Wheat Straw BioFiller (WSBF)
About OMTEC Inc.

- Founded in 1996
  - Maritimes defence products and services
- Supplying wheat straw biofiller (WSBF) to Ontario universities for research since 2006
- Supplying WSBF to automotive industry since 2009
  - Ford Flex project

OMTEC is:
- centrally located, providing a logistical advantage in bridging between farmers and compounders
- Canadian owned and provides local employment opportunities for Ontario residents
- acting as a bridge between manufacturing tiers and linking the supply chain
- Continuous collaboration with Ontario university research efforts
Wheat Straw Potential

- Wheat is one of the top three most cultivated crop in Ontario
- Wheat has grain to straw yield ratio of 1:2 by weight
- Wheat straw is a by-product – no impact to food production
- OMTEC’s annual wheat straw consumption will be a very small percentage of total wheat straw available in Ontario

### STEM BIOMASS AVAILABLE FROM MAJOR ONTARIO CROPS

<table>
<thead>
<tr>
<th>CROP</th>
<th>PRODUCTION (t, 2004)</th>
<th>RECOVERABLE STEM (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>5.3 million</td>
<td>3.3 million</td>
</tr>
<tr>
<td>Wheat</td>
<td>1.7 million</td>
<td>2.9 million</td>
</tr>
<tr>
<td>Soy</td>
<td>2.5 million</td>
<td>1.8 million</td>
</tr>
</tbody>
</table>

Source: OMAFRA, 2007
Raw Material – Purchase Criteria

- **Format**
  - Large square bales e.g. 3x3x8 or 3x4x6 ft

- **Appearance**
  - Visual inspection
    - Color – wants “bright” straw
    - Straw condition - intact or broken, length, amount of fines etc.
    - Cleanliness – percentage of impurities e.g. rocks, dirt, grain hulls etc.

- **Moisture**
  - Oven test
    - Require “dry straw”

- **Supply**
  - Location – southern Ontario
  - Availability – yearly contract
  - Quality of straw

- **Price**
  - $/ton
  - Storage option
  - Delivery quantity and frequency

Accepts
- Golden color
- Dry and crisp
- Little/no contamination

Rejects
- Black color
- Waterspots
- Mildew/mould
- Damp/wet
- Contaminated with dirt, insects etc.
Wheat Straw Biofiller Production Process

Wheat Straw Bale -> Chopper -> Hammer Mill

Dust Collector

Screen

Collection/Packaging
Grinding - Screening - Grading

- Hammer mill is superior to ball mill or disc mill
- Closed loop system for reprocessing oversize materials
- Grading based on means and distributions of:
  - Fiber length
  - Aspect Ratio
- Other qualities include:
  - Moisture content
  - Appearance (color)

Oversize feeds back to mill

Quality Screening

BioFiller Products
- Moisture
- Temperature
- Weight
WSBF BioFiller Characteristics

- Moisture
  - Oven test
- Particle Size
  - Optical microscopy & image analysis

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**WSBF-35 Length Distribution**

- 13.3% <50
- 29.9% 50-100
- 25.0% 100-250
- 14.6% 250-500
- 6.0% 500-750
- 3.0% 750-1000
- 7.5% >1000
# OMTEC WSBF – Variety of Grades

<table>
<thead>
<tr>
<th>Grade</th>
<th>Suggested Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSBF-TH</td>
<td><em>Long fibers obtained at the end of thrashing stage</em></td>
</tr>
<tr>
<td></td>
<td><em>Large parts with simple geometries</em></td>
</tr>
<tr>
<td>WSBF-15</td>
<td><em>Medium fibers obtained after milling and coarse screening</em></td>
</tr>
<tr>
<td></td>
<td><em>Medium-large parts with simple geometries</em></td>
</tr>
<tr>
<td>WSBF-25</td>
<td><em>Short fibers obtained after milling and medium screening</em></td>
</tr>
<tr>
<td></td>
<td><em>Most applications</em></td>
</tr>
<tr>
<td>WSBF-35</td>
<td><em>Fine fibers obtained after milling and fine screening</em></td>
</tr>
<tr>
<td></td>
<td><em>Medium-small parts with intricate geometries or narrow flow channels</em></td>
</tr>
<tr>
<td>WSBF-45</td>
<td><em>Fine dust collected at the end of fiber collection stage</em></td>
</tr>
<tr>
<td></td>
<td><em>Small parts with intricate geometries or narrow flow channels</em></td>
</tr>
<tr>
<td></td>
<td><em>Solid fuel production</em></td>
</tr>
</tbody>
</table>
OMTEC WSBF Applications

- **Automotive** – typically 10-40% WSBF
  - compartments, trays, consoles, trims, mud flaps, air dams, cowl screens, heat shields, air filter housings, etc.
- **Construction**
  - Structural Parts – up to 50% WSBF
  - Decking, Fencing, and Tile Materials
  - Roof Shingles – no filler level limits, estimated up to 80% WSBF
- **Consumer Products** – no filler level limits, estimated up to 70% WSBF
  - Broom Sticks, Curb Markers, Tool Handles
- **Packaging** – estimated 5-20% WSBF
  - Tupperware, boxes etc.
- **Solid Biomass Fuel** – 100% WSBF

**No Delay In End User Acceptance, As it Only Replaces Production Materials Without Changing or Introducing Form or Function**
OMTEC WSBF Impact

1t straw = 400m³ natural gas = 0.85t CO₂ reduction

Traditional uses: feed, bedding, nutrient recovery

$0-130/t

$40-90/t loss in nutrient value & manpower

$300-1500/t

Value Added

OMTEC

1t wood = 0.8t coal = 2.4t CO₂ reduction: Straw should be similar

7260BTU/lb

$40-90/t loss in nutrient value & manpower

$300-1500/t

Value Added

OMTEC

1t straw = 1t petro plastic = 1.5t CO₂ reduction

1670 kWh/t
Concluding Remarks

- There are many variables in wheat straw biofiller production
- Multidisciplinary involvement:
  - Science – agriculture, biology, chemistry
  - Engineering – chemical, mechanical, electrical
  - Business – marketing, management
- Continuous learning curve
- Strategy to Success
  - Tackle technological challenges
  - Improve and optimize
  - Scientific advancement
- Conversion of WSBF to solid fuel – technology will be refined

Together, We Can Fulfill the Promise of Environmentally Sustainable Economy of North America
CO2 Calculation on Slide 10

• Coal
  • 600000t wood pellet = 1TWh → 1.67MWh/t → 1670kWh/t
  OPG presentation
  •Coal CO2 5720 lb CO2 per 2000 lb coal (2.86 ton/ton) via complete combustion
    http://www.eia.doe.gov/cneaf/coal/quarterly/co2_article/co2.html
  •2000kWh/t coal
  → 1t wood = 0.835t coal → 2.4 ton CO2

• Natural Gas
  • 35500 BTU/m³ natural gas
  → Straw is 7260 BTU/lb → 4.89 lb straw = 1m³ natural gas → 1t straw = 2000 lb @5lb straw to 1m³ natural gas conversion = 400m³ natural gas
  •120.6 lb CO2/1000ft³ natural gas
    http://www.eia.doe.gov/oiar/1605/coefficients.html
  •35.3 ft³ = 1m³
    http://www.translatorscafe.com/cafe/units-converter/volume-lumber/calculator/cubic-foot-%5Bft%5E3%5D-to-cubic-meter-%5Bm%5E3%5D/
  → 4.3 lb CO2/m³ natural gas
  → 1703 lb CO2/400m³ = 0.85t CO2/t straw

• Plastic
  • 20000lb/yr straw replacement = 30000lb/yr CO2 reduction
    Ford article