

Current Organic Waste Conversion Technologies, Their Products and By-products – Technology Intelligence

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Outline

- Introduction
- Objectives and scope
- Methodology
- Key findings
- Conclusions

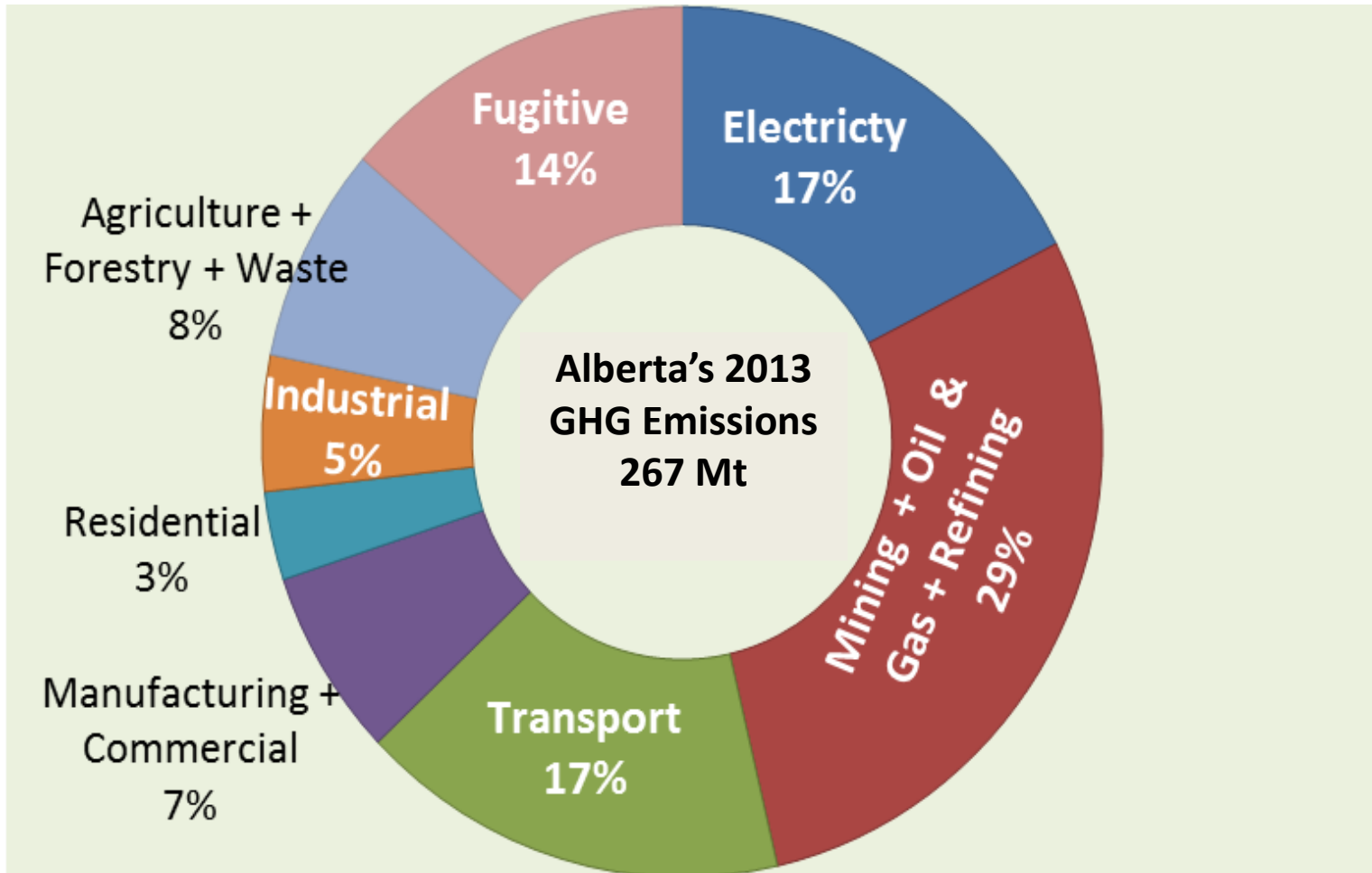
Introduction

This project contributes to achieving AI-EES's 2030 targets:

- **50% reduction in organic waste to landfills**
- **30% electricity from renewables**

and ultimately achieving a landfill-free Alberta

Introduction



Source: Environment Canada

Introduction

**Waste
(Mt/year)**

Municipalities

MSW

4

Solid organics

~3.2

Agriculture and Forestry

Organics

>16

GHG mitigation potential (*through conversion and avoiding landfilling & land application*): 16 Mt CO_{2,e} per year

Project objectives

Conduct a global sweep and identify technologies and their providers that convert Solid Organic Wastes (SOW)* into valuable products, such as biogas, syngas chemicals, and fertilizers

** wastes originating from hydrocarbons and carbohydrates*

Project scope

- **SOW Components:**
 - Municipal Solid Waste (MSW)
 - Industrial, Commercial and Institutional wastes (ICI)
 - Manure
 - Slaughterhouse waste and Specified Risk Materials (SRM)
 - Forest slash
- **Plant Capacity:** 10,000 – 100,000 t/year
- **Technology Maturity:** Near-commercial or commercial
- **Suitability:** For Alberta conditions

Methodology

- Creation of '**WANT**' Statement
- Identification of '**Key Intelligence Parameters**'*
- Selection of '**Key Words**'*
- Computer-based literature search using '**Key Words**'*
- Scoring identified technologies and providers*
- Ranking of technologies and providers*
- Finding additional information on higher scorers*
- Detailed consideration of top choices*
- Conclusions

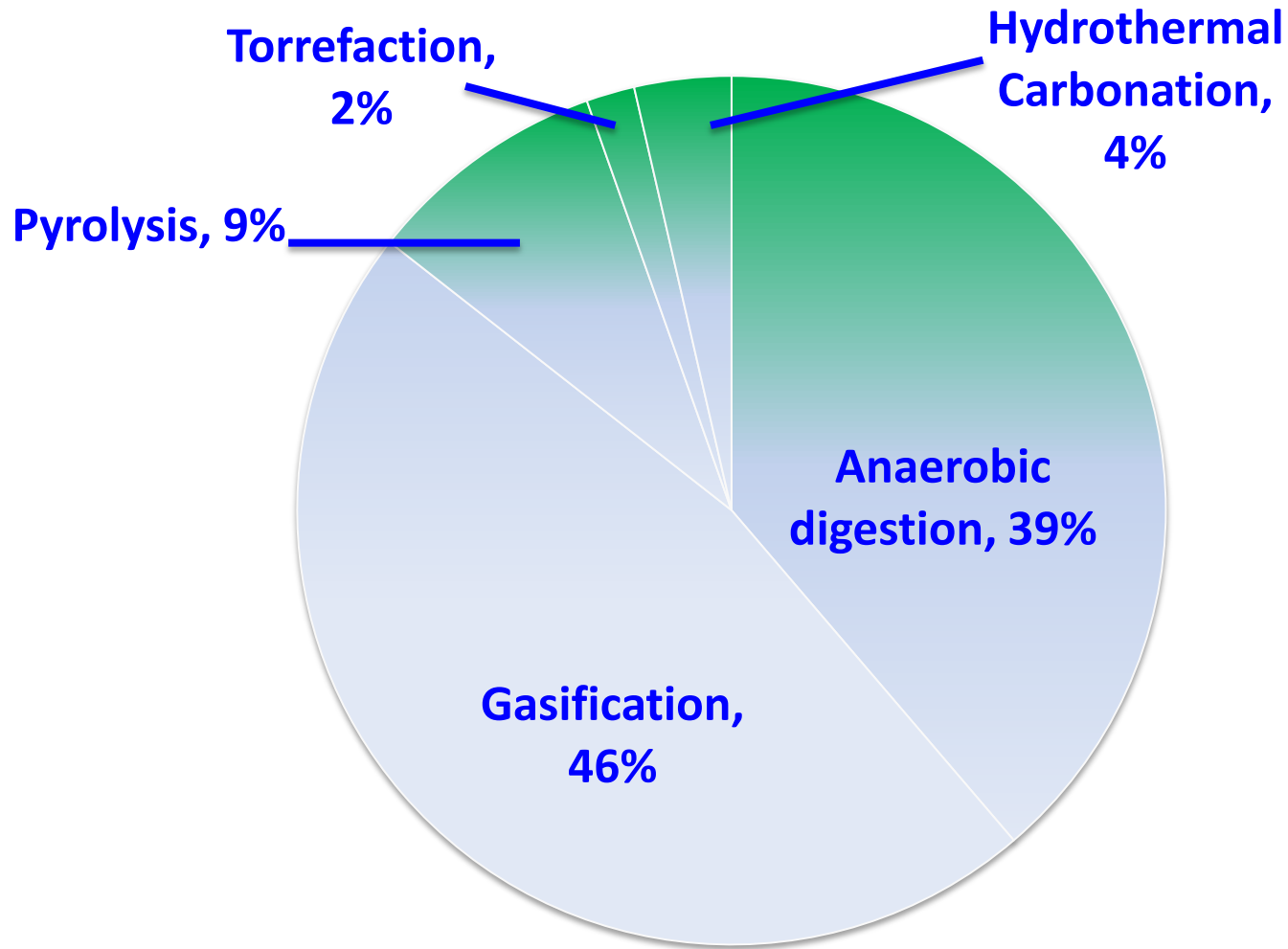
* *Work performed by or in collaboration with Signals Group*



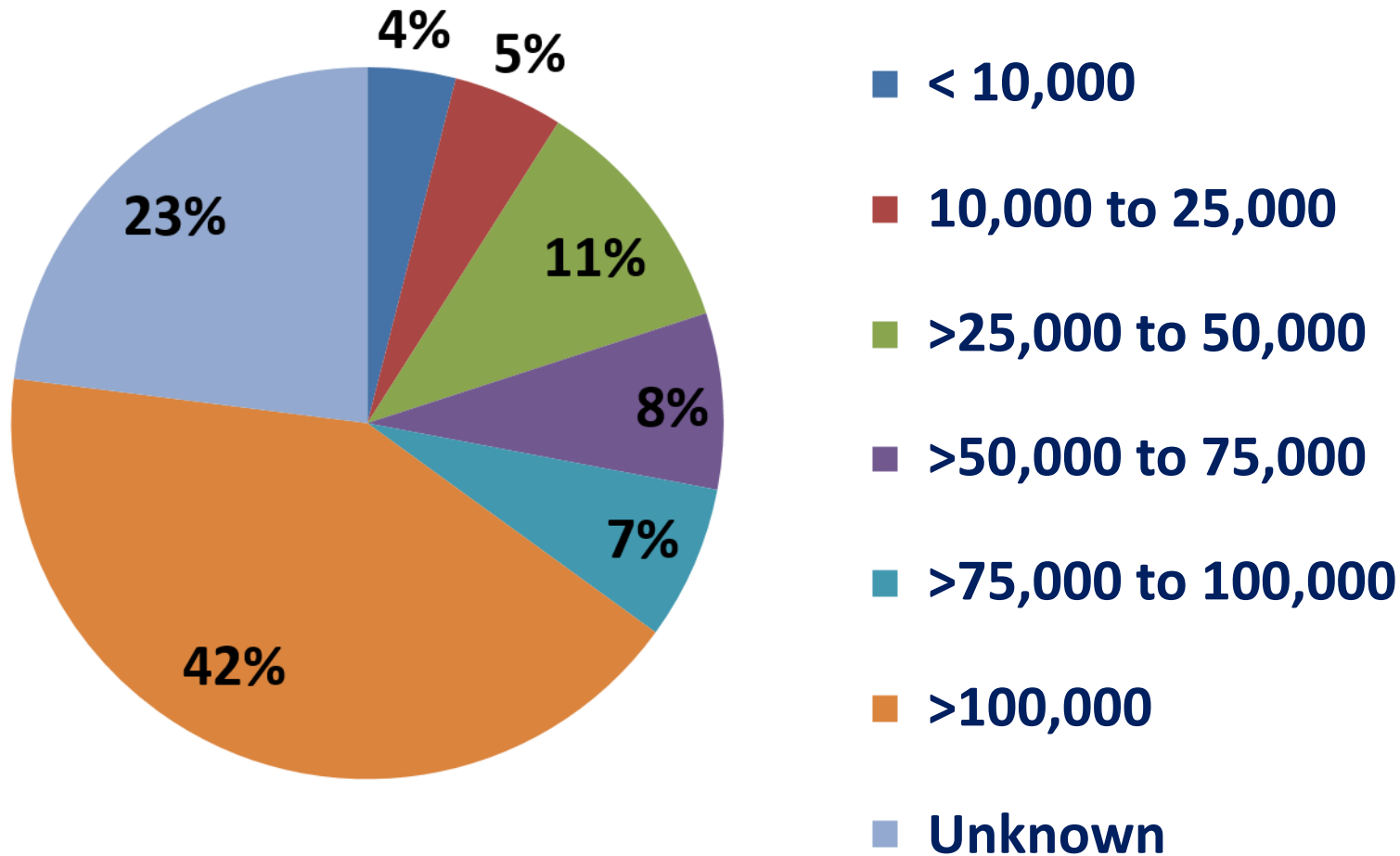
Findings: Overall

- **>700 companies** offer SOW conversion technologies
- **Primary technologies:**
 - Anaerobic digestion
 - Gasification and pyrolysis
- **Primary products** (depending on feed-stock and technology):
 - ***Thermo-chemical:*** Syngas, Liquids, Char – convertible to heat, electricity, fuels, petro-type organic liquids, char
 - ***Biological:*** Biogas (convertible to electricity, heat), Digestate / Compost
- **Plant Capacity:** Typically >100,000 t/y

Findings: Technology type

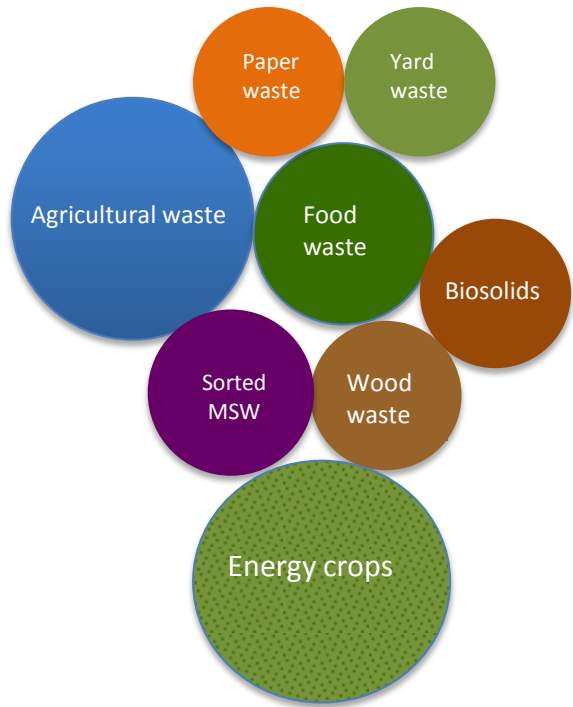


Findings: Plant capacity (t/year)

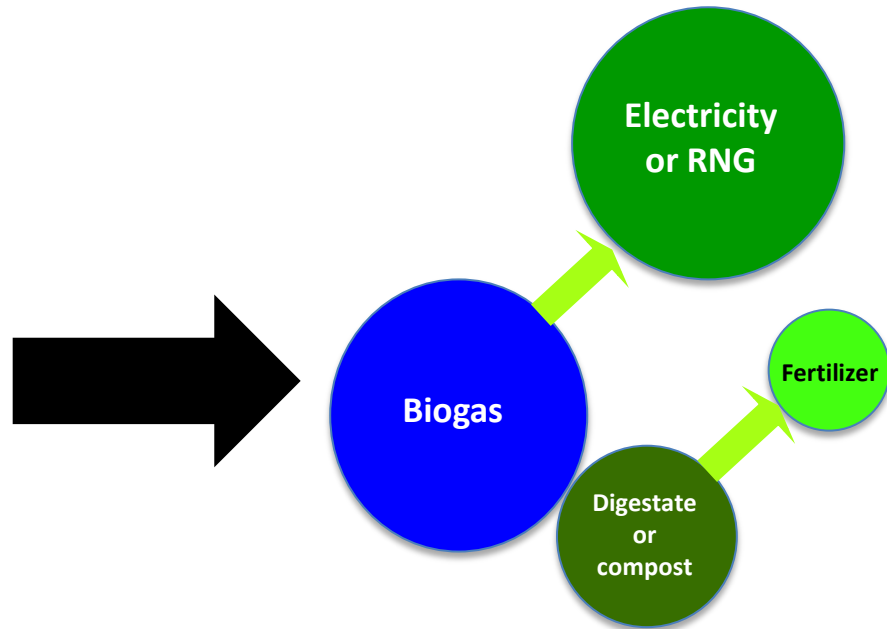


Anaerobic digestion

SOW Feed-stocks



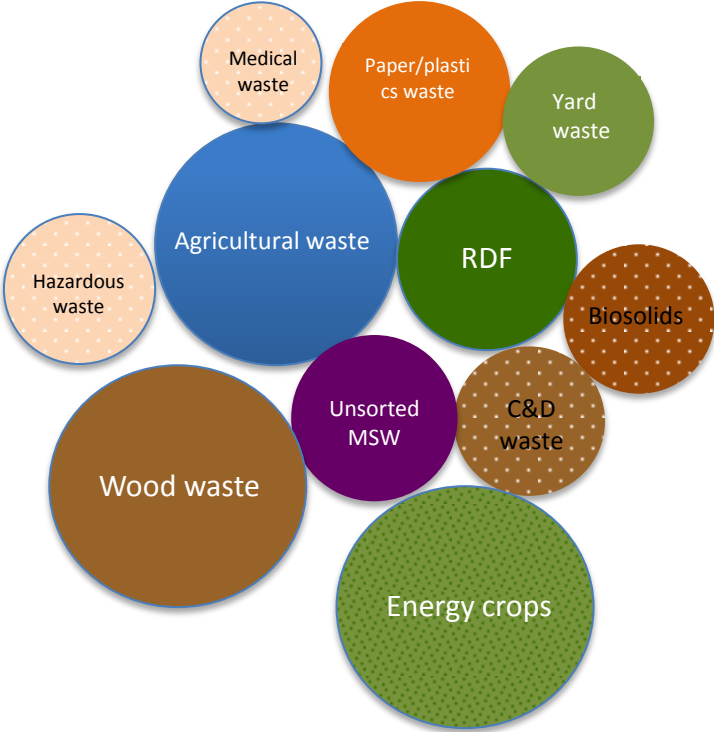
Products & By-products



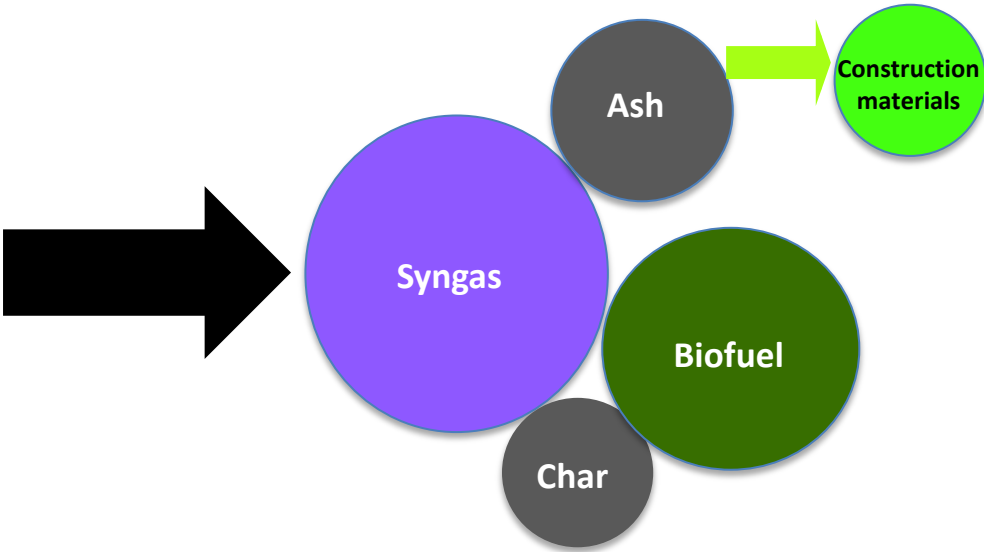
Provided by Signals Inc.

Gasification or Pyrolysis

SOW Feed-stocks



Products & By-products



Provided by Signals Inc.

Conclusions – biological processes

- **Biological processes** are favoured for:
 - SOW with high bio-digestible content
 - SOW with high moisture
 - good nutrient preservation
 - biogas production

- **Representative Technology Providers:**
 - BEKON Energy Technologies GmbH & Co. KG (HQ: Germany)
 - BioFerm (HQ: Germany)

Conclusions – thermal processes

- **Thermal processes** are favoured for:
 - SOW with low moisture content
 - the production of syngas, electricity, heat, petroleum-type liquids, and bio-solids

- **Representative Technology Providers:**
 - Enerkem (HQ: Canada)
 - Chinook Sciences Ltd (HQ: United Kingdom)
 - Ensyn Corporation (HQ: USA)

Conclusions – Torrefaction and Hydrothermal Carbonation

- Both are at late development stage
 - **Torrefaction** is preferable for dry feedstocks,
 - **Hydrothermal carbonation** for wet feedstocks
- Products are bio-coal or carbon-dense compounds, suitable as feedstocks for other processes, such as gasification and pyrolysis

Conclusions: Research Development Innovation Needs

- Continue development of existing biological and thermal technologies, with a focus on cost reductions and *scale-down*
- Improve nutrient recovery from digestate
- Accelerate development of small-scale processes for syngas and biogas conversion into high-value products
- Identify new high-value products for local and/or wider use, and develop their production technologies

Overarching Conclusions

- **Anaerobic digestion** and **gasification** are proven technologies for converting solid organic waste (SOW) into valuable products in Alberta
- **Pyrolysis, Torrefaction** and **Hydrothermal Carbonation** are promising SOW conversion technologies
- **SOW preparation and pre-treatment** favours all conversion technologies
- **Small-scale technologies** are needed for syngas and biogas conversion

Closing Remarks

- **SOW conversion technologies are critical to Alberta's municipalities achieving *a Landfill Free Alberta***
 - **Furthering the development of promising technologies**
 - **Establishing a showcase of the integrated MSW utilization and conversion facility in rural area**

Questions?

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