Alkaline Membrane Fuel Cell Workshop
System Break-Out Session

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Current State-of-art Performance

- MEA level
  - 200 mW/cm2 peak power at 0.5 V, 60-65C
- System level
  - Air-cooled 2 kW (net)
  - Energy density is advantage over incumbent battery and Gensets for stationary application
  - Significant price advantage over PEM fuel cells
- Refer to CellEra and Tokuyama presentations for more details

Application – Alcohol fuel small power levels

Application	Description	Power range
Military	Remote sensor	< 10 W
	Soldier Power	20- 50 W
	Battery charger	300 W
Commercial	Consumer electronics	< 100 W
	Recreation	< 500 W

Commercial Application – Hydrogen

Description	Power range
Back-up	1 – 10 kW
Material Handling	1 – 10 kW
Transportation	20 - 100 kW
Residential/CHP	1 – 10 kW
Reversible FC	TBD
APU	20 kW

Near Term Fuel Cell Requirements (3-5 years)

- Hydrogen fuel
- Back up power application
- Up to 5 kW
- Durability = 2000 h
- Reliability = 1000 start/stop cycles
- Ordinary air operation at ambient temperature (CO_2 scrubber part of system)

Medium Term Fuel Cell Requirements (5-7 years)

- Hydrogen fuel
- Back up power & material handling application
- Up to 10 kW
- Durability = 5000 h
- Reliability = 3000 start/stop cycles
- Ordinary air operation at ambient temperature (NO CO_2 scrubber required)

- Alcohol Fuel
- Soldier portable power application
- W – 300 W
- Durability = 1500 h
- Reliability = 50 start/stop cycles

Long Term Fuel Cell Requirements (7-12 years)

- Hydrogen fuel
- Transportation & Residential/CHP application
- 1 – 100 kW
- Durability = 5000 – 40000 h
- Reliability = 5000 - 10,0000 start/stop cycles
- Ordinary air operation at ambient temperature (NO CO_2 scrubber required)

- Alcohol Fuel
- Soldier portable power application
- W – 300 W
- Durability = 2500 h
- Reliability = 100 start/stop cycles
- Match the performance of alcohol-fed PEM without Pt for cost advantage

Research Needs

- Solution to deal with carbonate issue
  - Scrubber
  - PEM on anode + Alkaline membrane on cathode
  - High temperature operation
  - KOH to capture carbonate
- System approach to resolve the role and effect of carbonate
- Optimize operation conditions for durability and reliability
- Advanced reformer (for alcohol fuel)
  - Direct conversion to pure H2, Low cost, compact

Research Needs

- Pre-competitive benchmarking of system performance and techno-economic analysis
  - include standard testing protocols
- Membrane operating at T > 80C and has better water mobility
  - Results in higher power density and better durability
- Higher anode activity
  - Double layer effect & electrocatalysis
- Ionomer/catalyst interaction for higher utilization