

Wrap-Up and (Fast) Forward

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NH3FA

Argonne, 9/22/2015

Gordon Nyquist RIP 2015



Gordon saw ammonia as the next big bet in the energy sector. Instead of sitting on the sidelines, he decided he would involve himself by working with the NH3 Fuel Assn. Gordon had a deep passion for new technologies and new ventures and would be happy to be remembered by this group,

Gordon Nyquist 2012

“If Jesus doesn’t come back soon, my bet remains on NH3.

If he does come back soon ... well ... we were headed in the right direction just the same.”

Wrap-up -- What we've learned (or re-learned)

- Shiny objects can be a distraction
- NH_3 fuel is not new, just not widely known
- NH_3 can be produced in distributed fashion but economics are key
- New efficient NH_3 generators are available
- Engine conversion technologies exist (e.g. tractor)
- Cracked NH_3 is also a practical fuel cell feed
- Liquid NH_3 is an excellent energy storage/carrier substance
- It may be possible to store kite wind energy off-shore in submarines
- NH_3 “energy stations” using gensets deserve investigation and demonstration
- UK, Netherlands and Japan have significant NH_3 fuel development

Steve Wittrig, 2013

Title of 2013 Keynote presentation ...

We know that it (NH₃) works –
Now what?

(Also – “Hit it where they ain’t.”)

Parts of “Now what”

- What
- When
- How
- Who

Parts of “Now what”

- What
- When
- How
- Who

Sounds like the beginning of an international collaboration and NH₃ implementation Roadmap --

Now what?

(not an exhaustive list)

- Interest agricultural NH₃ producers in the NH₃ Fuel market
- Interest automakers in NH₃ fuel (stress benefits/advantages—shiny object?)
- Attract interest in stationary generator NH₃-conversion technology
- Begin to obtain state certification of NH₃ fuel
- Coordinate international R&D and commercial development activities (NH₃FA Affiliate program)
- Plan demonstration site for NH₃ Energy Station

2015 -- The Year of Shiny Objects

The NH₃ Economy -- Products

- Fertilizer
 - NH₃
 - Urea
 - Aqua
- Refrigeration
- Chemicals

Total = 130 million tons/year

- [Fuel] – zero tons/year now; potential for 10X current total if all oil replaced

The NH₃ Economy – Producers

- China (Coal)
- Russia
- US
- Trinidad-Tobago

Total = 130 million tons/year

The NH₃ Economy – Source of H₂

- Coal
- Natural Gas

Total = 130 million tons/year

- Water (green NH₃) ~ zero tons/year now;

The NH₃ Economy – CO₂

- “Brown” NH₃ from NG – 1.8 tons CO₂/ton
- NH₃ made from coal much worse (China)

No shortage of NG in US

US has tremendous reserves of coal

Make NH₃ from coal with C Seq?

Tom Hamann MSU, 2015

“I have become a big believer in ammonia as a fuel of the future.”

Shimshon Gottesfeld, U Del, 2015

“It’s all right to introduce me as the new best friend of NH_3 Fuel.”

Tom Hamann MSU, 2015

Thank all of you participants for helping ...

“Enable the Renewable Fuel of the
Future.”

THANK YOU