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HPC 4 ENERGY INNOVATION

HPC 4 MATERIALS

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HPC 4 MOBILITY

Numerical Modeling of Emergency Hydrogen Refueler for Fuel Cell Electric Vehicles

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U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

U.S. DEPARTMENT OF ENERGY Office of Fossil Energy

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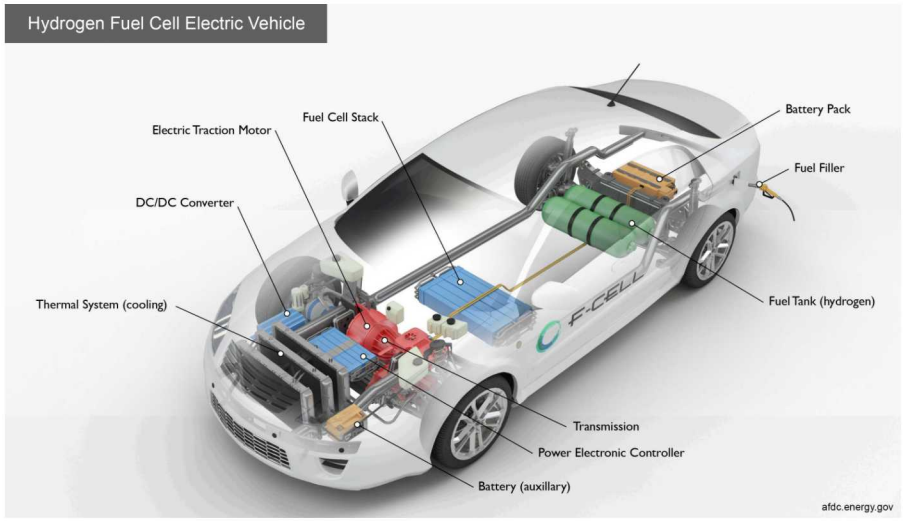
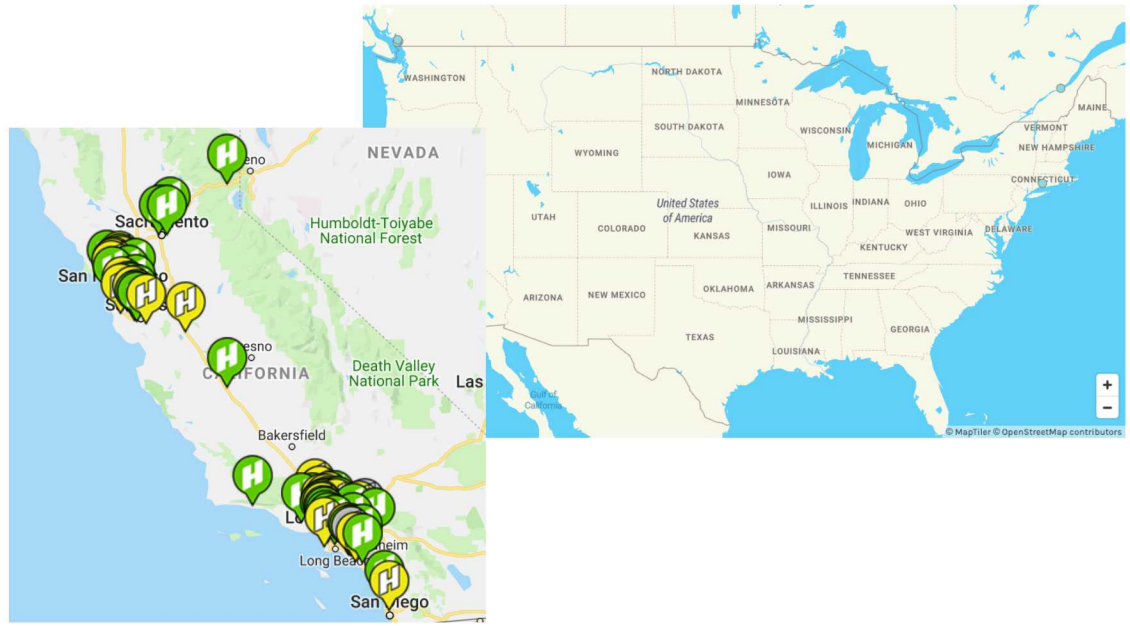
Industry need

- Zero emissions hydrogen fuel cell electrical vehicles (FCEV) have become more popular in the recent years



- Hydrogen fueling infrastructures are still under development
- Novel emergency hydrogen refueler for an individual consumer fuel cell electric vehicle



Helping to commercialize hydrogen FCEVs and the continuing commissioning of hydrogen refueling stations.

Approach

Skyhaven novel emergency refueler

Hydrogen Production

$$LiH(s) + H_2O(l) \rightarrow LiOH(s) + H_2(g)$$
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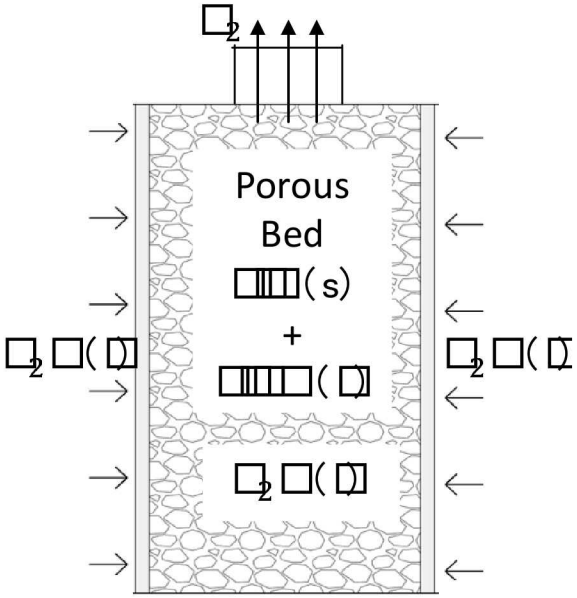
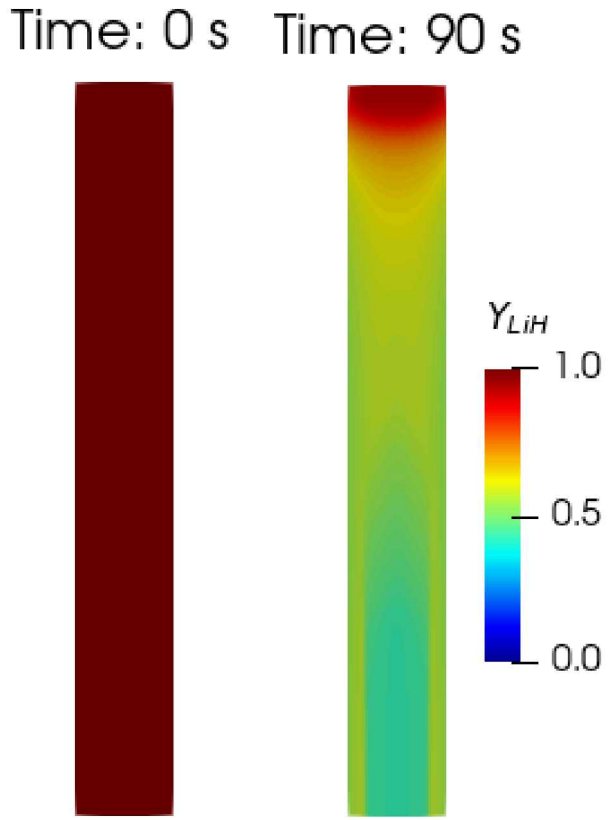
$$H_2O(l) \rightarrow H_2O(g)$$



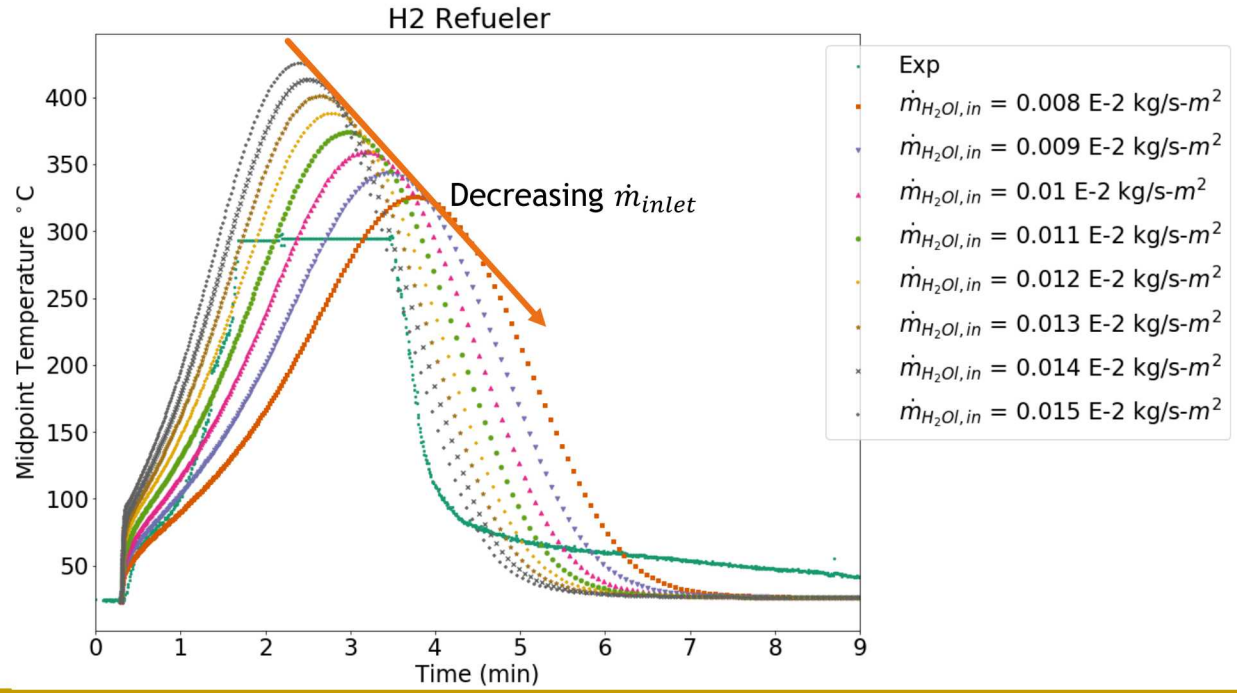
CFD Simulations



Advanced modeling of the reactor is needed to account for spatial and temporal variations of heat and mass transfer along with variable reaction rates.

Results

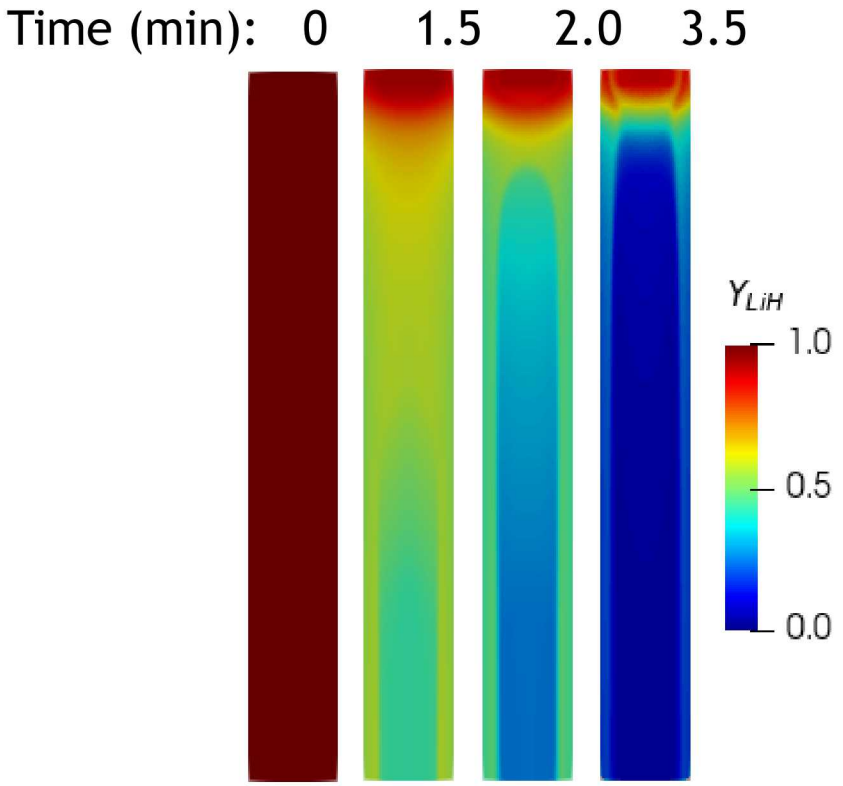
- Significant decreases in LiH bed temperature are seen as liquid water mass flow rate decreases
- LiH packing in refueler predicts porosity effects on temperature

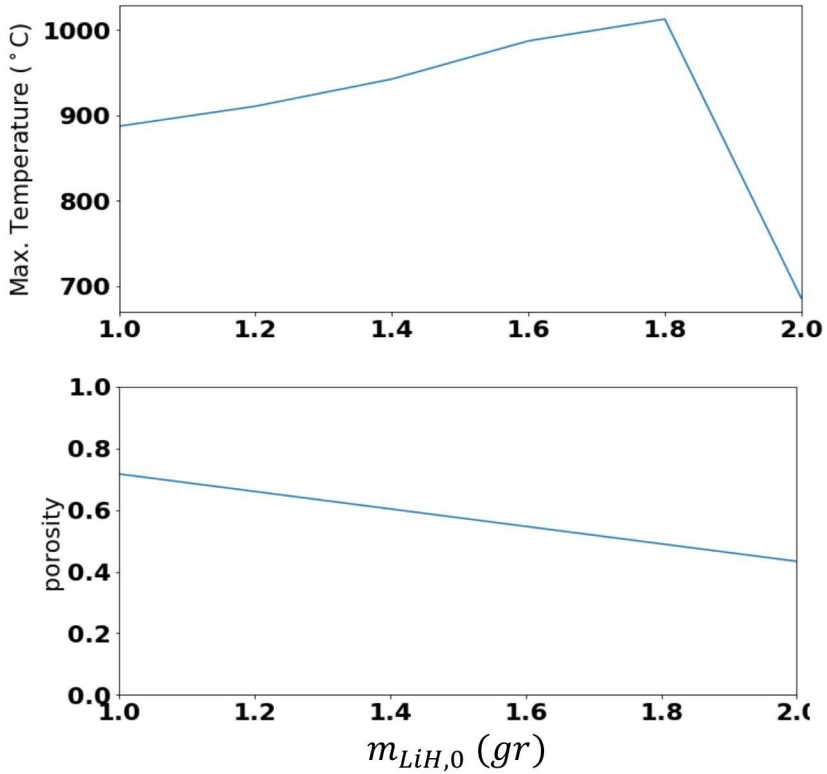


Robust numerical model demonstrates the impact of water feed to control LiH temperature and predicts that the amount of water flux directly governs the overall H_2 production.

Benefits

- Mass, energy, flow, and reaction rate modeling will aid in improving the design and performance of Skyhaven's compact emergency hydrogen refueler for fuel cell vehicles.





Parametric Study informs the design of the refueler design.

Possible Extra Slide - Visual re-cap and closing talking points)