



## GEI GLOBAL HTPEM Fuel Cell Spec Sheet Q & A

### 1. What is the efficiency of GEI's HYPERGEN High Temperature PEM fuel cell power system?

- Operating on natural gas the conversion from fuel input to power output exceeds 42% efficiency due to an effective internal high capacity steam generator.

### 2. What is the combined heat and power efficiency?

- Using the excess heat contained in the 330F (165 C) mineral oil coolant system for hot water or space heating, the overall system thermal efficiency can exceed 90-92% percent depending upon system conditions.



### 3. How much natural gas is required?

- MBTU/day = kW-hr/day output x 7.8

### 4. What is the BTU output of waste heat?

- For each 1 kW of power generated approximately 0.80 kW of thermal energy is available for an external heating load. For heating water the following equation can be used to conservatively determine the maximum water volume flow rate:

$$m_w \left( \frac{\text{gal}}{\text{min}} \right) = \frac{4.0}{\Delta T} \times P_{\text{stack}} (\text{kW})$$

So a 100 kW stack provides sufficient excess heat to raise temperature of water flowing at 40 gal/min by 10C. Or, say to raise water flowing at 40 gal/min by 50C requires a 500 kW system.

### 5. How many gallons of cooling water is required?

- No external cooling water is required

### 6. What is the operational life of unit?

- The operational life of BOP components are 60,000 hours, while the operational life of fuel cell membranes are 30,000 hours for a 10% reduction in efficiency; typical life is 50,000 hours. Upon which, membranes can be replaced for about 30-40% of the overall cost.

**7. What is the maintenance cost per kW-hr?**

- Maintenance cost is typically 0.002 cents per kW-hr, or about \$144.00 per month for a 100 kW system.

**8. What is the voltage output?**

- For a 100kW fuel cell power system, the DC voltage output is 96V and the AC output is 208V (or 480V) Three Phase for grid connectivity.

**9. Is a substation needed?**

- Depends on current in-place infrastructure, but if budget permits, it's recommended.

**10. What are the emissions?**

Emission Data	
Component	Lb/MW-hr
NOx	0.02
CO	0.02
VOC	0.01
CO2	1100

**11. Programmable Power Electronics.**

- The multi-channel and user programmable power electronics (PE) and controls hardware is developed to accept as input solar, wind, battery, fuel cells or other forms of DC energy as an input source. The PE system behaves as a power application bridge to decouple the user application load output from the energy supply input. The PE seamlessly integrates multiple DC input power sources to meet the desired power output demand. The user can specify max output current/power levels as well as rate (kW/sec) of input and output power charge and discharge allowed. No other fuel cell supplier has this capability.

