



Maintaining the US' Green Chemistry Leadership

A View from the Frontlines

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- **World's leading bio-polymer player**
 - 150,000 ton PLA plant in Blair, NE
 - Significant manufacturing know-how and an extensive IP position
- **Jointly owned by Cargill and PTTGC**
- **Proprietary portfolio of Ingeo bio-polymers & intermediates**
- **Ingeo - competitive on a cost and performance basis with traditional plastics (PS, PET)**
- **Superior environmental characteristics**
 - Lower carbon footprint , low fossil energy
 - Additional end-of-life options
- **Established global market channels**
 - Over 100,000 ton in annual sales volume
 - Commercial partnerships with global brands



Three Things Are Essential

“The 3 P’s”

Properties

- **Broad and adjustable physical property set**

Price

Sugars vs oil

Favorable yields,

Economies of scale

Feedstock hedging capabilities

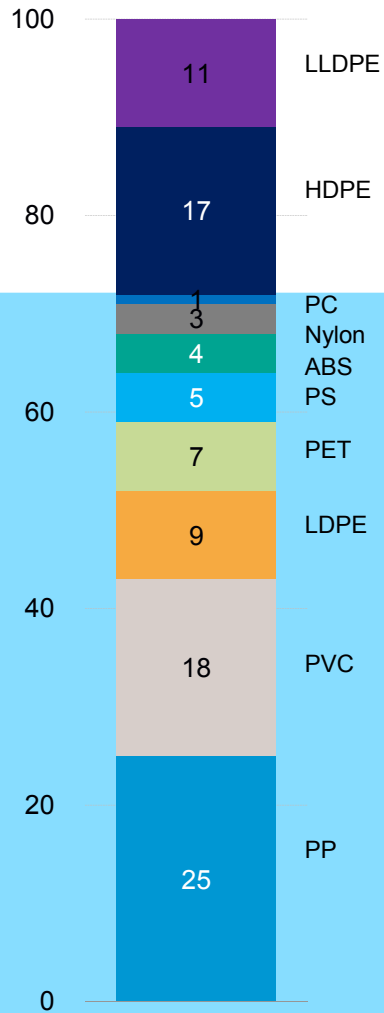
Cradle to cradle economics

Preferences

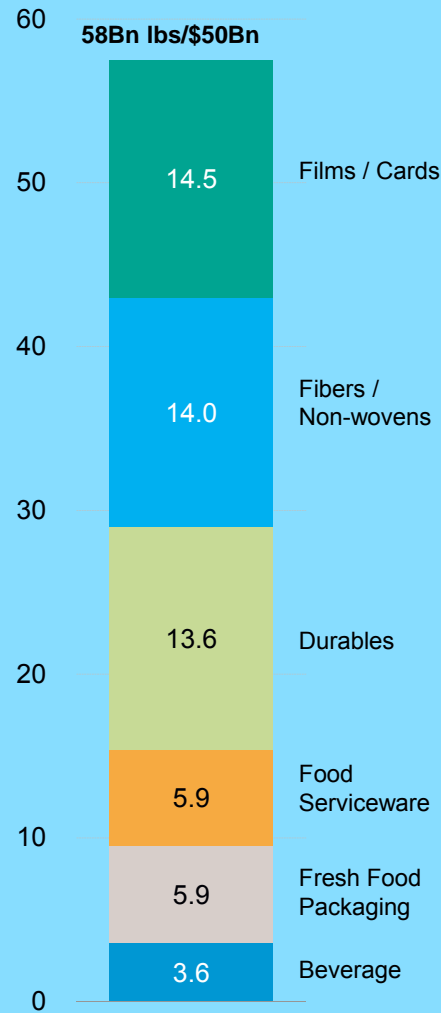
- **Lower carbon footprint and energy usage**
- **Renewable feedstock**
- **Health Concerns**
 - **BPA free**
 - **Phthalates free**
 - **Acrylonitrile free**
 - **Styrene free**



Plastics Consumption (%)



Total Addressable Market (Bn lbs.)



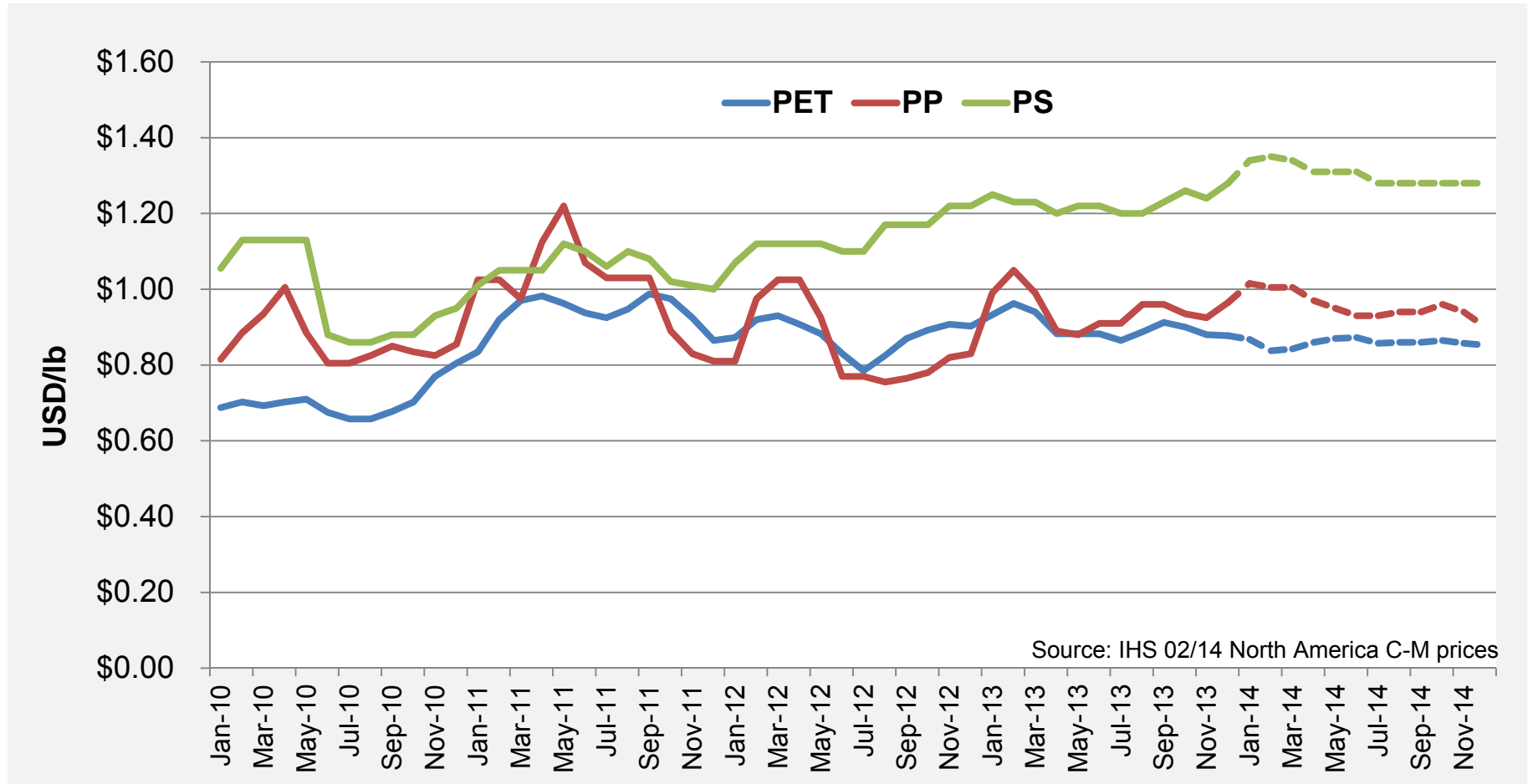
Our End Applications

- Cards**: Credit cards, ID cards
- Films**: Packaging films, agricultural films
- Apparel**: Clothing, shoes
- Home Textiles**: Bedding, curtains
- Non-Wovens**: Tissues, wipes
- Durable Goods**: Electronics, tools, toys
- Folder Cartons**: Shipping boxes, food containers
- Food Packaging**: Bowls, containers
- Serveware**: Plates, cups
- Bottles**: Water bottles, detergent bottles

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comparative cost stability



Clarifying Sugar to Polymer Yields

Polymer	Technology	Overall Process Yield	Kg sugar for 1 kg polymer
Bio PLA (Ingeo)	Sugar to PLA via lactic acid and lactides	80%	1.25
Bio PP	Sugar to ethanol to propylene to PP	47%	2.14
Bio PET	Bio MEG + Bio PTA from sugar	36%	2.77
Bio PE	Sugar to ethanol to ethylene to PE	31%	3.22



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



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

GENERATION I: 2nd step



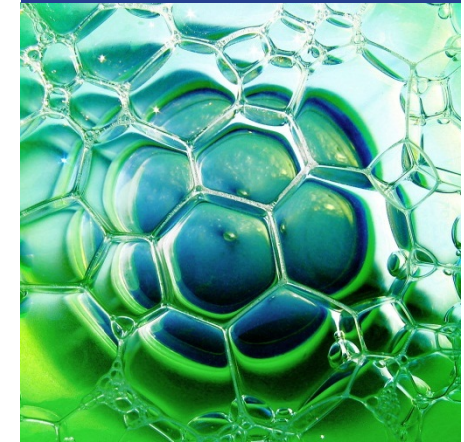
Where we are going now
Sucrose from locally abundant materials such as sugar cane

GENERATION II



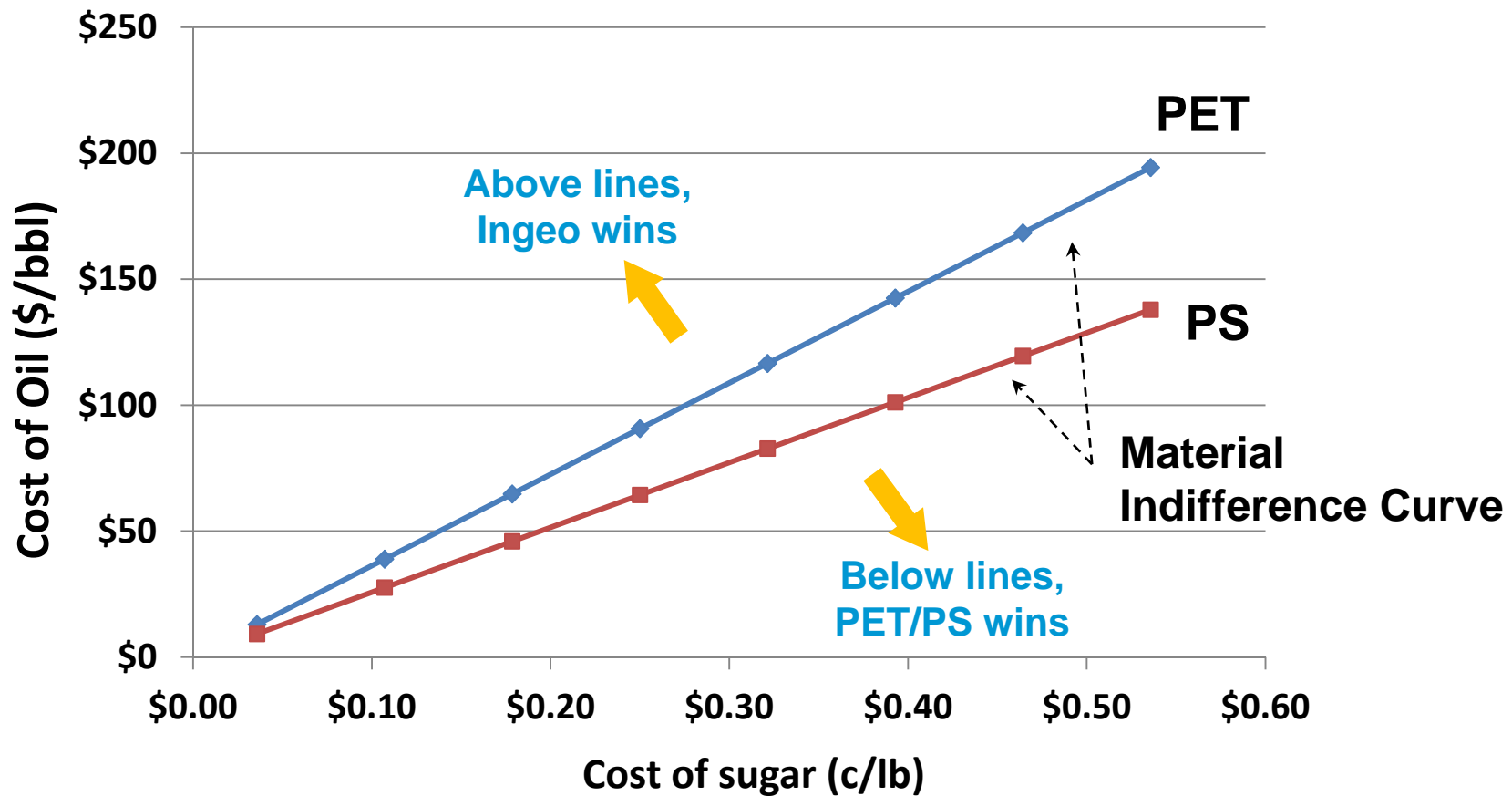
Next 3-5 years
Lignocellulosics: Sugars from bagasse, wood chips, switch grass or straw.

GENERATION NEXT



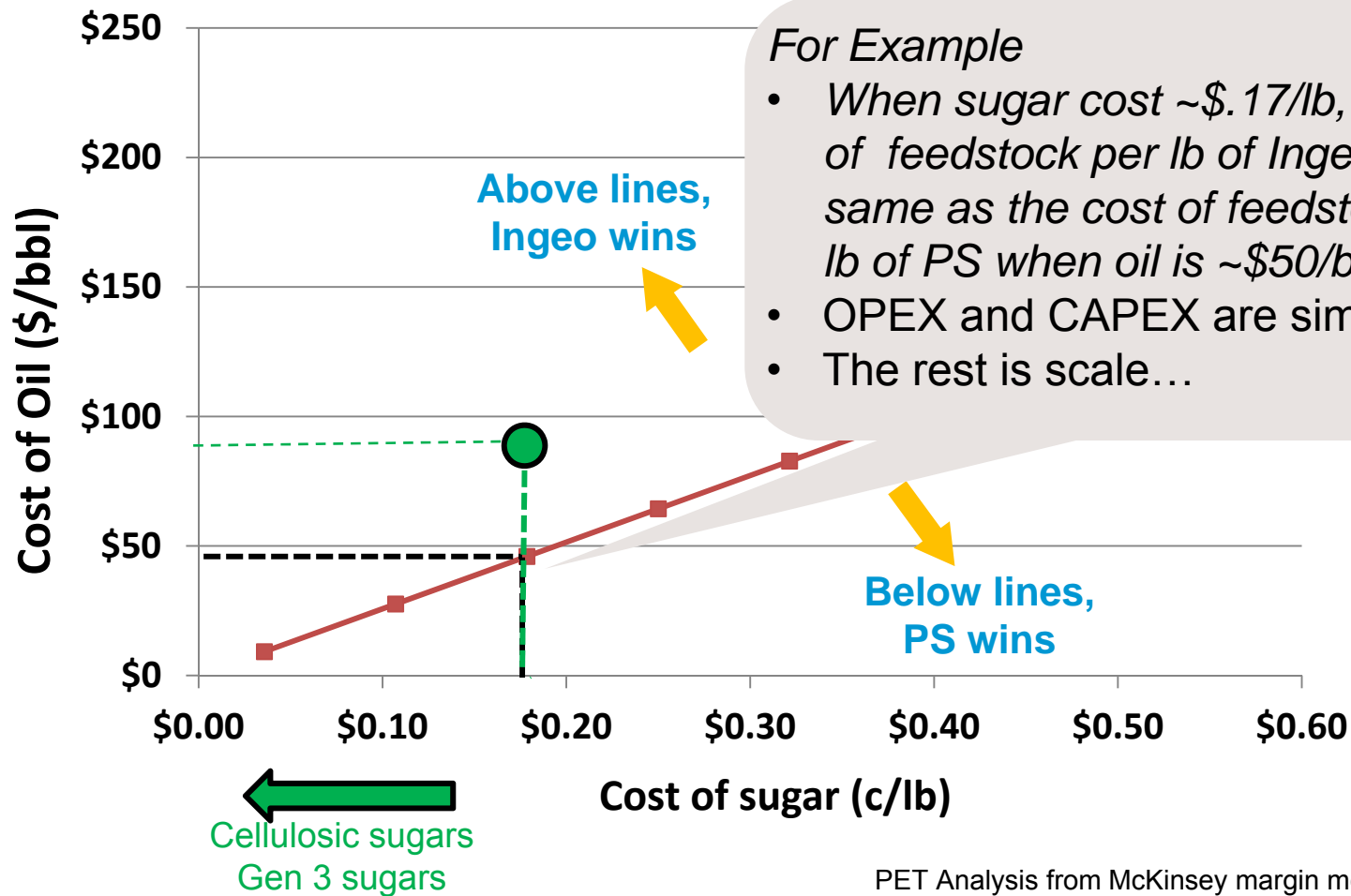
And next?
CO₂ to lactic acid technology?
CH₄ to lactic acid technology?

PET/PS/Ingeo Feedstock Cost Comparison



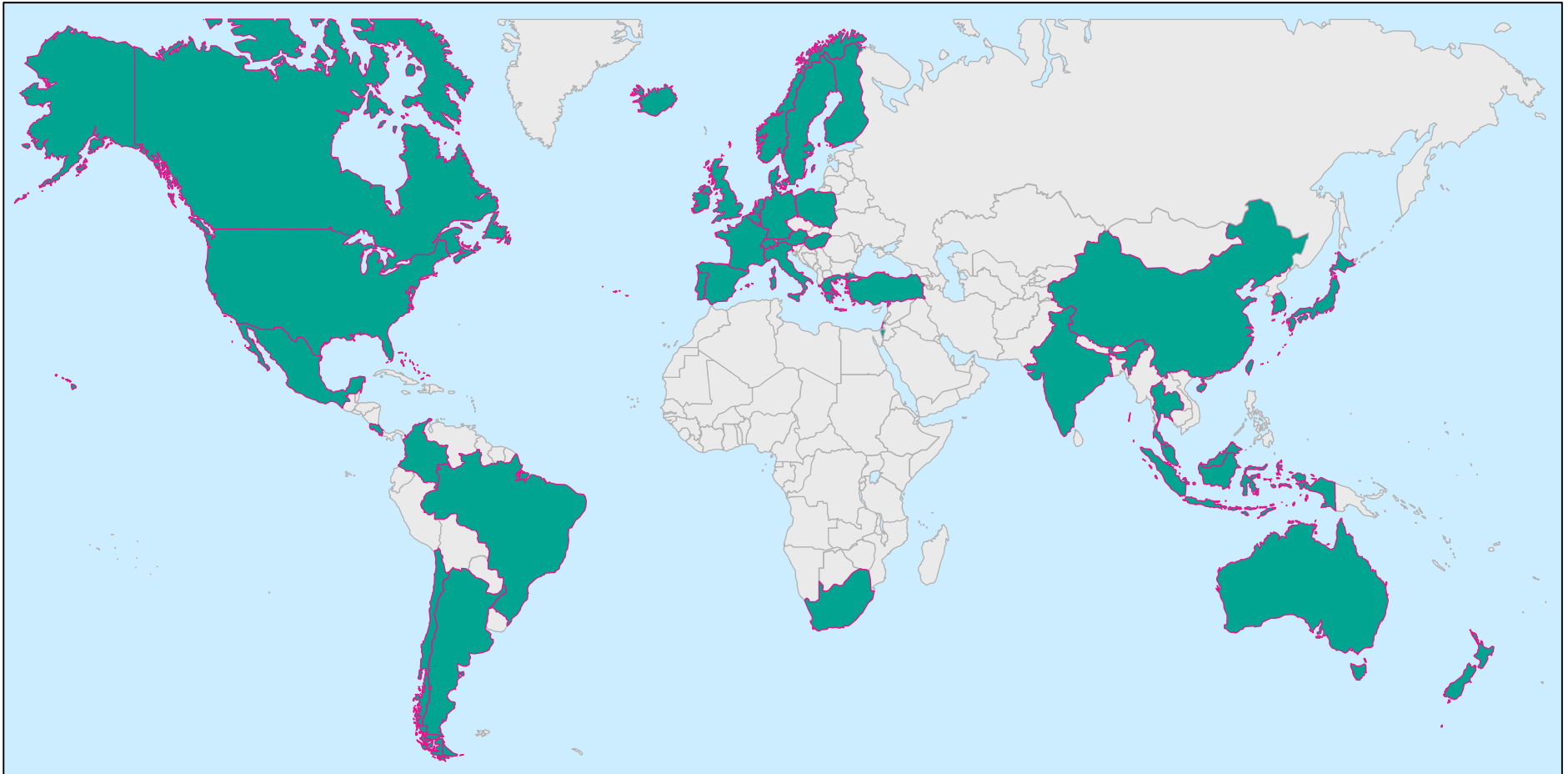
PET Analysis from McKinsey margin models, CMAI, February 2006

PET/PS/Ingeo Feedstock Cost Comparison



PET Analysis from McKinsey margin models, CMAI, February 2006

Where Are We Globally?



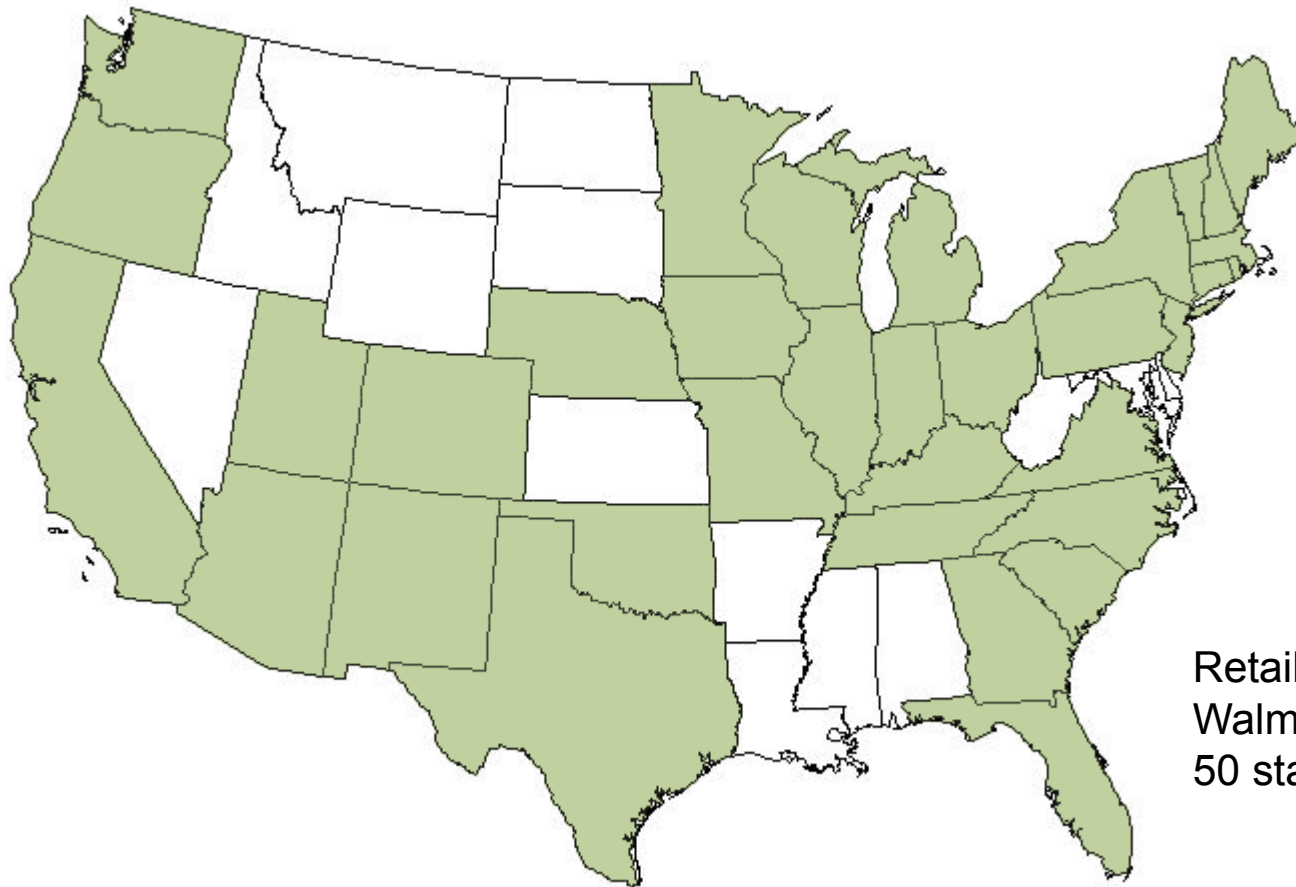
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NatureWorks LLC **Where Are We Nationally?**

MN led, Ingeo bioplastics & fibers are fueling green jobs & innovation in the national bio-economy



Retail presence (e.g. Walmart, Target) in all 50 states

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Rigids



Food Serviceware



Films



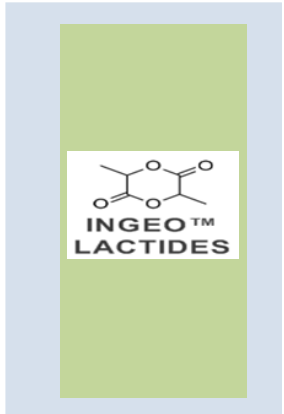
Nonwovens / Fibers



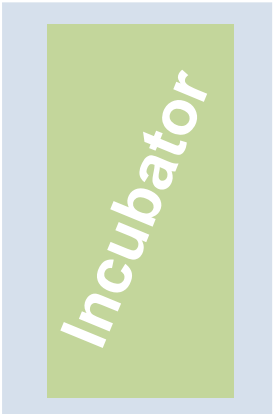
Durables








Lactides



Bus. Dev.



Performance features depend on your application

Nonwovens / Fibers	Rigids	Durables	Food Serviceware	Films
 <p>natural selection ingenious wet wipes made from plants not oil. @ingeo</p>	 <p>natural selection ingenious container made from plants not oil. @ingeo</p>	 <p>natural selection ingenious products made from plants not oil. @ingeo</p>	 <p>natural selection ingenious serviceware made from plants not oil. @ingeo</p>	 <p>natural selection ingenious films made from plants not oil. @ingeo</p>
<p>Key Properties</p> <ul style="list-style-type: none"> ■ Range of melting points/crystallinity levels ■ Tunable hydrolysis ■ Hydrophilic / moisture wicking ■ Inherent odor resistance ■ UV resistance ■ Low bonding temp 	<p>Key Properties</p> <ul style="list-style-type: none"> ■ Stiffness ■ Gloss, transparency ■ Printability ■ Weight reduction (vs. PET) 	<p>Key Properties</p> <ul style="list-style-type: none"> ■ Stiffness ■ Miscibility ■ Improved flow ■ Chemical resistance 	<p>Key Properties</p> <ul style="list-style-type: none"> ■ Stiffness ■ Compostability ■ High versatility for injection, extrusion and coating processes 	<p>Key Properties</p> <ul style="list-style-type: none"> ■ Stiffness ■ High gloss and transparency ■ Dead fold / twist retention ■ Grease, oil and aroma barriers ■ Chemical resistance ■ High throughput

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



GREEN SPORTS ALLIANCE



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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:

Leagues:

MLB
MLS
NBA
NHL
NLL
USTA
WNBA



2013 Rose Garden Achievements



87% landfill diversion rate



\$567,000+ waste diversion savings
(since 2008 baseline)



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Danone's Stonyfield - in their own words:

"IMPACT OF IN GEO CONVERSION"

- **Carbon savings** **Environmental**
 - 75% reduction in CO2 emissions
 - Equivalent to 1,320 MT CO₂/year savings
- **Ingeo out performs polystyrene** **Performance**
 - Stronger/less breakage
 - Better lid adherence
 - Lower temperature filling (less energy use)
 - Maintained line speed and shelf life
- **Addresses consumer concerns** **Consumer & Cost**
 - Well received by key opinion leaders
 - Reduction in human toxicity
 - Did NOT increase our retail price



Stonyfield CEO Gary_Hirschberg, Innovation Takes Root Conference Keynote:
 "Inventing a WIN-WIN-WIN-WIN-WIN FUTURE", February 21, 2012

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LEED is driving the green building industry.



Leadership in Energy & Environmental Design, is transforming the way we think about how our buildings and communities are designed, constructed, maintained and operated across the globe

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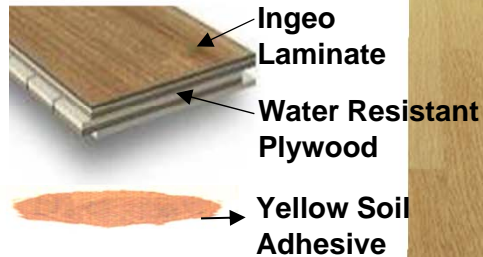


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Structure

9.0(T) x75(W) × 900(L)



Application

- Residential

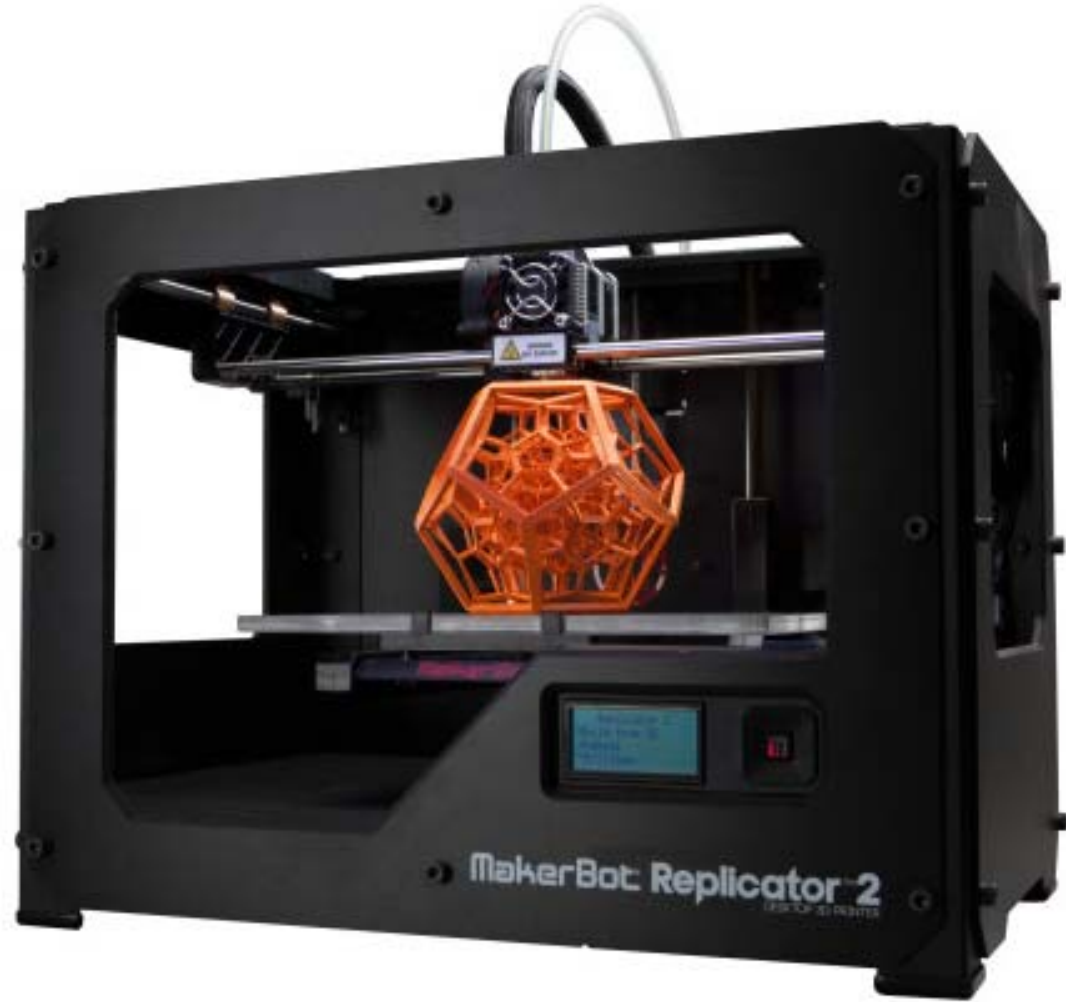
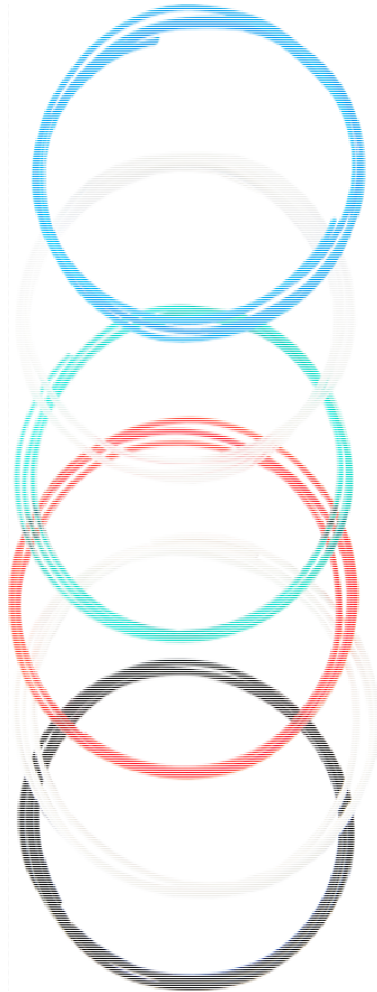
-  **Eco-friendly**
-  **Dent, scratch resistible**
-  **No color change by environmental**

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3D Printing



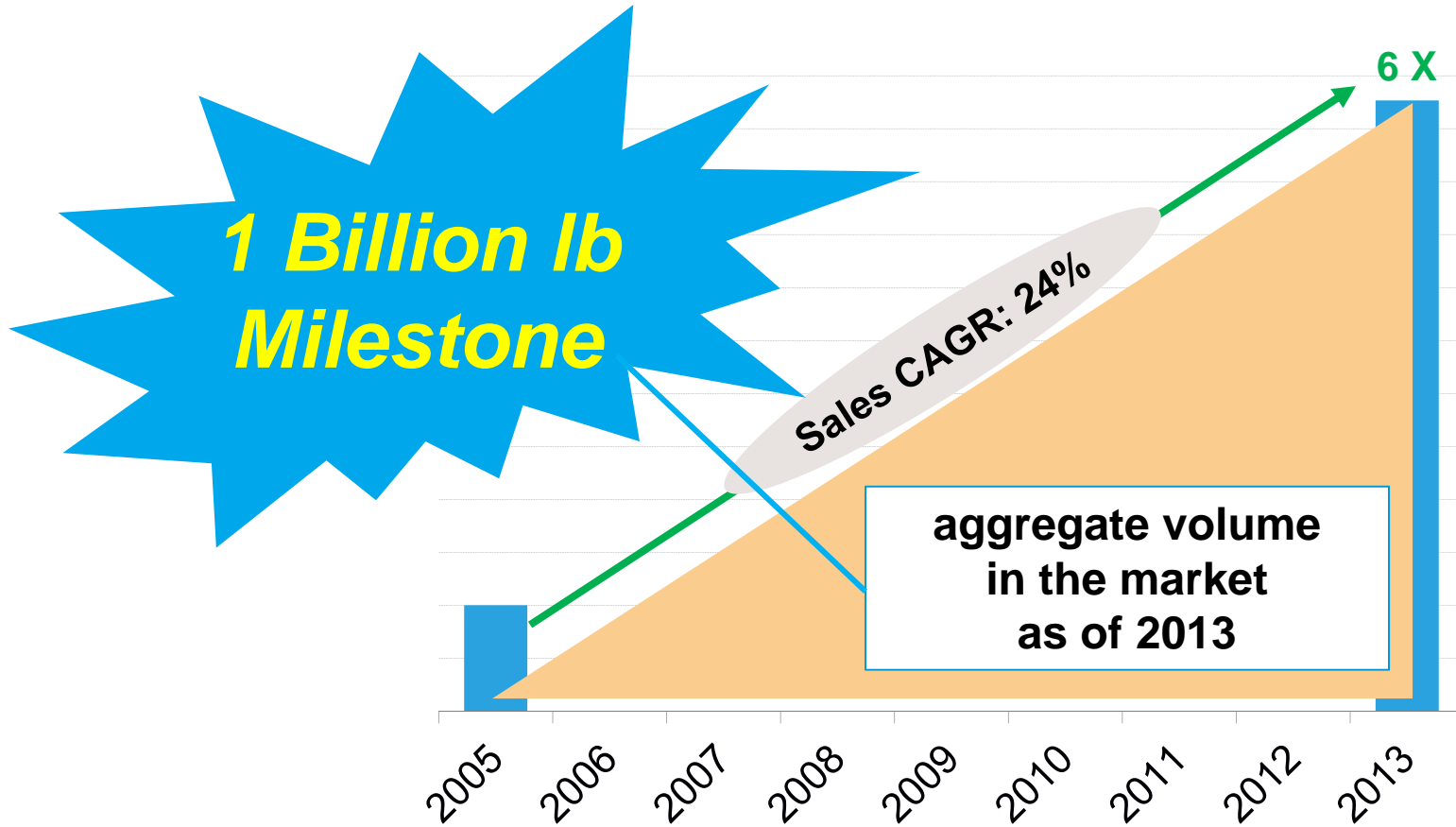
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What we've achieved in our time together

2005 – 2013

Our collective Footprint in the market



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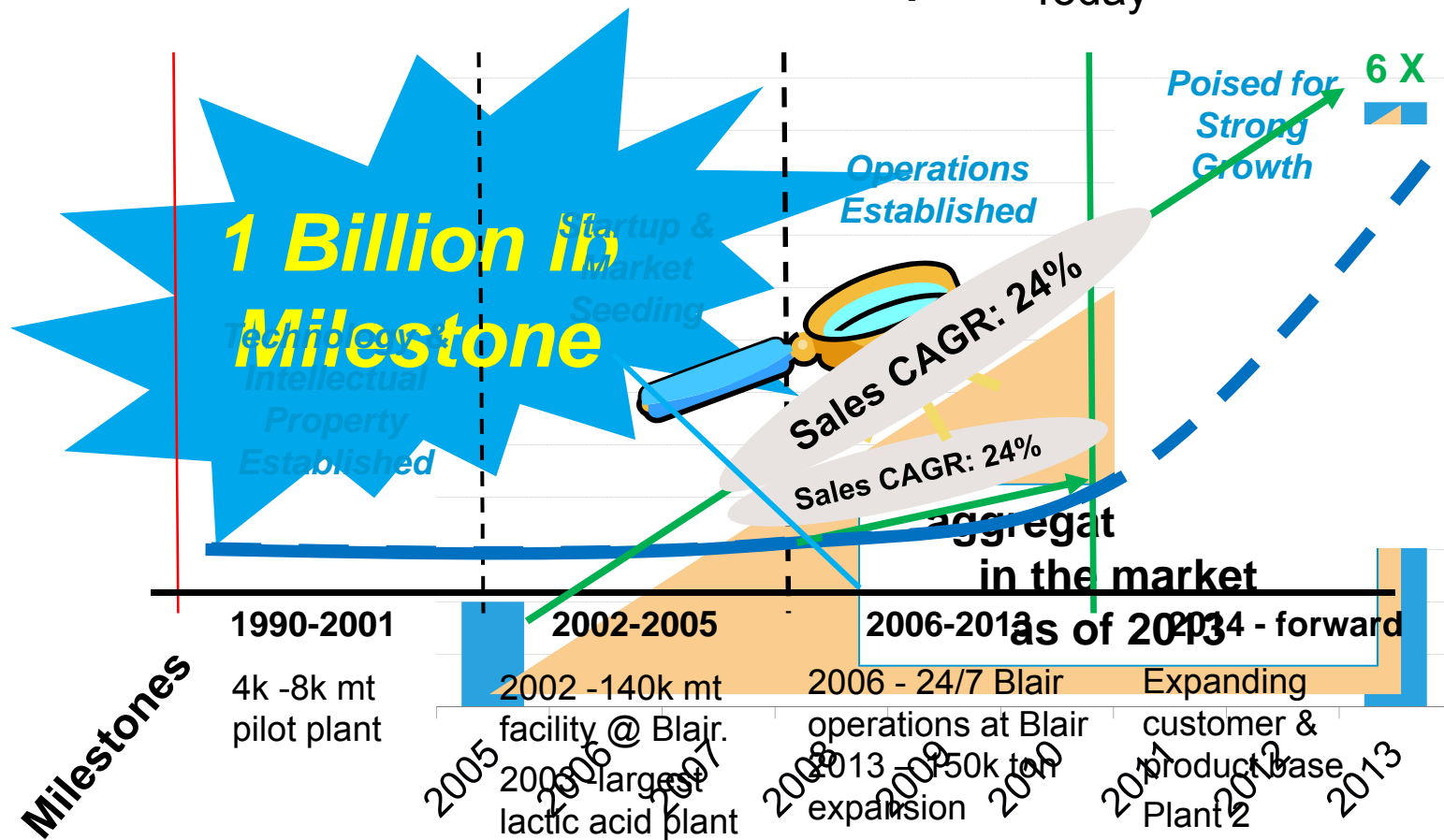


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Where we are in the bigger picture

2005 – 2013

Our collective Footprint in the market



Milestones

1990-2001
4k -8k mt pilot plant

2002-2005
2002 - 140k mt facility @ Blair.
2006 - largest lactic acid plant

2006-2013
2006 - 24/7 Blair operations at Blair
2008 - 50k ton expansion

2014 - forward
Expanding customer & product base
Plant 2



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Maintaining the US' Green Chemistry Leadership

- The US bio-plastic industry is ready for rapid expansion but:
 - Our industry is (very) capital-intensive (+/- \$1MM per mm lb capacity)
 - Financial markets (debt and equity) are “reluctant” investors in our sector (technology risk, scale-up risk, market risk)
- The bio-plastic industry is “sexy” and US will have to compete globally for investments (jobs, jobs, jobs)
- In order to lower investment risk and in order to be competitive against foreign programs, we could use an “incentive basket”



Benchmarking what the 'competition' is doing

Incentive Schemes Around the World

Supply Incentives














- Tax Credits
 - Production
 - Investment
- Tax Holidays
- Loan Guarantees
- Preferred Loan Rates

Demand Incentives

- Tax Breaks
 - Carbon tax
- Exemptions
 - Recycle fees
- Quotas
 - Taiwan/Korea retail legislation
- Bans (PE bags, PS foam)



Global Industrial Incentive Schemes – A Sampler

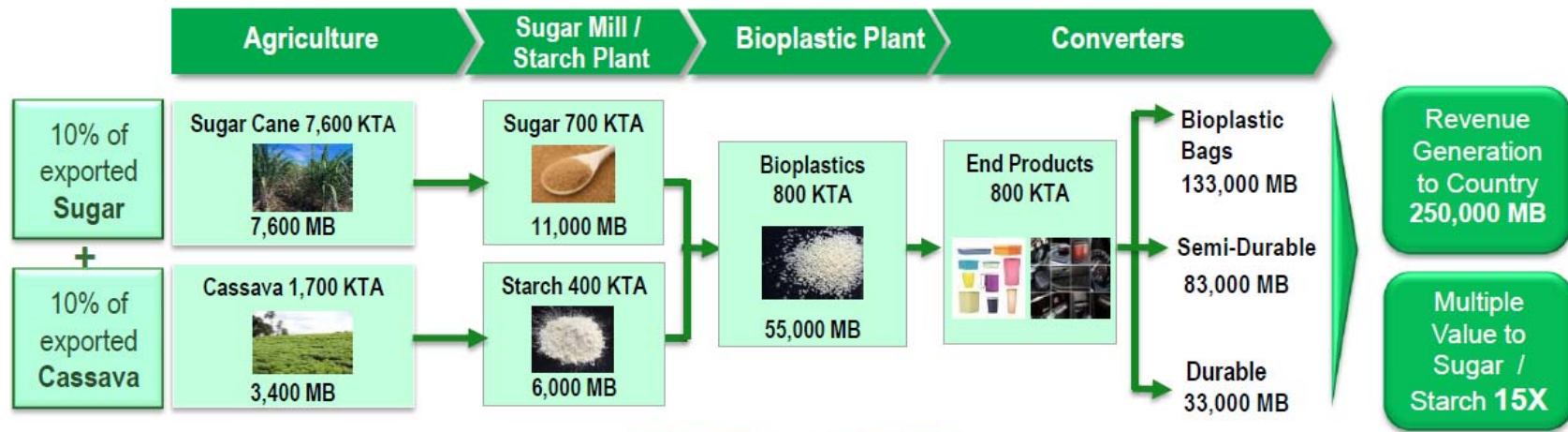
Country	Supply Incentives	Demand Incentives
 Taiwan		✓
 Korea		✓
 Japan	<ul style="list-style-type: none"> • 8-10 years tax holiday • loan guarantees • guaranteed rate 	✓
 Philippines		✓
 Australia		✓
 European Union		✓
 USA	✓	✓
 Thailand	✓	✓
 Brazil	✓	
 Malaysia	✓	
 Singapore	✓	
 Indonesia	✓	
 Canada	✓	

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Economic Impacts

- Revenue 250,000 MB per year

Human Capital

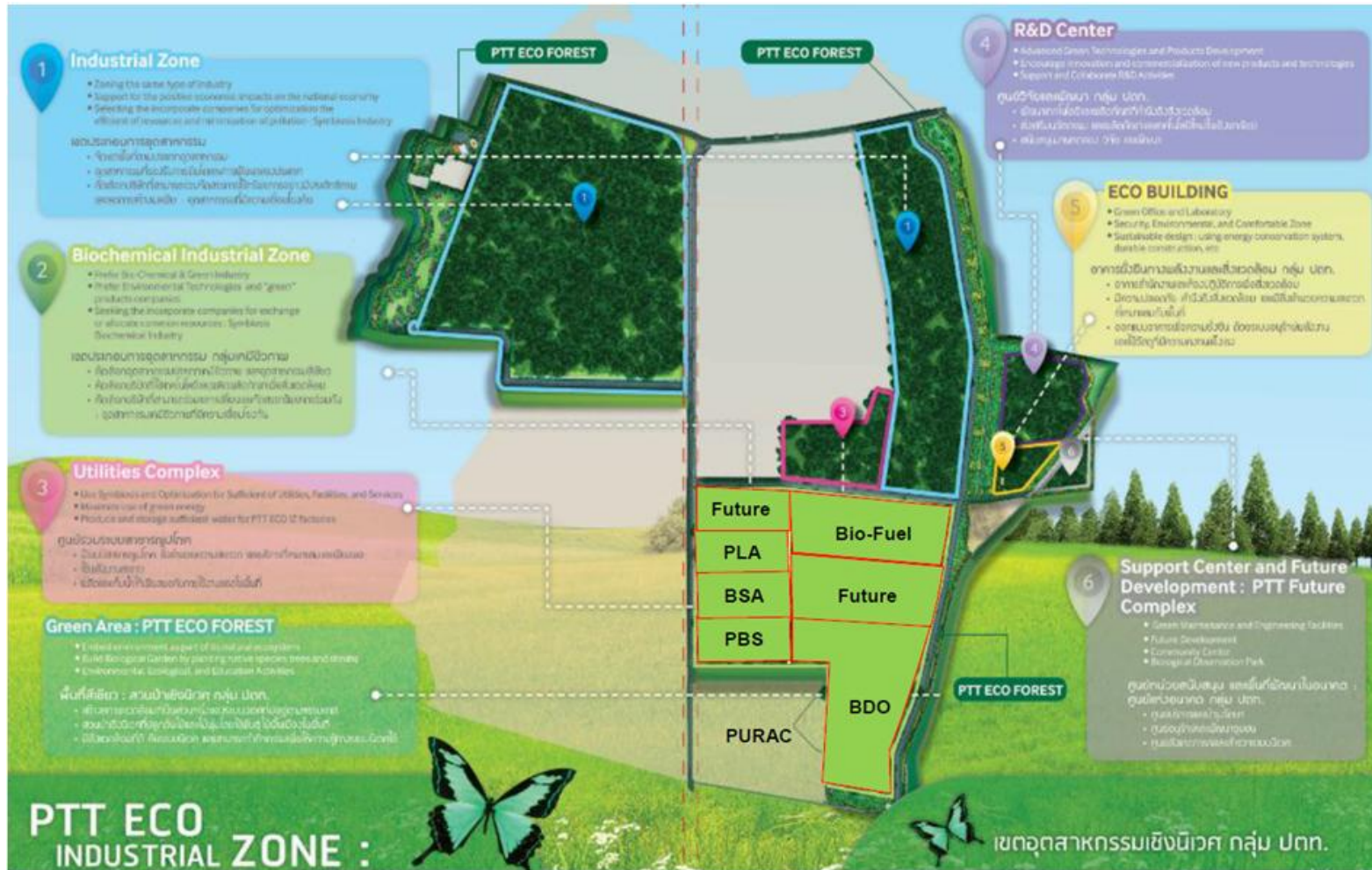
- > 500,000 Positions (Agricultures, Production, Sales and Logistics, Converters)

Relating Industries

- Food Exports
- Constructions
- Automotive
- Textiles

Putting It All Together - Thailand As An Example

PTT Eco Industrial Estate

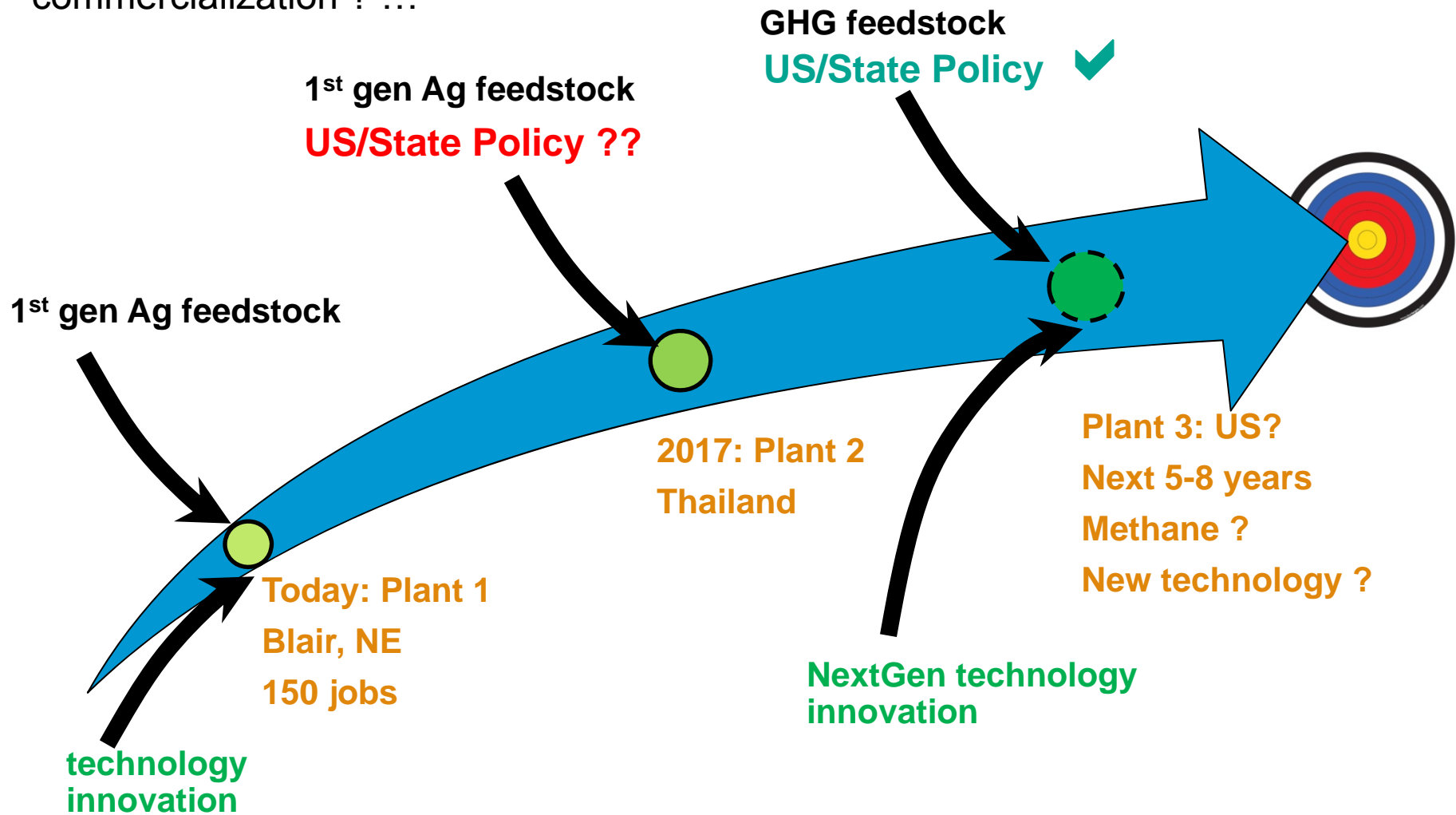


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NatureWorks' Journey:

Back to the US & Minnesota thru disruptive technology development and commercialization ? ...



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Questions ... ?

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