AASHTO Innovation Initiative

[Proposed] Nomination of Innovation Ready for Implementation

Sponsor

Nominations must be submitted by an AASHTO member DOT willing to help promote the innovation. If selected, the sponsoring DOT will be asked to promote the innovation to other states by participating on a Lead States Team supported by the AASHTO Innovation Initiative.

1. Sponsoring DOT (State): California DOT

2. Name and Title: Louie La Compte, Field Systems Engineer

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Innovation Description (10 points)

The term “innovation” may include processes, products, techniques, procedures, and practices.

3. Name of the innovation:

Hydrogen Fuel Cell Technology as Emergency Power to mitigate Utility Company's Annual Planned Power Shut Off

4. Please describe the innovation.

Supply 7 continuous days of power to critical Intelligent Transportation System (ITS) assets using a hydrogen fuel cell during utility company's annual Public Safety Power Shut-off (PSPS) events while meeting California's climate change initiative.

5. What is the existing baseline practice that the innovation intends to replace/improve?

Either a portable-gasoline or trailer-towed diesel prime mover generators were used to supply emergency power to critical ITS assets. .

6. What problems associated with the baseline practice does the innovation propose to solve?

The operation of these fossil fuel generators requires extensive man-hours. The fuel tanks' capacity is limited thus requiring multiple refueling in a day. The periodic maintenance of the engines is costly and subject to severe wear depending on the length of operation. The fossil fuel generator will retire in the near future when the combustion engine is banned in California

7. Briefly describe the history of its development.

On 2018, Governor Brown signed AB 100, to achieve 100 percent clean electricity. In late 2019, the local utility company, San Diego Gas and Electric (SDG&E), announced a new program to mitigate wildfires in the east county of San Diego, better known as Public Safety Power Shut-off. The PSPS program takes effect during dry high winds and low humidity. Whole swats of area of the east county would not have utility power for days and, at times, weeks. By late 2020, Governor Newson announced to fast track the State's climate goals of 100% renewable and zero-carbon electricity by 2045. The Department can see the trend to remove combustion engines in its inventory. The prudent action is to seek an alternative to combustion engines as a prime mover to future-proof emergency power generation.

8. What resources—such as technical specifications, training materials, and user guides—have you developed to assist with the deployment effort? If appropriate, please attach or provide weblinks to reports, videos, photographs, diagrams, or other images illustrating the appearance or functionality of the innovation (if electronic, please provide a separate file). Please list your attachments or weblinks here.

Extensive research for a local and out-of-state hydrogen fuel cell manufacturers was conducted. It was decided an in-State manufacturer was an advantage during the first installation to resolve any difficulties in the system integration between the ITS asset and existing power system. Meetings, presentations, and review of recent installations were sufficient to agree to proceed. It was decided that there was minimum risk of failures. At commissioning day, the ITS asset owner, maintenance personnel and safety personnel were given an onsite demonstration of the fuel cell operation as the utility power was de-energized and re-energized.

Attach photographs, diagrams, or other images here. If images are of larger resolution size, please provide as separate files.

State of Development (40 points)

Innovations must be successfully deployed in at least one State DOT. The AII selection process will favor innovations that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.

9. How ready is this innovation for implementation in an operational environment? Please select from the following options. Please describe.

☐ Prototype is fully functional and yet to be piloted

☒ Prototype has been piloted successfully in an operational environment

☐ Technology has been deployed multiple times in an operational environment

☒ Technology is ready for full-scale implementation

The prototype has been piloted with a favorable outcome for both the ITS asset owner and maintenance personnel. The automation of the system relieved the need for additional man-hours and improved the reliability of the ITS asset. The hydrogen fuel cell is a scalable technology. Other critical ITS assets in the broadband's middle mile communication system with higher power demand and a need for reliability is being studied for deployment.

10. What additional development is necessary to enable implementation of the innovation for routine use?

There is no additional development necessary to deploy the hydrogen fuel cell technology. The technology has reached full maturity and ready for scaled deployment.

11. Are other organizations using, currently developing, or have they shown interest in this innovation or of similar technology?? ☒ Yes ☐ No

If so, please list organization names and contacts. Please identify the source of this information.

Organization	Name	Phone	Email
City of Dublin	Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.
Caltrans, District 12	Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.
Caltrans, District 7	Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.

Potential Payoff (30 points)

Payoff is defined as the combination of broad applicability and significant benefit or advantage over baseline practice.

12. How does the innovation meet customer or stakeholder needs in your State DOT or other organizations that have used it?

Since the installation, the critical ITS asset operated without any interruption nor requiring maintenance resources. The hydrogen fuel cell has met all expectations from all stakeholders.

13. Identify the top three benefit types your DOT has realized from using this innovation. Describe the type and scale of benefits of using this innovation over baseline practice. Provide additional information, if available, using quantitative metrics, to describe the benefits.

Benefit Types	Please describe:
Improved Operation Performance	Improved the reliability of the critical ITS asset
Environmental Benefits	displaced a large amount of carbon footprint, reduce noise pollution and reduce the disposal of heavy metals and hazardous waste
Improved Safety	The critical asset performed its task during power outages seamlessly thus providing a safe traveling experience for the traveling public

Provide any additional description, if necessary:

Click or tap here to enter text.

14 How broadly might this innovation be deployed for other applications. in the transportation industry (including other disciplines of a DOT, other transportation modes, and private industry)?

The hydrogen fuel cell is a scalable technology that can be deployed in the broadband and communication system. Powering critical hubs and middle mile wireless transmission sites. All other ITS elements that are less critical but vital can be powered with an emergency power system.

Market Readiness (20 points)

The AII selection process will favor innovations that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.

15. What specific actions would another organization need to take along each of the following dimensions to adopt this innovation?

Check boxes that apply	Dimensions	Please describe:
☒	Gaining executive leadership support	A commitment to mitigate climate change must be in the organization's mission statement
☒	Communicating benefits	To persuade reluctant people to try innovative technology versus older technologies that are detrimental to the environment
☒	Overcoming funding constraints	Return on investment must consider not only cost but the reduction of the organization's carbon footprint must be included
☐	Acquiring in-house capabilities	Click or tap here to enter text.
☐	Addressing legal issues (if applicable) (e.g., liability and intellectual property)	Click or tap here to enter text.
☐	Resolving conflicts with existing national/state regulations and standards	Click or tap here to enter text.
☐	Other challenges	Click or tap here to enter text.

16. Please provide details of cost, effort, and length of time expended to deploy the innovation in your organization.

Cost: $60, 000.00

Level of Effort: minimal

Time: 1 month to design, 1 week to install and 1 year to evaluate

17. To what extent might implementation of this innovation require the involvement of third parties, including vendors, contractors, and consultants? If so, please describe. List the type of expertise required for implementation.

An electrical Contractor (C-10 license) to build the concrete pad, reroute conduit and conductors, make wiring connection and install components of the hydrogen fuel cell. The vendor or manufacturer of the hydrogen fuel cell to verify the connection, run test, check leaks, commissioning, and training.