Thank you to this afternoon's Networking Break sponsor!

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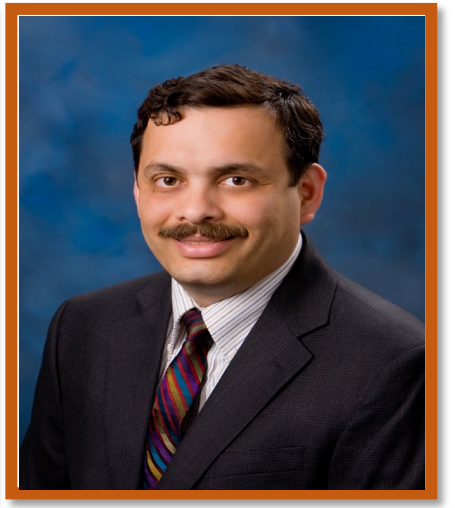
Bioindustrial Bankability

Stephanie Rich
Head of Platform
Bread & Butter Ventures

Suhas Narayanaswamy
Principal
Lewis & Clark AgriFood

Maxx Chatsko
Founder
Solt DB

Christian Kemp-Griffin
Chief Executive Officer
CelluComp



Sundeep Vani, Ph.D.
Consultant in Industrial Technology

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Lewis & Clark AgriFood - AURI

Suhas Narayanaswamy

Principal

Suhas brings over a decade of experience in the Food and Agriculture sectors, blending his roles as both an Investor and Operator. Currently, he spearheads investment initiatives for Lewis & Clark AgriFood, leveraging his expertise across the AgriFood landscape. Suhas has also made investments in several sectors including Bio Materials and serves on the boards of Natural Fiber Welding and Lingrove.

Prior to his current role, Suhas played a pivotal role in building and scaling a row crop seed business in India, where he cultivated deep connections within the farming community. His diverse investment portfolio spans from private investments and M&A to Buyouts, with notable stints at G2 Capital Advisors and Babson College Endowment where he evaluated and executed investments.

Suhas holds an MBA from Babson College, specializing in Finance and Entrepreneurship, complemented by a bachelor's degree in Electronics Engineering from Visvesvaraya Technological University. Suhas is committed to driving transformative change within the Food and Agriculture sectors.

Lewis & Clark AgriFood Overview

Late-stage venture and growth investments spanning food, agriculture, and beyond

Our Firm at a Glance

>$350mm AUM	>25 Investments made	80+ Years relevant experience
16 Investing professionals	St. Louis, MO Headquarters	4+ Key focus areas

Investment Focus

+ **STAGE:** Series A to C; Growth
+ **CHECK SIZE:** $5 to $20mm
+ **ROLE:** Lead or Co-Lead
+ **TYPE:** Equity or Debt
+ **LOCATION:** North American Focus
+ **USE:** Expansion Capital

Verticals and Target Categories

Plant Science & Technology
- Biological-Based Crop Inputs
- Digital Farm Management Solutions
- Novel Crop Genetics
- Robotics & Autonomy

Supply Chain Efficiency
- Food Waste & Retail Technologies
- Food Safety & Compliance
- Logistics & Trade Optimization
- Sustainable Packaging & Materials

Animal Health & Nutrition
- Digital Herd Management Solutions
- Genetics & Genetics-Based Tools
- Novel Feed Additives / Ingredients
- Vaccines & Therapeutics

Food & Food Technology
- Food-as-Medicine
- Discovery & Product Development
- Novel Food Ingredients
- Processing Technologies

Lewis & Clark Biomaterials Investments

Investing in novel platforms with superior performance and transformative potential

NATURAL FIBER WELDING®

Description	All natural, plant-based performance materials including leather alternatives and textiles from regenerative fibers

BMW

P2

Description	Novel green chemistry platform to develop high value ingredients, including alternatives to silicones and petroleum-derived polymers

Living proof.

Lingrove

Description	Plant-based, high-performance composite materials with applications across wall coverings, furniture, cabinets, vehicle interiors, and more

HYUNDAI

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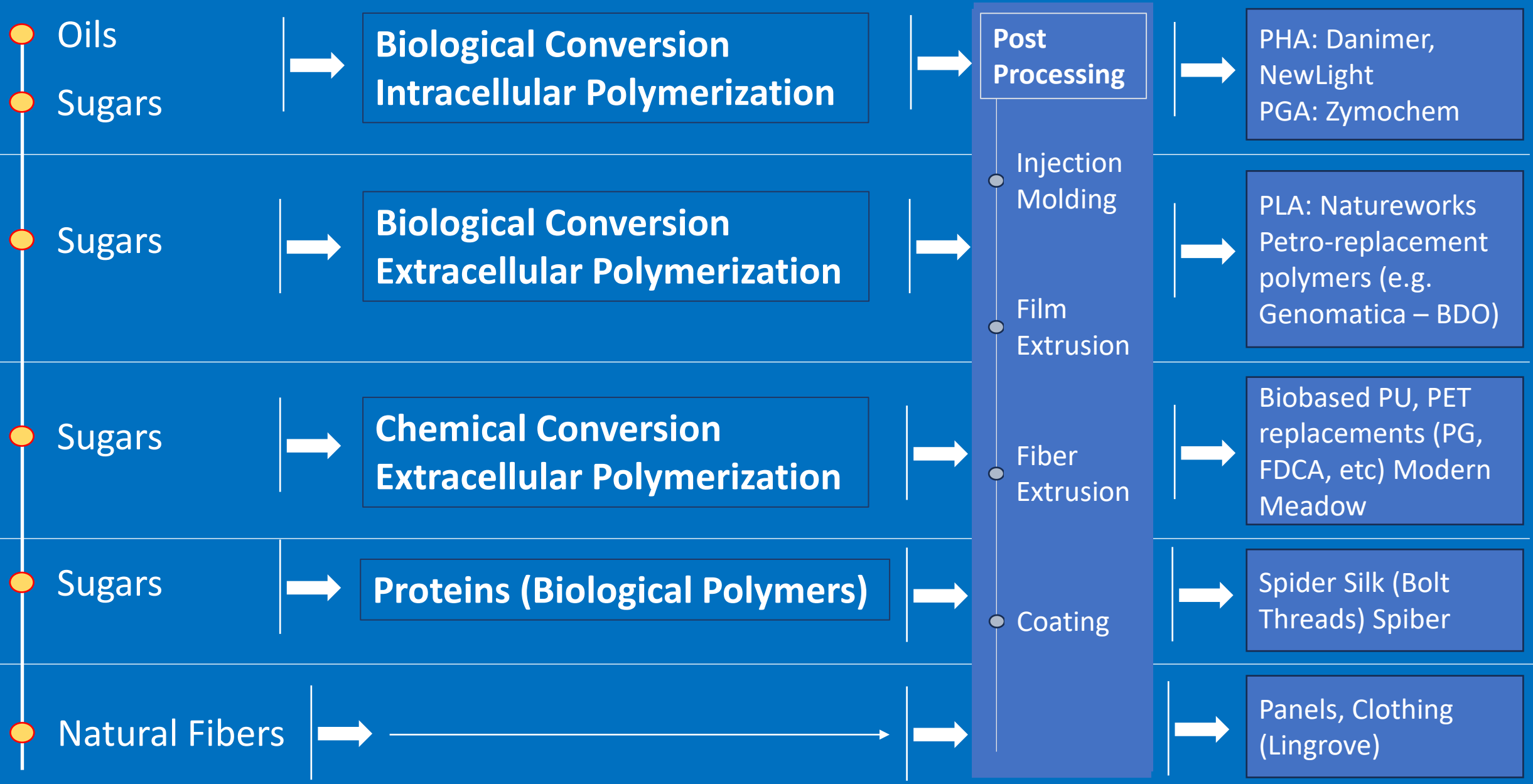
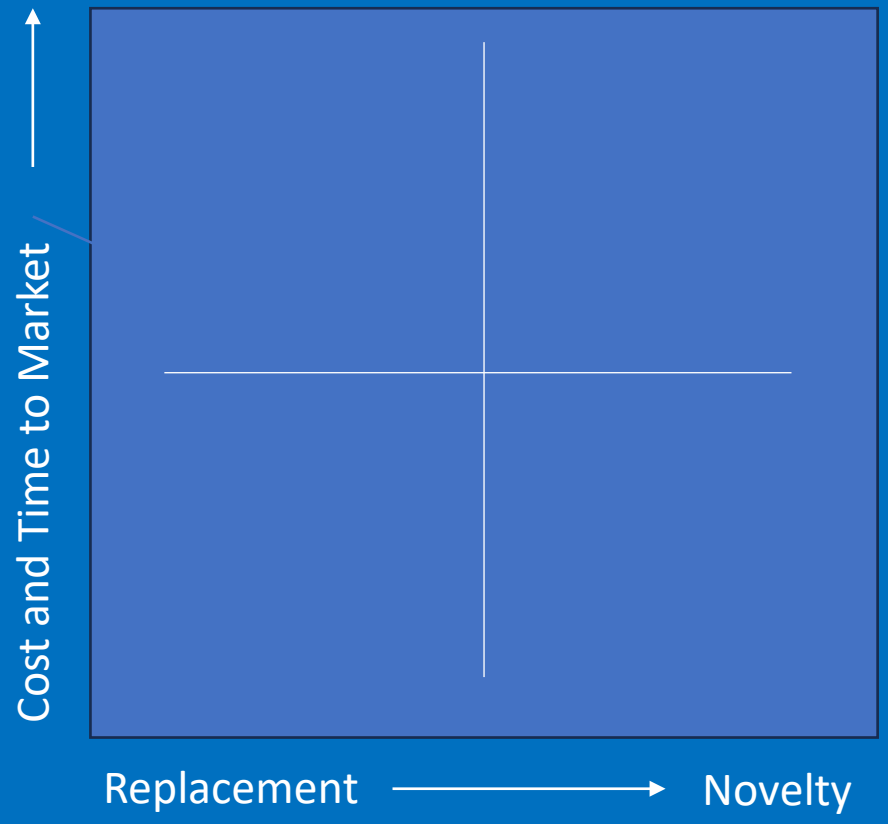
Biomaterials: Technical Framework



Biomaterials: Commercial Framework

Costs

- R&D
- Pilot and Commercialization
- Capital
- Customer Validation and Customer Acceptance
- Operating



Application (Margin & TAM)

- Fabrics
- Leather
- Packaging
- Architectural/Design Applications
- Disposable Diapers

Panel Discussion

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Audience Questions & Answers

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slido

Where do you feel the greatest challenge lies in financing for support of the bioindustrial sector?

ⓘ Start presenting to display the poll results on this slide.

Keynote Address: NatureWorks – A Case Study on Bioindustrial Success!

Joe Schroeder, Ph.D.
Chief Scientist
NatureWorks, LLC

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Agricultural Utilization Research Institute

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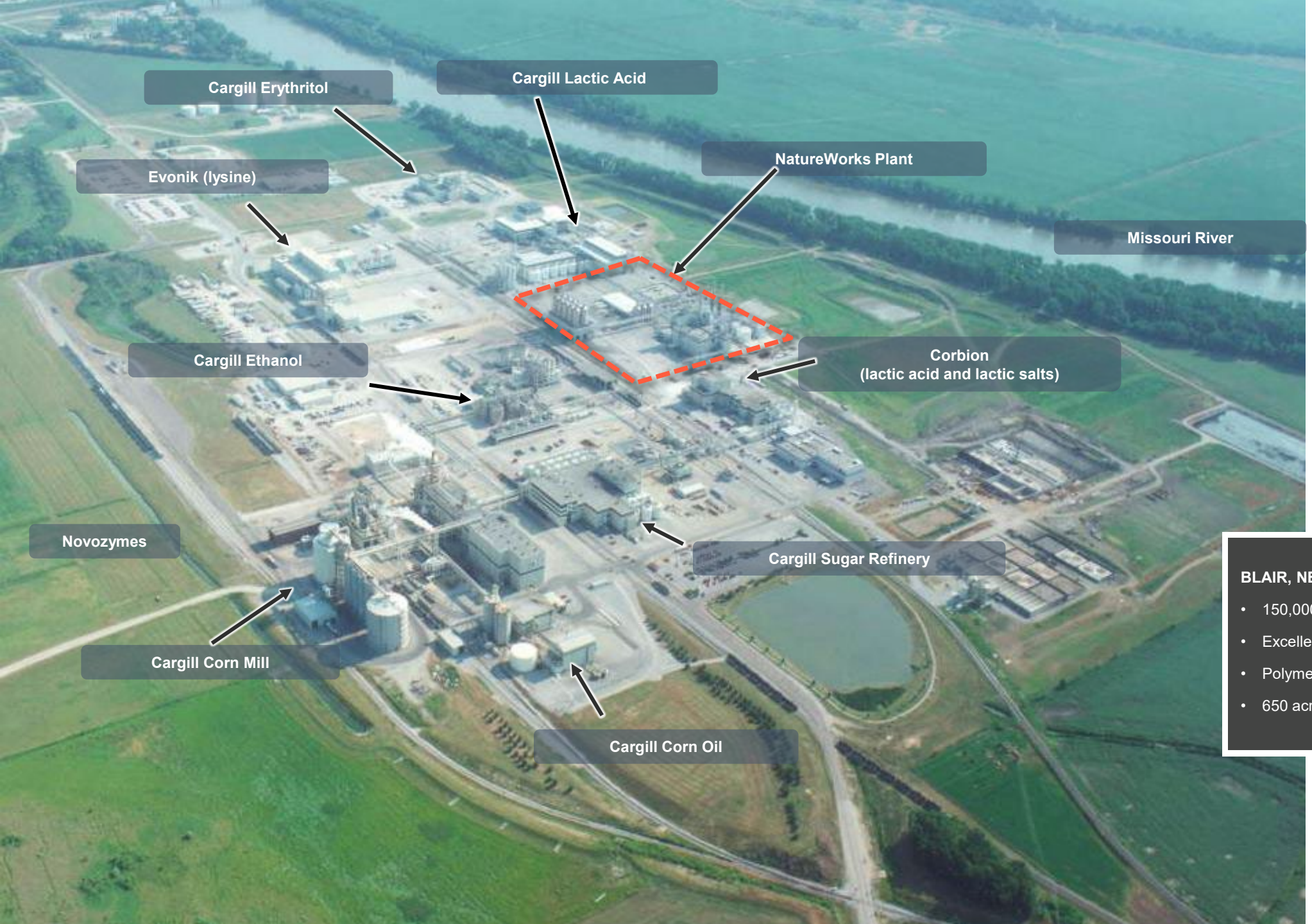
NatureWorks:
A Case Study on Bioindustrial Success

Joe Schroeder, Ph.D.
Chief Scientist, NatureWorks

Our Mission

to be the global leader in producing a broad family of performance plastics from renewable resources, dedicated to meeting the world's needs today without compromising the earth's ability to meet the needs of tomorrow.

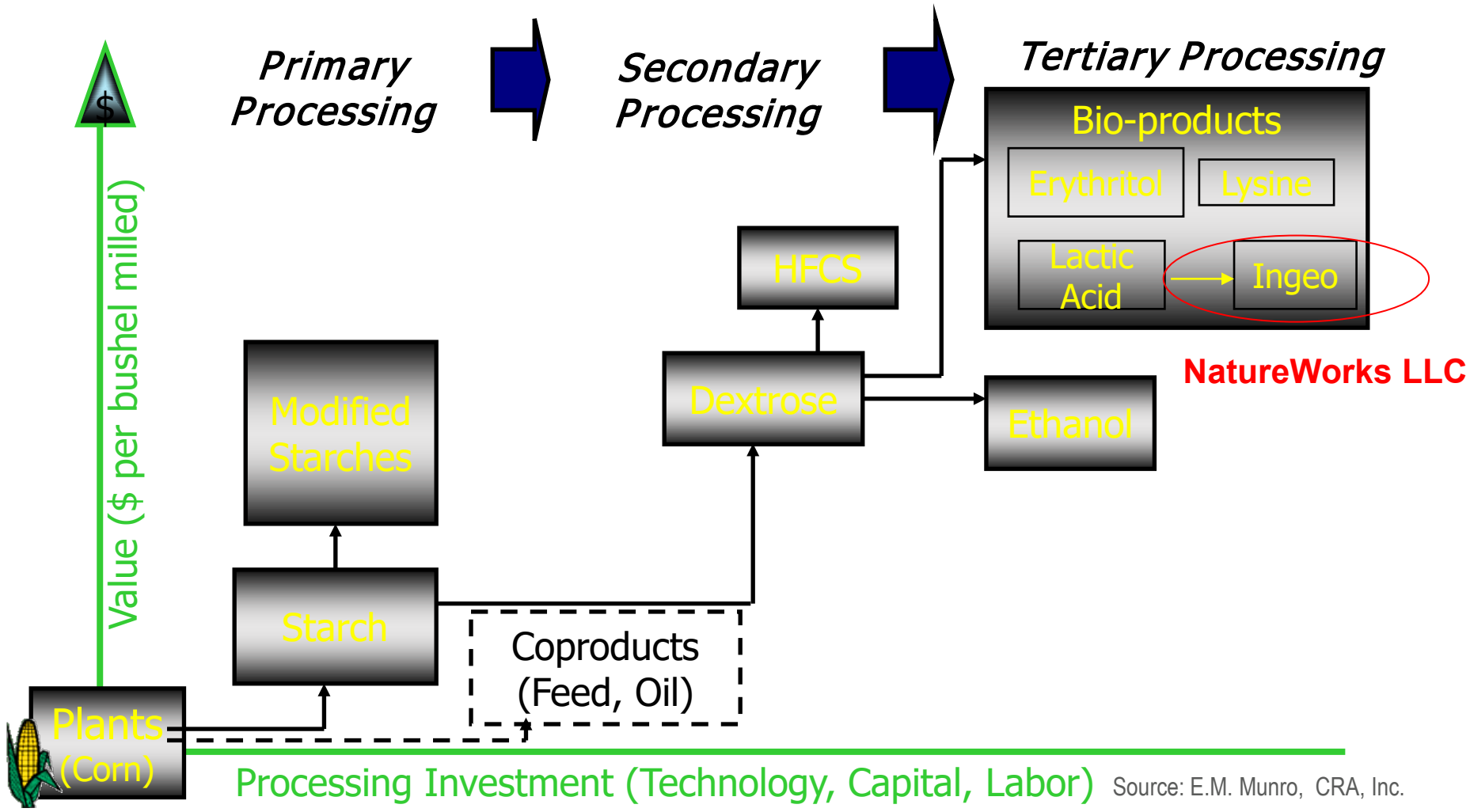


ingeo™ by NatureWorks

BLAIR, NEBRASKA FACILITY

- 150,000 MT nameplate capacity
- Excellent safety record
- Polymer plant online in 2002
- 650 acres - ~1 sq. mile – 263 ha.

Capital Investment Leads to Value



Source: E.M. Munro, CRA, Inc.

It's not food or bioplastic.
It's food AND bioplastic.

What do you get from one bushel of corn?

You can make…

- 4.4MT Ingeo per hectacre of corn

…and corn oil, gluten meal, and gluten feed products.

all of these[1]

0.7
kg of corn oil
cooking oil, margarine, mayonnaise, salad dressing, shortening, soups, printing ink, soap, leather tanning

AND

1.2
kg of gluten meal
amino acids, fur cleaner, poultry feed

AND

6.1
kg of gluten feed
livestock & poultry feed, pet food

and

one of these

14.3
kg of starch
adhesives, batteries, cardboard, crayons, degradable plastics, dyes, plywood, paper, antibiotics, chewing gum

OR

10.6
liters of fuel ethanol
motor fuel additive, alcoholic beverages, industrial alcohol

OR

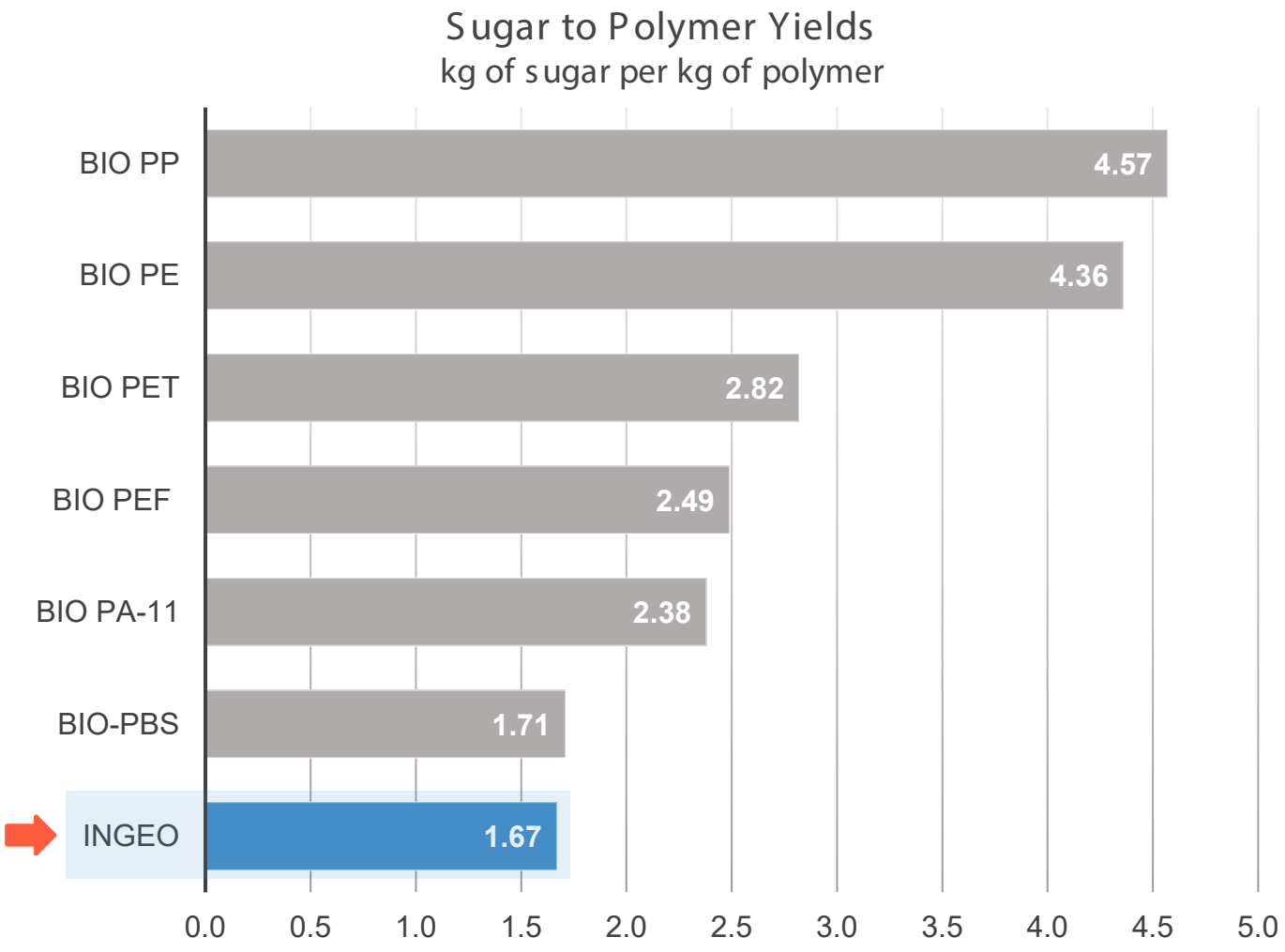
15
kg of sweetener
shoe polish, soft drinks & juices, jams & jellies, canned fruit, cereal, licorice, peanut butter, ketchup, marshmallows

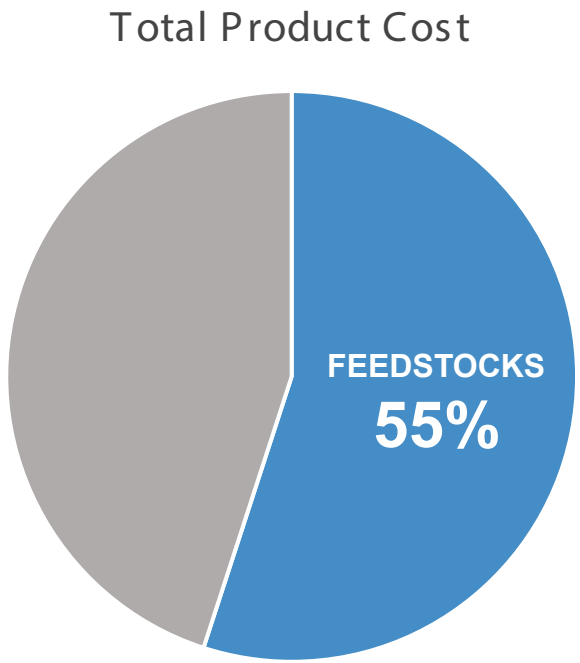
OR

10.2
kg of Ingeo biopolymer
nonwovens, food packaging, food serviceware, durables, apparel, films

1. National Corn Growers Association, World of Corn Report 2023
2. Yield 173 bu/acre, National Corn Growers Association, World of Corn Report 2023

Not all biopolymers are the same





With feedstocks as a significant portion of final product costs, research on improving yields can make or break a business.

Source: *IfBB institute for bioplastics and bio composites, Biopolymers Facts and Statistics [2022] Production capacities, processing routes, feedstock, land and water use*
https://www.ifbb-hannover.de/files/IfBB/ downloads/faltblaetter_broschueren/f+s/Biopolymers-Facts-Statistics-einseitig-2022.pdf

From feedstocks to product, the circular, safety, & sustainability claims behind biomaterial claims must be supported by rigorous 3rd party testing and credentials.

Product Health & Safety

CERTIFIED cradle to cradle — BRONZE

Material Health — GOLD

GREEN CHEMISTRY A U.S. EPA Program
Presidential Green Chemistry Award Recipient

GREENSCREEN CERTIFIED PLATINUM
FOOD SERVICE WARE 1.0 VERSION
20211163 CERTIFICATE NUMBER
CEH · CLEAN PRODUCTION ACTION

Biobased Content

USDA CERTIFIED BIOBASED PRODUCT
PRODUCT 100%

OK biobased

TÜV AUSTRIA
★★★★
S0149

VERIFIED BY eurofins
No genetic material detected
ingeo | vercet

Circular Economy

ELLEN MACARTHUR FOUNDATION Member

BPI ®
COMPOSTABLE IN INDUSTRIAL FACILITIES
Check locally, as these do not exist in many communities. **Not suitable for backyard composting.**
CERT # 890975

recyclable
passes WMU standard
www.wmich.edu/pilotplants

compostable

100% Certified Renewable and Sustainable Feedstocks

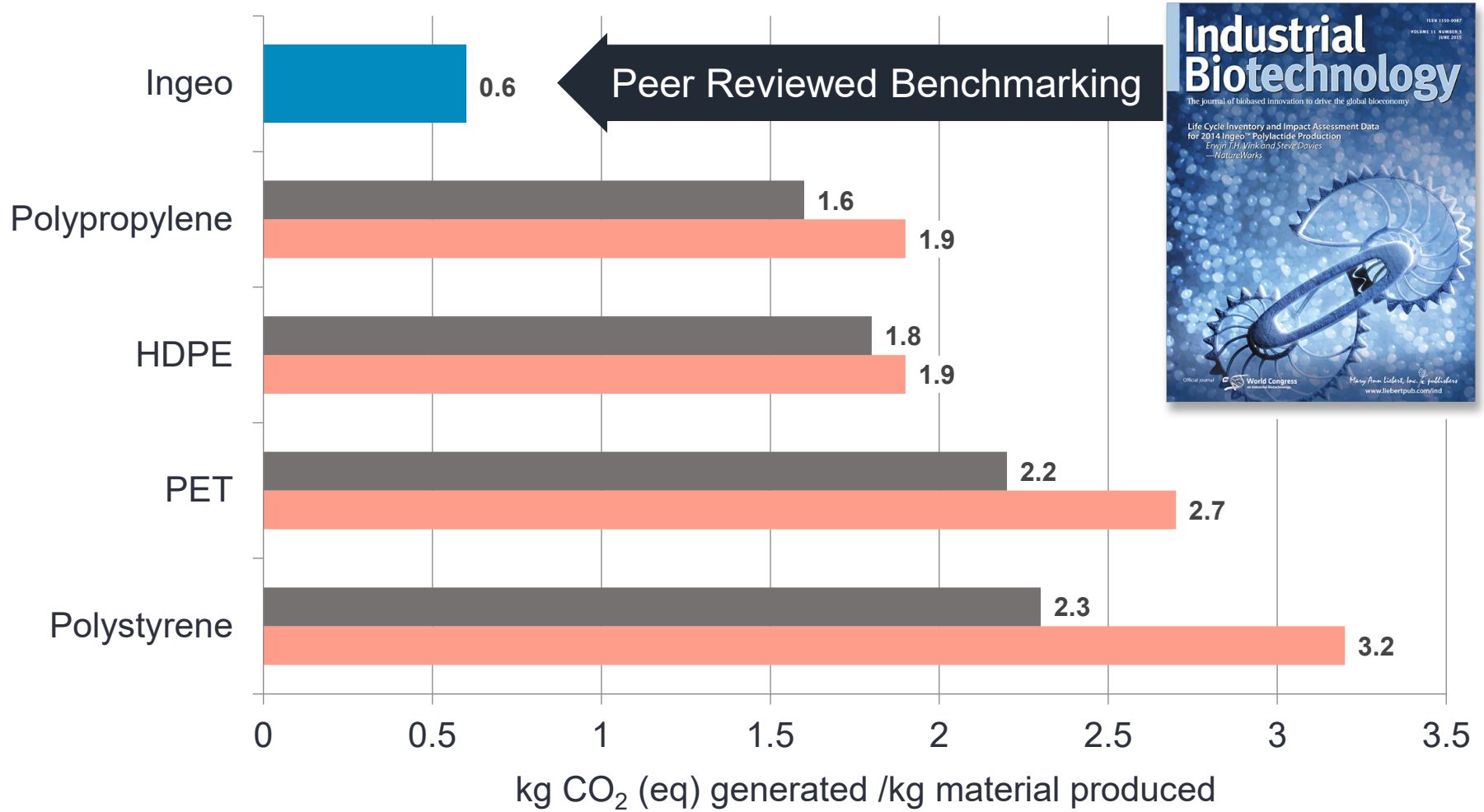
ISCC International Sustainability & Carbon Certification

NEW PLASTICS ECONOMY Global Commitment

Carbon Footprint

Carbon reduction begins with how plastics and materials are made

Peer-reviewed data benchmarks claims of 68% reduction in GHG footprint



EU Producers

PlasticsEurope
www.lca.plasticseurope.org

US Producers

APC -]American Plastics Council
http://plastics.americanchemistry.com

Our History

1989 — Project to commercialize PLA begins as part of a Cargill initiative to find alternative uses for sugar

1994 — Pilot PLA plant opened in Savage, MN

2002-2003 — Lactic acid and Ingeo PLA plants open in Blair, NE

2004 — First integrated run (lactic acid through Ingeo PLA) at Blair plant

2009 — Open state-of-the-art Ingeo Applications Development Facility in Savage, MN

2011 — Equity investment from PTTGC for 50% stake in NatureWorks

2012 — Blair plant capacity and product capability expansion to 150 kta

2015 — Published Ingeo LCA passes rigorous 3rd-party peer review

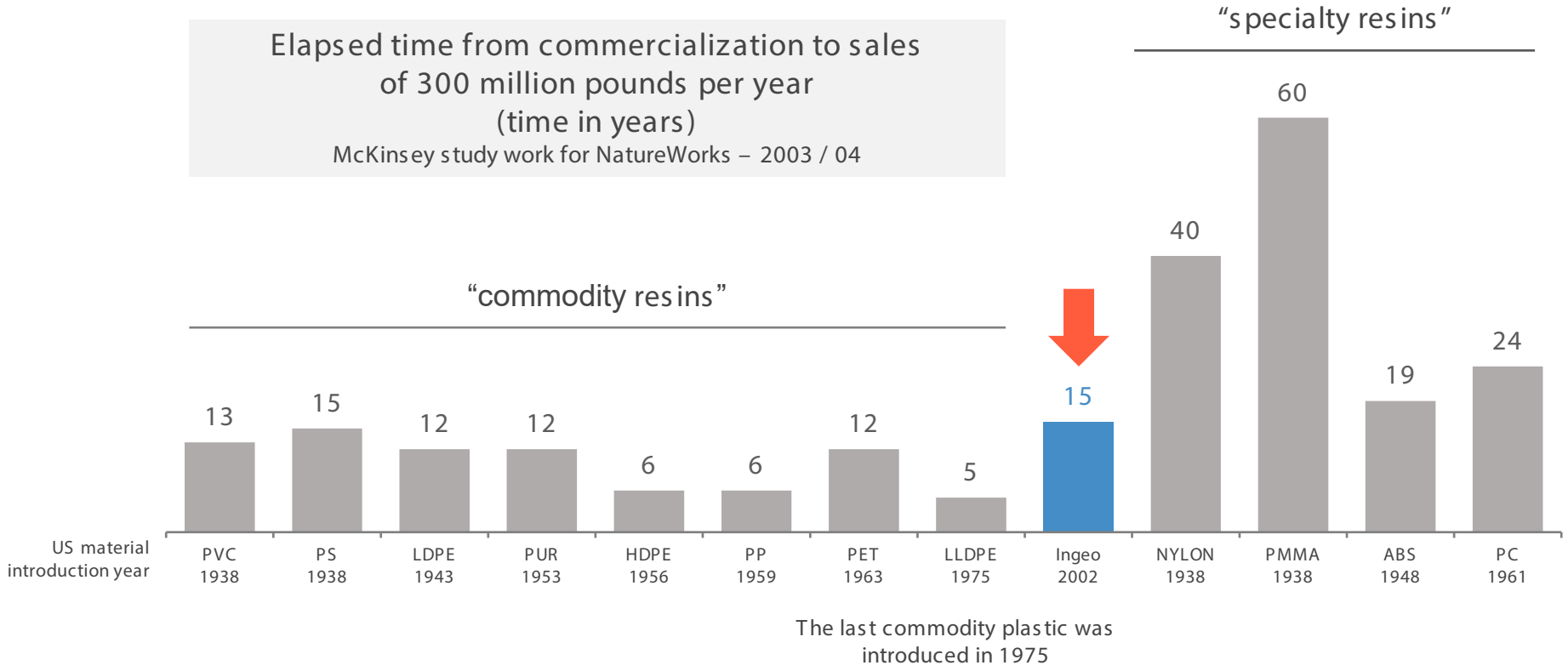
2016 — NatureWorks opens new $1M R&D facility for fermentation to lactic acid research

2020 — Announced additional lactide monomer purification technology to expand the availability of Ingeo biopolymer from Blair facility

2021 — NatureWorks passes final authorization to construct a fully integrated 75kta Ingeo PLA manufacturing facility in Thailand

2025 — NatureWorks Thailand manufacturing facility anticipated completion

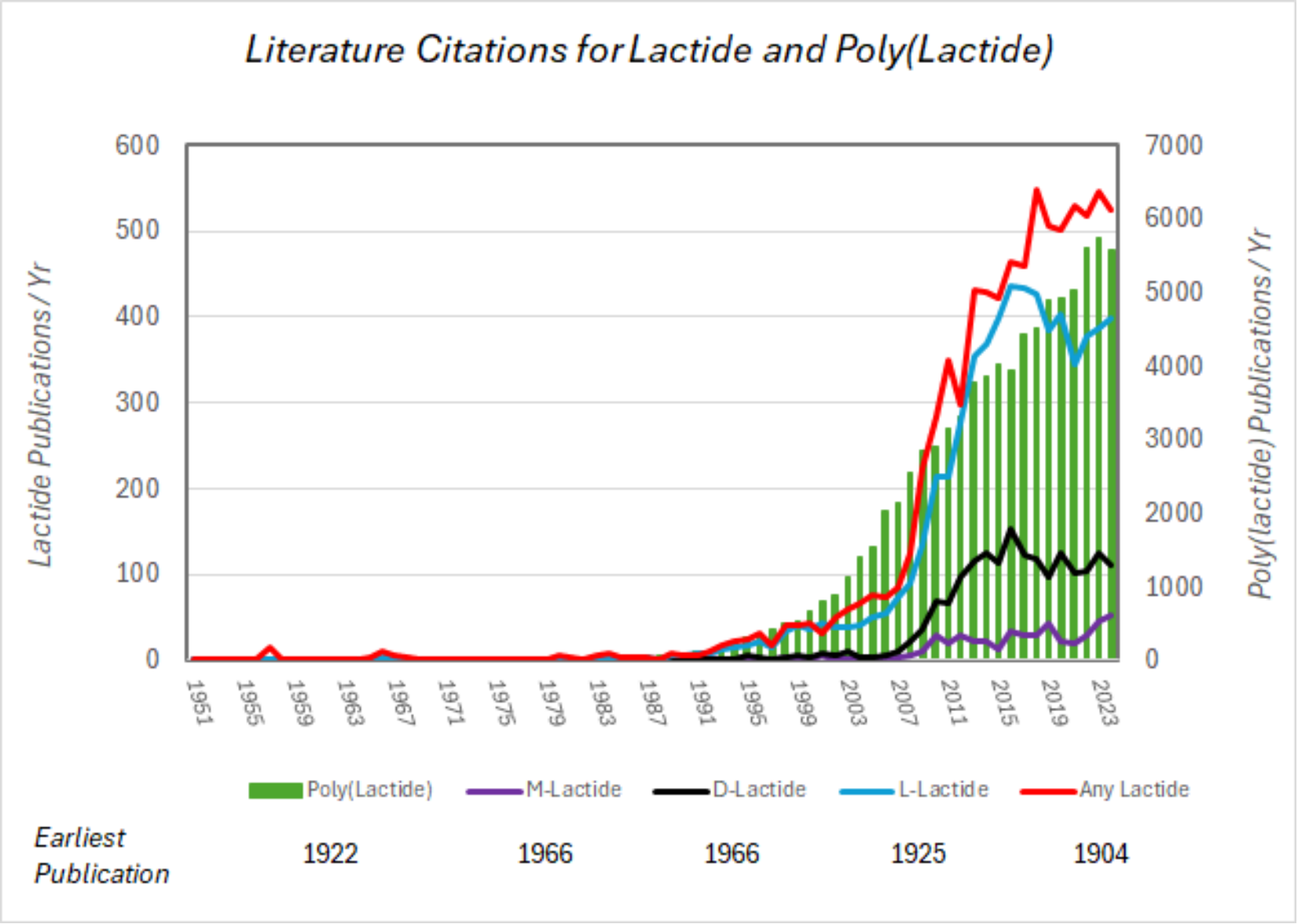
It took NatureWorks 15 years to first fill out capacity of the plant opened in 2002



PLA polymer was first identified in the 1920's when Wallace Carothers (the inventor of nylon) began working on it at DuPont

..we did not think it would take that long.

The Study of Lactide and Poly(Lactide) in Chemistry



Author	Count
Chen, Xuesi	286
Hillmyer, Marc A.	213
Dubois, Philippe	168
Tsuji, Hideto	152
Ren, Jie	151


VISIBILITY
MATURITY
Forbes
Plastic Fantastic?
Kathleen Bader wants to save the world from polluting oil plastics with her healthy corn polymers.
By Elizabeth MacDonald
Versace Adoption
TECHNOLOGY TRIGGER 2002
Walmart Adoption
PEAK OF INFLATED EXPECTATIONS 2004-2005
Marketside
MANGO PEACH SALSA
Apparel Market Not a Fit
Sun Chips Withdrawal
TROUGH OF DISILLUSIONMENT 2011
Sun Chips
ORIGINAL
SLOPE OF ENLIGHTENMENT
Compostable food serviceware & packaging designed to focus on diverting food away away from landfills
Makerbot Adoption & 3D Printing Launches
MakerBot Replicator 2
COMPOSTABLE
OFF THE EATEN Path
chickpea veggie crisps
New (quieter) flexible film structures launch for compostable food packaging
PLATEAU OF PRODUCTIVITY
Brands like PG Tips and Covim launch compostable tea bags and coffee capsules
Paper coatings free of PFAS and fit both composting and recycling streams
Peyr gl i wmwxMki s $™$ TPE$/$TL EGX™$TL E$ gsq t syr h$s v$vs jxi v$ r s r { szi r wm}kmri
We all start with a “killer app”.
Most of the time it’s wrong and we need to continue to drive knowledge.

2017-2018 was when consumer advocacy, government regulation, and NGO frameworks came together on plastics

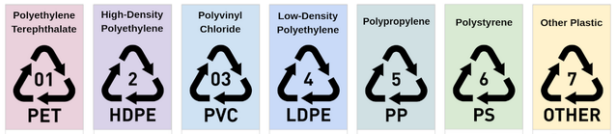
1983

Brundtland Commission put forth the conceptual framework for the three pillars of sustainable development: economic growth, environmental protection, and social equality, which would later be coined the “triple bottom line.”

1988

IPCC established to assess risk of climate change. Reports used to inform international climate policy.

Society of the Plastics Industry introduces resin identification codes



1992

Curbside recycling programs in the US reach 5,202 communities

1997

Kyoto Protocol established as the first international treaty aimed at reducing greenhouse gas emissions

2000

EPA confirms the link between plastic waste and global warming. Encourages recycling to reduce GHG emissions.

2007

Massachusetts vs EPA sets precedent for EPA to regulate CO2 and other GHG’s as pollutants

2015

Paris Agreement established as the most significant global climate agreement to date & requires all countries to set emissions-reduction pledges.

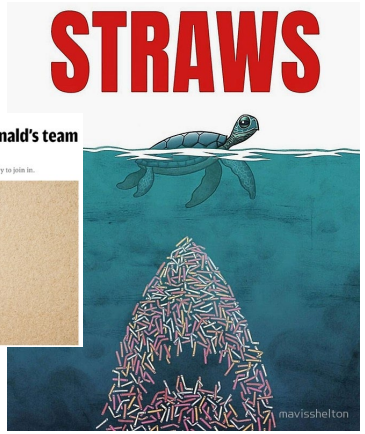
2016

Ellen MacArthur Foundation & the World Economic Forum publish the New Plastics Economy report which outlines principles of a circular plastics economy

2017-2018

China announces Operation National Sword to stop importing “recycled” plastics from the US & EU

EU develops the Single-Use Plastics Directive a holistic effort to regulate plastics.



The Telegraph

PG tips switches to plastic-free tea bags after 200,000 sign gardener’s petition

Starbucks to Eliminate Plastic Straws Globally by 2020
July 9, 2018

What's next? Expansion and scale is critical as global brands pledge plastics changes by 2025

Make 100% of our packaging recyclable globally by 2025. Use at least 50% recycled material in our packaging by 2030.

By 2025, halve use of virgin plastic, by reducing absolute use of plastic packaging by more than 100,000 tons and accelerating use of recycled plastic.

Every piece of packaging, from bottle caps to yogurt cups, will be reusable, recyclable, or compostable by 2025.

100% of our packaging is recyclable or reusable by 2025.

Reduce global use of virgin petroleum plastic in their packaging by 50% by 2030.

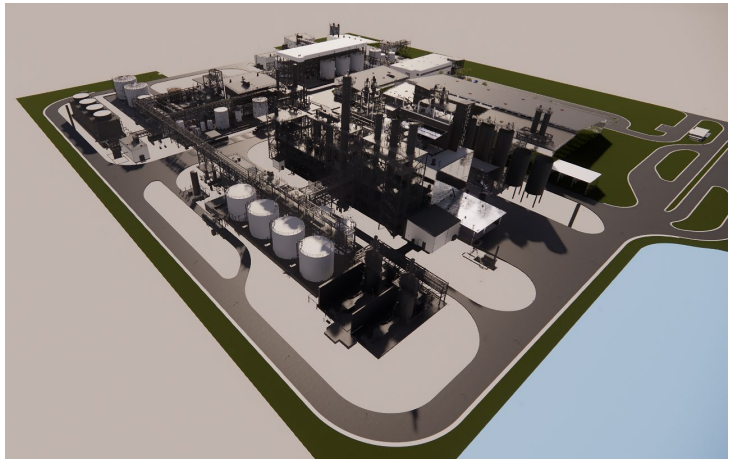
100% of their plastic packaging will be reusable, recyclable or compostable by 2025.

Design 100% of packaging to be recyclable, compostable, or biodegradable by 2025.

100% recyclable or compostable packaging material by 2025.

Under construction: New Fully Integrated Ingeo Manufacturing Plant in Thailand

- 75,000 tons per year nameplate capacity
- Dedicated Ingeo manufacturing with integrated lactic acid, lactide, and polymer manufacturing sites
- Located in Nakhon Sawan Province, Thailand
- On track to complete construction with full production anticipated in 2025
- Will produce the full portfolio of Ingeo grades
- Feedstock (sugar cane) will be sourced within a 50km radius
- Energy co-generation from onsite utilities supplier
- 2023: 2 million safe work hours milestone!



Scaling isn’t limited to manufacturing alone.

Sustainable Feedstocks

Manufacturing Ingeo

Converting Ingeo at Commercial Speed & Scale

Performance of Applications Made with Ingeo

Circularity & Closing the Loop

We are investing in scaling each step of the supply chain to support today’s demand, but also support the next generation technologies that will create the meaningful step change in scale of use for biopolymers in plastics & fibers applications.

Ingeo can be made into many applications looking for new performance & sustainability attributes

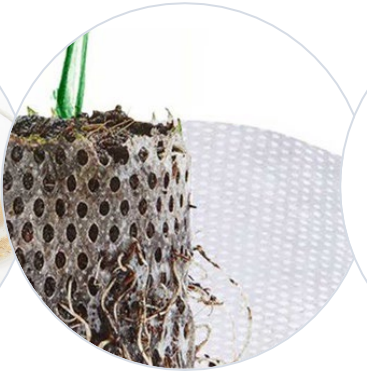

extrusion paper coatings


rigid food packaging

clear drink cups


coffee pods


tea bags


landscape materials


diapers


hygiene masks


household goods


refrigerator liners


3D printing filaments

flexible food packaging

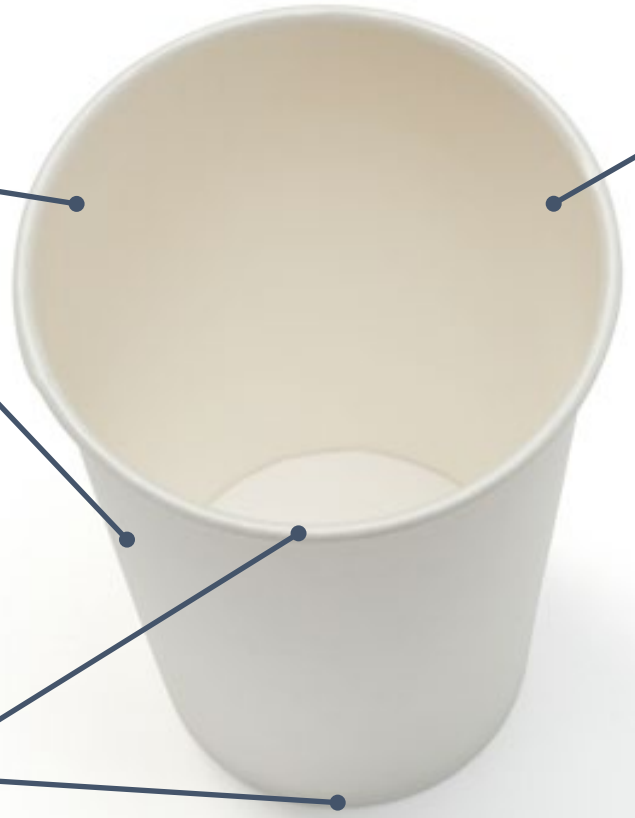

beauty

film bags and bin liners

Simple Paper Cup?

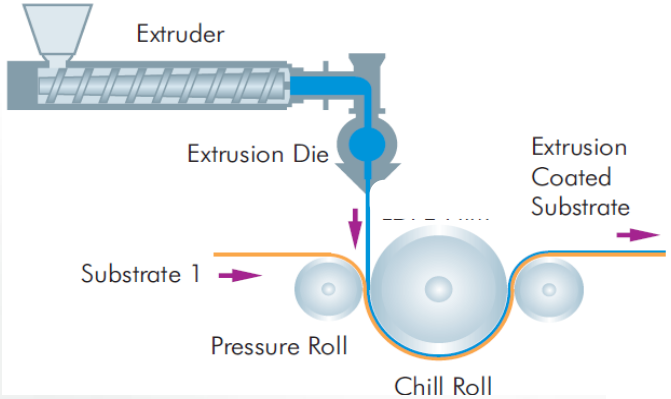
Safe Serviceware

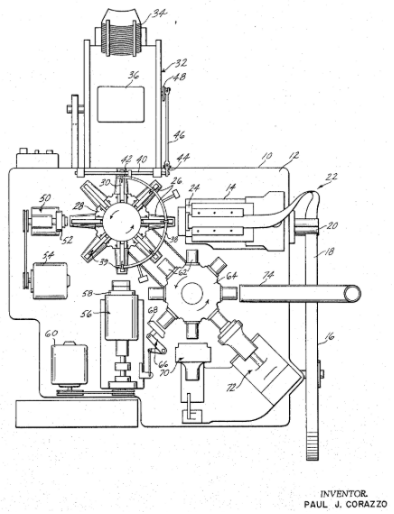
- Certified **compostable, repulpable, & recyclable**
- FDA compliant
- **No PFAS or other fluorinated chemicals**
- No taste or odor impact
- Approach 100% biobased



Melt Processing

- Modeled the process of coating paper to recommend **optimizations that increase output and line speeds by 150-200%**
- Stable web for faster line speeds, lower coating weights, less scrap

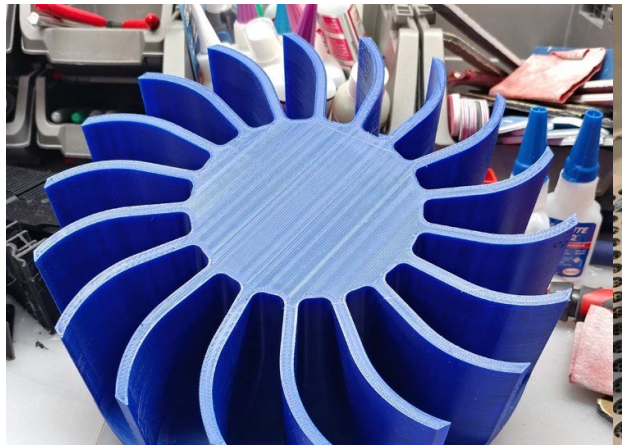


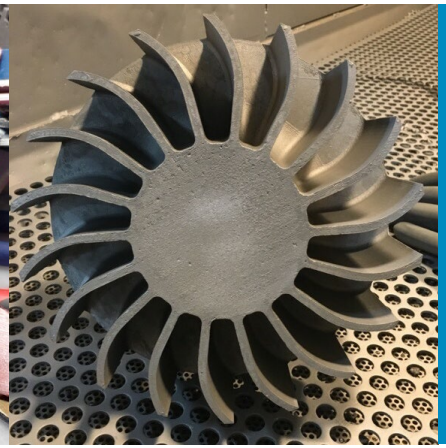


Cup Making

- Tougher coating for pinhole free cup at fastest production speeds
- Improved flow and penetration into paperboard to reduce coating weights and improve cup sealing range

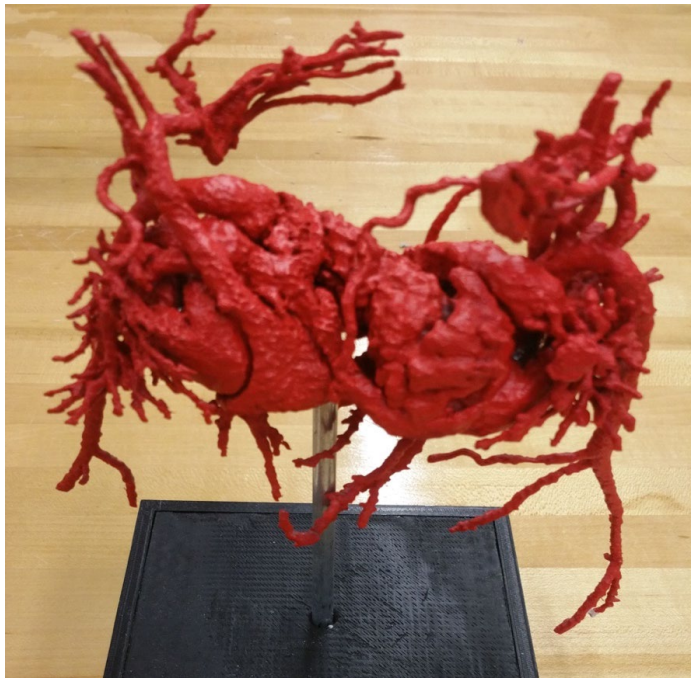
3D printing with Ingeo is leveraged in desktop and industrial applications including medical, foundry & large format





Metal Casting

Positive images for molds are accurate, cost-effective, and burn out cleanly with no residues.



Earl E. Bakken University of MN Medical Devices Center

Prototype of conjoined twins heart

Images courtesy of Adaptiiv

Chemotherapy bolus

Patient-specific accessories that significantly reduce air gaps, spare healthy tissue, and provide superior dose distribution compared to traditional methods

Large Format

Chairs mirror river rocks, are customized to match aesthetic of the space & easily printed.

90%

of a brewed pod is coffee, valuable organics mostly **lost** to landfills due to a complicated recycling process from packaging

Compostable coffee pods meet the rigorous, high heat and impact requirements for brewing while maintain coffee flavor and aroma through barrier options in the capsule & lidding

Excellent leakage seal

For extended shelf-life

High thermal resistance

You can’t do it alone . . . R&D Partnerships

Center for Sustainable Polymers (CSP - UMN)

CSP participants aim to design, prepare, and implement polymers derived from renewable resources for a wide range of advanced applications, and to promote future economic development, energy efficiency, and environmental sustainability in the emergent area of biobased products.

Center for BioPlastics and BioComposites (CB2 - NDSU)

The Center for Bioplastics and Biocomposites (CB2) develops high-value biobased products from agricultural and forestry feedstocks. Such materials include plastics, coatings, adhesives, and composites.

The Nonwovens Institute (NWI - NC State)

Facilitate the development of next-generation fiber-based materials and products, which lead to revolutionary and often life-enhancing products for both industrial and consumer marketplaces.

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Thank You

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Audience Questions & Answers

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Closing

Shannon Schlecht
Executive Director
AURI

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Best one word takeaway from the day?

ⓘ Start presenting to display the poll results on this slide.

2024 NEW USES FORUM
auri Agricultural Utilization Research Institute

Thank you for participating in the New Uses Forum 2024!

Networking Reception
4:30-6:30 PM

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