



TETRAVITAE BIOSCIENCE

**Impact of Process Design on Energy
Consumption in Butanol Production**

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TetraVitae Bioscience Introduction

Commercializing bioproduction of butanol and acetone

Building upon work of Dr. Hans Blaschek, University of Illinois

Industrially-qualified team



Discussion:

Impact of Process Design on Energy Consumption in Butanol Production

Life Cycle Analysis of GHG emissions for biobutanol production

Foundational analysis completed by Argonne researchers

- » Biobutanol from corn: Wu, Wang, Liu ⁽¹⁾
- » Detailed process simulation
- » Identification of energy consumption as an area for improvement

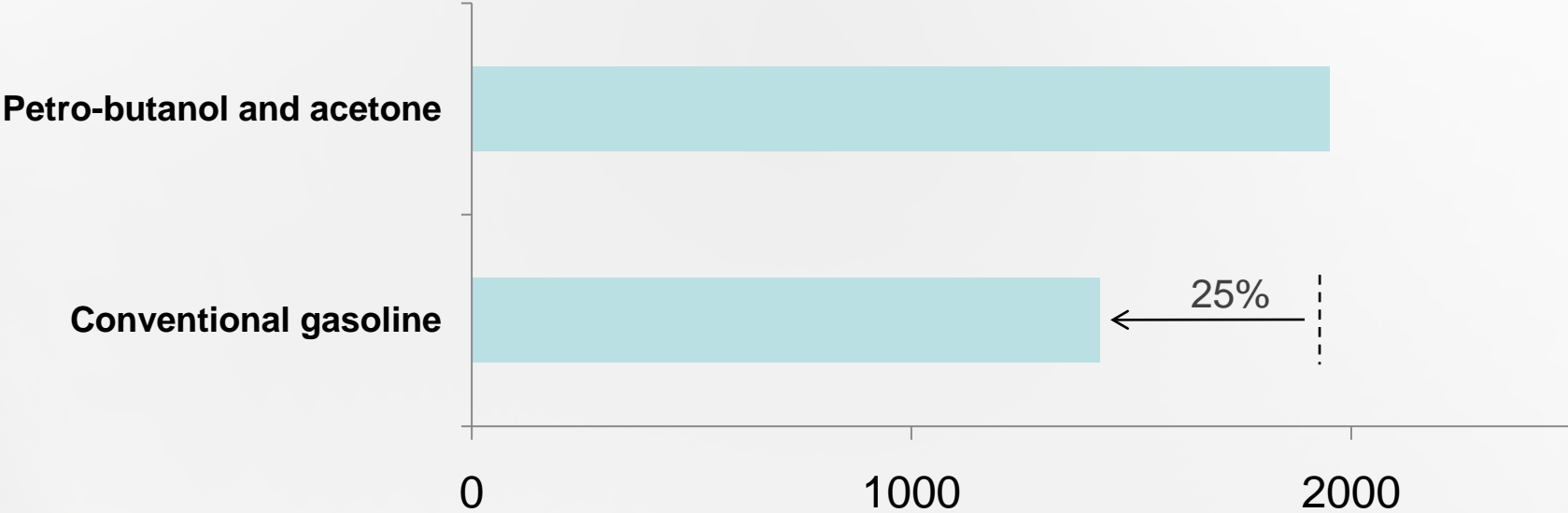
Insight from analysis completed by TetraVitae Bioscience

- » GHG savings depend on whether butanol replaces chemicals or fuels
- » Approach to water management dictates process energy

(1) Liu, Wu, Wang, "Simulation of the Process for Producing Butanol from Corn Fermentation," Ind. Eng. Chem. Res. 2009, 48

GHG savings vary significantly on the product being replaced

Emissions (g CO2 equivalent per lb of product)



Displacing petrochemicals saves more emissions than displacing fuels



Assessment of energy consumption in butanol production from corn

Water management drives energy usage

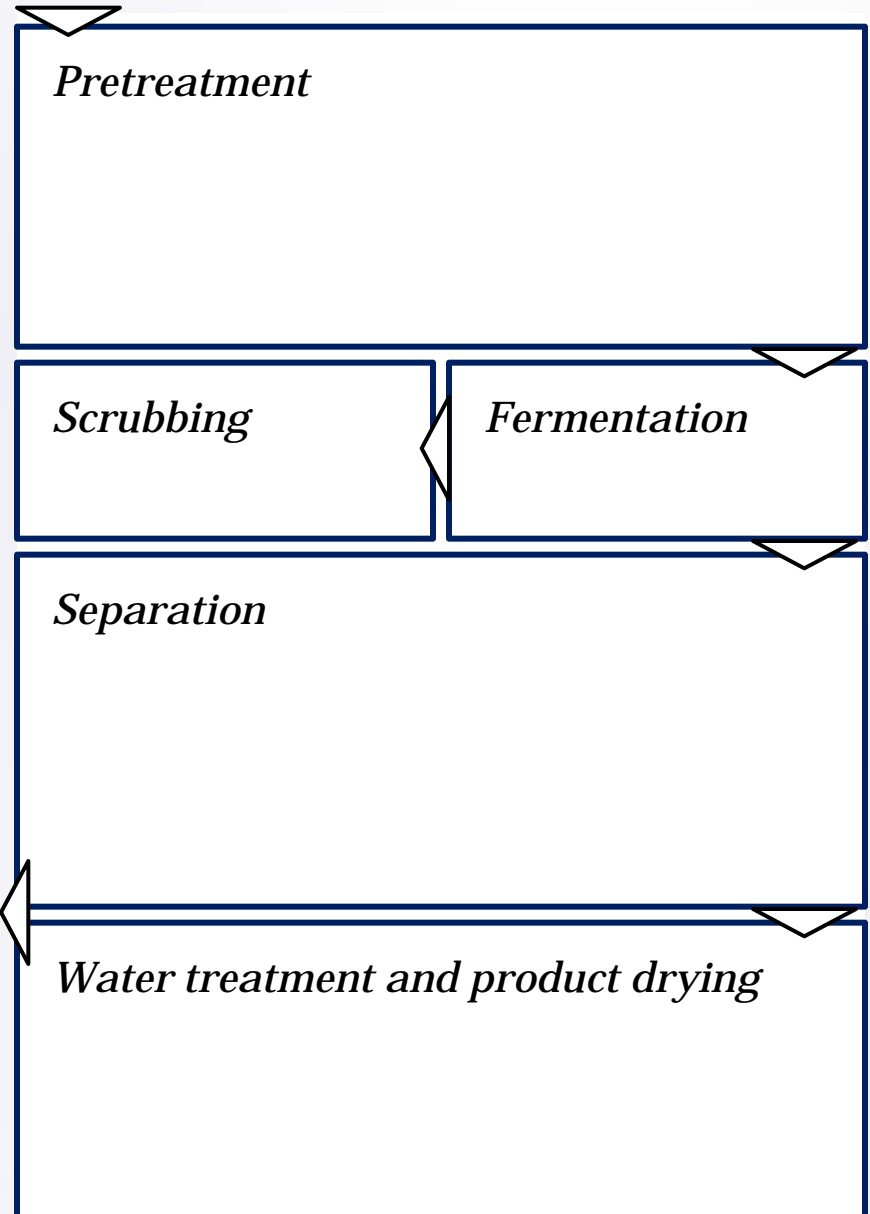
- » Product separation
- » Need to create dried distillers grains
- » Regulations restricting waste water

Approaches to reduce energy consumption

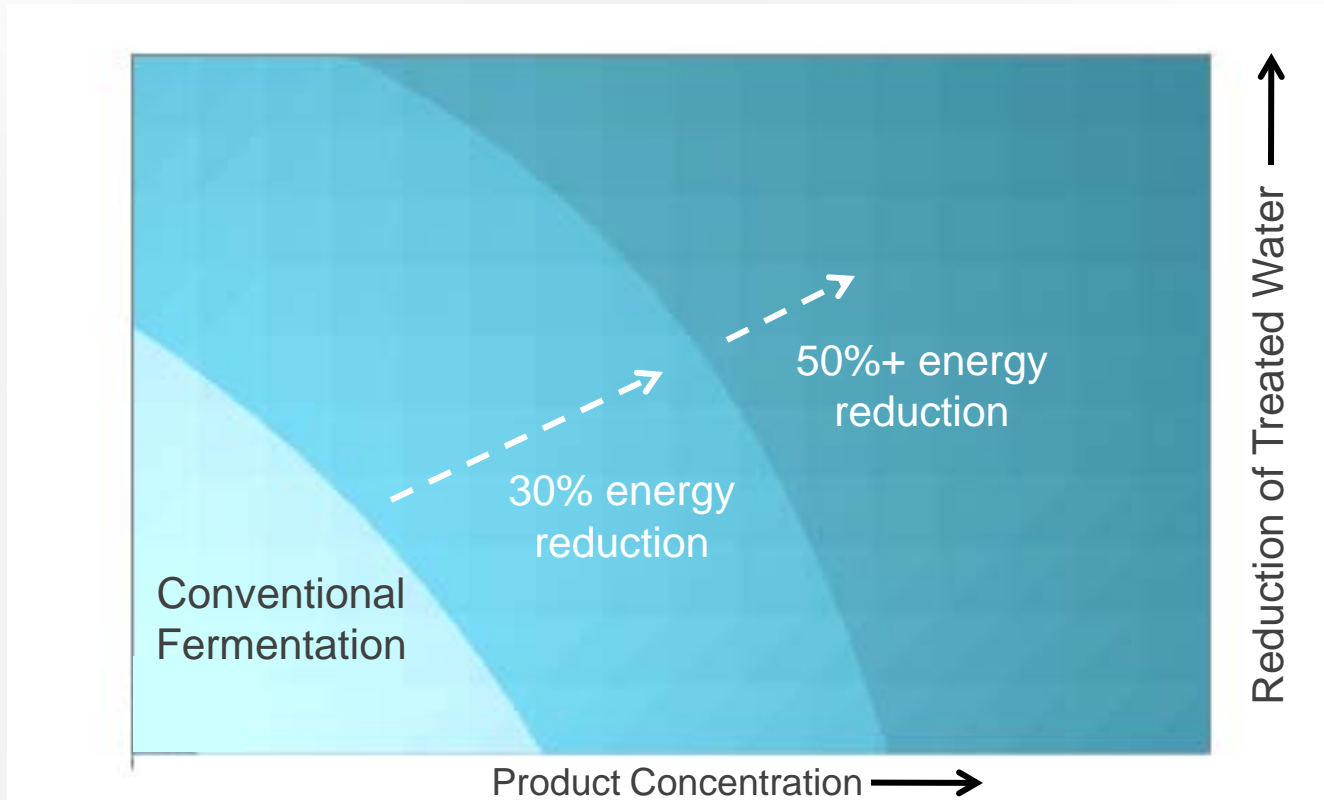
- » Increase product concentration
- » Process water
 - » Reduce
 - » Recycle
 - » More efficient clean-up

Products

Feedstock



Significant reductions in energy consumption are achievable



TetraVitae is developing multiple process technologies relevant to water management



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