H-Prize

Presentation to
Hydrogen Technology Advisory Committee
November 6, 2008

Overview

- EPAct 05 amended in Dec 07 to create cash award prizes to advance RD&D and commercial application of hydrogen energy systems
- Designed to leverage DOE funds with other donor funding and research results funded outside of DOE budgets
- First H-Prize -- mobile hydrogen storage

Project Management

- Hydrogen Education Foundation selected competitively Sep 2008
  - Charitable education arm of the National Hydrogen Association
  - 3-year cooperative agreement with interim evaluation at 18 months
- Funding
  - $900 K (FY08) obligated
  - Additional $300 K (FY09) soon
  - Supports $200 K for 18-month administration and $1 M first Prize
- Technology Transition Corporation (TTC) – subcontractor lead and DOE interface
  - Project Director – Jeff Serfass
  - Technical direction – Jerry Hinkle
- South Carolina Research Authority (SCRA) -- leads fundraising
  - SCRA lead – Russ Keller

Strategic Objectives of H-Prize Administration

- Create a pilot award process
- Organize and execute a comprehensive fund raising program
- Deploy H-Prize funds through fair and open competition
- Focus on critical technical challenges
  - Solutions move hydrogen and fuel cell technology closer to markets

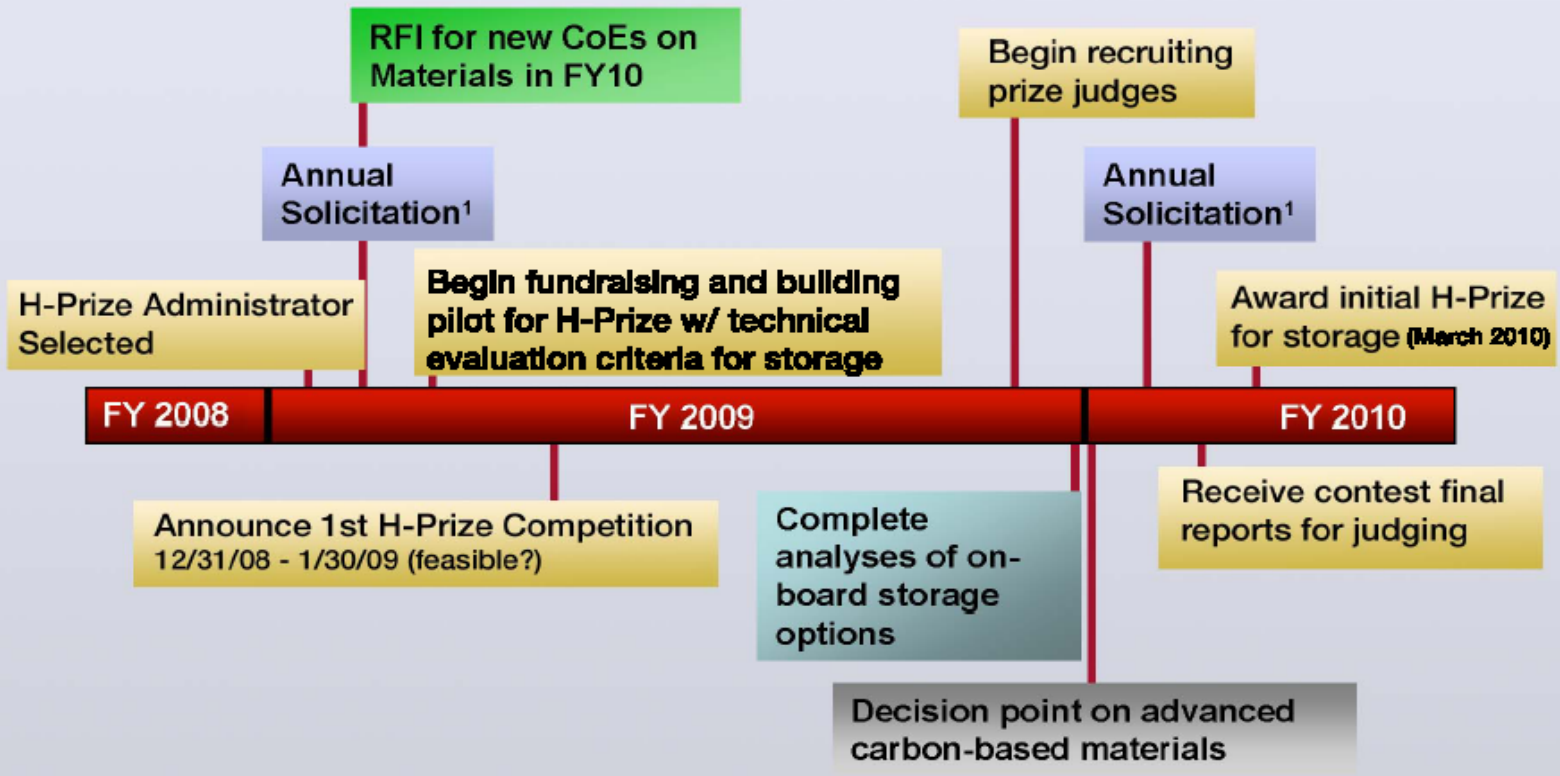
Technology Challenges Potentially Addressed by H-Prize

- Advancements in technologies, components and systems (≤ $1M)
  - Hydrogen production
  - Hydrogen storage
  - Hydrogen distribution
  - Hydrogen utilization
- Prototypes (≤ $4 M)
- Transformational technologies (≥ $10 M + matching funds)

Key Pilot Management Goals

- First contest announced – Feb 2009, including
  - $1 M H-Prize funding obligated
  - Technical Evaluation Criteria
  - Registration requirements
  - Application process
  - Submission deadline and judging plan
- Fundraising receives emphasis immediately
  - Goal of $2.2 M by Dec 2009
- Award applications received – Feb 2010
- Judging – Mar 2010
- First H-Prize announced -- Apr 2010
- First H-Prize awarded at DOE Spring 2010 Annual Merit Review

Key Hydrogen Storage Milestones & Future Plans



[1] subject to appropriations and direction
[2] In accordance with EISA (2007)

Technical Evaluation Criteria

- Work begins immediately
- Consultation with HTAC – Nov 2008
- Consultations continue
  - National Science Foundation
  - National Academies of Science and Engineering
  - Group meeting of DOE National Labs
  - Federal agencies
- Completed – Jan 2009

H-Prize for Mobile Storage

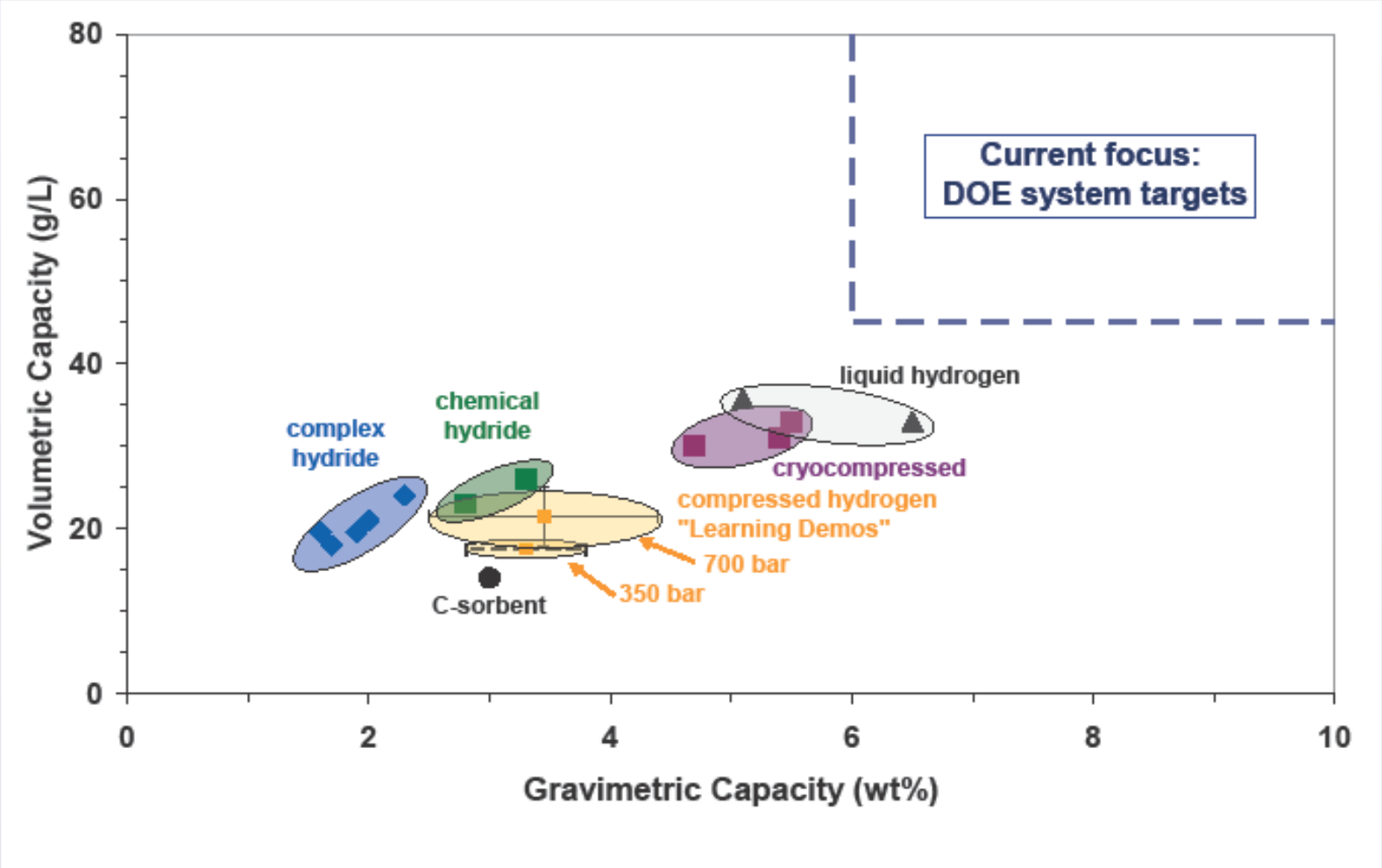
- "…incentives for breakthrough solutions to the critical challenge of hydrogen storage."
- "…advancements in technologies, components or systems related to hydrogen storage."
- DOE Goal: ***Achieve on-board H2 storage for>300m range, across different vehicle platforms, w/out compromising payload, space or performance (wt, vol, dynamics, safety, cost)***

On-board Storage Challenges

- Materials, weight, volume/space, pressure, temperature, cost
- Life cycle efficiency
- Durability/operability
- Charge and discharge rates
- Codes and standards
- Balance of plant components
- Dispensing
- Thermal management
- Subsystem life cycle assessments

Current Status

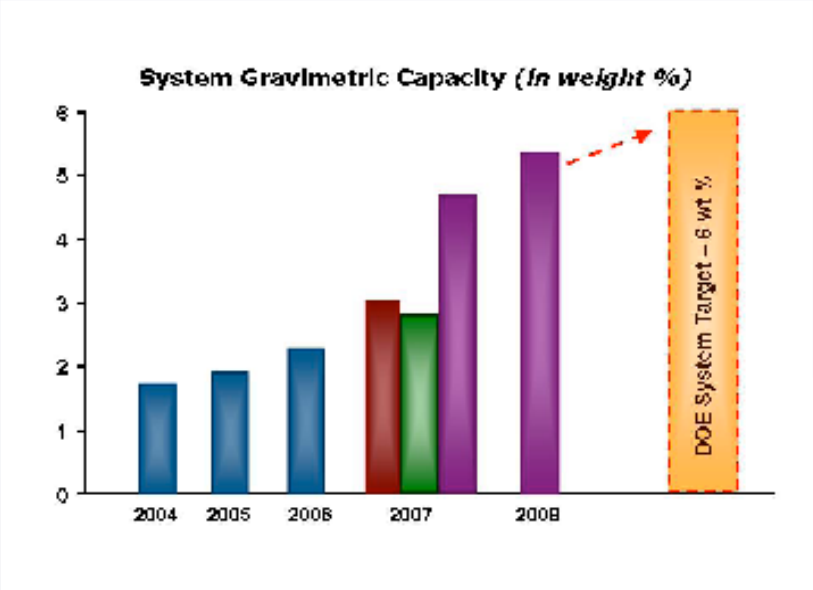
No technology meets targets

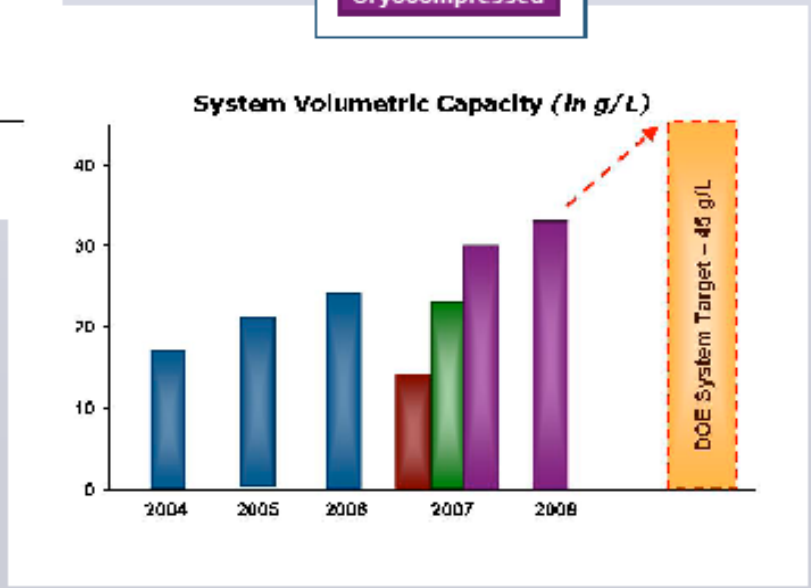


June 9, 2008 – http://www.hydrogen.energy.gov/pdfs/review08/5_storage_sunita_satyapal.pdf

Hydrogen Storage System Progress

- Preliminary system designs developed and improvements made
- But no technology meets 2010 targets



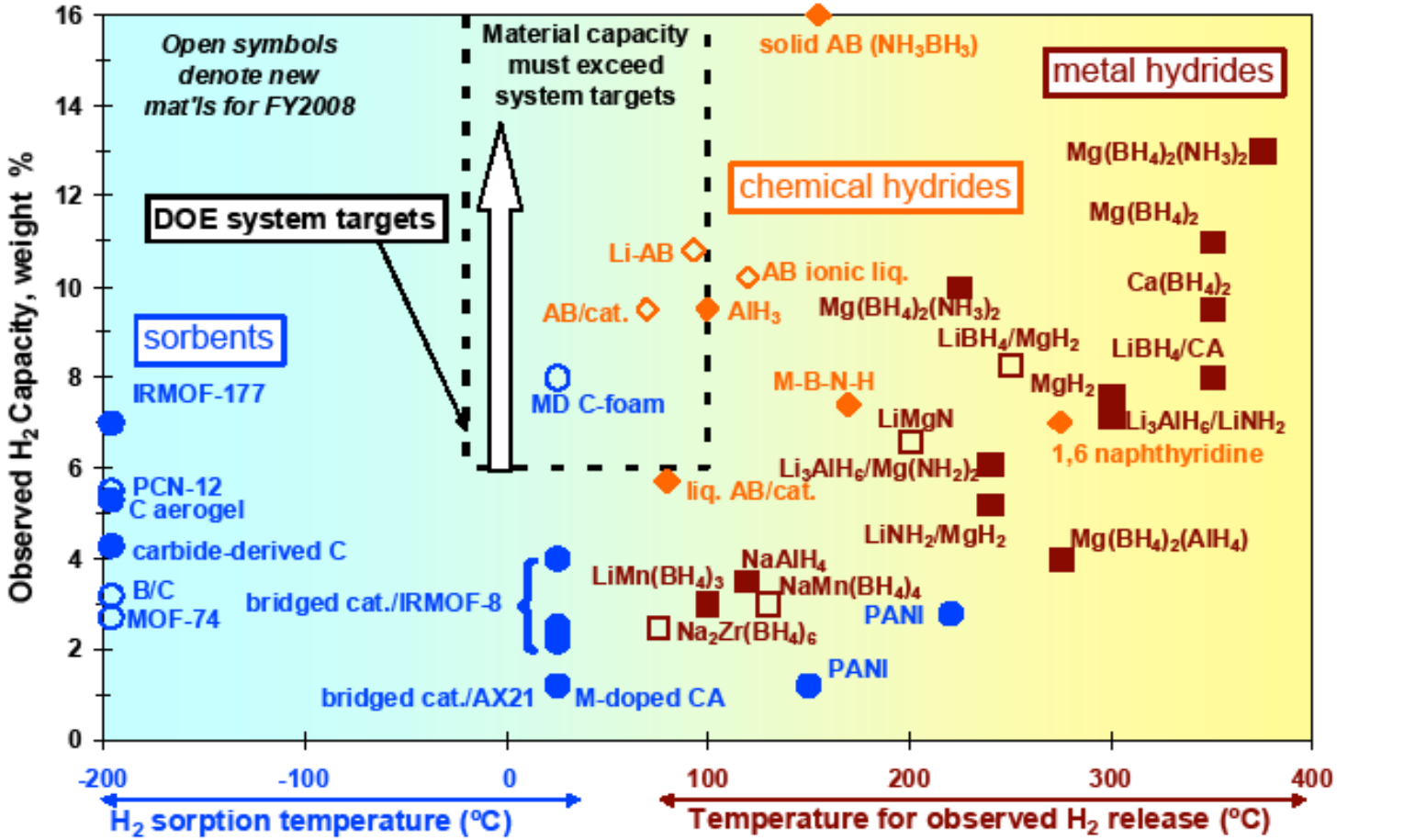


- *Projected system capacities based on modeling and material data.*
- *Subscale prototype developed for $NaAlH_4$*
- *Full scale prototype developed for cryocompressed tank*

June 9, 2008 – http://www.hydrogen.energy.gov/pdfs/review08/5_storage_sunita_satyapal.pdf

Progress

Material Capacity vs. Temperature



DOE: G. Thomas (2007), G. Sandrock (2008)

June 9, 2008 – http://www.hydrogen.energy.gov/pdfs/review08/5_storage_sunita_satyapal.pdf

DRAFT Criteria for Hydrogen Storage Material

Development and demonstration of innovative, “breakthrough” material(s) that meet the following (material-level criteria):

- Gravimetric capacity of > 7.5 weight % hydrogen (releasable hydrogen)
- Volumetric capacity of > 70 g/liter (releasable hydrogen)
- Temperature required for hydrogen release < 150C
- Pressure required for hydrogen charging < 150 atm
- Refueling time for charging hydrogen < 3 minutes (for 5 kg)
- Hydrogen discharge flow rates > 1 g/s (TBD)
- Cycle life of > 1000 cycles
- Goal is to have on –board regenerable materials

- Test results demonstrating the above requirements must be submitted based on data obtained by at least one independent laboratory, independent of the applicant’s own test results. The applicant must also provide a sample of the material(s) to DOE for independent verification that the above requirements have been met. The test results will then be submitted to the Panel of judges to determine eligibility for the prize award

October 17, 2008, DOE

DRAFT Criteria for Combinatorial Methods

(Materials discovery/testing)

- High throughput synthesis apparatus with at least 500(?) samples in parallel
- High throughput testing/assay apparatus providing 500(?) samples in parallel
- Parallel verification of assay method that correlates to available hydrogen capacity at set T/P conditions
- Assay data accurate to plus/minus 25%(?)
- Assay time cycles provide an several orders of magnitude time improvement over conventional capacity measurements(?)
- Applicability to liquids/solids, to exothermic/endothermic H_2 release materials, cryogenic materials

Oct 17, 2008 DOE

Thinking About Contest Criteria

- *Meet or exceed 2010 targets by X %?*
- *What truly pushes envelope?*
- *H2 community familiar with widely used DOE goals—simple, flexible*
- *What is readily and fairly judged?*
- *Build a testable device by 2010?*
- *Whole storage subsystem with envelope performance, or a material?*
- *What leads to a commercial solution—do 350-700 bar better?*
- *jhinkle@ttcorp.com, (202) 261-1307*

Advice Desired

- Evaluation Criteria
- Foundation and corporate sponsors
- Judges
- Anything that optimizes the potential to leverage DOE funds to produce useful research funded by others