# Keys to a Successful Thermal Conversion Technology Facility in Canada

Webinar
National Solid Waste Benchmarking Initiative (NSWBI)

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# Presentation Content

- ❖ Solid waste management hierarchy
- ❖ Conversion technology (CT) overview
- ❖ Thermal conversion technologies
- ❖ Anatomy of a conversion facility
- ❖ Overcoming challenges
- ❖ Benefits of thermal CTs
- ❖ Who should consider thermal CTs
- ❖ Approach to a successful thermal CT project
- ❖ Examples of potential successful projects

# Solid Waste Management Hierarchy

| Existing |
| --- |
| Source Reduction |
| Recycling / Composting |
| Waste-to-Energy |
| Landfilling |

| New |
| --- |
| Source Reduction |
| Recycling / Composting |
| Conversion Technologies |
| Waste-to-Energy |
| Landfilling |



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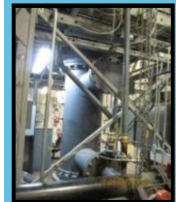


# What is a Conversion Technology (CT)?

A conversion technology converts the carbon-based portion of MSW, biomass or biosolids into useful products including electricity, fuel, chemicals, and fertilizer

*CTs are not Incinerators*

# Three Major Categories of CTs

1. Thermal – Can treat both organic and carbon-based (plastic) materials using higher temperatures (>700° F). Typically has a lower residual than biological technologies and more efficient.
2. Biological – Can decompose biodegradables using low temperatures (<400° F). Has a higher volume of residual than thermal technologies
3. Hybrid and Others – These are combination of thermal and biological mostly emerging

# Types of Thermal and Biological CTs

1 – Thermal CTs – Can handle all waste including food waste

- ❖ Pyrolysis
- ❖ Gasification
- ❖ Pyrolysis/Gasification
- ❖ Plasma Gasification


2 – Biological and Hybrid CTs – Needs source separation

- ❖ Anaerobic Digestion (AD)
- ❖ Gasification/Fermentation






# Pyrolysis

- Thermal degradation of organic materials using an indirect, external source of heat, at 750-1,650°F, in the absence or almost complete absence of oxygen, producing syngas
- The syngas (primarily $H_2$ and CO) can be used to produce electricity, fuel, or other chemicals
- Byproducts are carbon char, silica, metals, and inorganic materials



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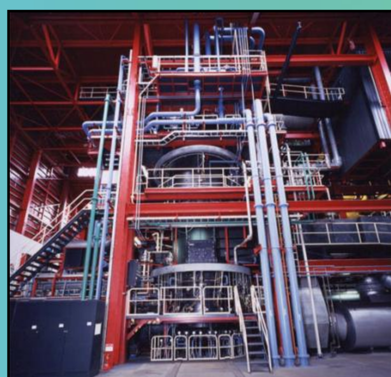
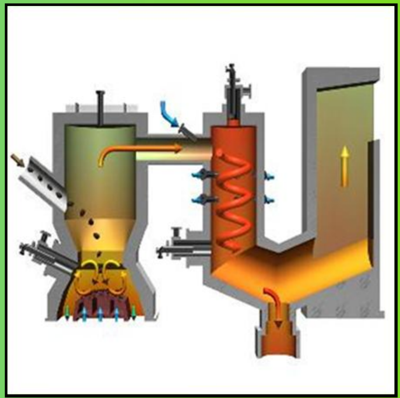
# Gasification

- Thermal conversion of organic materials at 1,400-2,500°F with <u>a limited supply of oxygen</u>, producing a syngas
- The syngas (primarily $H_2$ and CO) can be used to produce electricity, fuel, other chemicals.
- Inorganic materials are converted to bottom ash or slag










# Pyrolysis/Gasification

- Thermal degradation of organic materials using pyrolysis to produce syngas and carbon char as solid byproduct
- The byproduct (carbon char) is going through gasification process to produce additional syngas
- In case of high temperature gasification, the solid byproducts is slag and inert






# Plasma Gasification

- ❖ Uses AC and/or DC to produce an ionizing gas (plasma) at 6,000-10,000ºF
- ❖ Extensive use for destroying hazardous and medical wastes, melting incinerator ash to form inert slag
- ❖ New applications for processing MSW

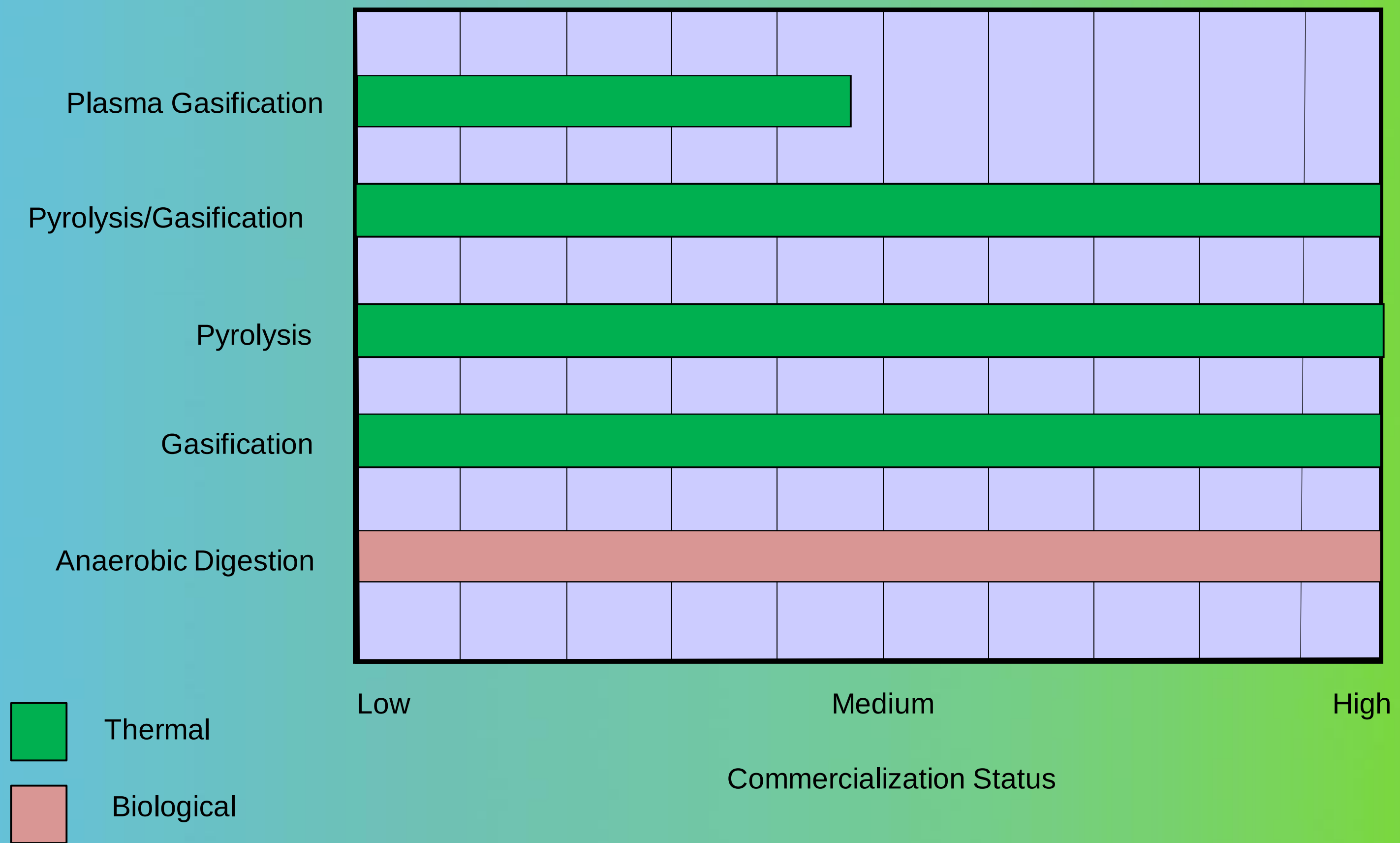
# Anatomy of a Conversion Facility

MSW, Biomass Biosolids → Pre-processing → Conversion Unit → Syngas/Biogas → Syngas Cleaning → Electricity/Steam/Fuel → Emission Control

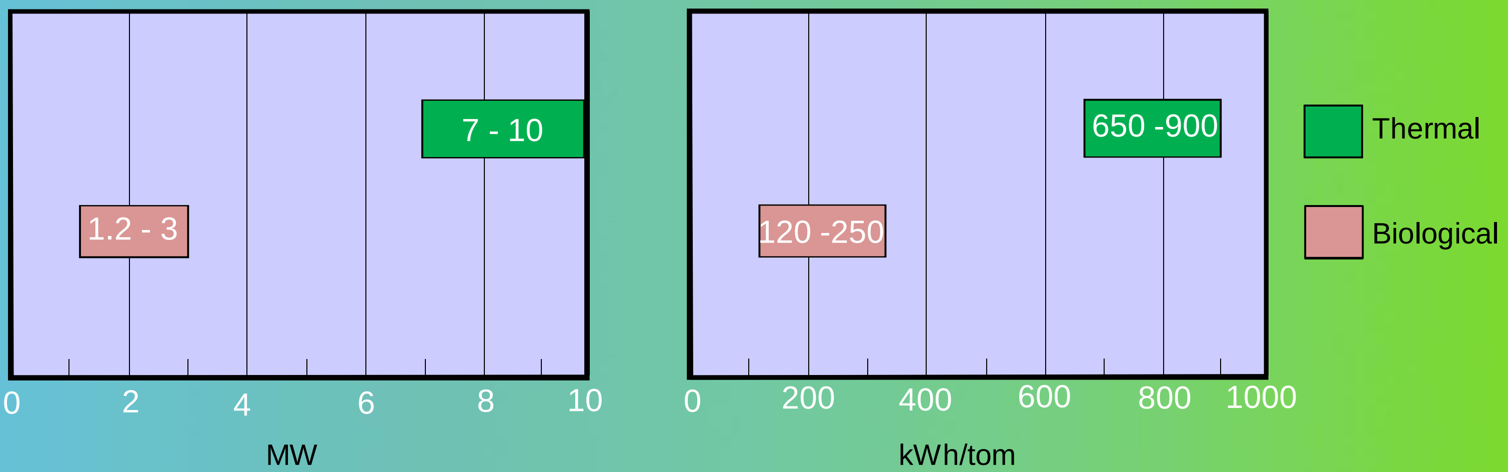
Pre-processing → Recyclable Material

Conversion Unit → By-products, Ash, Carbon Char Inert Material or Fertilizer

# CTs Commercialization Status



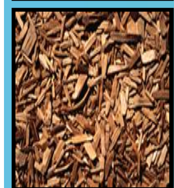
# Efficiency - Electricity Generation Throughput 100,000 TPY MSW



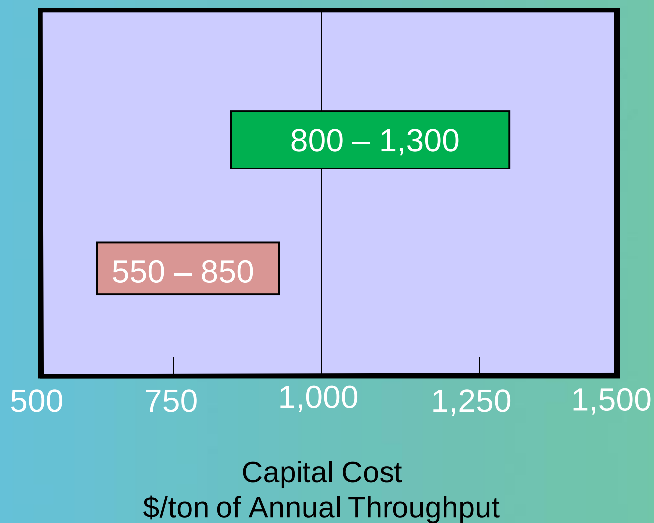

100,000 tpy MSW  is generated by a City with 122,000 residence
10 MW Provide electricity on an Average for  8,000 Home

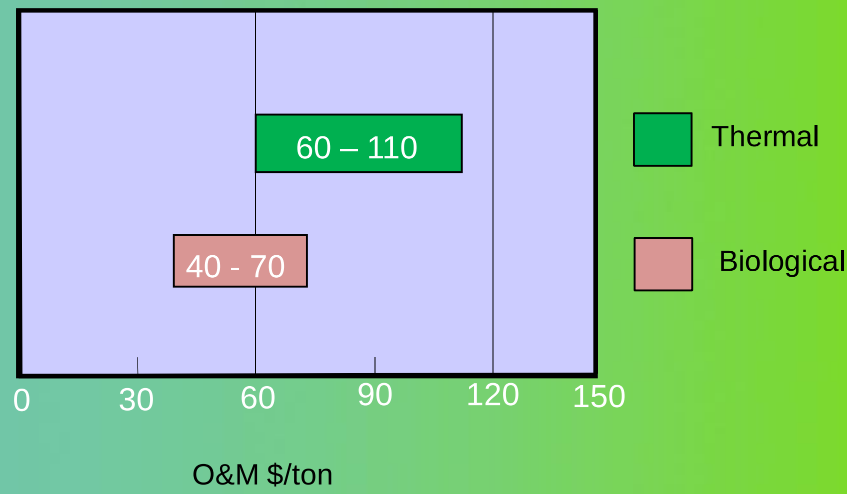
Sources US EPA






# Cost
# Throughput 100,000 TPY MSW

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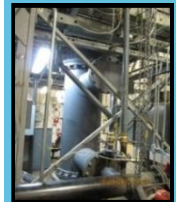
# Overcoming Challenges (Managing Risks)

- ❖ Perform a comprehensive technical evaluation
- ❖ Match vendor’s experience to your risk profile
- ❖ Evaluate vendor’s experience with heterogeneous feedstock such as MSW
- ❖ Evaluate integration of pre-processing, conversion system, and power or fuel generation
- ❖ Regarding cost uncertainty, risk is *inversely* related to experience
- ❖ Implement an *effective* public education and outreach program








# Benefits of Thermal CTs

- ❖ Waste diversion from landfills
- ❖ Modulized systems (flexibility in size)
- ❖ Help to manage waste locally
- ❖ Increase recycling
- ❖ Reduce greenhouse gas emissions
- ❖ Reduce air emissions
- ❖ Generate renewable energy
- ❖ Maximize value of by products and residuals


Environmental  Sustainability



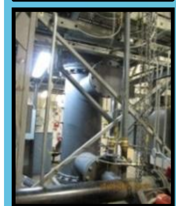



# Who Should Consider Thermal CTs?

- ❖ Municipalities with higher tipping fees and limited landfill capacities
- ❖ Municipalities with existing infrastructures – MRFs, TS, landfills, WTE or as part of AD facilities
- ❖ Willingness and ability to subsidize
- ❖ Municipalities with renewable energy goals
- ❖ Military basis and Islands with sustainability goals
- ❖ Entities processing tires, biomass, and MSW to generate renewable energy/fuel








# Approach to Successful Thermal CT Projects

- ❖ Formulate the objective(s) clearly
- ❖ Evaluate feedstock
- ❖ Determine infrastructure availability
- ❖ Select the right technology
- ❖ Evaluate preprocessing issues
- ❖ Identify benefits and challenges - cost
- ❖ Evaluate end products characteristics and marketability

Education and Public outreach

# Edmonton Solid Waste Integrated Facility

- ❖ The City of Edmonton operates a number of solid waste facilities at the Edmonton Waste Management Center.
- ❖ Material Recovery Facility (MRF): 40,000 TPY (160 TPD) with 10% residual.
- ❖ Composting Facility: 180,000 TPY (720 TPD)
- ❖ Clover Bar Landfill – Overcapacity and closing: 400,000 TPY (1,600 TPD)

# Edmonton Solid Waste Integrated Facility

Transfer station capacity

- ❖ 400,000 TPY (1,600 TPD)
- ❖ 180,000 TPY (720 TPD) for composting

# Edmonton Solid Waste Integrated Facility

1. Pre-processing facility – sorts waste for:
   - ❖ Composting facility
   - ❖ Refuse derived fuel (RDF) facility
2. Gasification facility: 100,000 TPY
3. Other supporting facilities

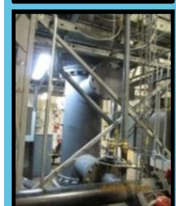
# City of Ames, Iowa

## Existing infrastructure and public support

- Resource recovery facility
- Waste to energy facility
- The right feedstock composition for a thermal CT
- Political, regulatory, and public support
- Completed technical and financial feasibility studies






# City of Cleveland, Ohio

- Feedstock availability (quantity and quality)
- Site and infrastructure availability with Road Ridge transfer station
- Public, regulatory, and stakeholders support
- Completed financial feasibility including financial models






# Conclusion

CTs are here and they will stay here. They are the future of solid waste disposal alternative

Thanks for Listening



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