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HYDROGEN POWER GENERATION

WITH PRE-COMBUSTION CARBON CAPTURE

GTI is a leading research, development, and training organization addressing global energy and environmental challenges. We're applying energy and aerospace experience to lower energy costs and provide cleaner sources of fuel and power.

HYDROGEN POWER GENERATION

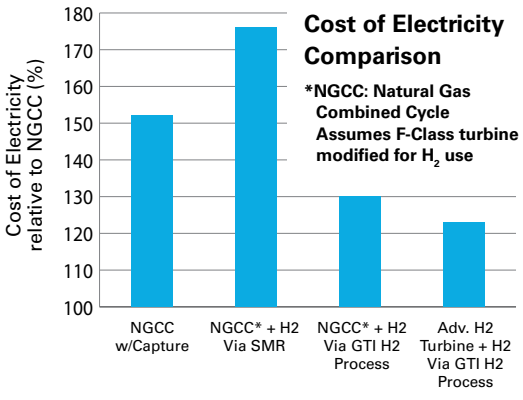
Cost-competitive H_2 generation with pre-combustion carbon capture

GTI has piloted a hydrogen production process with an inherent capability for carbon dioxide (CO_2) separation. The process is a cost-competitive, steam-neutral alternative to traditional steam methane reforming (SMR). It also produces a higher-quality hydrogen stream (>90%, which can be upgraded further) while eliminating the need for a water gas shift reactor. Furthermore, it also eliminates the costly amine system to separate the CO_2. This eliminates the associated capital expenditure and operating expenses of amine-based systems required for CO_2 capture from SMR and natural gas combined cycle (NGCC)-based power systems.

The concept for a 5MMSCFD (12,750 kg/day) modular demonstration plant has been defined and costs estimated for its construction and operation. The design is scalable to very large H_2 production rates (e.g., 100MMSCFD [255,000 kg/day]) with the attendant economies of scale, with single or multiple modules.

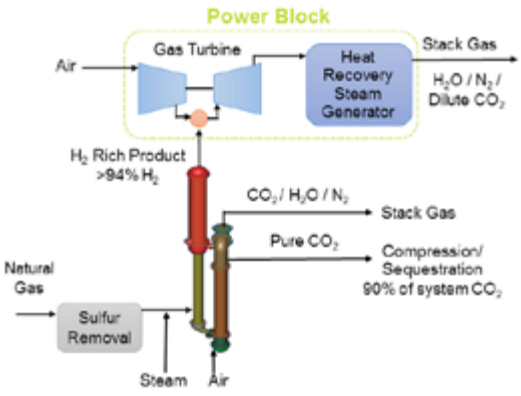
Because the process has a byproduct of essentially pure CO_2, it offers a cost-effective approach for pre-combustion carbon capture for a combined cycle power plant. GTI performed a preliminary evaluation of a commercial power plant using H_2 from GTI's process compared to a NGCC plant with carbon capture.

Using GTI's H_2 process with carbon capture will increase the cost of electricity by only 30%, making it the lowest cost carbon capture technology. The use of an advanced H_2 turbine will further reduce costs.



*NGCC assumes F-Class turbine modified for H_2 use

STATUS: GTI has completed pilot testing (under DOE funding), which verified catalyst stability and successfully demonstrated SER chemistry and process operation. H_2 purity and yield were at or above expected levels for the limited sorbent feed rates. The next step is to upgrade the pilot using an indirectly fired calciner, and demonstrate operations. In addition, GTI is executing a hydrogen-to-power study for U.S. DOE with major OEM support.



KEY FEATURES

- H_2 produced in one step
- Inherent CO_2 separation
- 90% size reduction vs SMR
- 20–30% lower capital cost vs SMR
- 10–20% increased H_2 production efficiency
- Steam neutral

APPLICATIONS

- Power generation with CO_2 capture
- Hydrogen for:
  - Refineries and biorefineries
  - Storage
  - Fertilizers (ammonia, urea)

BENEFITS

- 90% carbon capture
- Lowest-cost CO_2 capture option
- Excess H_2 may be stored for peak load use or sold
- Eliminate amine system

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