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CALTRANS DIVISION OF RESEARCH,
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Project Title:
Public Safety Power Shutdown –
Hydrogen Fuel Cell Mitigation Pilot

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Public Safety Power Shutdown – Hydrogen Fuel Cell Mitigation Pilot

Powering ITS Field Equipment During Power Outages

WHAT IS THE NEED?

California, Oregon, Washington, and other western states continue to experience an increase in wildfire risk and longer wildfire seasons. The combination of dry conditions and high winds can cause trees and debris to contact energized lines, damage utility equipment, and cause wildfires. Utilities may need to turn off power during severe weather to help prevent wildfires. This is called a Public Safety Power Shutoff (PSPS). A PSPS has a large safety and operational impact on Caltrans, including outages to traffic signal equipped intersections, Intelligent Transportation Systems (ITS), and communication hubs. Portable generator sets are added to some field sites to mitigate PSPS events. However, the portable generators must be refueled every few hours and need maintenance frequently, thus they are man-power intensive. In addition, the use of portable generators is not sustainable and conflict with the Caltrans goal to lead climate change. California AB 1346 eliminates the sale of small gas-powered engines used by portable generators by January 1, 2024 or a future date determined by California Air Resources Board (CARB).

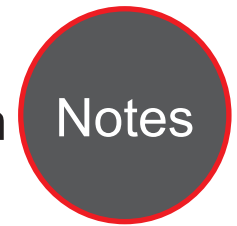
Caltrans needs to find an alternate source of power that is both reliable and cost effective to solve the PSPS outage issues. Hydrogen fuel cell (HFC) power backup systems are identified as a solid backup power source. Caltrans needs to understand how well HFCs operate at various field sites and conditions to determine if HFCs are a reliable power solution for PSPS events so that Caltrans can move forward with future HFC installations.

WHAT ARE WE DOING?

The Advanced Highway Maintenance and Construction Technology (AHMCT) Research Center will procure, install, operate, and evaluate four new HFC power backup systems in Districts 2 and 3, which have been impacted significantly by PSPS events. AHMCT will also evaluate two existing HFC power backup systems in Districts 3 and 11. The procurement and installation will be completed within 12 months of the project



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California's transportation system



start. The evaluation and documentation will be developed during this time and the subsequent 9 months. At the end of this effort, input for project design documentation will be available to the District for implementation at scale, as well as four operational HFC field sites set up by Caltrans.

WHAT IS OUR GOAL?

Depending on how HFCs perform, statewide policy and standards could be developed by Caltrans that will allow for the easy integration into the design of future ITS/traffic signal field sites and/or retrofit of current field sites.

WHAT IS THE BENEFIT?

This project, if successful, will increase the safety of the traveling public by eliminating dark intersections and powering other ITS infrastructure, including changeable message signs, video sites, roadside weather information systems, and communication hubs

Replacing existing portable generators with HFC units reduces the maintenance burden on Caltrans staff because HFCs can run without constant maintenance. Runtime of an HFC is only limited by the amount of hydrogen stored on site. Typical configurations using an electrical load of 750 watts will yield runtimes of up to 80 to 90 hours, before the need to refuel. Longer runtimes can be obtained by adding additional hydrogen bottles to the field site.

HFCs burn cleanly, producing water vapor as their emission. They do not use carbon-based fuels and do not contribute to greenhouse gas emissions. Therefore, eliminating portable gas generators and replacing them with HFCs would promote green and decarbonized technologies and moves Caltrans into compliance with AB 1346.

WHAT IS THE PROGRESS TO DATE?

- The research team has contracted with AHMCT

to provide research on HFCs. The contract was executed in Spring 2022.

- Districts 2 and 3 have selected their two candidate locations, for a total of four pilot locations.
- The research team has worked with the integration vendor to provide mockups of the fuel cabinet and piggy-back cabinet that will be attached to the fuel cabinet.
- The original preferred vendor of the HFC has gone out of business. The integration vendor has found a new vendor that has significant experience in the HFC space.
- The research team has procured the HFC equipment necessary for installation at four field sites.
- Supply chain issues have delayed the delivery of the HFC equipment. Originally scheduled for delivery in January 2023, the new target delivery date is April 2023.
- Meetings were held to discuss the field site preparation necessary to land the HFC cabinet and interconnection to the field equipment.
- The research team and integration vendor participated in a question-and-answer review meeting over the safety and deployment of HFC's in Districts 2 and 3.
- Discussions about how the hydrogen fuel cabinet layout have been ongoing with the vendor. At this time, most of the concerns have been addressed. Cabinet foundation and wiring diagrams will be released in late May 2023.
- The Districts are finalizing the locations for the HFC and site preparation will begin in late May, 2023.
- After extensive testing at the Caltrans Materials Engineering Testing (METS) Laboratory, it was found that the HFC equipment had extensive quality control and runtime issues. After a considerable amount of time was spent evaluating the HFC equipment, the technical advisory panel has decided not to deploy the HFC at this time.
- The research team is working on the final report and wrapping up their efforts.

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IMAGES

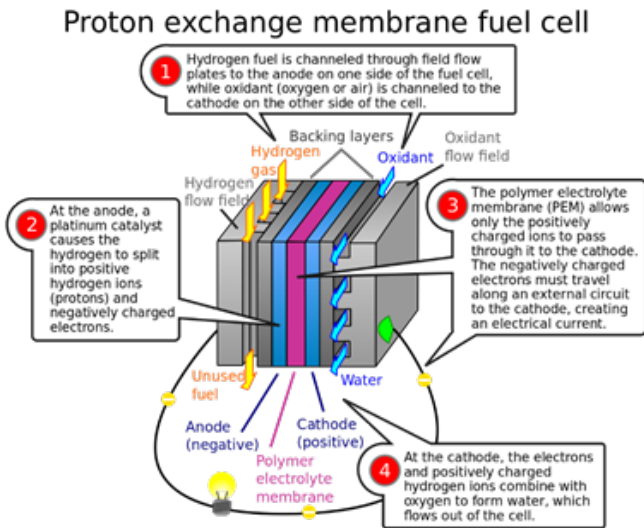


Image 1: Describes how a hydrogen fuel cell works - Source: Wikipedia



Image 3: Hydrogen Fuel Cell – Image Source: Caltrans



Image 2: Hydrogen Fuel Cylinder cabinet - Source: Caltrans

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