

IEEE Chicago/Rockford Consultants'
Network
Meeting
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**Overview of Selected Topics In
Micro Fuel Cell Power Systems
Safety Technology**

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Micro Fuel Cell Power Systems

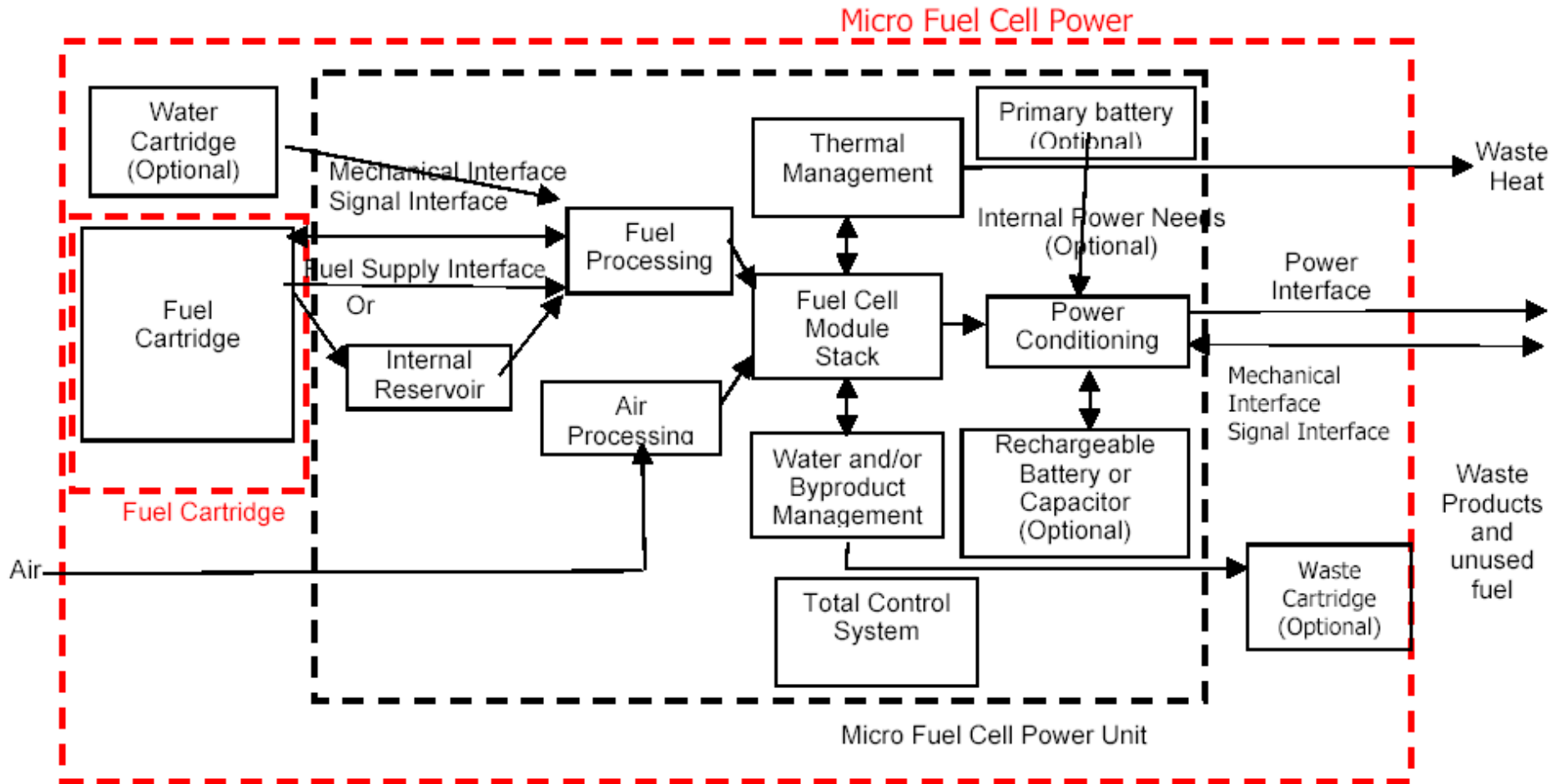
- **Emerging information technology equipment power markets**
 - **Consumer electronics**
 - **Commercial/industrial electronics**

- **Fuels:**

- **Methanol – direct**
- **Methanol - reformed**
- **Hydrogen stored in metal hydride**
- **Borohydride**
- **Butane**
- **Formic acid**



Micro Fuel Cell Block Diagram



Fuels Are Considered Hazardous Materials

– Fuels are:

- Corrosive**
- Toxic**
- Flammable**

– Shipping/transport regulations for hazardous materials

Fuel Details

Technology	Direct-D Indirect-I	UN Shipping Category	Fuel	Activator	Post Reaction Byproduct	Fuel/Activator Reaction
Methanol	D	UN 3473 – Class 3	Methanol or methanol/water	None	None	None
Reformed Methanol	I	UN 3473 – Class 3	Methanol or methanol/water	None	None	None
Formic acid	D	UN 3477 – Class 8	Formic acid <85%	None	None	None
Hydrogen	D	UN 3479 – Division 2.1	Hydrogen	None	None	None
Borohydride	D	UN 3477 – Class 8	Na or K – Borohydride, stabilized with alkaline salts	None	Borate salts	None
Borohydride	I	UN 3476 – Class 4.3	Na or K Borohydride	Water	Borate salts	Hydrolysis reaction
Borohydride	I	UN 3477 – Class 8	Na or K Borohydride	None or water	Borate salts	Hydrolysis reaction
Butane	I	UN 3478 – Division 2.1	Butane	None	None	None

Direct – Fuel reacts directly to produce power without hydrogen.

Indirect & Reformed – Converts fuel to hydrogen, then uses hydrogen in reaction with oxygen to produce power.

International Codes/Regulatory

- **United Nations (UN)**
- **International Civil Aviation Organization (ICAO)**
- **International Air Transportation Association (IATA)**
- **International Federation of Air Line Pilots' Associations (IFALPA)**
- **Air Line Pilots Association, International (ALPA)**
- **Country Regulatory Branches of Government (such as US-DOT)**

International Documents

- IEC 62282-6-100 (proposed)**
 - IEC/TC105-WG8**

- IEC- PAS 62282-6-1 (publicly available specification)**

Status of Draft Standard

- **Corrigendum issued 04/2007 for IEC PAS
62282-6-1**
- **Resolution of comments filed**
- **FDIS draft nearing completion**
- **RDIS stage expected late 2009**

Consultant Opportunities

- **Assist developer to work out safety issues with transportation regulators**
- **Assist developer to understand setting up a production line**
- **Assist developer to understand product safety standard and develop proposed revisions when appropriate**
- **Others**