III.E.2 Analyses of Hydrogen Storage Materials and On-Board Systems (New Project)

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Objective

- Determine cost and performance of on-board hydrogen storage options: metal hydrides, carbon-based materials, and chemical hydrogen storage, and compare to compressed gaseous hydrogen tanks.

Technical Barriers

This project addresses the following technical barriers from the Hydrogen Storage section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

- A. Cost
- C. Efficiency
- G. Life Cycle and Efficiency Analyses

Approach

The proposed work will help guide DOE and developers toward promising research and development (R&D) and commercialization pathways by evaluating the various hydrogen storage technologies on a consistent basis. A consistent and complete comparison of the various technology options is critical to technology downselection and eventual commercialization decisions. TIAX will evaluate four broad categories of on-board hydrogen storage; baseline storage (compressed hydrogen), reversible on-board storage (e.g., metal hydrides), high surface area sorbents (e.g., carbon-based materials), and regenerable off-board storage (e.g., chemical hydrides).

The specific objectives of the proposed work are as follows:

- Compare different on-board hydrogen storage approaches in terms of system lifecycle costs, energy efficiency and environmental impact;
- Examine the effects of cost and performance trade-offs for different storage approaches;
- Identify and compare other performance aspects that could result in barriers to successful commercialization;
- Project the long-term performance of the considered storage approaches relative to DOE targets; and
- Assist in identifying the most promising developmental pathways for on-board hydrogen storage.

Some of the complexities and risks introducing variability into the analyses include the uncertainties surrounding:

- Performance, cost and energy input requirements for alternative hydrogen storage technologies;
- Requirements of the hydrogen vehicle and fueling system;
- Future technology developments; and
- Consistency, accuracy, and timeliness of developer input.

System-level conceptual designs will be developed for each on-board storage system based on developers' on-going research, input from DOE and key stakeholders, in-house experience, and input from material experts. Process models and activities or product-based cost models will be developed for each system. Subsequently, lifecycle performance/cost predictions will be refined using developers' feedback. This will be an on-going and iterative process so that DOE and its contractors can increasingly focus their efforts on the most promising technology options.