An Organic Waste Inventory for Alberta’s Agrifood Sector

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Organic Waste Inventory Project

Contributing Partners:

- Alberta Government
- Alberta Innovates Energy and Environment Solutions
- ALMA Alberta Livestock and Meat Agency Ltd.

Team Members:
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- Tanishka Gupta
- Mohammad Ullah
- Siddarth Jain

Advisory Committee:
- Above partners
- AI Bio
- RCA
- EWMC
- AFPA
- City of Calgary
- Ind. Retail Grocers Association
- Waste Management of Canada
Bio-Industrial Opportunities Section

Bio-energy
Bio-materials
Bio-chemicals
Food and Feed

Textiles
Bio-composites
Green Building Materials
Pharmaceuticals
Personal Care
Industrial Chemicals
Cosmetics
Health Food Ingredients
Value-add
Animal Feed

Website: [http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/bt14861](http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/bt14861)
Bio-Industrial Opportunities Section

Why do study?

• Agriculture → an important Alberta industry
• Limited understanding of the sectors’ wastes and byproducts
• Frequently contacted by organizations looking for availability of organic waste
  ➢ Quantity, seasonality, location, quality/composition
• Aimed to fill data void
Food Wastes in Canada

- On farm
- Transport/Distribution
- Food Processing *
- Retail (grocery stores, distributors)*
- Food Service (restaurants, hotels)
- Households

Source: Value Chain Management, 2014
Industry Size

Livestock: +1,800 operations
Food Processing: +500 operations
Grocery industry: +35 possible brands
Yard waste: +1.3 million households (in addition to commercial and institutional)
Project Scope

• Focus areas:
  - Livestock industry (NRCB data)
  - Food processing industry (new data)
  - Grocery industry (new data)
  - Residential yard waste (existing data)

• Data collection:
  - Total mass/volume
  - Location
  - Description (type, moisture, state, etc)
  - Seasonal Variability
Methodology

• Literature review

• Data Gathering and Processing
  ➢ Compilation
  ➢ Verification
  ➢ Aggregation
  ➢ Anonymization
  ➢ Extrapolation
  ➢ Addition of geographic metadata/Mapping
Assumptions

• Data correct?
  ➢ Are we asking the right question(s)?
  ➢ How were primary data collected?

• Extrapolations
  ➢ Not all stakeholders were contacted
  ➢ Not all contacted stakeholders responded

• Moisture content

• Production capacity
Anonymization

Countywise

Landuse Regionwise

Lower Peace

Lower Athabasca

Upper Peace

Upper Athabasca

North Saskatchewan

Red Deer

South Saskatchewan
1. Livestock

- 1649 livestock operations reviewed
- Over 2.5 million dry tonnes of manure per year and 70,000 dry tonnes of on-farm dead per year were estimated
- No good information on current management or disposal of manure or on-farm dead
- >95% of manure is land applied
- Little seasonal variation
2. Food Processing

- 200/500+ Food Processors contacted
- Data from ~180 companies obtained
- 250k dry tonnes per year reported
- ~500k dry tonnes per year extrapolated
- Data quality varied widely
- Best waste stream resolution
- Large waste streams were more homogeneous than smaller waste streams
- Little seasonality observed
2. Food Processing

- Best resolution on waste management practices out of 4 subsectors
- Waste volumes and disposal practices do not correlate
- Most common practice = landfill
2. Food Processing

- Most disposal methods → negative to low value
3. Grocery

- Most challenging subsector to gather data
- 30 grocery brands included representing more than 500 stores
- 50,000 dry tonnes per year estimated
- Very few companies willing to share complete data
- Data quality varied widely
3. Grocery

- **Food Waste (including packaging)**: 44%
- **Source Separated Cardboard**: 35%
- **Source Separated Plastic**: 19%
- **Other (metal, glass, etc)**: 2%
4. Yard

- Used existing data set from E&P
- Added county data
- 200,000 tonnes of dry waste identified
- Highly seasonal
## Summary of Results

<table>
<thead>
<tr>
<th>Subsector</th>
<th>Dry tonnes per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock - manure</td>
<td>2,560,000</td>
</tr>
<tr>
<td>Livestock – on-farm dead</td>
<td>70,000</td>
</tr>
<tr>
<td>Food processing waste</td>
<td>500,000</td>
</tr>
<tr>
<td>Grocery store waste</td>
<td>50,000</td>
</tr>
<tr>
<td>Yard waste</td>
<td>200,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,380,000</strong></td>
</tr>
</tbody>
</table>

The map shows the countywise distribution of all waste (dry tonnes/year). The legend indicates the tonnage ranges for different color codes:

- **0 - 1,000**
- **1,001 - 50,000**
- **50,001 - 100,000**
- **100,001 - 140,000**
- **140,001 - 160,000**
- **180,001 - 220,000**
- **220,001 - 670,000**
- **670,001 - 680,000**
Disposal Fees for Mixed Wastes
# Biogas Potential?

<table>
<thead>
<tr>
<th>Organic type</th>
<th>$m^3/t$</th>
<th>'000 t/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef cattle manure</td>
<td>19-46</td>
<td>1822</td>
</tr>
<tr>
<td>Hog manure</td>
<td>28-46</td>
<td>216</td>
</tr>
<tr>
<td>Dairy manure</td>
<td>25-32</td>
<td>366</td>
</tr>
<tr>
<td>Poultry manure</td>
<td>69-96</td>
<td>130</td>
</tr>
<tr>
<td>Other manure</td>
<td>19-46 (est)</td>
<td>24</td>
</tr>
<tr>
<td>Animal carcasses</td>
<td>348-413</td>
<td>70</td>
</tr>
<tr>
<td>Food processing and grocery wastes</td>
<td>143-214</td>
<td>550</td>
</tr>
<tr>
<td>Yard waste</td>
<td>72-216</td>
<td>200</td>
</tr>
<tr>
<td>Wheat residuals</td>
<td>48-146</td>
<td>805</td>
</tr>
<tr>
<td>Barley residuals</td>
<td>169-291</td>
<td>3467</td>
</tr>
</tbody>
</table>

801 - 1435 M $m^3$ biogas/yr

- 1.7 kWh/m$^3$
- 7.7 MJ/m$^3$
- 217 MWh
- 8.7 pJ
- $1.5/MWh$
- $2/GJ$
- $28.6M$
- $17.2M$

*Excludes other organic feedstocks such as biosolids, animal fats, household and MSW, other agricultural residues, etc
Outcomes

• Stakeholder engagement
  (directly engage ~300 stakeholders)
• Waste Reduction opportunities identified
• Value-add opportunities identified
• Knowledge Foundation on which to:
  ➢ Inform policy
  ➢ Catalyze industry investment
Outcomes

- Source Reduction
- Food
- High Value Chemicals
- High Value Materials
- Biogas
- Compost
- Incineration
- Landfill
Outcomes

- Inquiry
- Data Query
- Permission
- Sharing & Collaboration
Challenges and Next Steps?

• Refine data and harmonize data?
• Data is a snapshot in time - routine data collection and sharing
• Set up program to support companies who wish to divert wastes to higher value uses
• Coordinate approaches to keep organic wastes out of landfills
• Incorporate data into BRIMS database?
• Waste water
BRIMS
Bio-Resource Information Management System

Biomass Data Framework:
- Crops
- Livestock
- Tree Components
- Landbase Allocation
- Mill Waste
- Mixed Solid Waste
- Residential Sludge
Challenges for industry

- Transportation costs
- Commodity pricing (especially in AB)
- High capital investment needed
- Homogeneity + moisture content
  - pre-processing?
- Time decay factor
- Secure constant supply stream
- Farmers worry about traceability of product
Acknowledgements

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Also thanks to:

- Advisory Committee Members
- Project team:
  - Jeff Bell
  - Ruth DeSantis
  - Tanishka Gupta
  - Mohammad Ullah
  - Siddharth Jain
Waste Value

Detailed report can be found [here](#)