Lion Electric Co.
Management Strategies for HD EV Drivetrain and Battery systems

Presented by
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and
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Created for, and special thanks to:

LION ELECTRIC
An all-electric commercial vehicle manufacturer

Created for, and special thanks to:
Lion Today

Experience Centers
- Sacramento, California
- Los Angeles, California
- Albany, New York
- 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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