

# TEA/LCA shows that sustainability Passive membrane transport of lignin-related compounds

## Background

- Novel consolidated dehydration and oligomerization (CADO) technology can convert sustainable ethanol into gasoline, diesel, and jet fuel blendstocks without adding hydrogen.

## Approach

- Simple technology allows low capital and operating costs. It is being scaled-up by Vertimass LLC.
- Detailed Technoeconomic and Life Cycle assessments (TEA/LCA) were performed

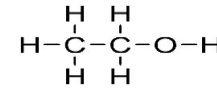
## Outcome

- TEA/LCA indicates that CADO passes on 40-70% GHG reductions with 1G ethanol and 70-96% reductions with 2G ethanol
- CADO approach can produce hydrocarbon fuels at about the same cost as removing water from ethanol
- Remaining challenge is to increase carbon number and reduce aromatics to allow blending with jet fuel

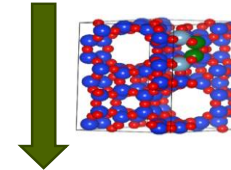
## Significance

- Hybrid biological/chemical conversion can expand market opportunities and impact
- Upgrading of alcohols can preserve the sustainability value.

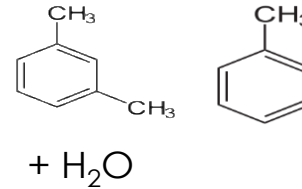
JR Hannon, LR Lynd, O Andradec, PT Benavides, GT Beckham, MJ Bidy, N Brown, MF Chagas, BH Davison, T Foust, TL Junqueira, MS Laser, Z Li, T Richard, L Tao, G Tuskan, M Wang, J Woods, CE Wyman. "Technoeconomic and life cycle analysis of catalytically converting wet ethanol into fungible fuel blendstocks." *PNAS* (2019) www.pnas.org/cgi/doi/10.1073/pnas.1821684116



Hydrous ethanol from distillation column



Low-cost metal-exchanged zeolite catalyst



Complete conversion to aromatic and aliphatic hydrocarbons typical of fuel blendstocks with coproduct water

*Aromatic and aliphatic hydrocarbons typical of fuel blendstocks (C<sub>4</sub>-C<sub>14</sub>) with trace ethylene byproducts*

