Advanced Hydrogen Compressor for Hydrogen Storage Integrated with a Powerplant

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DE-FE0032033

Siemens Energy

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Sub-Recipients: none

Location: Redmond, WA

DOE: $500,000
Non-DOE: $328,854

Total: $828,854

Objectives

- Design, manufacture and test an advanced compressor stage suitable for hydrogen compression service.
- Compressor performance (head rise, efficiency, range, etc) will be measured using industry standard testing protocols to evaluate the performance of the stage relative to conventional commercially available centrifugal compressors.
- Develop cost savings estimates as a result of utilization of the advanced compressor stage in commercial embodiments suitable for hydrogen generation and storage systems.

Relevance and Outcomes/Impact

- The compression of hydrogen to enable cost effective storage and/or transport (via high pressure pipeline) is a critical and often overlooked element of the hydrogen economy. Technologies to reduce acquisition and operating costs are critical to the cost effective operation of hydrogen generation and storage systems.

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Motivation for Development of Advanced Hydrogen Compression Technology

- A polymer electrolyte membrane (PEM) system, such as the Siemens Silyzer, can produce hydrogen with an efficiency of 75% based on HHV. Lower hydrogen discharge pressures result in higher conversion efficiencies but require more pressure ratio from the compressor.
- Local storage (or pipeline transport) of large quantities of hydrogen is required when a hydrogen production system is coupled with a powerplant and generally requires the hydrogen to be compressed to ~80 bar (1160 psi)
- A compressor is required to compresses the hydrogen from the low pressure at the production point to the pressure required for storage or transport.
- Multi-stage centrifugal turbocompressor are well suited to compressing large volumes of gas, but hydrogen presents several unique challenges that contribute to higher capital cost than many other gases:
  - Low head rise per stage due to the low mole weight of hydrogen, resulting in compressors with many stages, multiple pressure casings and drive systems and a large footprint
  - High cost and/or stress limited materials due to hydrogen embrittlement

The Siemens Energy Advanced Hydrogen Compressor utilizes a unique turbomachinery configuration to significantly increase head rise per stage and enable the use of lower cost hydrogen compatible materials.

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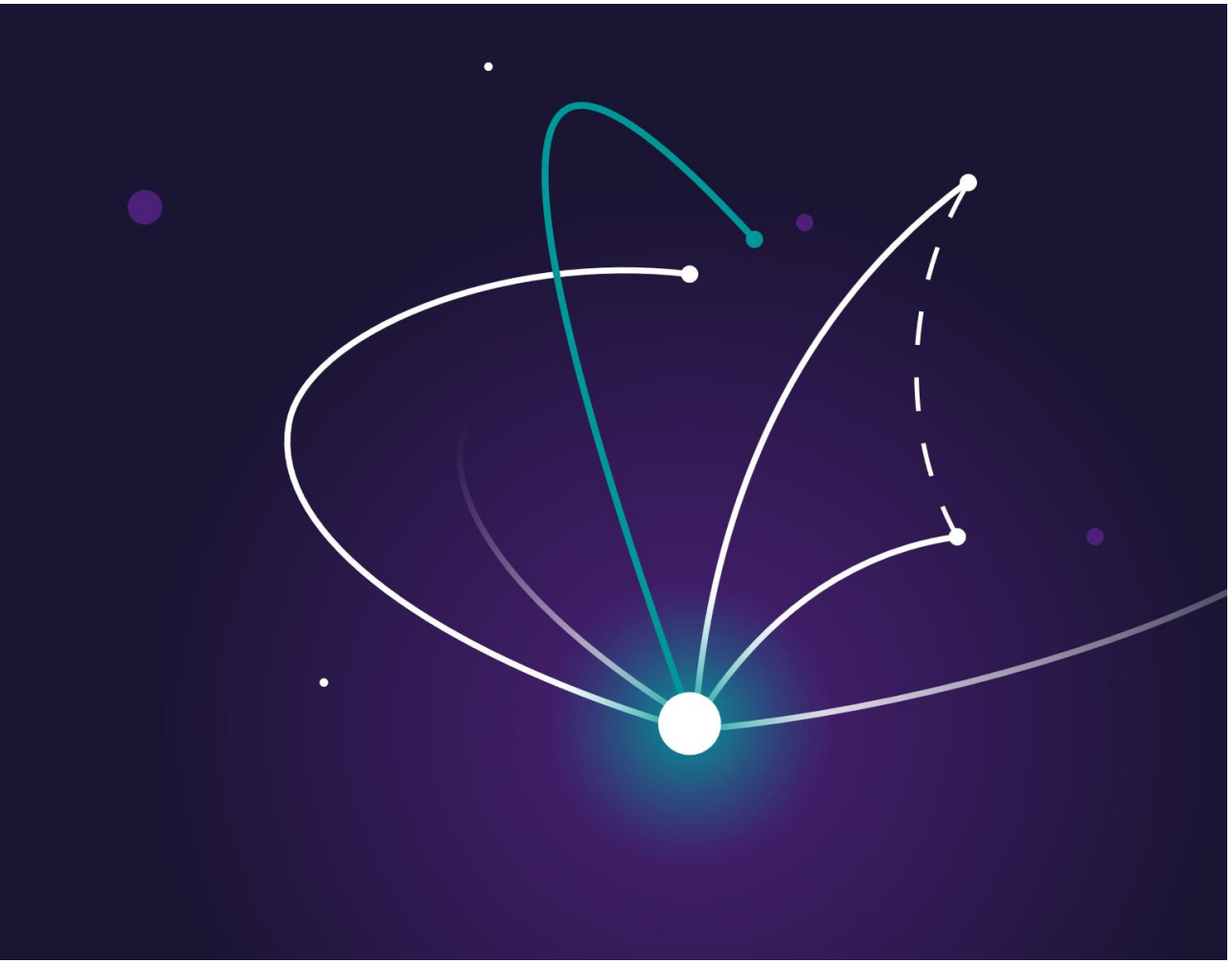
Compression costs for hydrogen are major CAPEX and OPEX contributors to overall hydrogen based energy storage systems.

Advanced technologies to address the compression requirements for hydrogen storage systems are important to improving the overall cost effectiveness of commercial viability of the hydrogen economy.

Contact



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