  - Siting suitability

Siting Suitability

Site	Pros	Cons
Comox Valley area - CVWMC	Proximity to the largest amount of waste generated will reduce hauling costs	Lack of adequate process water and sanitary sewer
Campbell River area - CRWMC	Existing waste management infrastructure that could serve dual purposes	Some, but not all utilities are available on-site.

Siting Suitability

Site	Pros	Cons
Campbell River area - Former Elk Falls Mill site	Former industrial site with utilities may not require significant utility upgrades	Within 100 m of a residential development, which may present public consultation challenges
Gold River area	Suitable from infrastructure and permitting perspectives	Remote location increases transportation costs

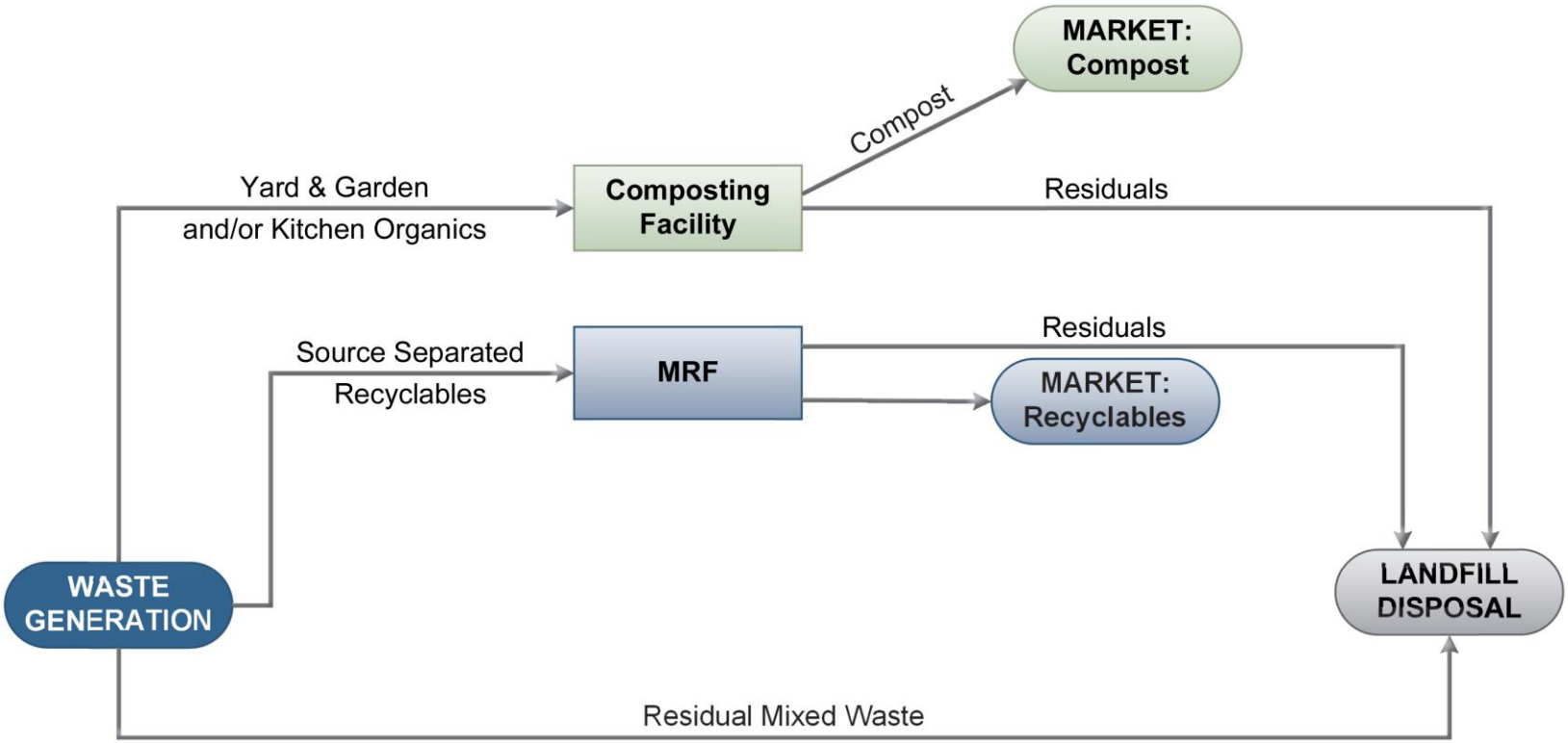
Regulatory Requirements

- Sending municipal solid waste to an WTE facility is an allowable activity under the *Environmental Management Act.*
- The CSWM must seek an amendment to their SWMP to reflect this intention.
- *Environmental Assessment Act* applies if the project meets the thresholds specified in the Reviewable Projects Regulation. This project does not meet those thresholds, but the Minister can require an EA.

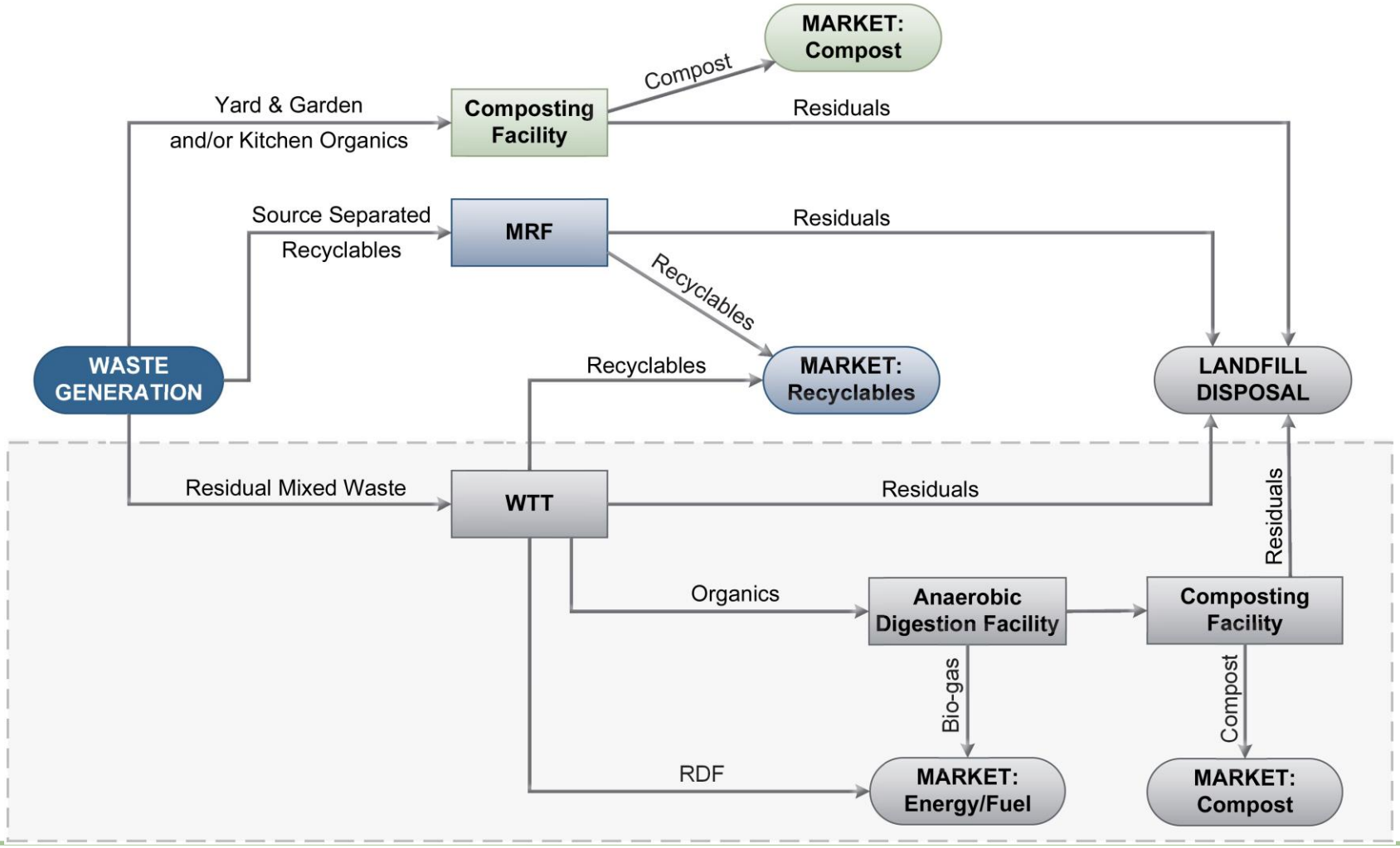
Regulatory Requirements

- Operational Certificate to authorize the WTE facility
- Other permit requirements - Municipal approvals (zoning and development permits).
- A facility must be designed and operated in a manner that protects the receiving environment.

Costs Analysis of Option 0 – Status Quo



Costs Analysis of Option 1 – WTT



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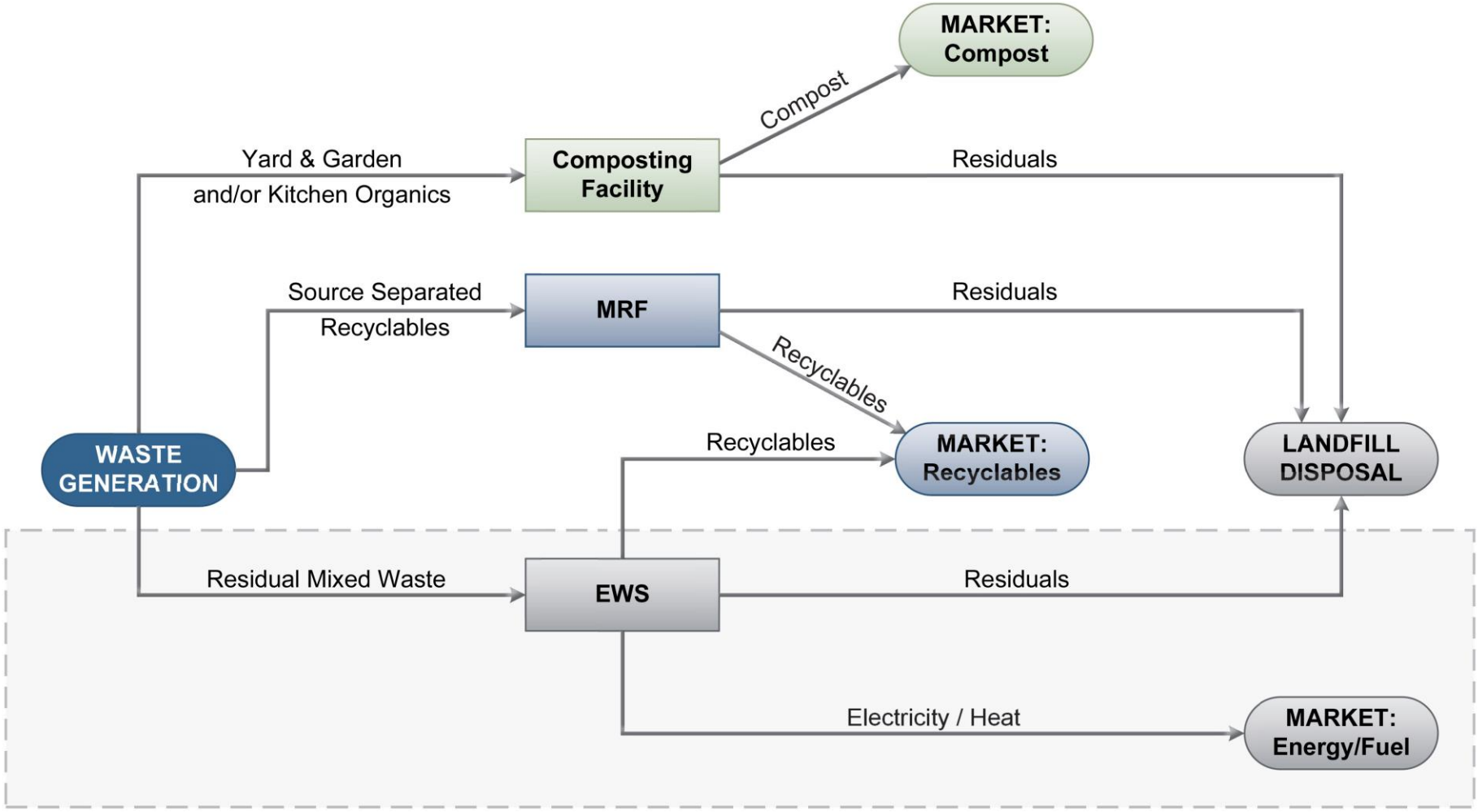
Costs Analysis of Option 2 – EWS



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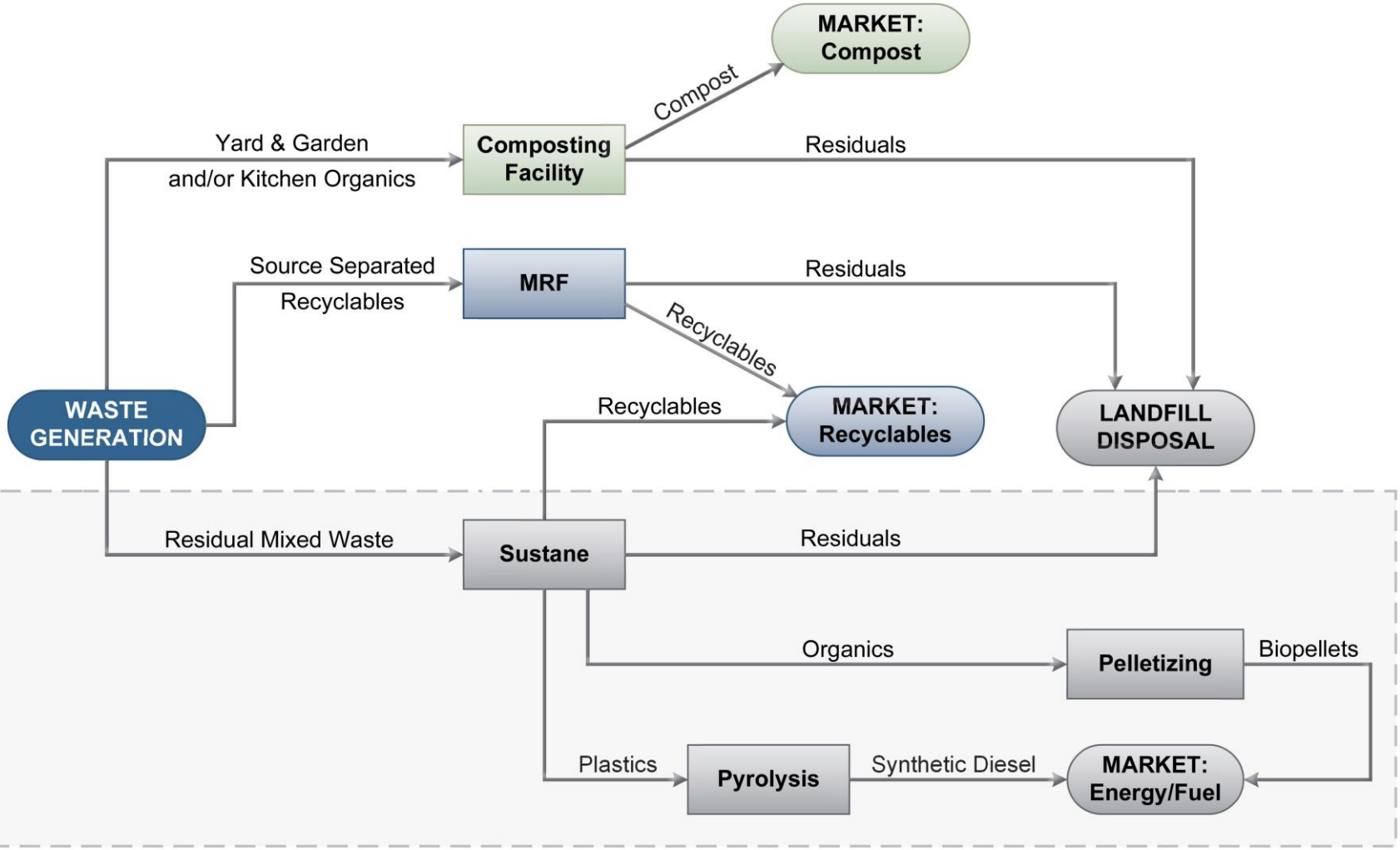
Costs Analysis of Option 3 – Sustane



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Long-term Costs and Revenues

		Capital Cost WTE Facility (one time lump sum $)	Capital Cost ($/tonne)	Operating Cost ($/tonne)	Revenue ($/tonne)	Total Break-Even Tipping Fee ($/tonne)
Year 1-25	WTT	$26.00M	$38.21	$120.00	-$7.20	$151.01
	EWS	$52.68M	$77.41	$116.00	-$31.90	$161.52
	Sustane	$25.00M	$36.74	$82.07	-$29.33	$89.48
Years 26-50	WTT	N/A	N/A	$120.00	-$7.20	$112.80
	EWS	N/A	N/A	$116.00	-$31.90	$84.10
	Sustane	N/A	N/A	$82.07	-$29.33	$52.74

2017 Long-Term Cost Model for $/tonne

Option		30 years	40 years	50 years
0	Status Quo	$82	$79	$76
1(a)	WTT in Comox Valley (CV)	$164	$159	$151
1(b)	WTT in Campbell River (CR)	$174	$167	$159
1(c)	WTT in Gold River (GR)	$199	$193	$185
2(a)	EWS in CV	$168	$153	$140
2(b)	EWS in CR	$177	$159	$146
2(c)	EWS in GR	$196	$181	$168
3(a)	Sustane in CV	$120	$111	$103
3(b)	Sustane in CV	$126	$115	$107
3(c)	Sustane in GR	$150	$140	$132

GHG Emissions

- 9% of BC's GHG emissions comes from waste
- Municipal solid waste landfills represent approximately 95% of emissions from waste
- Conventional WTE facilities produce GHGs through combustion, however methane production is avoided

GHG Emissions

Technology	GHG Contribution	GHG Offsets
WTT	• Landfilling of residual waste • Combustion of RDF	• Recycling of ferrous and non-ferrous metals and cardboard. • Generation of electricity from biogas
EWS	• Landfilling of residual waste • Combustion of MSW	• Recycling of ferrous metals • Generation of electricity
Sustane	• Landfilling of residual waste • Combustion of synthetic diesel	• Recycling of ferrous and non-ferrous metals and plastics

GHG Emissions (tonnes CO_2e)

Options		Total
0	Status Quo	821,000
1(a)	WTT in Comox Valley (CV)	-777,000
1(b)	WTT in Campbell River (CR)	-771,000
1(c)	WTT in Gold River (GR)	-745,000
2(a)	EWS in CV	179,000
2(b)	EWS in CR	183,000
2(c)	EWS in GR	207,000
3(a)	Sustane in CV	179,000
3(b)	Sustane in CR	182,000
3(c)	Sustane in GR	205,000

Constraints, Risks and Timelines

- Technical
- Financial
- Social and environmental

Technical Risks

- Sustane uses new technology for plastics with minimal commercial track record
- Sustane and WTT rely on end markets for recovered recyclables from mixed waste
- Sustane and WTT rely on markets to burn fuel produced from residual waste
- Sustane requires 20,000 litres of water per day

Financial Risks

- Potentially no markets for the products recovered
- Possible difficulties finding funding if:
  - Marginally proven technologies used
  - Public opposition
- Waste derived fuels, or energy from combustion might be lower if plastics removed through recycling

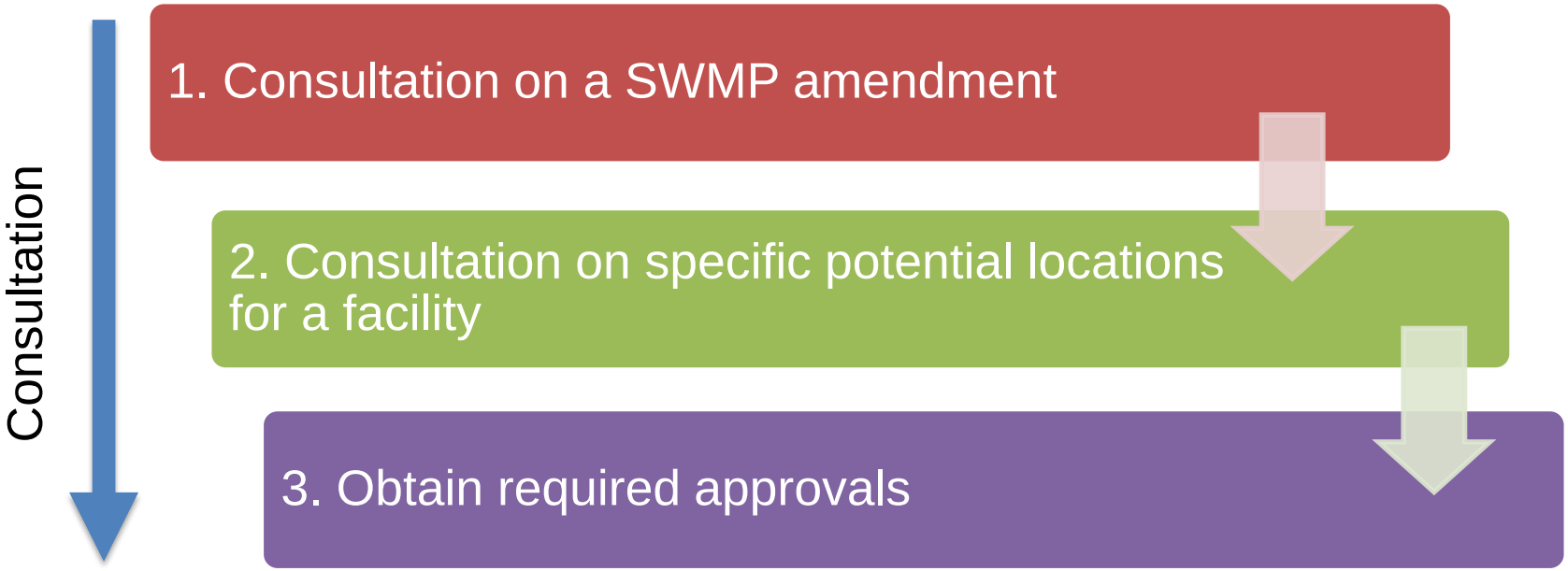
Social and Regulatory Risks

- Crucial to gain public acceptance
- Given the small size of the WTE facilities, there will be no trigger for an Environmental Assessment (EA), but EA can still be required by Minister of Environment.

Environmental Risks

- Air quality
  - Transportation to regional facility emissions
  - Exhaust emissions to air-shed
    - Generally addressed during permitting
    - To be researched once technologies chosen
    - Most emissions can be mitigated technically
- GHG emissions

Timelines


Consultation
1. Consultation on a SWMP amendment
2. Consultation on specific potential locations for a facility
3. Obtain required approvals

Conclusion

- The cost to continue landfilling is approximately $80/tonne
- Waste processing through one of the assessed WTE technology options would increase this cost by $31 to $110 per tonne
- Sustane provides the lowest cost option, however it remains more costly than landfilling and comes with technology risks

Conclusion

- Conventional combustion WTE is a proven technology with available markets for the energy, however it is expensive
- Creating a solid fuel (RDF or bio-pellets) is substantially less expensive than conventional combustion WTE
- The biggest risk with RDF and bio-pellets is finding long term markets for the product
- Landfilling still remains the most cost effective waste disposal option for the region

Thank You

Technology Categories Received

- Conventional Waste to Energy (WTE)
- Refuse Derived Fuel (RDF), in some cases combined with:
  - Anaerobic Digestion (AD)
  - Pyrolysis

- All technologies had some degree of recycling included

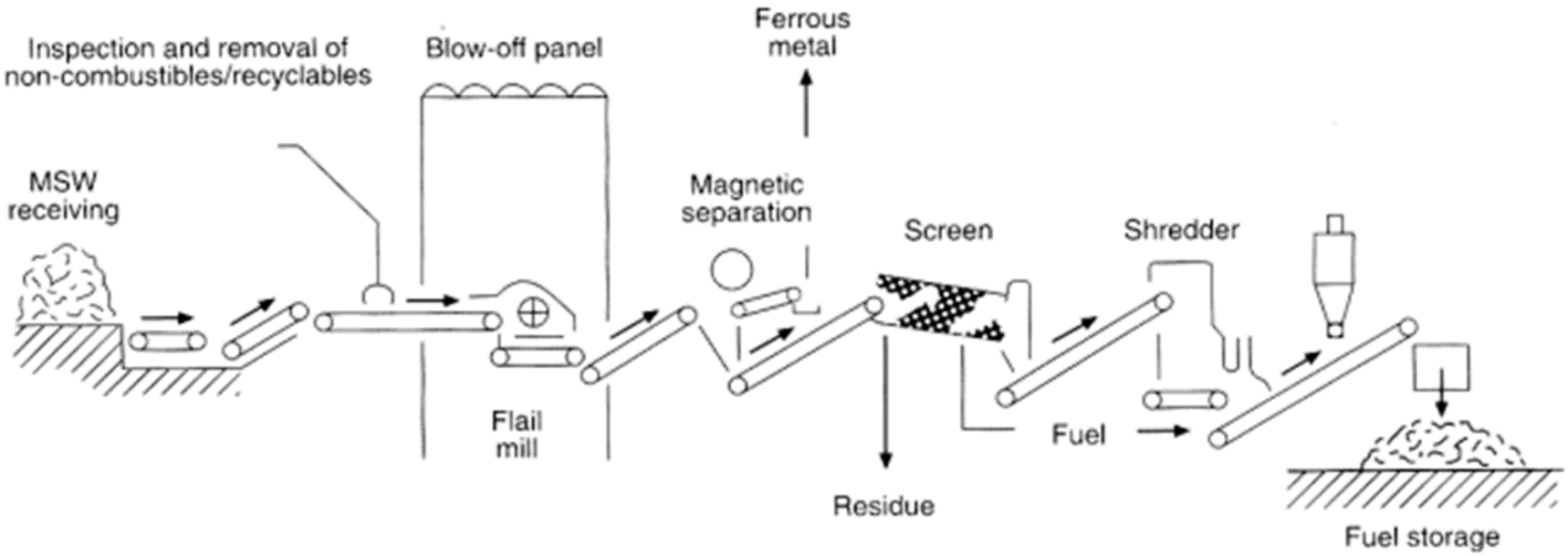
Conventional WTE

Conventional WTE

- Advantages
  - Takes all waste
  - Makes electricity and heat
  - Proven markets for products
  - Proven technology

- Disadvantages
  - Expensive compared to other technologies
  - Potential poor image in public's mind

RDF


Inspection and removal of non-combustibles/recyclables
Blow-off panel
Ferrous metal
MSW receiving
Magnetic separation
Screen
Shredder
Flail mill
Residue
Fuel
Fuel storage

RDF

- Advantages
  - Takes all waste
  - Sorts metals and other recyclables
  - Less costly than WTE
  - RDF product can be used by others
- Disadvantages
  - Markets for RDF hard to establish long-term
  - Value of RDF generally low
  - Value of recyclables from mixed waste often low

AD

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AD

- Advantages
  - Makes end products for which there are established markets (electricity, bio-gas)
  - Proven technology
  - Works well in combination with RDF
- Disadvantages
  - Takes only the organic portion of the waste stream
  - Expensive, since energy revenues do not offset cost

Pyrolysis

Pyrolysis

- Advantages
  - Can convert select waste streams to marketable products, e.g., plastics to oil

- Disadvantages
  - Takes only select portions of the waste
  - Unproven and not generally used for mixed waste
  - Complex, expensive thermal process
  - Few proven applications

RFI conclusion

- RDF and WTE both rank highly
  - RDF lower cost, but markets risky
  - EFW higher cost, with secure markets for energy
- RDF costs up to $30 million
- WTE costs about double of RDF
- WTE operating costs over $80 per tonne, after energy sales
- RDF operating costs under $80 per tonne, after fuel sales
- A landfill will be required with all technologies

GHG Emissions (tonnes CO_2e)

Options		Technology	Landfill	Transfer Station(s)	Total
0	Status Quo	0	813,000	8,000	821,000
1(a)	WTT in CV	-956,000	171,000	8,000	-777,000
1(b)	WTT in CR	-956,000	171,000	14,000	-771,000
1(c)	WTT in GR	-956,000	171,000	40,000	-745,000
2(a)	EWS in CV	443,000	171,000	8,000	179,000
2(b)	EWS in CR	443,000	171,000	12,000	183,000
2(c)	EWS in GR	443,000	171,000	36,000	207,000
3(a)	Sustane in CV	-306,000	171,000	8,000	179,000
3(b)	Sustane in CR	-306,000	171,000	11,000	182,000
3(c)	Sustane in GR	-306,000	171,000	34,000	205,000