Membrane Requirements for Back-up Power Applications

DOE High Temperature Working Group Meeting

November 16, 2009

Palm Springs, CA

www.idatech.com
info@idatech.com
63065 NE 18th Street
Bend, OR 97701
541.383.3390

IdaTech
Power For The Long Run

Technical Targets for Membranes - Automotive

Characteristics	Units	Calendar Year		
		2003 Status	2005	2010
Membrane Conductivity @ 25% RH @ Operating Temperature	Ω cm^{-1}	0.02	0.05	0.1
@ Room Temperature	Ω cm^{-1}	0.05	0.07	0.07
@ - 20°C	Ω cm^{-1}	0.01	0.01	0.01
Oxygen Cross-over	mA/cm^2	5	5	2
Hydrogen Cross-over	mA/cm^2	5	5	2
Cost	$/kW		50	5
Operating Temperature	°C	80	120	120
Durability	hours	1000	>4000	>5000
Survivability	°C	-20	-30	-40
Thermal Cyclability in Presence of Condensed Water		Yes	Yes	Yes




Back-Up Power System Classifications

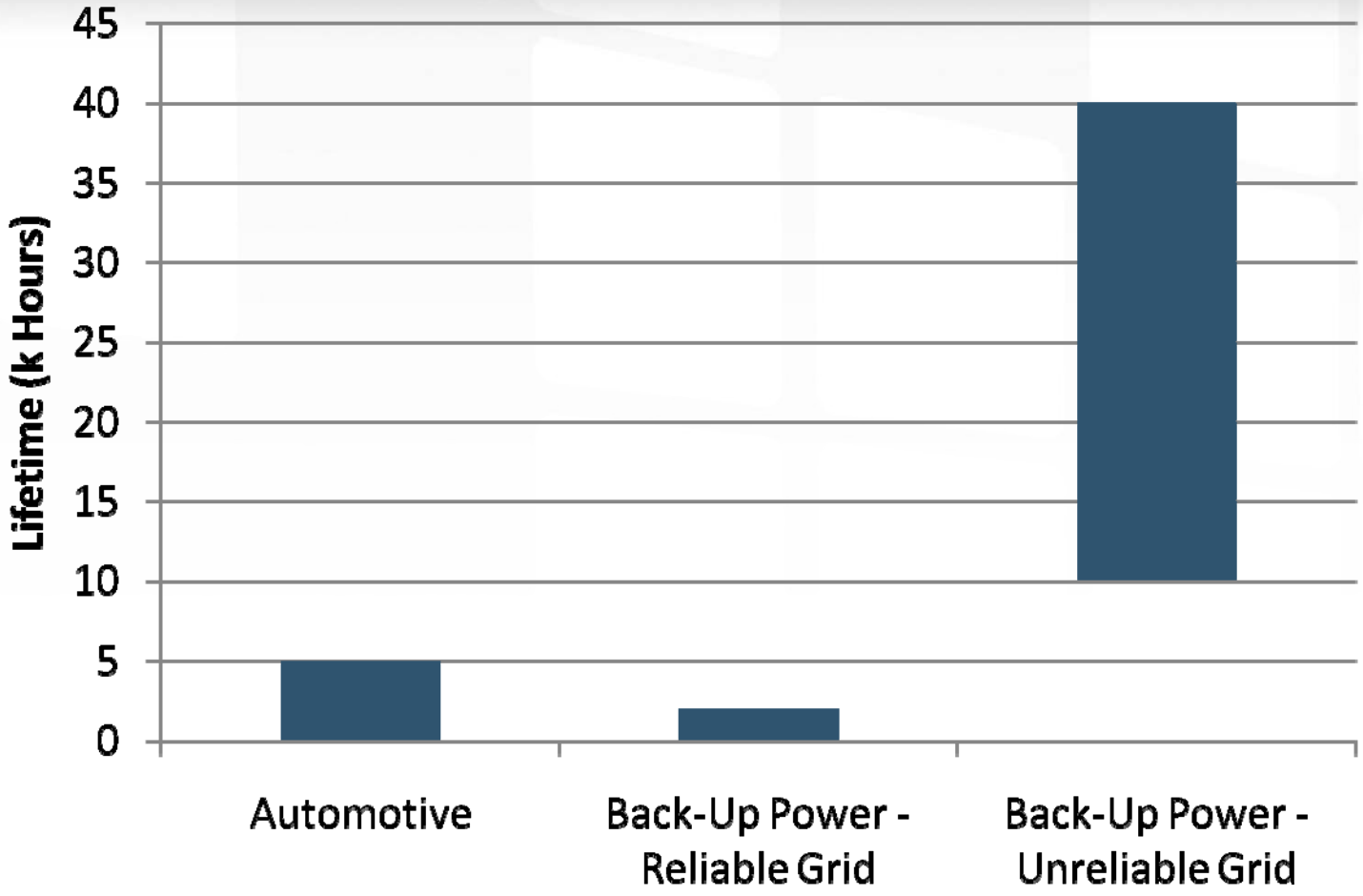
Reliable Grid

- North America, Japan, Western Europe
- Less than 10 hours/year
  - Grid functioning 99.89%

Unreliable Grid

- Southeast Asia, Central and South America, Eastern Europe, Africa and Middle East
- 1 – 6 hours/day
  - Grid functioning 75% – 95.8%

Comparisons - Lifetime



Cost

Incumbent Technology

Batteries can be:

- Expensive to maintain
- Unreliable after aging
- Temperature sensitive
- Difficult to dispose of

Generators can be:

- Unreliable
- Difficult to site
- Maintenance intensive
- Hazardous fuel spill
- Noisy

~1,000 USD
1 -2 hours
Reliable grid

12k – 16k USD
~ 24 hours
Depends on fuel tank sizing
Unreliable grid

Comparison – Load Profile

Automotive

- Highly variable
- Established, ‘representative’ cycle
- Multiple on/off cycles per day

Back-up Power (Reliable Grid)

- Fixed load with oscillations
- Unknown profile
- Very few on/off cycles
- Long periods of dormancy

Back-up Power (Unreliable Grid)

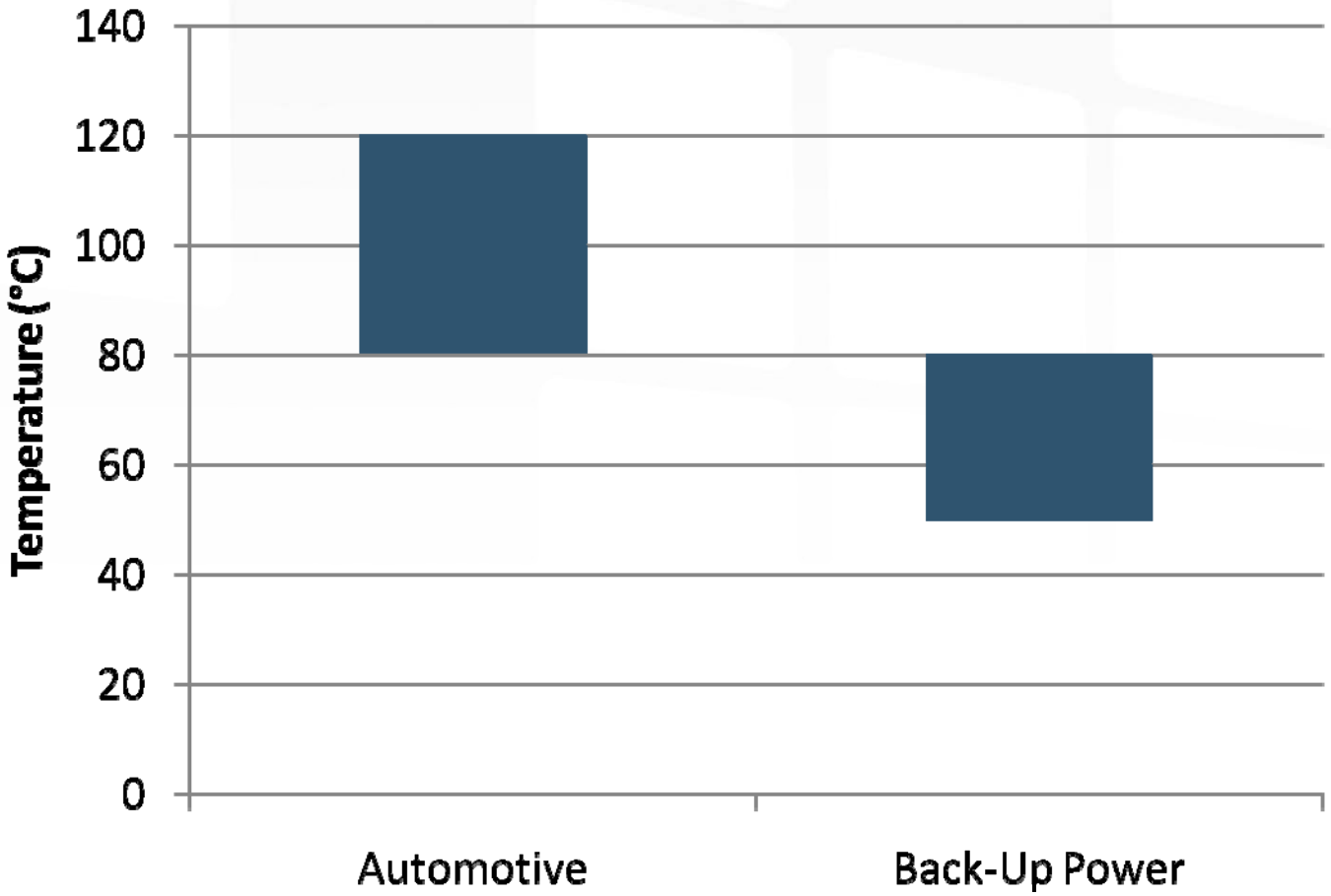
- Fixed load with oscillations
- Unknown profile
- Multiple on/off cycles per day

Relative Humidity

System

- Humidification is a digital function
- Two choices
  - Pay to put in humidification system ~ 100%
    - Liquid cooled system
  - No humidification system
    - Whatever ambient is that day
      - ~ 10% to 100%
    - Air cooled system

Comparisons – Operating Temperature




IdaTech
Power For The Long Run