

RESULTS SUMMARY

Evaluating the needs and considerations for transitioning a winter maintenance fleet to alternative fuel or electric vehicles will help agencies prepare for future fleet conversions.

PROJECT DETAILS

Project Title: Synthesis Report—
Electric Vehicle Technologies and
Alternative Fuels for Winter Road
Operations

Project Number: CR21-05

Project Cost: \$74,995

Report Date: February 2023

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MAY 2023

TRANSITIONING FLEETS TO ALTERNATIVE FUELS

Need for Research

Vehicles powered by renewable energy are gradually becoming commonplace and cost-effective. Alternative fuels and electric batteries are available to power larger vehicles and fleets, including refuse trucks, transit vehicles and school buses. Concurrently, many state departments of transportation (DOTs) have greenhouse gas emission reduction targets that could be advanced by alternative fuel use.

While electrification and alternative fuels may be on the near horizon for winter maintenance fleets, the transition will be no small task. Winter maintenance managers need to ensure alternative fuel or electric vehicles can provide the power and durability needed to operate in harsh winter conditions. Understanding operational needs, challenges and options will enable Clear Roads member agencies to effectively plan for future fleet conversions.

Objectives and Methodology

The goal of this project was to document the available technologies, energy sources, practical considerations and other needs that state DOTs may have in migrating their winter maintenance fleets to electric or alternative fuel vehicles.

Thirteen Clear Roads agencies responded to interviews and provided additional information regarding their winter fleets and operational practices. Data from the Clear Roads [Annual Survey of State Winter Maintenance Data](#) and a literature review that included agency policies and protocols rounded out an understanding of winter maintenance inventories and best practices. A review of management considerations, including infrastructure, staffing and supporting technology, revealed the primary challenges state DOTs may face in converting their fleets.

A survey of six state and local transportation agencies using alternative fuel vehicles identified issues with fuel storage, maintenance needs and staff training that might impede a winter maintenance fleet transition. The agencies also described lessons learned from using alternative fuel vehicles in the past.

An analysis of historical fuel transitions, primarily the shift from gasoline to diesel, identified considerations for converting fleets to electrification and alterna-



Planning the infrastructure to support electric or alternative fuel vehicles is crucial before transitioning a winter maintenance fleet. (Photo courtesy of the National Renewable Energy Laboratory.)

tive fuels. Interviews were held with state DOTs and local government fleets that have alternative fuel vehicles in their heavy-duty fleet, including winter maintenance vehicles. Lastly, discussions with vehicle and fuel system manufacturers provided an overview of available and planned options for heavy-duty uses.

Results

Alternative fuel options, including biodiesel, natural gas, liquefied petroleum gas (propane) and battery electric vehicles, are available for medium- and heavy-duty trucks. Other developing options include renewable diesel, renewable natural gas, renewable propane and hydrogen. The use of alternative fuels in winter maintenance fleets, however, is currently limited. Two agencies reported using natural gas but are phasing it out due to high vehicle maintenance costs and fueling station costs and availability. Several agencies use biodiesel blends (B20 with B10 in cold months) in their fleets. Other agencies are using a fueling system that enables the use of neat biodiesel (B100) year-round in heavy-duty trucks, including snowplows. Heavy-duty battery electric truck chassis that would perform snowplow duties were not currently available but are anticipated in the near term.

The transportation agencies that were surveyed and interviewed revealed the questions winter maintenance managers have in considering electric and alternative fuel vehicles for their fleets. Primary concerns included whether the vehicles could handle the power demands and rigorous, often extreme, operating conditions, including around the clock operation, during winter weather events.

Winter maintenance managers also have questions about the safety, costs, life cycles of batteries, and the impact of

salt and other deicers on electric vehicle components. Discussions with manufacturers confirmed that electric trucks will be designed to meet the same corrosion and safety requirements as diesel trucks. Other needs included:

- Infrastructure for maintenance and refueling, including over large geographic areas around a state.
- Specialized training for mechanics and other maintenance staff.
- Funding to support a multiyear replacement schedule and separate operating and capital fleet funds.
- Integrated technology, including fleet and fuel management systems and telematics, to monitor vehicle performance.

Successful, large-scale fuel transitions must be financially viable for all stakeholders and require widely available vehicles, fuel and infrastructure. Producers of alternative fuel and fuel systems, vehicles, engines and powertrains all reported that these options are proven in very cold weather conditions. Electric vehicle batteries, however, demonstrate reduced usable energy capacity in colder temperatures but manufacturers are working on solutions. Feasible hydrogen fuel cell electric vehicles will likely require five to 10 more years of development before winter roads maintenance relevant vehicles are available.

Benefits and Further Research

The researchers provided 30 recommendations with suggested priorities and estimated levels of effort. One recommendation—to conduct a pilot vehicle program—is consistent with reported agency interest to see data and proof that alternative fuels can meet winter maintenance needs and to become familiar with using nondiesel options.

As technology rapidly changes and alternative fuels become more mainstream, forward-looking winter maintenance managers will be prepared to take advantage of the benefits of alternative fuel and electric vehicles.

"This research synthesis is a great guide for planning and a resource for educating others in our agencies."

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