



California, Net-zero Rail by 2035

Caltrans' Zero-Emission Strategy

Caltrans | Momoko Tamaoki | Assistant Division Chief | May 16, 2023



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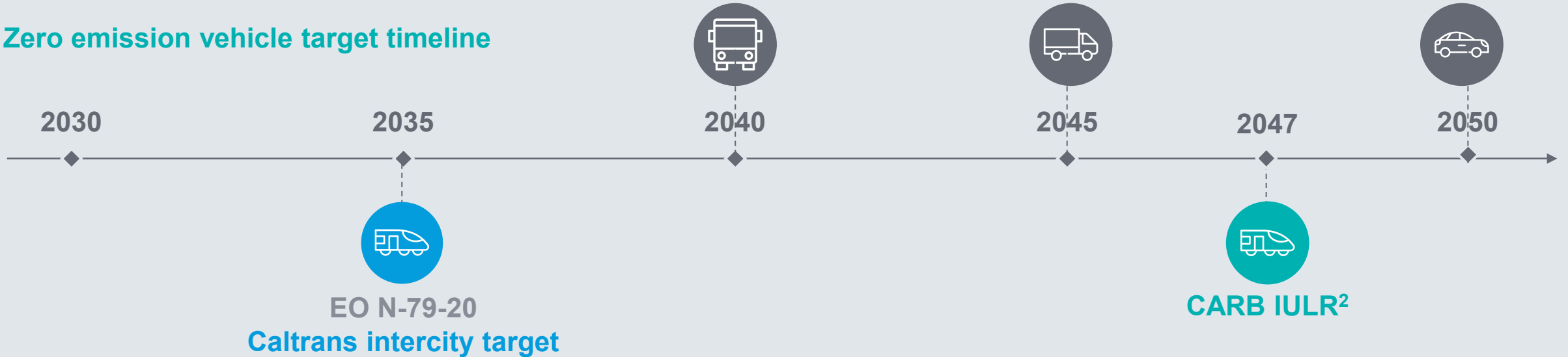






About Caltrans, DRMT

- Our vision is to make public transportation a viable option for all.
- Our mission is to provide measurable improvements to California's integrated and sustainable public transportation system.

California is advancing decarbonization of the transportation sector – with several target years for various transportation modes

Zero emission vehicle target timeline



- | | | | | |
|--|--|---|---|---|
| <p>EO N-79-20 goal:</p> <ul style="list-style-type: none"> – 100% zero-emission off-road vehicle fleet¹, including rail – Trucks fully ZE by 2045 wherever feasible – In-state sales of new passenger cars and trucks 100% ZE from 2035 | <p>CARB IULR² goal:</p> <ul style="list-style-type: none"> – 50% Tier 4 by 2030 – 100% Tier 4 by 2035 – 50% ZE by 2040 – 100% ZE by 2047 – New rail vehicles must be ZE starting 2030 | <p>Innovative Clean Transit Regulation:</p> <ul style="list-style-type: none"> – New buses ZE from 2029 onwards – Bus fleets of public transit agencies fully ZE by 2040 | <p>Advanced Clean Cars II:</p> <ul style="list-style-type: none"> – Reduce CAP & GHG from cars beyond the 2025 model year and increase the # of ZEV – All new passenger vehicles sold in CA to be ZE by 2035 | |
| | | <p> Buses</p> | <p> Off-road vehicle fleet</p> | <p> Medium- and heavy-duty vehicles</p> <p> Light-duty vehicles</p> |

(1) Off-road vehicle fleet must be zero-emission by 2035 according to EO N-79-20

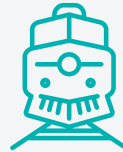
(2) CARB in-use locomotive regulation (IULR) as passed April 27, 2023

Sources: CARB, Caltrans, Governor’s Office

Caltrans has several initiatives for emissions reduction in California, including a passenger rail strategy and ZEMU¹ procurement



R&D efforts



Reduce emissions on F59 PHI locomotives



ZE Bus



ZE Working Group

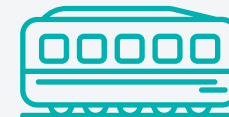


Alternative fuel testing & expansion to the entire fleet



Intercity passenger rail strategy²

Details next slides



ZEMU project¹



ZEHTRANS

(1) Fleet expansion with zero-emission multiple units (ZEMUs) (2) Intercity fleet transition to ZE

California Intercity Passenger Rail Zero-Emission Strategy

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Caltrans developed a ZE strategy for California intercity passenger rail to reduce emissions and achieve zero emissions by 2035



Caltrans developed a ZE strategy to:



Respond to urgent need and legislation / state mandates¹



Set goals / targets and provide a structured approach to move towards ZE, incl. setting technological cornerstones



Enable the launch of important initiatives and accelerate progress



Provide leadership and guidance and serve as a positive benchmark for other railways to act quickly in a coordinated manner



Collaboration with passenger rail agencies to leverage expertise for successful California wide ZE implementation

(1) EO N-79-20 and CARBs in-use locomotive regulation

Our fleet: Caltrans provides the equipment for three intercity corridors – services are managed by regional Joint Powers Authorities

California's Intercity Passenger Rail



Intercity diesel-electric locomotive fleet



F59PHI (EMD)

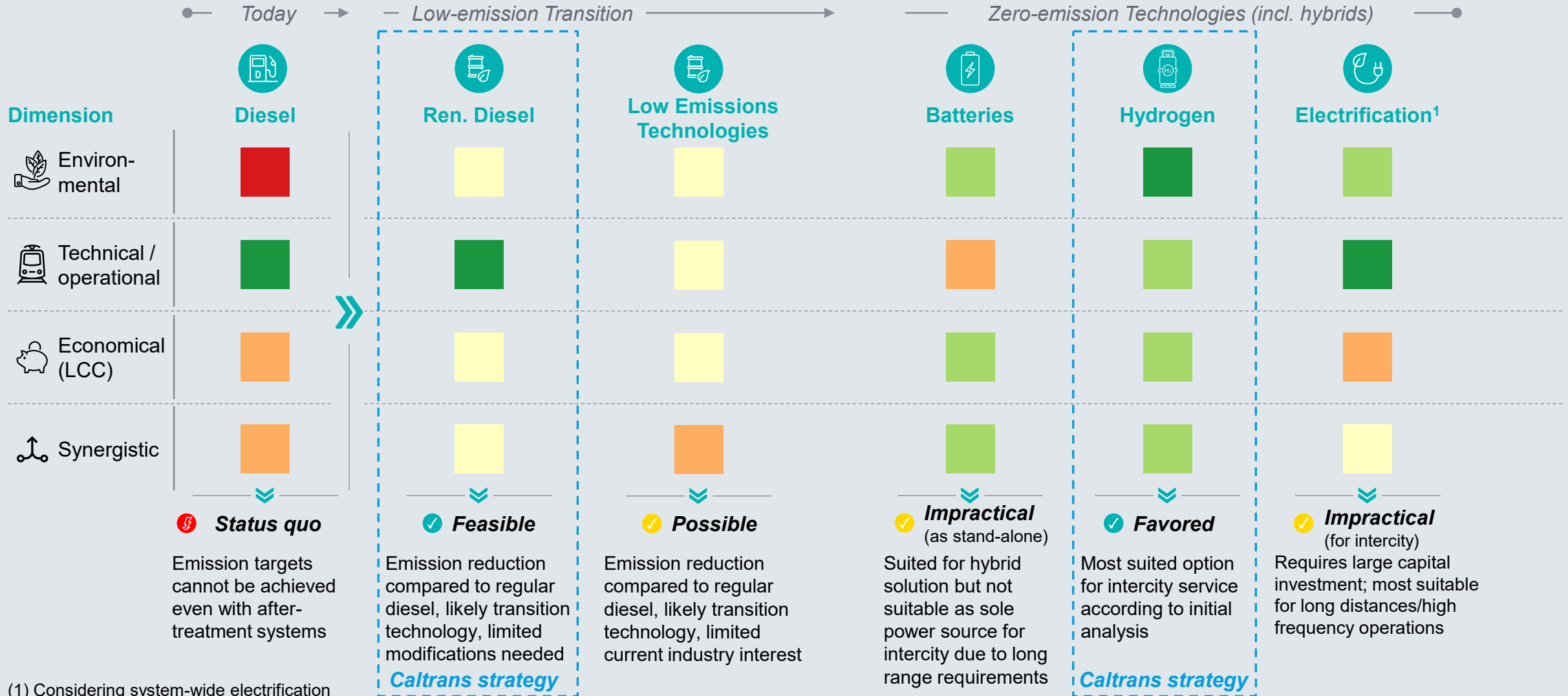
Year introduced: 1991 / 2001
Emission standard: Tier 2
Power: ~2200 kW



SC-44 (SIEMENS)

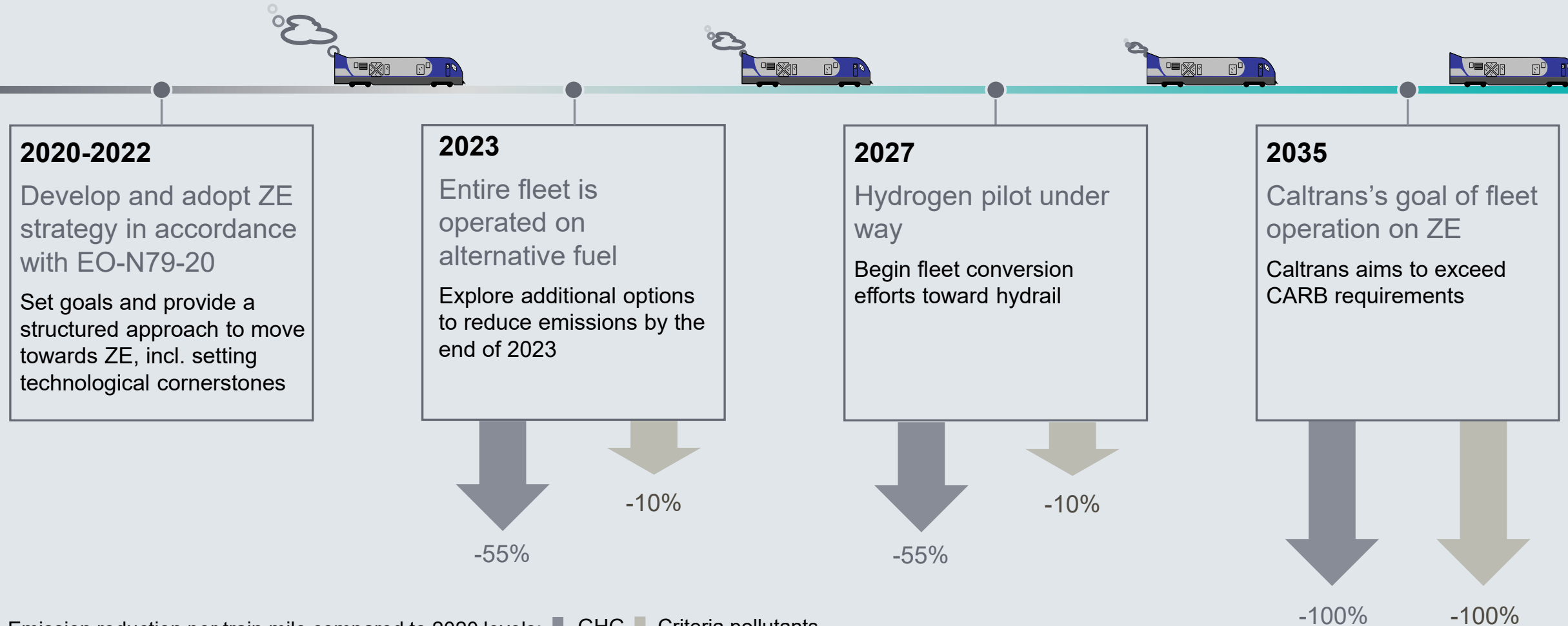
Year introduced: 2017
Emission standard: Tier 4
Power: ~3300 kW

Primary power for Caltrans intercity fleet: renewable diesel to reduce emission and hydrogen to achieve zero-emission



(1) Considering system-wide electrification
Source: DB assessment

Driving toward zero-emission intercity rail: Start with alternative fuels, upgrading to Tier 4 incl. energy efficiency, and Hydrail¹



Emission reduction per train mile compared to 2020 levels: ↓ GHG ↓ Criteria pollutants

(1) Adjustment of strategy possible, if technological breakthrough occurs



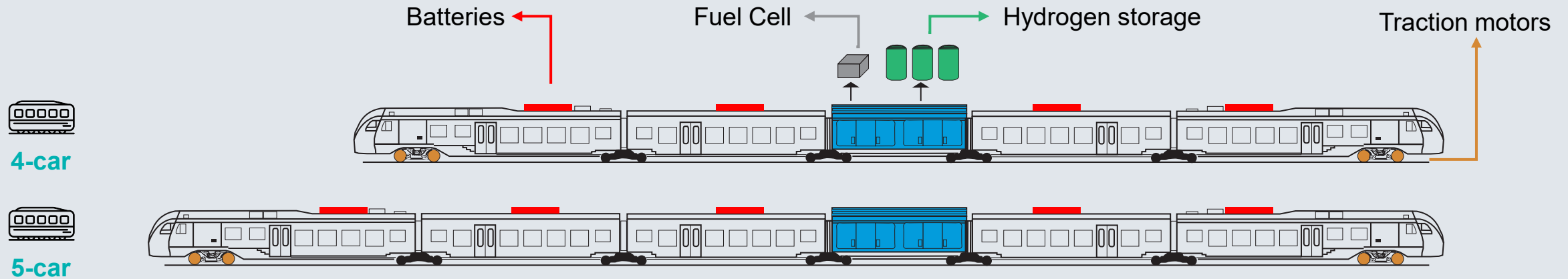
ZEMU Project Fleet Expansion

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Caltrans developed a concept for a possible ZEMU vehicle for a 4- and 5-car train aimed at expanding passenger rail service in California

Illustrative Example¹

Possible ZEMU configurations¹



Caltrans targeted characteristics

- Hydrogen: long range & fast fueling;
- Batteries: power & enabling regenerative braking
- Passenger capacity: ~200 seats
- Max vehicle speed: 90 mph
- Max vehicle range²: ~1000 miles (4-car), ~800 miles (5-car)

(1) General illustrative concept based on SBCTA ZEMU (2) Under favorable conditions (3) Memorandum of Understanding

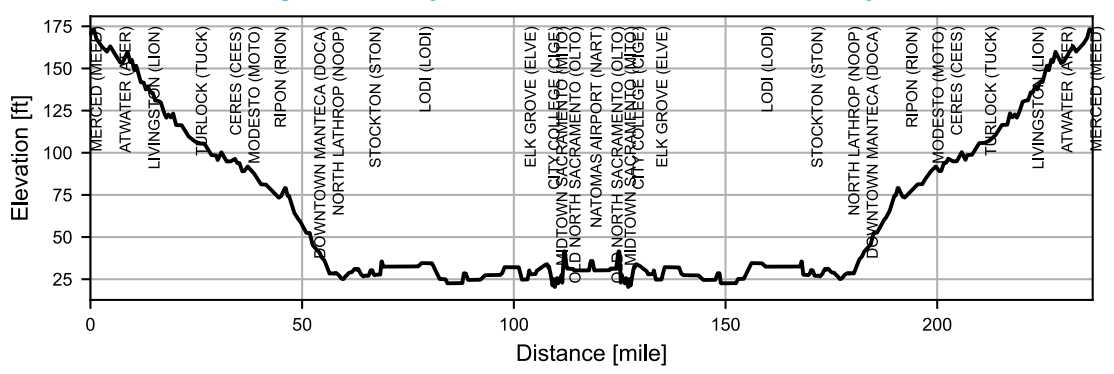
Valley Rail route from Merced to Natomas Airport

Route highlights and maps

Valley Rail route¹

- Route: Ceres-Merced & Lathrop-Ceres & Sacramento Extension
- # of stations²: 16 (1 existing, 15 planned)
- Distance³: 118.36 miles (190.48 km)
- Elevation (altitude):
 - Merced: 171.2 ft (52.18 m)
 - Natomas Airport is 39.37 (12 m); steepest grade (1%)

Elevation profile (elevation vs distance)



Geo / topo map of route



Existing & planned stations



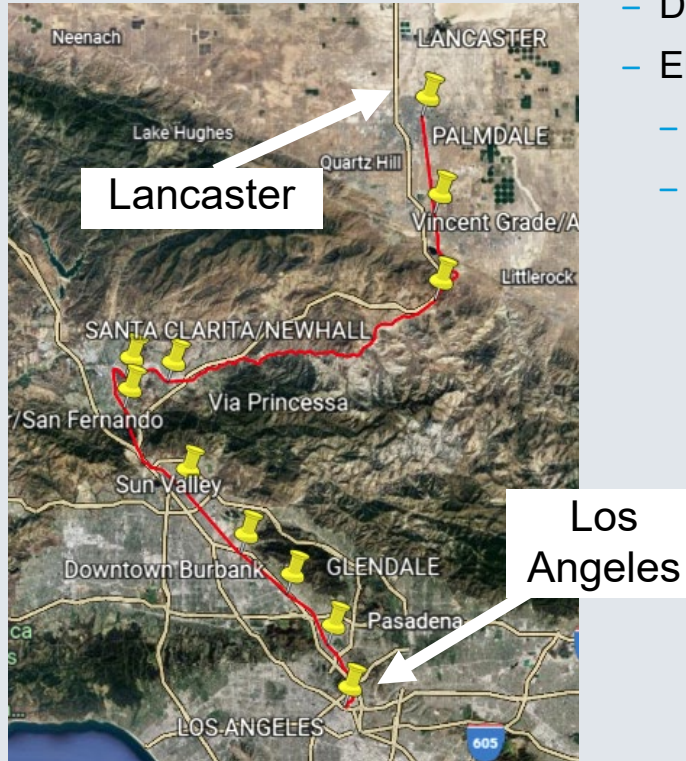
(1) Valley Rail line includes Ceres-Merced Extension, Lathrop-Ceres Extension, and Sacramento Extension
 (2) Station locations are based on information provided in the Environmental Impact Reports. Added Atwater as a separate station from Livingston.
 (3) One Way

Potential other routes for ZEMUs: Antelope Valley and Central Coast

Antelope Valley route¹

Steepest

- Route: Lancaster to L.A. Union Station
- # of stations: 13 (12 existing, 1 planned)
- Distance¹: 76.6miles (123.23km)
- Elevation (altitude):
 - Lancaster 2354ft (717.5m)
 - L.A. Union Station 309ft (94m);
 - steepest grade (5.45%)



Central Coast route¹

Longest

- Route: San Jose to Santa Barbara
- # of stations: 5
- Distance¹: 320miles (514.5km)
- Elevation (altitude):
 - San Jose 70ft (21.34m)
 - Santa Barbara is 10ft (3m);
 - steepest grade (2.47%)



(1) One Way



Thank you!

If you have any questions, please contact me.
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