Building the Biobased Economy

Biomass Research & Development Technical Advisory Committee

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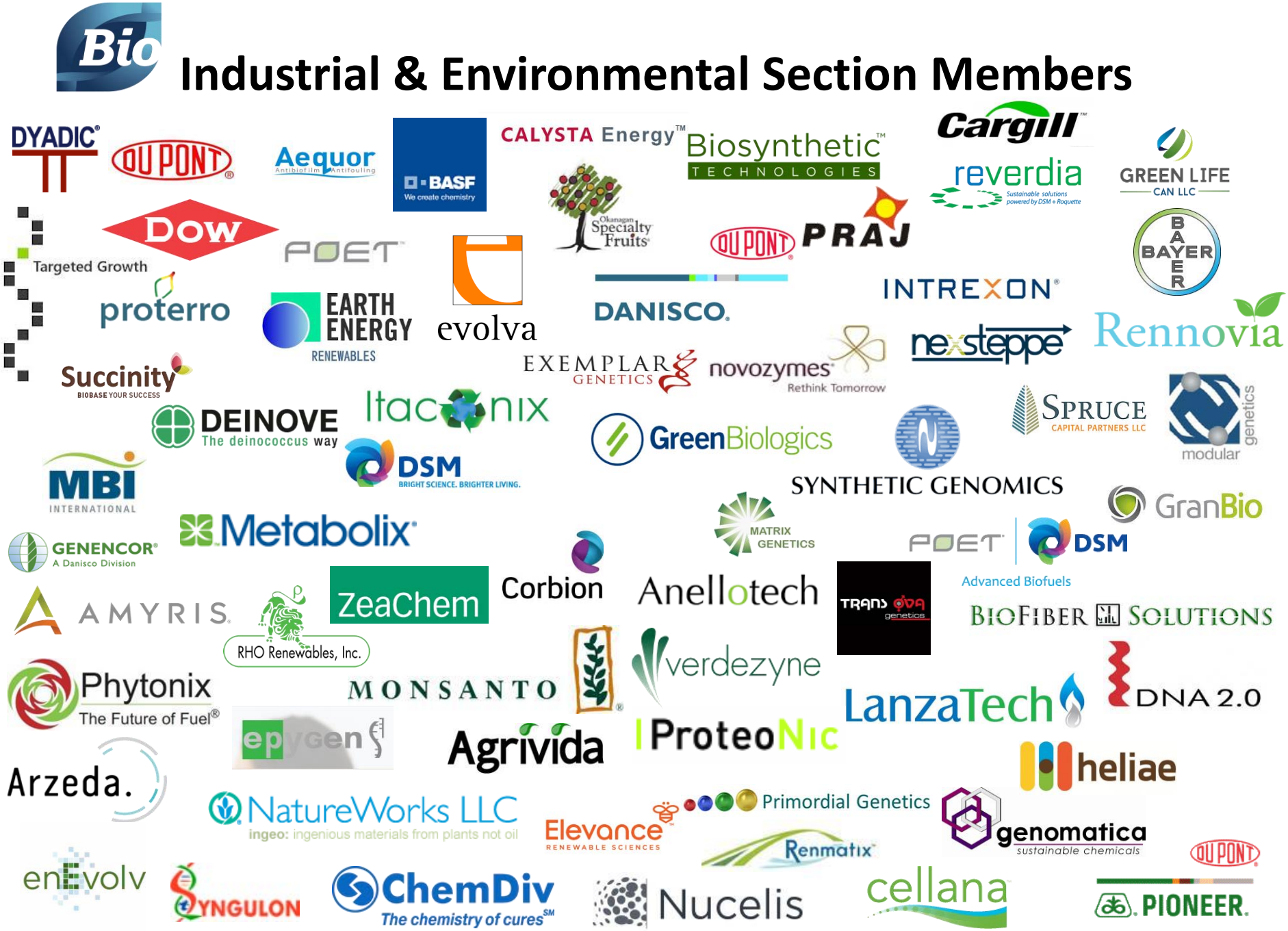
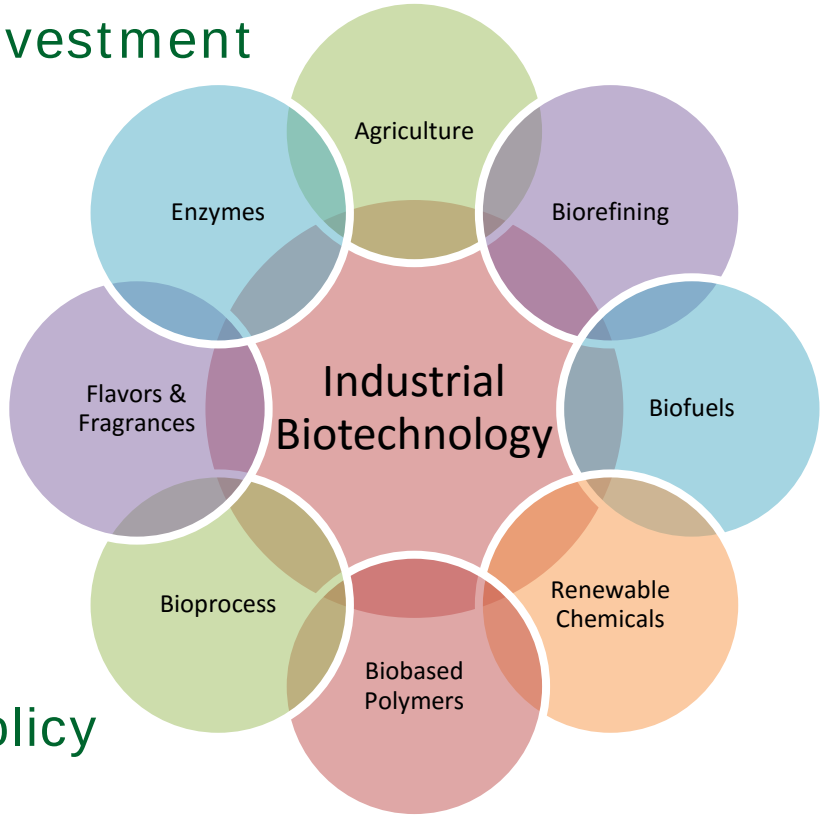
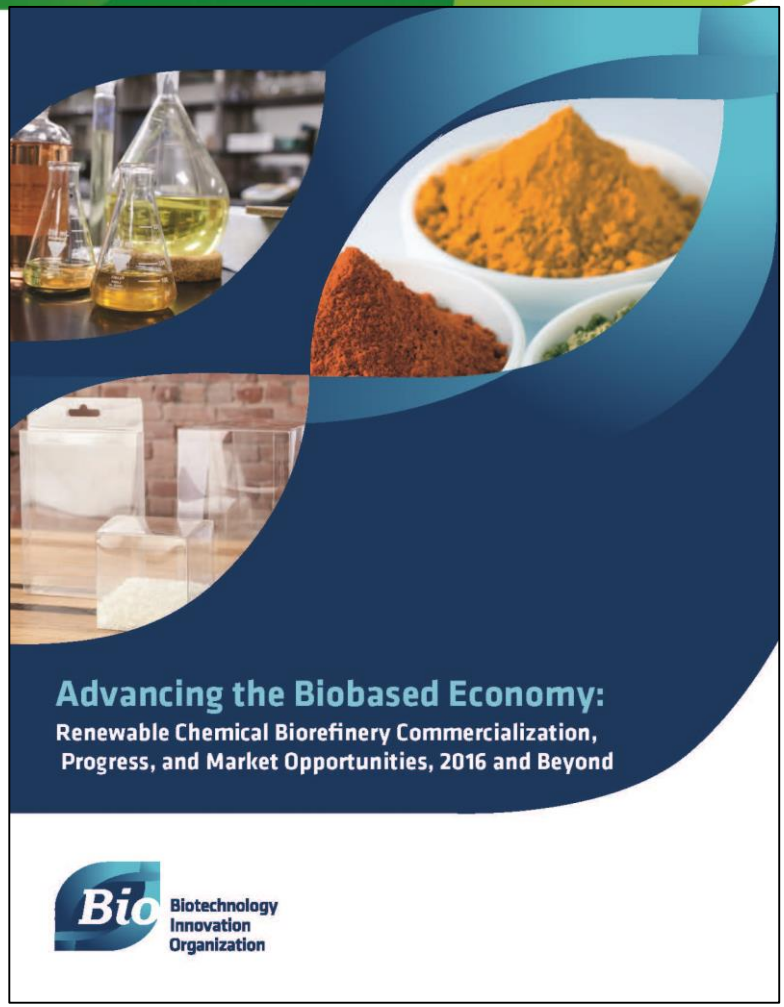


The Innovation Ecosystem

Investment



Policy



Top Ten Renewable Chemical Building Block Platforms

Value-Added Growth Opportunities

Top Ten Renewable Chemical Building Block Platforms
1,4-Succinic Acid
2,5-Furandicarboxylic Acid
Terephthalic Acid
Isoprene
1,3-Propanediol
Adipic Acid
Itaconic Acid
Glucaric Acid
Levulinic Acid
3-Hydroxypropionic Acid

Top Renewable Chemical Building **Blocks from DOE's 2004 Report**

Building Blocks
1,4 succinic, fumaric and malic acids
2,5 furan dicarboxylic acid
3 hydroxy propionic acid
aspartic acid
glucaric acid
glutamic acid
itaconic acid
levulinic acid
3-hydroxybutyrolactone
glycerol
sorbitol
xylitol/arabinitol

http://www.nrel.gov/docs/fy04osti/35523.pdf

Other Renewable Chemical Platforms

The term 'renewable chemical' means a monomer, polymer, plastic, *formulated product, or chemical substance produced from renewable biomass.*

Acetic acid

Acrylamide

Acrylic acid

Acyl glutamate

1,4-Butanediol (BDO)

iso-Butanol

n-Butanol

C10 and higher hydrocarbons produced from olefin metathesis

Caprolactam

Carboxylic acids produced from olefin metathesis

Diethyl methylene malonate

Dodecanedioic acid (DDDA)

Enzymes

Epichlorohydrin

Esters produced from olefin metathesis

Ethyl acetate

Ethylene glycol

Farnesene

Fumaric Acid

gamma-Butyrolactone

1,6-Hexanediol (1,6-HDO)

Hexamethylenediamine (HMD)

iso-Butene

Isosorbide

Lactic acid

Lactide

Menthol

Methyl ethyl ketone

Nootkatone

Polybutylsuccinate

Polyhydroxyalkonate (PHA)

Polylactic acid (PLA)

Polyethylene (PE)

Polyethylene furanoate (PEF)

Polyethylene terephthalate (PET)

Polyitaconic acid

Polyphenols

Polypropylene (PP)

Polyols from vegetable oils

Polyurethane resins (PUR)

Poly(xylitan levulinate ketal)

1,2-propanediol

Rhamnolipids

Short and medium chain carboxylic acids produced from anaerobic digestion

Steviol

Superabsorbent polymer (SAP)

Unsaturated polyester resins (UPR)

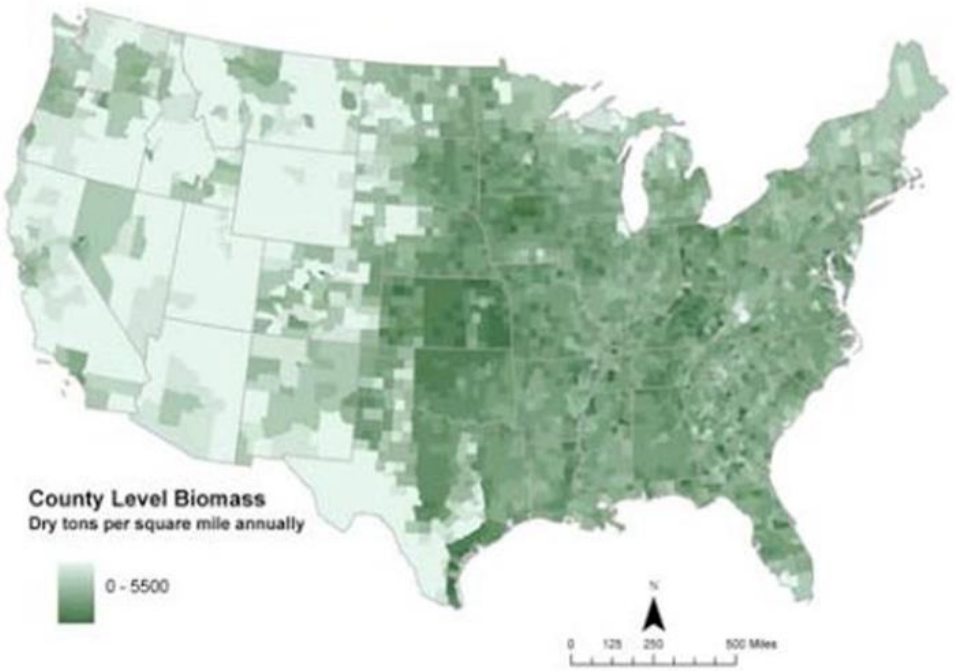
Vanillin

p-Xylene

U.S. Biomass Supply for a Bioenergy and Biobased Products Industry

- U.S. has 1 billion tons of biomass available *without* impacting farm and forest products such as food, feed, and fiber crops
  - Sufficient to replace 30% of nation's current petroleum consumption at a cost-competitive price

Source: U.S. Department of Energy 2016 Billion-Ton Update (U.S. Department of Energy)

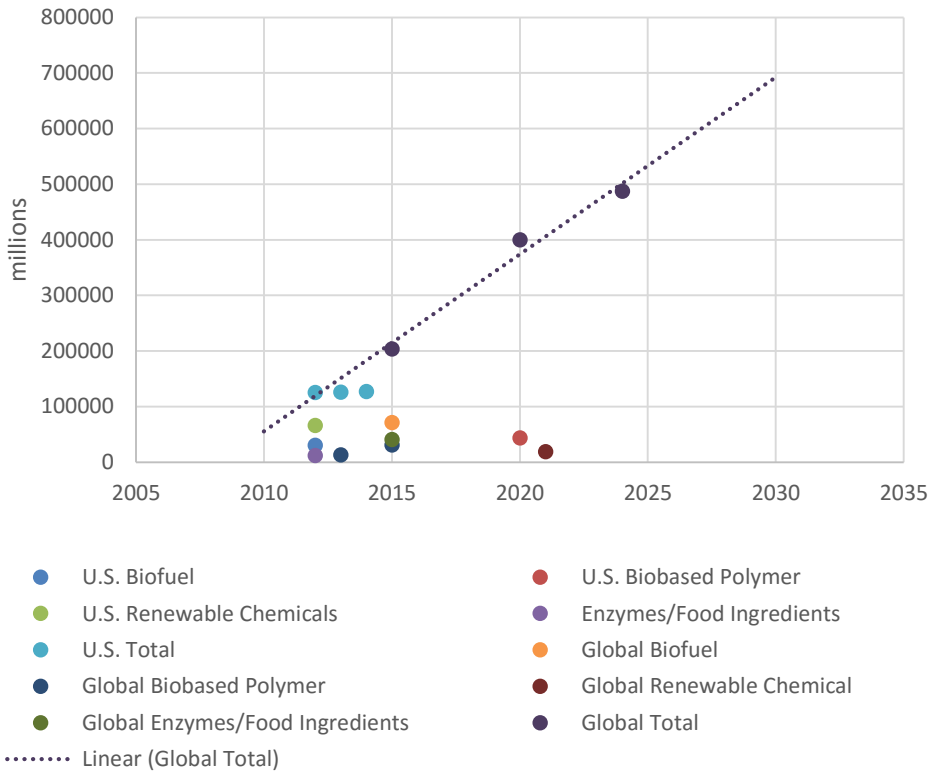


2017 Federal Policy Opportunities/Challenges

- Regulatory reform
- Renewable Fuel Standard
- 2018 Farm Bill
- Tax reform

A Potential Global Economic Powerhouse

- Projected growth for global biobased economy:
  - $203 billion in 2015
  - $400 billion by 2020
  - $487 billion by 2024
- From 2010 to 2015:
  - $9.2 billion invested in industrial biotech
  - $5.3 billion from VC



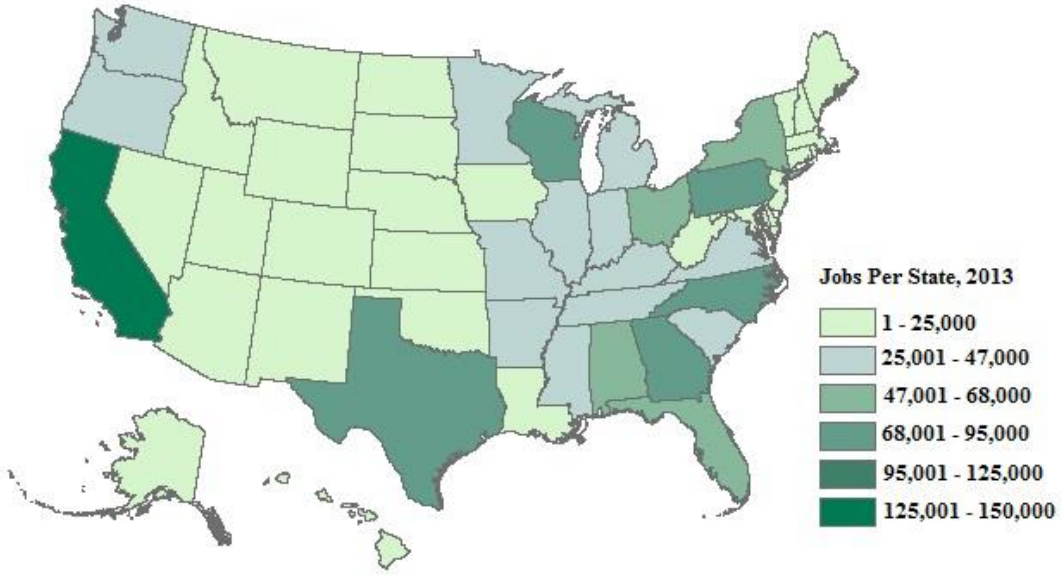
The U.S. Biobased Economy

USDA: An Economic Impact Analysis of the U.S. Biobased Products Industry 2016

4.2 million American Jobs

$393 billion economic value added

For every biobased product job, 1.76 more jobs are created



Greatest numbers of jobs in:
California
North Carolina
Texas
Georgia
Pennsylvania
Wisconsin
Ohio
New York
Alabama
and Florida

https://www.biopreferred.gov/BPResources/files/BiobasedProductsEconomicAnalysis2016.pdf

World Congress on Industrial Biotechnology

July 23 – 26, 2017
Montréal, Canada

Save the Date !

https://www.bio.org/events/bio-world-congress