

# Anellotech



## A New Cellulosic Biofuel Option

*To Help Meet Your D3 Renewable Volume Obligations*

# Meet the Anellotech Alliance

Technology, Catalyst, Engineering, Marketing



## Anellotech

- ✓ Program Management
- ✓ Research & Development
- ✓ Pilot Plants



- ✓ Process Development
- ✓ Modeling & Hydrodynamics
- ✓ Scale-Up



Johnson Matthey

**INTERCAT**<sup>JM</sup>

- ✓ Catalyst Technologies
- ✓ Formulations
- ✓ Catalyst Supply



- ✓ Process & Plant Design
- ✓ Technology Licensing & Marketing
- ✓ Start-Up & Operations Support

# AnelloMate via the Bio-TCat™ Process

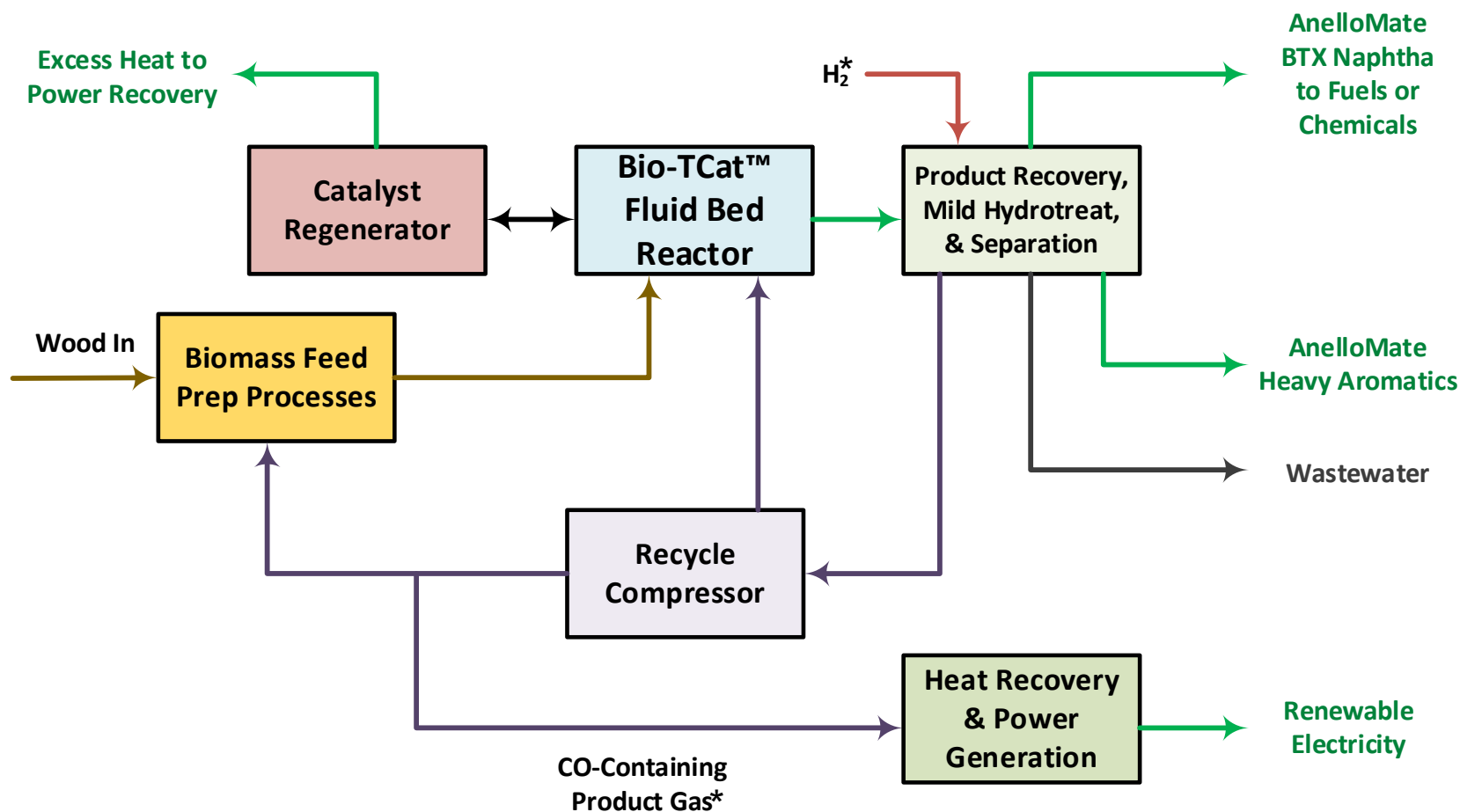
## Renewable Gasoline Blendstock



- Renewable cellulosic biofuel we call ‘AnelloMate’
  - meets EPA D3 criteria
  - provides 1.5 D3 RINS per gallon due to its greater energy density over ethanol
- Cost competitive with petro-based fuels & blendstocks
- Fungible with pipelines, refinery blending systems, fuel distribution and service station infrastructures
- Many product-related advantages over ethanol
- Thermo-catalytic conversion of non-food biomass
  - e.g. wood feedstock, fluid bed reactor with zeolite catalyst

# The Bio-TCat Process

## Renewable Fuels, Chemicals, and Energy



\*CO can be used to generate  $H_2$  for use within the process

# Advantages for Gasoline Blending

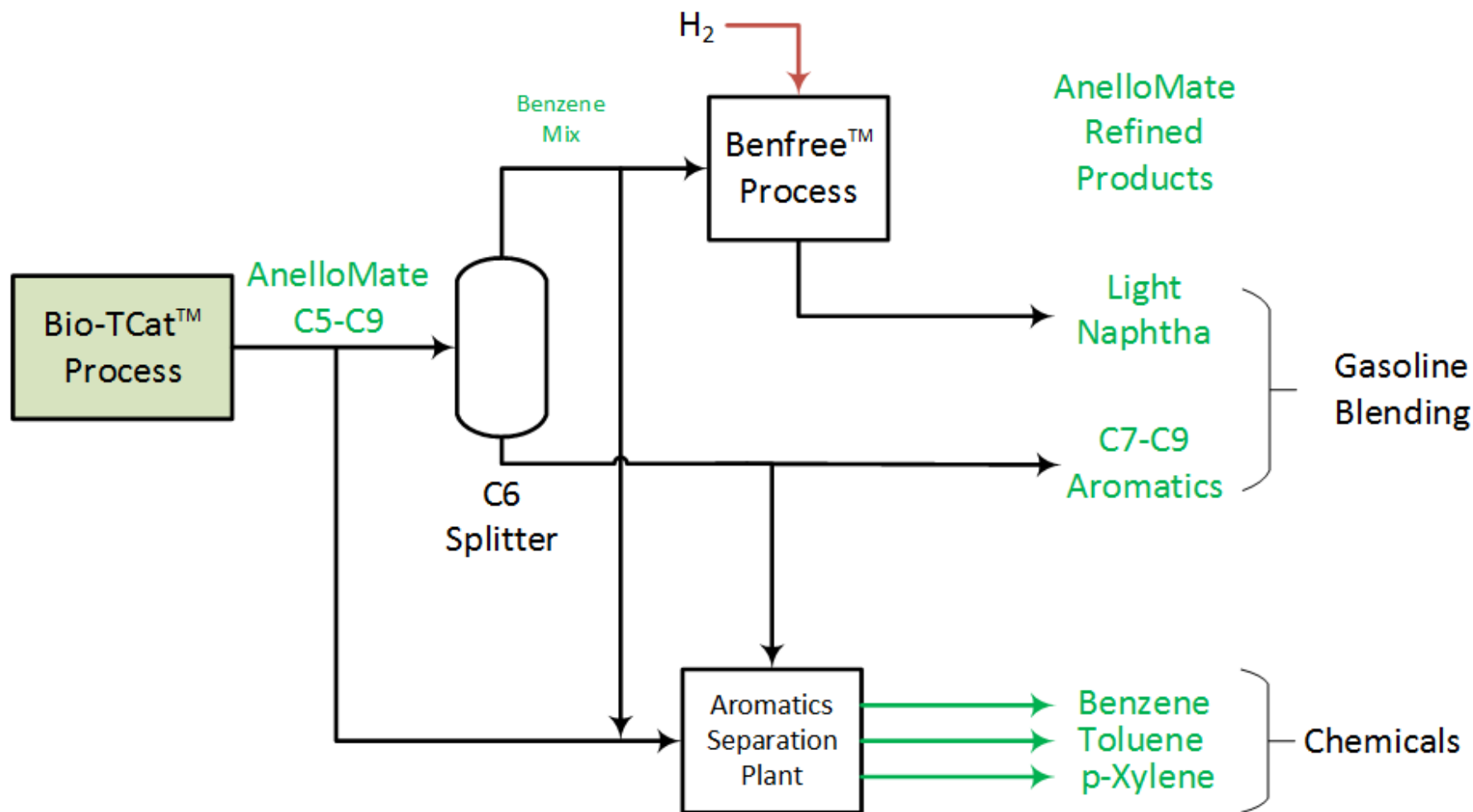
## Including Extra RIN Credits



Gasoline Blending Parameter	AnelloMate (AM)	Ethanol (EtOH)	Comments
D3 RIN Value	✓		1.5 RINs per wet gallon vs 1 for EtOH
Fungibility	✓		no oxygenates
Low Sulfur	✓	✓	1 ppm vs up to 30 ppm EtOH per ASTM D4806
Low RVP	✓		1-3 psi vs 16-20 for EtOH
Distillation Range	✓		broad boiling range vs EtOH
Energy Density & MPG	✓		EtOH has 1/3 <sup>rd</sup> less energy per gallon
High Octane	✓	✓	both over 100 (R+M)/2
Low Aromatics		✓	minimal aromatics in denatured EtOH
Low Benzene	✓	✓	AM low when processed in a benzene conversion unit or aromatics plant

# One Implementation Approach

## Bio-TCat for Fuels with Benzene Saturation



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