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# ALTERNATIVE FUELS TASK FORCE REPORT



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This report was created by the Minnesota Trucking Association's (MTA) Alternative Fuels Task force to provide analysis of alternative fuel types and offer recommendations to the MTA Board of Directors.



# OVERVIEW

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MTA members are encountering new energy options to power commercial trucks, including renewable diesel, hydrogen and electricity. MTA members need clarity on the feasibility and likelihood that these fuels will be widely available along key freight networks.

In response, the MTA Board of Directors established an Alternative Fuels Task Force charged with preparing an analysis of these alternative fuel types, including recommendations for MTA action, and identifying key barriers that must be overcome to make them truly viable for both local AND over-the-road trucking fleets. The task force met from June 2023 through November 2023 and developed this fact-finding report.

Vehicle electrification is being pushed by federal and state governments as a response to climate change, with the ultimate goal of eliminating internal combustion engines (ICE). Achieving "zero emission vehicles" (ZEV) is a tale of two very different worlds when it comes to passenger vehicles and long haul (Class 7-8) trucking.

Battery-electric vehicle (BEVs) electrification is happening today in the passenger vehicle space – although recent data shows sales are slowing. Consumers can purchase passenger vehicles, obtain repairs and access charging infrastructure for local driving. Battery-electric trucks (BETs) in the long-haul sector remain largely conceptual, with high costs, minimal product availability and no charging infrastructure. Very importantly, hydrogen and natural gas are also competing to replace fossil diesel. Each alternative propulsion system will require significant government incentives and private capital to build out a complete and reliable infrastructure system.

The reality is that Class 7-8 trucks will be powered by ICEs run on diesel or similar fuels for decades to come. Government policies need to acknowledge and address this reality rather than mandate the use of a specific alternative propulsion source - such as electricity - to power heavy trucks.

MTA member fleets are advised to follow a "go slow" approach regarding equipment investments as the vehicles, infrastructure and pricing are not practical for near or mid-term adoption for the long-haul sector. Electric yard trucks show the greatest near-term potential for adoption

While California and the Federal Government have clear mandates and funding to drive vehicle electrification for long haul trucks, Minnesota has no such plan. The MTA is positioned to play a significant and defining role in establishing legislative and regulatory truck energy policy and funding in Minnesota.

**1** Federal policy and funding are functionally picking vehicle electrification over other emerging alternative energy sources to power heavy trucks.

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**2** Minnesota has no current or pending regulations that mandate the USE of battery electric trucks (BETs) and fuel cell electric trucks (FCETs).

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**3** Minnesota has adopted broader policies that could set the stage for future mandated use. These include requiring vehicle dealers to sell an increasing percentage of low emission and zero emission vehicles (LEV and ZEV) up to 26,000 pounds (Class 2 to Class 6) and actively pursuing a low carbon fuel or “Clean Transportation” standard.

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**4** California Air Resources Board (CARB) has regulations that WILL impact Minnesota fleets operating in California:

- Require vehicle registrations and assessment of a \$30 fee per truck by January 31, 2024 and download on-board diagnostic data beginning mid-2024<sup>1</sup>
  - **Pending EPA approval:** Require reporting of designated California fleet and by 2030, any Minnesota long haul fleet with 50 or more trucks operating as few a one truck in California will be required to purchase and operate 10% of its California designated fleet as zero emitting vehicles (ZEVs). It increases to 100% in 2042<sup>2</sup>.
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**5** California is on course for major supply chain disruptions in 2024 as vehicles, energy grid, charging stations, maintenance/repair facilities and parts will likely not be adequately available to support compliance. This could be repeated in other jurisdictions.

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Battery-electric currently does not work for long haul trucking<sup>3</sup>:

- 6**
- Lack of available product
  - BETs pricing exceeds \$480,000 per tractor, and total cost of ownership is not equivalent or better than diesel powered trucks
  - Does not meet weight and range operational requirements



- Long charging times cut into available driver on-duty and driving hours
- Lack of infrastructure, both physical and human
- Lithium-ion batteries lose up to 40% of their capacity in cold weather.

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**7**

Though currently cost prohibitive and operationally unachievable, local return-to-base operations are the most likely early adopters of BET.

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**8**

Internal combustion engines (ICE) will remain the primary truck power source for decades to come, requiring continued access to fossil diesel and cleaner burning alternative fuels such as renewable diesel and natural gas.

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**9**

Hydrogen fuel cell technology and hybrid “range extender” technologies (e.g. natural gas engine charging on-board batteries) show promise for long haul trucking.

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**10**

Transition to new fuel and energy sources will require significant federal and state subsidies to build out the infrastructure and offset the cost differential for truck fleets. Federal incentives are minimal and state incentives are non-existent.

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**11**

MTA member demand is low for BETs. Less than 5% of MTA members responding to a survey currently operate battery, hydrogen fuel and/or natural gas-powered trucks. Similarly, less than 3% are likely to invest in new battery electric, hydrogen fuel cell or natural gas trucks in the next five years.

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**12**

The MTA is positioned to play a key role in creating policy direction and funding in Minnesota.

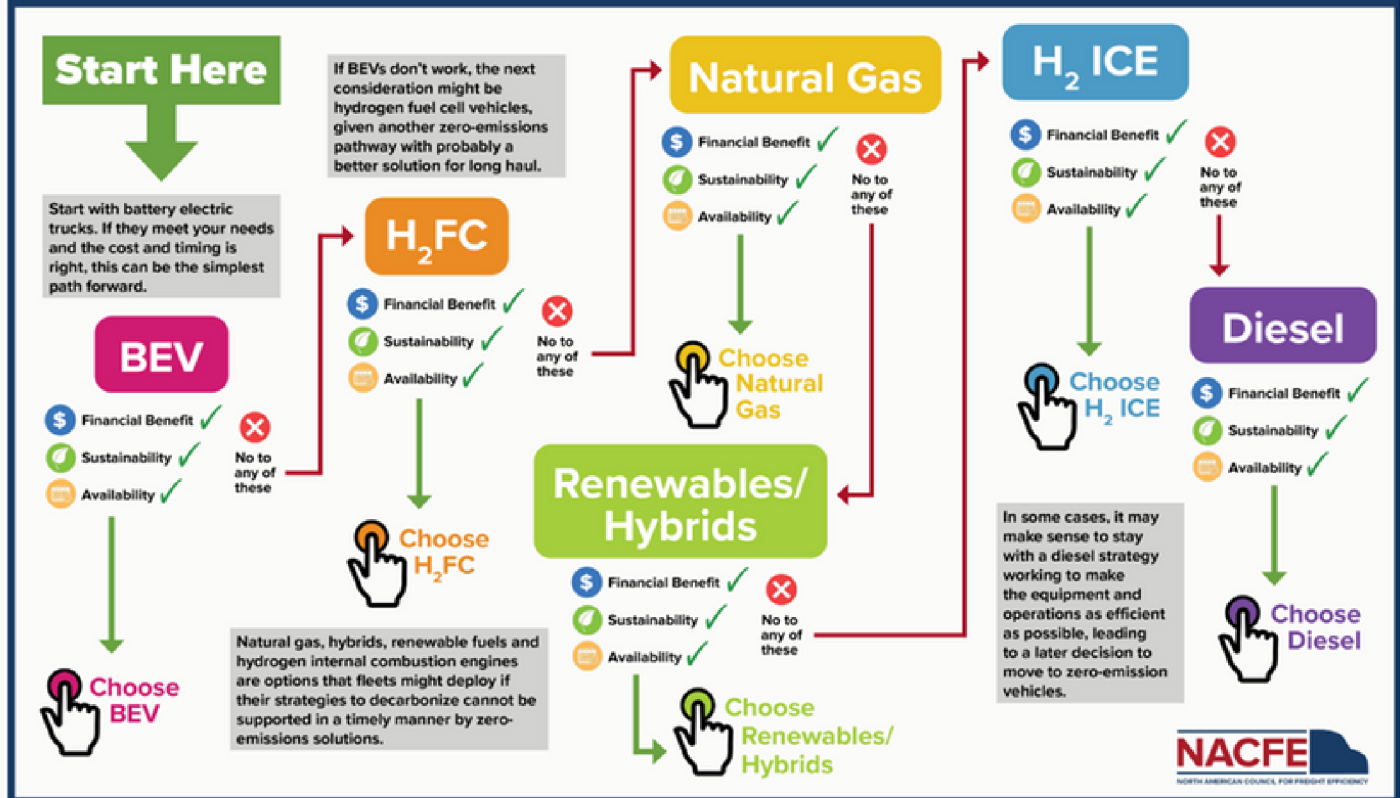
## Recommendations to MTA Board of Directors

- Immediately educate members regarding new California Clean Truck Check rule requiring vehicle registration by January 31, 2024 and ACF rule which, pending EPA approval, will require registration and ZEV purchases.
- Proactively educate the public, legislators, and regulators regarding potential negative impacts on the supply chain and the economy under a forced transition to battery electric vehicles.
- Lobby to create a regulatory framework that doesn't pick energy technology winners and losers.
- Lobby Congress to repeal the 12% federal excise tax.
- Support state and federal tax incentives to encourage the use of optional emission-reducing commercial truck fuel sources, powertrains, and fueling infrastructure.
- Host a summit to educate lawmakers, regulators, shippers, and MTA members regarding the challenges associated with vehicle electrification, ZET costs, current state of product and infrastructure, and development trends.
- Use information from the task force report and summit to build a knowledge database and resource guide for members and inform future MTA resource and content development.
- Develop public policy discussion guide to standardize terms to understand conversion ratios and impacts on vehicle performance.

## Recommendations to MTA Members

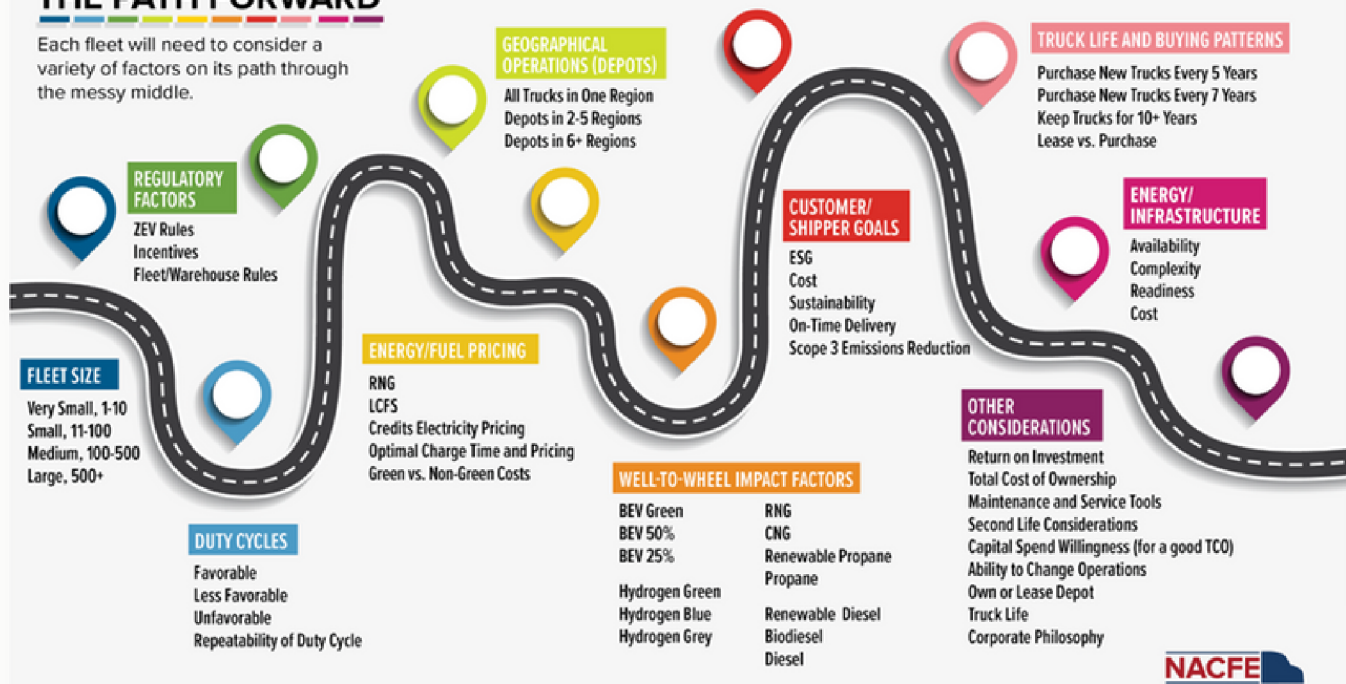
- Take a breath. Product and infrastructure to meet current operations are further away than you think. Minnesota has no defined regulations or incentive funding to mandate or incentivize heavy truck use patterns in the near future.
- If you operate in California, register your vehicles by January 31, 2024 for CTC and February 1, 2024 for ACF, if applicable. Follow-up with downloading on-board diagnostic data in mid-2024. Monitor ACF rule, which, pending EPA approval, will require registration and ZEV purchases.
- Meet with your electric utility provider early if you intend to implement fleet electrification as the planning and execution process is both long and expensive (2-3 years).
- Communicate with your legislators and local officials regarding the reality of transitioning away from internal combustion engines.
- Capture key operational factors for your fleet then compare to alternatives currently available using the North American Council on Freight Efficiency pathway/decision tree.
- Pay attention to MTA, OEM and dealer networks for updates.

## Framework for Powertrain Decision Making



## THE PATH FORWARD

Each fleet will need to consider a variety of factors on its path through the messy middle.



## Heavy Truck Availability and Cost

All legacy original equipment manufacturers of Class 7-8 trucks are developing non-ICE solutions. A new, clean-diesel long-haul tractor typically costs in the range of \$180,000 to \$200,000. A comparable battery-electric tractor costs upwards of \$480,000<sup>4</sup>

Currently, less than one percent of registered medium and heavy-duty trucks in Minnesota are BETs<sup>5</sup>

- There are at least 15 NEW manufacturers of medium and heavy-duty ZETs as of November 2023<sup>6</sup>
- 5,483 Class 2b-8 zero-emission trucks are deployed nationwide, mostly vans and pickup trucks<sup>7</sup>
- 46% of all EV trucks are in California<sup>7</sup>
- 9 medium-duty trucks and 11 heavy-duty EV trucks are registered in Minnesota as of July 2023.
- Battery electric trucks meeting certain criteria are eligible for up to a \$40,000 federal tax credit through the Section 45W Qualified Commercial Clean Vehicle Credit. Minnesota offers credits for new electric vehicles priced less than \$55,000 (MS 216C.401).
- Short of significant government subsidies, there is no financial incentive for fleets to transition away from fossil diesel ICE engines.

## Fueling and Charging

Fueling and charging stations for Class 2b-8 ZEVS are minimal and inadequate to support anything beyond local operations<sup>8</sup>

- The total cost of operations over a ten-year period has been calculated for diesel, hydrogen and electricity: Diesel ICE Vehicle = \$1.03/mile; Battery Electric Vehicle = \$1.38/mile; and Fuel Cell Electric Vehicle = \$1.50<sup>9</sup>

- Refueling hydrogen infrastructure for commercial trucks is presently nonexistent in Minnesota.
- Complete system capacity by energy type and vehicle type can be found at an interactive website: <https://afdc.energy.gov/>
- MnDOT maintains a dashboard distribution of plug-in electric vehicles (EVs) and charging stations throughout the state of Minnesota at: <https://www.dot.state.mn.us/sustainability/electric-vehicle-dashboard.html>

## Slower Fills and Shorter Ranges

BETs take much longer to charge and have much shorter ranges<sup>10</sup>

- It takes 15 minutes to dispense diesel fuel into a truck tractor, which can then travel roughly 1,200 miles before fueling again (200 gallons at 6 miles per gallon).
- Long haul battery-electric trucks take up to 5-8 hours to charge and can travel 150-330 miles –assuming chargers are available.
- Battery electric vehicle adoption requires significant due diligence to truly assess business model applicability.

## Alternative Propulsion Truck Demonstration

The North American Council on Freight Efficiency (NAFCE) is running battery electric truck demonstrations. Real-time results can be found at <https://runonless.com/>. What they have learned so far:

- Some trucks don't get charged every day, and others get charged multiple times per day.
- Some depots have a one-to-one relationship of trucks and chargers, but most have fewer chargers than trucks.
- Some trucks get high regenerative braking energy back and some barely get any.
- There is a growing variety of solutions to charge trucks without full permanent infrastructure, with renewable diesel being the most promising.



## Grid Capacity and Alternative Energy Sources

The current grid capacity for Class 2b-8 BEV is minimal. Expanding the power generation, transmission, and distribution system for electricity is a very long process. Changes to the system must be planned for many years in advance. Minnesota's largest electricity provider, Xcel Energy, models EV vehicle adoption by mode, then develops a 20-year plan accordingly.

## Raw Materials Sourcing and Disposal

Consistent access to rare minerals will be key to long-haul truck electrification.

- Tens of millions of tons of rare minerals will be needed to support a battery electric vehicle supply for medium- and heavy-duty vehicles.

The Department of Energy's July 2023 Critical Minerals Assessment identifies reserves of cobalt, lithium, nickel, graphite, gallium, magnesium as highly important to energy and in high supply risk through at least 2035.<sup>11</sup>

- Minnesota, North Dakota and South Dakota have been chosen to host one of seven U.S. "clean" hydrogen production hubs. Xcel Energy is a primary partner in the Upper Midwest venture which would use renewable power and nuclear energy to produce hydrogen in Minnesota.
- Current federal and state vehicle electrification mandates have no meaningful provision for disposal of the increased number of spent batteries.

## MTA Members Not Demanding Alternative to ICE

In November 2023 the MTA conducted a survey of its members to determine their interest in alternative propulsion solutions. In short, without government incentives MTA members are not likely to transition to ZET solutions. Hydrogen fuel cells have more interest than battery electric trucks within the respondents.

44 trucking fleets responded to the survey.

- 95% do not currently use alternative propulsion technologies such as battery electric, hydrogen fuel cell or compressed natural gas (CNG).
- The likelihood of fleets purchasing ZETs over the next five years is very low (NOT AT ALL likely = 84% battery electric, 75% hydrogen fuel cell and 81% CNG).
- Notably, 25% are somewhat likely to invest in hydrogen fuel cell vehicles in the next five years.
- 64% of fleets are extremely concerned or very concerned about the energy and fueling infrastructure for alternative propulsion technologies.
- 84% of fleets are extremely concerned or very concerned about the availability of trained vehicle technicians and maintenance/repair facilities in deciding to adopt alternative propulsion technologies.
- The likelihood of fleets purchasing alternative propulsion technologies WITHOUT government incentives is very low (NOT AT ALL likely – 86% battery electric and 75% hydrogen fuel cell or CNG).
- Government incentives and mandates rather than consumer demand are driving current interest in exploring alternative propulsion technologies (74% entirely or mostly government mandates vs. 26% consumer demand).

## United States Environmental Protection Agency (EPA)

Two current federal regulations will impact required technology, equipment availability and cost.

- *Clean Truck Plan (NOx)* – The national NOx standard incorporates changes to testing procedures and warranty requirements starting MY 2027 for ICEs. Truck purchasers will select from the new ICE models and will likely raise the cost of the engine.
- *GHG 3 MY 2027* – This proposes to adjust existing fuel efficiency standards for select vehicle classifications to capture future electric vehicle penetration. Truck purchasers will select from the new ICE and electric models and will likely raise the cost of the engine and/or vehicle.

## California Air Resources Board (CARB)

California has numerous regulatory mandates and incentives that will passively impact (e.g. formulation of fuel available in California) or actively impact Minnesota fleets (e.g. Register your truck in order to operate it in California).

- *Clean Truck Check* - New in-use requirements to register and test emissions control system on all trucks operating in California. Minnesota fleets operating in California MUST: 1) By January 31, 2024 register all trucks that will operate in California; 2) pay a \$30 fee per truck for which you receive a certificate; and 3) download on-board diagnostic data (OBD) beginning mid-2024.
- *Advanced Clean Fleets* – A truck fleet purchase mandate for zero-emission trucks in excess of ACT regulation. Impacts ANY Minnesota fleet that is greater than 50 or more power units AND operating one or more of those vehicles in California. Reporting is required by February 1, 2024. Starting in 2030, 10% of the fleet operating in California must be a ZEVs. In 2042, 100% of all vehicles operating in California must be ZEVs. It requires Minnesota fleets operating in California to purchase ZEV vehicles on an increasing percentage.

**Example:** North Star Trucking (NST) has 200 trucks. NST designates 20 trucks to operate in California. In 2030, 2 trucks (10%) must be ZEVs. In 2042, 20 trucks (100%) must be ZEVs. NST could designate all 200 trucks as operating in California, raising the base numbers for each calculation.

- *Omnibus Low NOx* - New tailpipe standards for heavy-duty trucks, expanded warranty requirements, new test procedures, and durability testing requirements for MY 2024 and MY 2027. Only affects those buying new trucks in California.
- *Advanced Clean Trucks* - Phasing in increasing percentages of zero-emission truck sales to 100% by 2036. Does NOT require fleets to purchase ZETs. Does require manufacturers to sell ZETs in higher percentages over time.
- *Low Carbon Fuel Standard* - Decreases the carbon intensity of transportation fuels. No new requirements on Minnesota fleets to change equipment or operations. However, only a low-carbon fuel mix is available in California, which increases can increase fuel costs for Minnesota fleets.

## State of Minnesota

Minnesota currently has no regulations mandating the USE of electric heavy trucks. It does have regulations impacting the sale of vehicles and transitioning the electric grid to carbon-free energy sources.

- Minnesota Clean Cars Regulation impacts the sale of light duty (< 10,000 lbs.) and medium duty (10,000 to 26,000 lbs.) vehicles and does not require new purchases. The rule takes effect in 2024 for 2025 model year. This includes ALL vehicle classes 2-6 or vehicles up to 26,000 pounds. This rule will require automobile dealers to sell a certain percentage of each vehicle class as zero-emission vehicles (ZEVs). Trucking companies will not be required to purchase ZEVs, but may find the supply of ICE trucks reduced in Minnesota as dealers are forced to change product mix. This does not apply to heavy duty (>26,000 lbs.) Class 7 and 8 vehicles.
- Adopting a LCFS in other states is projected to add significant cost to the price of gasoline and diesel. CARB reports that potential pass-through costs in 2030 will increase the per gallon price of gasoline \$0.12 - \$0.47 and the price of diesel \$0.14 - \$0.59. In 2050 these costs will increase the per gallon price of gasoline \$1.44 - \$1.80 and the price of diesel \$1.88 - \$2.35. It is highly likely Minnesotans will experience these same pass-through cost increases.<sup>12</sup>
- The 2023 Minnesota Legislature enacted legislation that commits Minnesota utility providers to carbon free electricity by 2040.
- Minnesota state agencies (Agriculture, Pollution Control and Transportation) are currently focused on leveraging state and federal dollars now available for LEVs and ZEVs.

## OEMs and Dealers

Legacy original equipment manufacturers are being challenged by both new entrants and federal mandates to shift production to medium and heavy-duty LETs and ZETs.. Truck dealers are largely in a reactive mode as they respond to OEM decisions and state and federal mandates.

- Engine manufacturers and CARB have entered into an agreement to align CARB and federal regulations to meet HD ICE engine standards beginning in 2027 and to meet the CARB ACT sales requirements.
- The American Truck Dealers Association has been providing testimony to both CARB and the EPA regarding the challenges they will face meeting the various proposed rules.
- Battery and hydrogen energy sources will require new safety protocols and training for operators, vehicle technicians, and emergency response personnel.

## Energy Providers

Meeting the energy demand of electrification will be a massive undertaking.

- Xcel Energy's mid-range (base case) projection adds less than 500 medium duty BETs per year from 2023 through 2028. The rate increases to roughly 1,400 medium duty BETs per year in 2034, then approximately stays at that incremental rate through 2050<sup>13</sup>

Xcel Energy's mid-range (base case) projection adds less than 250 heavy duty BETs per year from 2023 to 2027. The rate jumps to roughly 1,000 heavy duty BETs per year from 2035 to 2052<sup>13</sup>

- Full electrification of the entire U.S. vehicle fleet will require a 40.3% increase in the nation's current electricity generation, and 14% for freight trucks alone. (ATRI, 2022)[1] ([DM1])
- To scale the deployment of medium- and heavy-duty BETs envisioned by EPA's GHG3 rulemaking, 15,625 chargers would have to be installed every month between now and 2032, according to a Ricardo analysis<sup>14</sup>. The current diesel distribution and fueling network functions well and is poised for long term success.



## **United States Environmental Protection Agency (EPA)**

The US EPA has one NEW rulemaking underway: Greenhouse Gas Phase 3 (GHG 3). These new fuel efficiency standards will drive electric vehicle penetration in the marketplace. Rules have been proposed but not yet adopted. The target adoption date is March 2025 with a tentative effective date of 2027. ATA and others are pushing for a 2028 effective date. Fleets will not be required to purchase ZETs but they will functionally be pushed by dealers to do so in order for dealers to meet percentage sales requirements under rule,

## **California Air Resources Board (CARB)**

California will continue to phase in existing Clean Truck Check, Advance Clean Fleets, Omnibus Low NOx, Advanced Clean Trucks, and Low Carbon Fuel Standard, all of which have been already adopted.

## **State of Minnesota**

Minnesota is focused on mandated dealer sales of Class 2-6 light and medium duty LEV and ZEV cars and trucks. These were adopted through administrative rulemaking.

The 2023 Minnesota Legislature created a Clean Transportation Standard Working Group charged with recommending how to decarbonize transportation fuels in Minnesota. This is called a “low carbon fuel standard” or LCFS in states like California and Washington. The MTA sits on the workgroup and is working to influence the recommendations to reflect trucking industry realities. The 2024 Session of the Minnesota Legislature will likely introduce legislation to implement the recommendations.

Minnesota has no defined plan for mandating the use of Class 7-8 LETs and BETs at this time. Such rules could be adopted by Administrative Rule without action by the Minnesota Legislature.

## **Other States**

Eight other states have adopted an Advanced Clean Trucks regulation similar to California but have not yet implemented them for enforcement (New York, Washington, Massachusetts, Vermont, New Jersey, Colorado, Oregon, and Maryland).

- The Messy Middle: <https://nacfe.org/research/thought-leadership/#the-messy-middle>
- Run on Less: <https://runonless.com/>
- Adoption Trends: <https://nacfe.org/research/affs/>
- Benchmarking Tool: <https://nacfe.org/research/benchmarking-tool/#/getting-started>
- U.S. Department of Energy Alternative Fuels Interactive Database <https://afdc.energy.gov/>
- Advanced Clean Fleet tracker
- ATRI Electric Infrastructure Challenges: [OEMs and Dealers](#)
- Legacy original equipment manufacturers are being challenged by both new entrants and federal mandates to shift production to medium and heavy-duty LETs and ZETs.. Truck dealers are largely in a reactive mode as they respond to OEM decisions and state and federal mandates.
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- The American Truck Dealers Association has been providing testimony to both CARB and the EPA regarding the challenges they will face meeting the various proposed rules.
- Battery and hydrogen energy sources will require new safety protocols and training for operators, vehicle technicians, and emergency response personnel.
- ATRI Zero-Emission Truck Analysis: <https://truckingresearch.org/2022/05/understanding-the-co2-impacts-of-zero-emission-trucks/>
- CARB Enforcement Notice: [https://ww2.arb.ca.gov/sites/default/files/2023-12/231228acfnnotice\\_ADA.pdf](https://ww2.arb.ca.gov/sites/default/files/2023-12/231228acfnnotice_ADA.pdf)

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