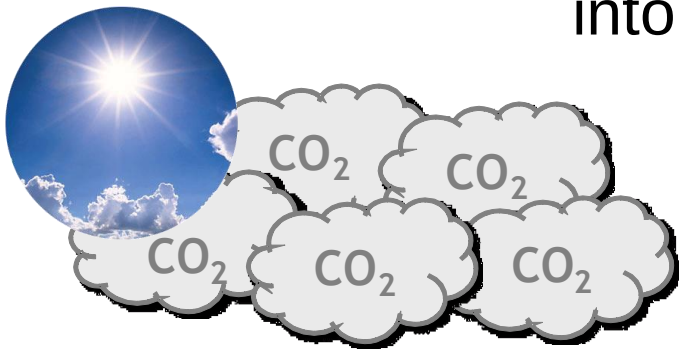
Perspective on Sustainable Packaging & Zero Waste

May 8, 2014

Steve Davies

Director - Public Affairs, NatureWorks

NatureWorks is in the business of turning greenhouse gases into performance products



Intermediates

ingeo™

Resins

- Additives (Modifiers)
- Adhesives
- Coatings
- Printing Toners
- Specialty Lactates
- Surfactants

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<u>How</u> we convert our atmospheric carbon feedstock into Ingeo matters of course, and we take a hard look at this in everything that we do

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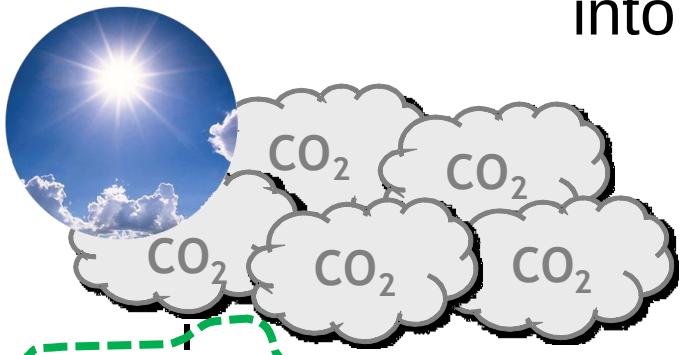

$CO_2 + H_2O$

1st Generation Ag feedstocks are a short term Bridging Tool

Plant

Sugars

Plants

Manufacture

Intermediates

ingeo™

Resins

- Additives (Modifiers)
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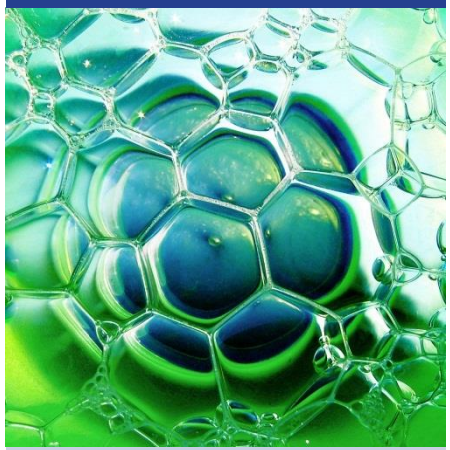
We are committed to feedstock diversification:

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.

GENERATION I: 1st step	**GENERATION I**: 2nd step	**GENERATION II**	**GENERATION NEXT**
			
Where we are today Dextrose from corn starch "Bridging Crops"	**Where we are going <u>now</u>** 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?** CO_2 to lactic acid technology? CH_4 to lactic acid technology?

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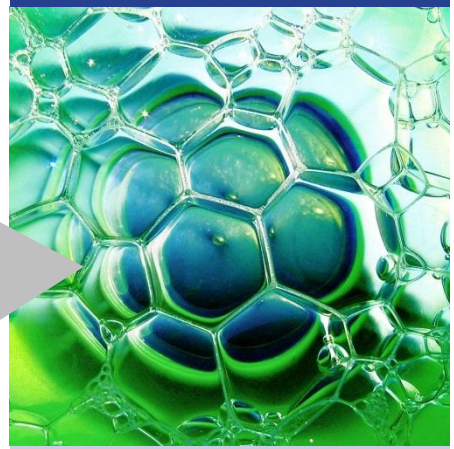
Q2-2013 Long Term R&D Partnership Established

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 ...

GENERATION NEXT



And next?

CO_2 to lactic acid technology?

CH_4 to lactic acid technology?

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2 - 3 December 2014, Haus der Technik, Essen, Germany

Industry Wide Engagement

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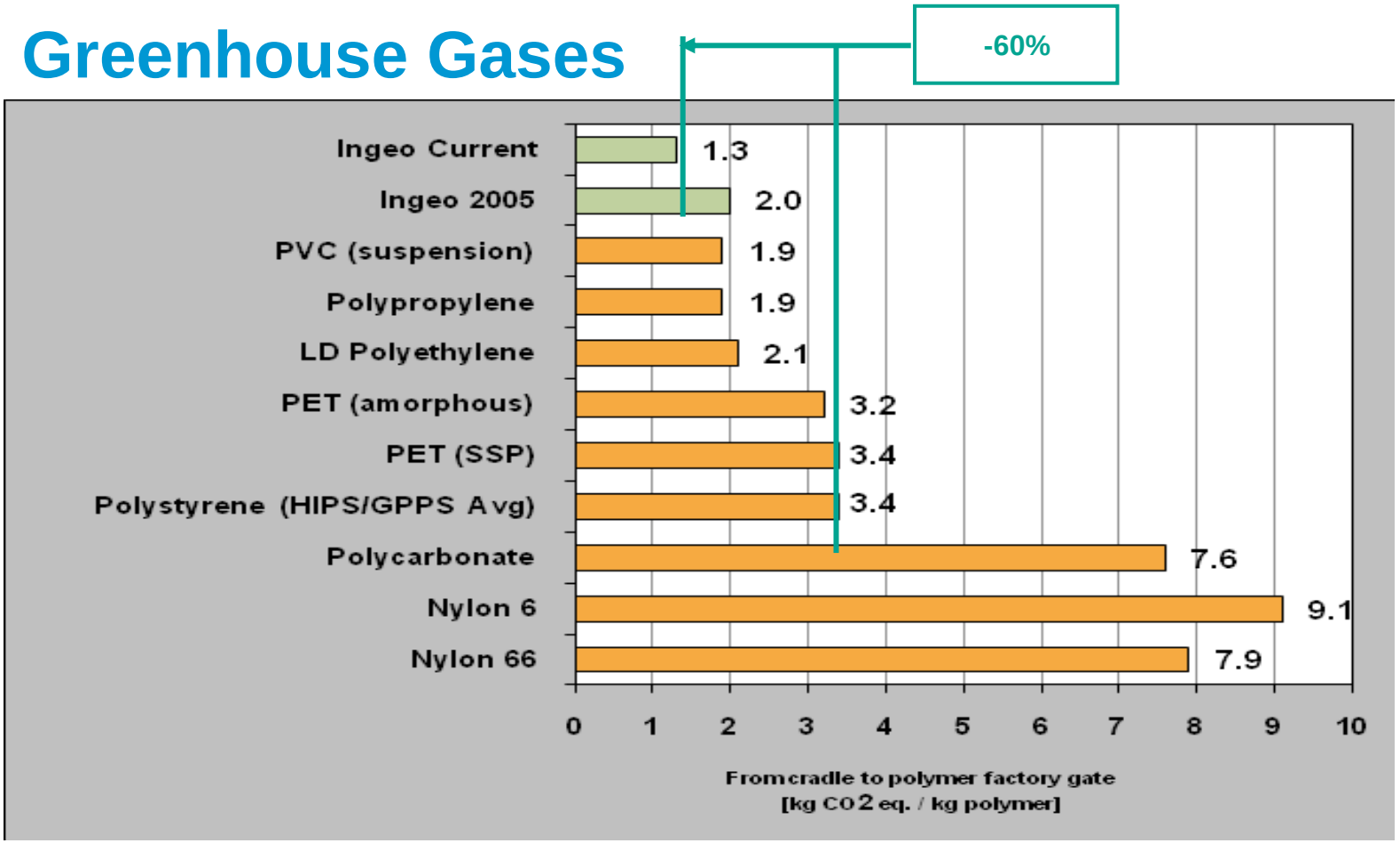
GHG Feedstock Implications . . .

Greenhouse Gases



Continuous improvement process

Ingeo 2005 ⇨ Ingeo Current ⇨ Future Improvement

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Where we are in the Market

Rigids

Food Serviceware

Films

Nonwovens / Fibers

Durables

Lactides

INGEO™ LACTIDES

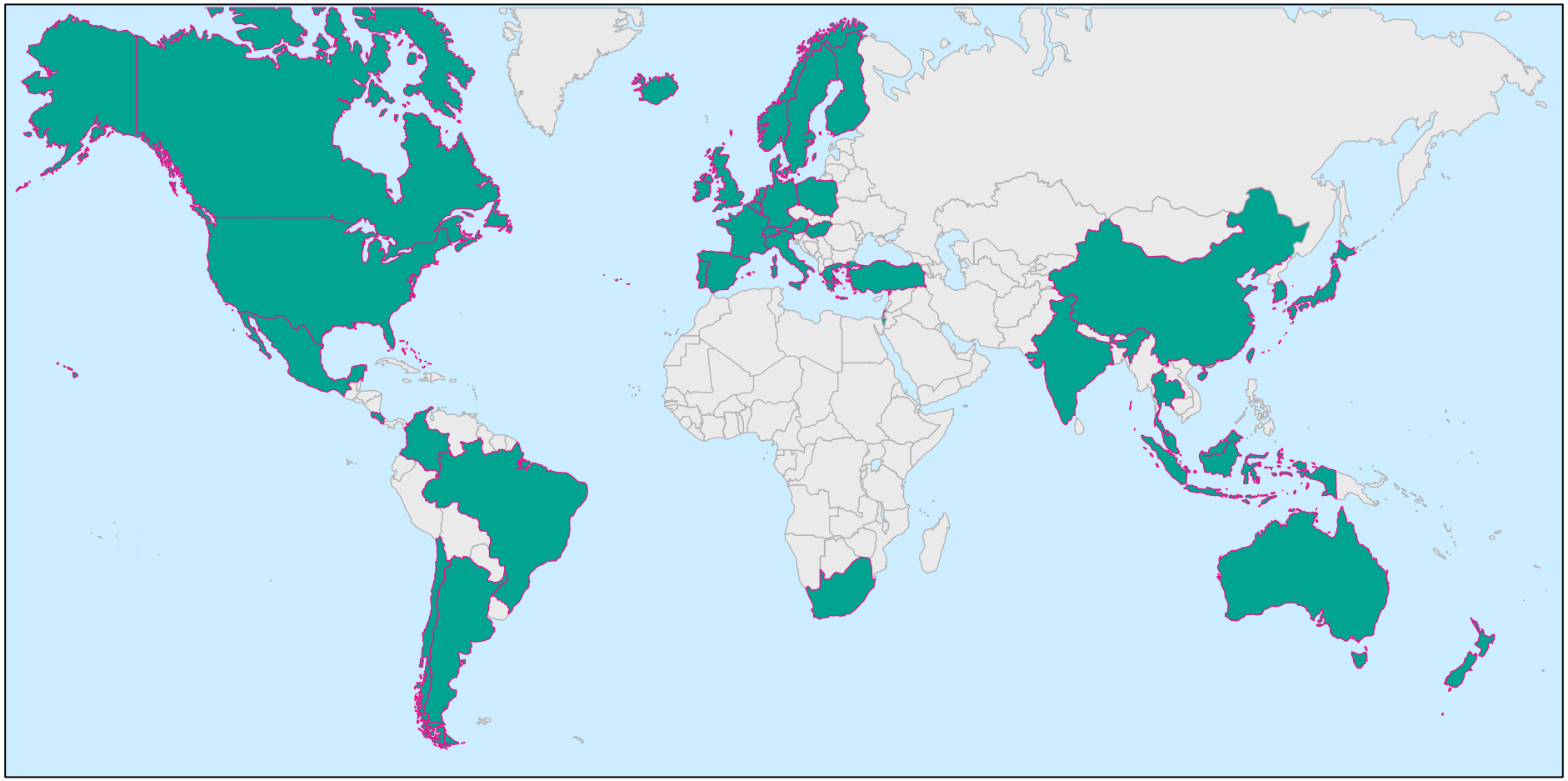
Bus. Dev.

Incubator

ingeo™

Where are we geographically

Global-scale adoption



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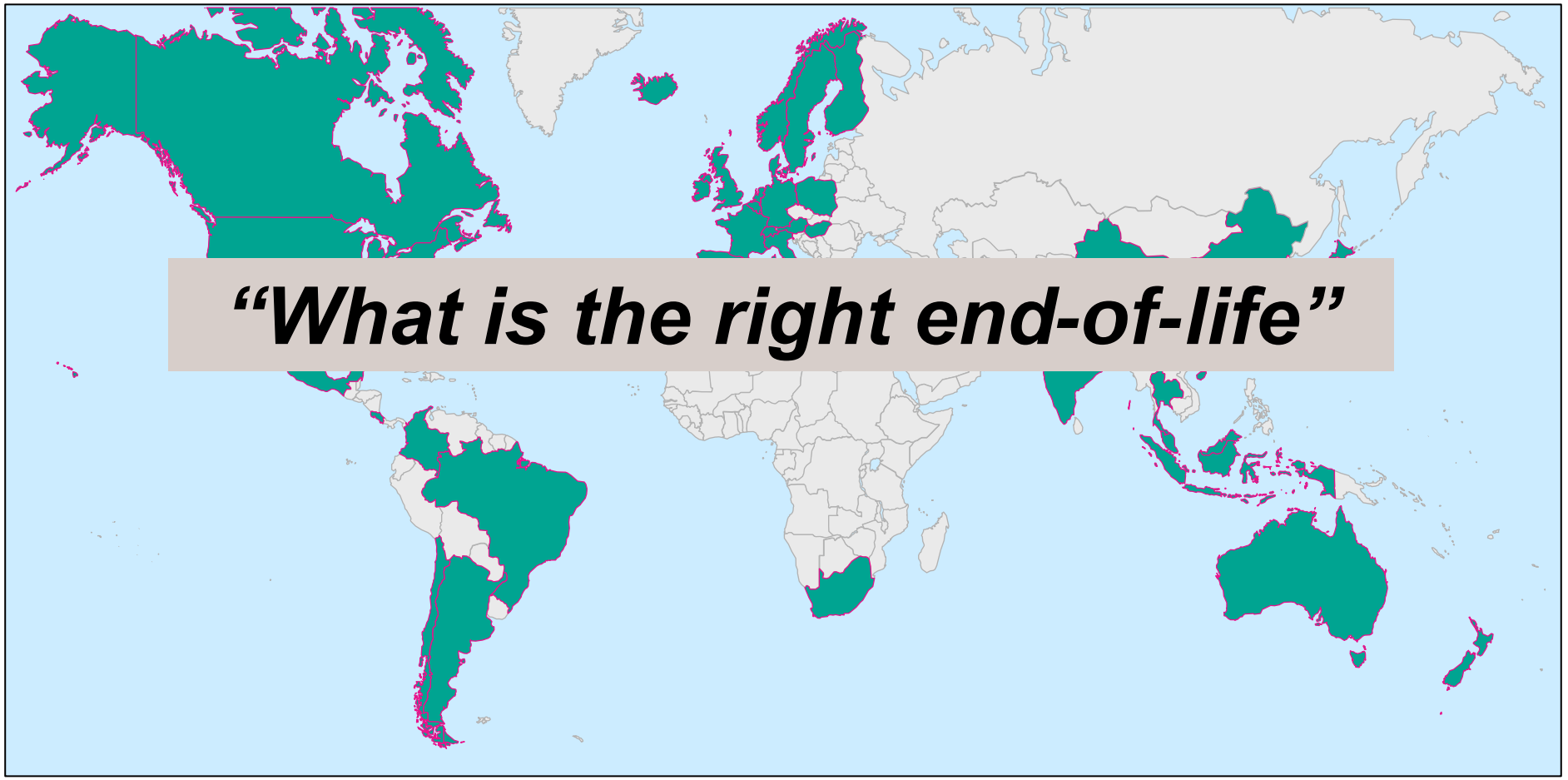
Global-scale adoption



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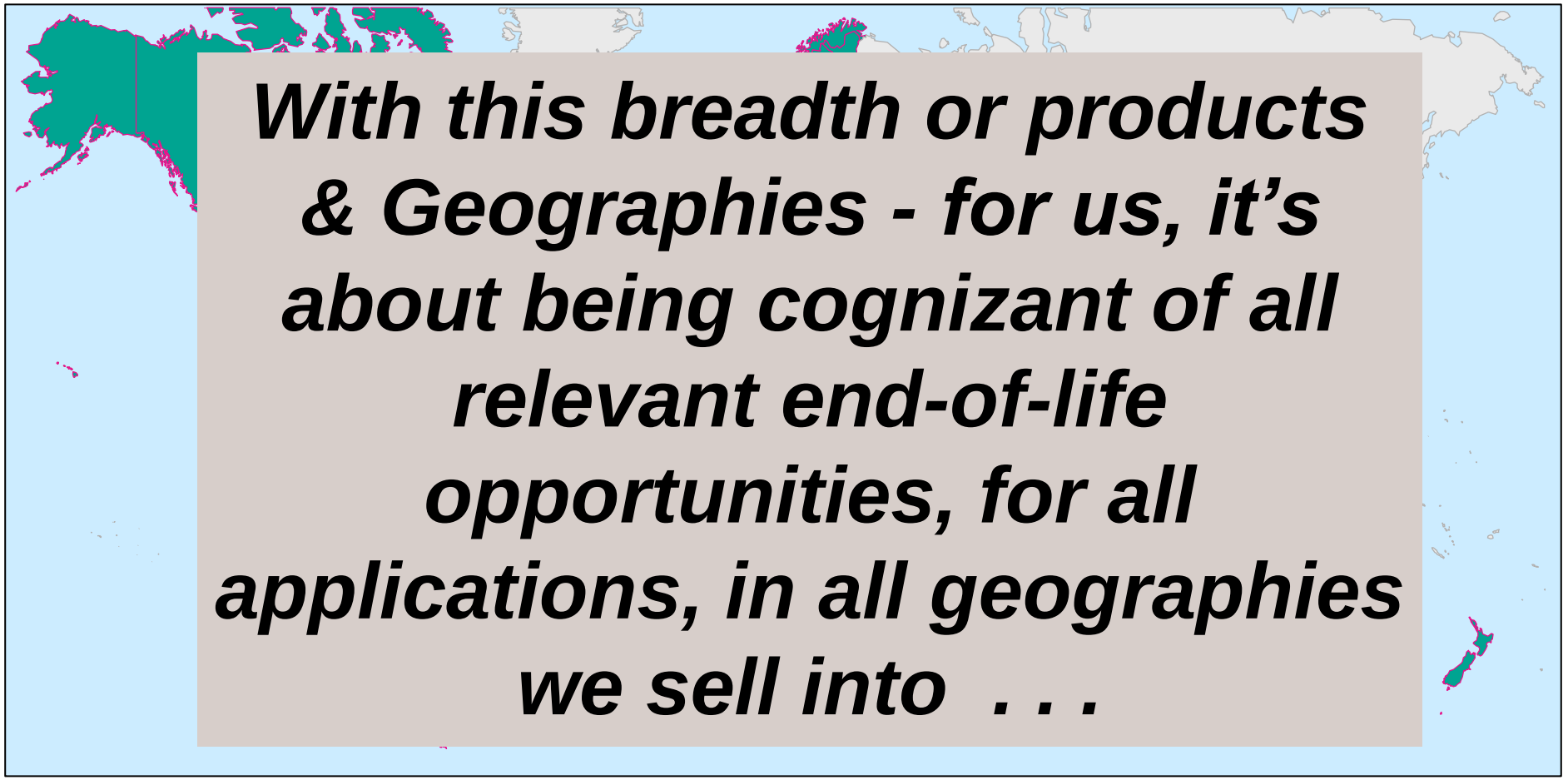
Global-scale adoption



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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.

CM
CERTIFIED
cradletocradle
SILVER

"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

Ingeo recycle

Ingeo composting

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

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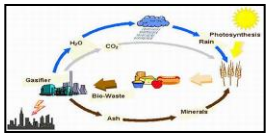
Ingeo Cradle to Cradle Options

	Incumbent Plastics	Ingeo
Mechanical Recycle 	✓	✓
Feedstock Recovery 		✓
Compost 		✓
Anaerobic Digestion 		✓
Energy Recovery 	✓	✓
Landfill 	✗	✗

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In Food Service, Ingeo provides a tool for organic waste diversion

GREEN SPORTS ALLIANCE

WHO'S ON BOARD

GREEN SPORTS ALLIANCE

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:

Leagues:

- MLB
- MLS
- NBA
- NHL
- NLL
- USTA
- WNBA

19 MLB Teams/Venues	18 NCAA Athletics Departments	13 NHL Teams/Venues
13 NFL Teams/Venues	8 NBA Teams/Venues	3 MLS Teams/Venues
2 PGA Tournaments		

PLUS: AEG Venues, Minor League Teams/Venues, Racetracks

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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

YES

NO

- 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.

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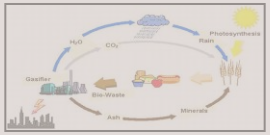
Recycle Options

	Incumbent Plastics	Ingeo
Mechanical Recycle 	✓	✓
Feedstock Recovery 		✓
Compost 		✓
Anaerobic Digestion 		✓
Energy Recovery 	✓	✓
Landfill 	✗	✗

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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

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All the while simultaneously

1. Developing end markets
2. Characterizing Ingeo presence in recyling system today
   - where is it, (which streams),
   - how much is there
   - what’s the economic potential
3. Working with recyclers to address sortation challenges

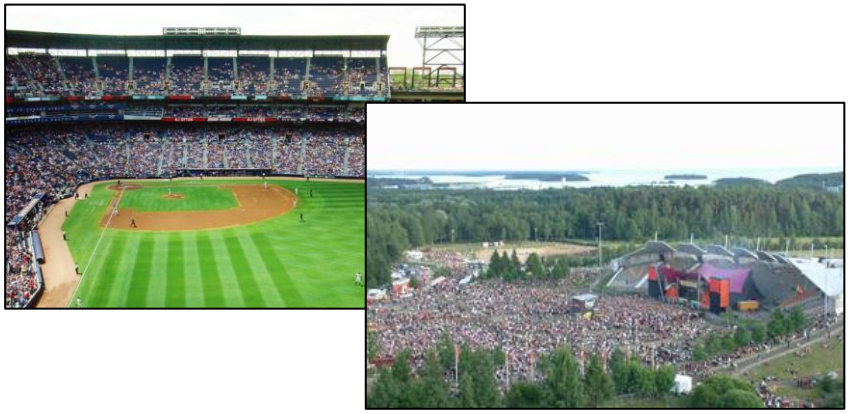
NatureWorks' Approach to the Post-Consumer PLA Collection & Recycling Challenge

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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