Production of High-value Chemicals from Renewable Feedstocks WBS 2.5.3.701

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Project Type

Directed Funding Opportunity (DFO), Agile BioFoundry

Goal:

- Develop a hybrid biomass-conversion technology integrating thermochemical gasification with syngas fermentation ($CO/H_2/CO_2$) to improve biorefinery economics

Project Timeline

- **Start Date:** March 2018
- **End Date:** June 30, 2020
- Project is 30% complete

	Total Funding Pre-FY17*	FY 17 Funding	FY 18 Funding	Total Planned Funding
DOE Funded	$0	$0	$0	$500,000 NREL-68% ORNL-32%
Project Cost Share	$0	$0	$0	Visolis $214,300

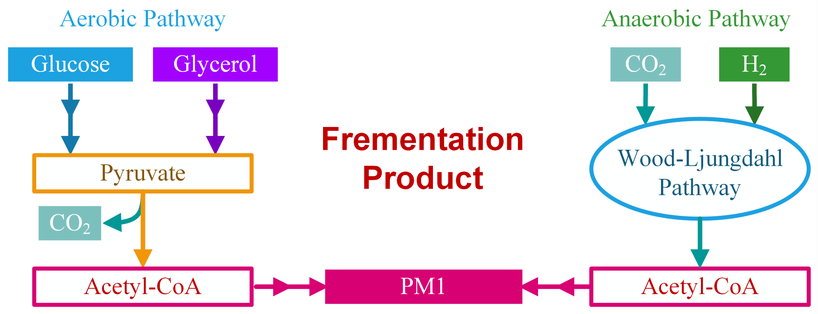
Management Approach

Project lead (Carrie Eckert), engineering product PM1 production in Clostridium ljungdahlii (Pin-Ching Maness) and Pichia kudrievzeviii (Carrie Eckert, University of Colorado subcontract)

Develop genetic tools for transformation of C. ljungdahlii (Adam Guss)

Technoeconomic analysis, process design and scale up (Brian Lee)

Technical Approach



- Low pH yeast (*Pichia kudriavzevii*) for the conversion of sugars to PM1 to bypass the need for pH buffering during fermentation
- *Clostridium ljungdahlii* for anaerobic fermentation of Syngas ($CO/H_2/CO_2$) to improve biomass utilization and increase carbon conversion efficiency (compared to carbon loss from glycolysis)

Potential Challenges:

- Genetic tools are limited for these non-model microbial systems
- Potential product toxicity

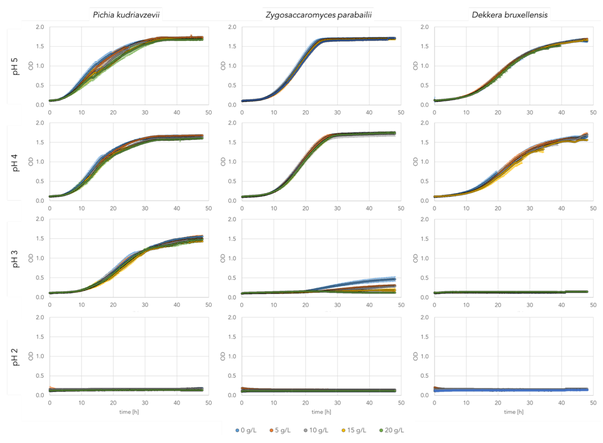
Critical Success Factors:

- Development of genetic tools to enable the Design Build Test Learn cycle for pathway engineering to improve product yields

Technical Progress and Future Plans

Current Progress:

- Determined pH growth minimum for *Pichia kudriavzevii*



- Improved transformation efficiency and development of genetic tools for introduction of PM1 pathway genes into *C. ljungdahlii*
- Preliminary technoeconomic analysis model constructed

Future Work:

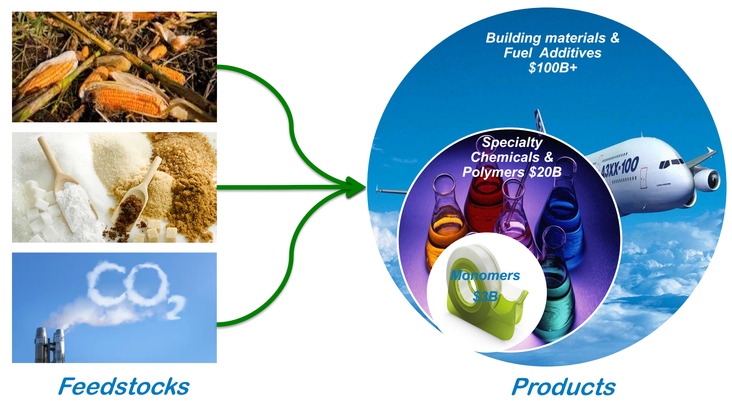
- Improve product titers in *P. kudriavzevii* and *C. ljungdahlii* using the Design Build Test Learn cycle
- Continued improvement of genetic tools, including promoters for optimized gene expression
- Scale up growth in bioreactors for target 5 g/L production in *P. kudriavzevii*

Relevance and Impact

RELEVANCE:

- Development of new platform organisms to overcome process limitations
- Enabling technologies for genetic engineering of non-model organisms to accelerate Design-Build-Test-Learn strategies for pathway engineering

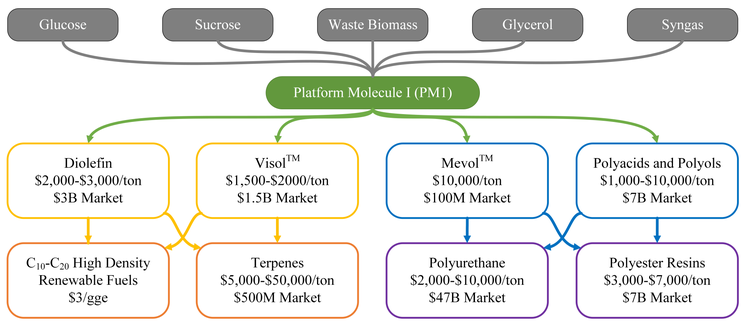
Visolis Vision
Renewable Chemicals and Fuels



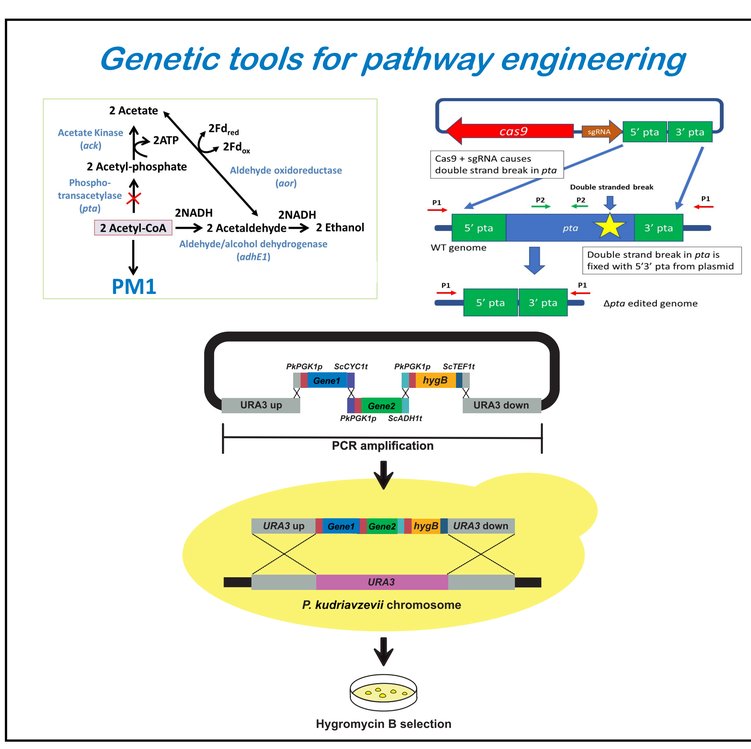
IMPACT:

- Renewable chemicals and fuels at competitive prices
- Stable, demand-responsive supply at reduced cost
- Carbon capture technology for the production of high value products
- Full deployment could meet DOE target of renewable fuel at $3/gge with co-production of high value products
- Displace and replace environmentally polluting and energy intensive petro-based processes for polymer and plastics production

Products and Market Size



Genetic tools for pathway engineering



This work was authored in part by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

2019 BETO Project Peer Review
Denver, Colorado
March 4, 2019 – March 8, 2019
NREL/PO-___-_____