



**Presentation to  
Renewable Chemicals Live Conference**

**April 2012**

# Rennovia Introduction

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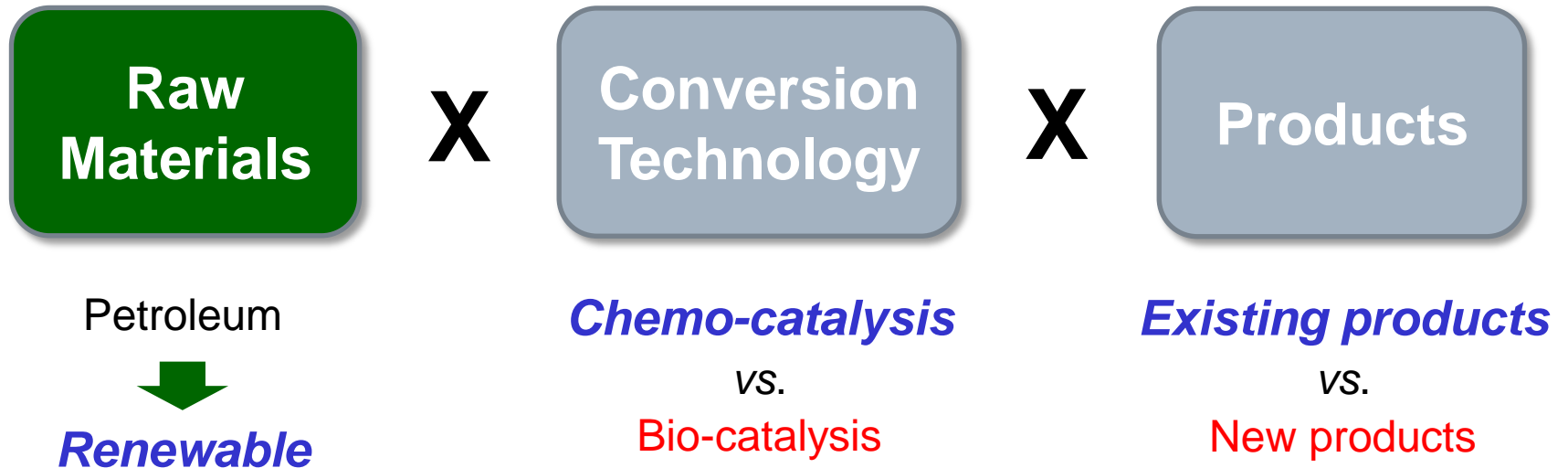
## OVERVIEW

- Venture-capital backed start-up company based in Menlo Park, CA
- Series A investors: 5AM Ventures and Versant Ventures (Sept. 2009)
- Led by senior chemical industry personnel:
  - Former employees of Chemtura, BP, DuPont, Symyx, Engelhard
  - CEO Bob Wedinger - 20+ year veteran of the chemicals industry
  - Founders Tom Boussie and Vince Murphy - ex-Symyx Technologies

## MISSION

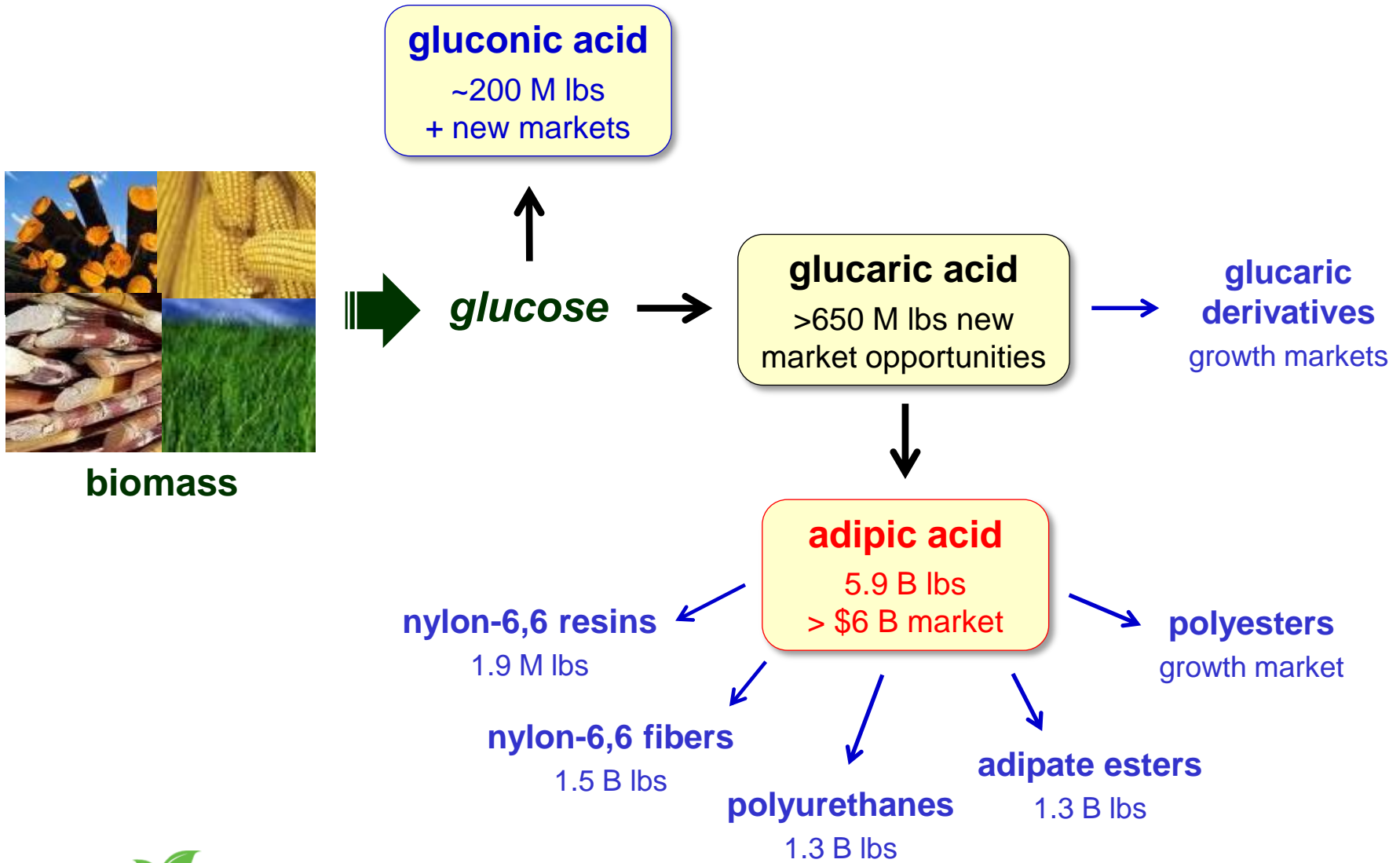
- Develop chemo-catalytic process technology for the production of existing major-market chemicals from renewable raw materials
- Focus on delivering fundamental cost advantage vs. incumbent petroleum-based processes
- Commercialize renewable chemicals in a multi-product pipeline

# Risk Reduction in Renewable Chemicals Production



- **Minimizing supply chain risk** by employing existing renewable raw materials and by producing existing “drop-in” chemical products
- **Minimizing conversion risk** by utilizing chemo-catalytic process technology

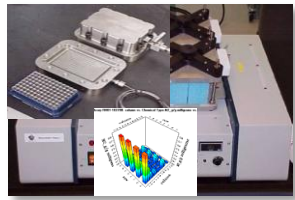
# Renewable Adipic Acid Product Family



# Process Development and Commercialization Schedule

Rennovia internal development

Leverage external resources



HT R&D



Continuous Reactors



Pilot Scale



**Renewable Adipic Acid Process in  
25 lb/day continuous production**



Commercial  
Demonstration

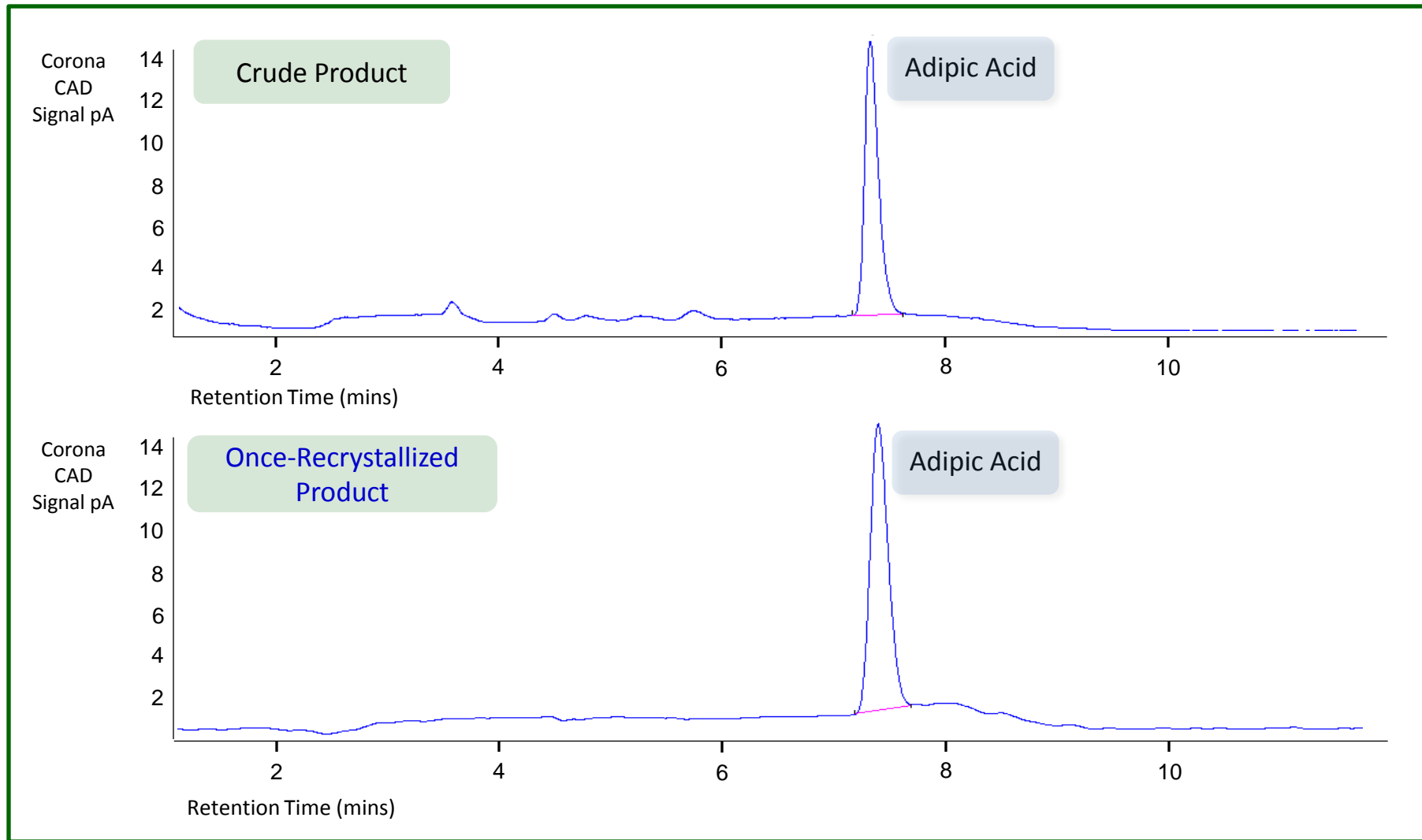


Commercial-Scale  
Production

- High-throughput R&D enabled rapid development of initial catalysts / processes
- Detailed techno-economic analysis confirms significant cost advantage vs. the incumbent petrochemical-based process and emerging fermentation processes
- Renewable adipic acid process currently at 1 lb/hr pilot-scale operation
- Adipic acid isolation, purification, and downstream product qualification in progress
- Design of 1 ton/day Commercial Demonstration Unit underway

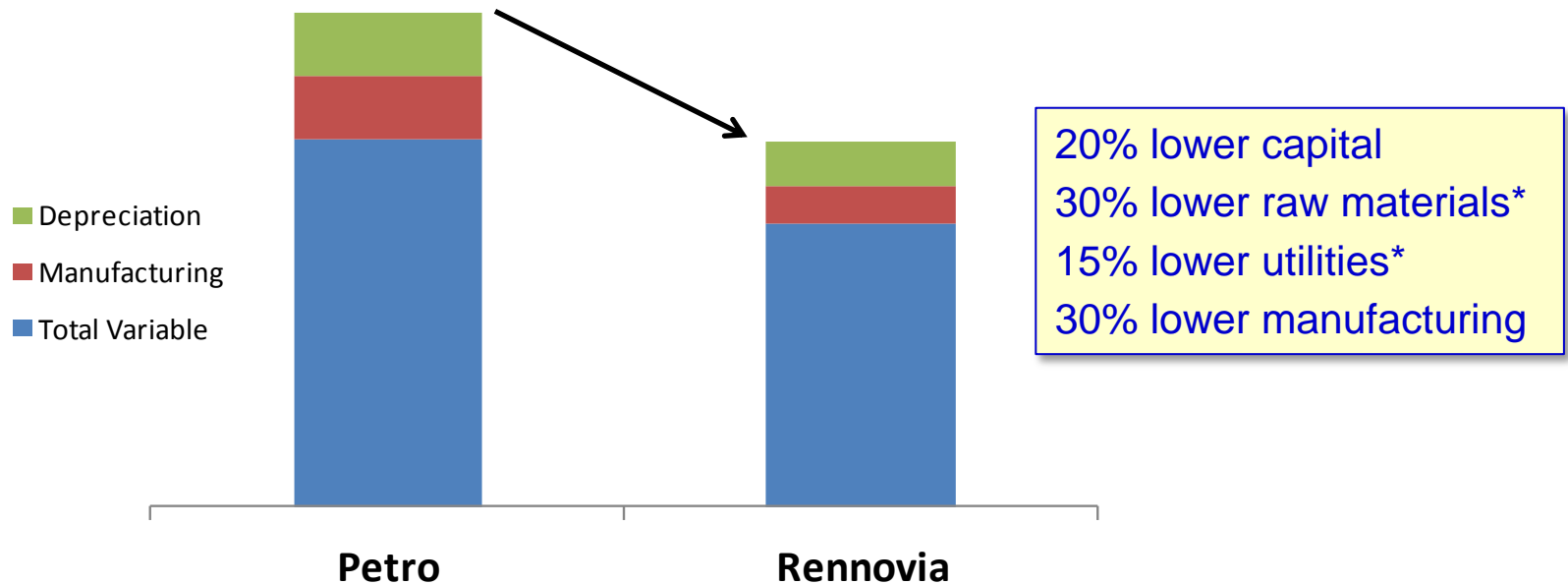
# Analysis of Crude Adipic Acid Product from CTU

Analytical Method Agilent LC with 2-D Corona CAD / MS Detection



# Advantaged Capex and Opex vs. Petro Adipic Acid

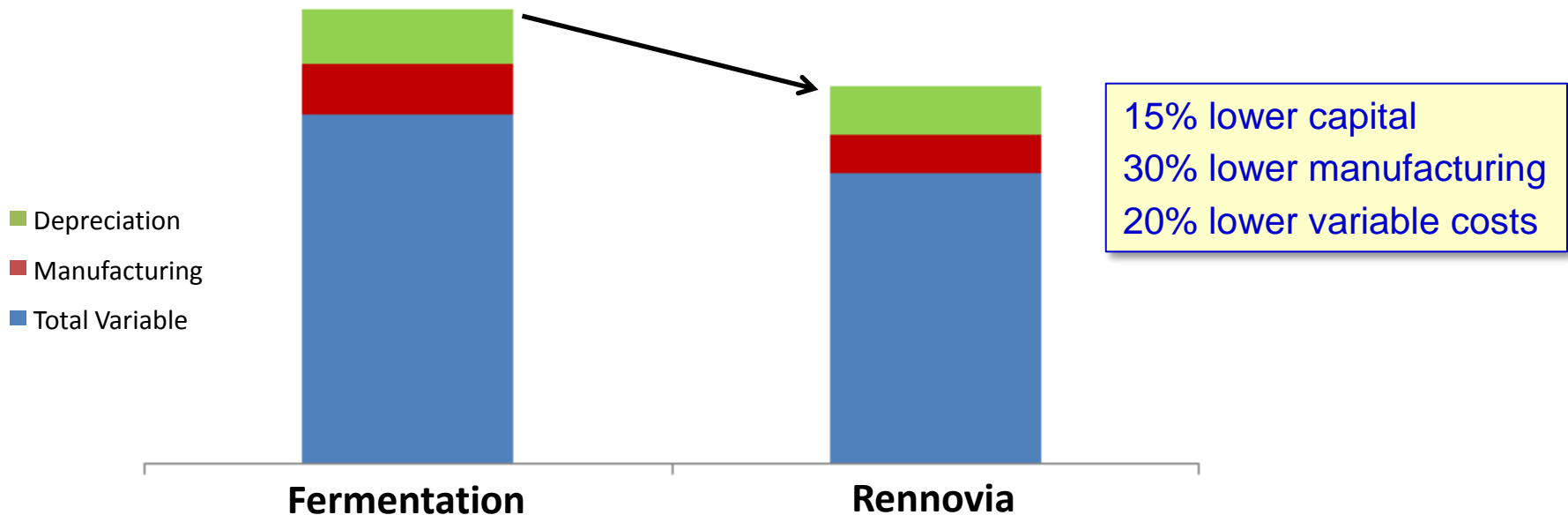
- Detailed engineering models constructed to compare Rennovia's renewable adipic acid process vs. the conventional cyclohexane oxidation process
- Rennovia process shows robust advantages in capex and opex vs. conventional petrochemical-based adipic acid process technology:



\*these data at \$0.15/lb glucose and \$70/bbl crude

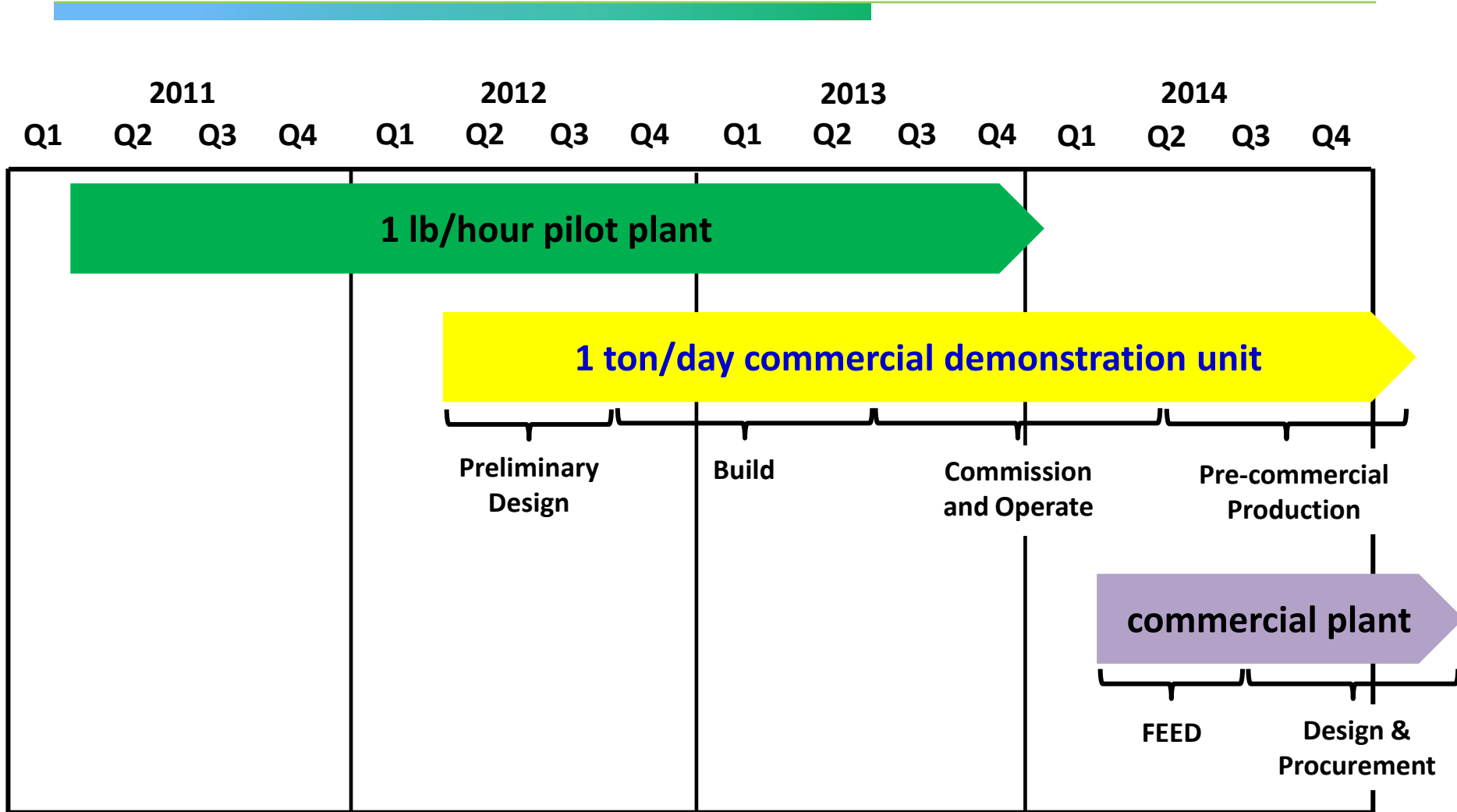
# Advantaged Production Costs vs. Fermentation Adipic Acid

- Rennovia's adipic acid process modeled against a theoretical fermentation process
- 300 M lbs/yr plant model assumptions:
  - Yield, utilities, capital, manufacturing cost, etc. from commercial fermentation processes
  - Low-pH fermentation and salt-free isolation technology assumed
  - Capital added for 3-stage adipic acid crystallization
  - For data below, same carbohydrate and utility prices used for both models

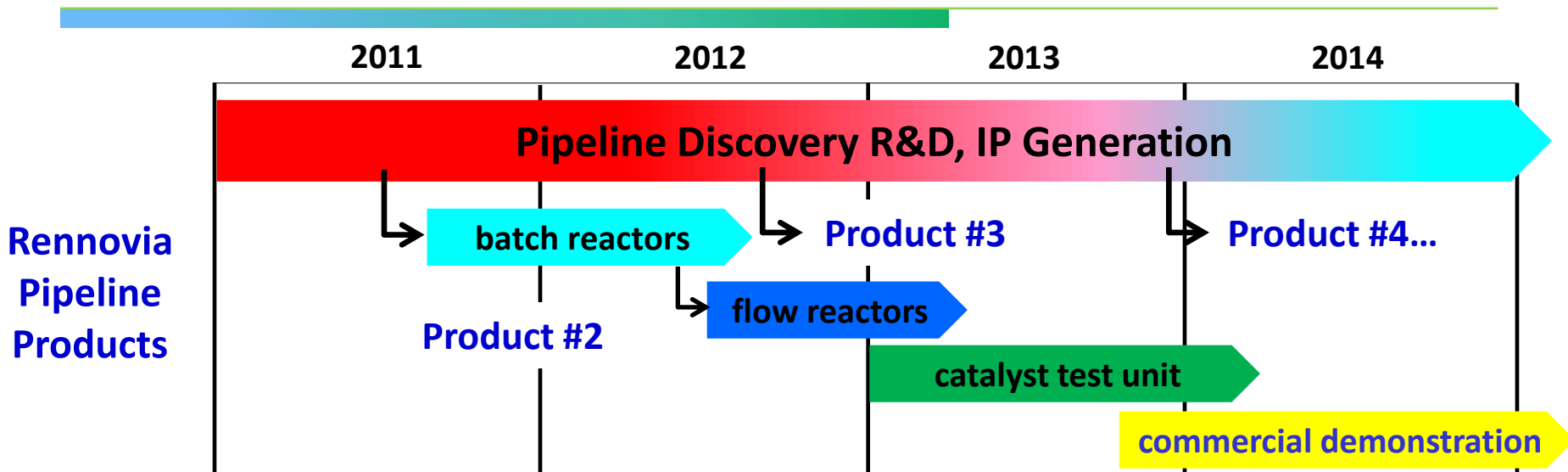




# Rennovia Adipic Acid Commercialization Timeline



# Rennovia Product Portfolio



- Strong chemical-industry interest in several product portfolio candidates
- Renovia Product #2 identified (unannounced):
  - ~\$6 B global market
  - Significant cost of production advantage over current petrochemical-based process
  - Foundational patent applications filed
  - Discovery R&D complete, entering scale-up
- Products #3 and #4 currently in discovery screening stage