



US DOE & USFCC Fuel Cells Meeting: Matching Federal Government Energy Needs with Energy Efficient Fuel Cells

Micro & Man-Portable Fuel Cells

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U.S. Fuel Cell Council

Micro & Man-Portable

- Less Than 100 Watts
- Consumer electronics, defense (soldier power), speciality applications

Portable, Backup, APU

- 100 Watts to 10 Kilowatts
- Battery replacement or charging, defense (platoon power), telecom backup, remote, auxiliary power

Buildings & Facilities

- 100 Kilowatts to Megawatts
-

Speciality vehicles & Material handling

- 1 to 50 Kilowatts
- Forklifts, airport tugs



Micro/Portable Fuel Cell Applications

- Consumer electronics:
 - Cell phones, PDAs, laptops, music players
- First Responder:
 - 2-way radios, communications centers
- Defense (solder power):
 - Communications, computing, sensors
- Industrial & Specialty applications:
 - Battery charging stations
 - Handheld data terminals
 - Inventory/warehouse management
 - Satellite Phones, surveillance



Portable Electronics Yearly Energy Usage



US Fuel Cell Council
www.usfcc.com

*Portable Electronics
Yearly Energy Usage*

10,500+ W-hr

Always On - Always Connected
3G – 4G
Large Color Displays
MP Camera & Flash
High speed data
TV-DBV
Games

In "High Power" mode
more of the time

2010

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Portable Fuel Cells – First Adopter

Initial Opportunity: Need for Extended Battery Life Away from Wall Plug

- First Responder
- Remote Homeland Security Applications
- Military – Soldier Power

Infrastructure non-existent or compromised in a disaster

For extended missions, Fuel Cell fuels offer 5-10 times energy density (lower weight) vs. rechargeable batteries

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Federal Government Energy Needs

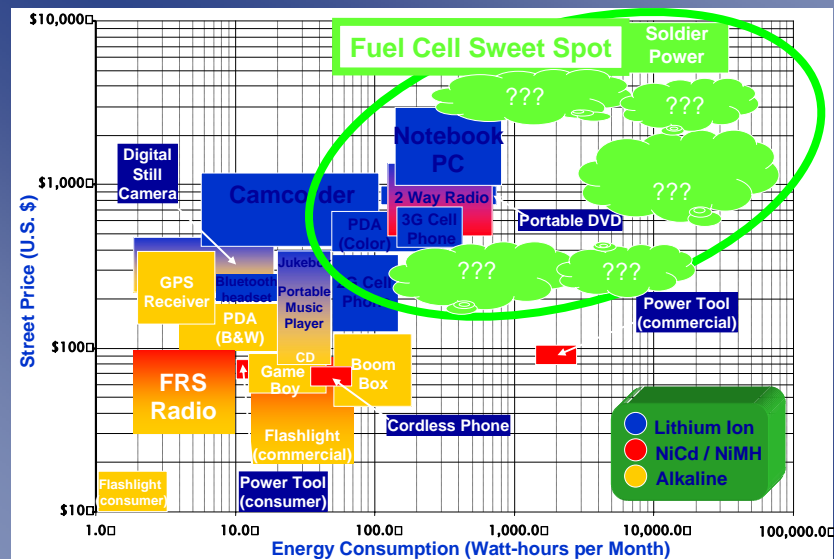
Fuel Cells Address Issues From the Federal Directives:

- Energy efficiency:
 - Drives higher efficiency chargers/electronics.
- Use of renewable energy:
 - Use of “renewable” hydrogen from photovoltaics, wind, etc.
- Reduction/elimination of toxic and hazardous chemicals and materials:
 - No heavy metals such as Cd, Hg, etc.
- Cost-effective recycling programs:
 - Economic incentive to recycle fuel cells (Pt catalyst)
- Increased diversion of solid waste
 - Recycling of fuel cartridges vs. disposal of batteries
- Electronics stewardship:
 - Longer lifetimes vs. batteries (limited cycle life)



Cost effective on a life-cycle basis:

- Fuel Cells can Cost Effective on a Life Cycle Basis compared to current technologies.
- Smaller, lighter, and cost less to use.



Handset Chargers Comparative Analysis



	Wall charger	4 X AA	Energi-to-go	24/7 Power Pack	Hydrogen Battery
Refill Rate	1/1	1/3	1/3	1/6	1/10
Use Cost	< \$0.01/Wh	\$0.33/Wh	\$0.50/Wh	\$0.75/Wh	\$0.10/Wh
Size	10 cc/Wh	10 cc/Wh	3-4 cc/Wh	10 cc/Wh	2-3 cc/Wh
Charge Time	1 h	3 h	3 h	3 h	1-3 h

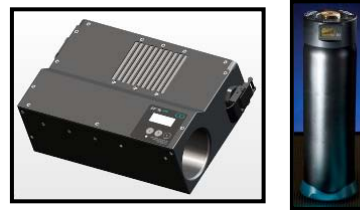
Portable Recharging Options

Portable Fuel Cell Activities

Special Operations Radio



Based on 11 day mission	Jadoo & MCEL Fuel Cell System	BA-5590 Battery
Configuration for mission	1 Fuel Cell 7 x 500 W-hr Fuel Cartridges	35 Battery Packs
Weight of System	11 kg (24 lbs)	36 kg (79 lbs)
Total Cost per system (FC amortized over 25 missions)	<\$1000	\$2625



Status: First prototype demonstrated Sept. 2006
Delivery to SOCOM in Q1-07

Competitive Advantage: Field hydration, non-flammable fuel
66% lighter than BA5590



Other Fuel Cell Advantages

- Total energy system is smaller/lighter for extended operating times
- Fast refuel
- Recharge/power “in the field”



Micro & Man-Portable Fuel Cells

- Angstrom Power
- DMFCC
- Jadoo Power
- Millennium Cell/Gecko Power
- MTI
- TruLite
- Ultracell