THE FUTURE
BIOBASED ECONOMY

MATTHEW CARR
MANAGING DIRECTOR,
INDUSTRIAL & ENVIRONMENTAL SECTION

BIOTECHNOLOGY INDUSTRY ORGANIZATION (BIO)

BIOMASS 2011
WASHINGTON, DC

27 JULY 2011

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THE FUTURE
BIOBASED ECONOMY

Moderator:

Matt Carr, *Managing Director, Biotechnology Industry Organization*

Keynote Speakers:

James Sturdevant
Director of Project Liberty, ***POET***

Henry Bryndza
Director of Biochemical Science and Engineering – Biomaterials, ***DuPont***

Mark Maher
Executive Director for Powertrain and Vehicle Integration, ***General Motors***

Richard Wynne
Director of Environment and Aviation Policy, ***Boeing Company***

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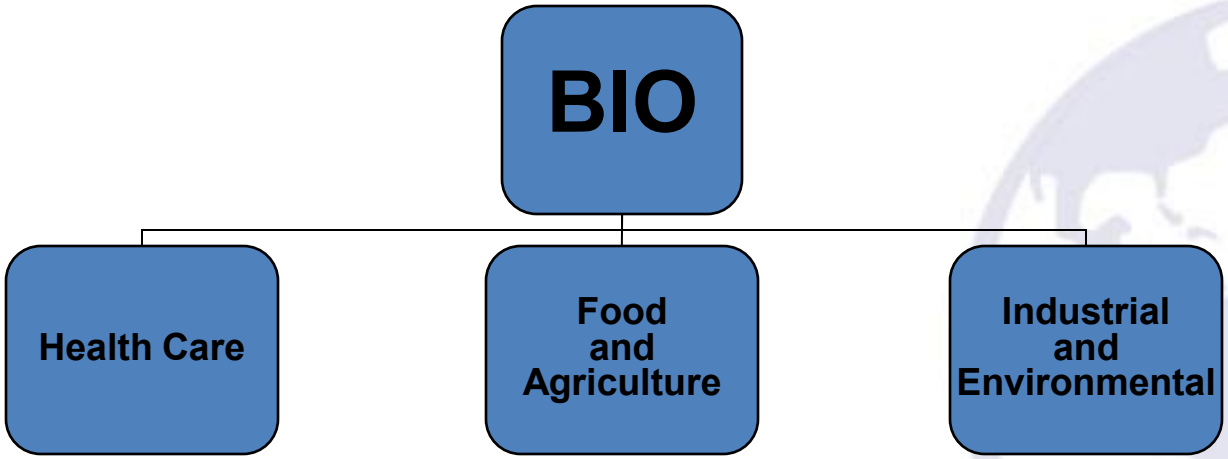
What is BIO?

- Biotechnology Industry Organization (BIO)
- Trade association based in Washington, D.C.
- Over 1,100 member companies
- Leading voice for advanced biofuels, renewable chemicals and biobased products



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SOME INDUSTRIAL AND ENVIRONMENTAL SECTION MEMBERS

THE BIOBASED ECONOMY
TODAY

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THE BIOBASED ECONOMY TODAY

Circa 2011	Market	Jobs
Biofuels	~ 10% of U.S. transport fuel market	~ 400,000 in U.S.
Renewable Chemicals / Biobased Products	3-4% U.S. chemicals sales	~40,000 U.S. jobs in biobased products. Many more when all renewable chemicals considered

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PURPOSE-GROWN ENERGY CROPS

- Commercial switchgrass seeds now on the market
- Variety of short rotation woody crops under development

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Mendel BIOTECHNOLOGY

ceres

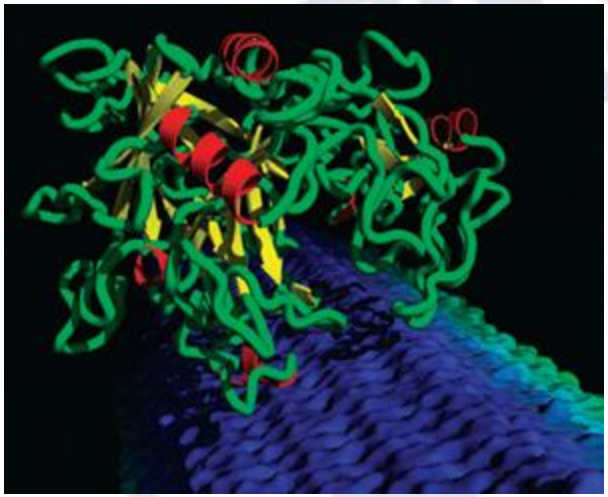
ARBORGEN

DRAMATIC COST REDUCTIONS FOR CELLULASE ENZYMES

- Novozymes, Genencor achieved 80% reduction in enzyme cost vs. 2008
- Forecast cellulosic ethanol production cost under $2.00 per gallon by 2011

Genencor International® A Danisco Company

novozymes® Rethink Tomorrow



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ALGAE

- Rapid evolution in technology
- Multiple developers moving to commercial demonstration
- Variety of approaches and end molecules

DOW

ALGENOL BIOFUELS
HARNESSING THE SUN TO FUEL THE WORLD™

ExxonMobil

SYNTHETIC GENOMICS

HR BioPetroleum

Chevron

MONSANTO

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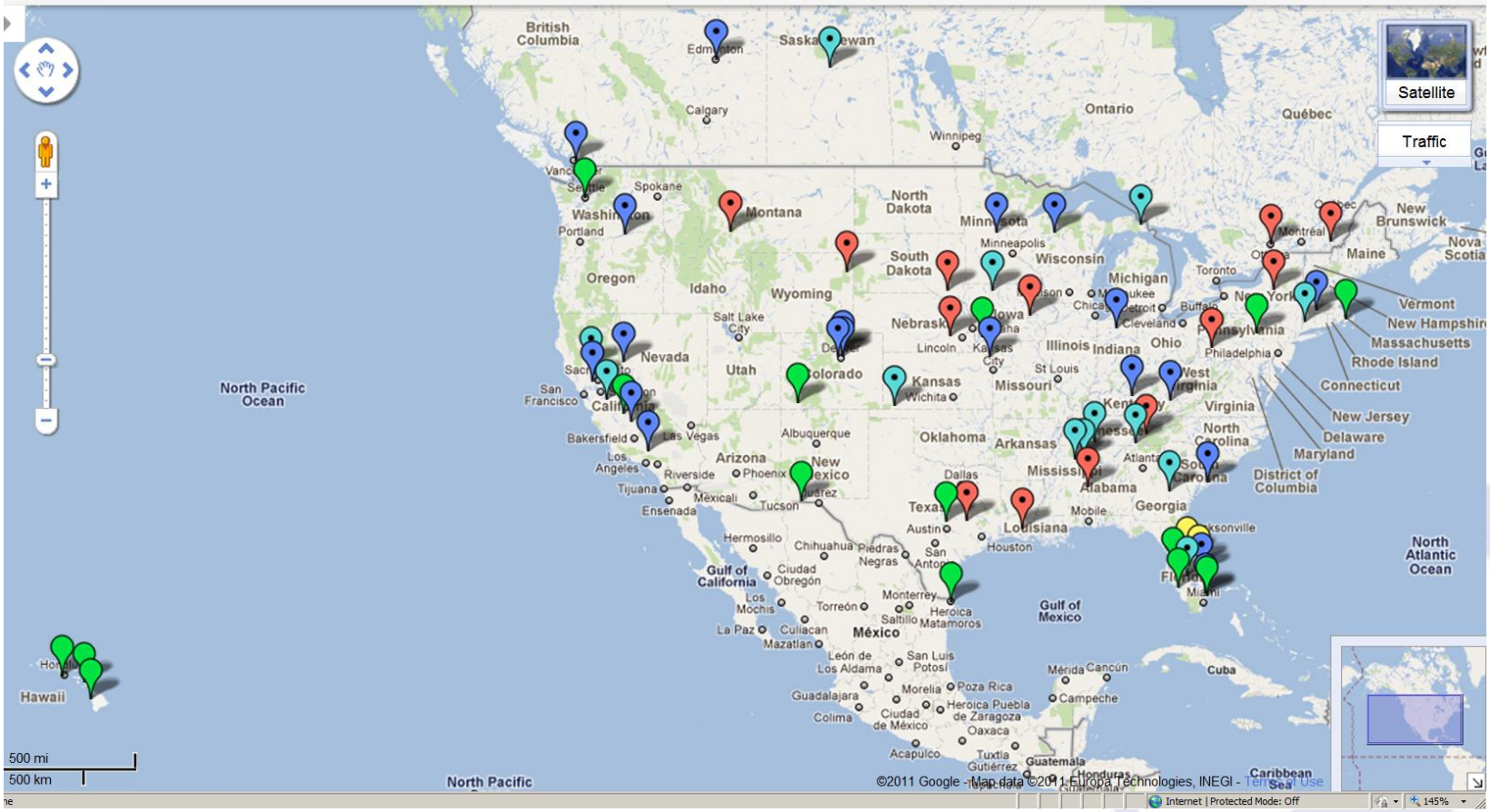
solazyme

Sapphire Energy

Over 50 Operating, Under Construction and Planned Cellulosic and Algae Biofuel Production Facilities In North America



Red icons indicated operating pilot/demonstration cellulosic biorefineries.
Light blue icons indicate planned commercial-scale cellulosic biofuel biorefineries.
Blue icons indicate additional demonstration and pilot scale biorefineries.
Green icons indicate operating / under construction algae facilities.
Yellow icons indicate planned algae facilities

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HIGHER ALCOHOLS & RENEWABLE HYDROCARBONS

- Biobutanol
  - **Higher energy density, infrastructure compatibility**

- Green gasoline / jet fuel
  - **Use synthetic biology to produce organisms capable of generating renewable petroleum surrogates – tremendous promise**

Cobalt Biofuels

bp

DUPONT

gevo

LS9, INC.
the renewable petroleum company™

AMYRIS

JOULE

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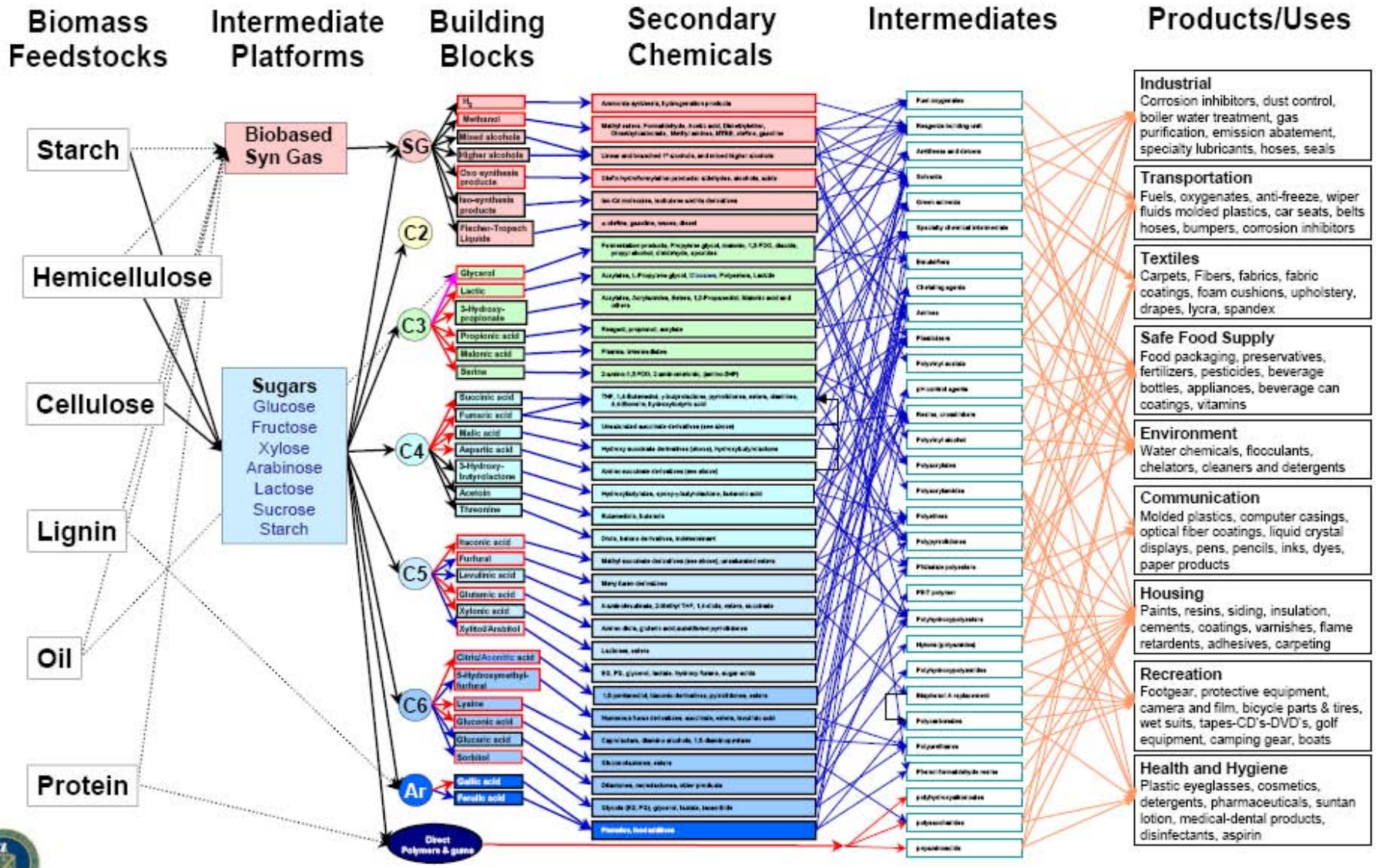
RENEWABLE CHEMICALS & BIOBASED PRODUCTS



RENEWABLE CHEMICALS & BIOBASED PRODUCTS

- Higher value products getting much more attention…
  - **Bio-polyethylene**
  - **Bio-succinic acid**
  - **Bio-isoprene**
  - **Bio-acrylic acid**
  - **Bio-butanediol**
  - **Bio-isobutene**

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RENEWABLE CHEMICALS & BIOBASED PRODUCTS

- Consumer product companies diving in…

Segetis

plantbottle™
up to 30% plant-based
100% recyclable bottle
redesigned plastic, recyclable as ever.

ZeaChem

P&G
Procter & Gamble

LS9, INC.
the renewable petroleum company™

solazyme®

Unilever

NatureWorks
Real. Right. Renewable.

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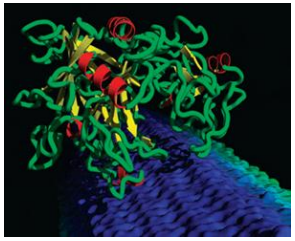
THE BIOBASED ECONOMY
TOMORROW



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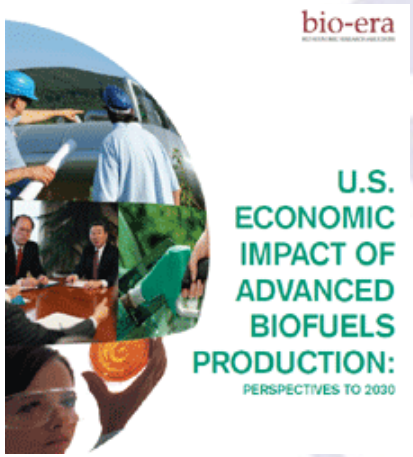
THE BIOBASED ECONOMY TOMORROW

Circa 2025	Market	Jobs
Biofuels	~ **25%** of U.S. transport fuel market under RFS	~ 800,000 additional jobs in U.S.
Renewable Chemicals / Biobased Products	**>20%** U.S. chemicals sales (USDA)	237,000 additional direct jobs in U.S.



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THE BIOBASED ECONOMY
CHALLENGES

- Access to capital / financing for first commercial biorefineries
- Establishing next-gen feedstock supplies
- Overcoming market/regulatory barriers
- ➢ **Policy instability**

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CHALLENGES:
POLICY INSTABILITY

- Funding cuts
- Expiring tax credits
- Threats to RFS

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THE BIOBASED ECONOMY
ROLE OF POLICY

NEED ROBUST, STABLE POLICY SUPPORT:

- **Feedstocks**
- **Financing**
- **Markets**
- **Coproducts**

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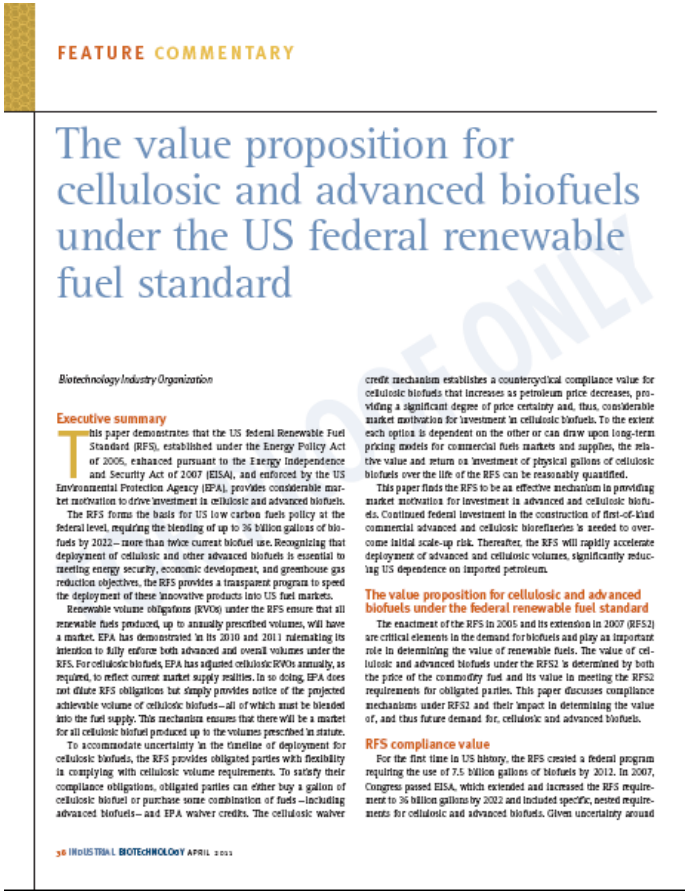
The RFS Supports and Incentivizes Investment in Cellulosic & Advanced Biofuels

- **The Federal RFS Law & EPA's Implementing Regulations:**
  - ***Establish*** market assurance for cellulosic and other advanced biofuels as long as the industry can produce them economically.
  - ***Present*** a stable market support system for cellulosic biofuels ensuring that they earn a compliance premium.
  - ***Provide*** a substantial price support to advanced biofuels (especially cellulosic biofuels), which makes for an attractive case for investment in this nascent industry.



FEATURE COMMENTARY

The value proposition for cellulosic and advanced biofuels under the US federal renewable fuel standard

Biotechnology Industry Organization

Executive summary

This paper demonstrates that the US federal Renewable Fuel Standard (RFS), established under the Energy Policy Act of 2005, enhanced pursuant to the Energy Independence and Security Act of 2007 (EISA), and enforced by the US Environmental Protection Agency (EPA), provides considerable market motivation to drive investment in cellulosic and advanced biofuels.

The RFS forms the basis for US low carbon fuels policy at the federal level, requiring the blending of up to 36 billion gallons of biofuels by 2022—more than twice current biofuel use. Recognizing that deployment of cellulosic and other advanced biofuels is essential to meeting energy security, economic development, and greenhouse gas reduction objectives, the RFS provides a transparent program to speed the deployment of these innovative products into US fuel markets.

Renewable volume obligations (RVOs) under the RFS ensure that all renewable fuels produced, up to annually prescribed volumes, will have a market. EPA has demonstrated in its 2010 and 2011 rulemaking its intention to fully enforce both advanced and overall volumes under the RFS. For cellulosic biofuels, EPA has adjusted cellulosic RVOs annually, as required, to reflect current market supply realities. In so doing, EPA does not dilute RFS obligations but simply provides notice of the projected achievable volume of cellulosic biofuels—all of which must be blended into the fuel supply. This mechanism ensures that there will be a market for all cellulosic biofuel produced up to the volumes prescribed in statute.

To accommodate uncertainty in the timeline of deployment for cellulosic biofuels, the RFS provides obligated parties with flexibility in complying with cellulosic volume requirements. To satisfy their compliance obligations, obligated parties can either buy a gallon of cellulosic biofuel or purchase some combination of fuels—including advanced biofuels—and EPA waiver credits. The cellulosic waiver credit mechanism establishes a countercyclical compliance value for cellulosic biofuels that increases as petroleum price decreases, providing a significant degree of price certainty and, thus, considerable market motivation for investment in cellulosic biofuels. To the extent each option is dependent on the other or can draw upon long-term pricing models for commercial fuels markets and supplies, the relative value and return on investment of physical gallons of cellulosic biofuels over the life of the RFS can be reasonably quantified.

This paper finds the RFS to be an effective mechanism in providing market motivation for investment in advanced and cellulosic biofuels. Continued federal investment in the construction of first-of-kind commercial advanced and cellulosic biorefineries is needed to overcome initial scale-up risk. Thereafter, the RFS will rapidly accelerate deployment of advanced and cellulosic volumes, significantly reducing US dependence on imported petroleum.

The value proposition for cellulosic and advanced biofuels under the federal renewable fuel standard

The enactment of the RFS in 2005 and its extension in 2007 (RFS2) are critical elements in the demand for biofuels and play an important role in determining the value of renewable fuels. The value of cellulosic and advanced biofuels under the RFS2 is determined by both the price of the commodity fuel and its value in meeting the RFS2 requirements for obligated parties. This paper discusses compliance mechanisms under RFS2 and their impact in determining the value of, and thus future demand for, cellulosic and advanced biofuels.

RFS compliance value

For the first time in US history, the RFS created a federal program requiring the use of 7.5 billion gallons of biofuels by 2012. In 2007, Congress passed EISA, which extended and increased the RFS requirement to 36 billion gallons by 2022 and included specific, nested requirements for cellulosic and advanced biofuels. Given uncertainty around

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OPPORTUNITY:

BIO 5 YEAR PLAN PROPOSAL

BIOBASED ECONOMY JOBS & DEVELOPMENT ACT

Unleashing the Promise of Biotechnology

Advancing American Innovation to Cure Disease and Save Lives

Bio BIOTECHNOLOGY INDUSTRY ORGANIZATION

Biotechnology companies are working every day to solve the greatest challenges facing our society — whether it's finding a cure for cancer, protecting against bio-terror threats, or creating renewable energy sources. Yet despite the urgent need for scientific breakthroughs in these areas, current government policies are holding back the potential and promise of biotechnology.

What's needed is a policy environment that incentivizes the magnitude of investment necessary to translate the scientific potential that resides in the thousands of American biotech companies into the breakthrough cures, treatments, enhanced agricultural products, vaccines to defend against bioterrorism and revolutionary biofuels that can transform society. Only by transforming the policy environment can we create a robust innovation economy that helps America compete globally by maintaining our position as world leader in biotechnology research and development. And only by investing in biotech today can we discover the new treatments and cures that will not only save lives, but reduce long-term health care costs by keeping people healthier and reducing chronic disease.

To this end, I began a process last summer of interviewing thought leaders within and outside of our industry for the purpose of envisioning game-changing strategies. We contracted with Dr. Elias Zerhouni, former Director of the National Institutes of Health, to conduct an analysis of the challenges we face and a more comprehensive survey of medical experts, academic researchers, and other life science leaders to suggest out-of-the-box, big ideas to significantly advance biotechnology's chances to succeed.

Over the past six months, we worked with BIO Board members and staff to review these ideas, debate their merits, and offer alternative and additional approaches to develop a comprehensive national policy strategy.

The policy agenda summarized in this brochure is the result of this rigorous policy development process. It reflects the input and suggestions gathered throughout this process from biotech CEOs, venture capitalists, current and former government officials, academic and medical researchers, patient advocates and other experts. Our recommendations reflect the big, bold and daring thinking required to create new models to encourage investment in innovation and to speed up the discovery of scientific breakthroughs. In short, this agenda will enable the biotechnology industry to fulfill its promise to help, heal, fuel, and feed the world.

Sincerely,

James C. Greenwood
President & CEO, BIO

Biotechnology is all around us and a big part of our lives, providing breakthrough products to cure disease, protect against bio-terrorism, feed the hungry, and clean our environment. At its simplest, biotechnology harnesses cellular and biomolecular processes and puts them to work to help solve our most intractable problems.

Society has tapped just a small fraction of the many potential uses — and benefits — of biotechnology. Every day, research scientists explore new ways to improve our quality of life using biotechnology. In fact, biotechnology presents some of the most promising opportunities for helping policymakers achieve their goal of supporting innovation in health care, renewable energy, and green technologies. However, biotech research and development is a particularly high-risk undertaking because of the substantial start-up costs, lengthy experimentation period, and possibility that the technology will not prove viable. That puts biotechnology companies at the mercy of investors. Complicating matters, the regulatory review processes are not keeping up with rapidly advancing science and are making it a more difficult environment to develop new treatments and products.

Fully realizing the promise of biotechnology requires a comprehensive national strategy that fine-tunes some policies and overhauls others. In the pages that follow, we outline a policy agenda that we believe will enable U.S. biotech companies to transform the innovative ideas of today into the realities of tomorrow.

I. Promoting Investment in Innovation

Congress has historically provided tax incentives to high-risk endeavors (such as oil and gas exploration, alternative energy, and high-tech start-ups) as a means for encouraging new investment. However, current tax law does not do enough to foster investment in health care, green technology, or energy-focused biotechnology companies. Given the economic and societal benefits of

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OPPORTUNITY:
THE BIOBASED ECONOMY JOBS & DEVELOPMENT ACT

- Comprehensive bill to facilitate the future biobased economy in five titles:
  - *Agriculture*
  - *Tax*
  - *Defense*
  - *Energy*
  - *Environment*

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➢ *Agriculture*

- Biomass Crop Assistance Program – Reauthorization and Enhancement
- Federal Crop Insurance for Purpose Grown Energy Crops
- Feedstock Sustainability Enhancement Grants
- Farm Bill Energy Title Amendments for Renewable Chemicals

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OPPORTUNITY:
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- ***Tax***
  - Tax Credit for Production of Qualifying Renewable Chemicals
  - Advanced Biofuels Tax Reform

- ***Defense***
  - Strategic Biorefinery Initiative
  - Long-term Offtake Authority

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➢ *Energy*

- Repurpose and Retrofit Grant Program
- Synthetic Biology for Enhanced Sustainability of Biofuels and Renewable Chemicals
- Industrial Process R&D Program

➢ *Environment*

- EPA R&D Program for Renewable Chemicals

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BIO PACIFIC RIM SUMMIT - NOVEMBER 21-23
KUALA LUMPUR, MALAYSIA

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