

Lion Electric Co.

Management Strategies for HD EV Drivetrain and Battery systems

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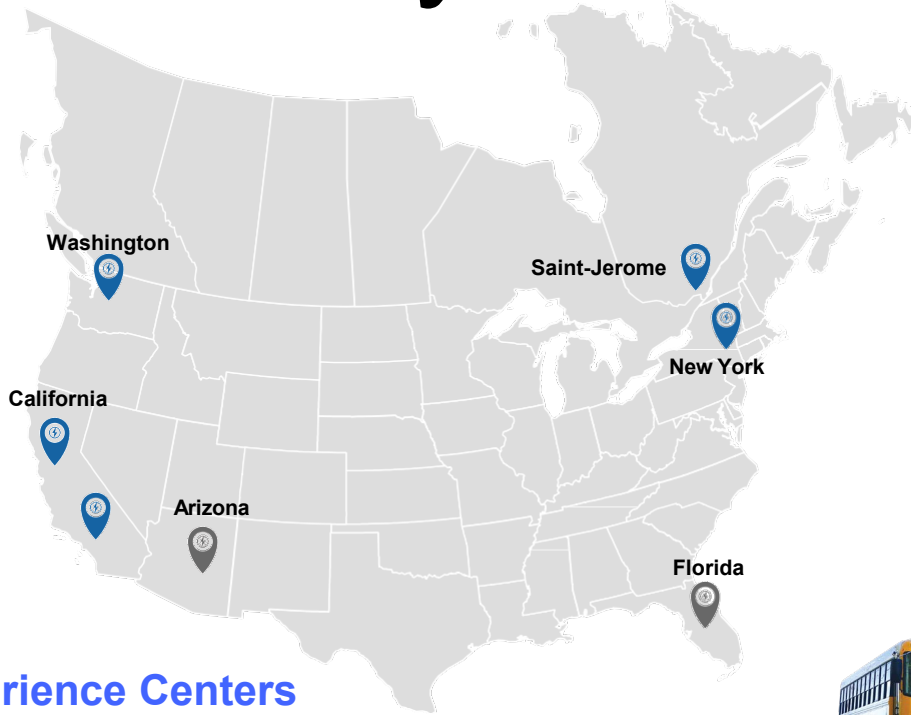
 **LION ELECTRIC**

An all-electric commercial
vehicle manufacturer

Created for, and special
thanks to:



Lion Today



Experience Centers

- Sacramento, California
- Albany, New York
- Los Angeles, California
- Seattle, Washington



350+ employees / 2,000 indirect jobs



2,500 electric vehicles per year manufacturing capacity



300+ electric vehicles in operation



More than 6 million zero-emission miles driven



EV timeline

2008



Lion was founded



2016



LIONC

C-Type 100% Electric

2019



LionM, Lion8, LionA

Minibus Shuttle / Paratransit

Class 8 Urban Truck

Mini Schoolbus

100% Electric

2020



Lion8 - Refuse

100% Electric

EV timeline

2020



LionD, Lion8 - Aerial

Type D School Bus

Aerial Truck

100% Electric

Q4 - 2020



LION8 – Tractor,
Lion6

Class 8 Tractor

Class 6 Urban Truck

100% Electric

2021



Lion5, Lion7, Lion8 – Boom, Ambulance

Class 6 & 7 Urban Trucks

Boom Truck

Ambulance

100% Electric

Journey: Real World Data

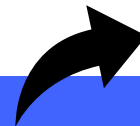


OEM DESIGN, ENGINEERING, TESTING

- Purpose Built vs Retrofit
- Generational improvements: 3rd generation
- Energy Consumption
 - Weather
 - Geography
 - Driver behavior
- Real Operational Cost Calculations

FLEET

- Routes
 - Type – fixed/variable
 - Actual mileage
 - Auxiliary Energy Consumption
- Operator Training
 - Understand & Accept the system
 - Robust training
 - Routine Feedback



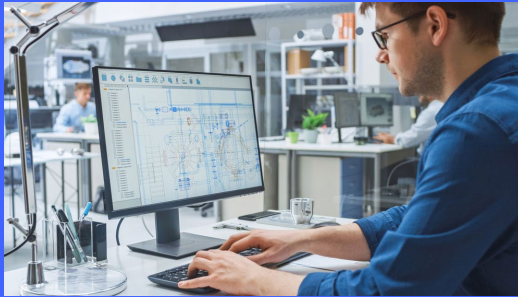
INFRASTRUCTURE – CHARGERS

- Power Available
- Type of chargers
- Cost of Energy
 - Daily changes in rates
 - Peak demand
 - Annual impact (SMUD)
- Develop a charging strategy

EV Truck Specifications



- ❑ Chassis & Body design:
 - ❑ Retrofit vs Purpose built : weight does not equal durability – Aircraft industry solved this 50 years ago.
 - ❑ Engineered to be lighter and stronger
- ❑ Hydraulics on an EV: more steps = more loss.
- ❑ Traction motors:
 - ❑ Liquid cooled
 - ❑ Phases



- ❑ Integrated safety systems: Cameras, ADAS
- ❑ Programable charge parameters
- ❑ Driver energy use profile



- ❑ Telematics with live feedback and alerts
- ❑ Brakes, suspension, auxiliary system
- ❑ Batteries
 - ❑ Types and applications for HD

Fleet Behaviors & Assumptions

- ❑ Route length vs loiter time – Track real data first!
 - ❑ Choose routes for success
- ❑ Driver behavior: impact upon range
 - ❑ Conservation of energy: the stop
 - ❑ Trackable, measurable: create a standard
- ❑ Importance of resiliency: Charger plan
- ❑ Range vs Battery size vs chargers
- ❑ Importance of Vehicle Life
 - ❑ Intersection between maintenance costs
 - ❑ Re-evaluate vehicle replacement schedule



Charger Infrastructure



- Charging strategies & designs
- Combine slow and fast charging
 - Leverage overnight slow charging
 - Focused demand chargers
- Understand and negotiate your rates
 - Time of use
 - Base Annual rates
 - Capturing grid capacity:
- CA fleets use LCFS credits
- Resiliency
 - Battery back-up
 - Solar / wind
 - generators



Battery Systems

- Battery Types
- Battery Degradation
 - Charging strategy impact
- Air Cooled vs Actively Cooled vs Liquid Cooled
 - What is best for municipal vehicles
- Battery Replacement Cost budgeting
- Battery Lives and repurposing
- The future: Energy as a service



The bright move

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