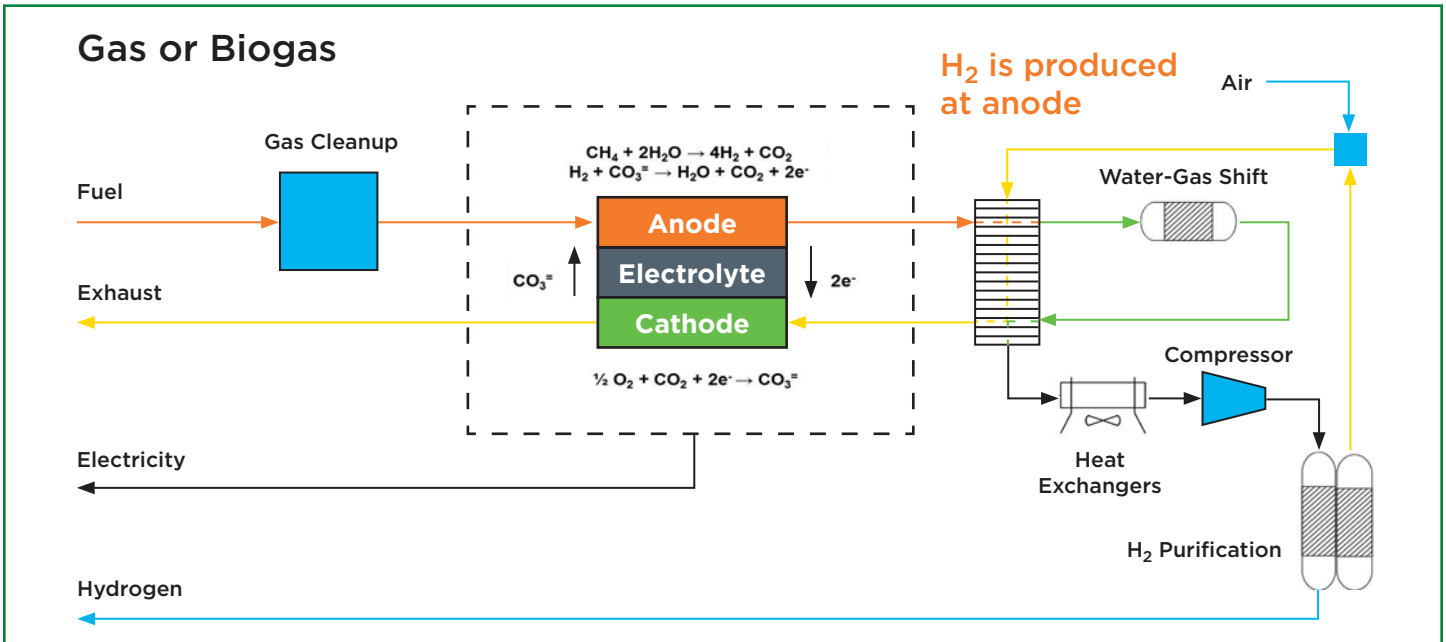
Tri-Generation Success Story

World's First Tri-Gen Energy Station– Fountain Valley

The Fountain Valley energy station, supported in part by a $2.2 million grant from the Energy Department, is the world's first tri-generation hydrogen energy and electrical power station to provide transportation fuel to the public and electric power to an industrial facility. Located at the Orange County Sanitation District's wastewater treatment plant in Fountain Valley, California, the unit is a combined heat, hydrogen, and power (CHHP) system that co-produces hydrogen in addition to electricity and heat, making it a tri-generation system. The hydrogen produced by the system supplies a hydrogen fueling station that is open to the public and can support between 25 and 50 fuel cell electric vehicle fills per day. The fuel cell also produces approximately 250 kW of power for use by the wastewater treatment plant with nearly zero criteria pollutant emissions. In addition, since the power is made from a renewable waste stream, greenhouse gas emissions are substantially reduced.

Photograph of the state-of-the-art hydrogen fueling station with fueling at 5,000 and 10,000 psi according to the latest SAE protocols for rapid 3-minute complete tank refueling.

The Fountain Valley tri-generation fuel cell and hydrogen energy station uses anaerobically digested biogas from the municipal wastewater treatment plant as the fuel for a fuel cell. The CHHP system uses a molten carbonate fuel cell, chosen for its high efficiency and the capability to co-produce hydrogen. The system is integrated with a hydrogen purification



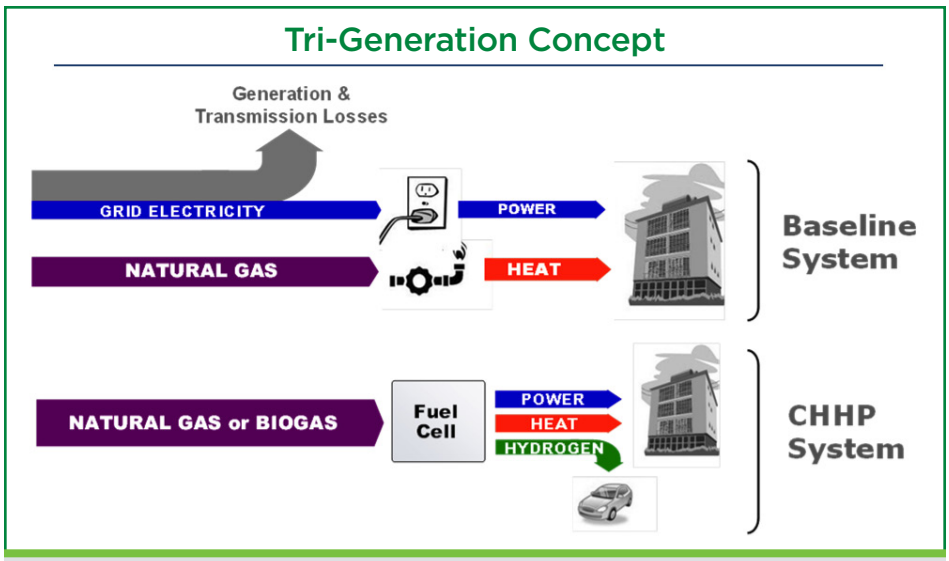
Anaerobic digester gas fuel is cleaned and then sent to a molten carbonate fuel cell that converts the hydrocarbons to a hydrogen rich mixture and produces electricity. Careful design modifications allow extra production of hydrogen that is separated, compressed, and dispensed to fuel cell vehicles.

system to produce approximately 100 kg of hydrogen per day. The hydrogen is stored on-site in high pressure tubes at <7,000 psi near the tri-generation system and next to the fueling station.

The project was developed as a partnership between the U.S. Department of Energy, California Air Resources Board, the Orange County Sanitation District, academia, and private industry. The project is managed by Air Products and additional partners include FuelCell Energy, Inc., the South Coast Air Quality Management District, and the National Fuel Cell Research Center of the University of California, Irvine.

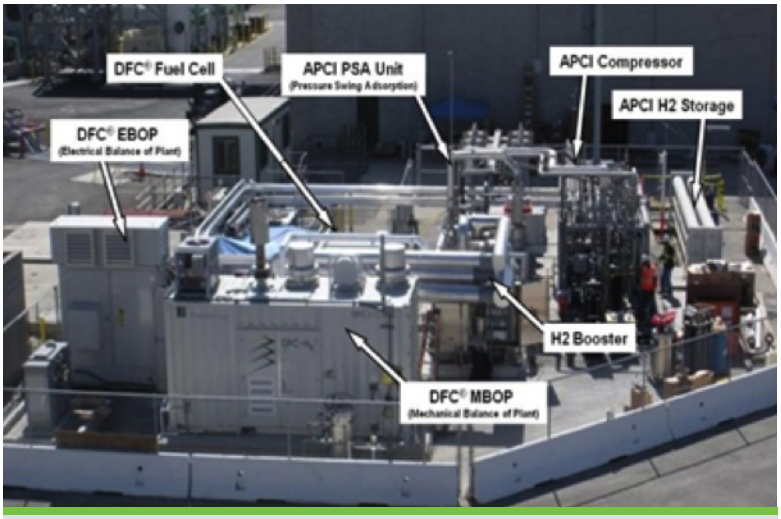
Tri-Generation as an Infrastructure Bridge

Early infrastructure deployment presents a challenge to the hydrogen and fuel cell industry because station investment often needs to come before the vehicle demand. Auto manufacturers from around the world have announced plans to commercialize fuel cell electric vehicles between 2013 and 2017 and have called for increased investment in refueling infrastructure.



Tri-generation, or combined heat, hydrogen and power (CHHP), systems can locally produce useful power, heat, and fuel with low emissions and high efficiency that avoids the energy and emissions penalties of transmission/transportation of traditional methods.

With a tri-gen system, product hydrogen is only generated when it is needed for refueling. Otherwise the hydrogen is used internally, and the system continuously produces heat and electricity, thereby leveraging all of the capital that is invested in the plant and helping to mitigate potential stranded capital issues.



A photograph of the Fountain Valley tri-generation system shows the fuel cell from FuelCell Energy and the hydrogen separation and compression equipment from Air Products and Chemicals, Inc. (APCI).

The Fountain Valley tri-generation fuel cell system also demonstrates the versatility of fuel cells to utilize multiple feedstocks, such as biogas and natural gas, to produce power and renewable hydrogen that can be used to fuel light duty vehicles. Primarily running on biogas, the system can also use natural gas to sustain a consistent fuel flow in the case of any disruption in biogas availability or quality.

Early market projects, like this tri-generation system, are addressing many of the logistical and other real-world challenges that will confront fueling stations of the future. Tri-gen will help to open regional markets where significant investment would be required to initiate hydrogen production.

The high efficiency and low emissions local production of hydrogen, electricity, and heat may make tri-generation systems a bridge technology for introducing and sustaining technology for supporting hydrogen infrastructure.

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