

Hydrogen Hidden in Ethanol

The Solution For Advancing Hydrogen
In Aviation & Other Sectors



gölu-H₂



**BROWN ENERGY
SOLUTIONS INC.**
BROWN IS THE NEW GREEN

HyEn+

Michael A. Maher – Chairman & Co- Founder

Michael D.K. Lewison - President & Co-Founder

T.O. VIRIDI, INC.





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SOLUTIONS INC.**
BROWN IS THE NEW GREEN

 **SBI BIOENERGY INC.**

ONEC

 **FLEXIBLE
ENERGY
SOLUTIONS**



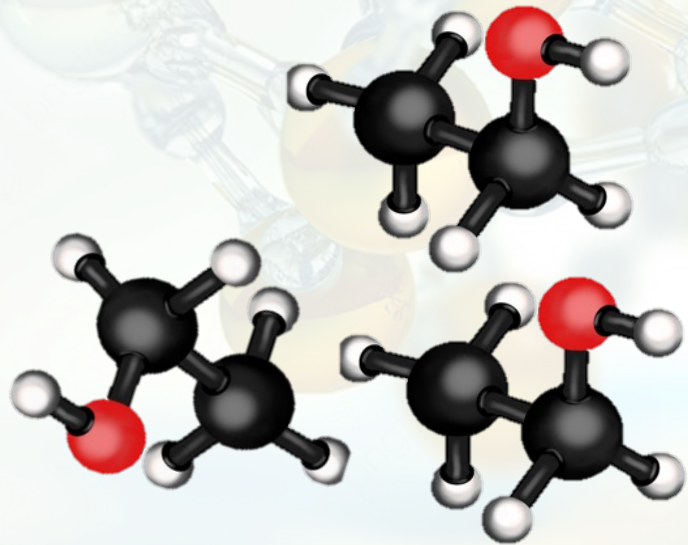
gölu-H₂



DR. MIRZA CONSULTANTS INC.
GREENHOUSE SPECIALIST

WHAT IS ETHANOL?

It's "C₂H₆O"



Meet Topsy!





WHAT IS ETHANOL? Cont'd

Is a Bio-Fuel! It's made from:

Switchgrass



Corn



Sugar





WHAT IS ETHANOL? Cont'd

It's drinking alcohol – “moonshine”

It's hand sanitizer



It's safe and abundant





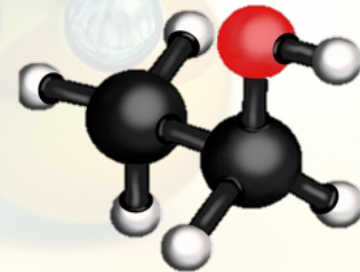
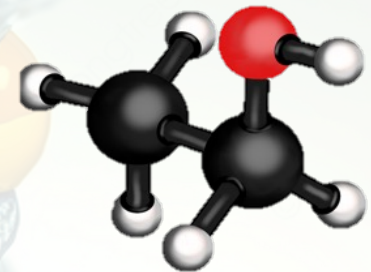
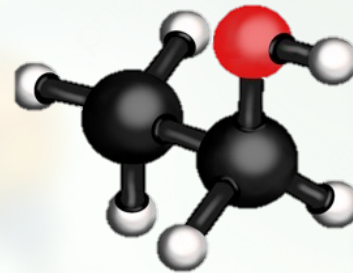
WHAT IS ETHANOL? Cont'd

The third most abundantly produced fuel in the USA – after gasoline and diesel

- 44M gallons /day – produced and distributed (capacity of >50M g/d)

Primarily used in gasoline as an:

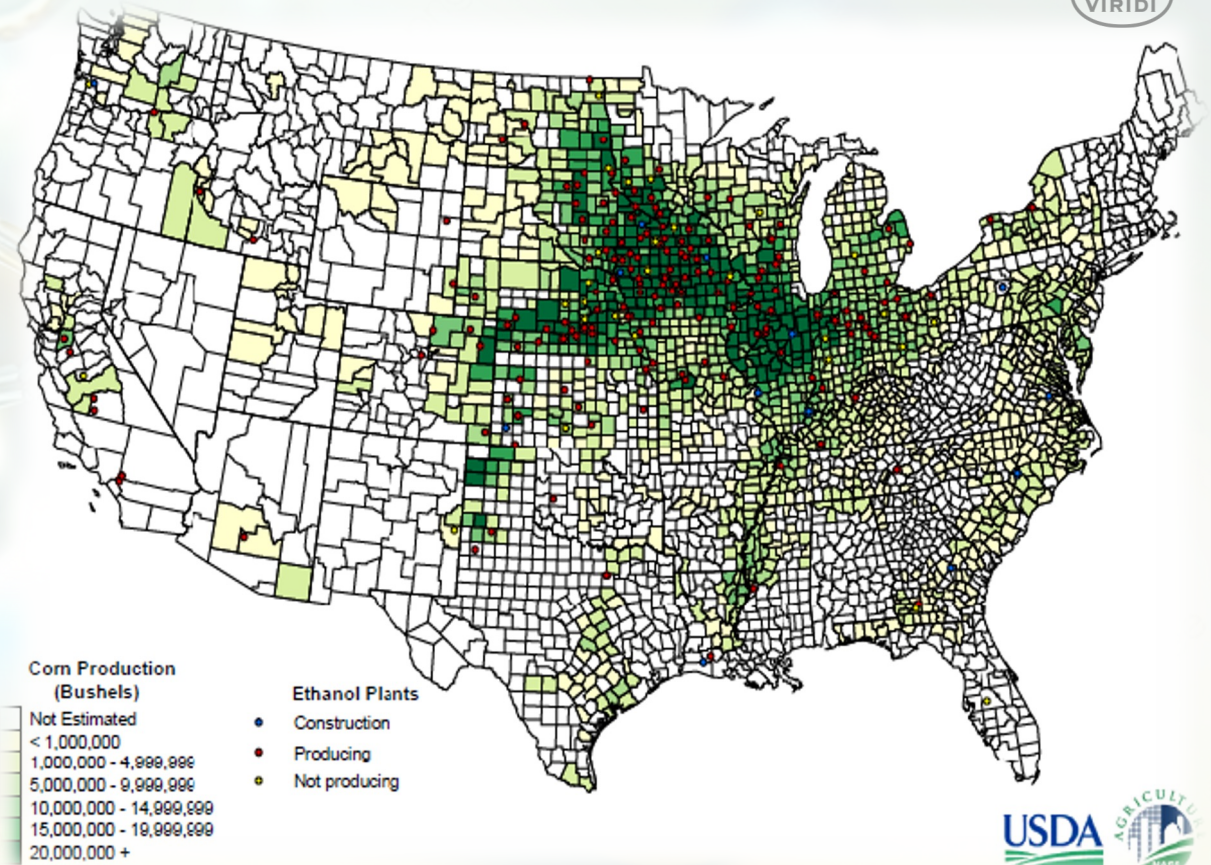
- Octane Booster (replaces formerly used lead)
- Oxygenator – enables a more complete burn of fuel, reducing emissions



WHAT IS ETHANOL? Cont'd

Nationwide Availability
Ethanol is distributed to all 50 states, ensuring widespread access across the country

Consistent Supply
Ethanol is available every day, making it a reliable fuel and industrial resource





WHAT IS ETHANOL? Cont'd

Uses existing infrastructure to move to all corners of the US and the Globe

Can be moved and stored in re-purposed existing infrastructure





WHAT IS ETHANOL? Cont'd

CI scores as low as 5-10 & even lower with modern switchgrass technologies

CI becomes negative through HyEn+

"The more energy we make, the more carbon we remove from the atmosphere"

HyEn+





Ethanol to Hydrogen Life Cycle vs. Solar-Electrolysis Lifecycle

Which is really green?

Solar & wind powered electrolysis have a CI score average of ~1-6

HyEn+ averages -10 to -30

HyEn+ has a lesser impact



Solar Footprint
For Hydrogen Production

VS. **HyEn+**



A Re-Imagined Solution




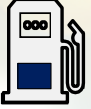

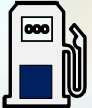
Easily Distributed Hydrogen - Easily Deployed

HyEnt+



MORE HYDROGEN – LOWER FOOTPRINT



Delivery Method	Total Hydrogen per Delivery	Advantage/Disadvantage
 TOV/HyEn+ Ethanol	 7,000 kg- 9,000 kg	Existing infrastructure
 Liquid H2	 3,500 Kg	Cryogenic form
 Gaseous Hydrogen	 700 Kg	Highly Compressed

HyEn+ EFFICIENCIES

Per Kg Of Produced Hydrogen:

- Ethanol input – 1.8 US Gallons
 - Yielding 0.7Kg Hydrogen
 - >99% efficiency
- Water input 0.7 US Gallons
 - Yielding 0.3Kg Hydrogen
 - >42% efficiency

Total Efficiency of Hydrogen Yielded from Input Ethanol:

- Exceeds 141%



OUR TOV/HyEn+ SYSTEMS

Are Self-Sustaining with no consumption of outside electricity

Employs existing infrastructure – on-site transport and on-site fuel storage (especially at airports)

Are Compact– Less than 2 TEU (Twenty-foot Equivalent Unit) – per 1,000Kg production

Are Eco-Friendly Operations – atmospheric carbon reduction

Flexible for Multiple Applications – Ideal for airports with 1MW+ electricity use

A real solution – available today - for transition to hydrogen beginning with ground support and beyond



A CASE STUDY - THE AVIATION SECTOR

CHALLENGES IN BRINGING HYDROGEN TO AVIATION



The Problems:

- Transporting green hydrogen to airports is complex and costly
- Existing infrastructure is designed for Jet A and diesel, not hydrogen
- Significant new infrastructural investments required

The Solution:

- Production On-Site & On Demand
- Reduce the need for large volumes of hydrogen storage
- Eliminate costly transportation
- Make use of existing infrastructure



PRODUCING GREEN HYDROGEN AT AIRPORTS

GEOGRAPHIC LIMITATIONS



Spatial Requirements for Electrolysis Based Hydrogen Production

Most large airports don't have the available land for large-scale green solar fueled hydrogen production

Over 75 acres are needed for solar, battery, and storage for each ton of hydrogen per day



PRODUCING GREEN HYDROGEN AT AIRPORTS

GEOGRAPHIC LIMITATIONS



Atlanta Hartsfield-Jackson Airport ATL:
Largest in the USA - 4,700 acres



PRODUCING GREEN HYDROGEN AT AIRPORTS

GEOGRAPHIC LIMITATIONS



London Heathrow LHR:
Largest in Europe -4,700 acres



PRODUCING GREEN HYDROGEN AT AIRPORTS

GEOGRAPHIC LIMITATIONS



Denver International Airport DEN:
Largest Footprint in USA 33,500+ acres



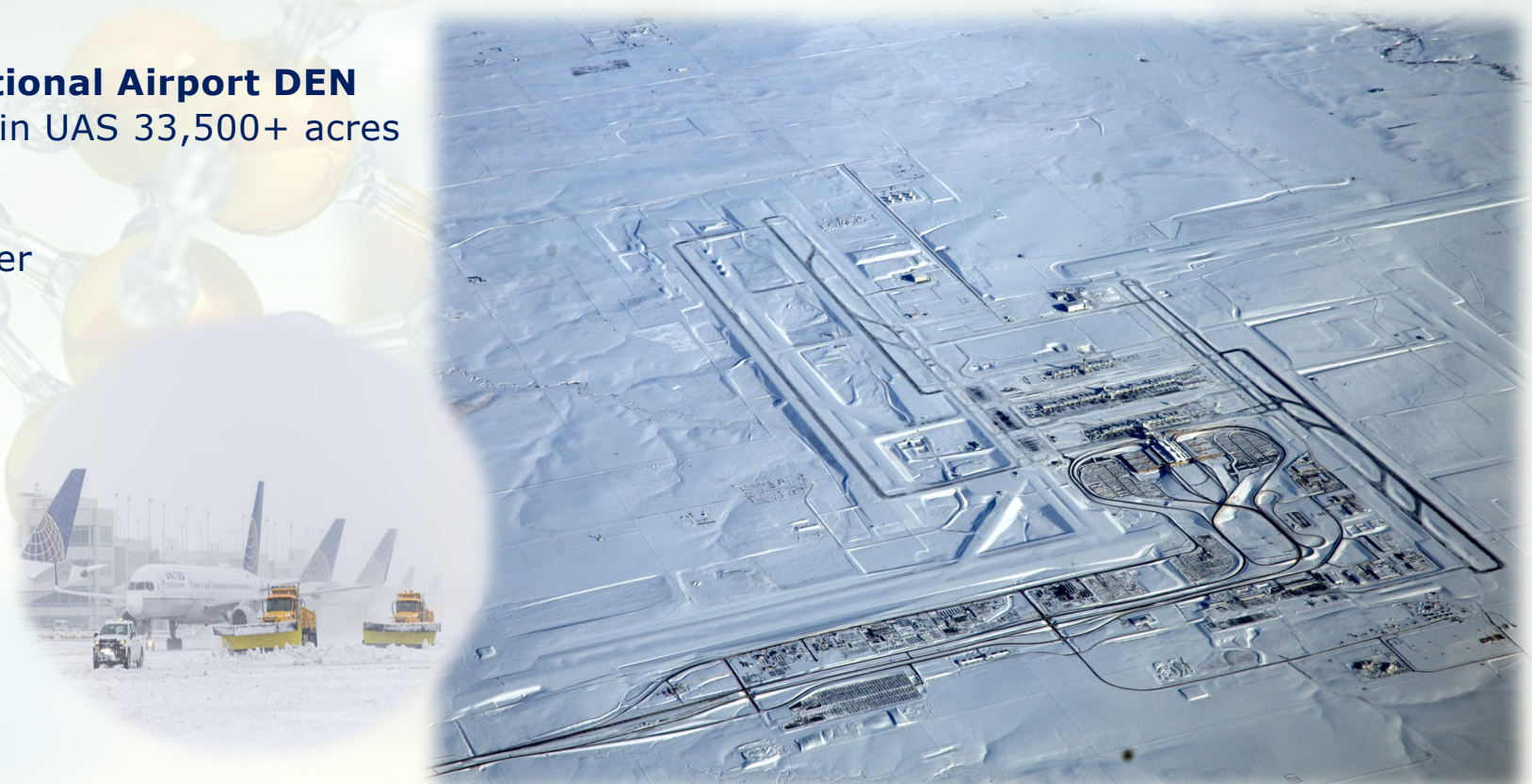
PRODUCING GREEN HYDROGEN AT AIRPORTS

GEOGRAPHIC LIMITATIONS



Denver International Airport DEN
Largest Footprint in UAS 33,500+ acres

WINTER! In Denver



HyEn+ At the Airport

The Future is here!



CHEERS TO ETHANOL!



Tipsy Out!



TOV HyEn+ is TRULY

Hydrogen When and Where You Need It

Ready Today for the Green Aviation Future

1MT – 4MT /Day systems installing in 2025

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TRULY