

Keeping the Innovation Cycle Going



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President & CEO
NatureWorks

Innovation Takes Root II
April 15, 2010



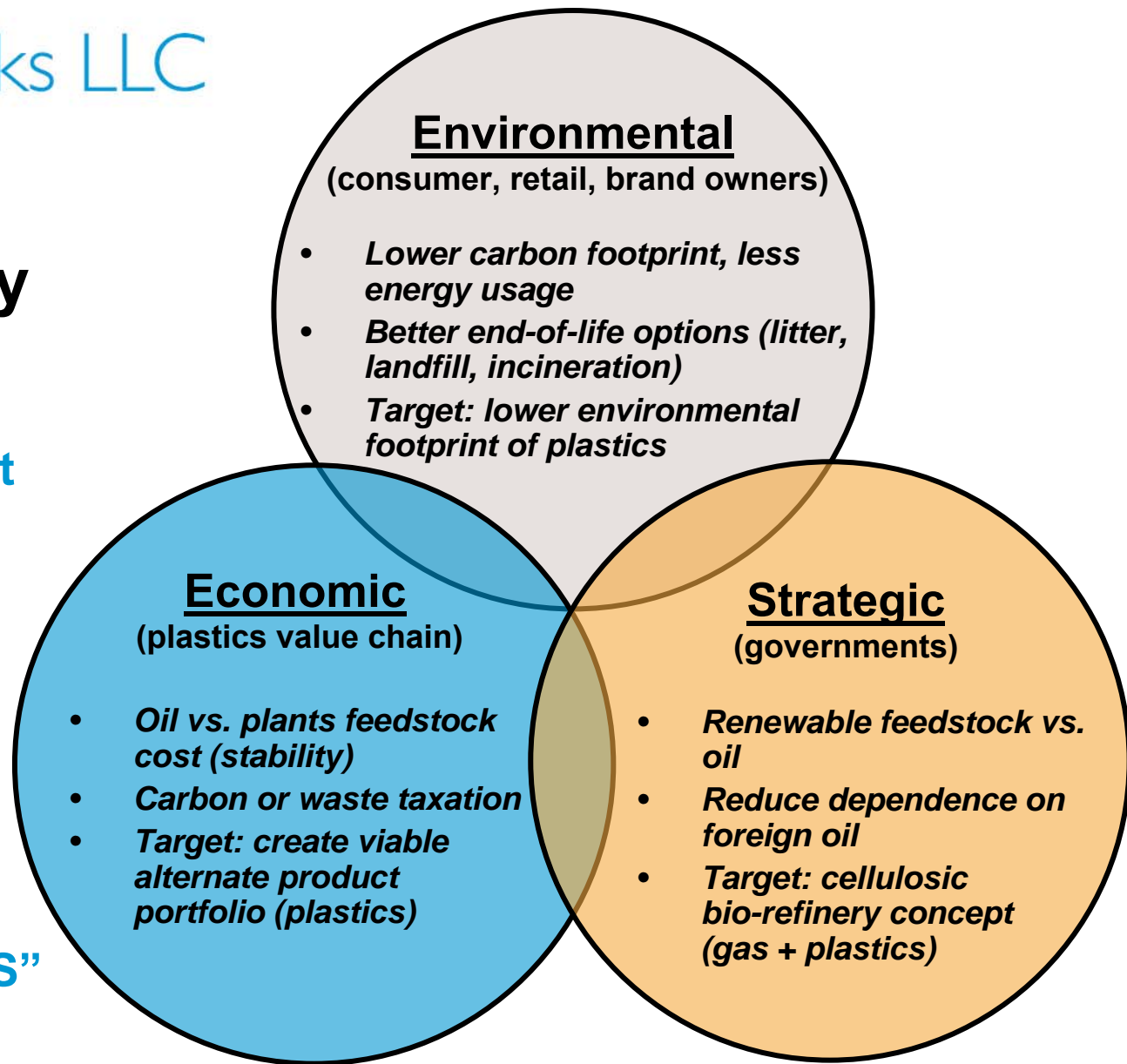
Keeping the Innovation Cycle Going

- **Value Drivers** for the Biopolymer Industry
- 2010 & Beyond: **Opportunities & Issues**



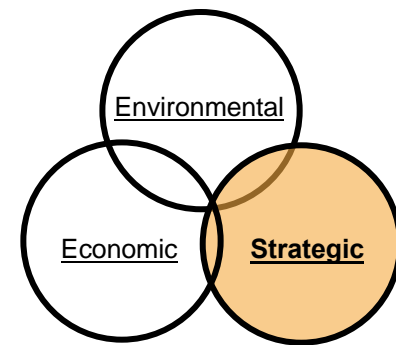
Value Drivers For The Industry

Even in these
extraordinarily difficult
economic times, the
STRATEGIC
and
ENVIRONMENTAL
value drivers remain
strong



“A SIGN OF THE TIMES”





HOW TO DEVELOP A “GREEN” ECONOMY?

What works in terms of government programs? A NatureWorks view

Positive Reinforcement

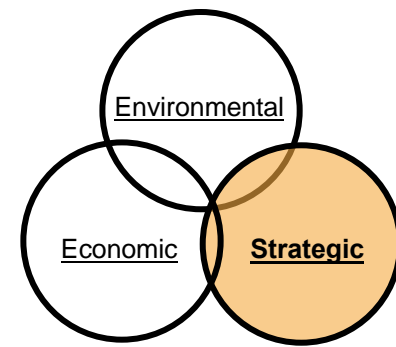


1. Tax Credits can work well:
 - Stimulates domestic investment
 - Lowers/eliminates “economies-of-scale” gap against mature industry
2. Incentives easier to implement when based on “Renewable” value proposition rather than “End-of-Life” (infrastructure constraints), e.g.

	or		versus		“green dot”
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3. Scope and duration of incentive program needs to be well defined e.g.

Dutch packaging tax <i>(annually updated)</i>	versus	US PTC <i>(firm for 15 years)</i>
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HOW TO DEVELOP A “GREEN” ECONOMY?

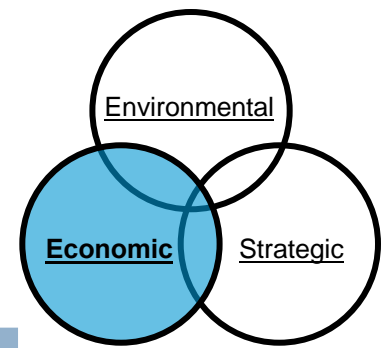
What works in terms of government programs? A NatureWorks view

Negative Reinforcement 

- 1. Bans (e.g. polystyrene foam on US West coast) can work well
 - Viable Ingeo™ alternatives are available



- 2. Usage mandates (e.g. Taiwan) work well if enforced:
 - Gives domestic industry quantifiable market
 - Gives domestic industry early economies of scale and platform for export

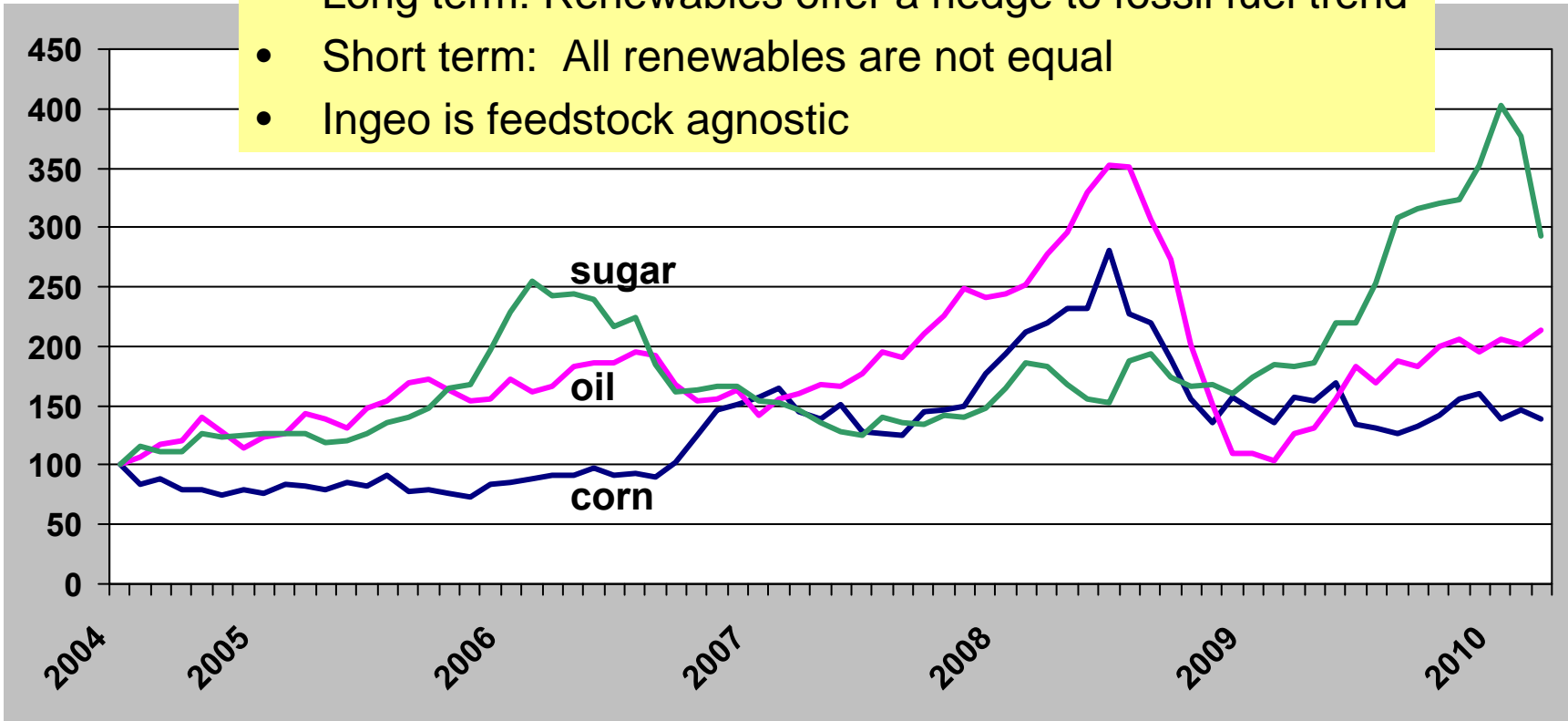


Renewable vs. non-renewable:

Historical prices over time

Prices are rebased to 100

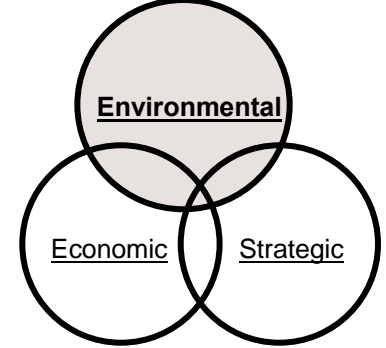
- Long term: Renewables offer a hedge to fossil fuel trend
- Short term: All renewables are not equal
- Ingeo is feedstock agnostic



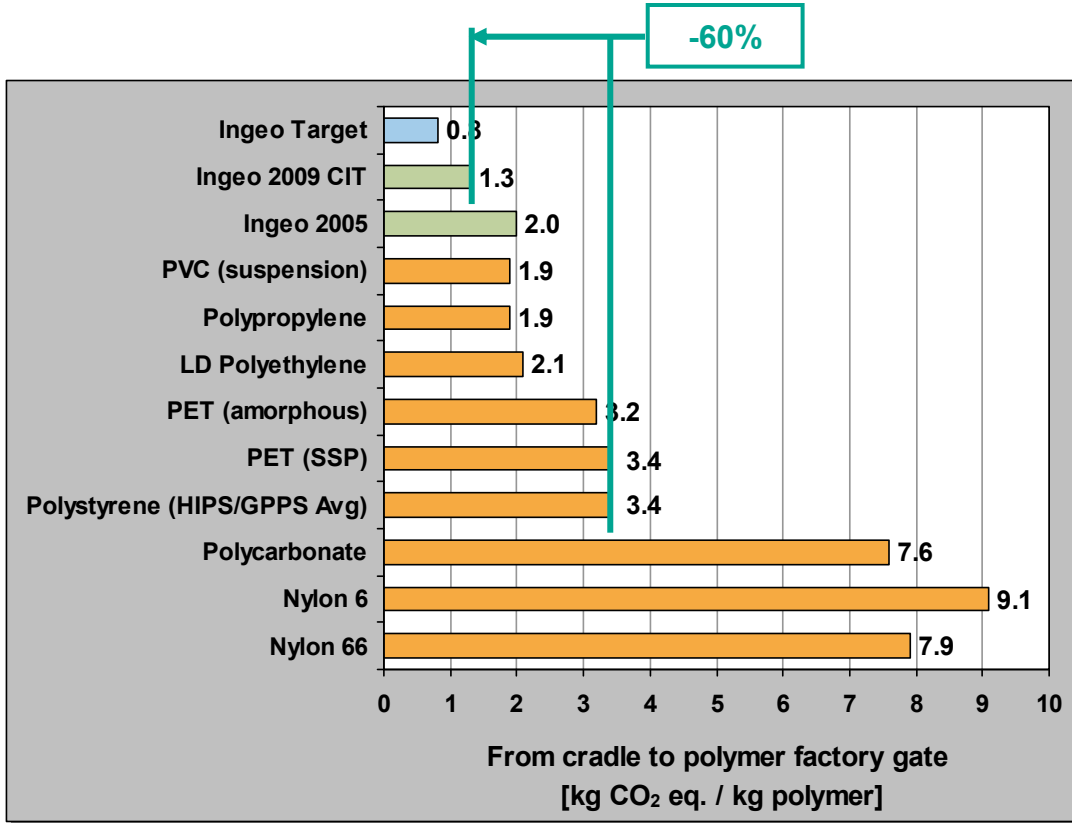
Source: CMAI, CBOT

Note: Oil price represents WTI spot petroleum price; corn price represents Illinois #2 yellow corn spot price





Comparing environmental footprint: Greenhouse Gas emissions

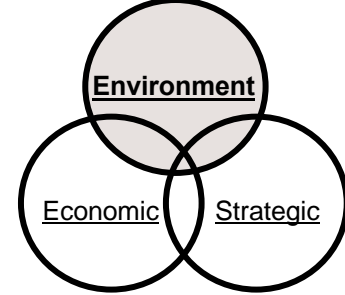


Cap & Trade?
Carbon tax?

- Ingeo: Vink E.T.H. et al. The eco-profiles for current and near-future NatureWorks® polylactide (PLA) production. Industrial Biotechnology, Volume 3, Number 1, 2007, Page 58-81.
- Fossil based polymers: *PlasticsEurope*; www.lca.plasticseurope.org
- GWP₁₀₀ factors according to IPCC (CO₂=1, CH₄=23 N₂O=296)

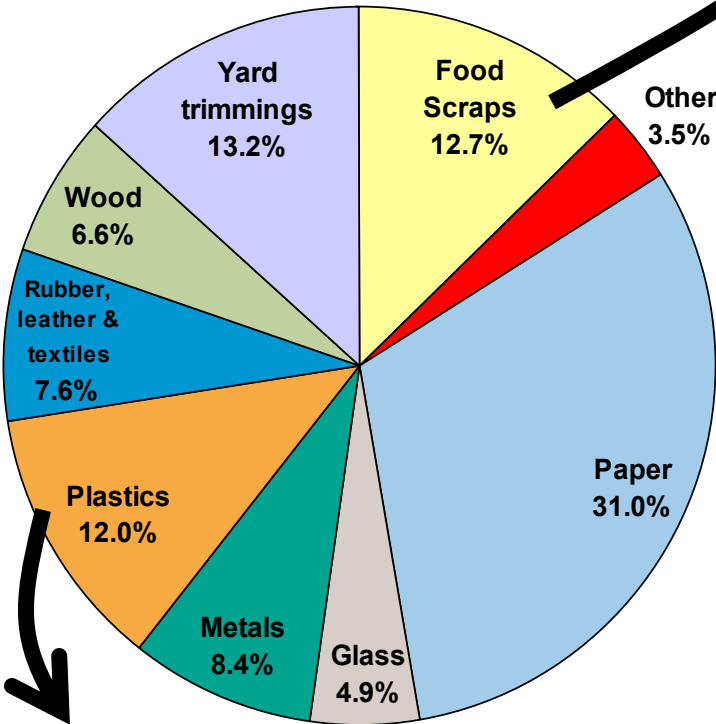
Continuous improvement process
Ingeo 2005 → Ingeo 2009 → Ingeo target









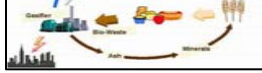
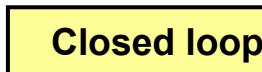
31.8 MM tons/year
Methane (x23 CO₂) release in landfill

Total US MSW Generation (by material), 2008
250 Million tons (before recycling)



30 MM tons/year
< 10% recycled (some PET bottles only)

Comparing After-Use Options

End of Life Options	Incumbent Plastics	Ingeo™
Landfill 	✓	✓
Recycle 	✓	✓
Incineration 	✓	✓
Compost 	X	✓
Anaerobic Digestion 	X	✓
Feedstock Recovery 		

Food waste diversion:
From landfill to composting facility

Closed loop recycling vs. today's
Bottle ► package ► landfill



Keeping the Innovation Cycle Going

- Value Drivers for the Biopolymer Industry
- 2010 & Beyond: **Opportunities & Issues**



2010 & Beyond: NatureWorks Looking Forward



Improving
Economies of Scale

Globalizing the
Manufacturing Platform

Broadening Products
& Applications

Monetizing the EOL
Value Proposition

Cellulosic
Feedstocks



Improving Economies of Scale



Feedstock outlook

Variable Cost
Parity
is within range



Infrastructure outlook

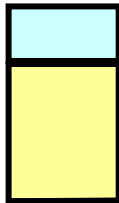
Fixed Cost
Infrastructure discrepancy
Requires scale



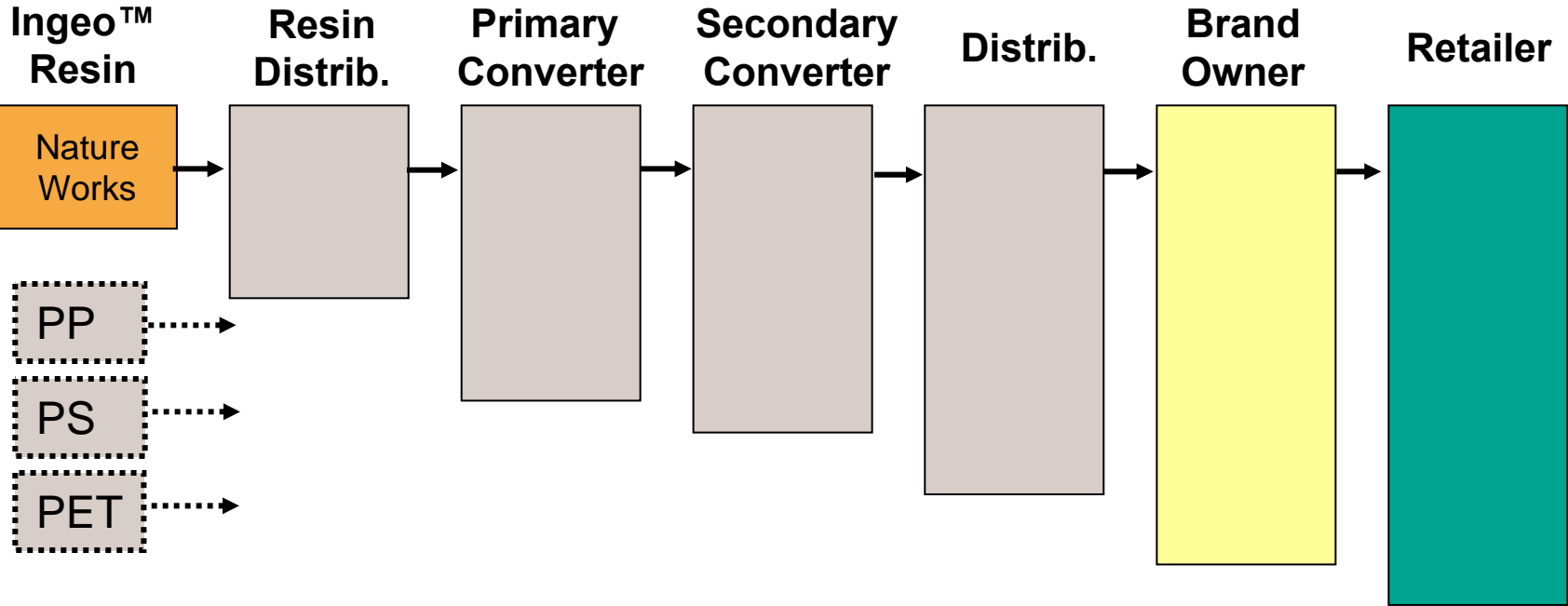
Improving Economies of Scale

Economies of scale required throughout the value chain

Resin premium

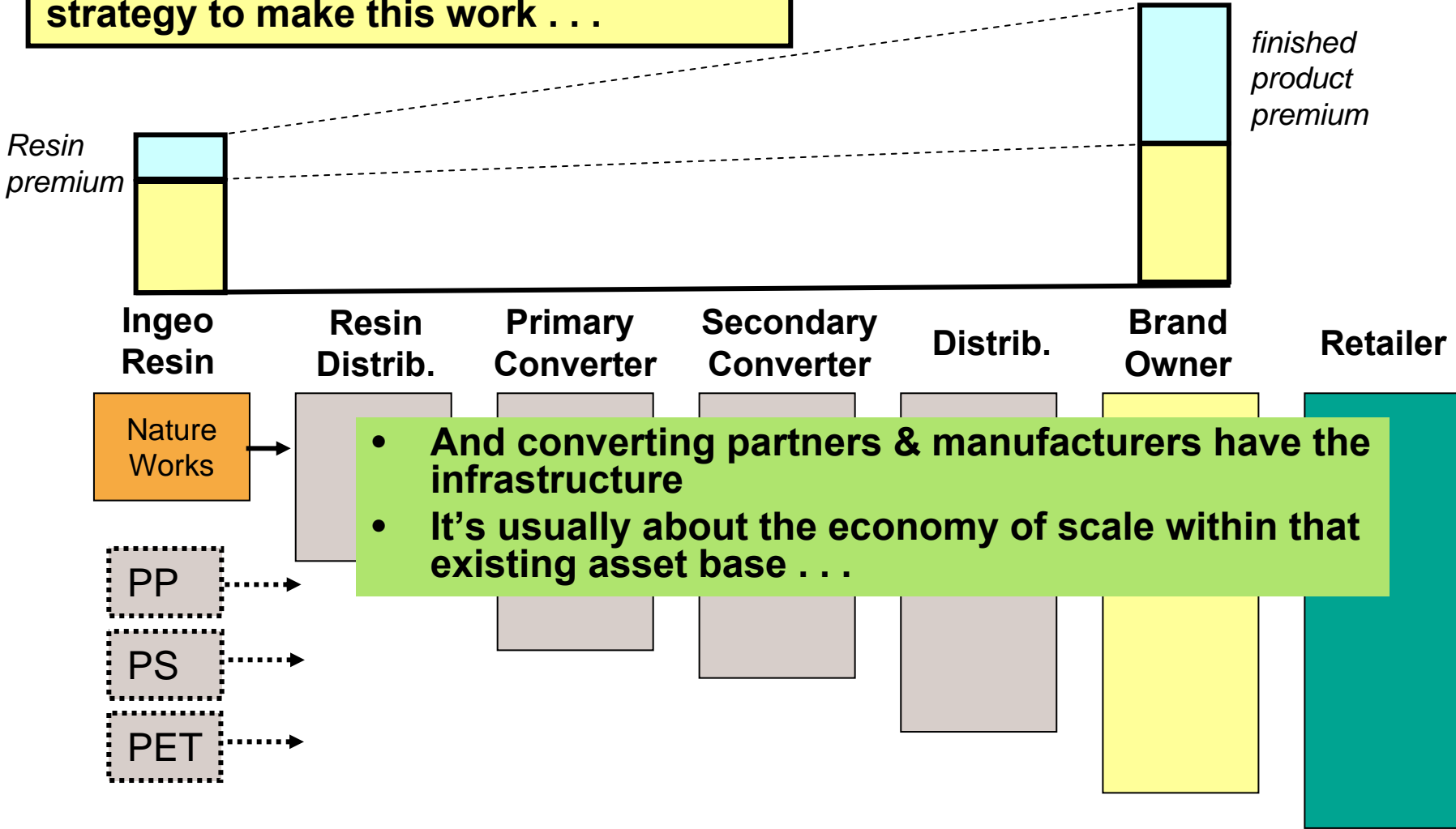


finished product premium



Improving Economies of Scale

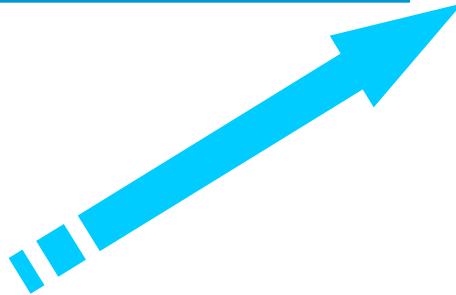
NatureWorks has the capacity and the strategy to make this work . . .



Globalizing the Manufacturing Platform

To: Assessing a 2nd Grass Roots Facility

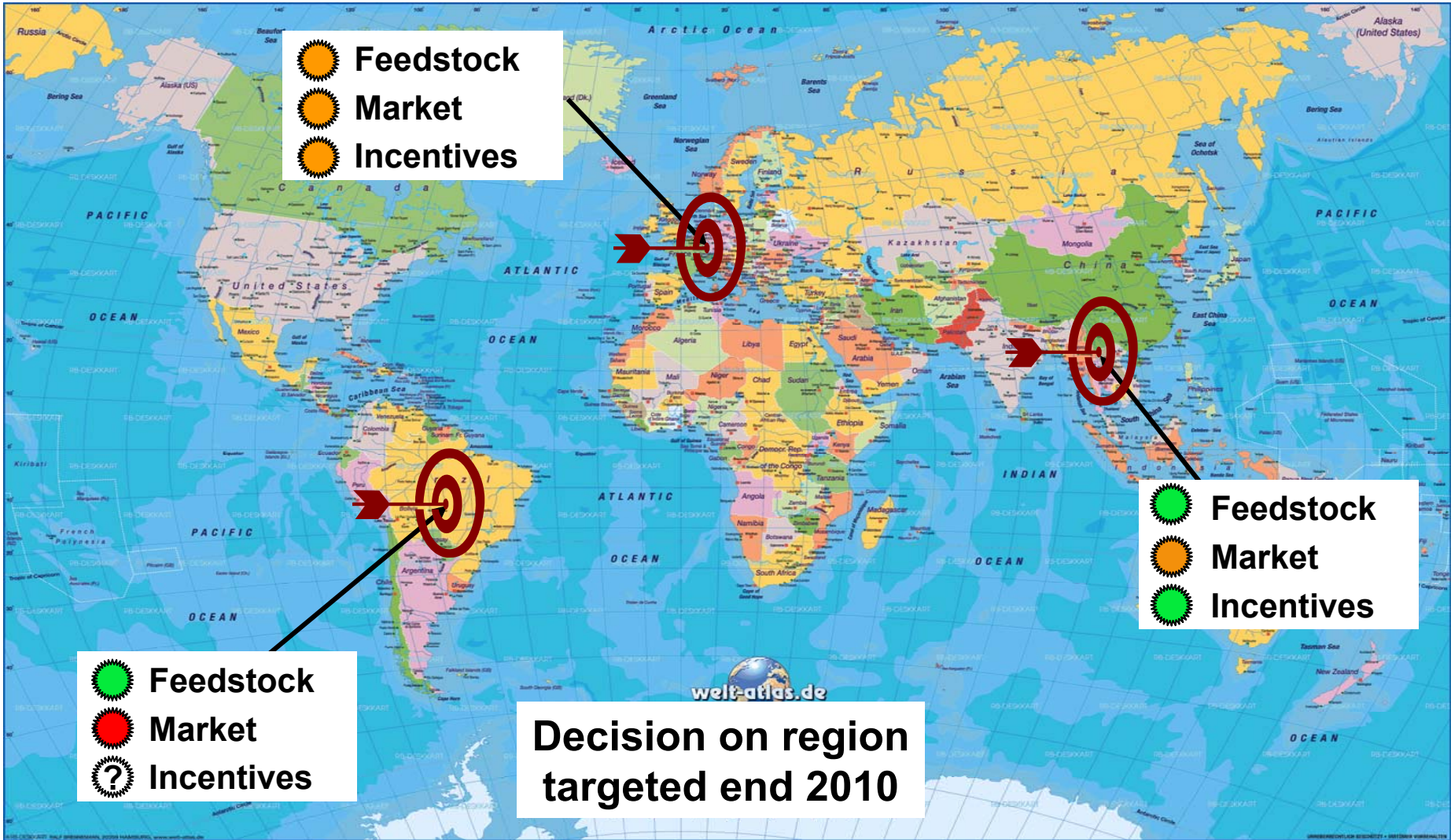
- NatureWorks starting the preliminary exploration for a 2nd production site, aiming at a 2013/2014 start-up
 - Significant global interest for site selection



From: filling out our first, North American Facility:

June-2009: NatureWorks commissioned full 300 MM lbs Ingeo™ capacity, doubling from 150 MM lbs





ingenious materials from plants not oil



Globalizing the Manufacturing Platform

Broadening from

A comprehensive platform of polymer grades with world scale economies

NatureWorks

Ingeo Poly lactides

Ingeo Lactides

- 8000 Series - foam
- 7000 Series – ISBM Bottles
- 6000 Series – fibers/nonwovens
- 4000 Series - films
- 3000 Series – Injection Molding
- 2000 Series - Thermoforming



To ...

Now offering polymer grade Ingeo lactides to support further global growth of the industry

Globalizing the Manufacturing Platform

Broadening from

A comprehensive platform of polymer grades with world scale economies

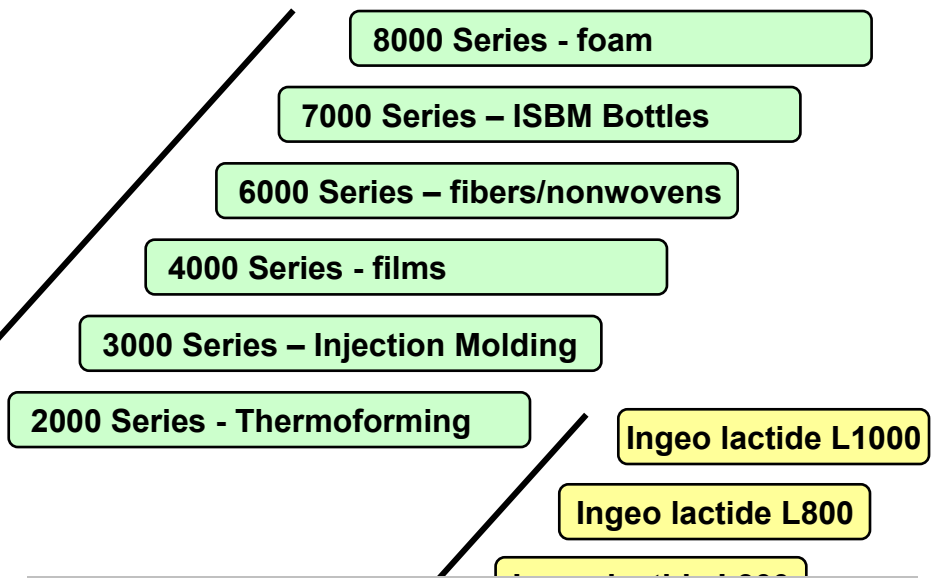
NatureWorks

Ingeo Poly lactides

Ingeo Lactides

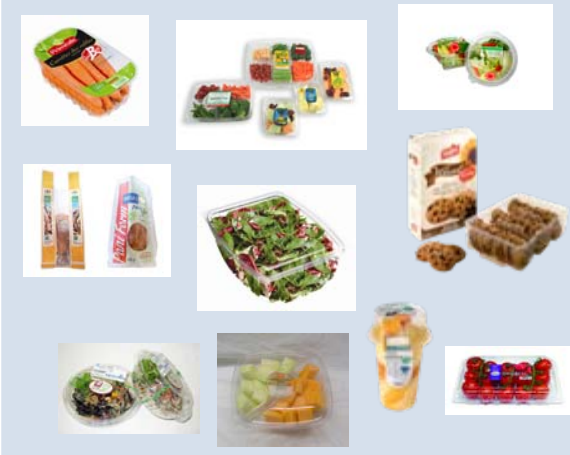
To ...

Now offering polymer grade Ingeo lactides to support further global growth of the industry



Manuel Natal
NatureWorks Global Lactide Segment Lead
manuel_natal@natureworksllc.com

Fresh food packaging



Food serviceware



Films/cards



Beverages



Nonwovens/fibers



Durables



Clarified Polypropylene

Clarified Polypropylene

GP Polystyrene

GP Polystyrene

Ingeo 3251D

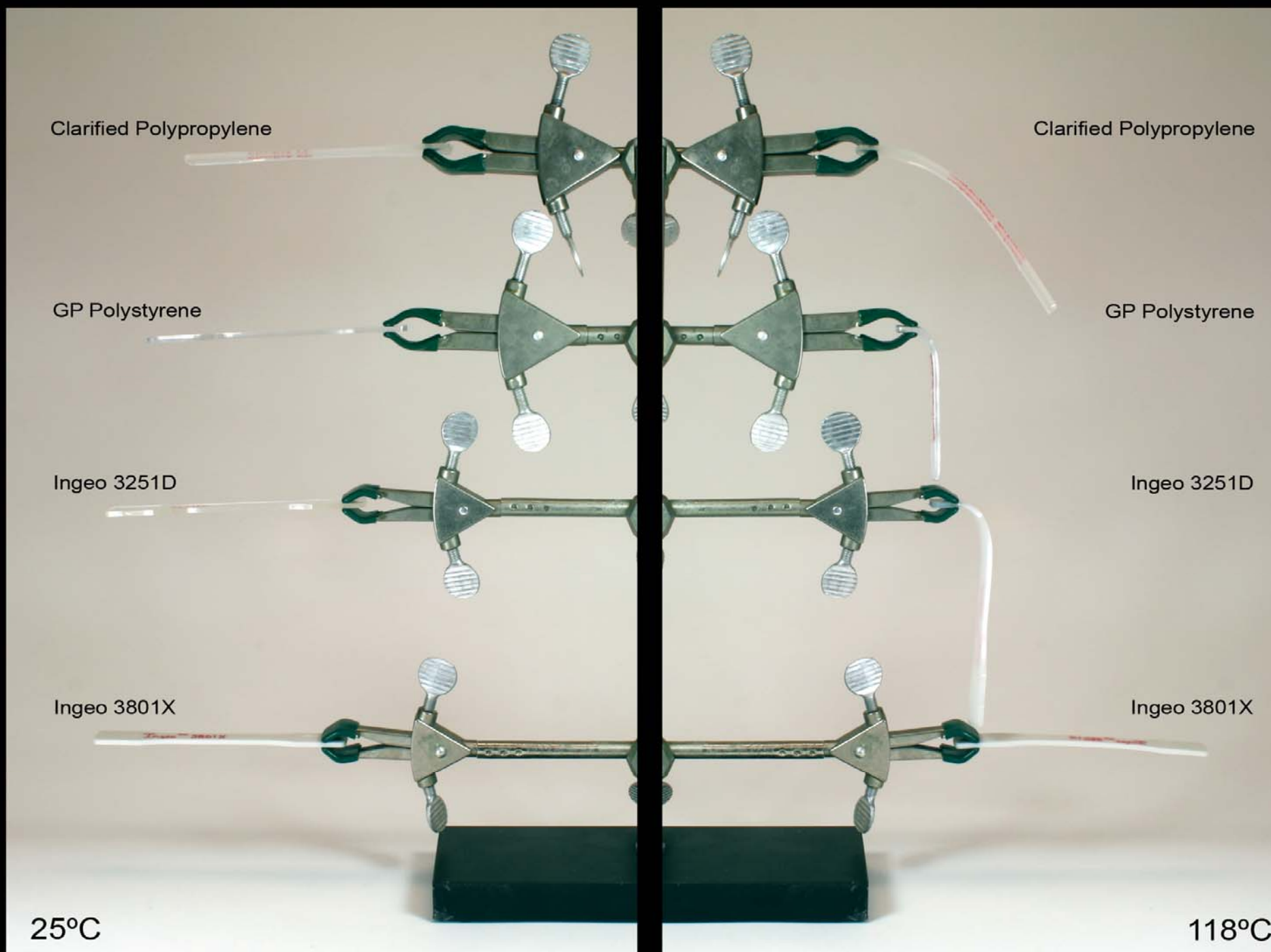
Ingeo 3251D

Ingeo 3801X

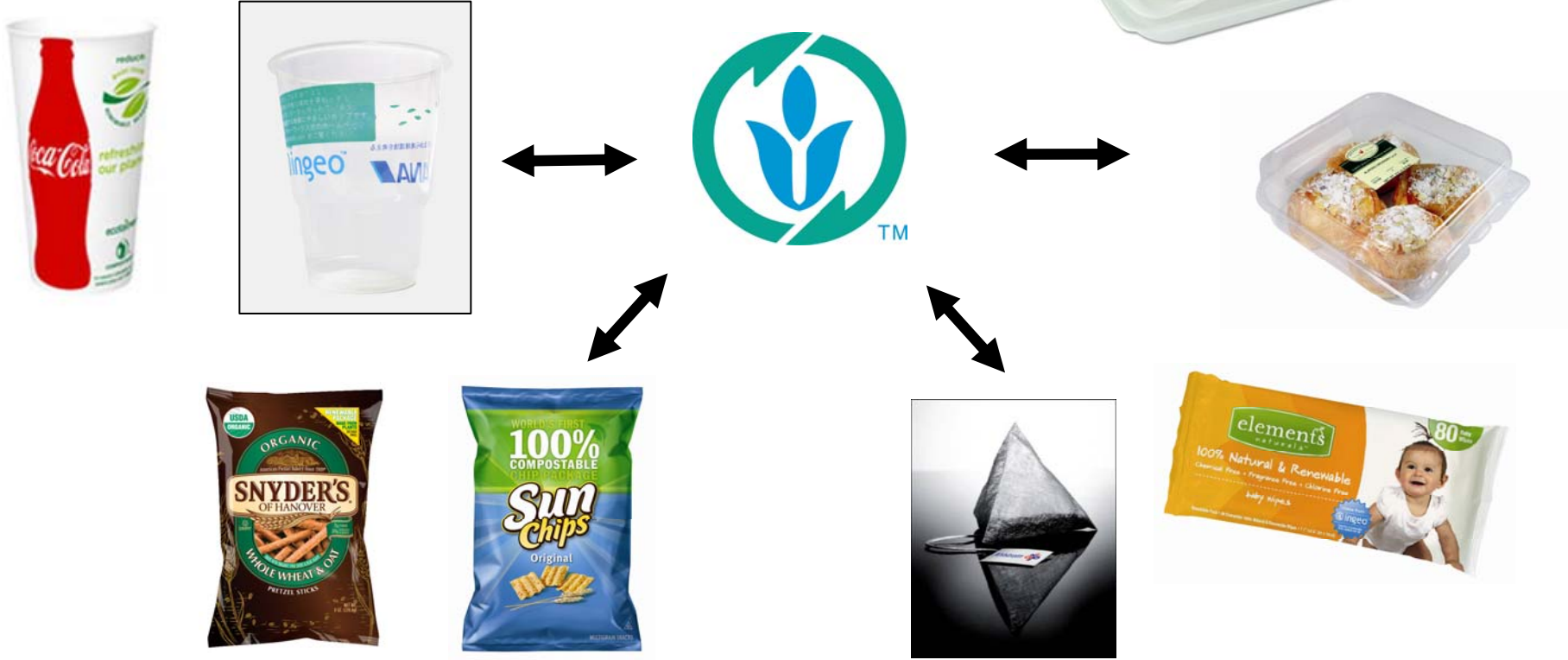
Ingeo 3801X

25°C

118°C



NatureWorks & Partners

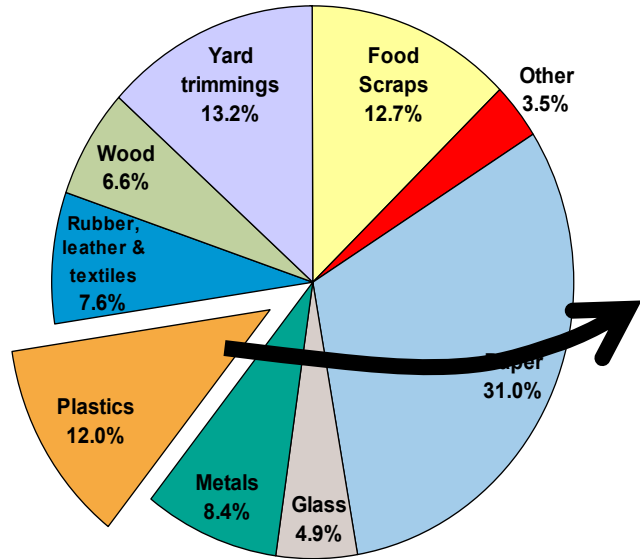


ingenious materials from plants not oil

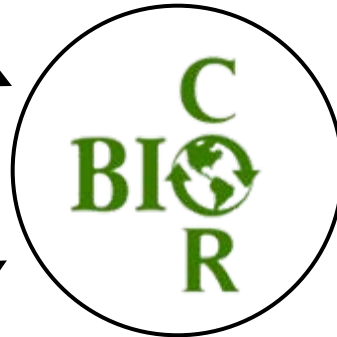
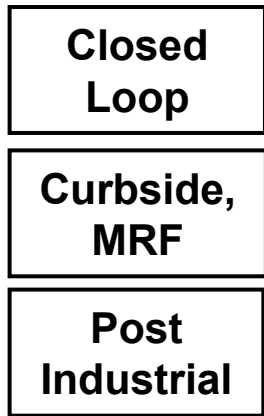


RENEWABLE ► SUSTAINABLE ► END-OF-LIFE ► FEEDSTOCK RECOVERY

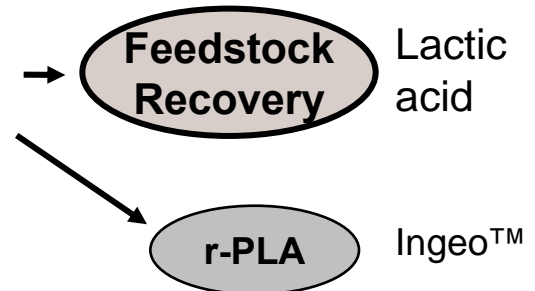
North America



Feedstocks



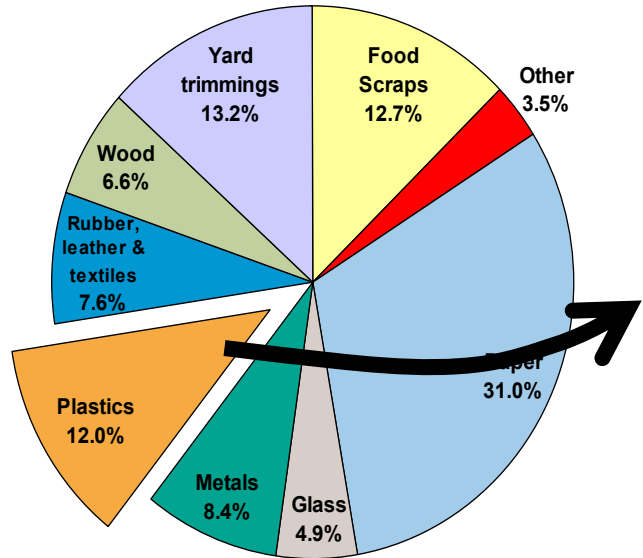
End Markets



Total US MSW Generation (by material), 2008
250 Million tons (before recycling)

Source: Municipal Solid Waste in the US: 2008 Facts & Figures

RENEWABLE ► SUSTAINABLE ► END-OF-LIFE ► FEEDSTOCK RECOVERY



Feedstocks

- Closed Loop
- Curbside, MRF
- Post Industrial

Europe

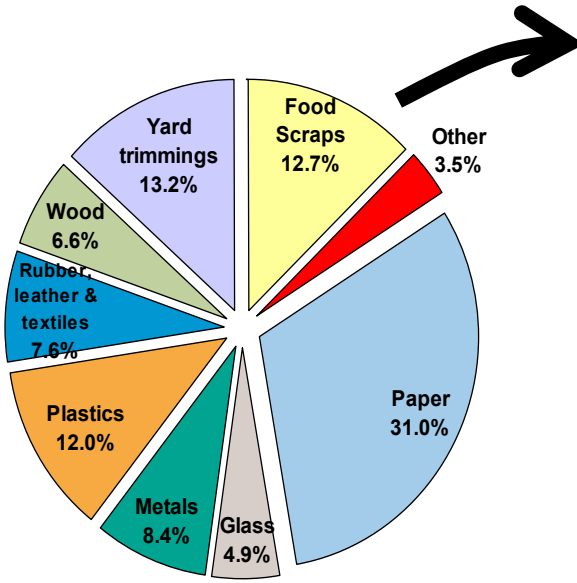


Total US MSW Generation (by material), 2008
250 Million tons (before recycling)

Source: Municipal Solid Waste in the US: 2008 Facts & Figures

RENEWABLE ► SUSTAINABLE ► END-OF-LIFE ► COMPOST

Total US MSW Generation (by material), 2008
250 Million tons (before recycling)



Source: Municipal Solid Waste in the US: 2008 Facts & Figures



- **Ingeo™ uniquely offers after use options which:**
 - Offers a true cradle-to-cradle, zero waste solution
 - Results in a superior LCA
 - Makes economic business sense --- to 3rd parties
- **The next couple of years is all about infrastructure**
 - Companies such as BioCor and Galactic have aggressive growth plans...
 - Will similar models emerge in other regions?
 - Will a global feedstock recovery infrastructure emerge, driven by demands for lactic acid?
 - How will drive to remove food residuals from Landfill translate into growing composting infrastructure?



Where we are



Where we're going



- Our footprint is small: At full capacity, Ingeo™ represents:
 - < 0.2 % of 2007 US corn production (< .05 % of global corn production)
- Ingeo is feedstock Agnostic. 2nd plant will use most abundant local industrial sugar or starch source
- 2nd generation is becoming an industrial reality



Cellulosic Feedstocks

Abengoa - Spain



Myriant - Louisiana



Switching from 1st to 2nd generation feedstock will be as much an **economic** as an **environmental** decision



- US government strongly supports cellulosic bio-refinery concept
- Various feedstocks being evaluated
- Questions:
 - Timing of first bio-refineries?
 - Economics of bio-refineries?

Biopolymers are here to stay . . .

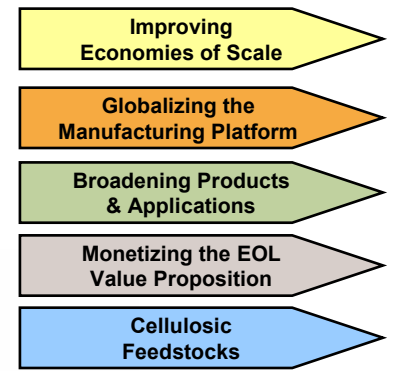
- Meet a strategic need to shed our oil addiction
- Meet a strategic need to lower our carbon footprint
- Meet global consumer expectation for sustainability without sacrifice

Biopolymers are no longer “embryonic”

(translation: hard to get, hard to use, very expensive)

Let the journey continue . . .

- New entries into the market place (partially Bio PET, bio PE, PHA)
- Feedstock diversification
- Economies of scale (resin, converters)
- Recycling infrastructure



Keeping innovation going



3M
 Accent Signage
 Accredo Packaging
 AET Films
 Ahlstrom
 Ametek Westchester Plastics
 ANA / All Nippon Airways
 Archer Daniels Midland Company
 Arkema, Inc.
 Ashland Distribution
 Aspen Research Corporation
 Avantium
 Avery Dennison
 Bangor University
 BASF Corporation
 BASF Netherlands B.V.
 Belgium Gov.
 BI-AX International, Inc.
 Biogistica
 bioplastics MAGAZINE
 BioCor
 Biogistica
 Bioserie by Dandelion Research Ltd
 Blue Lake Citrus
 BP Consulting
 Brückner, Inc.
 Business Performance Resins - Arkema
 Cabot Corporation
 California State University, Chico
 Carbon Trust
 Cargill-Brazil
 Carpak
 Caspak Products Pty Ltd
 CBC America Corp
 Cereplast, Inc.
 Chien Fua Bio-Tech Industry Co., LTD.
 CL Chemical
 Clariant, S.A.
 Clear Lam Packaging, Inc.
 ClearVision Design
 Compounding Magazine
 Cosalco Group
 Danimer Scientific, LLC
 Darnel, Inc.
 Daruma Consultoria
 Dia Foods Co., Ltd.
 D-Idea
 DSM Innovation Center

DS-Sommer
 Dyne-A-Pak Inc.
 Eastman Chemical CO
 ECM Plastics, Inc
 EDANA EU
 Elements Naturals
 Enercon Industries Corp.
 Fabri-Kai
 Far Eastern New Century Chemical Fiber Plant
 Far Eastern New Century Corporation
 Filtration Technologies, Inc.
 Filtration Technology
 FKUR Plastics Corp
 FPIInnovations
 Frito-Lay
 Futamura Chemical Co., Ltd.
 Gala Industries, Inc.
 Galactic
 Green Light Flow
 Greener World Media, Inc.
 HallStar
 Hartford Glen Water
 HAVI Global Solutions
 Hisun Biomaterials Co., LTD
 HPSS Global
 Hua Yi Company
 Huhtamaki Films, Inc.
 ICIS
 ICO Polymers
 IMA-UFRJ
 Inha University
 Institute of Chemical and Engineering Sciences
 Interface Americas
 International Paper
 Iowa State University
 Jacob Holm Industries America
 Jamplast
 Jolybar Ltd.
 KAFRIT Ind.
 Kao Specialties Americas., LLC
 Keller and Heckman

Kimberly Clark Corporation
 KuanChun Paper Industry Co., Ltd/Nano Fiber Tech, Inc.
 Kureha Corporation
 Lapol, LLC
 Leistriz
 Liang Haw Technology Co. Ltd
 LOHAS Forum
 Mirel Bioplastics by Telles
 Mitsubishi Plastic, Inc.
 Myriant Technologies
 Nippon Paper Industries
 Novus Works, Inc.
 Natur-Tec Sustainable Plastics
 Netherlands Foreign Investment Agency
 Nissan Chemical
 Novus International
 Organic Waste Systems
 Packaging World/Greener Package.com
 Plastic Bank
 Plastic Engineering Associates Licensing, Inc.
 Plastic News
 Plastic Technologies, Inc
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 PTT Public Co., Ltd.
 Purac
 Quimicoplasticos
 Republic Plastics
 Rhein Chemie Corporation
 Royce Colors
 RTP Company
 SABIC Innovative Plastics
 Schlumberger
 Sealed Air Corporation

Seepas Pty, Ltd.
 Segetis, Inc.
 Singapore Economic Development Board
 SKC Limited
 SKC, Inc.
 Snyder's of Hanover
 Sommer Needlepunch
 Sony Corporation
 Spartech Corporation
 Specialty Minerals Inc.
 Sterling Public Relations
 Stonyfield Farms
 Tora Enso Oyi
 Sukano Polymers
 Sukano Products Ltd.
 Sumitomo shoji research Institute, Inc.
 Sumotomo Corporation
 Sustainable Biomaterials Collaborative -IISR
 Technology BV
 f Industries
 agaku Co., Ltd.
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 Apex Company
 The Brenmar Company
 The Hershey Company
 Tianan Biologic
 Toray Plastics
 Toray Saehan Inc
 Total Petrochemicals
 U.S. Pacific
 Uhde Inventa-Fischer
 UNIC Technology (SUZHOU) LTD
 Unitaka, LTD
 Universal Dynamics
 US. Pacific
 USDA
 UT Nonwovens Research Lab
 Valor Brands
 Waste Management
 Wei Mon Industry Co., Ltd.
 Welex Incorporated
 WWF US
 Zhejiang Hisun Biomaterials Co.,Ltd

Thank you for attending

Together, let's keep the innovation cycle going

