Glass recycling innovation: the Quebec case
About Éco Entreprises Québec

• Private, non-for-profit organization
• Board of directors: 10 Brand owners representatives and 4 non-members
• EPR = financial responsibility only since 2005
• $112 M (USD) a year in compensation to municipal curbside recycling services
• Based in Montreal, Quebec
A Value Chain

**Recyclable Materials Value Chain**

**Companies and Organizations**
Use, marketing and reintroduction of containers, packaging and printed matter in a circular economy.

**Conditioners and Recyclers**
Conditioning and transformation of recovered materials
Sale of recycled and transformed materials

**Sorting Centres**
Manual and mechanical sorting, baling or bulking of materials
Transaction between the sorting centre and conditioners and recyclers

**Municipal Collection**
Collection and transportation to the sorting centre

**In Stores**
Purchase of products by consumers

**At Home and In Public Places**
Product consumption and placing CP&PM in recycling bins
Door-to-door collection

Together, greener and more effective.
Quebec Recycling Highlights

- 8.3 million people
- 1,667,441 surface km²
- 23 sorting centres
Quebec Recycling Highlights

- Recycling services since the 1980s
- 600 municipalities offer the service

99% 94 kg/hab 141 $/t
5 Optimization Levers to Support the Industry’s Evolution

- Optimize what and how consumers recycle
- Improve the quality of collected materials
- Encourage information sharing and the implementation of best practices
- Improve sorting centre performance and efficiency
- Apply a regional or provincial perspective to sorting and conditioning activities
Glass in the Quebec bin

- 776,000 tons of recyclable matter collected annually
- 111,600 tons of glass in the bin
- 40,000 tons of the glass in the bin is flint glass
- 1 out of 4 wine bottle is a clear glass bottle
- 62% of clear glass comes from oil bottles, jam jars, pickles, ketchup, salad dressing containers, etc.

776,000 tons/year

111,600 tons of glass
Turning a crisis into an opportunity

3 factors came together to cause the situation:

• A severe decline in the demand for mineral wool, the primary end market for glass

• The shutdown of the main glass conditionner, Klareco

• Under-investment in recycling facilities for glass processing
The Glass Works Plan
The *Innovative Glass Works* Plan: higher quality, higher value

$5 \, M$ investment

3 COMPONENTS OF THE *INNOVATIVE GLASS WORKS* PLAN

MODERNIZE MATERIAL RECOVERY FACILITIES

1) Demonstration projects ($3.1 \, M$)
2) R&D projects ($1 \, M$)

STIMULATE AND DIVERSIFY THE DEVELOPMENT OF MARKET OUTLETS

3) Financial support to promote and develop market outlets for glass ($0.9 \, M$)
Technologically-advanced equipment to sort and clean glass collected via curbside recycling
Glass sorting and cleaning

GLASS AFTER PROCESSING (VARIOUS SIZES POSSIBLE)
Selecting MRFs in a nutshell – a rigorous approach

Selection process:
– 5 meetings of internal and external experts
– Over 700 hours of analysis

• MRFs visits
  – 11 MRFs visited out of 18 applicants
  – +3500 km by car or by plane

• Glass characterization
  – 1 new protocol of glass characterization developed
  – 90 glass samples analyzed
  – 665 kg of glass manually sorted

• MRFs configuration plans
  – Over 30 work plans by ÉEQ, Machinex and Krysteline.
## Pilot projects - Investments

<table>
<thead>
<tr>
<th>Investment Detail</th>
<th>Estimated Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment in equipment</td>
<td>2 070 000 $</td>
</tr>
<tr>
<td>Financial participation support (average operating cost of 22$/t)</td>
<td>730 000 $</td>
</tr>
<tr>
<td>Project management Fees</td>
<td>225 000 $</td>
</tr>
<tr>
<td>Transportation Costs (25% of Glass sorted)</td>
<td>85 000 $</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3 110 000 $</strong></td>
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</tbody>
</table>
Economic model for glass recycling

• **Pilot-project in 5 MRF**
  – 33,000 t of glass/year, which represents almost 30% of glass quantity in the curbside recycling system in Quebec
  – System throughput: from 1 t/h to 8 t/h → from regional MRF to large size MRF
  – Actual cost of managing glass: -20$/t + transport

• **Cost of implementation and operation**
  – Cost of systems: from $250,000 to $1.12 M
  – MRFs investment: $40,000 to $190,000
  – Workforce: 1 sorter per shift for quality control of incoming glass
  – Electricity: 1.00 $US/t of processed glass @ $0.05/kwh

• **Revenue**
  – Increase sales not only for glass but also for other recovered materials such as steel, aluminium, plastics and fibers
Turning a threat into an opportunity
Stimulating new end markets using recycled glass: support for recyclers and conditioners

TESTS AND PROTOTYPES
- **Eligible expenses**: labour, equipment and materials supply/rental, external professional fees (excluded: equipment in sorting centres)
- **Up to $75 K**

MARKETING
- **Eligible expenses**: external professional and study fees
- **Up to $20 K**

ACCREDITATION, CERTIFICATION AND STANDARDIZATION
- **Eligible expenses**: external professional and study fees, applications for IP rights
- **Up to $40 K**
Market studies shows potential for new end markets

**DATA CONCERNING THE DIFFERENT USES OF RECYCLED GLASS IN QUEBEC, ONTARIO, AND THE NORTH-EASTERN UNITED STATES**

<table>
<thead>
<tr>
<th>Uses</th>
<th>Advantages</th>
<th>Maturity Level</th>
<th>Product Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filters for drinking water, swimming pools and wastewater</td>
<td>Better resists proliferation of bacteria, reduces backwash, and saves water</td>
<td>Developing market</td>
<td>$50 - $220</td>
</tr>
<tr>
<td>Abrasives</td>
<td>No heavy metals or free silica, performance-enhancing angles</td>
<td>Developing market, in existence for ~7 years</td>
<td>$150 – $220</td>
</tr>
<tr>
<td>Glass wool</td>
<td>Recycled product, lower melting temperature</td>
<td>Exists for 10 years</td>
<td>$70</td>
</tr>
<tr>
<td>Concrete with glass powder for non-structural works (sidewalks, street furniture, noise-abatement walls, etc.)</td>
<td>Easier to manipulate, more resistant on certain surfaces</td>
<td>Growth market</td>
<td>$110 - $150</td>
</tr>
</tbody>
</table>
Foam glass

In Europe, a plant produces 30-50k t/y generates sales of 35-56M$
Cement additive

• Glass powder is produced locally and therefore incurs lower transportation costs compared to other cement additives that must be imported into Quebec.

• Glass powder provides concrete with very interesting properties, including:
  - Smaller environmental footprint
  - Impermeability to chloride ions
  - Better structural resistance
  - Better handling of concrete

• Growing in Quebec and in the U.S.
Water Filtration

• In North America
  - Estimated growth of 8% of the water equipment market
  - No manufacturers for filtration glass used for drinking water treatment
  - Well-established elsewhere in the world

• In Quebec:
  - Estimated potential of 18,000 t/y worth $0.9 M - $1.4 M
  - Retail price ranges from 35 $/t to 60 $/t
Abrasive

- 14 main suppliers of glass abrasives in North America, two of which are in Quebec and four in other Canadian provinces.
- 152,000 t/y currently used in Quebec, Ontario and northeast U.S.
- The abrasives market is expected to continue its strong growth, estimated at 3.8%/year until 2019.
- Market worth between $31M – $40M/y at distribution price ranging from $200-$260
Current end markets
Glass: a multi-purpose material
Market studies under way

- Supplementary Cimenting Materials
- Slab and Cobblestone
- Exterior floor covering
- Foam glass
- Sandblast
- Septic tank media filter
- Swimming pool media filter
- Synthetic Turf
- Termite Barrier
Key success factors

• A thorough analysis
• Support and investments from brand owners
• Support from the value chain and the government
• Strong partnership
• MRFs:
  – A tailored approach
  – Open communication channel with MRFs (under confidentiality agreements)
  – KPIs, including measurement of glass quality and 1st glass characterization protocol
  – Collaborative approach with MRF to develop a diversity of end markets
• Change management and strategic communications
Key success factors
A multi-disciplinary team

- Technical and economical analysts
- Scientific and environmental backgrounds
- Engineers
- Project manager
- Life cycle analysis expert
- Public Affairs Adviser
- Business Development
- Communications expert
The next steps

• Discussions with remelt to take part in the pilot projects
• Gearing up for installation in the coming weeks
• Support of market outlets – launch of new business development activities
Questions?
Thank you!