

# Your Mission for this Breakout Session

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- ▶ 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

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- ▶ 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)

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- ▶ 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

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▶ 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.
- Long reforming startup time. See No-go decision for the DOE reforming effort, 2004.

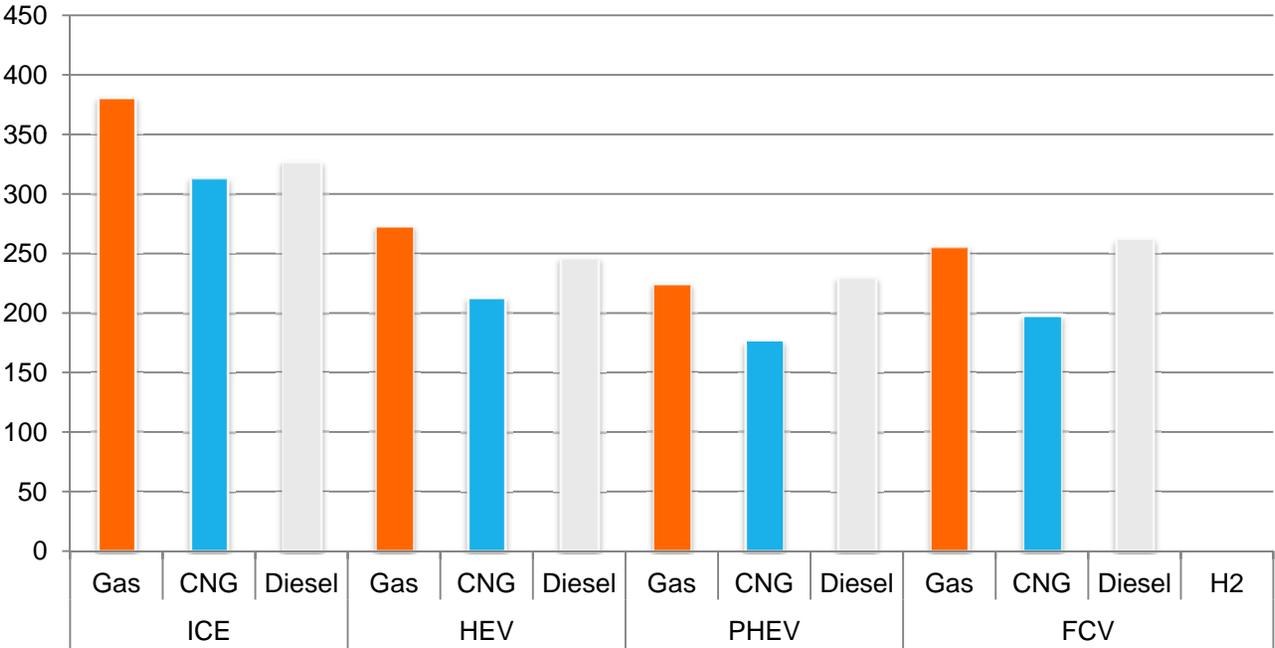
▶ Home refueling for NGVs?

- Target a \$40 home refueler, 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

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- ▶ 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

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## 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 H<sub>2</sub> storage material and enables "bridge" fuels
- 3) ITFCs offers the potential to reduce BOP cost
- 4) ITFCs offer potential for higher efficiency and lower CO<sub>2</sub> 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