PowerAvenue LLC

At a Glance

Mass Manufacturer
of Secure and Clean Power

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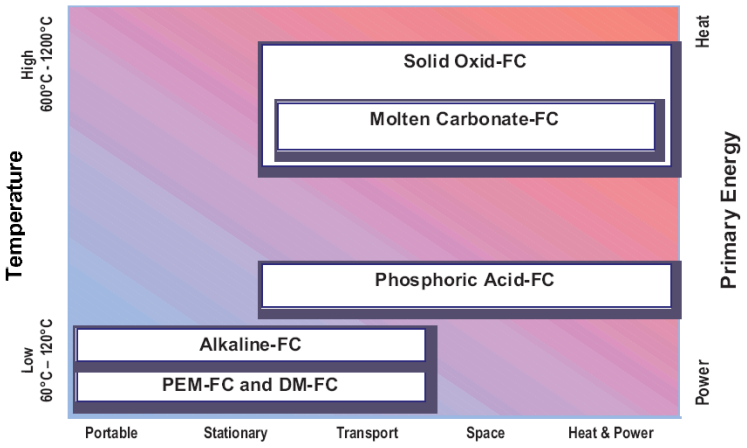
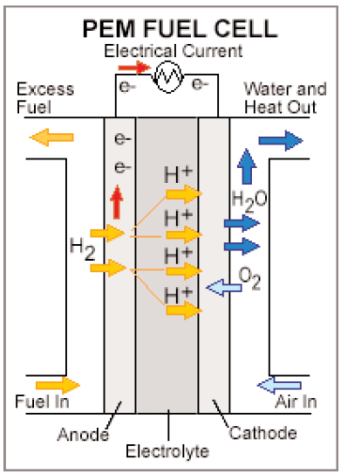
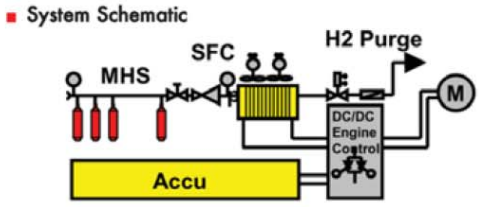
PEM Advantage/Applications

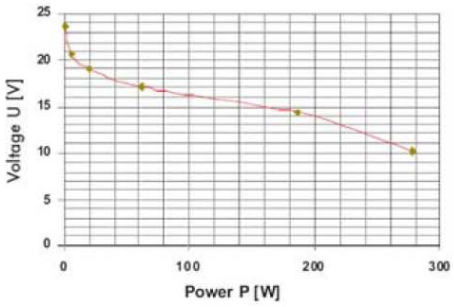
Fuel Cell Types	A-FC	PEM-FC	DM-FC	PA-FC	MC-FC	SO-FC
	Alkaline	Proton Exchange Membrane	Direct Methanol	Phosphoric Acid	Molten Carbonate	Solid Oxide
Applications	Transportation Space Military Energy Storage Systems Portable Power Systems Decentralized Stationary Systems			Combined heat and power for: Decentralized Stationary Systems Transportation		
Operating Temperature (in °Celsius)	< 100	60 - 120		160 - 220	600 - 800	500 - 1000

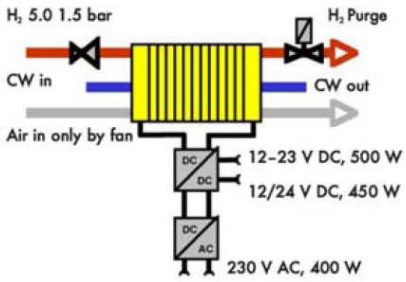
Application of fuel cell type may vary depending on source of institute or company.

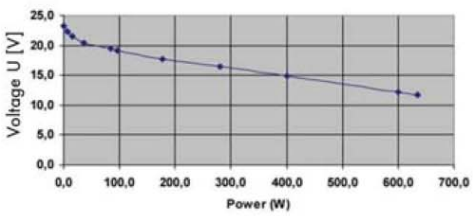












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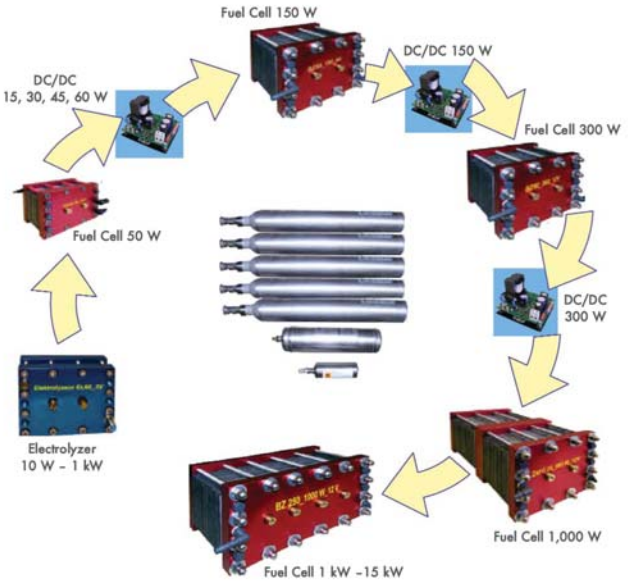
Stationary and Mobile Power Applications

PowerAvenue Fuel Cells

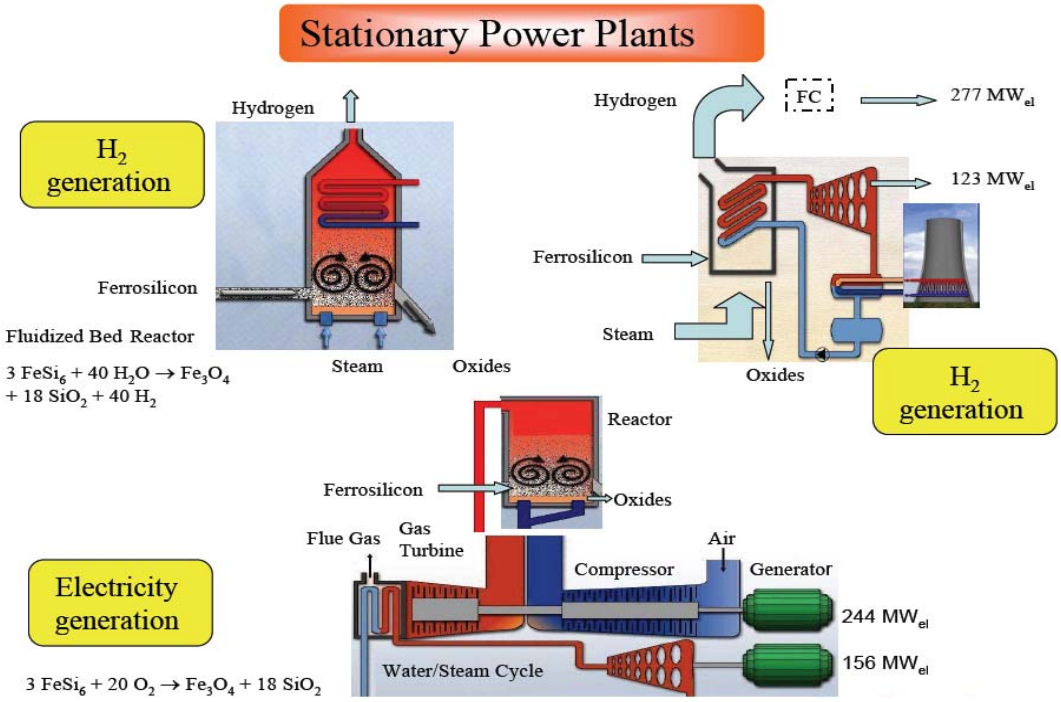


Portable Products	Stationary Products
• Portable Generator	• Bungalow Primary Power
• CPS, Video Equipment	• Residential Primary Power
• Bicycle	• Neighborhood Generator
• Recreational Vehicles	• Small Power Plant
• Forklift	• Medium Power Plant
• Gardening	• Hospital, Clinic
• Solar Back-Up	• IT, Telecom Premium Power
• Toys	• Mobile Trailer Back-Up Power
• Wheel Chair	
• Golf Cart	
• Scooters	
• Shipyard vehicles	**Special Applications**
• Pure Oxygen Production	
• Mining Lights	• Utensils
• Wind Back-Up	• Biomedical Equipment
• Shopping Cart	• Clean Cars (SUV)

500 W TECHNICAL SPECIFICATIONS

Design:	**FFC Foil-Fuel Cell**
Air Supply:	**Fan only**
Cooling:	**Water cooling**
Nominal Power:	**500 Watt**
Nominal Voltage:	**23-12 V DC without DC/DC**
Active Area:	**119 cm^2**
Dimensions:	**260 x 130 x 106 mm^3**
Weight:	**3 kg**

Stationary Power Plants



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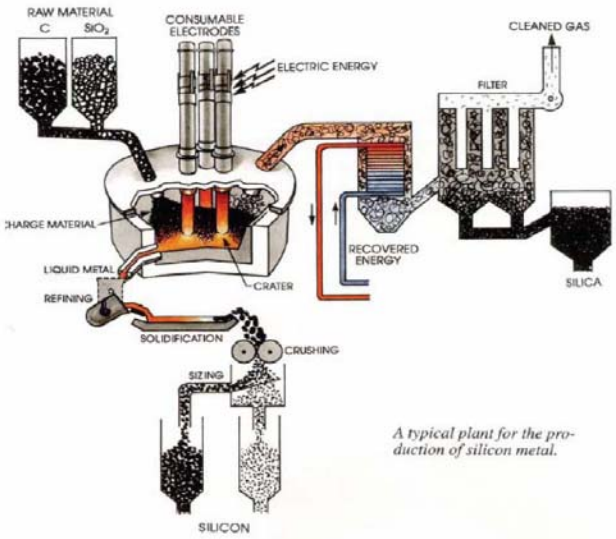
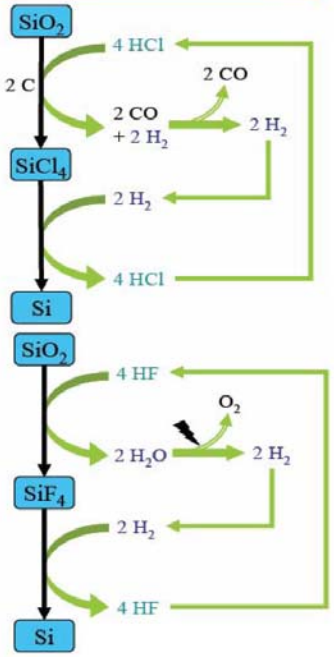
The Energy Consuming Process



A Better Solution



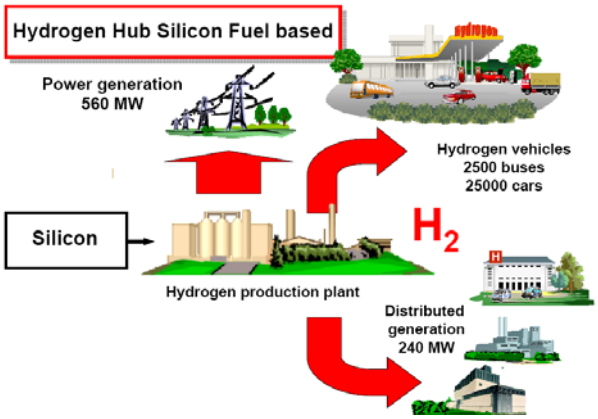
Hydrogen Combustion Turbine

Silicon/Hydrogen fuel Power Plant

In the 21st century, nations must optimize use of low-quality fossil fuels and sustainable-source energy while giving equal consideration to resource depletion, environment protection, and the varying economic considerations affecting all nations. Because these three factors -- energy, environment, and economy -- are interdependent, advances in one must be compatible with the others.

The following data are for conversion of Silicon to Hydrogen and the use of Hydrogen in a H2 burning gas turbine to generate electricity. Since many of the process and component efficiencies are not well known, a 50% overall efficiency has been assumed for the entire process. This number maybe on the optimistic side since most fossil-fuel power plants operate at below 40% cycle efficiency.

Silicon Consumption	1MW	10MW	50MW	100 MW
Si consumption per hour	220 kg	2.22 tons	11.1 tons	22.2 tons
Si consumption per day	5400 kg	54 tons	270 tons	540 tons
Si consumption per year	1940 tons	19,400 tons	97,000 tons	194,000 tons



Avoided CO_2 for each hydrogen hub

Hydrogen Hub Silicon Fuel based

Installation Forecast electric power **800 MW**

Vehicles ~ 2,500 buses

~ 25,000 cars

2.3 – 2.7 million ton CO_2/year

Hydrogen Hub Solar Fuel based

Installation Forecast electric power **50 MW**

Vehicles ~ 1,300 buses

~ 13,000 cars

0.3 million ton CO_2/year

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Pound for pound hydrogen holds more energy	
Hydrogen	52,000 BTU/lb (120 kJ/g)
Gasoline	19,000 BTU/lb (43.5 kJ/g)

Fuel efficiency comparison	
1 gal of gasoline	25 mi
1 gal of hydrogen (1 kg)	60 mi

Energy yield of hydrogen	
1 kg of H_2	115,000 BTU
1 kg of H_2	33.3 kWh
1 kg of H_2	120 MJ

Fuel	Energy [kJ/g]	Energy [kJ/l]
Coal	29.3	
Brown coal	8.1	
Wood	14.6	
Gasoline	43.5	30,590
Diesel	42.7	29,890
Methanol	19.6	15,630
Natural gas	50.0	31.7
Hydrogen	119.9	10

1 kg of pure silicon (Si) can be extracted from 2 kg of SiO_2 ("clean sand")
1 kg of hydrogen is obtained from 7 kg of silicon, or
1 kg of hydrogen is obtained from 14 kg of sand, or

1 kg of sand yields 2.4 kWh of energy

Power Conversion and Applications		
Power rating	applications	hp
15 – 100 W	small electronics, toys, etc.	
1.5 kW – 2.5 kW	bicycles, scooters, golf carts, fork lifts	2 – 3.3
5 kW	stationary units, houses, campers, ... at 110 V, provides 45 Amps (typical homes use about 40 amps at a given time); several modules can provide typical power	6.7
100 kW	high power, compact size applications typical 1/2 ton truck uses two 100-kW (total of 268 hp) units	134

Hydrogen Conversions and Facts	
1 mole of H_2	2 g
1 mole of H_2	22.4 L
Heat of combustion	242 kJ/mol (LHV)
1 standard ft^3 of H_2	2.53g

Comparison to other fuels	
Fuel (kg)	Output (kWh)
gasoline	13.0
methanol	5.6
propane	12.9
ethanol	7.5
butane	12.7
natural gas	13.9
HYDROGEN	33.3

Production of 1 MW of Electricity*		
Reactants	Consumption rate kg/h	Consumption rate metric tons/yr
Sand	900	8000
Silicon	400	3700
H2	60	535
Water	556 (liters/h)	5,000,000 liters per year

Operational Hydrogen Requirements (Fuel cell efficiency – 50%)		
Power output (kW)	Mass rate (g/min)	Volume rate (Liters/min)
1	1	11
5	5	56
10	10	112
15	15	167
50	50	556
100	100	1,120

Typical Combustion Reactions Where Fuel "Burning" Takes Place		
natural gas + oxygen	→	CO_2 + water + 891 kJ/mole heat
or		
gasoline + oxygen	→	CO_2 + water + 5471 kJ/mole heat
Noncombustion Alternative Energy Schemes (NASA's Sodium Sulfide battery)		
sodium + sulfur	→	sodium sulfide + 183 kJ/mole heat
***PowerAvenue's* Use of Silicon to Generate Hydrogen**		
silicon + water	→	sand + hydrogen + 340 kJ/mole heat

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A. Portable Business Line — $50 million

Based on the financial projections, this plan calls for a $50 million investment in 2008/2009. Initial funding will allow PowerAvenue to establish full manufacturing capability to be able to produce at the lowest cost and at a high production rate of specific fuel cell series.

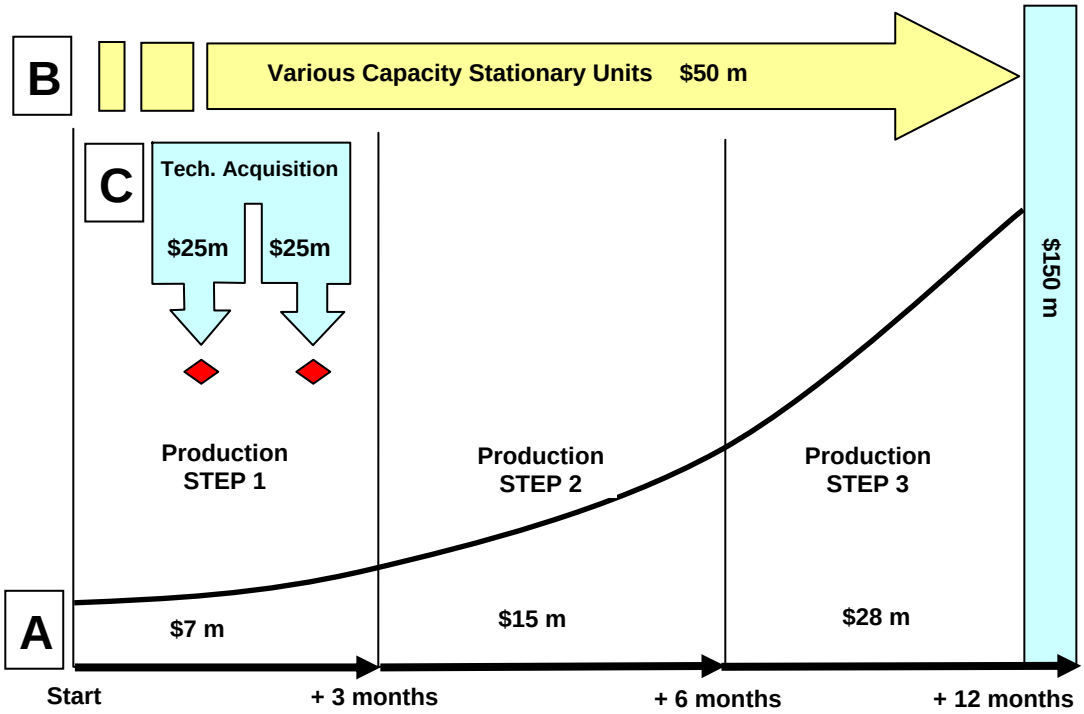
B. Stationary Business Line — $50 million

Based on the financial projections, this plan also calls for a $50 million investment in 2008/2009. Initial funding will allow PowerAvenue to establish full manufacturing capability to produce at the lowest cost and at a high production rate of specific fuel cell series. The models produced in this activity will be driven by specific market needs. Initially, the plant will produce UPS power backup systems and in the next stage will focus on residential/small office units.

C. Technology & Component Acquisition — $50 million

An additional investment of $50 million will be required to procure additional technology and components to leverage production of fuel cell applications and to secure a USP towards potential competitors.

Total $150 million



1. Hire key marketing, sales, and manufacturing personnel
2. Complete product design
3. Purchase and setup of production equipment
4. Complete fuel cell tooling
5. Renovate facility and execute construction improvements
6. Purchase materials and increase inventory
7. Develop strategic manufacturing and distribution partnership programs
8. Create logistic base – HR, IT, and facility management
9. Execute initial public offering (IPO)
10. Initial regional expansion