"NatureWorks and Closed Venue Success"
(Noting Things Change Thanks To Innovation)

August 22, 2012

Doug Kunnemann
Business Segment Director
NatureWorks LLC
doug_kunnemann@natureworksllc.com

Agenda

- **“Bioplastics” and “plastics”**
  - **a broader perspective**
- **Ingeo™ by NatureWorks LLC**
  - **Background and Applications**
- **Closed Venue Success**
- **End of Life “opportunities”**
  - **Recycle**
  - **Compost**
    - Other Approaches and Issue Management
- **Issues and Next Steps**

What are bioplastics?

"Bioplastics"

Some are of bio-based / agricultural origin

Replace Existing Nonrenewable Plastics
(Coca Cola's 20% biobased PET, bioethanol based polyethylene, etc

Some are "biodegradable"

Synthetic polyesters designed to degrade In appropriate environments
(BASF, Mitsubishi)

What are bioplastics?

"Bioplastics"

Some are of bio-based / agricultural origin

Must be certifiable as <u>biobased</u>

•ASTM D6866

Some are "biodegradable"

"Degradation" must be defined & certified – e.g. (ASTM)

- Compostable - D6400
- Marine Degradable – D7801
- Soil Degradable - D5988

Biodegradable Plastics and Bio-Additives

- **Some Quotes To Note!**
  - **"Biodegradable plastic is an incomplete definition. Additional specification is needed - the Environment (industrial compost, marine water, anaerobic digester, home compost, landfill) and the Timeframe."**

    (Joseph P. Green – Ph.D. CA State Chico)

  - **"Consumers would love an oxo-biodegradable bottle, but right now, the technologies out there would do more harm than good. So to deliver something that would be more detrimental to the environment … It would be wrong and it would be green washing."**

    (Denise Lefebvre, VP Global Packaging Food and Beverage – PepsiCo)

Bioplastics by Life-cycle

		"Where it Goes" End of Life	
"Where it Comes From" Beginning of Life		Neither Biodegradable nor Compostable	Biodegradable / Compostable
	Hi Biobased Content	•Nylon (Polyamide) 11 •Bio-PE	•Ingeo •Mirel PHA's •Thermoplastic starches
	Some BioBased Content	•Bio PTT, bio PET •PA 6,10 •Conventional Plastic / /Bioplastic Blends	•Aliphatic – Aromatic copolyester (AAC) & Starch Blends •AAC/Ingeo Blends
	Fossil Based	•Conventional Plastics •PE, PP, PS, PET, ABS, PC, PVC	•AAC's •PBS

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Who We Are…

- ***NatureWorks LLC established in 1997***
- ***Wholly owned by Cargill***
- ***World's first and largest bio-plastics manufacturing facility***
  - ***140,000 metric ton name plate capacity***
  - ***2nd production line operational in '09***
- ***Resulting NatureWorks based innovations can be found around the globe under the Ingeo™ brand name***

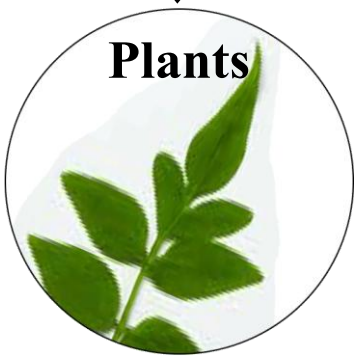
Where It Comes From . . .

Plastics & fibers from plants, not oil

Carbon dioxide and water

ingeo™

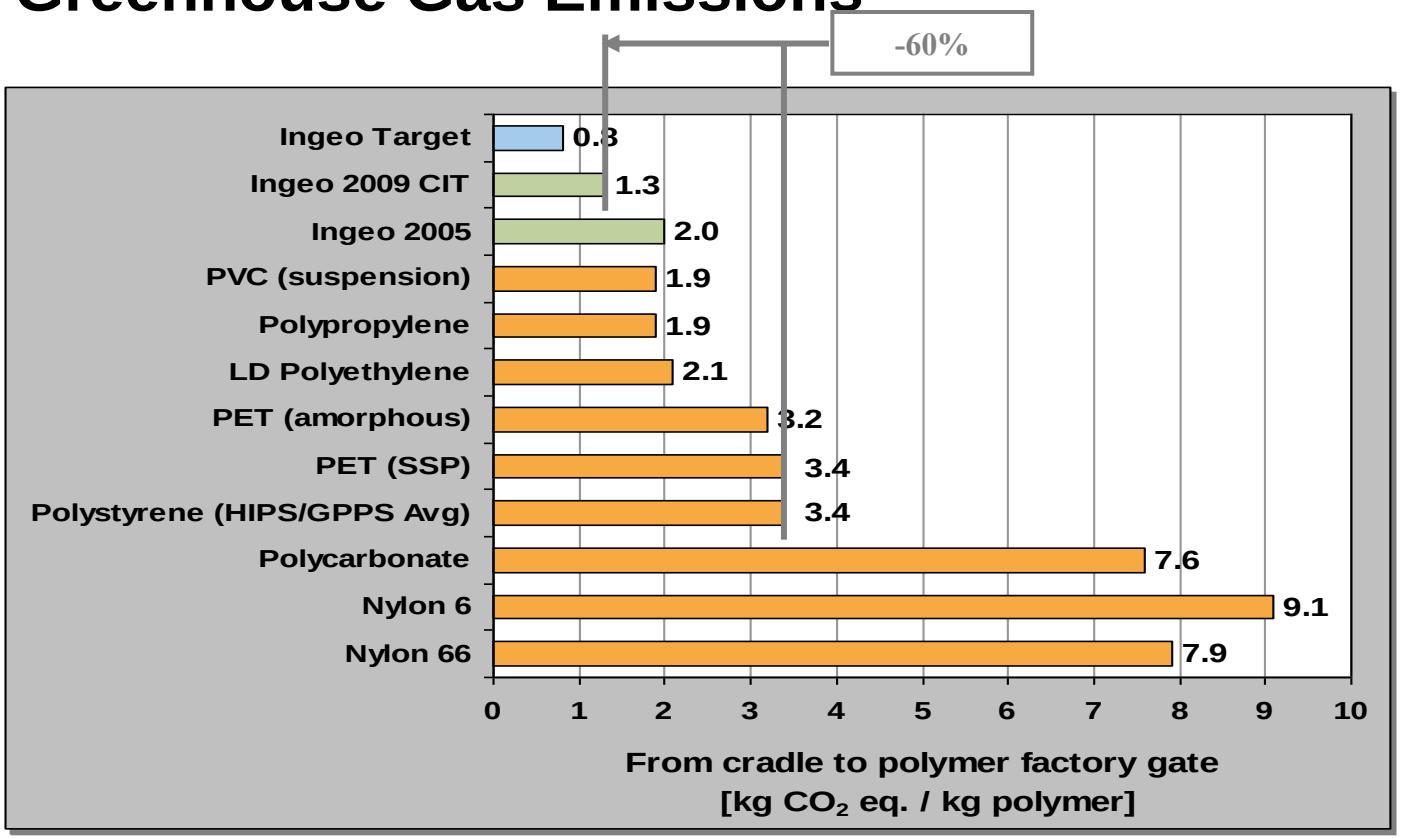
Our Customers

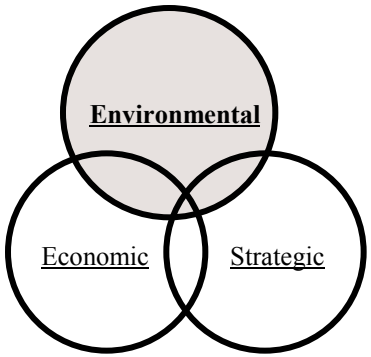


sugar
(dextrose)

manufacturing

Comparing Environmental Footprint: Greenhouse Gas Emissions





- 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: Plastics*Europe*; www.lca.plasticseurope.org
- GWP_{100} factors according to IPCC (CO_2=1, CH_4=23 N_2O=296)

Continuous improvement process

Ingeo 2005 ➡ Ingeo 2009 ➡ Ingeo target

Things Do Change Thanks To Innovation!

Marietta, GA just welcomed a new Whole Foods store (East Cobb)

What I like about any store is innovation!
I'm excited to see Whole Foods is:
- Thinking end of life (recycle and compost)
- Allowing "Ingenious Innovative yogurt containers" in their stores. (Made from plants – not oil!)

“It’s a win-win-win-win. It’s price-neutral, a big win on carbon, and a much stronger package. It’s not perfection, but it is a giant leap.”

Gary Hirshberg, Chairman, president, &“CE-Yo”

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Danone and WWF launch sustainable Ingeo™ Activia Yogurt Cup in Germany

Improves packaging carbon footprint by 25% and use 43% less fossil resources

Ingeo Innovations

Thinking of you

Electrolux

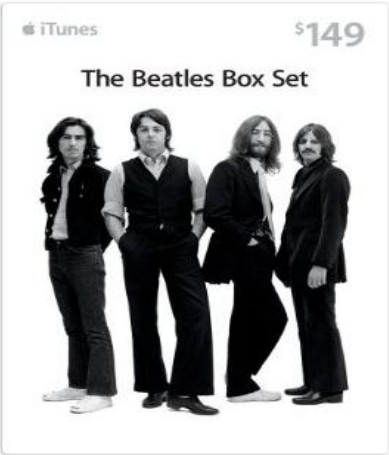
Bioserie iPhone 4 Cover

bioserie

Henkel's Pritt Correction Roller

Henkel Pritt

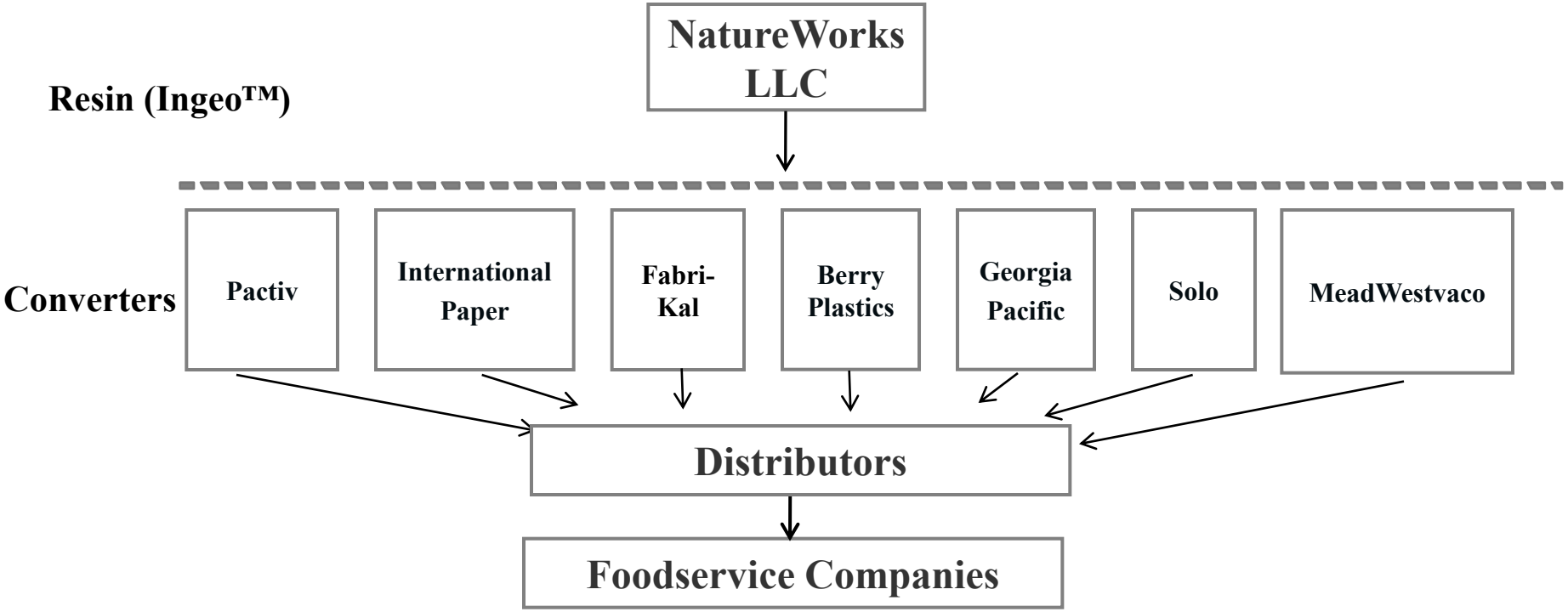
ingeo™ plant-based card



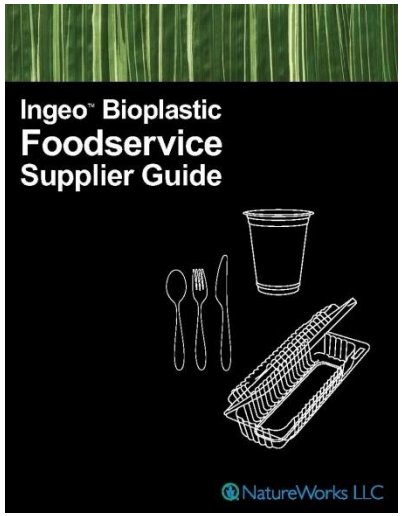
iTunes

Target

NatureWorks LLC Role With Major U.S. Converters Who Use Ingeo™



Ingeo™ Food Serviceware Suppliers



Why Ingeo™?

We make our biopolymer from annually renewable resources, plants...

...creating an alternative to traditional plastics made from oil...

...and giving you the performance plastics your business needs with the environmental conscience your customers expect.

Contents

Why Ingeo?....3
Asean Corporation....4
CDS Srl....8
Chien Fua Bio-Tech Industry Co., Ltd....9
Clear Lam Packaging, Inc....12
Danimer Scientific, LLC....18
Dyne-A-Pak....21
EcolGreen Co., Ltd....22
Eco-Products....25
Excellent Packaging & Supply....29
Fabri-Kal....40
GreenGood Eco-Tech Co. Ltd....44
Hanchang Paper....53
Huhtamäki Oyj....57
ILPA Srl....61
International Paper....65
InnoWare Plastic, Inc....68
IPI....71
Isap Packaging Spa....72
King Yuan Fu Packing Co., Ltd....74
P.P. Packaging Co.,Ltd....76
Pack&Proper Co....78
Plastic Suppliers, Inc....82
Printpack Inc....84
Repurpose Compostables....86
Sabert Corporation....88
Sealed Air....93
See Box Corporation....95
Stream Source....98
Toraysaehan....100
Tilton....102
Vitembal Si....110
Wei Mon Industry Co., Ltd....113
Wilkinson Industries, Inc....115
Winfa Packaging Co., Ltd....121
World Centric....127

Visit http://www.natureworksllc.com/Where-to-Buy.aspx (near the bottom of the page).

Innovative Approaches To EOL* – Starbucks!

- **Per "Waste & Opportunity U.S. Beverage Container Recycling Scorecard and Report, 2011** **(Amy Galland, Ph.D.,Res. Dir. - As You Sow)**
  - ***Paper cups are also a challenge for recycling….Starbucks has been working with recyclers and paper mills running tests that have determined that its paper hot cups can be successfully recycled in paper mills. In 2011 the company is beginning to run a pilot to close the loop.***

Alternatives to PE coated paper cups exist.

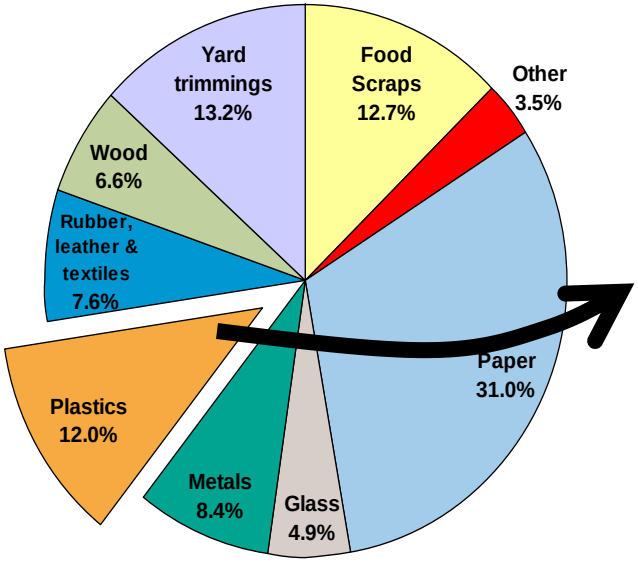
We and others recognize/support Starbucks efforts in food/compostable packaging waste diversion (Focus on Food Service market)

Suppliers, converters and composters hope compostable cups will be included in future Retail based *End of Life assessments!

The Compostable Cup. Starbucks new PLA hot cup, exclusively for foodservice.

Ingeo - Recyclability and Compostability

- **Ingeo is unique in that it can be**
  - **Mechanically recycled into rPLA**
  - **Chemically recycled (hydrolysis) back into lactic acid**



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

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

North America

Feedstocks

Closed Loop

Curbside, MRF

Post Industrial

End Markets

Feedstock Recovery → Lactic acid

r-PLA

www.biocor.org

1-888-9BIOCOR

Ingeo - Recyclability and **Compostability**

- **Compostability**
  - **End of life for plastic (fossil fuel based) packaging contaminated with food is the landfill (i.e. associated LCA impacts - costs, energy and water)**
  - **Ingeo based certified (BPI and ASTM) compostable packaging is an "enabler":**
    - **ENABLES FOOD AND PACKAGING WASTE TO BE COLLECTED AS "ONE" STREAM AND DIVERTED FROM LANDFILL (reduces hauling, tipping and landfill costs)**

)

- States actively engaged:

WA (Seattle), CA (San Francisco), and OR (Portland)

- GA (Atlanta and GreenCo)

-Nationwide networking with retailers

Quest Recycling – Plano, TX

Cedar Grove – (working with Bunzl Seattle)

- Industrial composters have shared - "I secure more compostable waste by accepting both food and compostable packaging wastes"

Oregon's ONLY Major Pro Sports Team

Portland Trail Blazers & the Rose Quarter Achieve LEED Gold Certification

- **Energy Use**
  - **Wind Energy**
  - **High Efficiency Lights**
- **Mass Transit--30% percent of visitors ride bikes, bus or trains**
- **Water Conservation**
- **Recycling and Composting**

What's most interesting here – they pursued this on their own without regulations or bans as drivers!

StalkMarket Provides Ingeo™ Based Cups, Plates, Bowls & Cutlery for Food/Beverage Service in the Rose Garden

Composting with StalkMarket based food serviceware

- Saves Money
- Good for the Environment
- Builds Community

Portland Trail Blazer/Rose Garden Results

(Green Sporting Alliance Summit – Portland, OR. – August 1-3, 2011)

The financial return on this investment has been realized in the form of reduced operational costs of landfill tipping fees and solid waste hauling

Pre-sorted recyclable and compostable materials cost significantly less per ton than trash destined for the landfill

Recycling stations increased guest participation in carrying debris out of the seating bowl and sorting it properly reducing cleaning labor costs

Key Outcomes:

- **80% landfill diversion rate in 2010**
- **Removed petroleum base plastics from the supply chain**
- **Avoided greenhouse gas emissions by diverting food waste decomposition in the landfill**

NatureWorks LLC Compostabilty Market Focus

Ingeo based “compostability” efforts target food serviceware applications!

Composting "Compostables" Is Not Without Issue!

- **Issues associated with food serviceware include:**
  - **Identification**
  - **Certification(s)**
    - Will articles (promoted as compostable) compost (BPI, ASTM, etc.)?
    - USDA Organic Compost Certification (NOP/OMRI)
  - **Composting operating processes and parameters**
    - Windrow vs Gore vs. …..
      - Requests to reassess timing (disintegration) of existing testing standards being pursued
  - **Education (from the "converter to consumer")**
  - **Associated costs**
    - Compostables (themselves)
    - At the composting site

Issue Management – Next Steps

- **Identification**
  - **Cedar Grove Packaging (The Brown Stripe)**
  - **Other initiatives**
    - USCC Compostable Plastics Task Force
    - USDA Biopreferred (bio-content only!)

      Need to understand both intent/outcome of any program!

- **Certifications**
  - **BPI Certification and ASTM 6400D, D7801 and D5988**
    - ASTM discussions on disintegration continue!
  - **USDA Organic Certified Compost (OMRI/NOP)**
    - A BPI led team now assessing this issue (bio-based packaging labeled as “synthetic”)
    - USCC Compostable Plastics Task Force

Summary

- **Bioplastics represent an option for many existing and new applications (focus on carbon footprint)**
  - **Questions remain regarding biodegradable plastics and biodegradable additives**
- **NatureWorks LLC and other biopolymer based companies offer renewable, recyclable and/or compostable options**
  - **Ingeo offers multiple end of life options**
  - **Working with other associations that target Zero Waste solutions**
    - **USCC, SPC, FPI, SPI, Elemental Impact and others**
    - **We (NatureWorks LLC) look forward to joining GRC in 2012!**
- **Closed venues provide immediate opportunities to implements recycling/compostable initiatives**
  - **Doesn't require bans or regulations to create change here!**
  - **As noted**
    - **Reduced operating costs (landfill tipping fees/solid waste hauling)**
    - **Diversion of food and packaging wastes from landfill**

New Opportunity To Position Biopolymer Uses:

USDA BioPreferred Label Program

	Existing	New
USDA	USDA ORGANIC	USDA CERTIFIED BIOBASED PRODUCT PRODUCT 57% FP
DOE	Energy Energy ENERGY STAR	FP USDA CERTIFIED BIOBASED PRODUCT PACKAGE 32%