Why Zero-Emission Fleet?

- Zero tailpipe emissions
- Quieter
- Lower maintenance costs
- State, regional & local policy for clean energy
- Industry movement
- Battery electric best now, but new technologies on horizon
Growing Alternative Fuels

U.S. Transit Buses by Fuel Type

Last updated: August 2016
Printed on June 18
Growth in Alternatives

Percent Change 2008-2015

- Diesel
- Natural Gas
- Electric & Hybrid
- Biodiesel
US Transit Agency BEB Experience

- 21 transit agencies in the US with BEB experience – most with less than 10 buses
- Agencies with most experience:
  - Antelope Valley Transportation Authority: 77 buses, full conversion by 2018
  - Foothill Transit: 17 buses, 13 more on order
  - King County Metro: 120 BEBs by 2020
  - IndyGo: 21 buses, 13 more on order

Source: TCRP Synthesis 130: Battery Electric Buses State of the Practice
TriMet Alternative Fuel Plan

• Two pronged strategy:
  • Short term: Apply for federal funding
  • Longer term: Develop comprehensive plan for conversion to non-diesel fleet

• 5 “fast charge” buses arriving this fall
• Application for 5 “slow charge”
• Prepare NRV strategy
Comprehensive Plan

- Consultant report
- HB 2017 opportunity
  - ~$50-55m per year additional resources
  - Legislative language
- Adopt comprehensive plan this fall
- Build battery electric bus into new/remodeled facilities
Key Considerations

- Short term vs long term
- Experienced vs new manufacturers
- Improving technology & price
- 14 year bus vs 16 year bus
- Fast charge vs slow charge
- Maintenance cost savings
- Space
- Inability to borrow directly against HB2017
Baseline Costs Analysis

Costs and Credits to TriMet
1. Diesel Fuel Costs
2. Electricity Costs
3. Maintenance
4. Vehicle Purchase
5. Charger Infrastructure
6. Clean Fuel Credits
7. Renewable Identification Number (RIN) Credits

Social Costs
1. Emissions (Tailpipe and From Grid)
2. Noise

TriMet Role
## Confidence Level Assessment

<table>
<thead>
<tr>
<th></th>
<th>Pessimistic</th>
<th>Moderate</th>
<th>Optimistic</th>
<th>Highest Confidence Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACCOUNTING</strong></td>
<td>$2018</td>
<td>$2018</td>
<td>$2018</td>
<td>$2018</td>
</tr>
<tr>
<td><strong>DISCOUNT RATE</strong></td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td><strong>BEB LIFETIME</strong></td>
<td>14 yrs</td>
<td>16 yrs</td>
<td>16 yrs</td>
<td>16 yrs</td>
</tr>
<tr>
<td><strong>FINAL FLEET SIZE</strong></td>
<td>981</td>
<td>981</td>
<td>981</td>
<td>981</td>
</tr>
<tr>
<td><strong>DIESEL FUEL PRICE TREND</strong></td>
<td>2% annual growth</td>
<td>4.34% annual growth</td>
<td>6.5% annual growth</td>
<td>2.00% annual growth</td>
</tr>
<tr>
<td><strong>RINS CREDITS</strong></td>
<td>None</td>
<td>Half value</td>
<td>Full value</td>
<td>None</td>
</tr>
<tr>
<td><strong>MAINTENANCE SAVINGS</strong></td>
<td>5%</td>
<td>20%</td>
<td>25%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>CHARGER MAINTENANCE (EACH)</strong></td>
<td>$200/year</td>
<td>$200/year</td>
<td>$200/year</td>
<td>$200/year</td>
</tr>
</tbody>
</table>

**Legend**

- Very confident
- Confident
- Less Confident
- Very Unconfident
## Confidence Level Assessment

<table>
<thead>
<tr>
<th>Electric bus price decline</th>
<th>Pessimistic</th>
<th>Moderate</th>
<th>Optimistic</th>
<th>Highest Confidence Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follows CARB's most pessimistic slow charge bus projection</td>
<td>Follows the average trend of CARB's slow charge bus projections</td>
<td>Follows the trend of the California Air Resources Board's (CARB) most optimistic slow charge bus projection</td>
<td>Follows the average trend of CARB's slow charge bus projections</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bus purchase cost</th>
<th>$1,087,322</th>
<th>$1,008,794</th>
<th>$930,267</th>
<th>$1,008,794</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charger cost (depot)</td>
<td>$85,122</td>
<td>$68,909</td>
<td>$64,855</td>
<td>$68,909</td>
</tr>
<tr>
<td>Charger:bus ratio</td>
<td>1:2</td>
<td>1:2</td>
<td>1:2</td>
<td>1:2</td>
</tr>
<tr>
<td>% Peak charging</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Energy per mile</td>
<td>2.57 kWh per mi</td>
<td>2.362 kWh per mi</td>
<td>2.20 kWh per mi</td>
<td>2.362 kWh per mi</td>
</tr>
<tr>
<td>Clean Fuel Credit value</td>
<td>$50 per credit</td>
<td>$100 per credit</td>
<td>$150 per credit</td>
<td>$100 per credit</td>
</tr>
</tbody>
</table>
Cumulative Net Cost or Savings of Choosing Electric Fleet over Diesel Fleet

All costs are shown in 2018 dollars.
Near Term Strategy

• 5 fast charge buses on line this fall
• Apply for federal grant for 5 slow charge buses
• Produce alternative fuels strategy
• Work with HB2017 advisory committee to develop funding plan
• Incorporate charging into Powell Garage Plan
Investment Allocation Proposal

Service FY19-FY23 $33 mil (60%)
Includes buses & system capital:
  • More Frequency
  • More Coverage
  • Later/Earlier Service
  • Weekend Service

Low Income Fare $12 mil (22%)

Unallocated Funds $6.45 mil (12%)

Regional Coordination $3 mil (5%)

School Transportation $550,000 (1%)

1 Time Only Funds
Examples:
  - Larger Buses
  - Transit Priority
  - E-Bus Charging
  - Infrastructure
  - Digital Displays
  - TC Security Improvements

Unallocated Funds $6.45 mil (12%)
HB2017 Planning Timeline

We are here: Electric Bus Strategy Consideration

- Develop plan
- Public workshops
- Regional coordination selection process
- Public input
- Format into one plan
- Endorsements
- QE Committee approves plan
- TriMet board approval
- Initial STIF applications due
- Second STIF application opportunity, if needed

Events:
- TEAC/CAT Update
- JPACT Update
- Draft Plan Approval by Advisory Committee
- R1 Act Update
- TriMet Board - 1st Review
- TriMet Board - Approval
- Final Plan Approval by Advisory Committee
- Submit plan

Timeline:
- Mar. '18
- April '18
- May '18
- June '18
- July '18
- Aug. '18
- Sept. '18
- Oct. '18
- Nov. '18
- Dec. '18
- Jan. '19
- Feb. '19
- Mar. '19
New Flyer Fast Charge Bus