Case study:
CO₂ consumption in concrete

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Elliot Bender, Vice President, Brampton Brick
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Concrete Abundance

- World’s most abundant man-made material, ~50% by mass of all materials produced
- Durable, low-cost construction material
- Cement contributes to 5% of global CO₂
- Growing recognition by regulators and construction specifiers of cement CO₂ climate contribution
- 100,000 potential customers, only 5% in North America
Case Study: Concrete and Carbon

A concrete block with the CO2 baked right in

Brampton Brick is one of a growing number of companies trapping carbon dioxide in their products.

By TYLER HAMILTON  Climate and Economy Reporter
Wed, Sept 30, 2015
CO$_2$ utilization technology

Win-win solution for industry where CO$_2$ is beneficially used to lower production costs and increase sales to the green building market.
Converting gas to Nano materials

In-situ formation of nano-CaCO$_3$ consistent with ex-situ nano-calcite addition
Essential Supply Chain Integration

• Retrofit technology with simple 1 day installation and NO CAPEX
• Compatible with existing production methods, standards and materials
• Concrete construction and standards are unchanged
• Access existing global CO$_2$ distribution network ($200 - >$400/ tonne)
• Industrial emissions sources: refineries, fertilizer, etc.
Essential: Customer Value

![Graph showing the strength (MPA) over different curing times for Control and CarbonCure.](image)

- **Strength (MPA)**
- **Curing Time**
  - 1 day: 114%
  - 3 day: 126%
  - 7 day: 121%
  - 28 day: 118%
Essential: Customer Sales Advantage
Lessons Learned

• Observations:
  – Our staff and physical plant are critical components to the commercialization process
  – The development process always takes longer than expected
  – Several prototypes were tested before the right solution was discovered

• Ongoing challenges:
  – Extracting green value from customers, either market share or price
  – Cheap knock-offs entering the market

• Critical success factor: Leadership buy-in
Potential GHG reductions

• Currently
  – 6 masonry plants = 90,000 kg CO₂ annually
  – 36 ready mixed and block plants mostly in the US

• Proposed OCE project
  – Expand to 29 new ready mixed and block concrete plants in Ontario
  – Provide reductions by up to 115,000 tCO₂ annually during project
  – Catalyze faster adoption at the Province's ~200 concrete plants, to reduce GHGs by ~ 900,000 tCO₂ annually

<table>
<thead>
<tr>
<th># Plants</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total plants in US and Canada</td>
<td>36</td>
</tr>
<tr>
<td>Block production plants in ON</td>
<td>6</td>
</tr>
<tr>
<td>Brampton Brick – Markham, ON</td>
<td>1</td>
</tr>
<tr>
<td>New ready mixed concrete plants</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total installation at end of OCE project</strong></td>
<td><strong>35</strong></td>
</tr>
<tr>
<td><strong>Total potential installations in ON</strong></td>
<td><strong>~200</strong></td>
</tr>
</tbody>
</table>
## Global Springboard

<table>
<thead>
<tr>
<th>Region</th>
<th>Concrete Production (m³)</th>
<th>Sequestered CO₂ (tonnes)</th>
<th>Avoided CO₂ (tonnes)</th>
<th>Total CO₂ mitigation (tonne)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>2,941,200,000</td>
<td>2,205,900</td>
<td>52,941,600</td>
<td>55,147,500</td>
</tr>
<tr>
<td>India</td>
<td>181,214,286</td>
<td>158,563</td>
<td>3,805,500</td>
<td>3,964,063</td>
</tr>
<tr>
<td>Rest of Asia</td>
<td>666,500,000</td>
<td>583,188</td>
<td>13,996,500</td>
<td>14,579,688</td>
</tr>
<tr>
<td>Africa</td>
<td>173,228,571</td>
<td>151,575</td>
<td>3,637,800</td>
<td>3,789,375</td>
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<tr>
<td>United States</td>
<td>215,000,000</td>
<td>145,125</td>
<td>3,483,000</td>
<td>3,628,125</td>
</tr>
<tr>
<td>Rest of Americas</td>
<td>214,348,485</td>
<td>176,838</td>
<td>4,244,100</td>
<td>4,420,938</td>
</tr>
<tr>
<td>Europe</td>
<td>613,148,148</td>
<td>413,875</td>
<td>9,933,000</td>
<td>10,346,875</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5,405,176,527</strong></td>
<td><strong>4,101,225</strong></td>
<td><strong>98,429,400</strong></td>
<td><strong>102,530,625</strong></td>
</tr>
</tbody>
</table>
Manufacturer’s experience

“Working with the CarbonCure engineering and technical service team has been a great experience. The technology and plant integration has been well planned and executed”
- Brad Cobble Dick, VP Technical Services, Brampton Brick

“Since our decision to manufacture 100% of our concrete and lightweight block with CarbonCure, we have received nationwide media attention, and architects now come to use unsolicited with new project specifications”
- Dave Carter, President, Brampton Brick