## Breakout Group 5: Solid Oxide Fuel Cells

### PARTICIPANTS

| Name | Organization |
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### KEY CONSIDERATIONS/POINTS

- As part of the FY08 Omnibus Appropriations bill, EERE was instructed as follows: "Within available funds, the Department is directed to fund research on solid oxide fuel cells (SOFCs) for small-to-medium scale applications"

- Constraints considered throughout the breakout session:
  - Avoid duplicating efforts undertaken by DOE's Solid State Energy Conversion Alliance (SECA) Program.
  - Keep in mind EERE's mission/perspective
  - Maintain a focus on cost, efficiency, and manufacturability

- SOFCs can operate on a wide variety of fuels including:
  - Hydrocarbon fuels, which are commonly used today
  - Renewable fuels, as they continue to be introduced
  - Hydrogen, as a hydrogen economy begins to develop

### APPLICATIONS

- Primary Applications
  - Stationary Power
    - Less than 50 kW; do not restrict fuel choice
    - Combined heat and power applications maximize SOFC benefit of high grade waste heat
    - Critical and remote power are good early market applications
    - Biomass-fueled SOFCs are an area of interest
  - Auxiliary Power Units (APUs) / Portable Generators
    - Less than 10 kW; operate primarily on liquid fuels
    - Long haul truck APUs are a particularly good application due to the large energy savings and market size
    - Recreation vehicle and marine APUs are an earlier, high visibility market with a customer potentially willing to pay a price premium
    - Emergency generators and other direct competition to current genset technology
    - Special issues include shock and vibration and start/stop (i.e., thermal) cycling

- Secondary Applications
  - Motive power for hybrid vehicles (SOFC/battery hybrid)
  - Portable power of less than 1 kW addressing the power size gap existing between batteries and engine-based generators

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### RD&D Needs

| FUEL PROCESSING | SOFC MATERIALS | BALANCE OF PLANT COMPONENTS | FUELS FOR SOFCS |
|---|---|---|---|
| • Mainly focus on liquid fuel issues<br>• Fuel flexibility<br>• Internal reforming<br>• Fuel mixing/vaporization<br>• Polishing desulfurization (20 ppm down to 2 ppm)<br>• Reactor design tools | • Lower temperature operation (600-700oC)<br>• Resistance to thermal cycling and shock and vibration<br>• Redox tolerance<br>• Sulfur tolerant anode | • Insulation<br>• Heat exchangers<br>• Sensors (e.g., fuel/air flow ) | • Biomass<br>- Synthesis gas with low levels of tar<br>- Direct utilization of carbon<br>• Bio-derived liquid fuels<br>- Alcohols<br>- Glycerin<br>- Fischer-Tropsch liquids |