Perspective on Sustainable Packaging & Zero Waste

May 8, 2014
Steve Davies
Director - Public Affairs, NatureWorks
NatureWorks is in the business of turning greenhouse gases into performance products.
How we convert our atmospheric carbon feedstock into Ingeo matters of course, and we take a hard look at this in everything that we do
NatureWorks is in the business of turning greenhouse gases into performance products.

1st Generation Ag feedstocks are a short term Bridging Tool.

Plants

 Manufacture

CO₂ + H₂O → Intermediates

Resins

NatureWorks

Additives (Modifiers)
Adhesives
Coatings
Printing Toners
 Specialty Lactates
Surfactants
We are committed to feedstock diversification:

*Performance materials made by transforming whatever are the right, abundant, local resources*

Investment in innovation and R&D collaboration to grow our Ingeo feedstock portfolio.

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**Where we are today**
Dextrose from corn starch
“Bridging Crops”

**Where we are going now**
Sucrose from locally abundant materials such as sugar cane

**Next 3-5 years**
Lignocellulosics: Sugars from bagasse, wood chips, switch grass or straw.

**And next?**
CO₂ to lactic acid technology?
CH₄ to lactic acid technology?
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**Q2-2013 Long Term R&D Partnership Established**

**CALYSTA Energy™**

**NatureWorks**

**Calysta Energy™ and NatureWorks Announce an R&D Collaboration to Transform Methane into the Lactic Acid Building Block for Bioplastics**

*MENLO PARK, Calif., and MINNETONKA, Minn., June 18, 2013 — Calysta Energy™ and NatureWorks have entered into an exclusive, multi-year collaboration to research and develop a practical, world-scale production process for fermenting methane – a potent greenhouse gas (GHG) – into lactic acid, the building block for***
2 - 3 December 2014, Haus der Technik, Essen, Germany

Industry Wide Engagement
Greenhouse Gases

Continuous improvement process
Ingeo 2005 → Ingeo Current → Future Improvement

GHG Feedstock Implications . . .
### Where we are in the Market

<table>
<thead>
<tr>
<th>Rigids</th>
<th>Food Serviceware</th>
<th>Films</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Rigids" /></td>
<td><img src="image2.png" alt="Food Serviceware" /></td>
<td><img src="image3.png" alt="Films" /></td>
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<td><img src="image6.png" alt="Lactides" /></td>
<td><img src="image7.png" alt="Bus. Dev." /></td>
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</tbody>
</table>

**Incubator**
Where are we geographically

Global-scale adoption
Where are we geographically

Global-scale adoption

“What is the right end-of-life”
Where are we geographically

Global-scale adoption

With this breadth or products & Geographies - for us, it’s about being cognizant of all relevant end-of-life opportunities, for all applications, in all geographies we sell into . . .
How we look at things . . .
Ingeo From A Cradle-to-Cradle Perspective

“Nature doesn’t have a design problem, people do”

William McDonough and Michael Braungart, 2002

“Technical nutrients”
- basically inorganic or synthetic materials manufactured by humans—such as plastics and metals—that can be used many times over without any loss in quality, staying in a continuous cycle.

“Biological nutrients”
- Biological nutrients and materials are organic materials that can decompose into the natural environment, soil, water, etc. without affecting it in a negative way, providing food for bacteria and microbiological life.

Source: Cradle to Cradle: Remaking the Way We Make Things by William McDonough & Michael Braungart
## Ingeo Cradle to Cradle Options

<table>
<thead>
<tr>
<th></th>
<th>Incumbent Plastics</th>
<th>Ingeo</th>
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<tbody>
<tr>
<td><strong>Mechanical Recycle</strong></td>
<td>✔</td>
<td>✔</td>
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<tr>
<td><strong>Feedstock Recovery</strong></td>
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<td>✔</td>
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<td><strong>Compost</strong></td>
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<td>✔</td>
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<tr>
<td><strong>Anaerobic Digestion</strong></td>
<td></td>
<td>✔</td>
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<tr>
<td><strong>Energy Recovery</strong></td>
<td>✔</td>
<td>✔</td>
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<tr>
<td><strong>Landfill</strong></td>
<td>✗</td>
<td>✗</td>
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In Food Service, Ingeo provides a tool for organic waste diversion
WHO’S ON BOARD

Since launching nationally in March 2011 with 6 professional teams and 5 venues as founding members, the Green Sports Alliance has grown to over 190 teams and venues from 16 sports leagues. Alliance Members include:

<table>
<thead>
<tr>
<th>Leagues</th>
<th>MLB</th>
<th>MLS</th>
<th>NBA</th>
<th>NHL</th>
<th>NLL</th>
<th>USTA</th>
<th>WNBA</th>
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<tr>
<td><strong>Teams/Venues</strong></td>
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<td><strong>Tournaments</strong></td>
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**PLUS:** AEG Venues, Minor League Teams/Venues, Racetracks
Ingeo: Myths, Realities and Misperceptions

• Being a compostable resin, all items made from PLA are compostable and should be composted at the end of life.

Not Necessarily

• Compostability makes sense for diverting food and agricultural material. If the product doesn’t do that then composting isn’t the best end of life option.
<table>
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In a nutshell - NatureWorks approach

Develop Business by:

• Selling Ingeo grades into consumer products where the potential for recycle stream contamination is minimal
• Targeting products which today, have little or no recycle yet occurring
• Achieving scale “safely”
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**Implications . . .**

- Constrained sales into certain applications & geographies
In a nutshell - NatureWorks approach

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**All the while simultaneously**

1. Developing end markets
2. Characterizing Ingeo presence in recycling system today
   - where is it, (which streams),
   - how much is there
   - what’s the economic potential
3. Working with recyclers to address sortation challenges
NatureWorks’ Approach to the Post-Consumer PLA Collection & Recycling Challenge

**Closed Loop Public Venue Collection Programs**
- Sports Venues
- Concerts/Music Festivals
- Other Events/Venues
- Corporate Campuses

**Municipal Recycling Initiatives**
- Foodservice Packaging Institute (FPI) – Plastics Recovery Group
- AMERIPEN
- Secondary Processing of Mixed Plastics and MRF Residuals
Questions

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