Aris Energy Solutions

Fuel Cell Information for Van Ranst Multi-Family Project

- Fire Safety
- Noise
- Local Emissions
- Permitting Process
- Similar Installations

June 27, 2022

Fire Safety

- The fire protection requirements will be similar to a gas boiler or gas furnace.
- The entire building will have a fire suppression system to meet code and this will include the rooftop area with the fuel cells and electrical panels.
- This will include two-hour fire rated walls, smoke detectors and heat detector. Sprinklers are often not included in rooms with electrical panels or the code may require water skirts if they are required – will conform to code.
- The fire suppression system has not yet been designed and specified as that task is a part of the building's larger detailed design for plumbing, mechanical equipment, electric circuits to the applicable local codes.
- When the fire department arrives the first thing they do at the street is to shut off the gas and the electric service to the building, which will shutoff the fuel cells.
- The fuel cell has no fuel storage. When the gas is shut off, it shuts down.

Noise

- Noise less then 47 dB(a)
- See decibel table below to relate to common noise levels. It is noticeably more quiet that a household refrigerator.

Environmental Noise	*dBA*
Jet engine at 100'	140
Pain Begins	*125*
Pneumatic chipper at ear	120
Chain saw at 3'	110
Power mower	107
Subway train at 200'	95
Walkman on 5/10	94
Level at which sustained exposure may result in hearing loss	*80-90*
City Traffic	85
Telephone dial tone	80
Chamber music, in a small auditorium	75-85
Vacuum cleaner	75
Normal conversation	60-70
Business Office	60-65
Household refrigerator	55
Suburban area at night	40
Whisper	25
Quiet natural area with no wind	20
Threshold of hearing	0

Local Emissions

- Since this is not a combustion process, there are no sulfur compounds (SOX, or acid rain) and there are no nitrogen oxides (NOX or smog), no particulates
- The high electrical efficiency enables a very low emissions factor of about 0.5 lbs of CO2 per kw-hr, about half of the amount of carbon level of this downstate portion of the NY-ISO grid.
- That level is even lower if we take credit for the by-product combined heat and power, and lower still if/when the gas utility blends 20% green hydrogen into the pipeline natural gas.

Permitting Process (Brief Description)

- Obtain gas and electric Load Letters, starting with the Gas Load Letter from ConEd Gas. By use of the fuel cell and the use of the Air Source Heat Pumps, both of which are leading technologies, the gas demand will be LESS than the current gas demand, as much as half of it. This will be documented in the Con Ed Gas application.
- Electrical interconnect permit application by the electrical contractor, similar to the same process for the rooftop solar system. The fuel cell's hybrid inverter is fully UL listed for electrical utility interconnect. This has been done in the Long Island homeowner's installation with PSEG-LI.

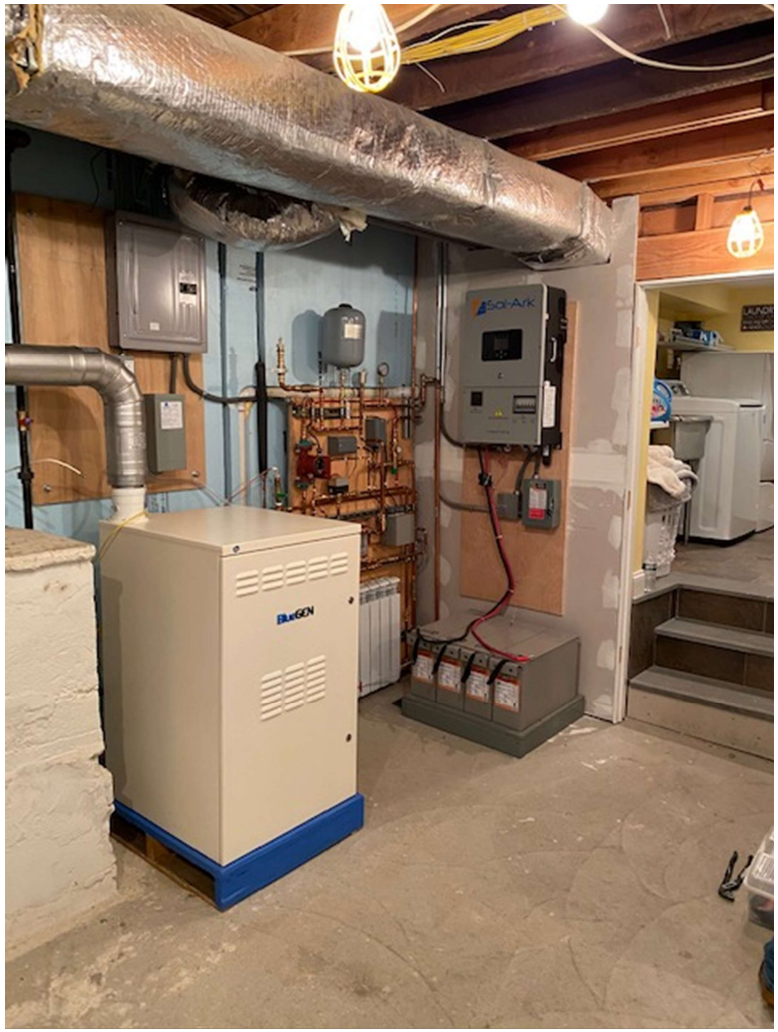
Similar Installations

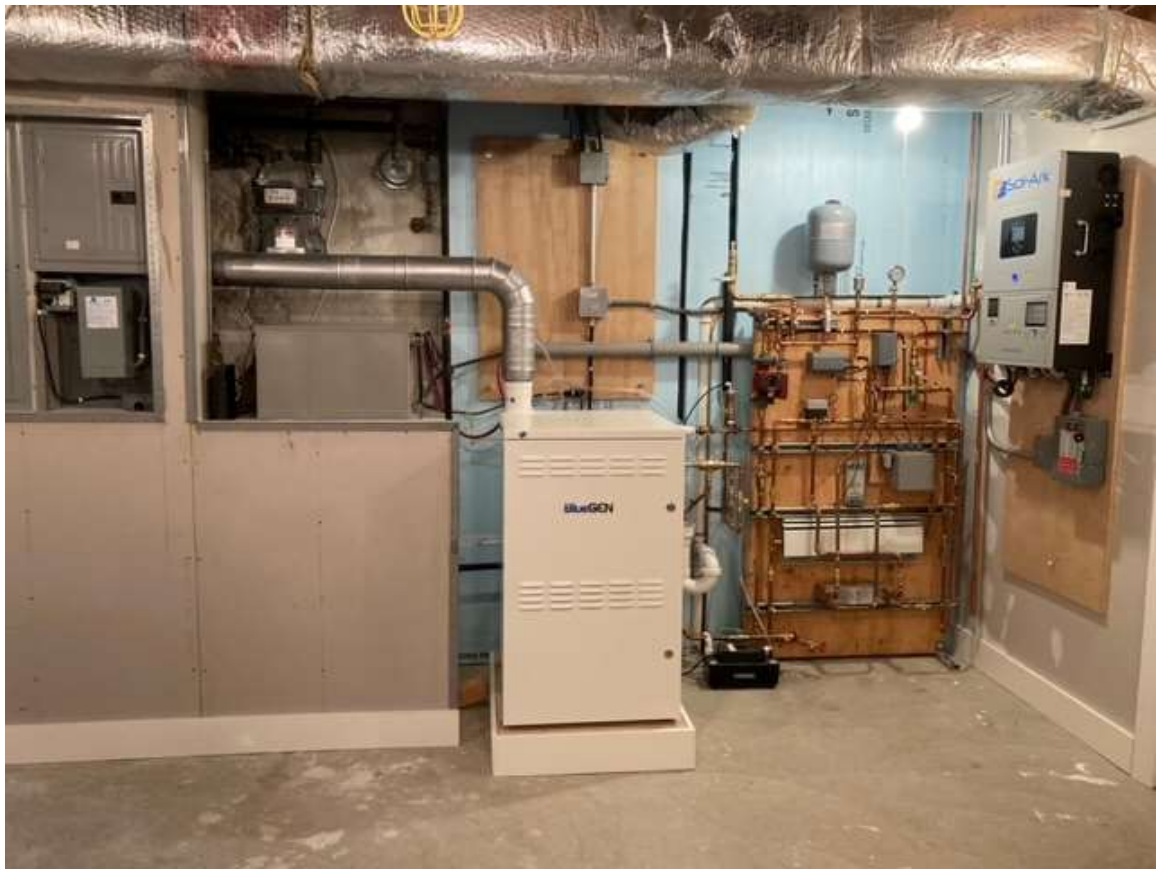
- There are over 2500 of these units operating for over 40 million cumulative operating hours in single family homes and small businesses in Europe.
- While well demonstrated in Europe, Aris Energy is just starting to install the units in the US. Our current US installations do not include a multi-family building. However,
  - We have a successful operating unit in a Long Island homeowner's basement*
  - We have 9 operating units in two federal government labs (Brookhaven National Lab in NY*, National Energy Technology Lab in Morgantown WV**)
  - We are installing 15 units at the NASA data center in Fairmont WV within a few months**
- Please see following 7 slides with photos of US and European operating fuel cells

* Sponsored by the National Grid utility company

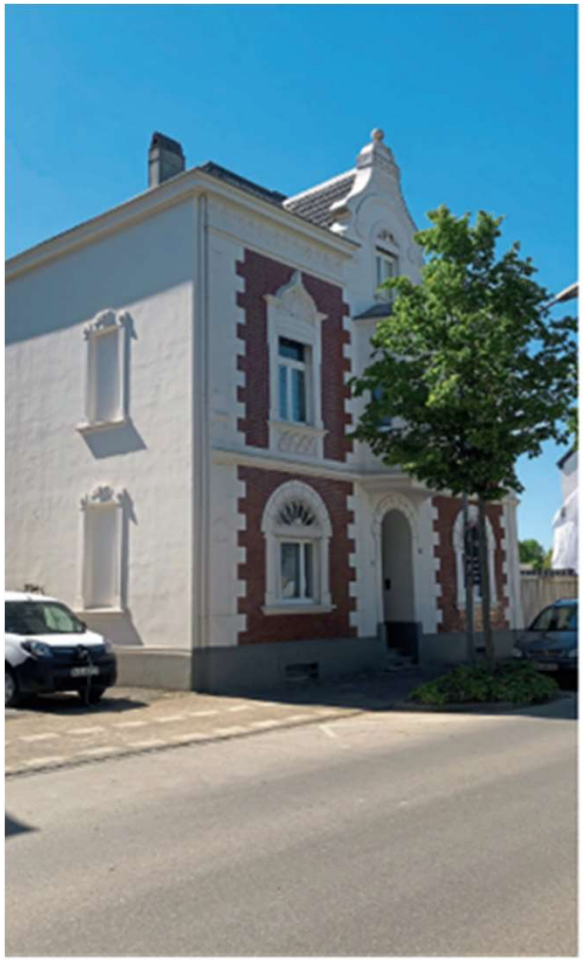
** Sponsored by the US Department of Energy

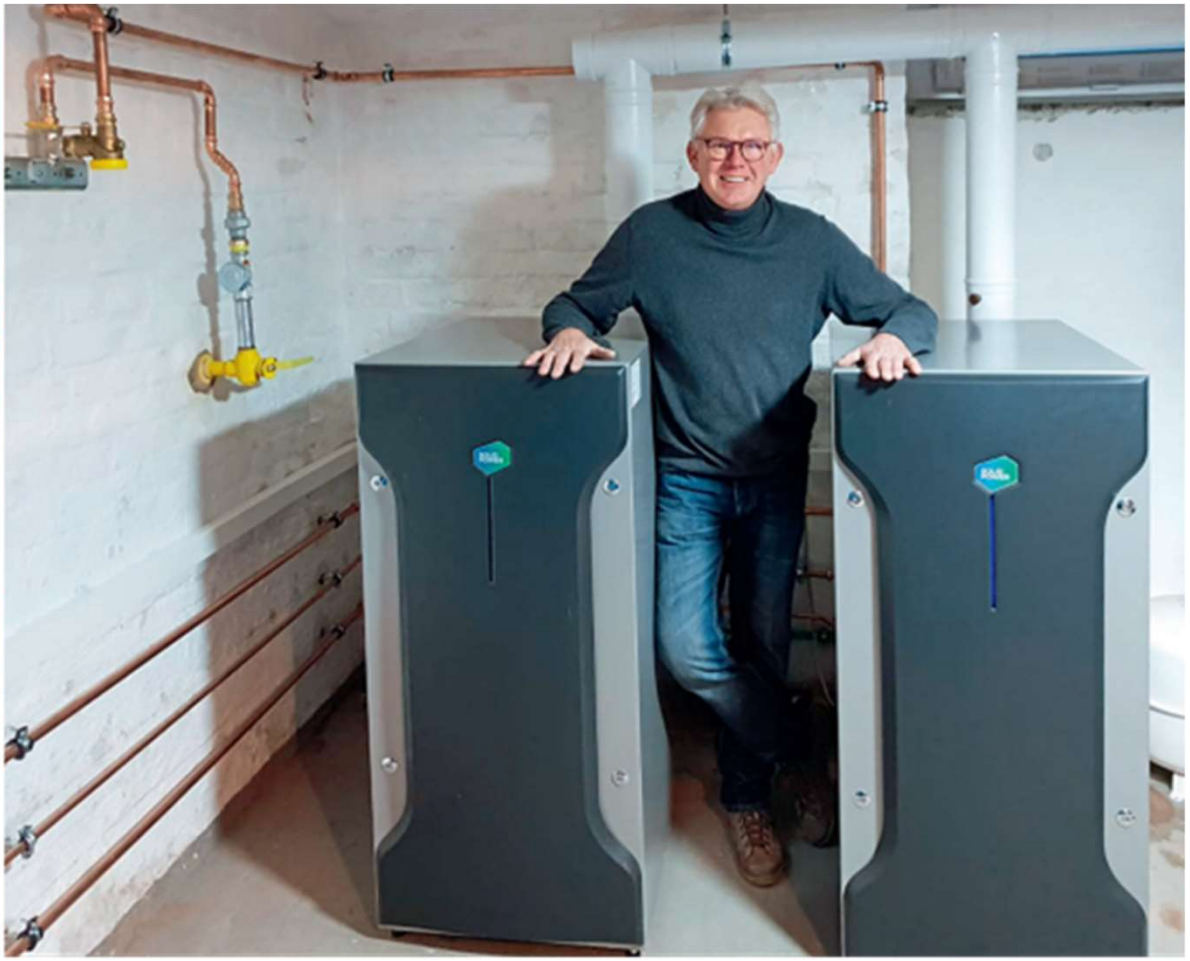
Installation Photos (Long Island Residence)





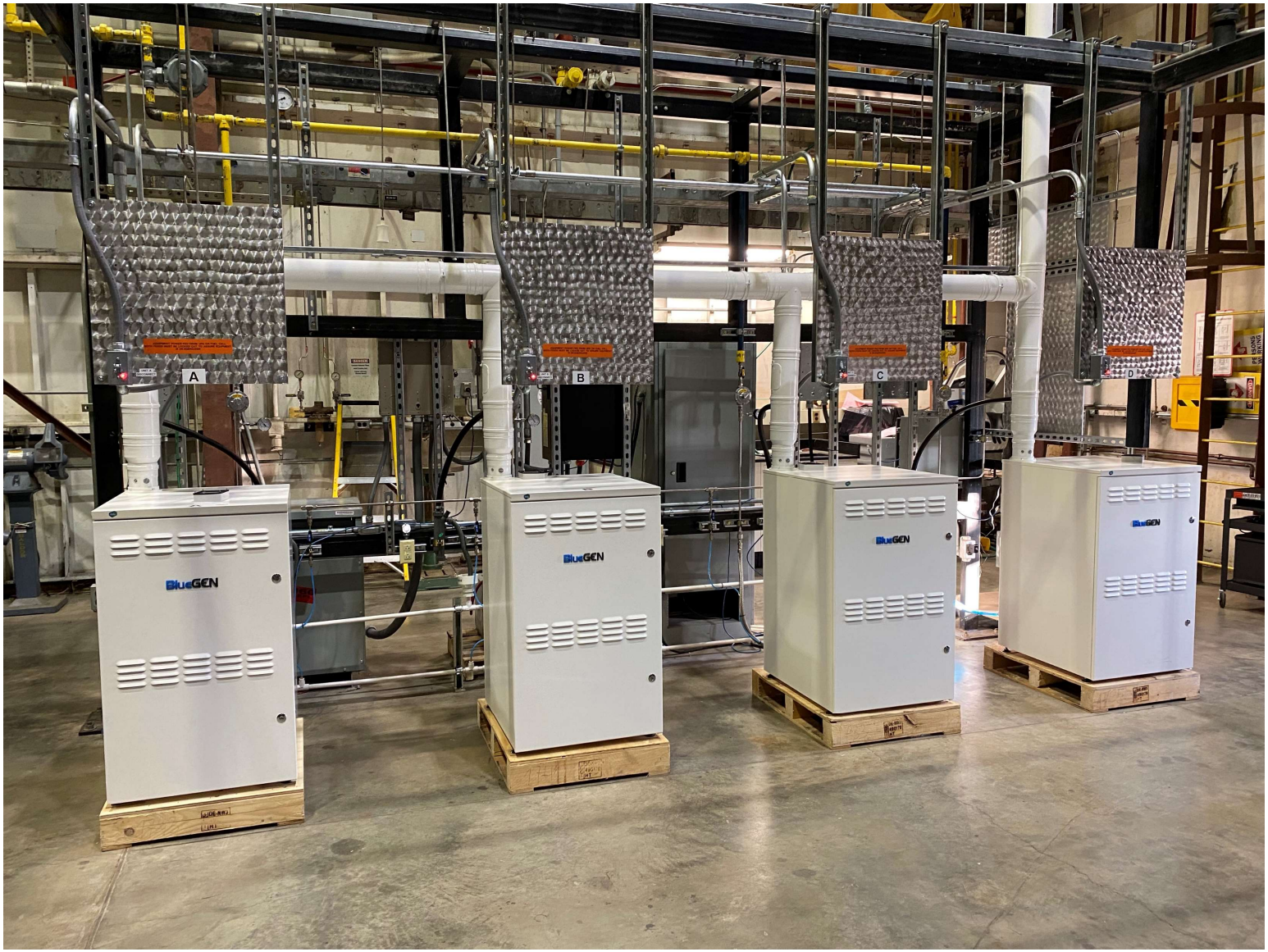
European Installation Photos (Multi-Family)





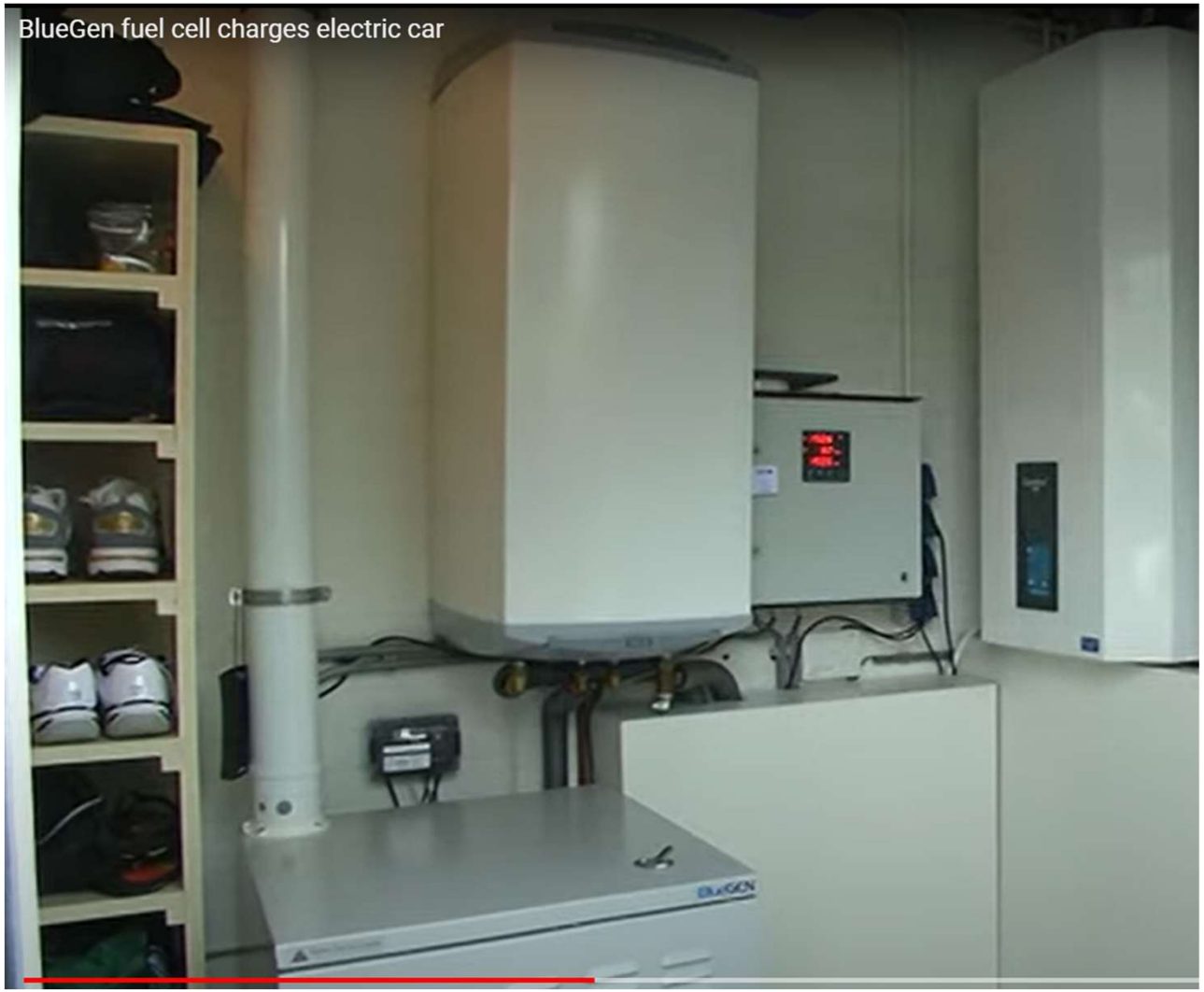
Installation Photos (Brookhaven National Lab)

Installation Photos (NETL – Morgantown, WV)



European Installation Photos

Early European Residential Photos



Note: This image from a YouTube video published in 2013, showing the BlueGEN fuel cell powering the home and an electric vehicle, with by-product heat. (ahead of its time)

https://www.youtube.com/watch?v=V4oXVJdx5AM

European Installation Photo

Photo illustrates modularity when the units are manifolded

Prepared by:

Dan Connors

Dan Connors, CEO

Aris Energy Solutions LLC

June 27, 2022