

**Applications:**

- Auxiliary power (1-5kW)
- Distributed power
- Marine power
- Transportation

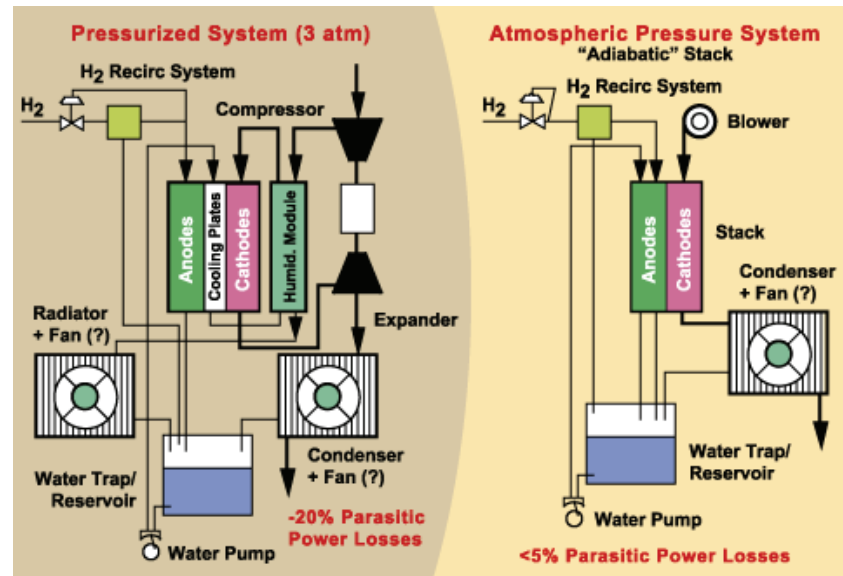
**Benefits:**

- Fewer components
- Lower cost balance of plant
- Operation at atmospheric pressure
- Rapid start-up

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**Summary:**

Adiabatic fuel cell stacks are simple, low-cost and reliable. Operating at near-ambient pressure, their efficiency and net power density make them competitive with more complex pressurized systems. Two Los Alamos National Laboratory (LANL) innovations enable adiabatic stacks. The first is direct humidification of the fuel cell membrane electrode assemblies (MEAs) with liquid water. The second innovation relates to the operation of the fuel cell stack at very-near-ambient pressure. LANL is pleased to offer both enabling technologies non-exclusively to industry partners.

Direct MEA humidification is made possible through the introduction of an anode-wicking backing that conveys liquid water from the anode flow-field plenum through the nominally hydrophobic gas diffusion layer directly to the membrane throughout the active area. During the normal operation of this well-humidified fuel cell stack with a dry, ambient temperature cathode air inlet, the airstream becomes heated and saturated with water vapor as it passes through the cells. This effect provides *in situ* evaporative cooling of the stack, eliminating the need for separate cooling systems or in-stack cooling plates. The non-isothermal stack operation and evaporative cooling result in an "adiabatic" stack. The simplicity of the adiabatic system is easy to appreciate when compared to the conventional system, with its extensive flow and control elements (see figure).

**Development Stage:**

This technology has been extensively tested and is ready for immediate commercialization.

**Patent Status:**

US Patent 5952119  
US Patent 6117577

Fuel Cell Membrane Humidification  
Ambient Pressure Fuel Cell System