U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Fuel Cell Emergency Relief Truck Request for Information

DOE-FCTO, DOE-VTO, DOD, DHS

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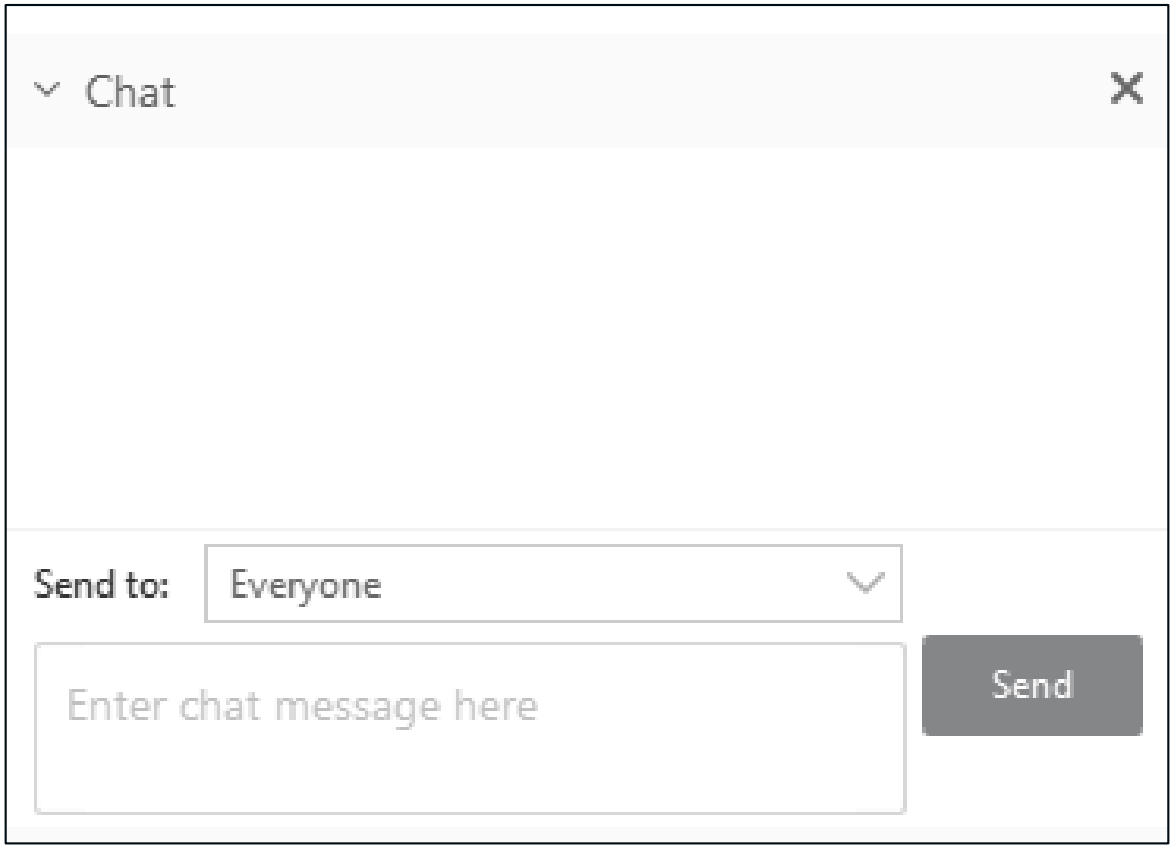
Fuel Cell Technologies Office Webinar

1- 2 PM EDT September 5, 2019

Question and Answer

- Please type your questions to the chat box. **Send to: (HOST)**



Concept and Purpose of this Project

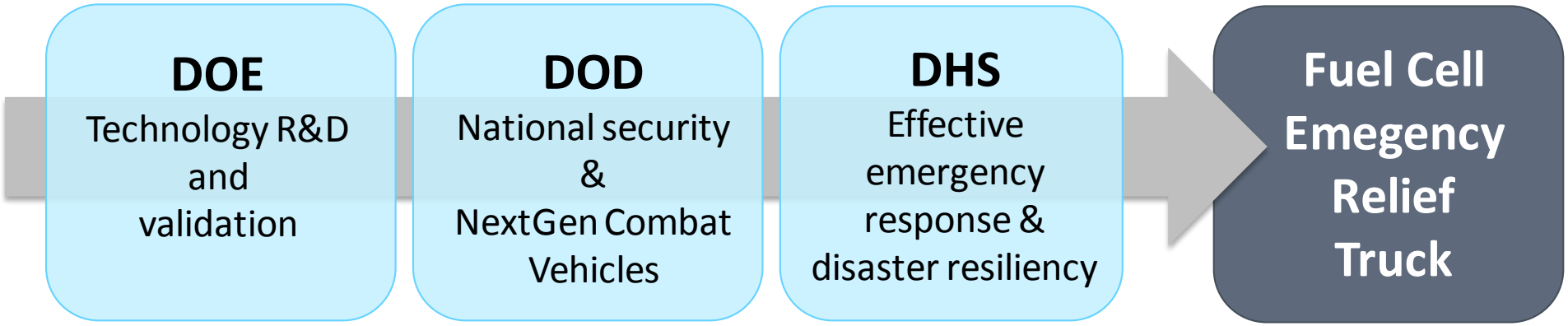
- Build, test, and validate at multiple locations a Class 5 or 6 fuel cell hybrid emergency relief truck
- Assess the feasibility of hydrogen fuel cell power for emergency relief applications
- Identify challenge and barriers for wider adoption of technology in this sector

Purpose of the Webinar

- To obtain feedback from vehicle manufacturers on emergency response truck proposed design (e.g. power requirement and specifications) and implementation feasibility

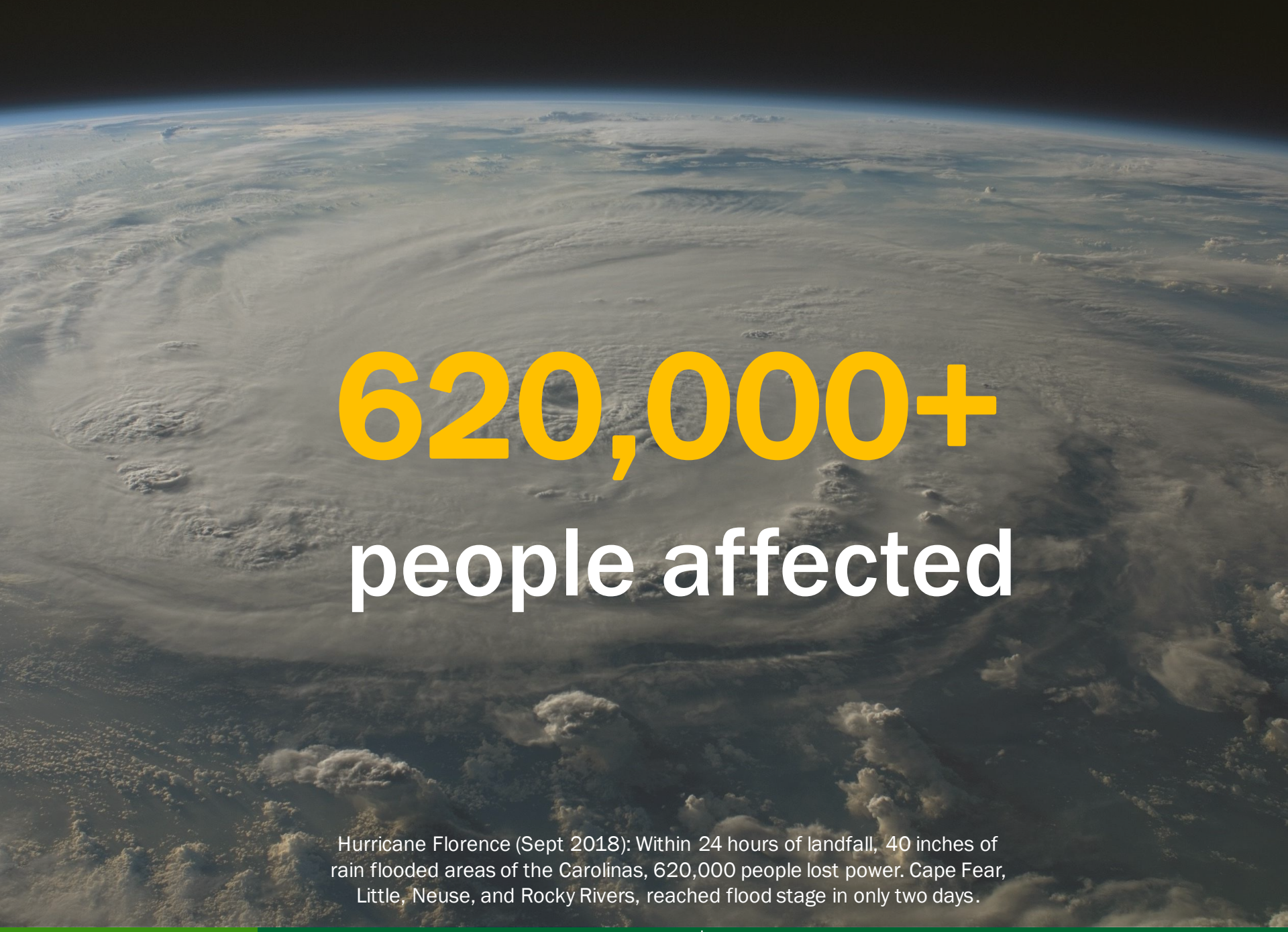
Participating Organizations and Goals

- **Department of Energy (DOE)**
  - Fuel Cell Technologies Office (FCTO)
  - Vehicle Technologies Office (VTO)
- **Department of Defense (DOD)**
  - U.S. Army Futures Command Ground Vehicle Systems Center (GVSC)
  - U.S. Army Corps of Engineers, Engineer Research and Development Center, Construction Engineering Research Laboratory (CERL)
- **Department of Homeland Security (DHS)**
  - Science and Technology Directorate (S&T)



CA Wildfires: In just 2018 alone, over 15,000 structures (including homes) and 230,000 acres were scorched by 3 separate wildfires in California

Source: CNN



Hurricane Florence (Sept 2018): Within 24 hours of landfall, 40 inches of rain flooded areas of the Carolinas, 620,000 people lost power. Cape Fear, Little, Neuse, and Rocky Rivers, reached flood stage in only two days.

Hurricane Michael (Oct 2018): The storm wreaked havoc in the Florida Panhandle, damaging hospitals and homes, cutting off transportation, and leaving over a million buildings without electricity.

Advantages of FC Disaster Response Trucks

Noise-free, zero emissions, reliable (no moving parts) electricity generation

DC power output from FC stack for shelter, lights, heating or communication applications

Stack generates potable water

Waste heat may be used for shelter, cooking, etc

Versatile Response to Diverse Emergency Scenarios

- Distribution
  - Food
  - Water
  - Relief supplies
- Command and Control
- Communications
- Light and Power
- Ambulance
- Medical Support Service

Source: Red Cross

Prospective Design Specifications
Emergency Response Trucks

Stack Power (kW)	Water Output (gal/h)	Heat Output (kW)	Total Output over 72 h		
			H_2 Consumed (kg)	H_2O Produced (gal)	Heat Output (kWh x1000)
50	1.3	5.6	108	96	4.0
80	2.1	8.9	173	153	6.4
150	4.0	16.7	324	286	12.0

Review underway with DOE, Army GVSC, and DHS.

Assuming LHV of H_2, 50% electric efficiency, 10% thermal efficiency, cooled condenser: 75% water collection efficiency

Class 5 or 6 FCET with nominal 25 kW AC power export and 180 mi range

Up to 72 h operation in field providing electricity output

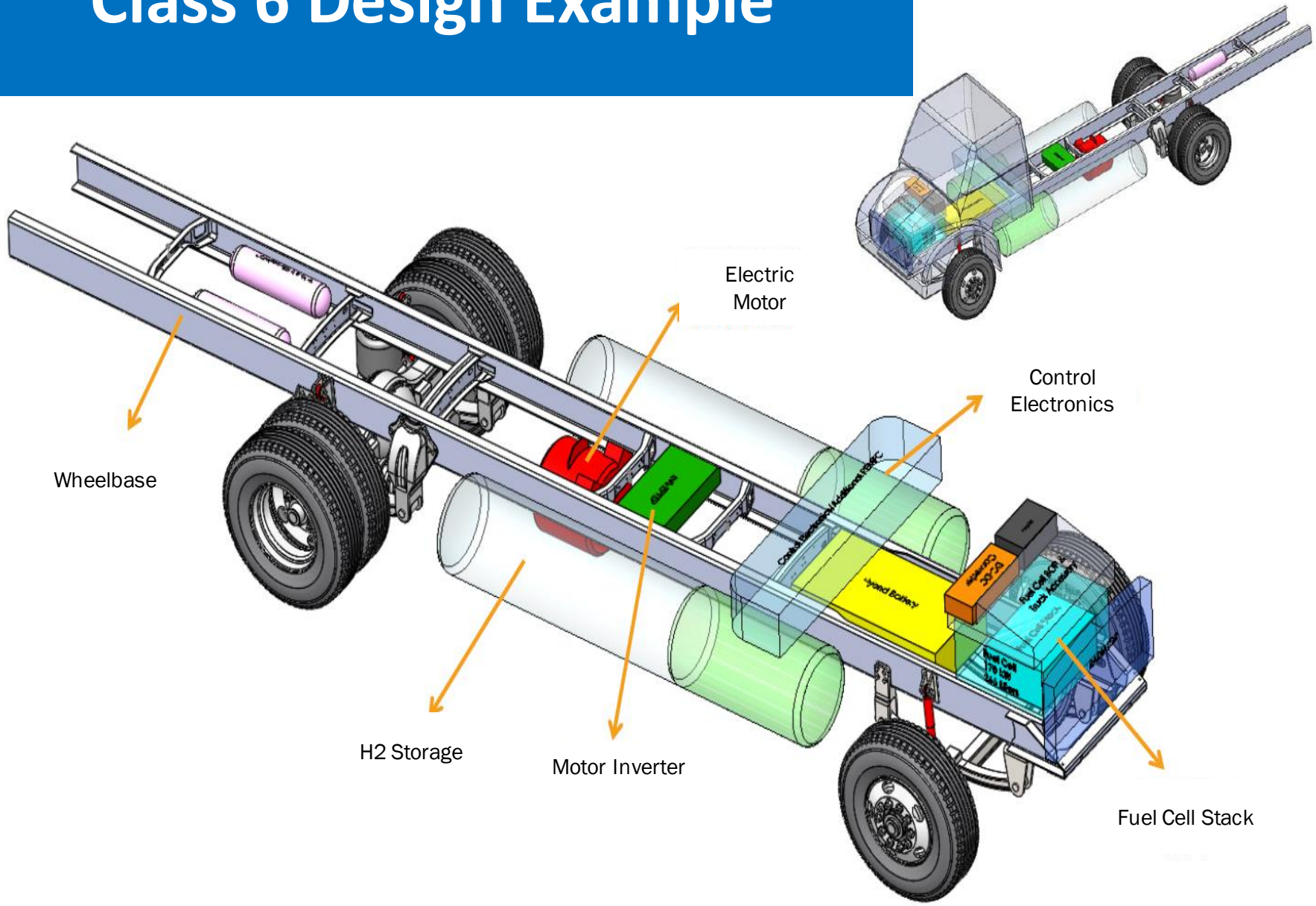
Sufficient H_2 storage

13.5 kg for motive power and 100 kg for stationary power function

Benchmark Example

- Chassis: 16,000 – 26,000 lbs.
- Diesel Engine
- Modular re-mountable aluminum body
- Generator for export power
- Emergency light package

Class 6 Design Example



Project Concept

- Develop of a TRL-7 fuel cell powered hybrid emergency relief truck, which would include developing one primary fuel cell powered system on a commercially available Class 5 or 6 truck.
    - TRL-7 is defined as a demonstration under real operating conditions including full scale testing and design verification in a relevant, operational environment.
- Test and validate operability of the truck, including dyno testing and multiple field evaluations.
- Shared-costs partnership, ideally 1:1, proposed total cost between $1.5 - $2.0M.
- 19-month project, including design, construction, and testing of truck.

Notional Project Schedule

	Month	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Task 0	Award	X																			
Task 1	Kickoff Mtg		X																		
Task 2	Preliminary Design Review					X															
Task 3	Safety Plan					X															
Task 4	Prefinal Design Review							X													
Task 5	Prototype complete																X				
Task 6	Commercialization Plan & Safety eval																X				
Task 7	Initial Operational test at applicants site																	X			
Task 8	Dyno testing at applicants site																	X			
Task 9	Field Test No. 1																		X		
Task 10	Field Tests No. 2																			X	
Task 11	Final Report																				X

Questions for Discussion

- Is a 19-month project duration, including design, construction, and testing of the truck, sufficient?
- How would you go about designing the battery-fuel cell power mix?
- What design considerations should be made for onboard hydrogen storage?
- What design considerations are needed to provide exportable power?
- How might water production from the fuel cell best be made available?
- How could heat be utilized?
- Are Class 5-6 truck platforms generally available that would be suitable for the application described?

Thank you

Please provide additional comments, no later than 19 September, 2019 to:

h2therescue@hq.doe.gov

Additional Questions & Comments