Mountain Line’s Battery Electric Journey

Missoula, MT

August 6, 2020
Mountain Line provides over 1.5 million rides at zero-fare each year to a city of 73,000.

Our district is 70 square-miles.

2019 our fixed-route service covered 686,258 miles.

We have 75 employees, 12 fixed-routes and a robust paratransit and senior van service.

Missoula, MT can experience highs in the 100s and lows around -10 degrees, with modest snowfall in winter.
Our Fleet

- 30 Coaches
  - 29- to 35-ft
  - Gillig (20), Eldorado (4), Proterra (6)

- 12 Paratransit Vehicles
  - ADA accessible vans and cutaway buses

- 5 Service Vehicles
Going Electric

• 2014 “Clean Fuel Path” Resolution
• 3rd Time’s a (Low-No) Charm
• A Big Year (2018)
Going Electric

• Start of Service - August 2019

• Six (6) Proterra Battery Electric Buses (440 kWh)

• Seven (7) 60-kW Chargers
Successes
A Big Debut

It’s electric: Mountain Line’s new blue bus powered by green technology

BY MARTIN KIDSTON

JULY 26, 2019

City Council president Bryan von Laszewski steps off Mountain Line’s first electric bus after taking a short ride around the city on Wednesday, July 23, 2019. (Martin Kidston/Missoula Current)

Mountain Line took advantage of summer weather and a growing downtown crowd on Wednesday to showcase its newest addition—a gleaming blue bus that whimpers instead of roars.

Taco John’s supports clean powered buses

Mountain Line prepares for July arrival of 6 electric buses
Planning for Delivery

21 months

Bus Procurement & Build
(Proterra)

Charging Equipment Procurement
(Proterra)

Facility Design
(Local Firm)

Facility Construction
(Local Firm)

Bus Delivery & Deployment
Community Collaborations

Brings together teams of stakeholders from across the United States—including utilities, state and local governments, nonprofits, innovative companies, and electric system operators.

Teams work to implement innovative applications of solar and distributed energy resources (DERs) in their unique locations and contexts.

Over the course of 15 to 18 months, teams receive direct funding, analytical support from NREL and other expert partners, and facilitation support.

Montana Team:

Sensitivity Analysis Results

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Optimal Size of PV + Storage</th>
<th>A. Direct Purchase</th>
<th>B. No Limit on Net Metering</th>
<th>C. Lower Cost of Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Size (kW)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>277</td>
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<tr>
<td>Storage Size (kWh)</td>
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<td>1,515</td>
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<tr>
<td>Storage Cost ($)</td>
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<td>$0</td>
<td>$0</td>
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<tr>
<td>PV Size (kW DC)</td>
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<td>PV Cost ($)</td>
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<td>PV Electricity Produced (kWh)</td>
<td>59,356</td>
<td>59,356</td>
<td>845,065</td>
<td>385,997</td>
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<tr>
<td>Percent RE (%)</td>
<td>7%</td>
<td>7%</td>
<td>100%</td>
<td>46%</td>
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<tr>
<td>Purchased Utility Electricity (kWh/yr)</td>
<td>796,079</td>
<td>796,079</td>
<td>729,556</td>
<td>555,029</td>
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<td>Year 1 Utility Electric Costs (Energy $)</td>
<td>$61,835</td>
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<td>Year 1 Utility Electric Costs (Demand $)</td>
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<td>Year 1 Total Utility Cost ($)</td>
<td>$106,463</td>
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<td>Lifecycle Cost of Electricity</td>
<td>$2,131,778</td>
<td>$2,129,562</td>
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</tbody>
</table>

Net Present Value

- A. Direct Purchase: $2,466
- B. No Limit on Net Metering: $4,682
- C. Lower Cost of Storage: $66,415

January 1 – January 7
Monitoring Performance

• “Smart” Meters make it possible

• **Primary Data Sources**
  • Availability Form (Google Form)
  • Proterra APEX
  • Smart Meters
  • Energy Bills

• **Key Performance Indicators**
  • Availability
  • Maintenance Issues
  • Energy Consumption by Block
  • Fuel Economy
  • Energy Consumption by Temperature
Challenges
Operational Differences

- Additional complexity in our bus barn
- Efficiency fluctuations up to 50%
- Cabin preconditioning + mid-day charging in winter months
Cost of Electricity (and Diesel)

- No “Smart” Charging means high demand charges
- High unit energy cost ($/kWh) to charge buses vs. to power building
- High energy cost ($/mile) vs. diesel
- Diesel contract led to grounding of electric buses during peak Coronavirus service reduction
A Zero-Emission Future

• In February 2020, our board committed to a zero-tailpipe-emissions fleet by 2035.

• By spring 2022, we'll have a total of 12 electric buses on the road, bringing us to 40% electric fixed route fleet.

• Working with our investor-owned utility on a transit-specific rate case to bring to the public service commission in late 2020
Thank you

Corey Aldridge  
General Manager  
vcaristo@mountainline.com  
406-543-8386

Vince Caristo  
Projects and Planning Manager  
vcaristo@mountainline.com  
406-215-2468