<u>Sorbent Gas Storage, Morning Breakout Session</u>

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 higher performance gas storage 10-15 years from now.

Gas storage metrics:
- >400 v/v, 35 bar, 295K (1/2 E density of gasoline)
- Isosteric heat of adsorption (kJ/mol)?, <100°C desorption
- <$200/GGE stored; >5 yr lifetime (>2000 cycles); >40 wt%
- Engineering targets: compaction? thermal conductivity? degradation? contaminants?

Working assumptions, state-of-the-art:
- MOF: 230 v/v, 35 bar, 290K, 39 wt%
- Activated Carbon: 200 v/v, 35 bar, 295K
- COF: 97 v/v, 35 bar, 298K
- Isosteric heat of adsorption (kJ/mol)?

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? What are the most promising classes of materials?
3. What approaches offer the greatest opportunity? Increasing gas storage per volume? OR Improving lifetime, stability, and reducing degradation?
4. What are the technical and economic barriers?
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 sorbent designs change if tank pressure was 500/1000/2000 psi (35/69/138 bar)?
7. What is the trade-off between high energy density and moderate desorption temperatures? Is there a way to integrate thermal management into refueling?
8. How can you design for compaction? What are the major contaminants? Can you design for cycle life (2000 cycles)? What are the appropriate tests/metrics here?
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?