Conversion of Waste CO_2 and Shale Gas to High Value Chemicals

DE-EE0005766
Novomer/Praxair
Budget Period 1

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This presentation does not contain any proprietary, confidential, or otherwise restricted information.

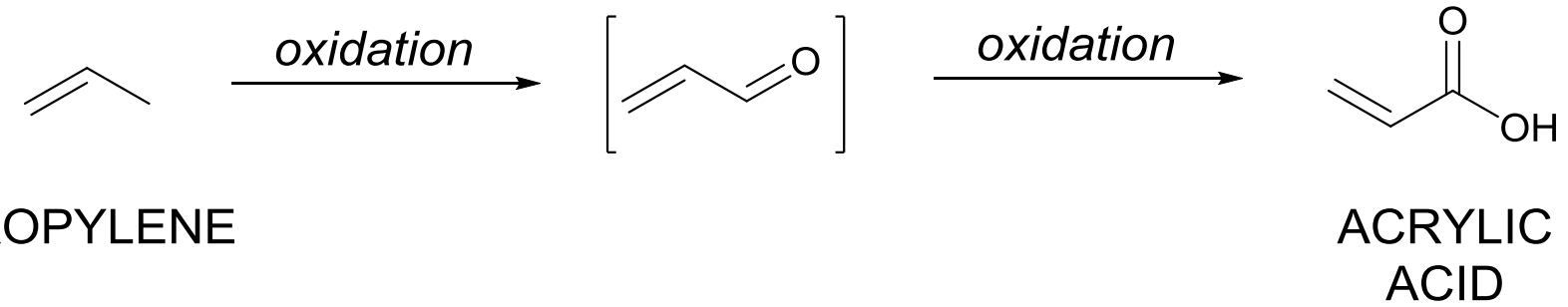
Project Objective

- Novomer is developing a new route to Acrylic Acid and Acrylates using proprietary catalysts and processing
- The Novomer route will use **ethylene** as the feedstock instead of **propylene** and will use Praxair's CO_2 to CO technology
- Using Ethylene and CO as feedstocks provides economic advantages versus the incumbent process

Key Challenge: Developing a robust process and scaling up to a pilot/demonstration facility

Technical Approach

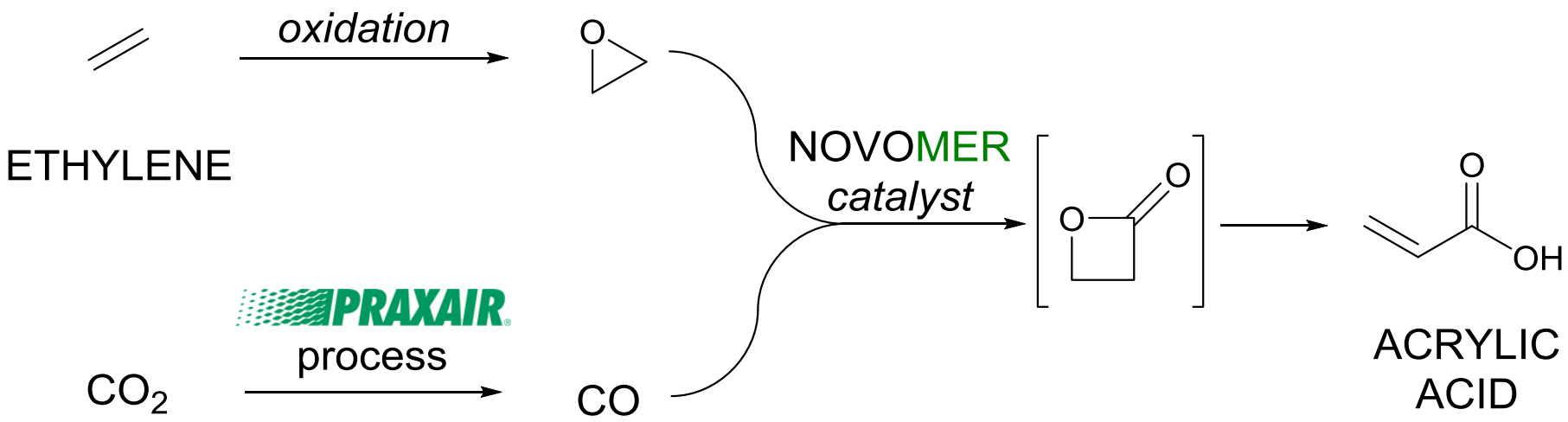
Current Process:



- Low selectivity
- High temperature, energy intensive process
- Capital intensive process
- Propylene feedstock prices tied to oil prices

Technical Approach

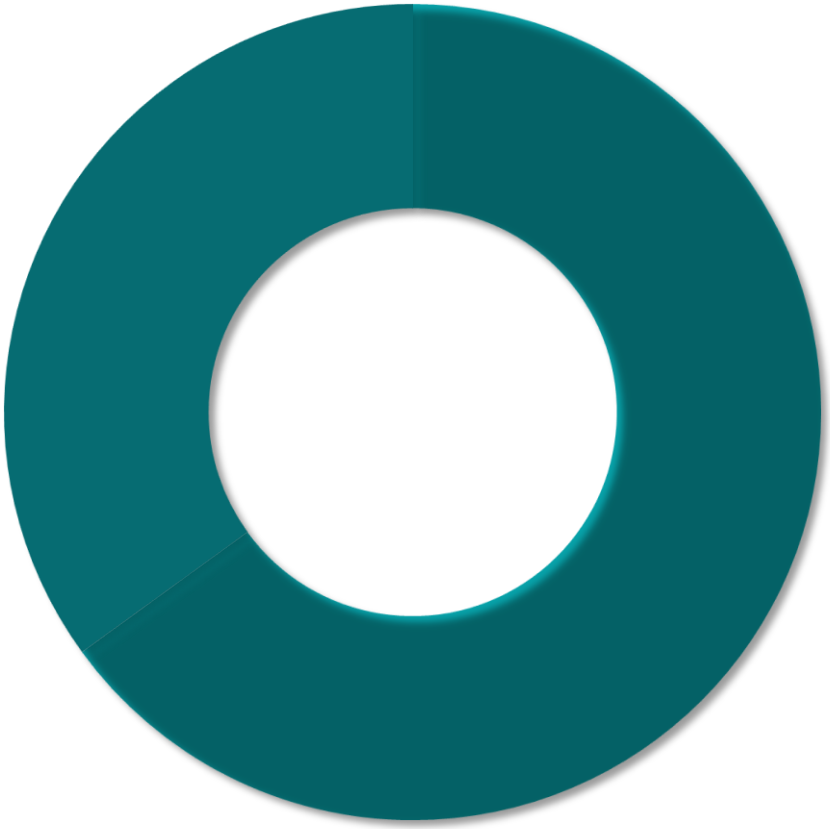
New Process:



- Lower capital requirements
- High selectivity in each step
- Lower energy requirements
- Domestically sourced feedstocks

Transition and Deployment

Acrylic Acid End-use

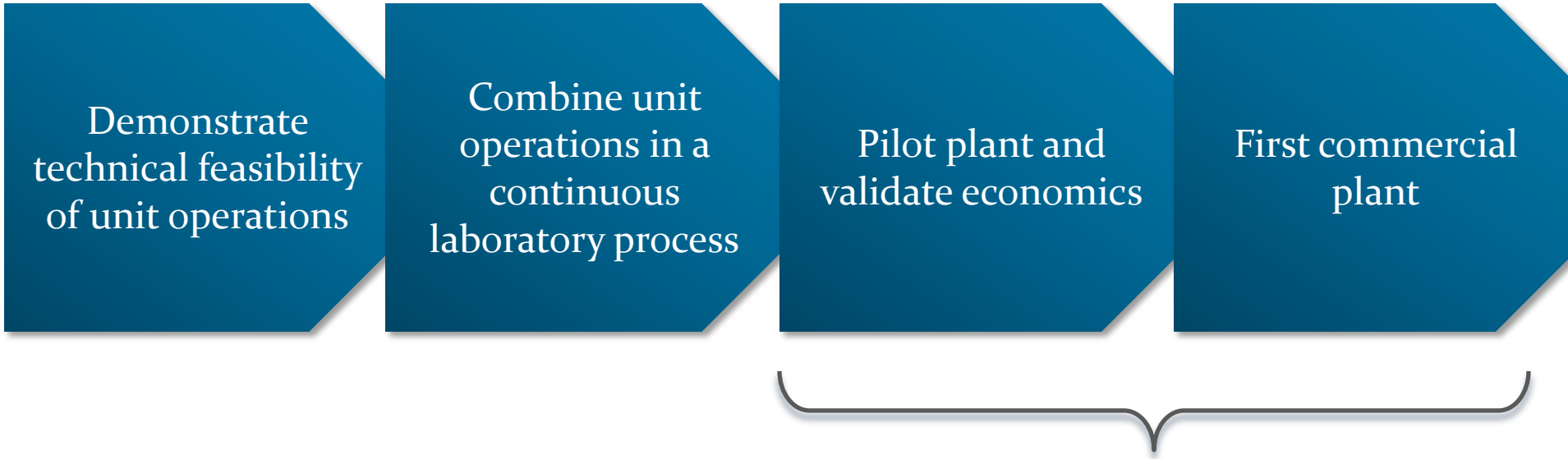


- Acrylate Esters - Paints, Coatings, Adhesives, Other
- Super Absorbent Polymers - Diapers

Transition and Deployment

Path to Market

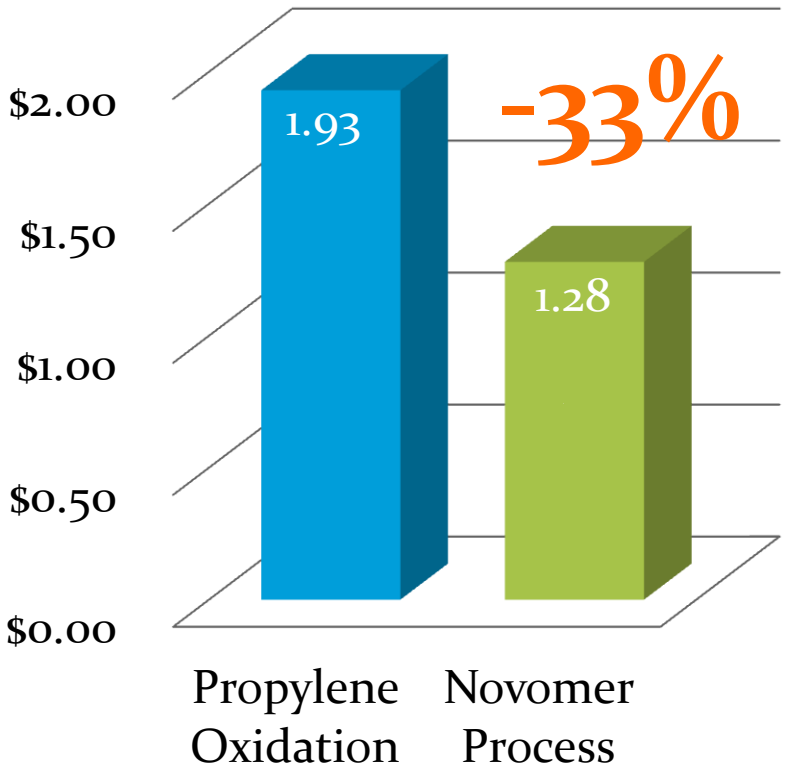
DOE Project Scope



Joint Development with Partner

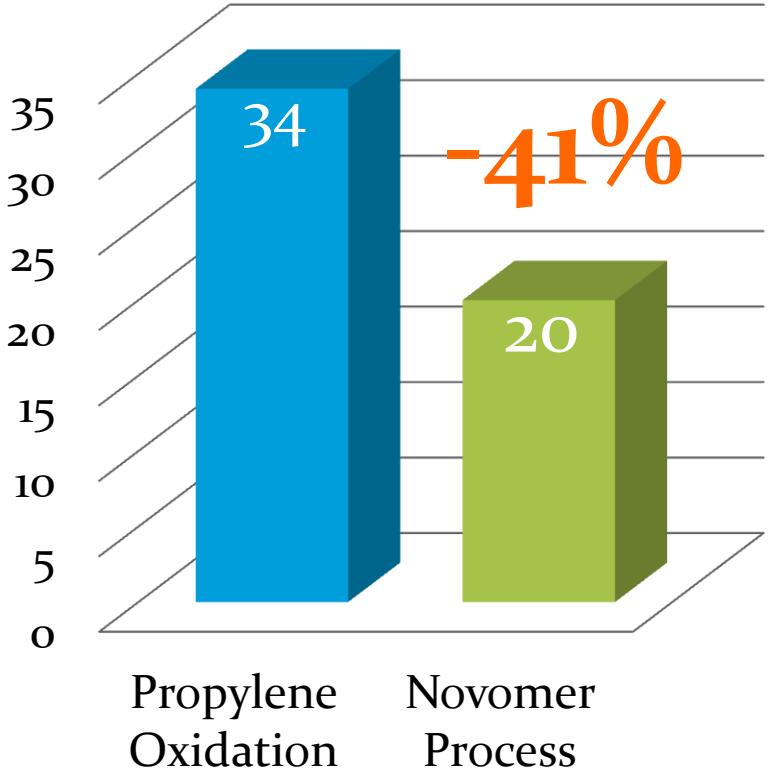
Measure of Success

Acrylic Acid Cost (Transfer Price, USD)



SAP grade Acrylic Acid
US Gulf Coast Feedstock Pricing, 2013

Energy Footprint (10^3 Btu/kg)



Carbon footprint data from the Eco-invent Industry Database

Project Management & Budget

Project Review	Milestones
Year 1 Review (7/31/14)	- All unit operations demonstrated individually and meeting initial technical goals for demonstrating feasibility - Process economic and life cycle analysis models refined to identify key metrics for cost and energy advantaged process - Initial demonstration of CO_2 -> CO process
Year 2 Review (7/31/15)	- All unit operations connected with recycle loops and steady state is achievable - Run reactor continuously and meet key metrics identified in the economic model - Validate assumptions on CO_2 -> CO energy requirements
Year 3 Review (4/31/16)	- Secure partner for pilot plant construction/operation - Integrate CO from CO_2 into the process - Validate and refine economic models with reactor data

Total Project Budget		
	DOE Investment:	$5.0 MM (76%)
	Cost Share:	$1.6 MM (24%)
	Total	$6.6 MM

Results and Accomplishments

- Unit Operations
  - Continuously stirred tank reactor: **operational**
  - Catalyst separations unit: **operational**
  - Acrylic acid conversion unit: **in progress**
  - Solid oxide electrolysis cell: **in progress**

- Economic model
  - Model refined, incorporating newest information on reactor performance and separations system