

# CO<sub>2</sub>-Based Polyols for Polyurethane Applications

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*GC3 Innovators Roundtable - 2015*

NOVOMER was founded in 2004 to commercialize innovative catalyst technologies from Cornell University

### Key Technologies:

- CO<sub>2</sub> as a raw material for polymers
  - CO as raw material to fine chemicals
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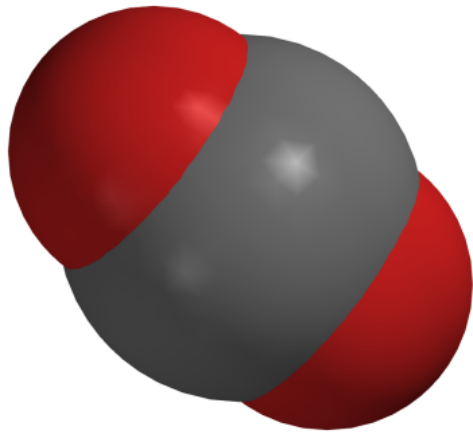
Saudi Aramco  
Energy Ventures



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## Carbon Dioxide is an attractive chemical feedstock

CO<sub>2</sub> is:



Non-toxic

Non-flammable

Non-corrosive

Abundant

Inexpensive

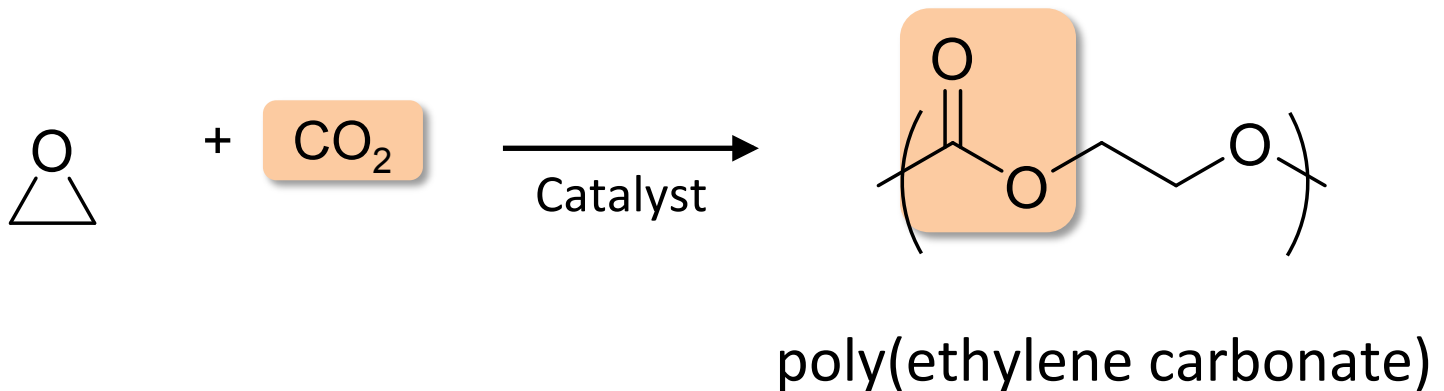
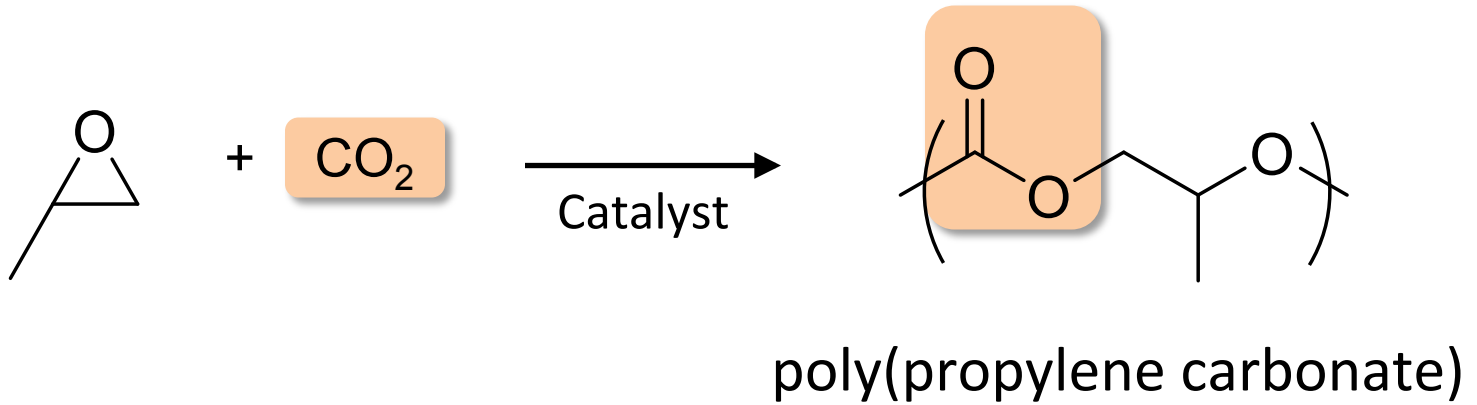
Readily transported

Limited in reactivity

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# Opportunity

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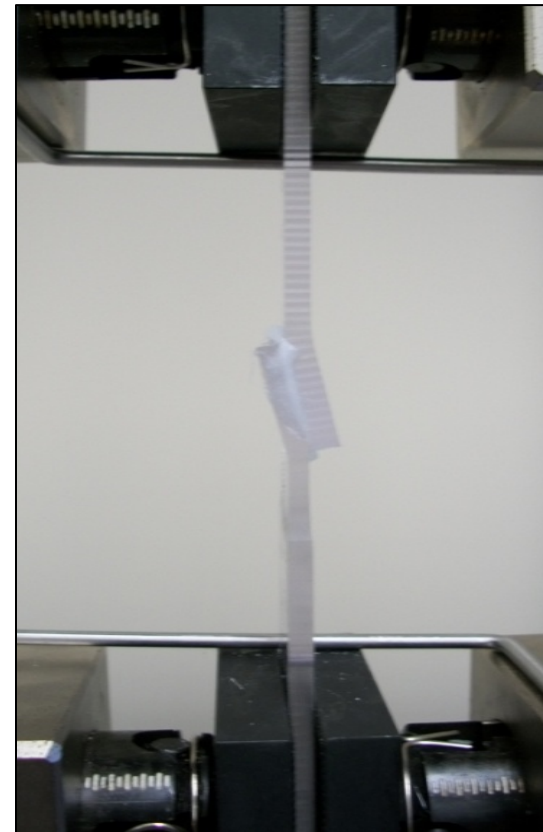
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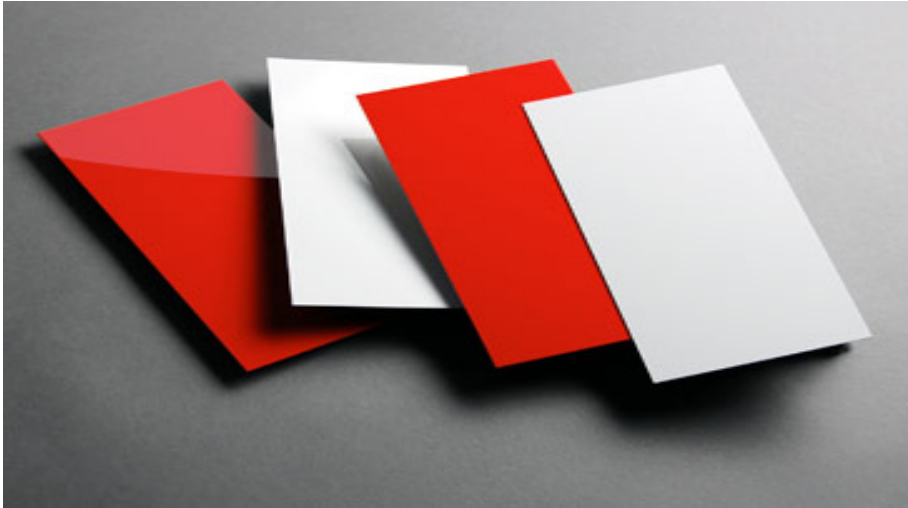
# CONVERGE<sup>®</sup> Polyols

- Product launched in 2014
  - 8 products
    - Four different polyol products with various molecular weights, initiators
    - Two formulated products for hot melt adhesives
    - Two formulated products for foam applications
  - Several thousand tons in capacity
  - Sales and distribution in NA, Europe and Asia
  - Commercial quantities are currently available
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## Adhesives

- Excellent hydrolytic stability
- Rapid green strength in hot melt systems
- Compatible with common polyols and other components
- Retains properties after prolonged heating
- Often see substrate failure on common substrates before the bond breaks





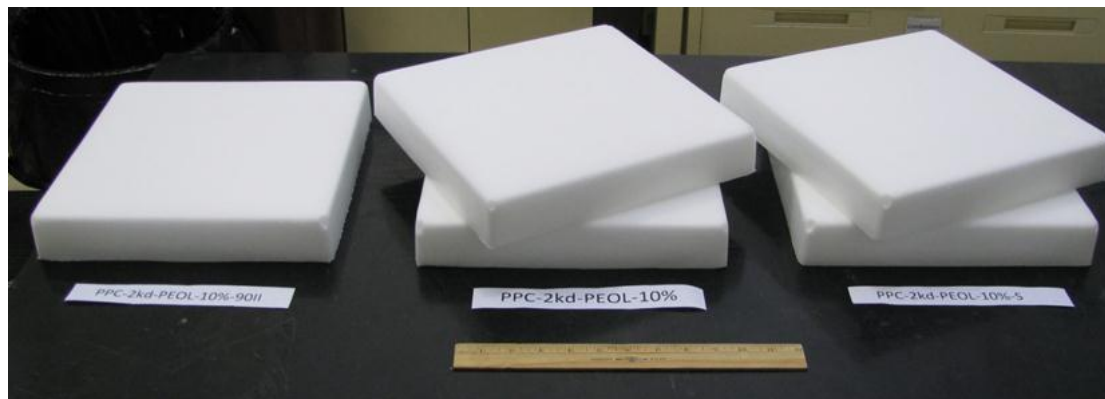
## Coatings

- High hardness and flexibility
  - Good adhesion to metal and plastic substrates
  - UV stable
  - Stable in the presence of water, acids, solvents
  - Formulate clear or pigmented coatings
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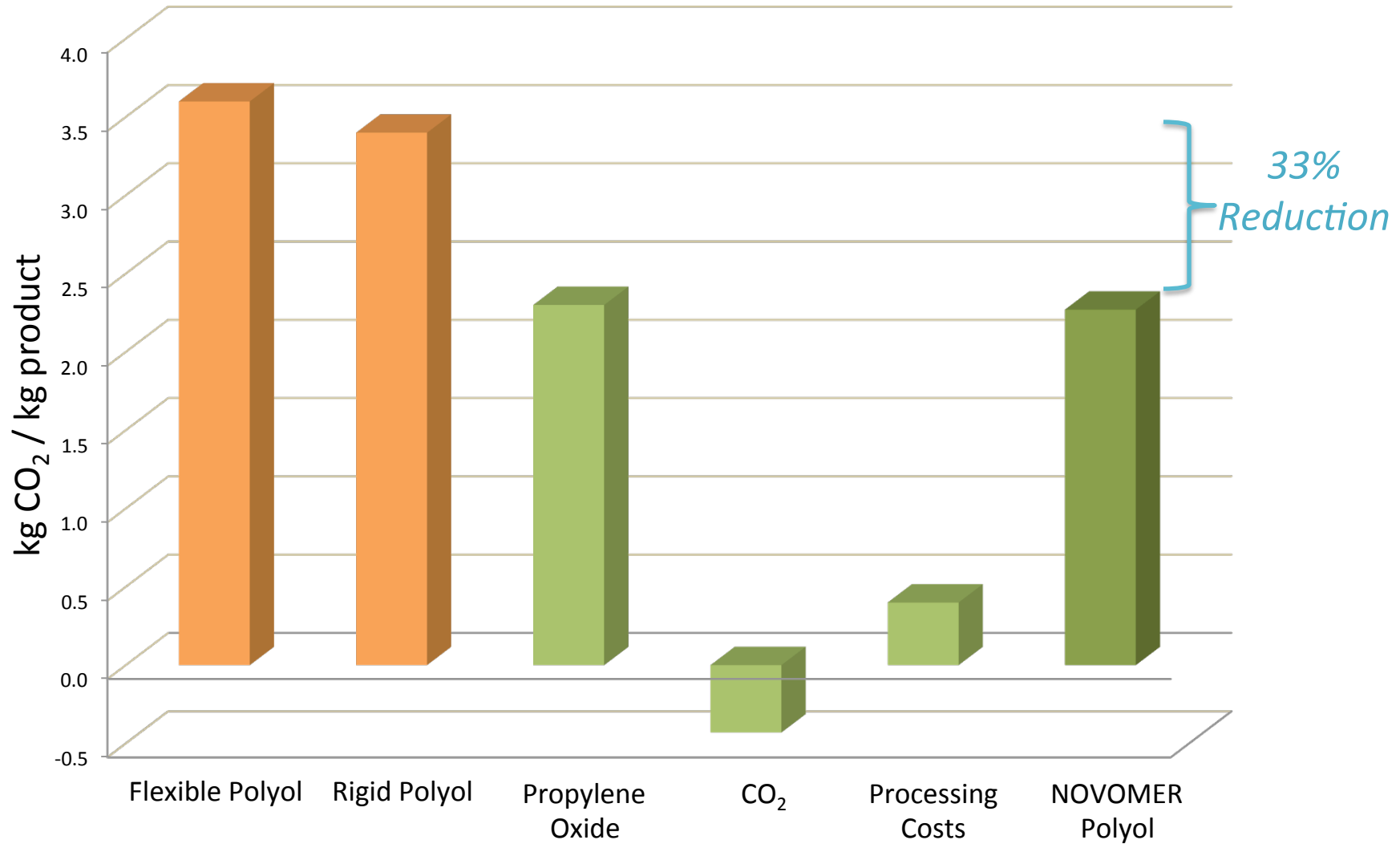


## Flexible Foams

- Increases strength in flexible and viscoelastic foams
- Enhances load bearing properties
- Low calorific value due to CO<sub>2</sub> content; ~40% lower heat of combustion than other polyols

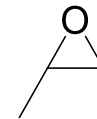
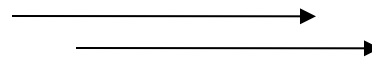


# Life Cycle Analysis



# On the Horizon

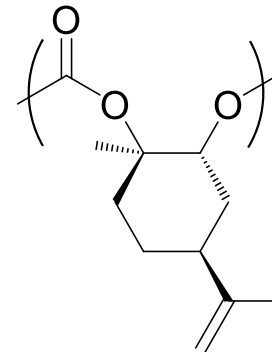
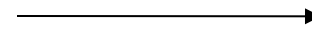
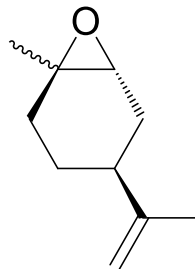
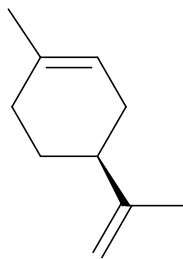
Starch  
Sugar  
Cellulose  
Oils



via glycerine



via ethanol



Limonene

*major component of orange peel oil*

Thank you

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