futurefuel strategies

How U.S. Government Policy Leads the World in Delivering the Bioeconomy

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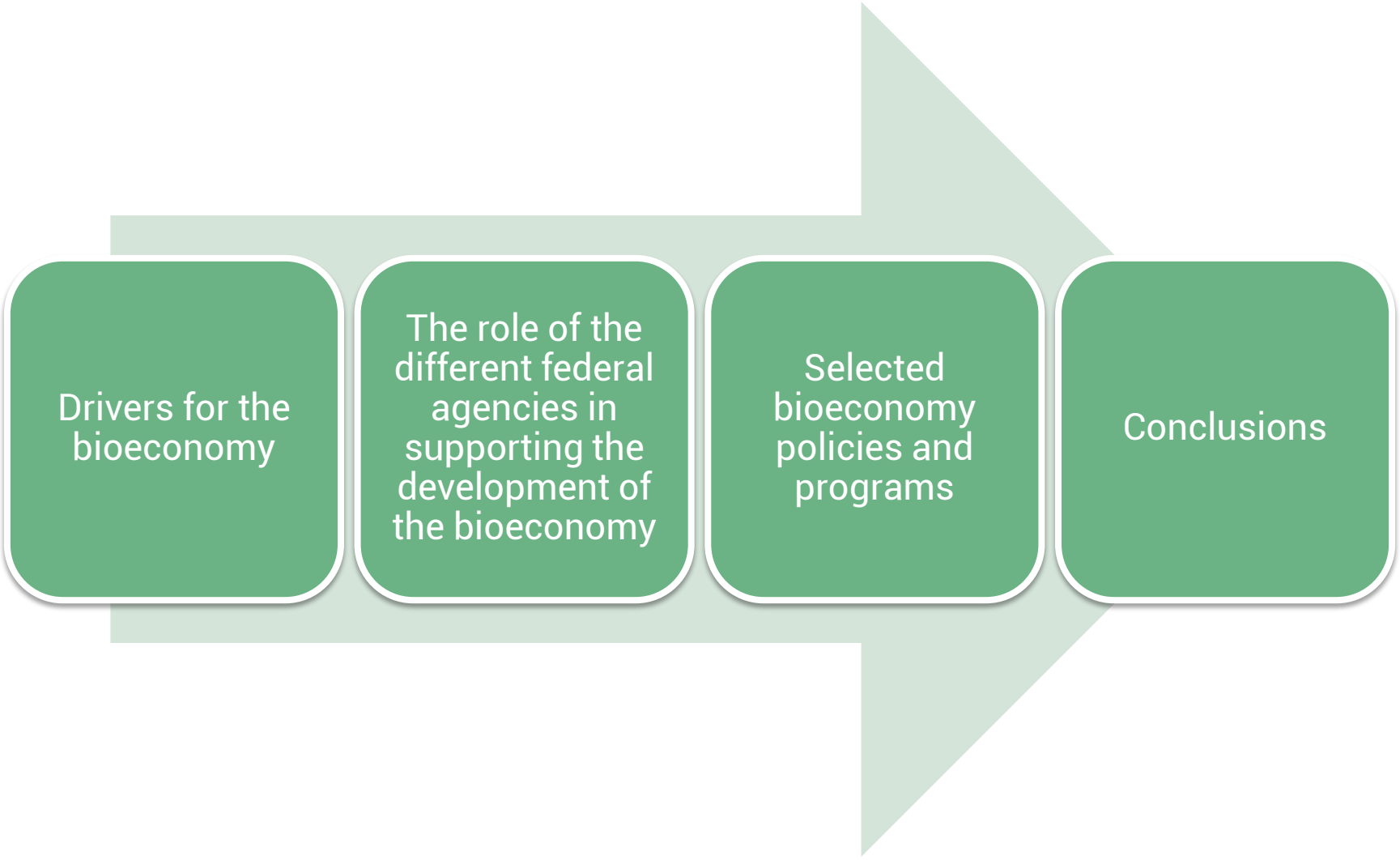
Scaling Up Conference, Ottawa, November 16, 2016

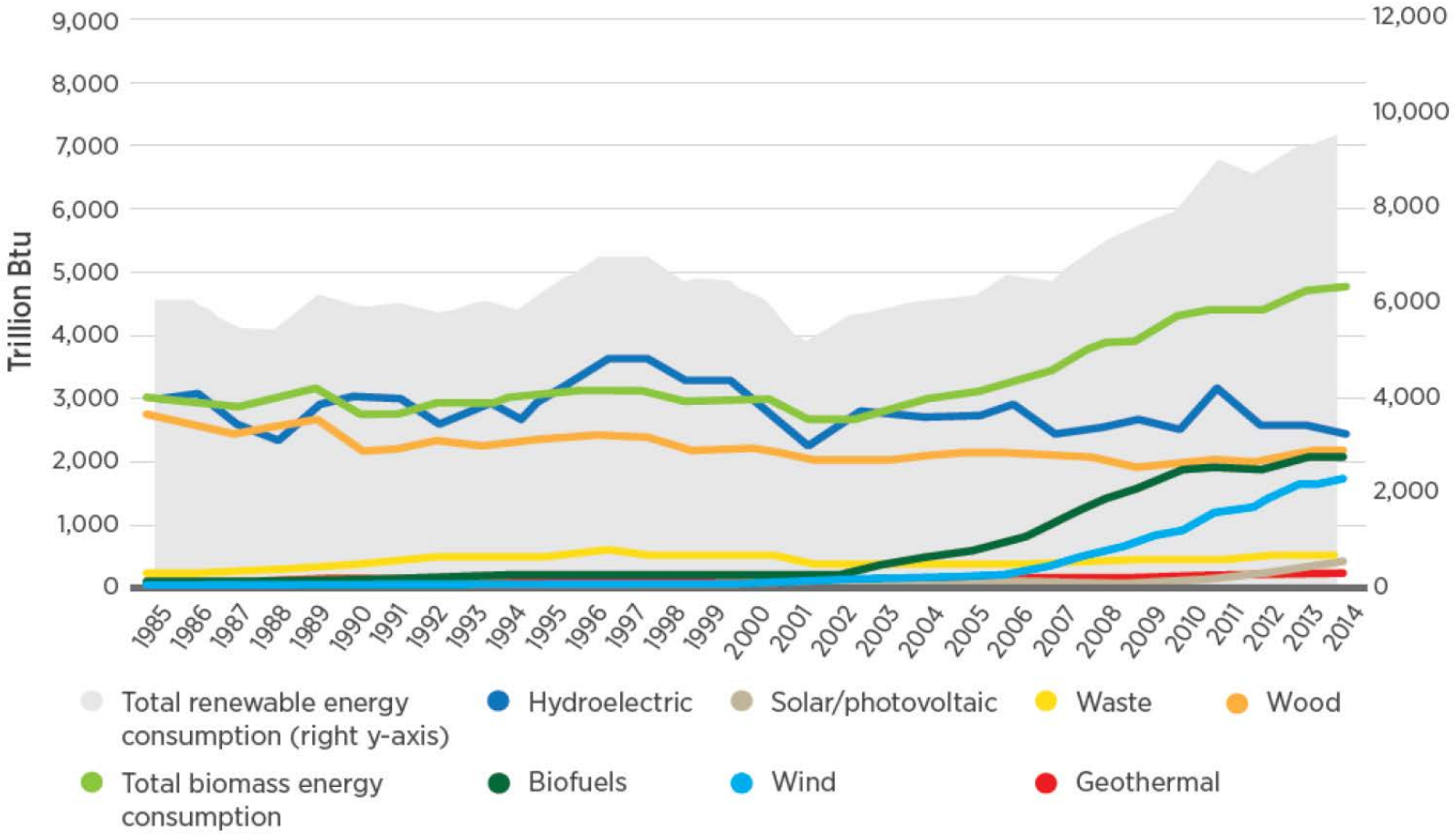
Presentation Overview



Drivers

Biomass is the Largest Source of Renewables' Consumption in the U.S.

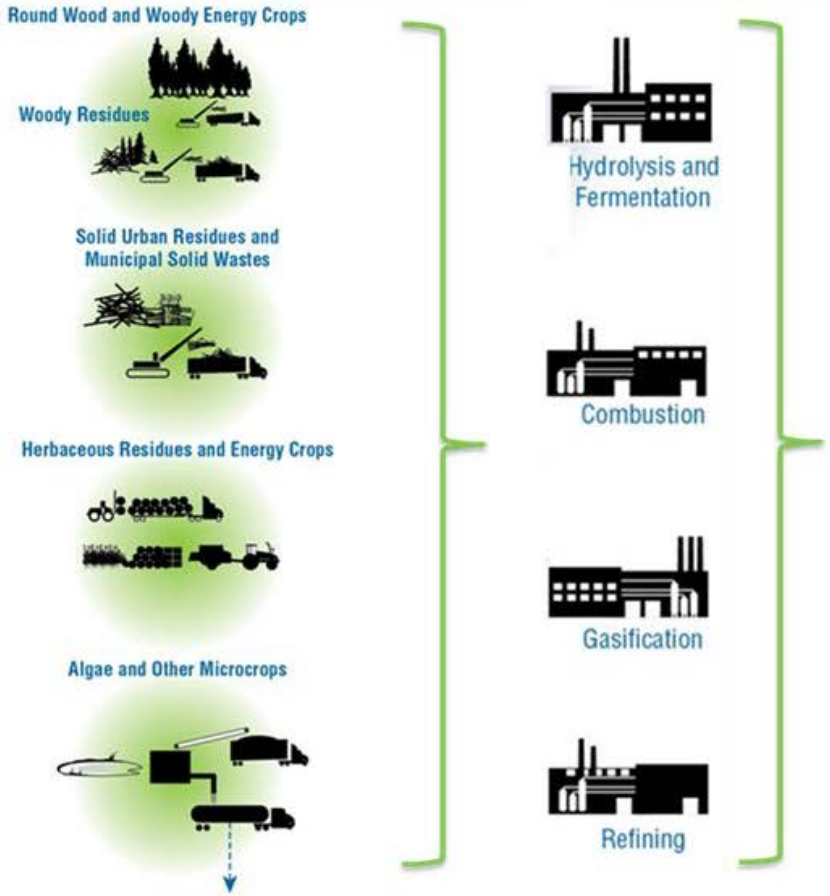
Figure 2.2 | Primary renewable energy consumption by source and total consumption (1985–2014)



Source: Data from EIA (2015d).

The Bioeconomy Concept in the U.S.

Includes Biofuels and Bio-products



DRIVERS

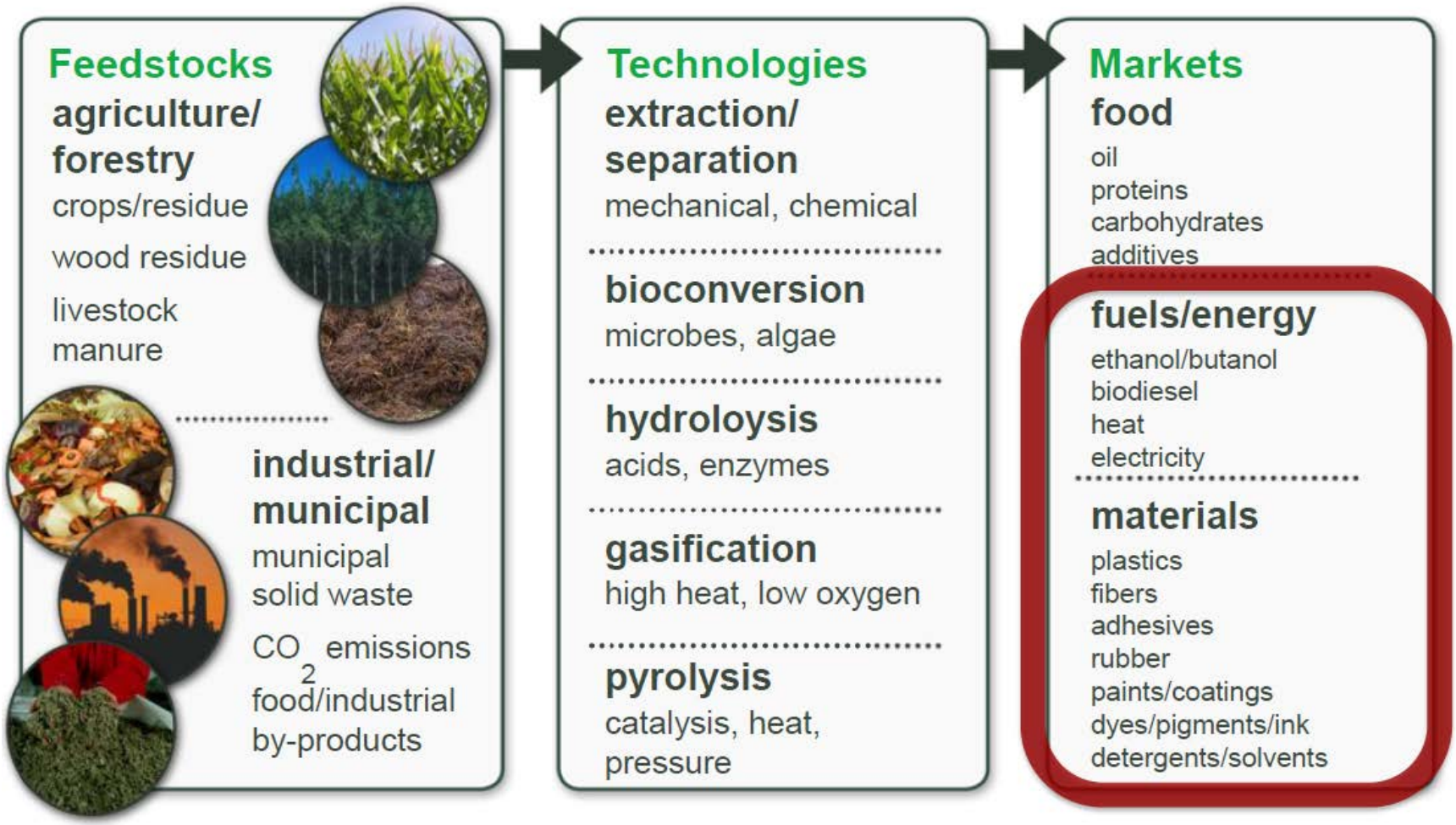
- Revenue and economic growth
- Broad spectrum of new jobs
- Rural development
- Advanced technologies and manufacturing
- Reduced emissions and Environmental Sustainability
- Export potential of technology and products
- Positive societal changes
- Investments and new infrastructure

Definition: "The global industrial transition of sustainably utilizing renewable aquatic and terrestrial biomass resources in energy, intermediate, and final products for economic, environmental, social, and national security benefits."

Source: DOE/EERE/BETO Program

The Advanced Bioeconomy

Includes Biofuels, Bioproducts and Even Food



Source: DOE/EERE/BETO Program

What the Barrel Is Worth…Can the Bioeconomy Capture a Bigger Piece?

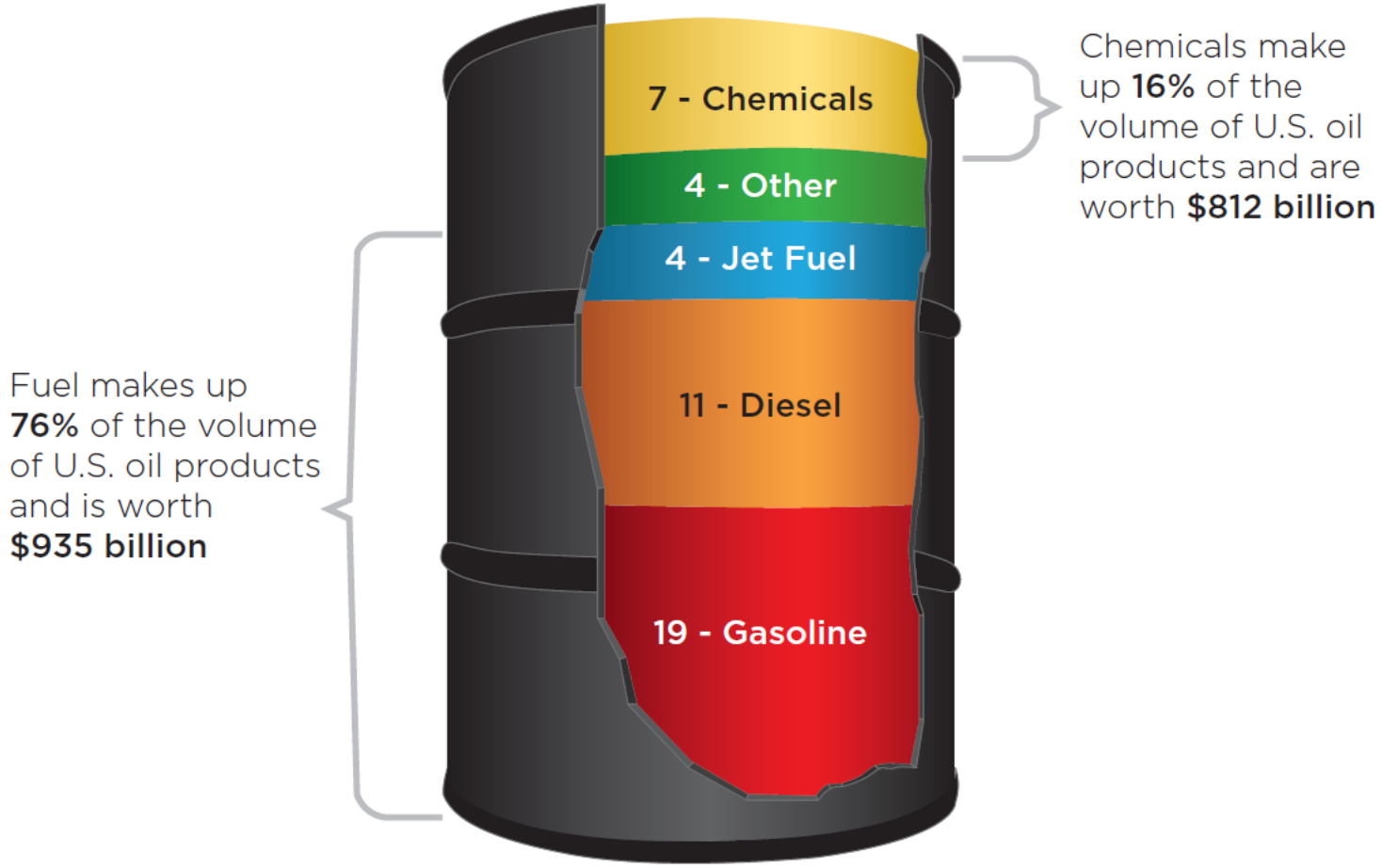
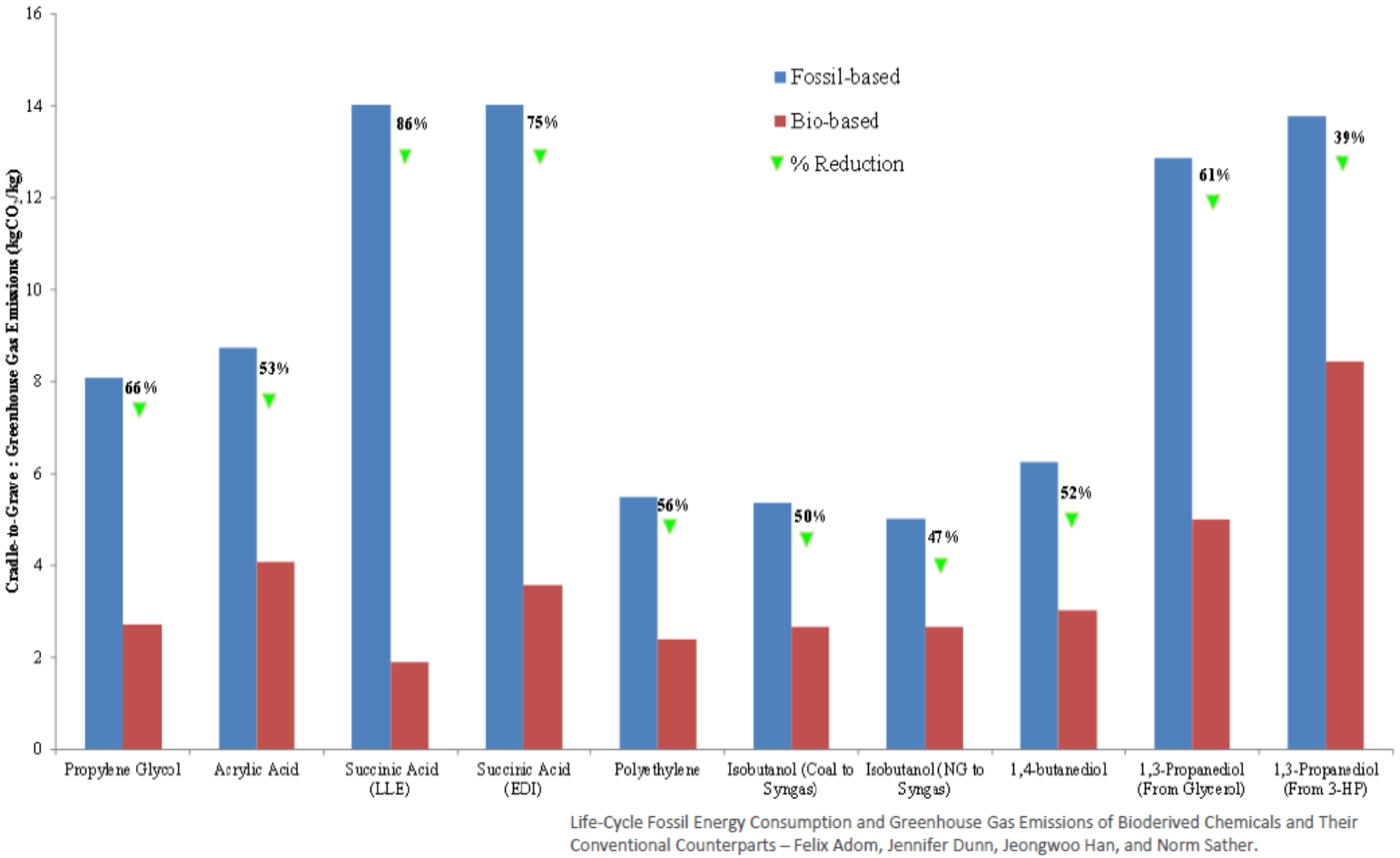


Figure 4. Products and revenue from a barrel of oil. *Source: DOE-BETO citing Bloomberg New Energy Finance, U.S. Energy Information Administration, American Chemical Council*

GHG Reductions from Bio-Derived Chemicals

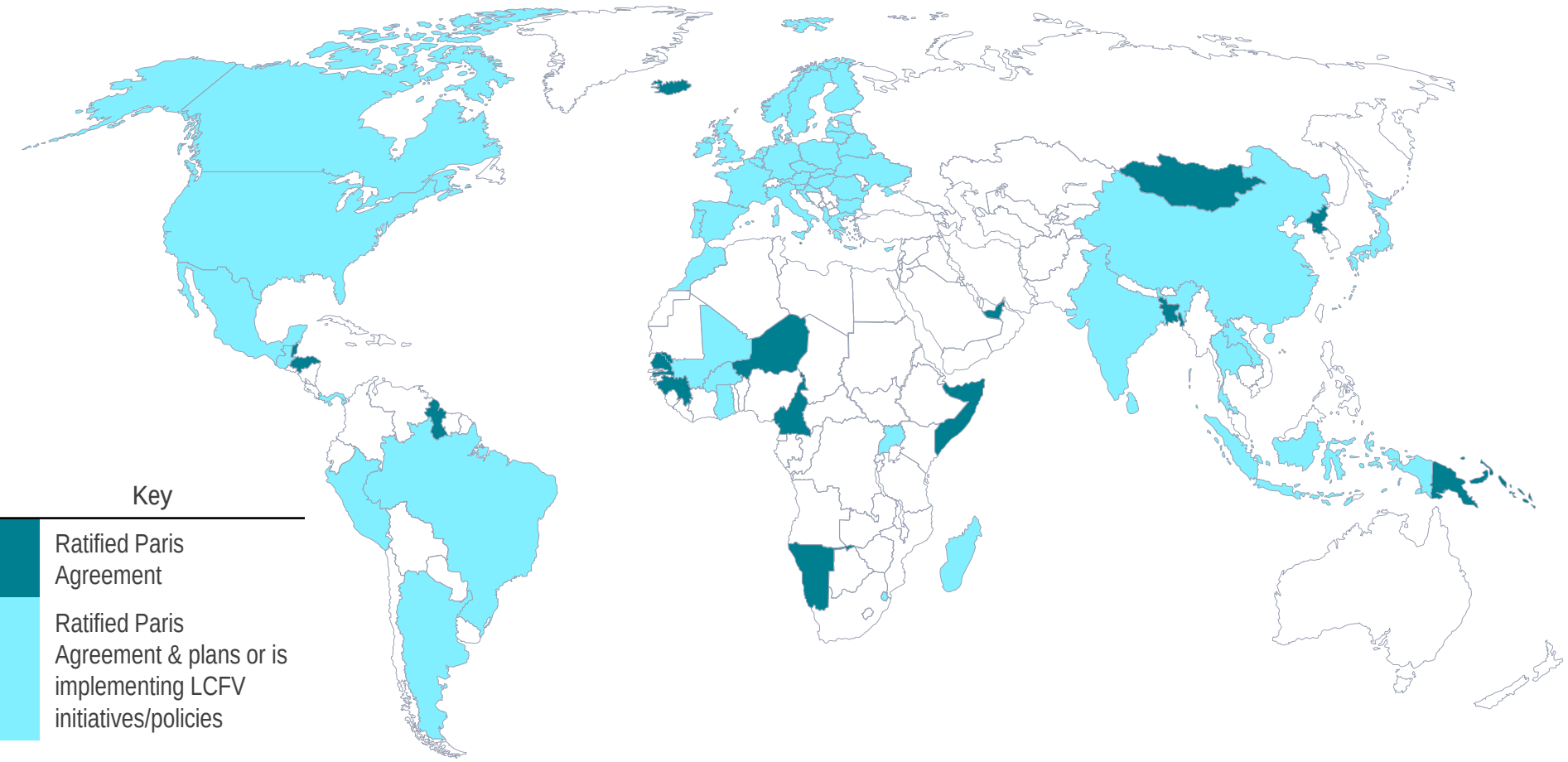
Future Compliance with Paris Agreement Commitments Increasingly Critical Driver



Greenhouse gas emission reductions from bio-derived chemicals v. their conventional counterparts.

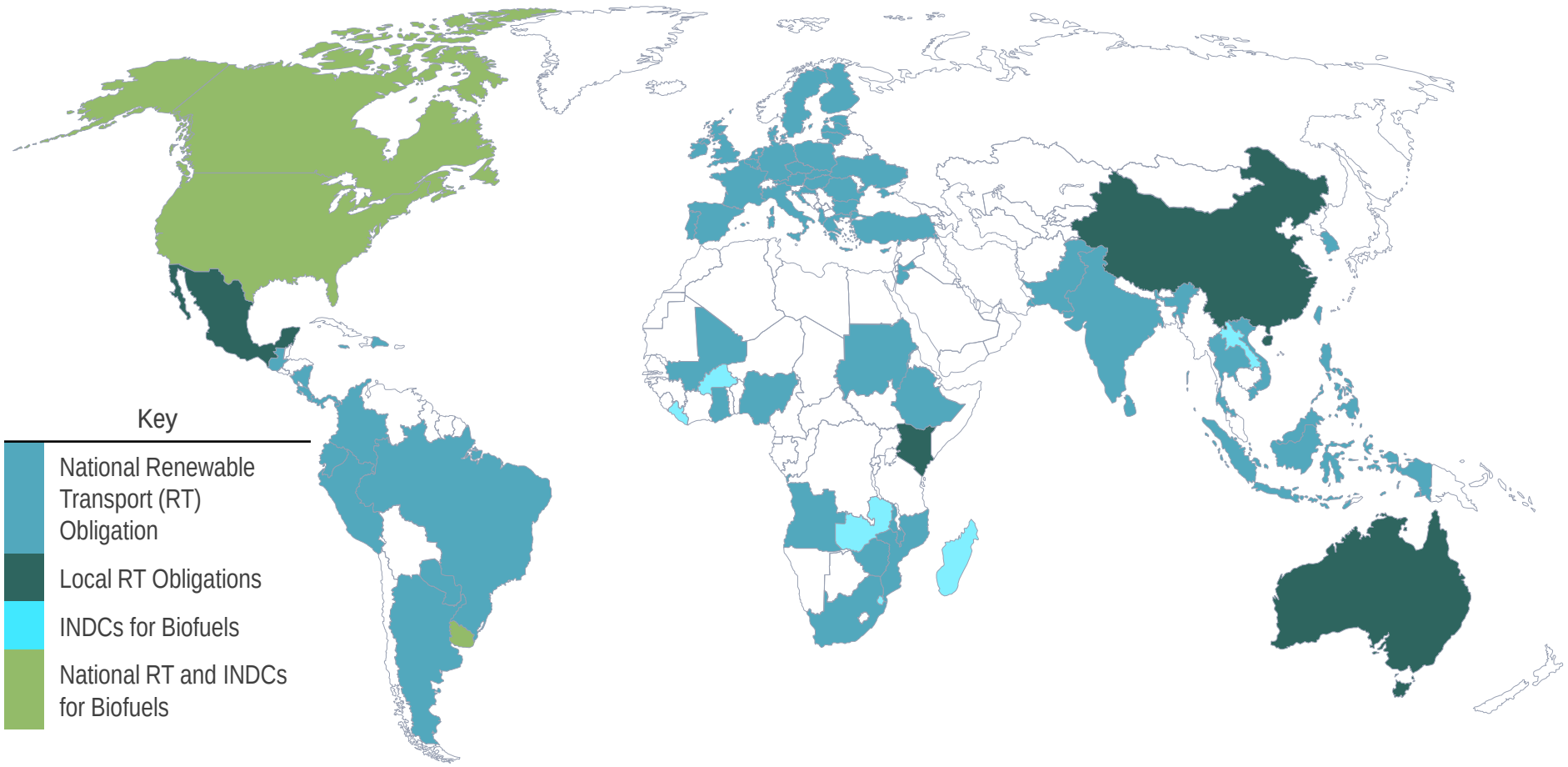
Source: DOE/EERE/BETO Program

Countries Ratifying the Paris Agreement & Are Planning/Implementing LCFV Initiatives



Source: UN Treaty Collection, Oct. 6, 2016

Global Renewable Transport Obligations & Global INDCs that Reference Biofuels



Sources: Renewables 2016 Global Status Report, REN 21; Intended Nationally-Determined Contributions (INDCs) Offer Opportunities for Ambitious Action on Transport and Climate Change, Partnership for Low Carbon Transport; Global Renewable Fuels Alliance

The Role of Federal Agencies in Facilitating the Bioeconomy

Fostering the Bioeconomy is a Multi-Agency Effort and a Federal Priority

Agriculture	Defense	Energy
Interior	Transportation	EPA
NASA	National Science Foundation	Office of Science & Technology Policy

Work Concerns Four Main Thematic Areas in the Bioeconomy Supply Chain

Feedstock Supply

- DOE, USDA, NSF

Biomass Conversion

- DOE, USDA, NSF

Bioenergy Distribution

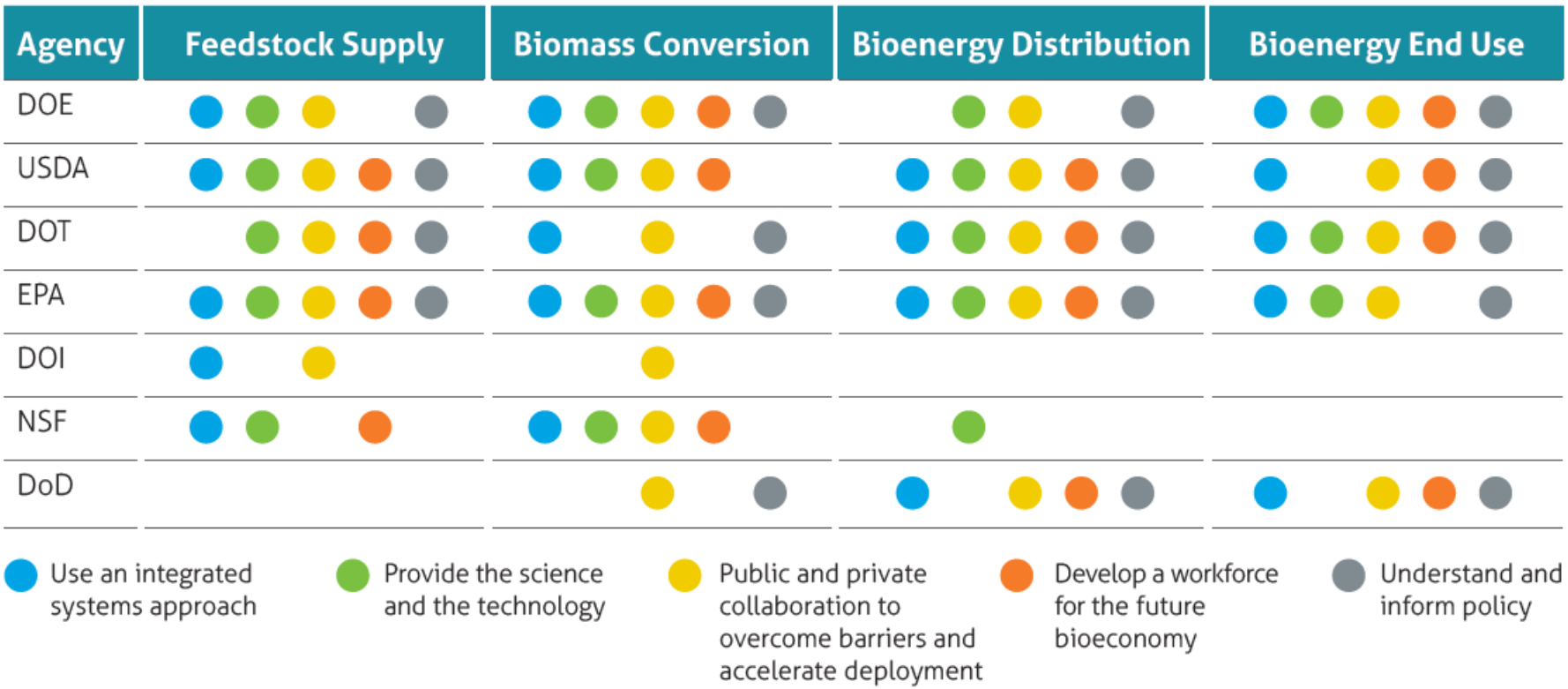
- DOE, DOD, DOT, EPA

Bioenergy End Use

- DOE, EPA, USDA, DOD, DOT

Source: DOE/EERE/BETO Program

Synergies & Roles for Agencies Across the Bioeconomy Supply Chain



Source: DOE/EERE/BETO Program

Major Federal Agency Collaborations

Agencies	Nature of the Collaboration
USDA-DOE	Biomass Feedstock Coordination Group
USDA-DOE	Woody Biomass Utilization Group
USDA-DOE	Farm to Fly 2.0 (renewable jet fuel)
USDA-DOD	Defense Production Act (advanced drop-in fuels for the military)
DOD-DOE	MOU re: commercial scale biorefineries for drop-in jet fuels and diesel
DOE-DOT	Infrastructure needs and capacity
DOE-FAA	Development of alternative jet fuels and roadmap
DOE-EPA	Coordination on Renewable Fuels Standard Program, DOE R&D, sustainability activities and improved data sharing
DOE-National Labs	Co-Optima Program: Develop new fuels and vehicles with higher performance and reduce petroleum consumption 30% v. 2030 BAU
DOE-Office of Science	R&D such as energy crops, systems biology, climate change/sustainability
DOE-ARPA-E	Information sharing on key projects

Source: DOE/EERE/BETO Program

High-Level Advisory Committees Engage Industry Stakeholders & Inform Congress

Interagency Biomass R&D Board

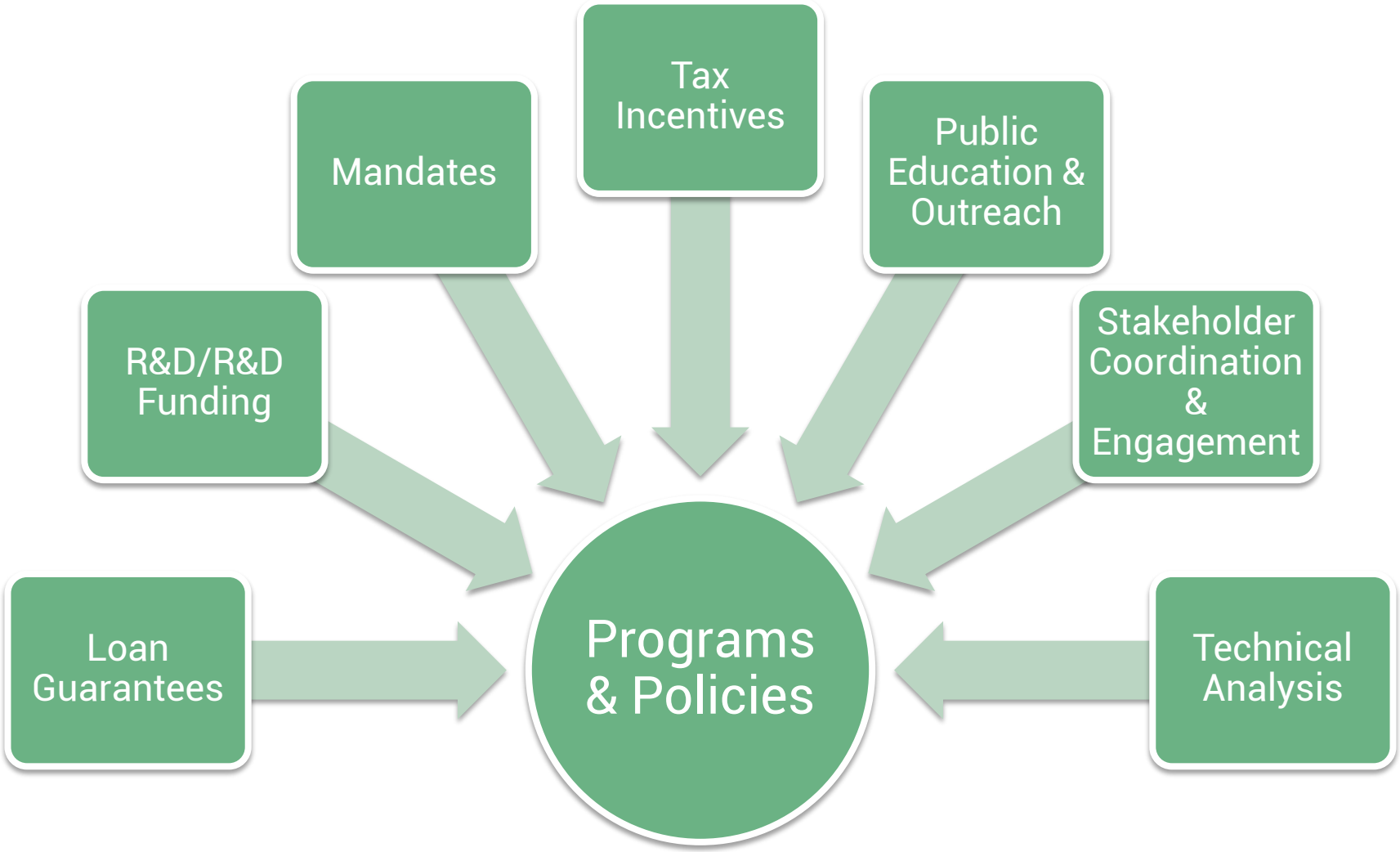
- Senate confirmed co-chairs from USDA and DOE
- Includes other senior level representatives from EPA, DOI, NSF, Office of Science & Technology Policy, DOT and DOD

Technical Advisory Committee

- Advises the Secretaries of Agriculture and Energy on Biomass R&D Initiative
- Jointly appointed by the secretaries
- Comprised of 30 external stakeholders
- Responsible for providing recommendations and identifying industry barriers and solutions in their respective fields

Selected Federal Programs & Policies to Foster the Bioeconomy

Different Types of Federal Bioeconomy Programs & Policy Tools Used



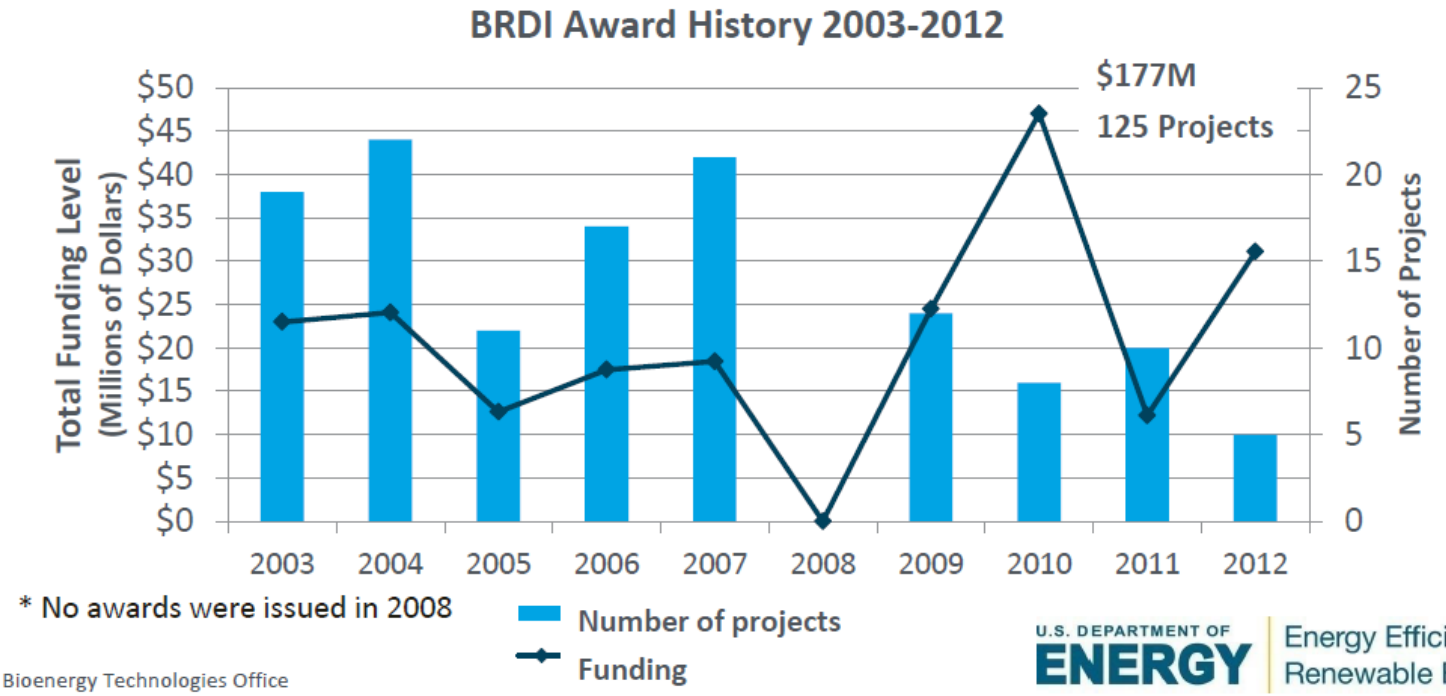
Major Federal Programs & Policies

Focus on the Four Thematic Areas

Agency	Program
DOE	**Biorefinery Project Grants**: Funds cooperative R&D on biomass
	Loan Guarantees: Several programs of loan guarantees to construct facilities that produce ethanol from cellulosic material, municipal solid waste and/or sugarcane; others for energy projects that reduce air pollutant and GHG emissions
	Cellulosic Ethanol Reserve Auction: Provides per-gallon incentive payments for these fuels until production reaches 1 BGY or 2015
EPA	**Renewable Fuels Standard Program**: Requires an increasing volume of bio-based fuels in the gasoline, diesel and jet fuel pools that includes specific targets for bio-based diesel, advanced biofuels and cellulosic biofuels through 2022
IRS	**Biofuels Tax Credits**: Biodiesel, second generation biofuel producer, second generation biofuel production property depreciation allowance
USDA	**The Biomass Crop Assistance Program (BCAP)**: provides financial assistance to owners and operators of agricultural and non-industrial private forest land who wish to establish, produce, and deliver biomass feedstocks
	Feedstock Flexibility Program for Bioenergy Producers: Encourages the domestic production of biofuels from surplus sugar
	Bioenergy Program for Advanced Biofuels: Provides payments to producers to support and expand production of advanced biofuels
	Rural Energy Program for American Program (REAP): Provides guaranteed loan financing and grant funding to agricultural producers and rural small businesses for renewable energy systems or to make energy efficiency improvements
	Biodiesel Fuel Education Program: Competitive grants are available to educate governmental and private entities that operate vehicle fleets, the public, and other interested entities about the benefits of biodiesel use

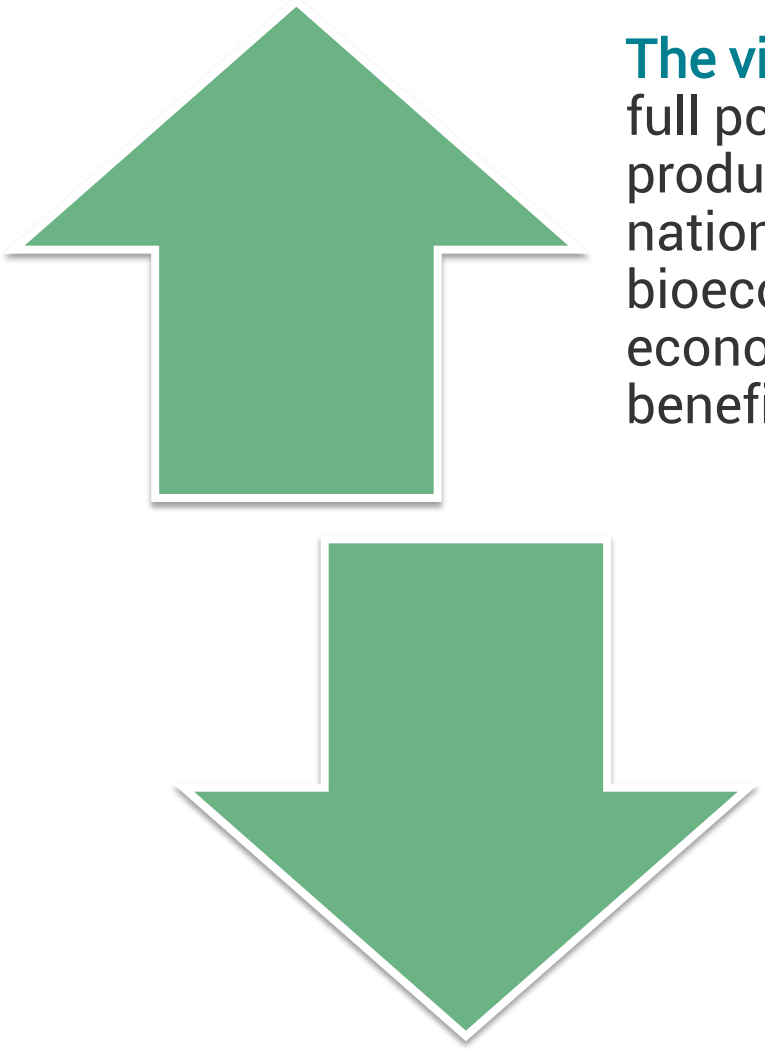
Biomass R&D Initiative

- Provides grant funding for projects in R&D and demonstration of biofuels and bio-based products in feedstocks development, biofuels and biobased products development and biofuels development analysis
- Solicitation jointly run by DOE and USDA
- Established Biomass R&D board and TAC, discussed earlier



U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

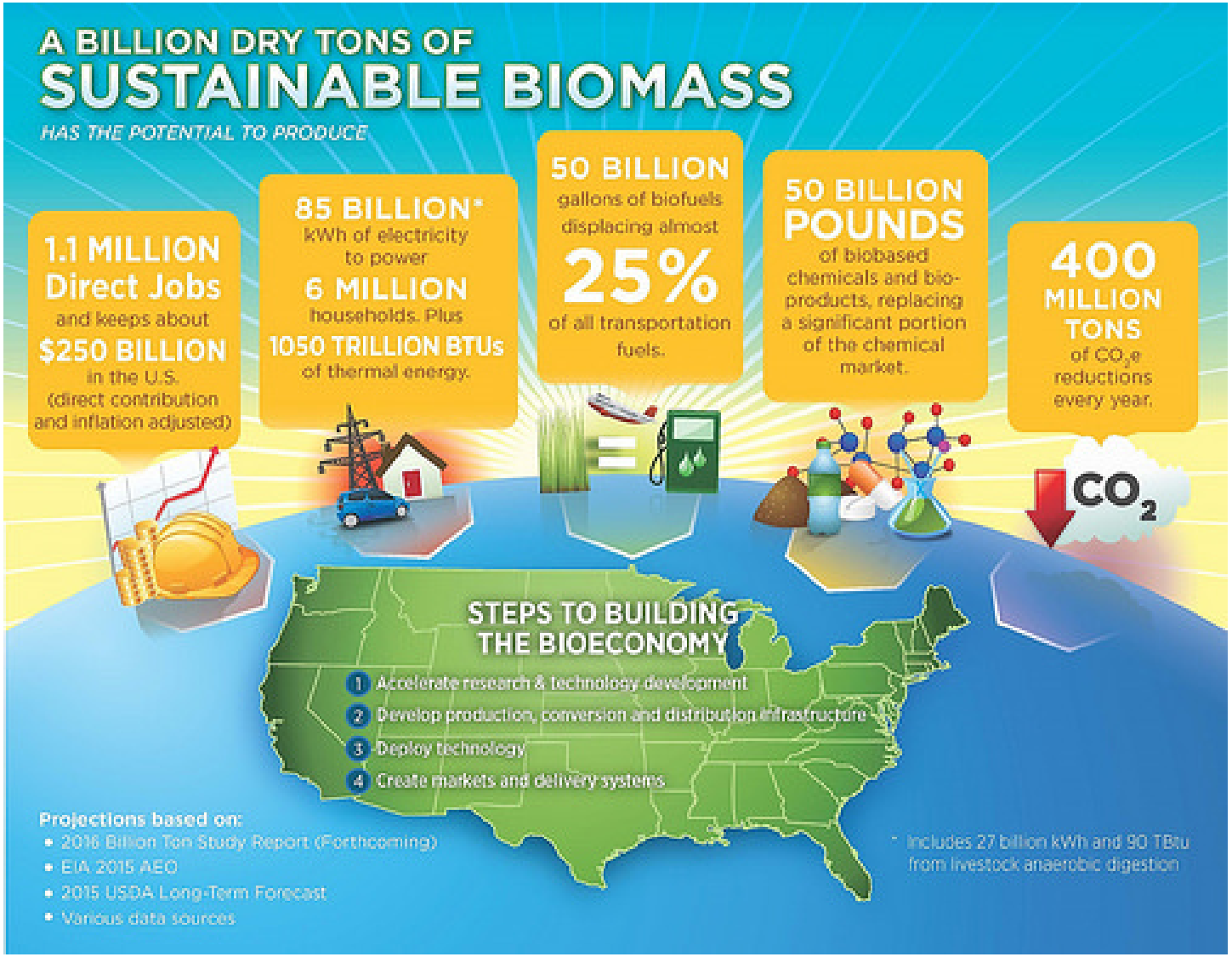
The Billion Ton Economy



The vision: “to sustainably reach the full potential of biomass-derived products as a way of expanding our nation's economy. In doing so, the bioeconomy will provide multiple economic, environmental, and social benefits to the nation."

The goal: “to develop and provide innovative ways to remove barriers to expanding the sustainable use of Nation's abundant biomass resources for biofuels, bioproducts, and biopower, while maximizing economic, social, and environmental outcomes."

Why the Billion Ton Report?



Defense Production Act

Supporting Commercialization of Drop-in Fuels

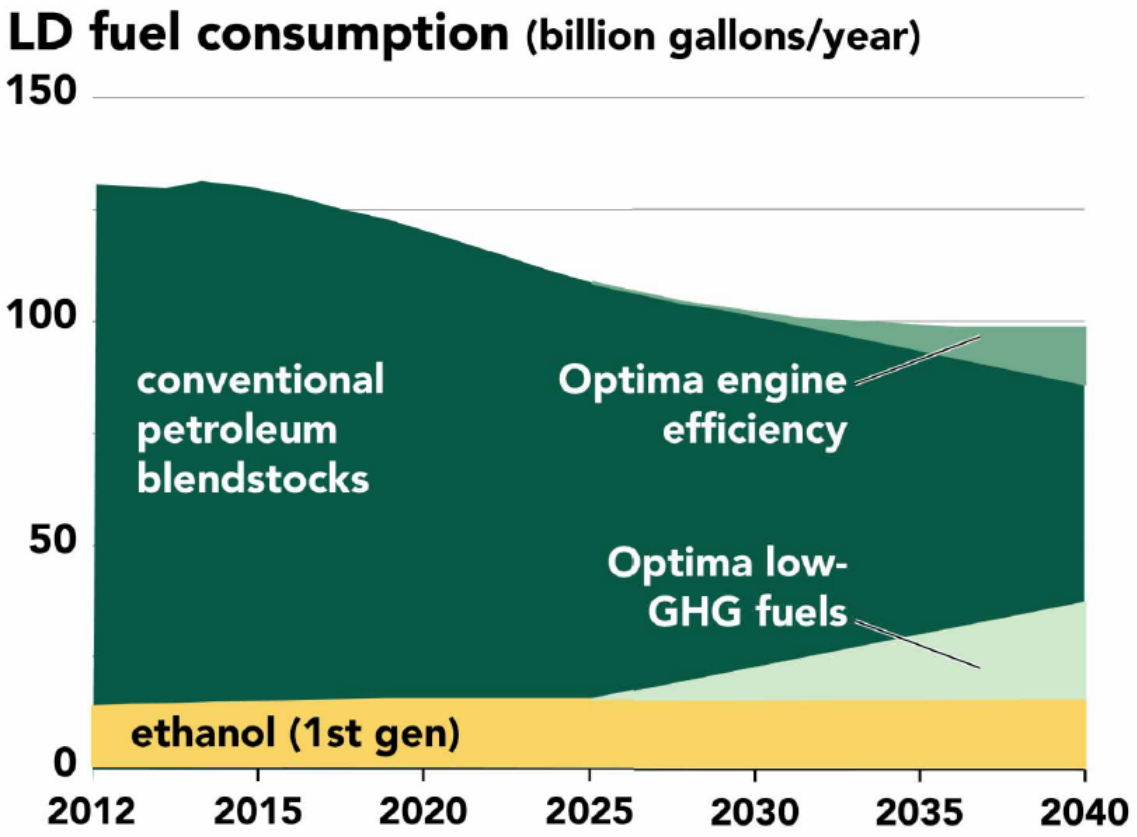
- Three projects selected in 2014 to build commercial biorefineries to product drop-in fuels from non-food biomass feedstocks
- Production anticipated to begin in 2017
- Fuels are approved for use as jet fuel by ASTM at up to 50/50 blends.

Company	Location	Feedstock	Capacity	Groundbreaking	Off-Take Agreements
EMERALD BIOFUELS	Gulf Coast	Fats and Greases	82 MM g/y	TBA	TBD
Fulcrum BIOENERGY	McCarran, NV	MSW	10 MM g/y	Spring/Summer of 2015	CATHAY PACIFIC
RED ROCK BIOFUELS	Lakeview, OR	Woody Biomass	12 MM g/y	TBA	SOUTHWEST AIRLINES

Co-Optima Program

Identifying Target Values for Critical Fuel Properties that Maximize Efficiency & Emissions Performance

Reductions from efficiency displacement



source: EIA 2014 reference case

Conclusions

What Makes the U.S. Successful?

Funding is One Thing, but It's More Than That

- **Clear Priorities**:
  - Fostering the bioeconomy is a clear federal priority driven by need to mitigate climate change and reduce dependence on fossil fuels
- **Coordination**:
  - Intra- and inter-agency coordination and commitment is key
- **Funding:**
  - Never enough, but the federal government has been to date the largest single funder of bioenergy R&D in the U.S. (and maybe globally, too)
- **Stakeholder Engagement**:
  - Stakeholders in the space are engaged in various programs and in different parts of the process
- **First-Class Analytics**:
  - From the national labs to within the agencies **themselves**
- **Consumer Awareness:**
  - Public education and outreach down to the consumer level

The Agencies Continue to Identify and Close Gaps – Some Examples

- Education:
  - Public outreach and education needs to improve
- Analyses:
  - Integrating public health and water concerns into future analyses is important objective
  - Lessons learned in developing "pioneer facilities" need to be better taken advantage of
  - Need to promote petroleum refinery co-location as a strategic goal
  - Identify and improve support for relevant co-products
- Inter-agency coordination:
  - Federal coordination is a lot stronger than it used to be, but in some areas such as R&D enhanced coordination needed
- Staff turnover can be an issue at the agencies
- Adequate government funding

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Thank You!

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