

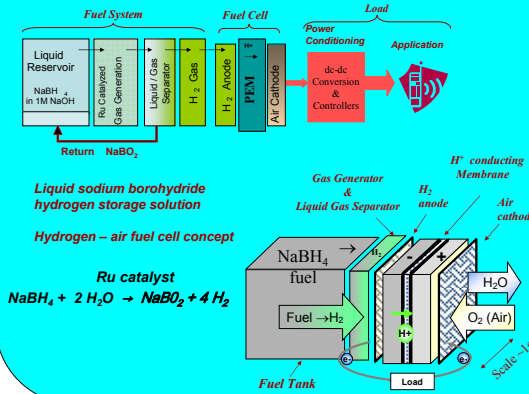
# Fuel Cell System as Longer Lived Battery Replacement

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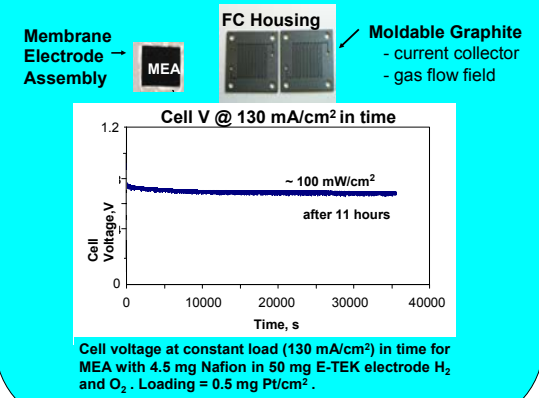
## 1 Overview

Power-hungry next-generation portable electronics applications require power sources with more energy density than batteries. As much as 10 times greater energy can be made available by replacing a battery-pack with a fuel-cell power-pack of the same size and weight provided a suitable supply of hydrogen is available. This supply is being provided by a new compact microreactor, which converts alkaline borohydride solution to H<sub>2</sub>. The entire system is orientation independent and operates at room temperature and pressure. New materials, microfabrication and microfluidics technology enable this new power-source technology. A complete power-source prototype is being developed for wireless and hand-carried electronics. The prototype consists of an energy-rich borohydride fuel cartridge, a micropump, a catalytic hydrogen generator, a fuel-cell, a small battery and electronics for battery recharging, system controlling and power conditioning.

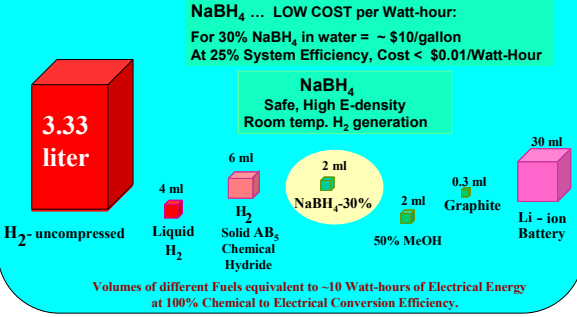
## 4 Diagrams of fuel/fuel-cell sub-system



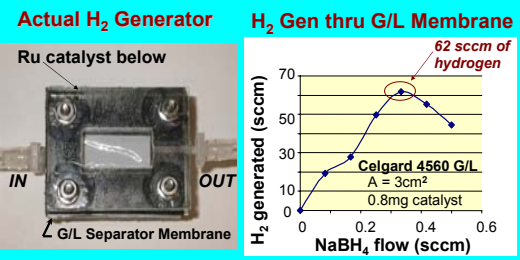
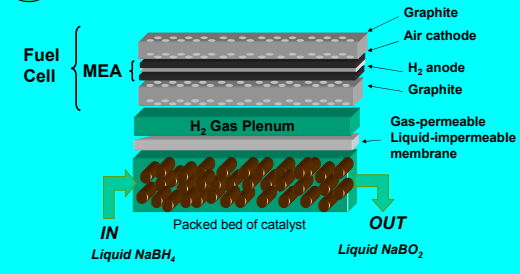
## 6 Fuel Cell Performance



## 2 Fuels and Relative Energy Density



## 5 H<sub>2</sub> Generator integrated to Fuel Cell



## 7 Implications of technology

- Extended life for Wireless applications from energy dense alkaline borohydride H<sub>2</sub> storage (2500 Wh/liter or kilogram) and compact H<sub>2</sub> generator with the reliable efficient H<sub>2</sub> - air fuel cell.
- H<sub>2</sub> storage solution is safe: nontoxic, nonflammable.
- Virtually no free hydrogen during power generation.
- Fuel cell system is cost competitive with batteries.
- Ambient temperature and pressure operation is compatible with hand-carried portable applications.
- Liquid would leak slowly and safely from a punctured liquid alkaline borohydride storage-solution cartridge, whereas a ruptured pressurized tank of H<sub>2</sub> is hazardous and H<sub>2</sub> would be lost nearly instantaneously.
- With electronics for system control and power conditioning makes a complete fuel cell power pack with 3 to 10x more life than a battery pack of comparable size and weight.

## 3 Preparation of Ru Catalyst for H<sub>2</sub> Generation

