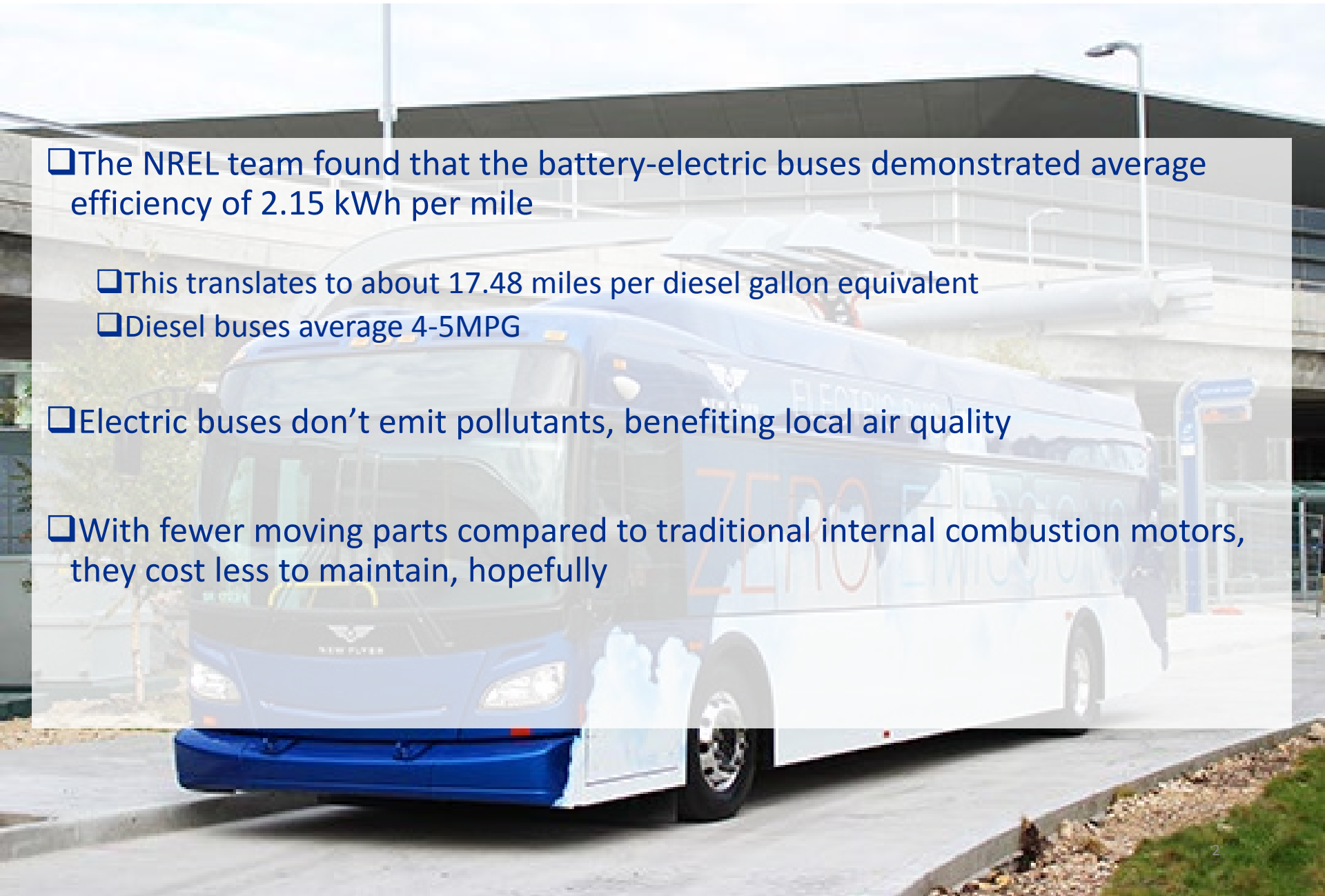
Battery-Electric Buses Maximization Rather than Optimization

Hal Johnson

Utah Transit Authority

Feb 2020

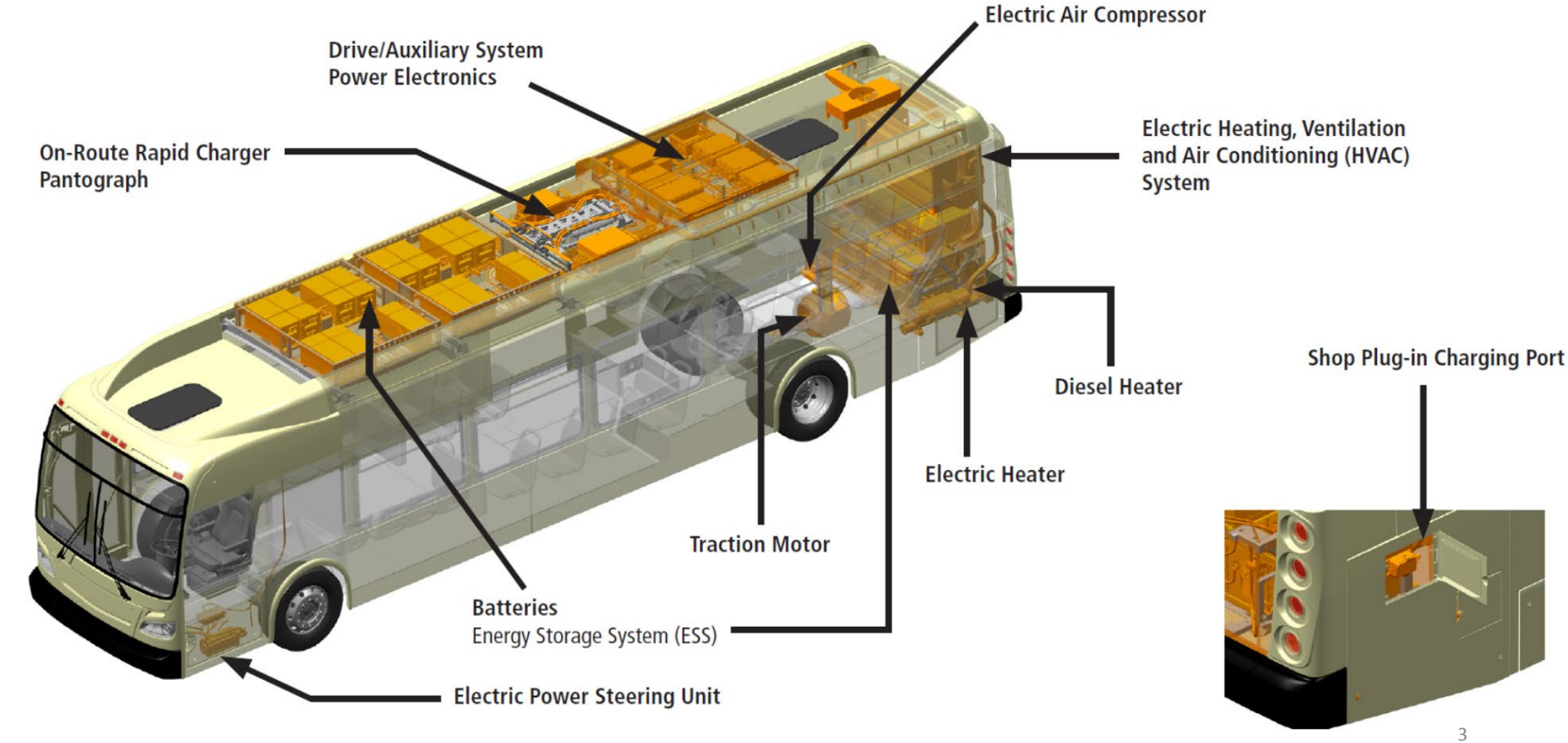
Why Electric Buses?



- The NREL team found that the battery-electric buses demonstrated average efficiency of 2.15 kWh per mile
  - This translates to about 17.48 miles per diesel gallon equivalent
  - Diesel buses average 4-5MPG
- Electric buses don't emit pollutants, benefiting local air quality
- With fewer moving parts compared to traditional internal combustion motors, they cost less to maintain, hopefully

What is a battery-electric bus?

- A battery-electric bus is driven by an electric motor and obtains energy from on-board batteries



Maximizing Electric Buses

- Batteries upsized from 200kWh to 400kWh for extra range
- Added diesel heater to extend winter range. Providing electric heat uses 1kWh per mile
- 1 dispenser per bus depot charging
- 450kWh overhead fast charge rather than 300kWh
- A second high powered charger is being added to support system redundancy and support future projects

Results

- UTA's electric buses can run up to 200 miles between charges
- Small things matter:
  - Electric heat can use up to 50 miles of range
  - Hills make a difference. Buses charge on the way down the hill but not all of the energy is recouped
  - Eco driving makes a big difference: up to 1 KWh per mile
  - Temperature makes a difference

New Flyer Connect report diesel heater not in use

Summary:
2.45KWh per mile
Hours in service: 5.4
Miles: 46.3
Remaining range: 80

NEW FLYER
NEW FLYER CONNECT®

CONNECT 360™

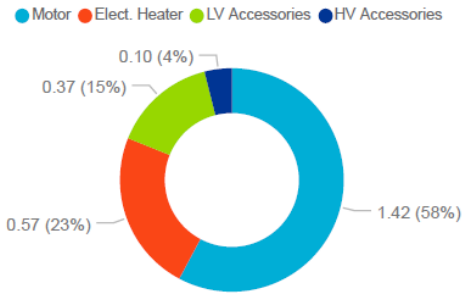
DATE	BUS	MODEL	ESS CAPACITY	TRIP
Fri, Dec 27, 2019	18152	XE40	400 kWh	1

UTA

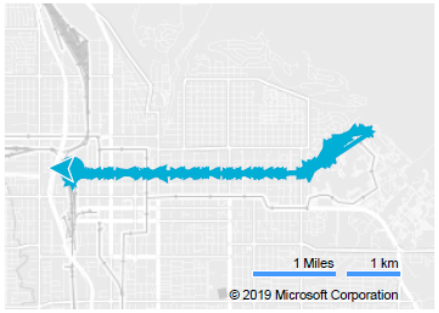
TRIP DETAILS

06:19 am Start Time	46.29 Mileage (miles)	82.80 SOC MAX (%)	2.45 Energy Consumption (kWh/mile)
12:01 pm End Time	35.14 Average Temperature (°F)	54.40 SOC MIN (%)	19.93 Energy Consumption (kWh/hour)
05:42:01 Duration	8.12 Average Speed (mph)	113.60 Energy Used (kWh)	

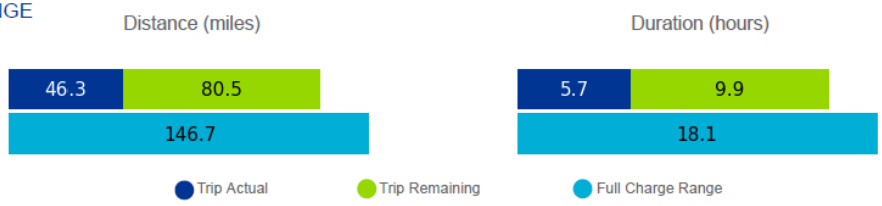
ENERGY CONSUMPTION BY SUB-SYSTEM (kWh/mile)



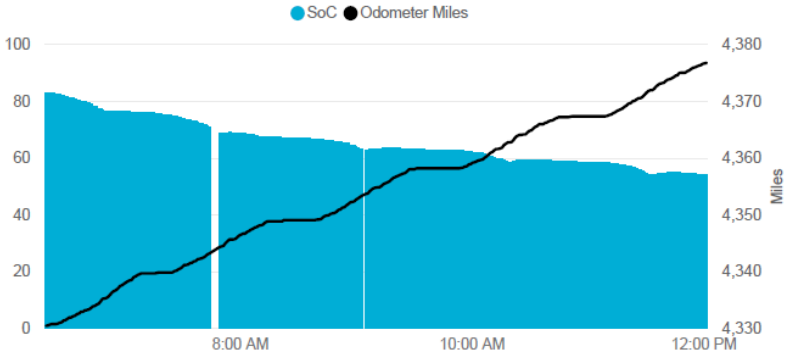
ROUTE



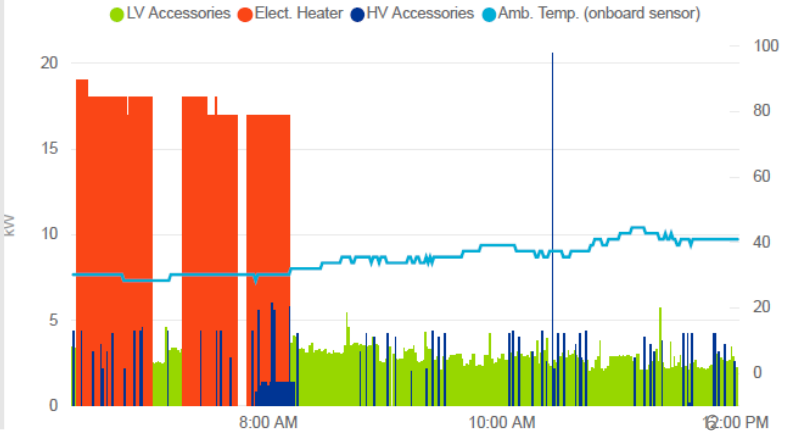
RANGE



STATE OF CHARGE AND ODOMETER MILES



SUB-SYSTEMS POWER AND AMBIENT TEMPERATURE



New Flyer Connect® Proprietary Technology and Analytics

New Flyer Connect Report diesel heater in use

Summary:
1.76 KWh per mile
Hours in service: .4
Miles: 9

NEW FLYER
NEW FLYER CONNECT®
CONNECT 360

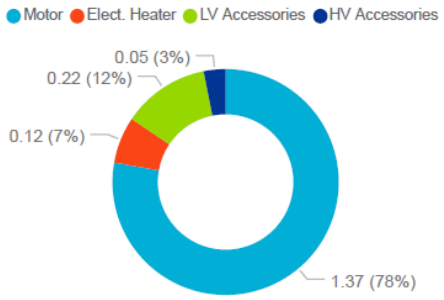
DATE	BUS	MODEL	ESS CAPACITY	TRIP
Fri, Dec 27, 2019	18152	XE40	400 kWh	2

UTA

TRIP DETAILS

12:22 pm Start Time	9.09 Mileage (miles)	58.40 SOC MAX (%)	1.76 Energy Consumption (kWh/mile)
01:08 pm End Time	41.69 Average Temperature (°F)	53.60 SOC MIN (%)	20.70 Energy Consumption (kWh/hour)
00:46:23 Duration	11.76 Average Speed (mph)	16.00 Energy Used (kWh)	

ENERGY CONSUMPTION BY SUB-SYSTEM (kWh/mile)



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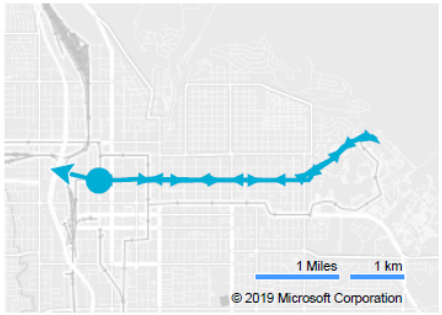

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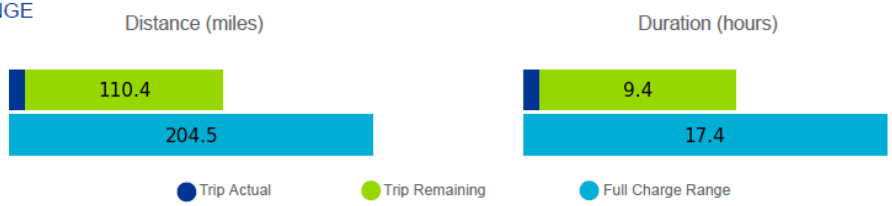

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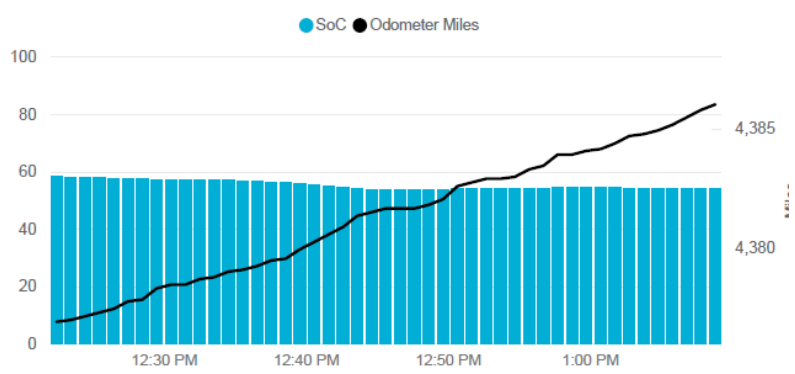

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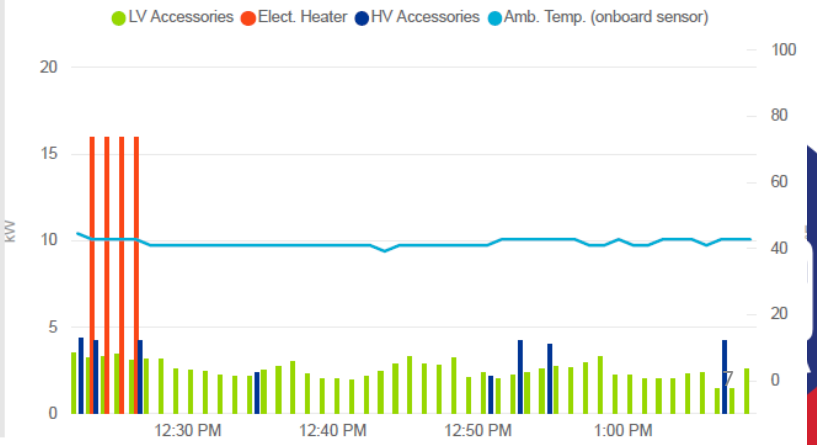


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- End, thank you for your time