Propane-Fueled Cooling Systems

Energy-efficient technology offers promising market opportunity for propane industry

Homes and businesses rely on cooling systems to provide basic comfort and maintain air quality indoors. However, as energy prices rise, so does the cost of cooling. Advances in propane-fueled gas cooling technologies can offer consumers and businesses a reliable, cost-effective, and energy-efficient alternative to electric systems.

"Gas Cooling" or "Gas Air Conditioning" refers to any system that uses gaseous fuel to cool a given space, either directly or through dehumidification. Due to recent reliability and economic concerns with the electric grid coupled with indoor air quality concerns, propane-fueled technologies have become a more attractive alternative for both types of cooling methods.

Propane-fueled cooling systems can be used anywhere and are extremely valuable in areas where connection to the electric grid is either unreliable or unavailable. By operating efficiently, they can also help reduce energy costs as well as the load on the already over-burdened electric grid.

The existing and potential benefits of this developing technology have created an important market opportunity for the propane industry. According to initial projections, the sale of 100,000 propane-fueled engine heat pumps over the next ten years to customers could increase the propane load by over 100 million gallons (PERC, **Docket 11957**, January 2007).

Project Description

Building on research conducted by the U.S. Department of Energy, the Propane Education & Research Council (PERC) funded the *Study of Propane-Fired Gas Cooling Technologies* (**Docket 11957**). Led by the Energy Resources Center of the University of Illinois at Chicago, the objectives of the study were to:

- Identify and ascertain the status of current propane-fueled cooling technologies
- Outline the technical challenges to improving efficiency and cost
- Recommend a course of R&D development and/or demonstration for the propane industry

Propane Engine-Driven Heat Pumps for Rooftops

Identified as having the highest market potential for propane, engine-driven heat pumps offer commercial and residential facilities an efficient and economic alternative to conventional air conditioning with electric resistance heat.

A rooftop propane heat pump system packages all of the cooling and heating components into a single unit, including the propane-fueled engine, condensing units, and air moving equipment.

10-Ton Gas Engine-Driven AC Heat Pump Assembly

Propane-Fueled AC in Off-Grid Home

Project Implementation

The study surveyed available gas-fueled equipment, current developments, and national economic factors to identify areas in which propane has the potential to become the fuel of choice. Research was based on the understanding that propane-fueled technologies must:

- Be practical and cost-effective
- Expand the capabilities of propane systems
- Provide clear benefits to consumers
- Motivate customers through economic and functional advantages

Research focused on small systems for use in residences or small commercial operations. It reviewed existing and emerging gas cooling products 25 refrigeration tons (RT) and below, as well as technologies between 25 RT and 200 RT that would be most amenable to using propane as a fuel source.

Project Complete: Key Conclusions

Market selection was based on first and operating costs, as well as enhanced customer features. The most promising markets are briefly described in the table below.

Next Steps

The suggested follow-up to this report includes:

- Selection of specific technologies for pursuit
- More detailed economic and market analyses
- In-depth evaluation of propane compared to electricity in targeted cooling applications
- Investigation of cooperative development programs with the natural gas industry

Market Opportunities for Propane-Fueled Gas Cooling

Technology	Priority Market	Description
Propane-Fueled Engine-Driven Heat Pumps	Commercial Facilities and Cold Climate Homes	A compressor circulates refrigerant for cooling in the summer and heating in the winter. Compared to conventional electric heat pumps, a propane-fueled engine, rather than an electric motor, drives the compressor, allowing for variable-speed operating capability and greater efficiency when operating partial loads.
"Snowbird" Desiccant Dehumidifier	Southern Humid Climate Residential, Vacant Summer Homes	Desiccants draw moisture from indoor air and use propane heat to exhaust moisture outdoors. When the home is not in use, propane dehumidifiers can achieve lower humidity levels with less energy use than conventional electric air conditioning (AC).
Desiccant Enhanced AC	Southern Humid Climate Hotels and Resorts	Integrated AC and desiccant components effectively control space humidity, allowing higher thermostat settings than AC alone for enhanced occupant comfort, reduced mold and bacteria growth, and extended life of carpeting and furnishings.
Propane-Fueled Absorption AC or Propane-Fueled Cogeneration AC	Off-Grid Homes	Absorption AC is a stand-alone system that uses a refrigerant, absorbent, and propane heat to cool indoor spaces, reducing the load from on-site generators. Another stand-alone system is cogeneration AC, providing both cooling and electricity to the home.
Propane-Fueled Absorption Heat Pumps with Heat Recovery	Hot Dry Climate Hotels and Resorts	Absorption heat pumps use a reversible ammonia water absorption cycle for cooling in the summer and heating in the winter. Unlike conventional heat pumps, adding waste heat recovery provides heating for domestic water or swimming pools.

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