

busworld®





An Electric Revolution for Commercial Bus and Coach Fleets

Dr John Warner
Chief Customer Officer, American Battery Solutions

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American Battery Solutions at a glance

Our energy is electric!

Founded in 2018

Led by a team of pioneers and innovators with decades of experience developing advanced batteries.

>165 employees

Automotive battery systems expertise in cells, BMS, thermal, structural and vehicle integration.

8 GWh capable manufacturing plant

290,000 sq. ft of innovation and manufacturing state-of-the-art facilities with proven high-quality delivery record.

Customer pipeline and target markets



Scalable products already in production

Low voltage



High voltage



Custom packs



Strategic partnerships for supply & technology leadership

High energy cells

LG Energy Solution

SAMSUNG SDI

Fast-charge cells

TOSHIBA

ABS Proprietary BMS



Volume manufacturing - experienced high-quality plant

Automotive-grade quality. Installed capacity. Ohio centralized location.

Michigan Innovation Center



Metro Detroit, Michigan area

115,000 Sq. Ft. engineering, test and validation facility

125+ Engineers developing state-of the art battery technology

Pilot line Flexible semi-automatic prototype build facility

Test lab Cell, module and pack testing with specialized large test chambers

Ohio Manufacturing Facility



Acquired BOSCH BATTERY SYSTEMS North American facility in 2019

60,000 Battery pack systems delivered

170,000 Sq. Ft. expandable to 213,000

IATF16949 Certified (as part of Bosch) quality management system

Zero PPM Quality performance for FCA, BMW, Daimler and GM

2021 Installed
2 GWh

Building capacity
7 GWh

With expansion
8 GWh



Proliance™ High Voltage Battery Family

The first in a series of standardized, flexible high voltage battery packs



Characteristic	Unit	T350-50	T350-100	T665-110
Voltage, Nominal	V	352	352	665
Voltage, Range	V	268 - 403	268 - 403	540 - 738
Energy, Total	kWh	52	104	110
Capacity	Ah	150	312	160

*All specifications are preliminary and subject to change



ABS Proliance T350-50, T350-100 & T665-110
First product available in late 2022



Coaches are not cars!

Automotive

- Single battery pack
- 330-350 V Nominal
- 50-100kWh energy
- 11.5-year / 150k mile vehicle life
- Generally short daily drive cycle
- 0.346kWh per 1 mile
- 200-300-miles per charge
- ~5.3k miles per year (average)



Coach

- Multiple battery packs
- 620-670 V Nominal
- 350-700 kWh energy
- 12+ year/250k mile vehicle life
- Long-daily drive cycle
- 2.1 – 2.8 kWh / mile
- 130 – 260-miles pre charge
- 19k - 22k miles per year (average)

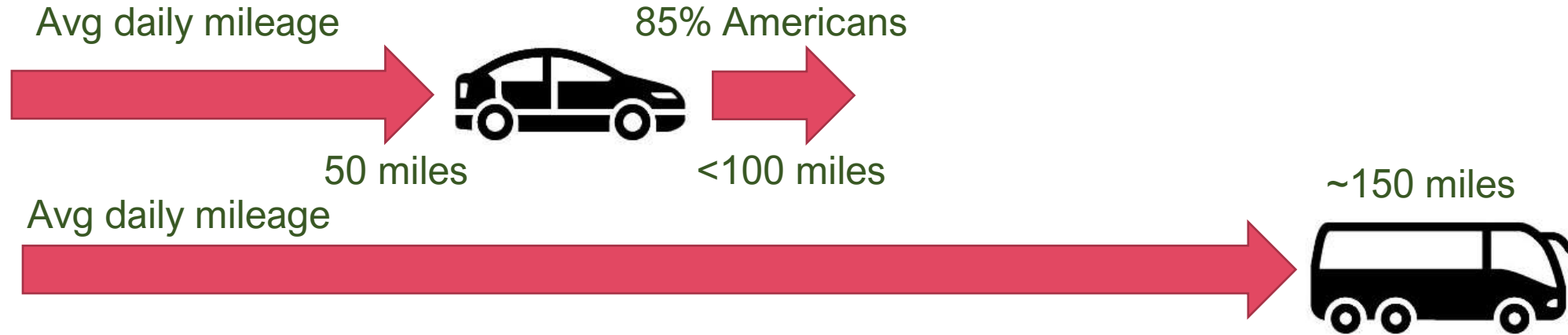


Coaches and buses have a much higher usage model than automotive EVs

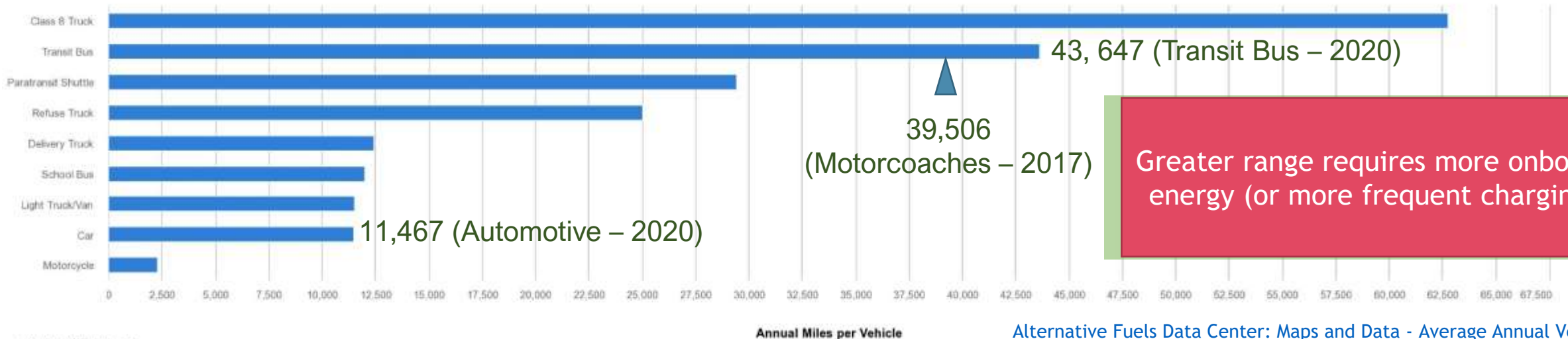
Battery systems must be designed to accommodate a more continuous operation model



Longer average driving range



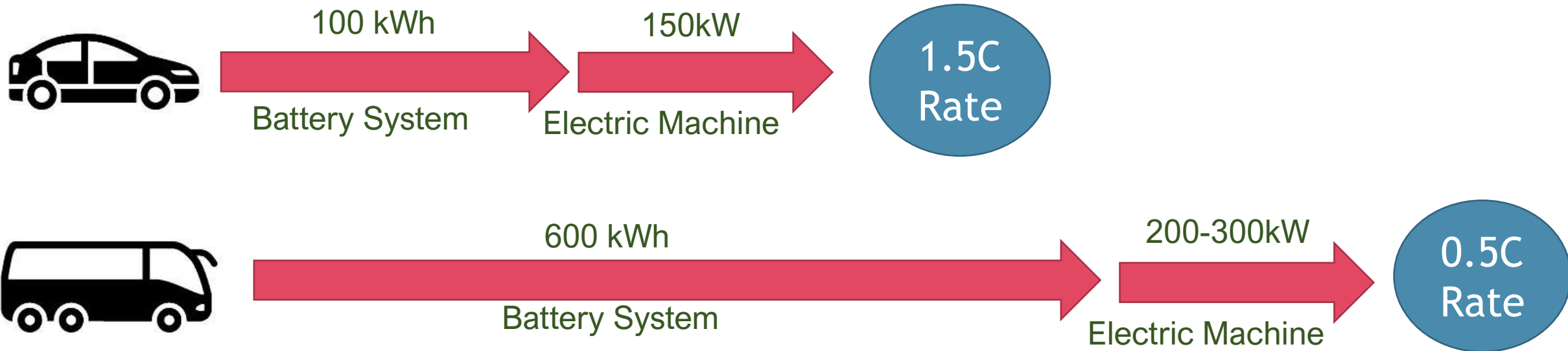
Average Annual Vehicle Miles Traveled by Major Vehicle Category



Greater range requires more onboard energy (or more frequent charging)



Larger battery systems reduces C-rate



Larger battery systems =
lower C-rates =
Lower heat generation, longer life

Optimize thermal management
system, current collectors, etc



Coach batteries mount differently



Automotive batteries mount under chassis, integrated into the frame



Coach batteries often mount in different positions - requiring additional shock and vibration analysis, as well as more detailed CFD liquid flow analysis

Coaches use available space - often make trade offs with baggage storage and axle weight



Future technology roadmap

Cell technologies

Near term technologies

- High nickel content – NMC/NMCA
- Higher silicon blended anodes
- High energy LFP
- Cobalt free cathodes

Mid-term

- Larger form factor cells
- Dry coating processes
- Tabless electrode

Longer term technologies

- Semi-solid state / Hybrid lithium-metal anodes
- Solid-state batteries (SSB)
- Anode-less SSB

Other technologies (may not be applicable to coach/bus)

- Na-ion
- High Mn content cathodes

Pack technologies

Cell to pack

Cell to chassis

Wireless BMS

Li-ion 24V/48V

