Your Mission for this Breakout Session

1. Would an IT-FC provide a transformational impact on cost?

2. Is it worth reconsidering on-board reforming?

3. Can a FCV compete with other drive trains?
Topics for Discussion

- Intermediate-temperature devices

- Fuels
  - Hydrocarbons and onboard reforming
  - Hydrogen and new storage technology

- Comparison to other drive trains
  - Emissions
  - Cost

- Vehicle size/appropriate applications for FCV
Intermediate Temperature Devices (200-500 C)

Brainstorm! List both benefits and challenges.

- Which of these is most valuable?
- Which reduces cost the most?

Feedback:
Pros for IT-FCs: decreasing fuel purity requirements; eliminating the platinum; simplification of the balance of plant; lower cost interconnects and seals.

200-500C may not be optimal. Ask at what temp the BOP will facilitate cost reduction, and target that temp.

Cons: Fueling is still an issue, and Cost of FCs is large
Fuels feedback

Pros:
- On-board reforming could enable use of NG, gasoline, diesel, JP8: flex-fuels.
- The intermediate temperature range would tolerate higher impurity levels in the fuels.
- Compared to batteries, quick refuel time.

Cons:
- Onboard reformation + fuel cell may only be marginally more efficient than a hybrid vehicle.

Home refueling for NGVs?
- Target a $40 home refueling, which takes 8 hrs to refuel
Comparison to other drive trains

- Emissions of FCVs running on HCs

**GHG emissions during operation**
(from Argonne GREET model)
Requirements for Vehicle applications

- For FCVs or FC hybrids to be marketable, what breakthroughs need to happen?
  - For vehicle OEMS to take it, it needs to be a drop-in to an existing platform
  - Non-hydrogen fuels—fuels that are readily available.
  - Capex and cost at pump are the main considerations.
  - IT-FC could potentially reduce system complexity and cost of BOP. Might need to ascertain an optimum temperature.
  - $/kW may not be the right metric. Consider 5-6kW range extenders.
Vehicle Session Concluding Remarks

I. What are the top reasons for research into ITFCs for transportation?
   1) FCV needs a new approach, new ideas, challenge to shift existing PEMFC paradigm (approach)
   2) ITFCs enable fuel flexibility, impurity tolerance, new H2 storage material and enables "bridge" fuels
   3) ITFCs offers the potential to reduce BOP cost
   4) ITFCs offer potential for higher efficiency and lower CO2 emissions on WTW basis
   5) ITFCs offer more marketplace diversity, customer choice

II. What are the technology distinguishers for ITFCs in the transportation sector?
   1) Potential for reversible reactions--i.e. power generation and storage combine--dual functionality--fundamentally changes economics
   2) Quick refueling, compared to batteries
   3) Convenient--if conventional fuel can be used, little change to consumer behavior/expectations
   4) Reduction in BOP--simpler thermal management than either PEMFCs or SOFCs--low cost/high efficiency heat exchange