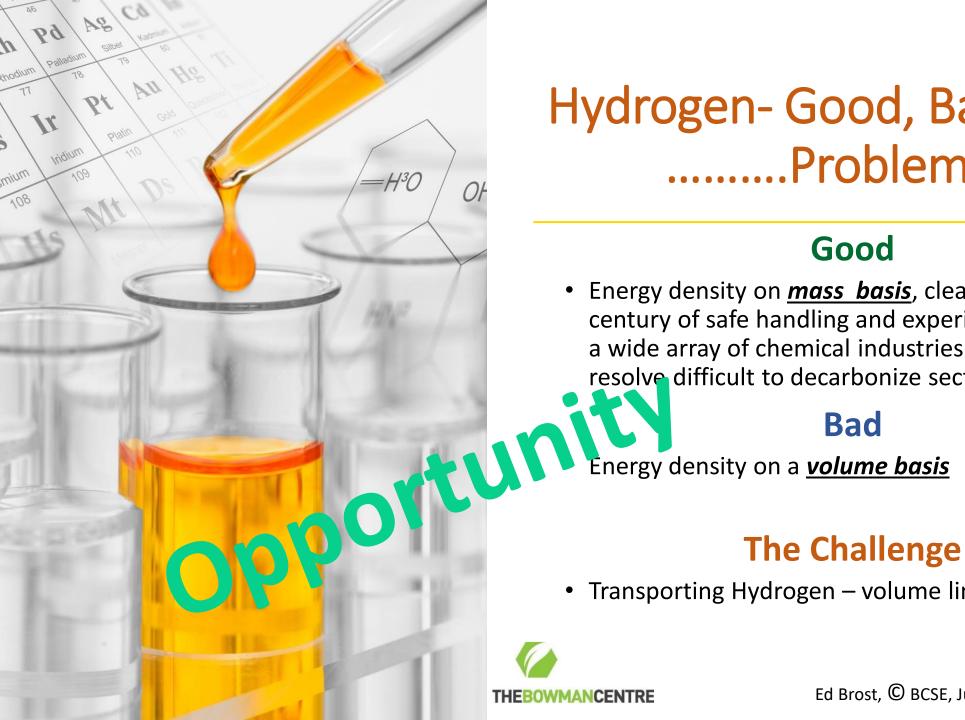


## **AGENDA**

- Low Carbon Hydrogen Good, Bad, Ugly
- Challenges associated with transporting Hydrogen to Future Markets
- Introduce organic chemical Hydrogen Carriers;
  - An emerging business opportunity for the Petrochemical Sector?





## Hydrogen- Good, Bad and the .Problem????

#### Good

Energy density on *mass basis*, clean burning, A century of safe handling and experience, feedstock for a wide array of chemical industries and a candidate to resolve difficult to decarbonize sectors

Transporting Hydrogen – volume limitations



# **Transportation Fundamentals**

**Mass Limited** 

**Volume Limited** 







# Petrochemicals as Hydrogen Carriers





# Hydrogen Carriers

#### Metals

• LiH

### Inorganic Liquid Hydrogen Carriers

• Ammonia

# Petrochemical Liquid Organic Hydrogen Carriers (LOHC)

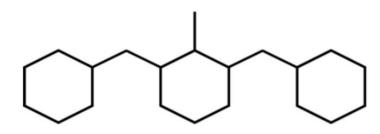
- Methanol
- Reversable Hydrogenate/dehydrogenate aromatics
- Di-benzyl toluene/para di-benzyl toluene



## A Candidate Hydrogen Carrier

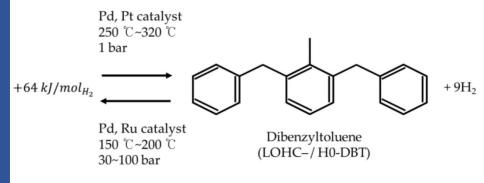
## **DBT**

- This chemical carrier in the hydrogen "lean" version is *Perhydro-Di Benzyltoluene*
- When loaded up with hydrogen the "rich" version is *Di Benzyltoluene*
- The difference between the rich and lean version of this chemical workhorse is 18 hydrogen atoms!



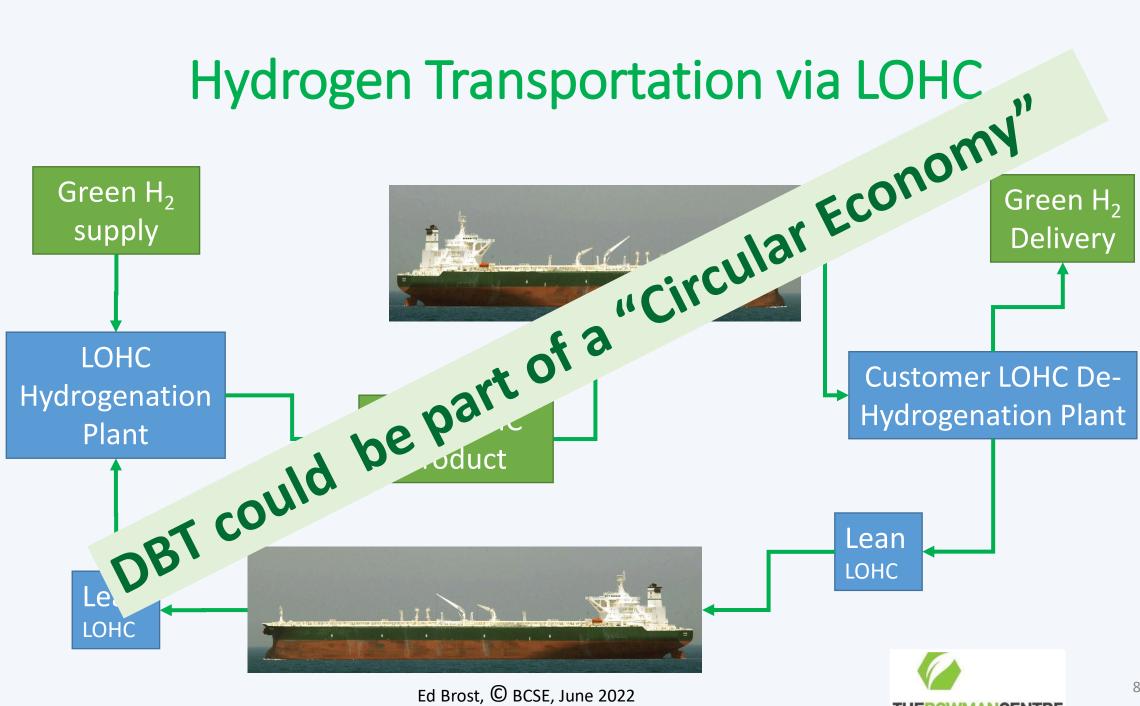
Perhydro-dibenzyltoluene (LOHC+/H18-DBT)

Denyarogenation



Hydrogenation





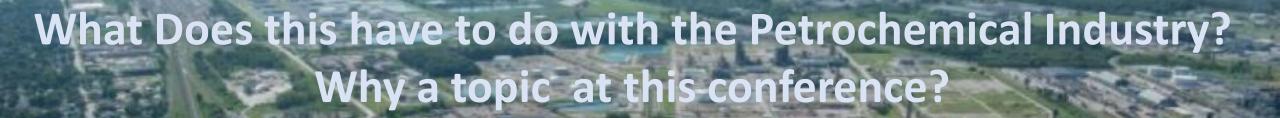
**THEBOWMANCENTRE** 

# LOHC Transporting Hydrogen









Potential for a new petrochemical to support decarbonization

Green Hydrogen

