PLASTICS
INDUSTRY ASSOCIATION

Opportunities and Challenges for Biobased Plastics R&D

Patrick Krieger, PLASTICS

We are the full supply chain


Recyclers
Material Suppliers
Brand Owners
Equipment Makers
Processors
Mold Makers

Bioplastics Division

- The PLASTICS Bioplastics Division works to develop bioplastics as an integral part of the plastics industry by:
  - **Educating** consumer, the plastics industry, and the government about bioplastics
  - **Advocating** on behalf of the industry to regulators and legislators
  - **Collaborating** with organizations and companies to promote bioplastics

BIOPLASTICS
DIVISION

Current Members

- Attis Innovations
- BASF Corporation
- BiologiQ, Inc.
- Braskem America
- The Coca-Cola Company
- Danimer Scientific
- Earth Renewable Technologies
- Eastman Chemical Company
- Heritage Bags
- Center for Bioplastics and Biocomposites
- Jarden Plastic Solutions
- JinHui ZhaoLong High Technology Co.
- Leistritz
- NatureWorks LLC
- Novamont North America, Inc.
- PepsiCo
- Plastic Technologies, Inc.
- PolyOne Corporation
- Teknor Apex Company
- Total Corbion PLA bv

Recent Bioplastics Division Activities/Projects

BIOPLASTICS WEEK

Innovation in Bioplastics Award 2018

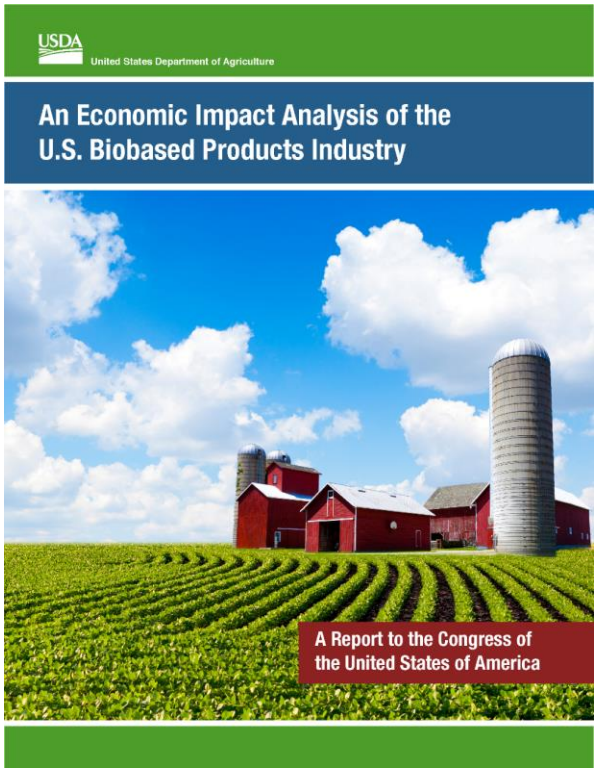
September 17-21,2018
#BioplasticsWeek

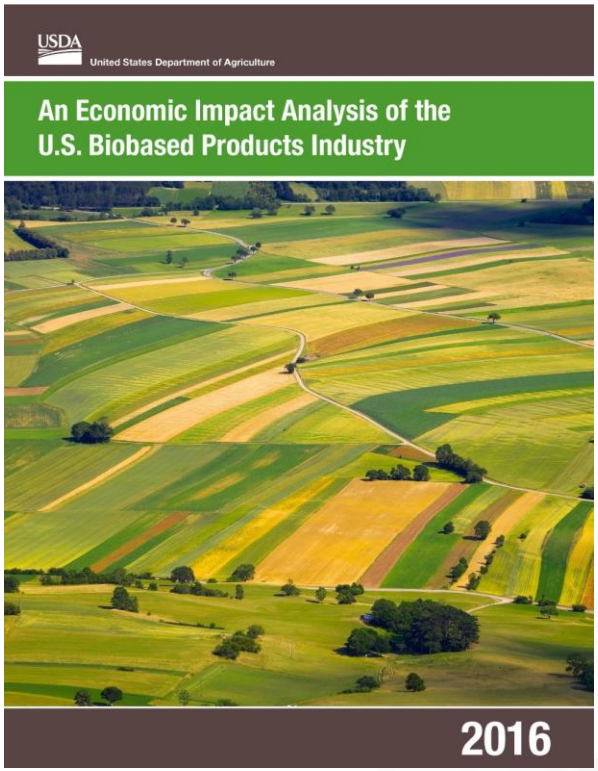
For more information, go to: plasticsindustry.org/bioplastics

USDA BioPreferred® Program

- Increase the purchase and use of biobased products
- Two major parts of the program:
  - Mandatory purchasing requirements for federal agencies
  - Voluntary labeling initiative for biobased products
- ~3,000 products certified and labeled products

BioPreferred®


USDA
United States Department of Agriculture
An Economic Impact Analysis of the U.S. Biobased Products Industry
A Report to the Congress of the United States of America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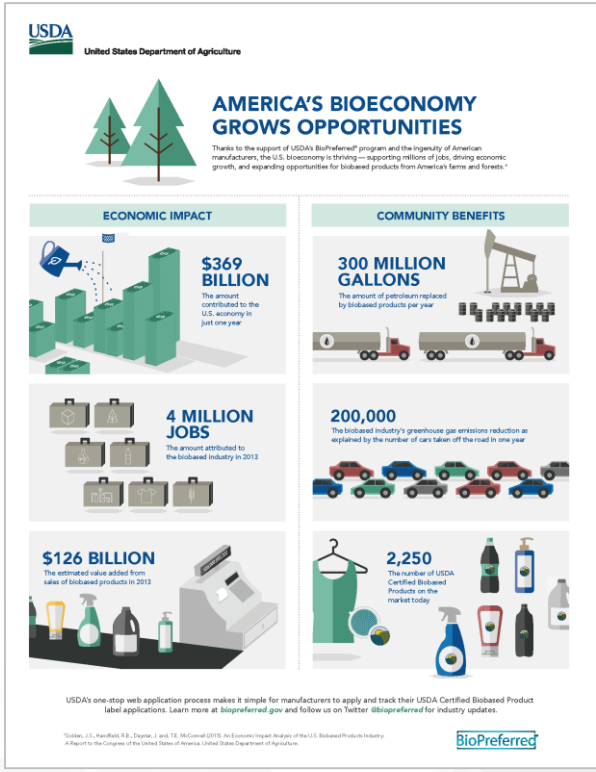
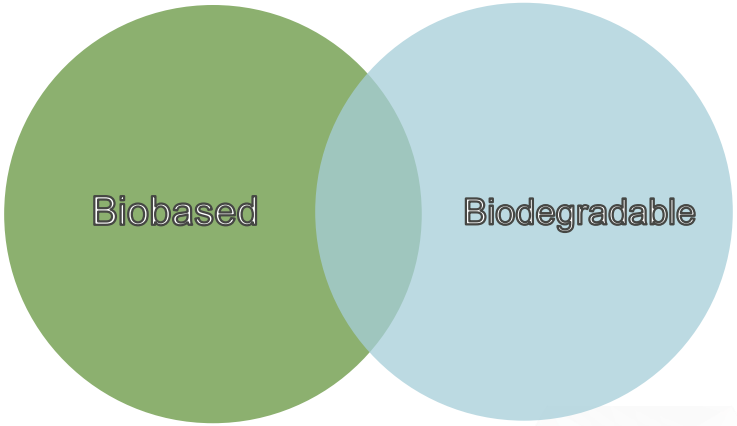
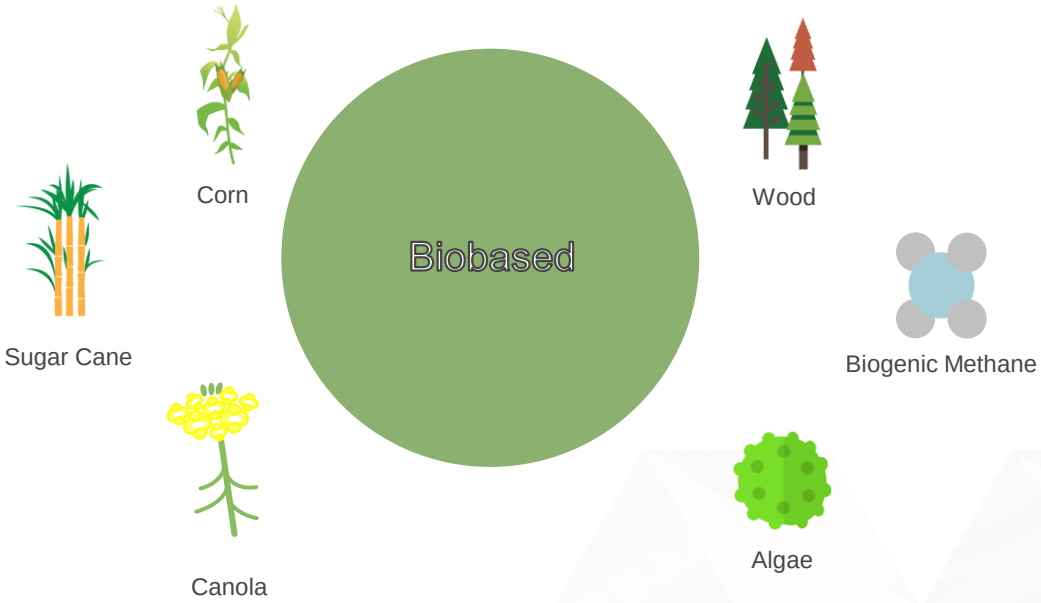

USDA
United States Department of Agriculture
AMERICA'S BIOECONOMY GROWS OPPORTUNITIES
Thanks to the support of USDA's BioPreferred® program and the ingenuity of American manufacturers, the U.S. bioeconomy is thriving — supporting millions of jobs, driving economic growth, and expanding opportunities for biobased products from America's farms and forests.*
ECONOMIC IMPACT
$369 BILLION
The amount contributed to the U.S. economy in just one year
4 MILLION JOBS
The amount attributed to the biobased industry in 2013
$126 BILLION
The estimated value added from sales of biobased products in 2013
COMMUNITY BENEFITS
300 MILLION GALLONS
The amount of petroleum replaced by biobased products per year
200,000
The biobased industry's greenhouse gas emissions reduction as explained by the number of cars taken off the road in one year
2,250
The number of USDA Certified Biobased Products on the market today
USDA's one-stop web application process makes it simple for manufacturers to apply and track their USDA Certified Biobased Product label applications. Learn more at biopreferred.gov and follow us on Twitter @biopreferred for industry updates.
BioPreferred

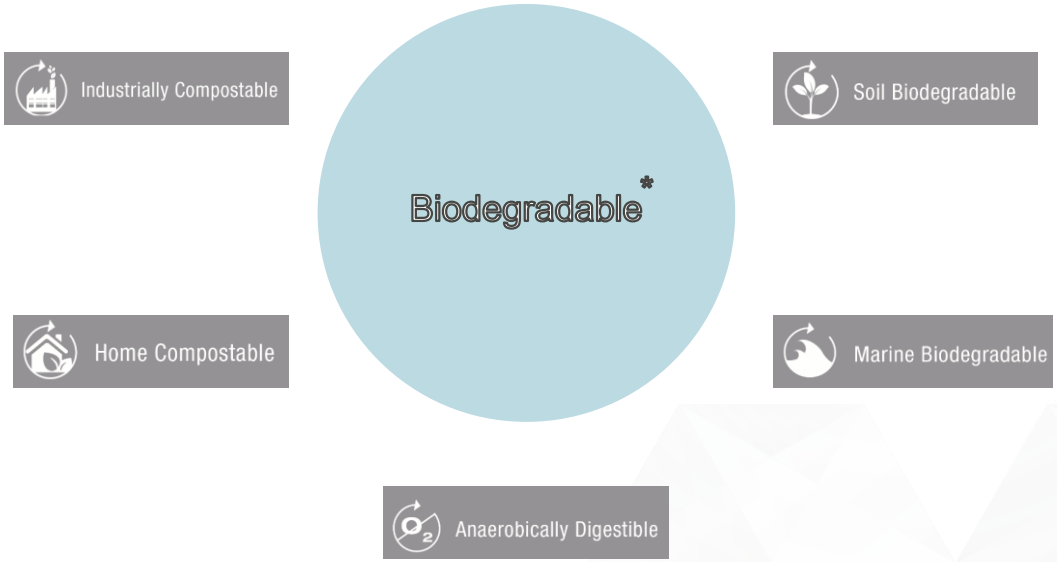

Biobased
Biodegradable


Biobased
Biodegradable

A biobased bioplastic is made, wholly or in part, from renewable resources



Degrade through biological action in a defined environment into carbon dioxide or methane, water, and biomass.



*As per ASTM D6400 – “Standard Specification for Labeling of Plastics Designed to be Aerobically Composted in Municipal or Industrial Facilities”

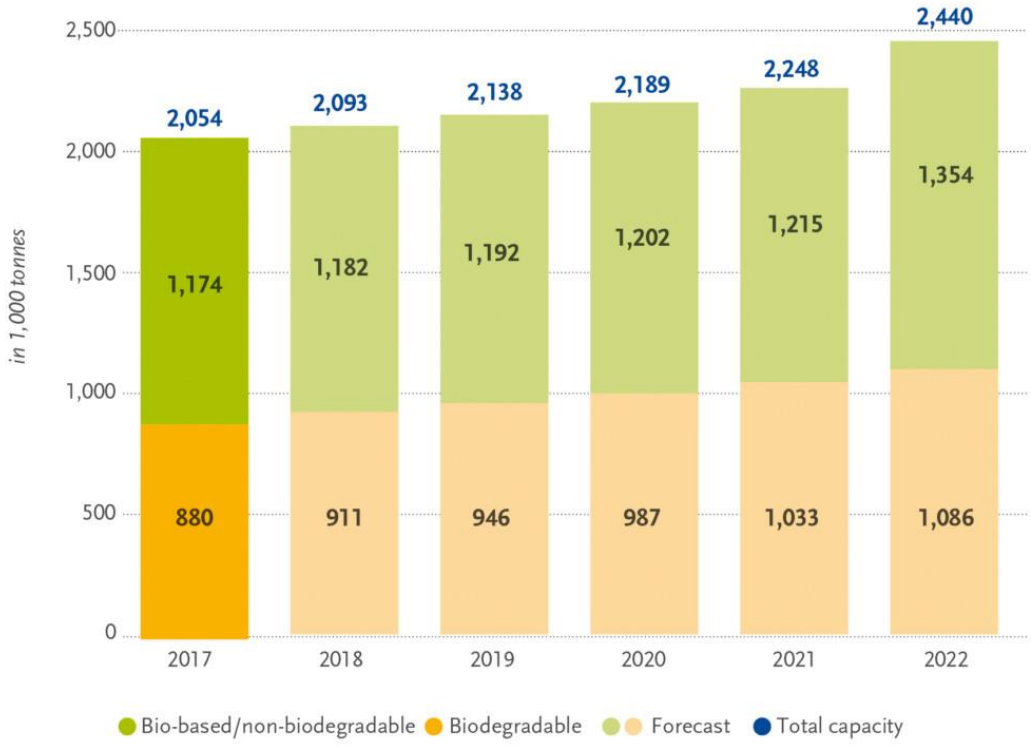
Why Biobased Bioplastics?

- Diversification of feedstocks
- Potential reduction in greenhouse gases
- Consumer and Brand Owners Preferences
- Government Policies

Opportunities

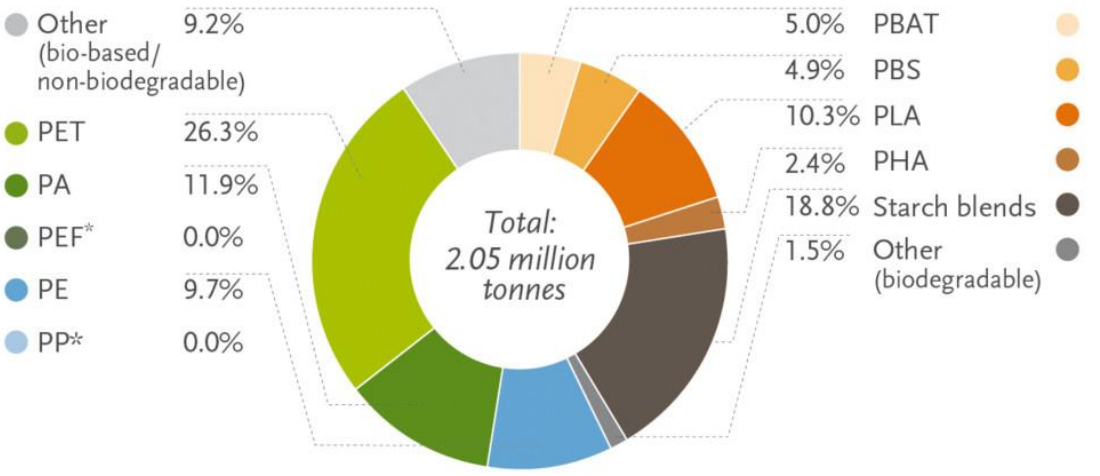
Markets & Trends

Global production capacities of bioplastics



Source: European Bioplastics, nova-Institute (2017).
More information: ***www.bio-based.eu/markets*** *and* ***www.european-bioplastics.org/market***

Global production capacities of bioplastics 2017 (by material type)



*Bio-based PP and PEF are currently in development and predicted to be available in commercial scale in 2020.

Source: European Bioplastics, nova-Institute (2017).
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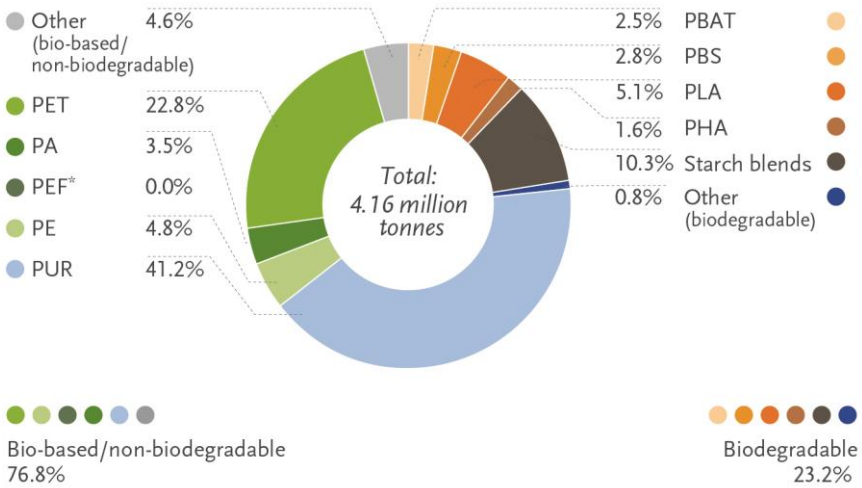
Global production capacities of bioplastics 2016 (by material type)



*PEF is currently in development and predicted to be available in commercial scale in 2020.

Source: European Bioplastics, nova-Institute (2016).
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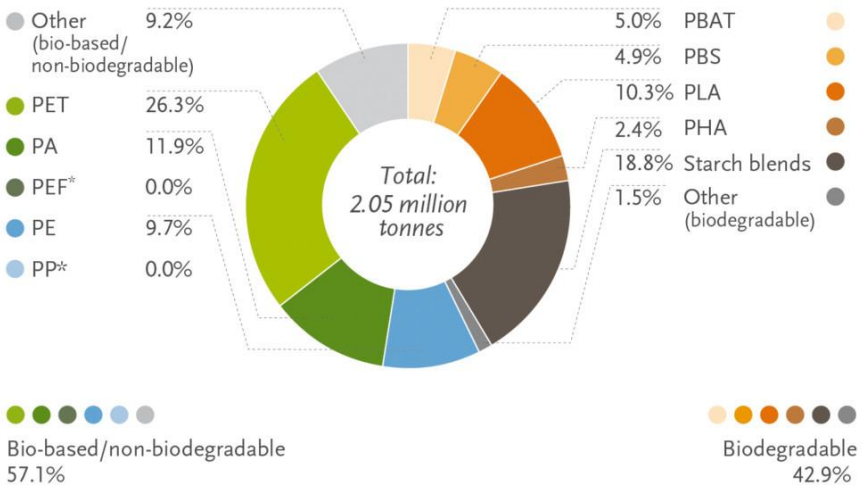

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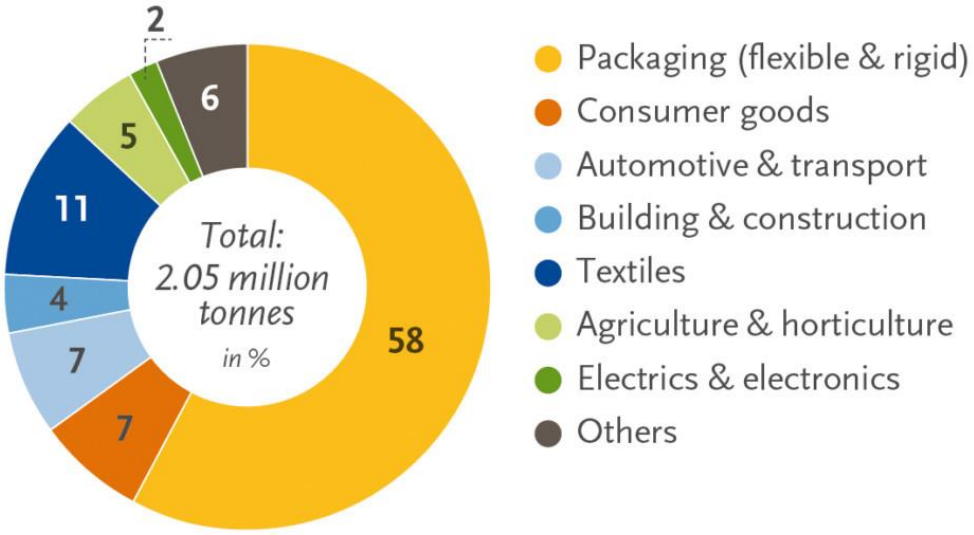
Source: European Bioplastics, nova-Institute (2017).
More information: **www.bio-based.eu/markets** and **www.european-bioplastics.org/market**

Global production capacities of bioplastics in 2017 (by market segment)



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Trends

Polymers, Production, Products

2018 Trends - Polymers

- Furan dicarboxylic methyl ester (FDME) & Polytrimethylene furandicarboxyate (PTF)
- Monoethylene glycol (MEG), Polyethylene terephthalate (PET), & PTF
- Polypropylene (PP)
- Benzene, Toluene, Paraxylene & Xylene

2018 Trends - Production

- Polyhydroxyalkanoates (PHAs)
- 1,3-propanediol (PDO), polytrimethylene terephthalate (PTT), & polyurethanes
- Polylactic Acid (PLA)
- Overall, production is increasing

2018 Trends - Products

- Packaging & Food Service Ware
- Automotive
- Electronics
- Consumer Goods
  - Toys
  - Clothing
  - Footwear

Challenges

Data

- US Market Data Gaps
- No NAICS Codes

Investment

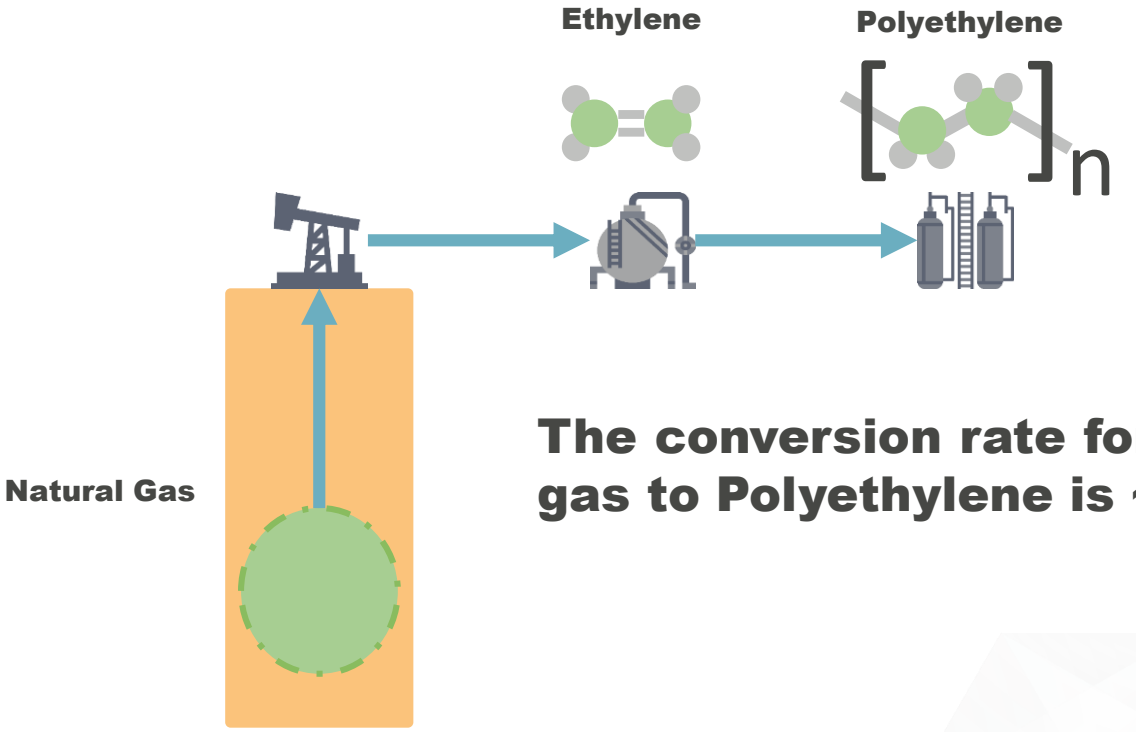
- Federal Grants
  - Encourage review panels to be feedstock agnostic

Access to Sustainable End of Life Options

- Encourage the development of new industrial composters and aerobic digesters
- Allow compostable plastic products to be used in USDA organic program, remove 100% biobased content requirements

Infrastructure/Logistics

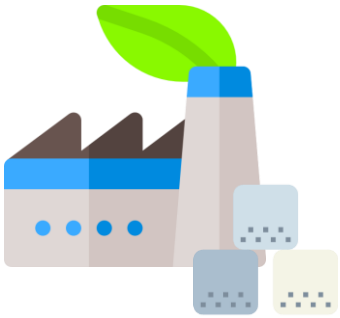
- Compared to “fossil” based plastics, biobased bioplastics have a wide array of challenges to feedstock access which need to be accounted for when developing a new feedstock and/or polymer.



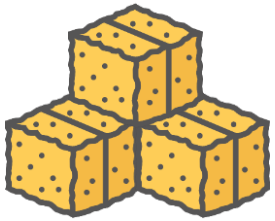
The conversion rate for Ethylene gas to Polyethylene is ~97%

Conversion Rates for Biobased Polymers

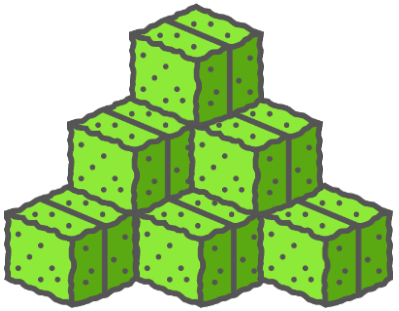
Polymer	Carbohydrate
Polylactic Acid	1 : ~ 1.6
Biobased PET	1 : ~ 4
Biobased PE	1 : ~ 5



150 kT
carbohydrates



300 kT lignocellulosic
material (bone dry)



600 kT lignocellulosic
material (actual biomass)

Operate 365

or

*Numbers are approximations

Other Logistics Considerations

- Seasonality
- Storage
- Shortages
- Locations

Thank You

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