

Compression and Refueling, Morning Breakout Session

ARPA-E's goals are to

1. Validate or improve our strawman metrics to be technically audacious but possible with sufficient stretching
2. Identify and understand potential new designs, materials, and processes that could result in dramatically cheaper and more efficient compressors 10-15 years from now.

Compression and refueling metrics:

- Price of compression is <\$1k/scfm (at-home) and <\$0.5k/scfm (station)
- Compression efficiency is >60% vs. theoretical minimum
- Compression without lubrication (both at-home and station)
- Vehicles tanks can be filled to >95% capacity
- Refueling rates are >0.5 GGE/hr (at-home, >1scfm) and >10 GGE/min (station)
 - 2.7 GGE/hr (5 scfm) is legal limit for at-home refueling (National Fire Code)

Working assumptions, state-of-the-art:

- Price of compression is >\$4k/scfm (at-home) and \$1k/scfm (station)
 - Compression efficiency is 40% vs. theoretical minimum
 - Vehicles tanks can only be filled to 80-85% capacity
 - Refueling rates are 0.4 GGE/hr (at-home) and 2-10 GGE/ min (station)
1. What are the high level techno-economic metrics necessary for commercial adoption? What fundamental materials and process performance metrics are necessary for success?
 2. What advances/breakthroughs (if any) have there been in the last 10 years that might make this possible now?
 3. What approaches offer the greatest opportunity? Have they been tested at any scale?
 4. What are the technical and economic barriers to these approaches?
 5. What novel/unique approaches could be enabling for this technology? What materials and engineering challenges, if overcome, would make this possible?
 6. How would designs change if tank pressure was 500 psi instead of 3600 psi?
 7. Are there new designs that can reduce the number of stages of compression?
 8. Is there a way to integrate thermal management into refueling?
 9. What can be done with \$3-4M, 2-3yrs? What is the largest prototype that could be built under this budget? Is there any value to funding seedlings <\$1M? What are appropriate targets 1-yr? 3-yrs?
 10. Where is the ARPA-E white space? Are there new technologies that can put us on new learning curves? Long term, why might this be successful?