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TechBriefs

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Integrated Onboard Vehicle Natural Gas Storage Heating and Cooling System

Savannah River National Laboratory has developed an integrated natural gas storage heating/cooling scheme that connects a vehicle's existing onboard heat-exchanger fluids to an adsorbent natural gas system to provide temperature swing capabilities to maximize the system's gas storage capacity.

Benefits

- Uses temperature-assisted pressure swing to store more gas in a smaller volume
- Utilizes heat transfer systems already on a vehicle to control the gas temperature:
  - Radiator fluid and/or air conditioning coolant for heating (needed to maintain pressure and assist in gas release from absorbents)
  - Air conditioning coolant for cooling (primarily for refueling)
- Avoids the heat issues of conventional compressed gas storage

Applications and Industries

- Most applicable to automotive industry and other commercial markets that utilize (or plan to use) mobile gas storage (e.g., in forklifts, heavy machinery, and portable generators)
- Could also be useful in stationary gas storage vessels needing both heating and cooling utilities

Intellectual Property

- Divisional patent based on US 9,683,704 B2 issued on 20 June 2017.
- Technology Readiness Level (TRL) 2 or 3:
  - Basic system models created
  - Finite element analysis (FEA) models of several adsorbent tanks with internal heat exchangers created
  - Lab-scale prototype heat exchanger system built and demonstrated for hydrogen

Contact Information

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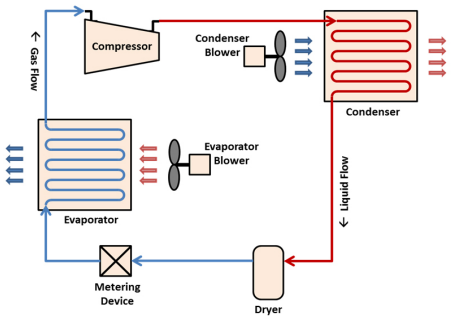
Need

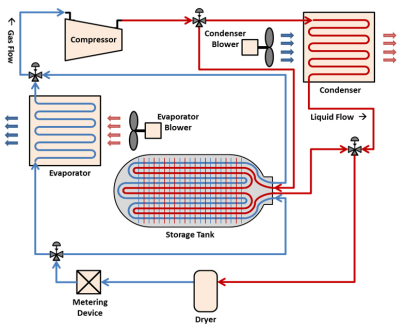
Mass, volume, and cost are obstacles to designing new vehicle technologies to compete with gasoline/diesel internal combustion engines. Adapting an internal combustion engine to run on less expensive and lower emission natural gas, for example, can actually increase a vehicle's mass, volume, and cost because natural gas currently requires greater storage capacity than a gasoline/diesel tank, necessitating modifications to a vehicle's framework. Natural gas is normally stored on motor vehicles in high pressure tanks that use changes in pressure to charge and discharge the gas.

Description

SRNL's integrated gas storage heating/cooling scheme connects the existing onboard heat exchanger fluids (with some possible augmentation) to an adsorbent such as activated carbon or a metal-organic framework. With this design, the same amount of natural gas can be stored in a volume comparable to current gasoline/diesel tanks at a lower pressure than conventional natural gas storage, which also reduces both cost and mass. In addition, by using the onboard heat exchanger fluids, SRNL's integrated gas storage heating/cooling scheme also avoids the heat issues that plague conventional compressed gas storage.



Standard automotive air conditioning system diagram



Automotive air conditioning schematic for a thermal fluid by-pass to an absorbent storage vessel to heat or cool the vessel in place of the condenser or evaporator, respectively.