

ENABLING THE HYDROGEN ECONOMY

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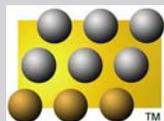
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DATE SEP 29 2009

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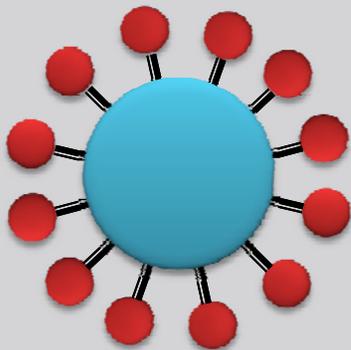
HYDRNOL Carrier

- Simple organic molecule
- Liquid over a wide temperature range
- Stored and transported at normal temperature and pressure (No need for cryo or pressure treatment)
- Uses current fueling infrastructure
- Safe as gasoline or diesel
- Exceeds DOE goals
- Enables renewable energy
- Releases Hydrogen as needed

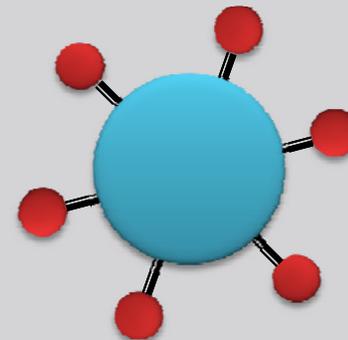
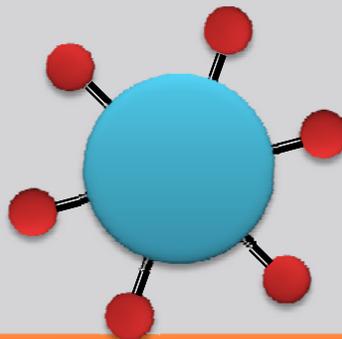


HYDRNOL – Molecular Concept

HYDRNOL



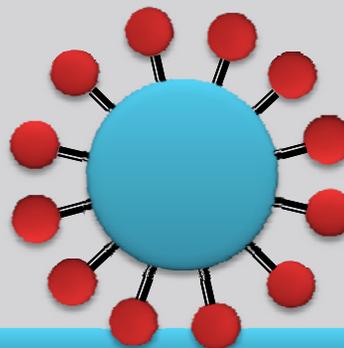
Hydrogen to use



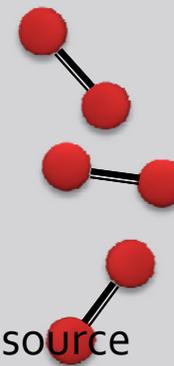
Spent HYDRNOL



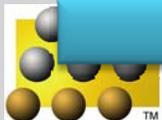
Dehydrogenation Catalyst Surface



Hydrogen from source



Hydrogenation Catalyst Surface



Vehicle Implementation

Standard Gasoline Tanker
vs. Specialized
Cryo/compressed Tanker

Produce virgin
HYDRNOL™

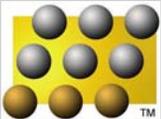
Deliver HYDRNOL™ to
Service Stations

Recycling ~100 times

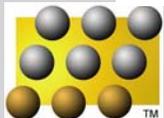
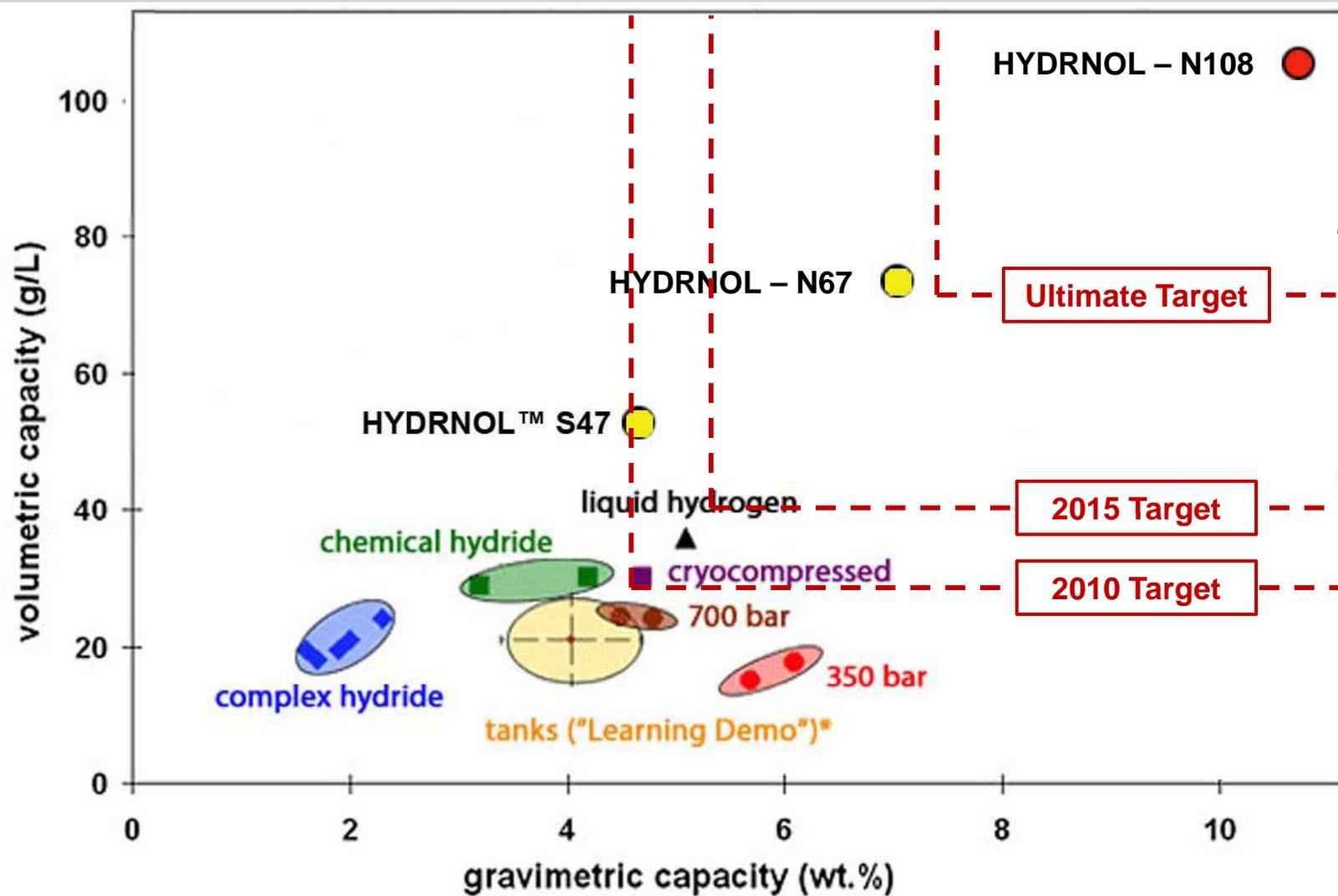
HYDRNOL™ delivered
to vehicle

Spent HYDRNOL™ re-
hydrogenated with
hydrogen source and
added back into use
circuit

HYDRNOL station is around 1/10 of
cost of cryo-compressed station
\$40 MM vs. \$400 MM for California

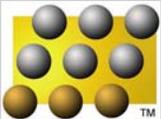


DOE Targets – Comparison with Other Storage

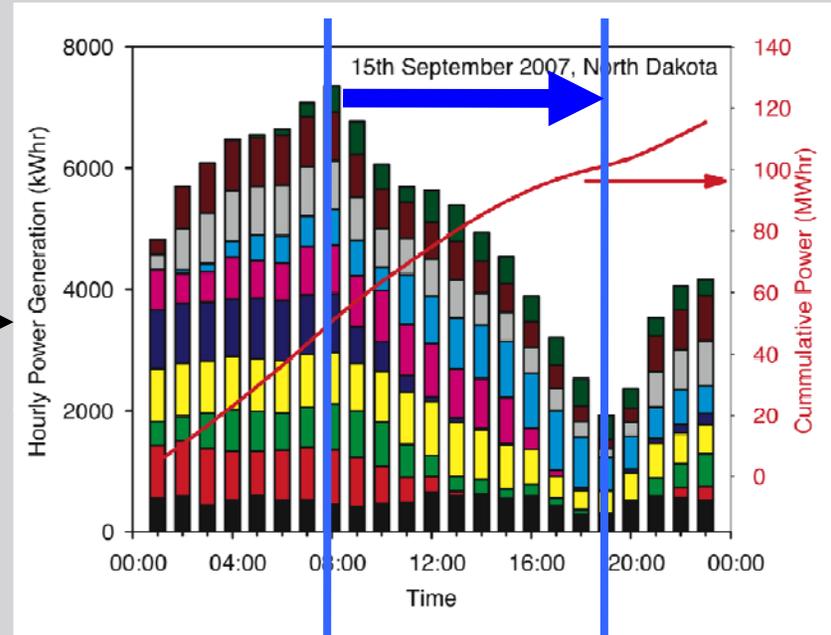


HYDRNOL as a Transitional Technology

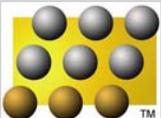
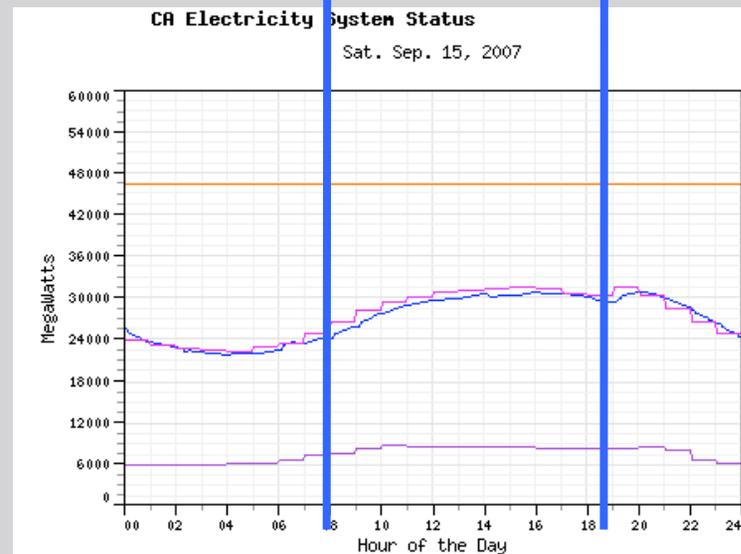
- Hydrogen can initially be derived from Natural Gas (SMR), then renewable sources as they become available
- You build value from the first installation
- Does not require significant user re-education
- Diesel co-combustion to reduce particulates
- Low capital cost to deploy including existing vehicle retrofit
- Optimal fueling points already established for gasoline



Power Shifting



A method is needed to store the wind production until required



Asemblon – Hydrogen Technical Roadmap

2010/2011

2009/2010

2008/2009

Concept Proof

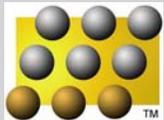
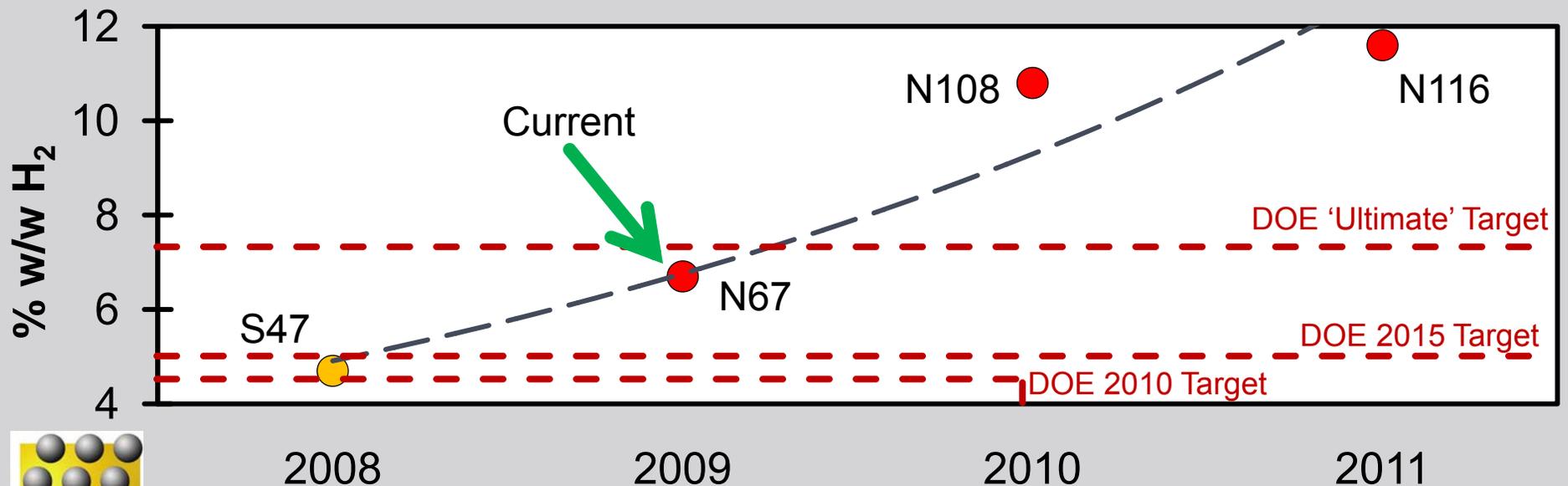
Fundamental
Operating
Parameters

Scale-up to
Alpha reactor

Development
of Beta reactor

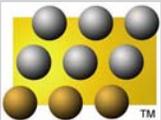
Integration of
Beta reactor to
prototype

Demonstration
of prototype



Demonstration Partners

- Automobile
 - Clemson University – International Center for Automotive Research (18-24 months, H₂ICE)
 - BMW, Mazda
 - PACCAR/Kenworth (18-24 months, 32 KW Fuel Cell)
- Static
 - Basin Electric/DOE (18-24 months, H₂ICE co-combustion)
 - Wind to hydrogen
 - Footprint for HYDRNOL station
 - Co-Combustion vehicles
- Small engines (12-18 months, small consumer)
 - NREL/Clemson University – South Carolina Institute for Energy Studies



The California Opportunity

- Cost effectively meet the 30% by 2030 renewable requirement
- Reduce diesel emissions at the Ports
- Accelerate hydrogen adoption and resulting tax revenues to further supplement renewables
- Conversion of legacy ICE vehicles vs. waiting for fuel cell vehicle availability

