



A Circular Bioeconomy: The Path to Carbon Neutrality

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Select Committee on Biotechnology
Select Committee on Green Innovation and
Entrepreneurship
California State Assembly
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1. THE BIOECONOMY

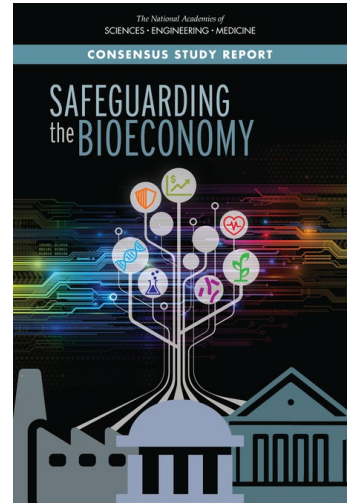
1. FROM SUGARS TO BIOMASS: THE BIG OPPORTUNITY

2. HOW BERKELEY LAB IS ADVANCING THE BIOECONOMY

3. HOW CALIFORNIA CAN WIN

1. THE BIOECONOMY

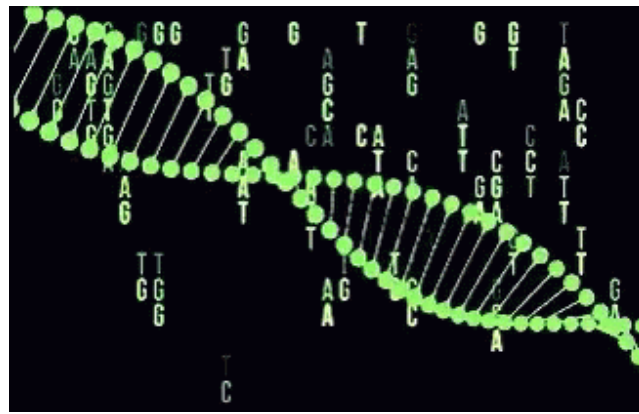
- **\$1 Trillion in 2020 in US** – quadrupling over the next 10 years.
- **Economic activity** – biology can convert sugars into high-value products. Innovations in biotechnology, engineering, and computing are turning an age old human activity (think beer and winemaking) into a burgeoning industry.
- **A major opportunity for California** – leading in biomass, biotech, and computing – biotech and biomanufacturing have far-reaching implications!



BIOMASS



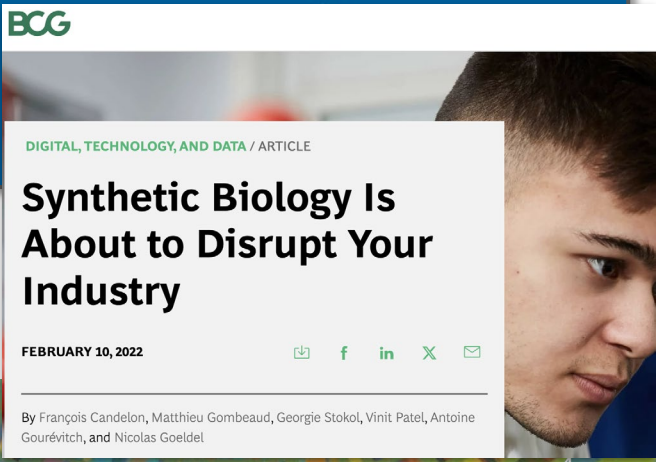
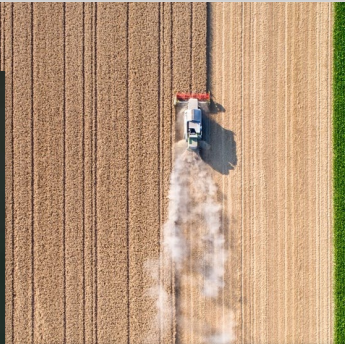
BIOTECHNOLOGY



COMPUTING



❖ Biotechnology Is Transforming Many Sectors



❖ 2022 Bioeconomy Executive Order



SEPTEMBER 12, 2022

Executive Order on Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconomy

 BRIEFING ROOM ▶ PRESIDENTIAL ACTIONS

- Bolster and coordinate **Federal investments in R&D**.
- Foster a **biotech data ecosystem** for responsible research.
- Expand **domestic biomanufacturing**, piloting, prototyping.
- Boost sustainable **biomass production** & climate-smart incentives.
- **Expand market opportunities** for bioenergy, bio-products & services.
- Train a diverse, **skilled workforce** and a next generation of leaders.

2. FROM SUGARS TO BIOMASS: THE BIG OPPORTUNITY



California produces 56 million tons of forest, farm waste biomass yearly.

A thriving bioeconomy can convert biomass to carbon-neutral products, leaving the oil in the ground...

A single, devastating California fire season wiped out years of efforts to cut emissions
Los Angeles Times



Agricultural burn bans to take effect by the end of 2024



What 56 million tons of biomass annually means for California

2.5B gallons jet fuel
> 50% current consumption

2.5B lbs of bioproducts
fuels, food, chems...

Cut CO₂ by 25 megatons

61,000 jobs

*Based on extrapolation for DOE's billion ton report.

3. HOW BERKELEY LAB IS ADVANCING THE BIOECONOMY

Joint BioEnergy Institute

JBEI

Jay Keasling, CEO



\$28M/year DOE, IP

Establish knowledge and technologies to maximize the transformation of carbon from crops into biofuels and bioproducts.



Agile BioFoundry

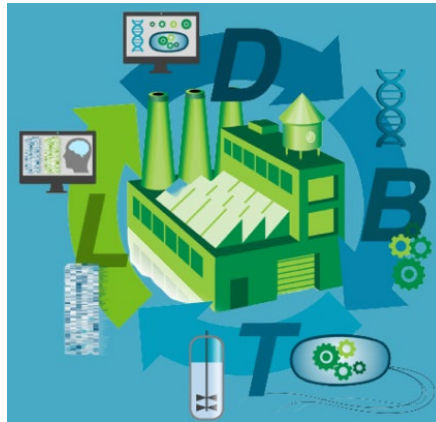


Nathan Hillson, Lead PI



\$20M/year from DOE, IP

Robust platform for faster, cheaper biological engineering; industry focus; mission-aligned R&D



Advanced Biofuels and Bioproducts Process Development Unit



Deepti Tanjore, Director

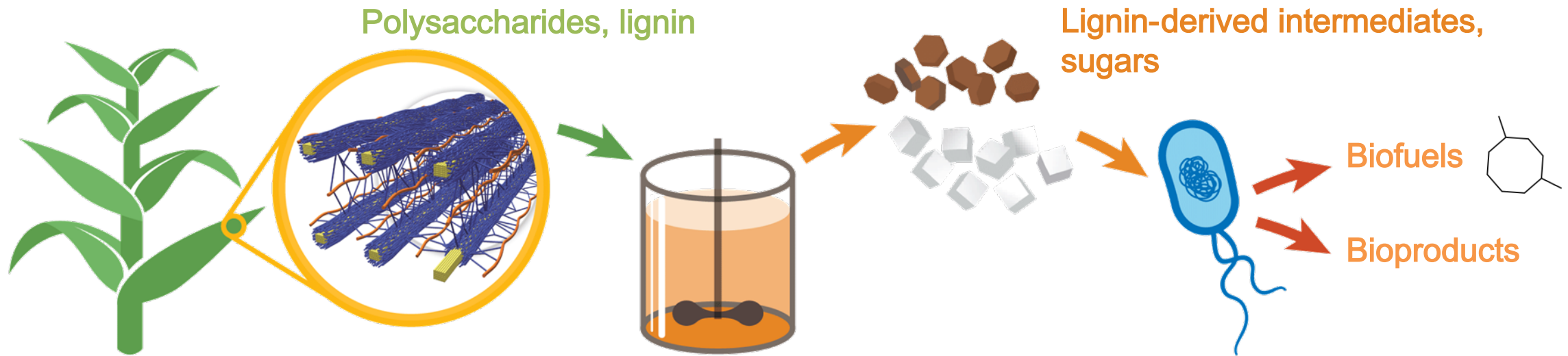


\$5.5M/year from DOE & others

The science of scale-up; seek paths to turn waste carbon into bio-based fuels, chemicals, materials, food, and more.



Maximize available carbon from biomass and develop economically meaningful paths to fuels and products



JBEI's bio-isoprenol acetate can be upgraded to an energy-dense sustainable aviation fuel (SAF). This new fuel will be flown in a business jet in 2025!

❖ ABPDU: The Jumping Off Point for BioMFG

Biofuels & Biomass

Materials & Chemicals

Food, Health, & Ag



Perfect Day



❖ A Skilled Workforce for the CA Bioeconomy

- The ABPDU + UC Berkeley, UC Merced, Laney College, Solano Community College and others are expanding the bioeconomy workforce.
- Over 100 ABPDU alumni of former staff and students.
- Publishing open source tools at abpdu.lbl.gov
- Leverage skills from local industries, build strong curricula, and consider the role of apprenticeships.



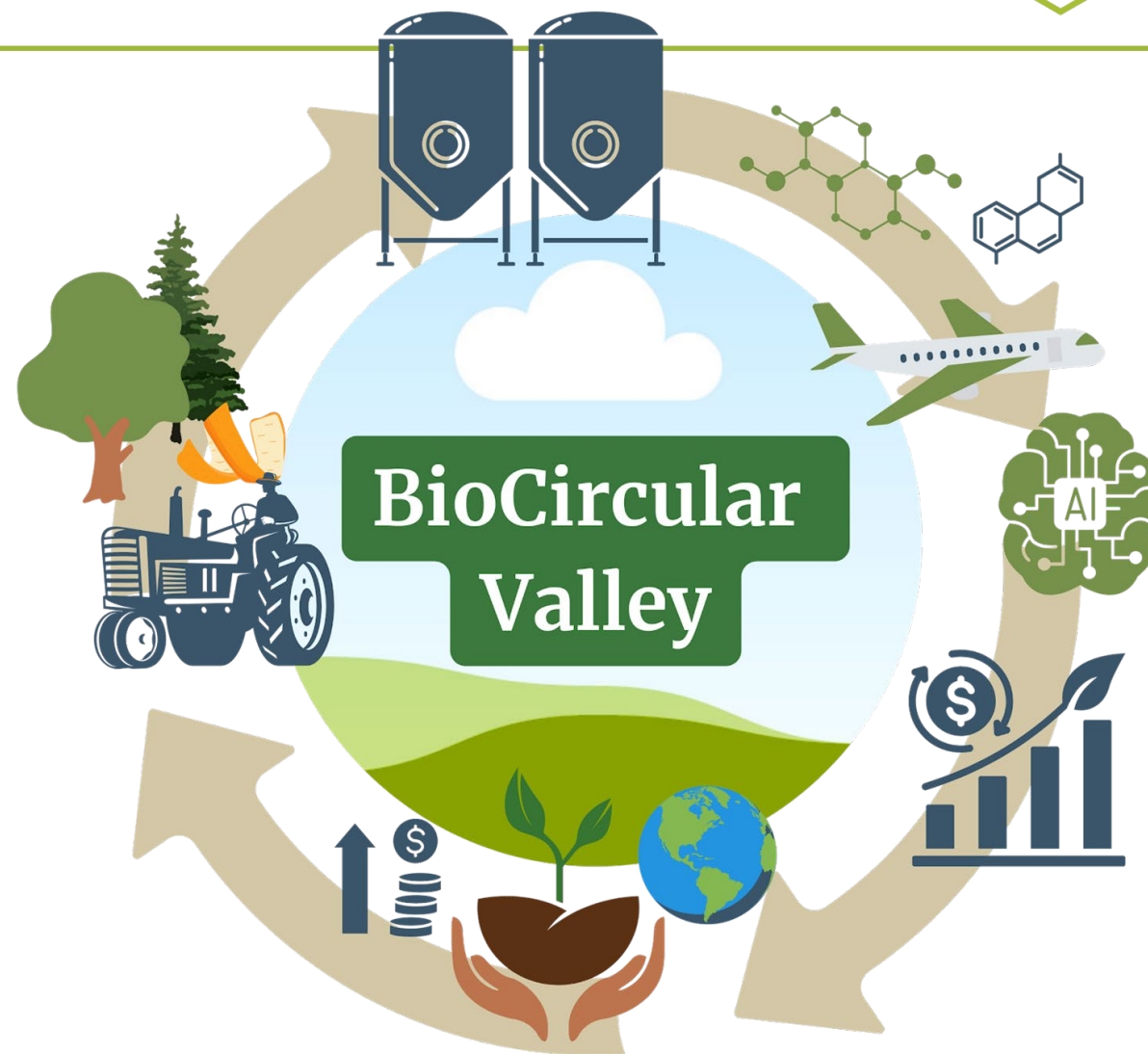
❖ BioCircular Valley - *BioCirV*

A large, 5 year investment to build toward an inclusive, circular bioeconomy in the region.

Agronomics
Chemometrics
Conversion
Data & Modeling
Bioeconomy Cartography Tool

LBNL
UC Berkeley
UC Merced
UC ANR

BEAM Circular
USDA ARS Albany
Almond Board of CA
Several others!



❖ Federal Dollars to Advance a Circular Bioeconomy



The banner features three logos on the left: the University of California, Merced seal; the Berkeley Lab logo; and the BEAM Circular logo. To the right, the text reads "NSF ENGINES DEVELOPMENT AWARD". Below this, a blue box contains the text "Advancing circular bioeconomy technologies in North San Joaquin Valley (CA)".



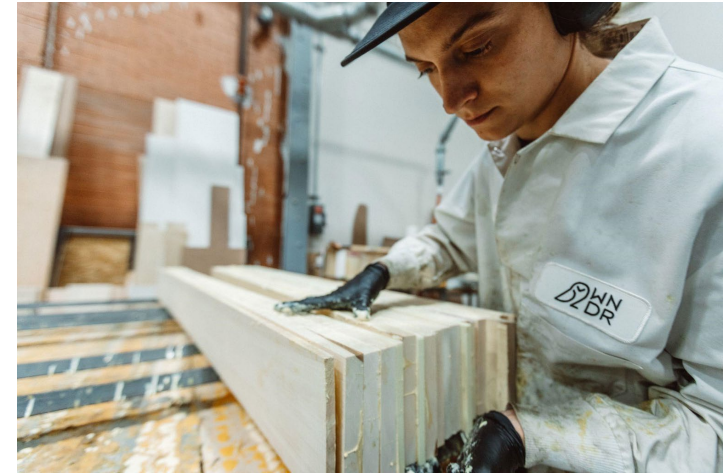
The Circular Bioeconomy Innovation Collaborative (CBIO Collaborative)

- Diverse coalition of partners pursuing a **Type 2, \$160M NSF** grant.
- Braiding multiple investments to strategically advance the bioeconomy.
- Accelerating bioconversion R&D.

4. HOW CALIFORNIA CAN WIN

Policy levers

- Encourage a bio(*preferred*) economy in California.
- Invest in research to accelerate biomass conversion in California.
- Invest in scale-up facilities to support bioMFG jobs in the state.
- Set strategic workforce development vision for the CA bioeconomy.



Thank you

Lawrence Berkeley National Laboratory

<https://www.lbl.gov/>

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