King County Metro

Sustainably and equitably achieving a zero-emission fleet

King County

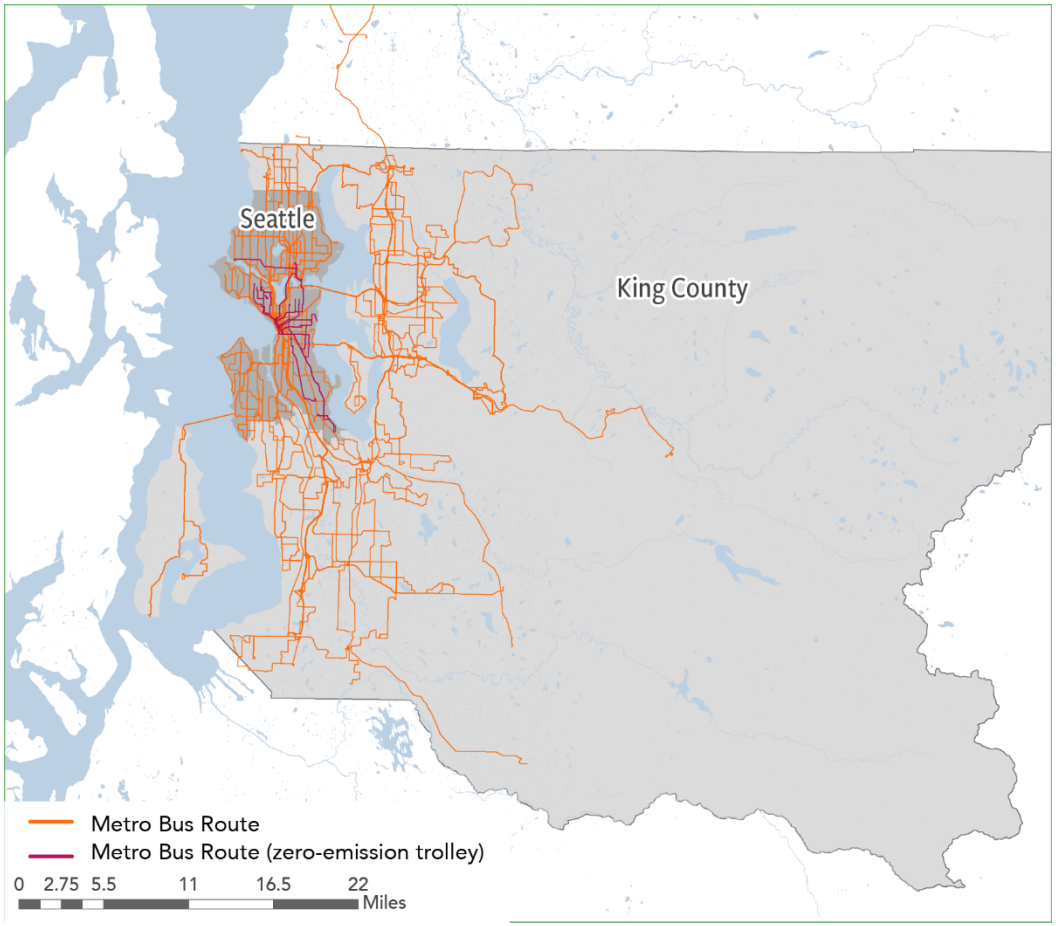
Sam Schwartz

Purpose

Develop a road map to guide King County Metro to transition to a zero-emission fleet.

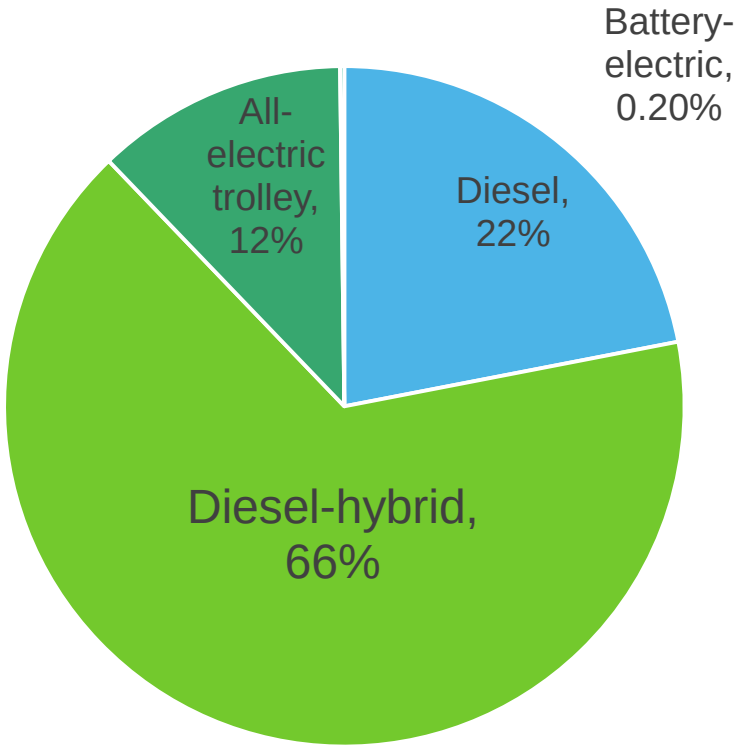
King County Metro

- 10th largest transit bus agency in the U.S. by ridership
- Operates the 4th largest fleet of buses in the country (1,420 buses)
- Second largest trolleybus system in the country by ridership and fleet size



Metro's Fleet

- Metro's current zero-emission fleet includes three Proterra all-electric, fast-charge battery-operated buses, as well as a fleet of 174 electric trolley buses.



Proterra battery bus

The future of Metro

- Transportation accounts for nearly half of all greenhouse gas emissions in Washington.
- In King County, fossil fuel use for transportation is one of the top two sources of GHG emissions.
- A key strategy for reducing vehicle emissions is to integrate innovative technologies and lower-carbon fuels into operations.

The future of Metro

In 2015, Metro had **126 million boardings**. In the past year, the King County region has had the **highest transit growth** for all large metropolitan areas in the U.S.

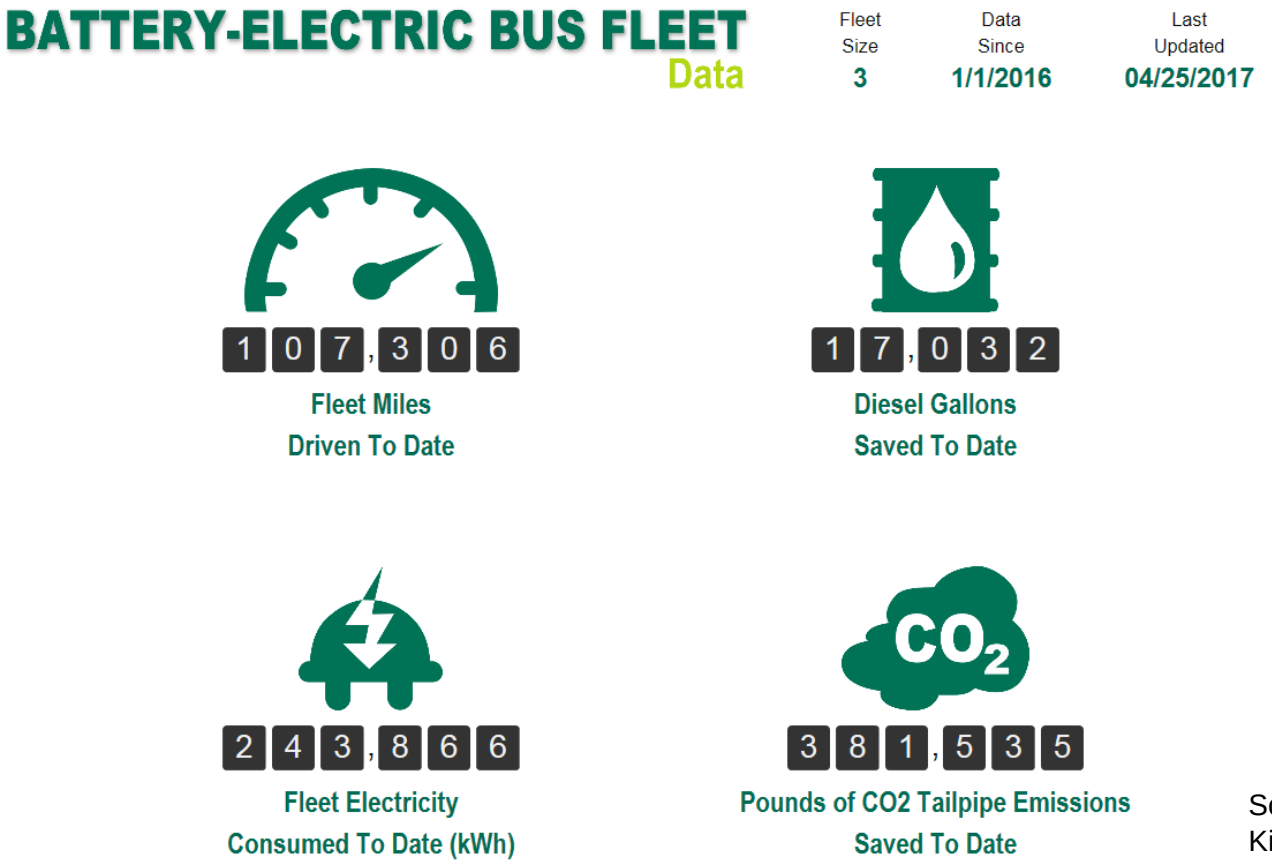
Targets or priority actions:

- Increase ridership to 142 million boardings by 2020, and to 225 million boardings by 2040
- Grow transit service through 2020 with no increase in GHG emissions.
- Increase the use of alternative fuels (e.g. electricity, biofuels) in Metro's fleet by 10 percent by 2025

Battery- electric bus technology benefits

- Eliminates GHG emissions from fleet operations
- Eliminates tailpipe air pollution emissions
- Reduces noise to levels equivalent to a passenger c

Metro's current battery fleet



Source: Proterra and King County Metro

Battery-electric bus market

- Battery-electric bus manufacturing and technology are still in their development stages, but they are progressing rapidly
- Currently, five agencies in the United States are operating **10 or more electric buses**
- 38 agencies in the U.S. have **at least one electric bus** in service
- The industry is currently focusing mainly on 40-foot standard bus designs. Offerings in the **60-foot articulated bus** category are still growing

Battery- electric bus technology

Slow-charge bus

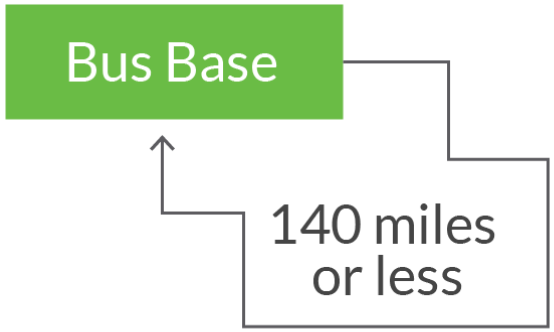
- Charges at base
- Range of 140 miles
- ~2 to 5 hours to charge midday or overnight
- Charger cost is $34k per bus

Fast-charge bus

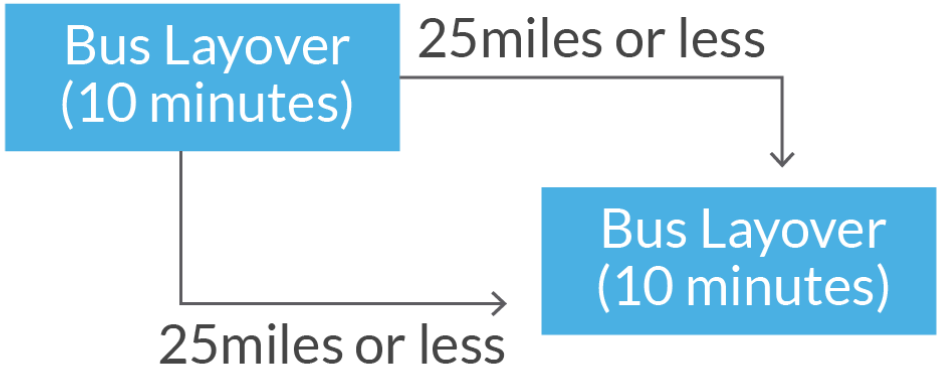
- Charges at bus layover
- Range of 25 miles
- 10 minutes to charge
- Charger cost is $144k per bus

Battery- electric bus technology

SLOW-CHARGE



FAST-CHARGE



PROCESS

King County Council Motion

- Recommendation on whether Metro should adopt a carbon-neutral or a zero-emission fleet goal
- Requested cost and benefit, technology, service, and equity analyses

Internal technical review panel

- Vehicle Maintenance
- Service Development
- Power and Facilities
- Finance and Budget
- Human Resources
- Operations
- Design and Construction
- Strategy and Performance

Common themes and lessons learned

INFRASTRUCTURE: Charging station siting and power requirements

SCALABILITY: Choosing what is right for Metro and thinking about long-term universal charging needs

SERVICE QUALITY: Changes in quality of service and scheduling

COORDINATION: Communication between all departments and relationships with utility companies and jurisdictions

MAINTENANCE AND OPS: Input and support from operators and training needs

ANALYSES

Service Analysis

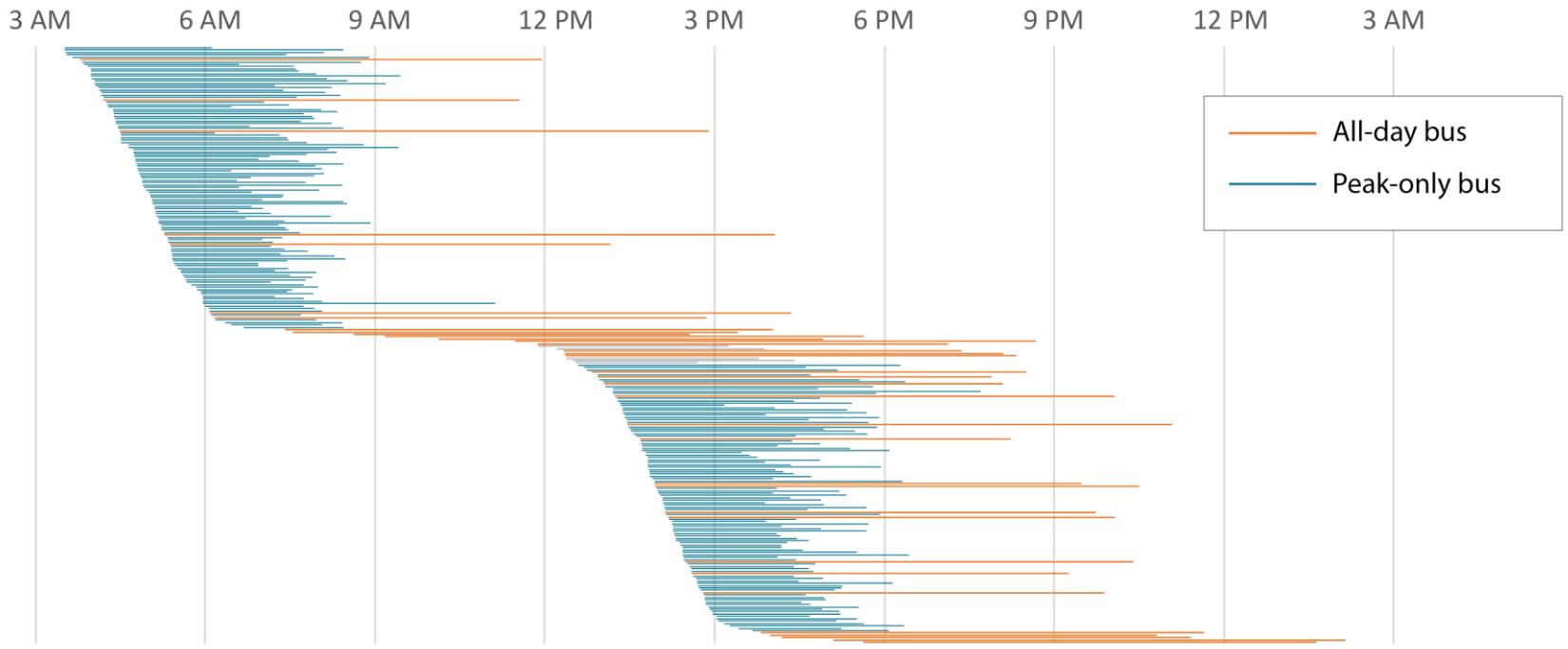
Service analysis

- Purpose
  - Battery-electric buses should be introduced into the bus network in a way that minimizes impacts on operations and service
  - How does Metro's service match the operational characteristics of new battery-electric buses?

Service analysis

- Methodology
  - Using HASTUS (planning/scheduling software) outputs, analyzed where and how far buses travel throughout King County
  - Looked only at bus scheduling and service design to determine the number of buses that could potentially transition to battery-electric buses
  - Considered layover locations and bus bases

Example bus base schedule



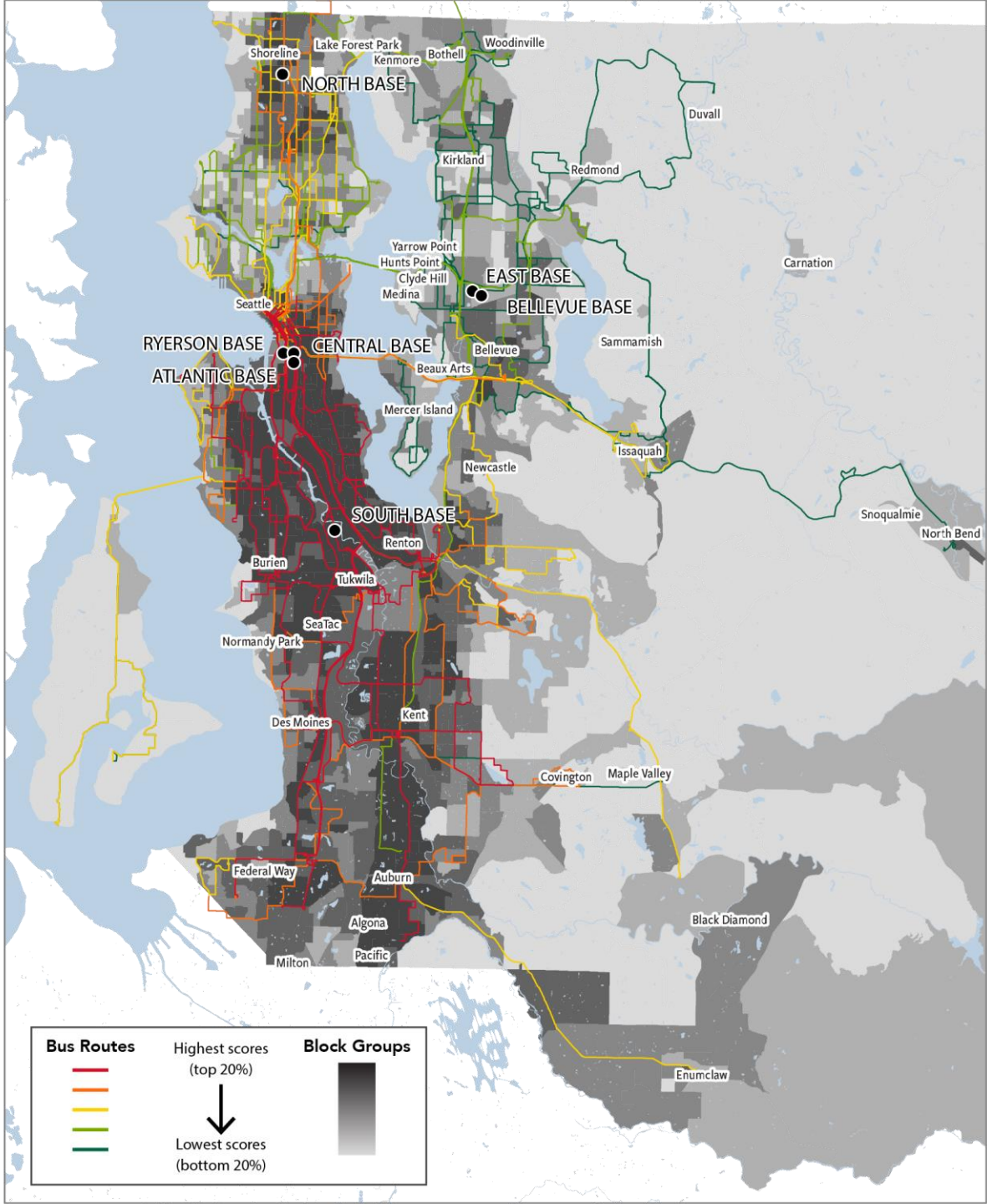
Service analysis results

- Between 140-187 diesel and hybrid buses—**35 to 47 percent of the 40-foot fleet**—could be transitioned to battery-electric fast-charge buses
  - Must consider siting constraints and efficiency of charging infrastructure
- Current slow-charge battery-electric technology could meet service needs of **70 percent of Metro's current operations**
  - 90 percent could be served by next generation battery range

Equity Analysis

Non- zero-emission bus routes

Red routes indicate high priority routes that operate near most vulnerable populations



FINDINGS

What does this mean for Metro?

A mix of slow-charge and fast-charge technology, along with some service adjustments, could make it possible for Metro to achieve a **100 percent battery-electric bus fleet.**

According to the fleet replacement plan, this could be achieved by **2034 under a 14-year replacement** schedule or by **2036 under a 16-year replacement.**

This will help to achieve King County's GHG emission reduction goals

King County buys nation's largest fleet of battery-electric buses

January 2017

- King County Metro Transit announced it will acquire **120 all-electric fast-charge** battery buses by 2020
- Will also acquire up **to nine slow-charge** long-range electric buses from different manufacturers to test the battery technology with a range of about 140 miles

Local News | Local Politics | Traffic Lab

Coming soon to a Metro transit route near you: more battery-powered electric buses

Originally published January 9, 2017 at 12:08 pm | *Updated January 18, 2017 at 10:31 am*

1 of 2 *Battery-powered buses, like this one headed to Crossroads, connect to an overhead dock that recharges their batteries in about 10 minutes at the Eastgate Transit Center. (Mike*

Proterra Snags Order For Up To 73 Battery-Powered Buses From Seattle

Alan Ohnsman, FORBES STAFF
Thumbing a ride at the intersection of technology, autos and mobility FULL BIO

Proterra CEO Ryan Popple and King County Executive Dow Constantine in Seattle on January 10. (Proterra)

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