Member Webinar:

"Electrifying Ports Behind the Fence: A Deep Dive into Electric Terminal Trucks and Infrastructure" presented by Orange EV

We build better terminal trucks

Safer. More reliable. Lower cost.

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OrangeEV.com

Who are we?

Founded in 2012

> 1,200 deployed

> 275 fleets

> 15.8 million miles

#1 ELECTRIC TERMINAL TRUCK MANUFACTURER

Deployed nationally since 2015 initial production, across weather and duty cycles

- *In-market longevity and experience*
- *Company based in USA*
- *Trucks built in USA*
- *100% EV focus*

Growing exponentially since first deployment

- *"We come to you" service and support model*
- *75% greater uptime*
- *Real-time telematics*

Chosen by more than 275 fleets across 38 states, Canada, and the Caribbean

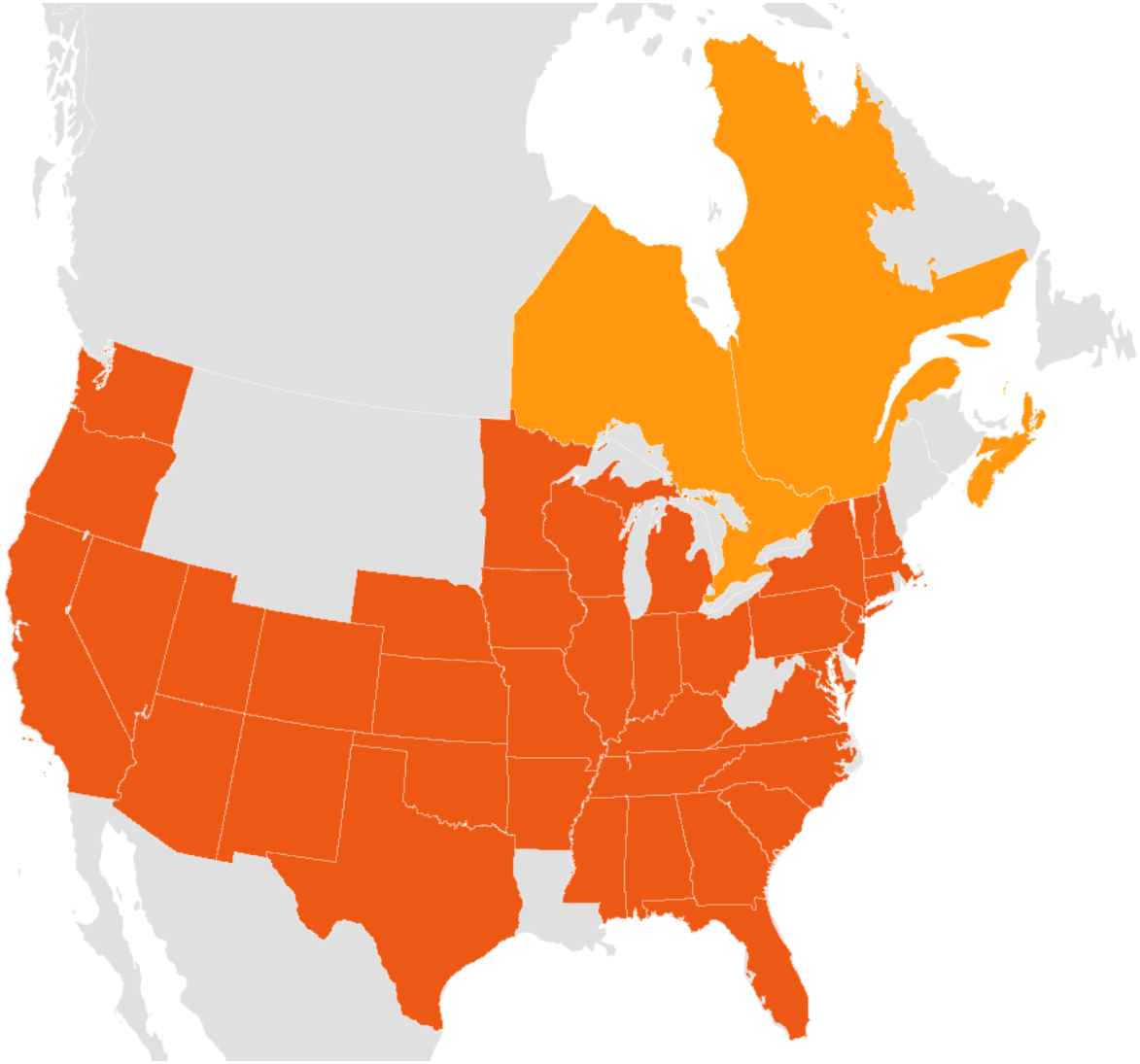
- *References and referrals available from other sophisticated, industry-leading customers*

Commercially deployed fleet has surpassed

15.8 million miles and 5.9 million hours

- *Designed for driver comfort and safety*
- *Smoother and quieter truck handling*
- *50% shorter stopping distance*

PROVEN ACROSS THE UNITED STATES AND IN CANADA



- ✓ Deployed in **38 states** across the U.S. and in **Ontario, Quebec, and Nova Scotia Canada**
- ✓ Working coast to coast in mission critical roles
- ✓ Proven to work in extreme temperatures, from frigid, snowy northern climates, to hot, dusty, desert environments in the south and west
- ✓ Multiple sites are 100% electric in their yard truck fleet with Orange EV trucks (i.e., no diesel yard trucks in use)

United States Deployments
Canada Deployments

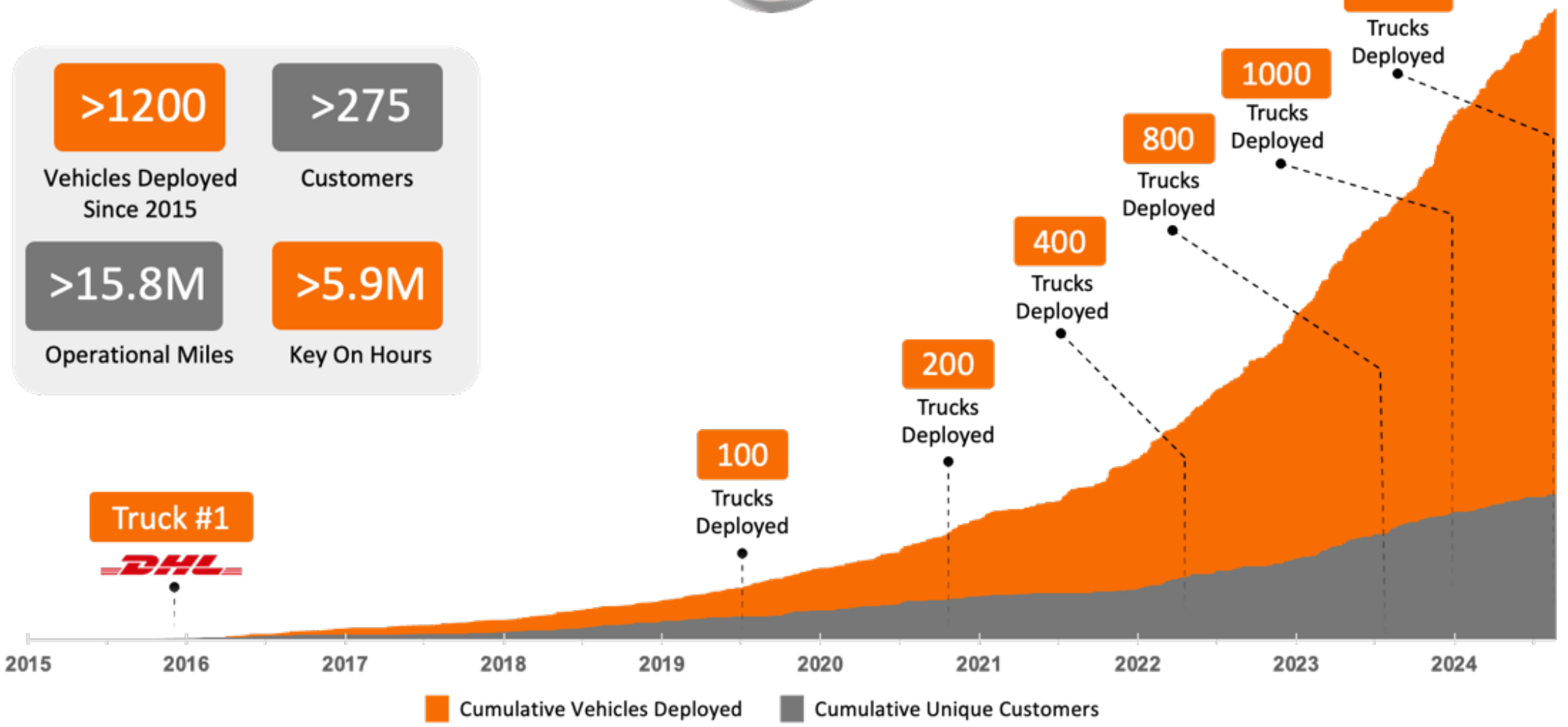
ACCELERATING VEHICLE SALES & CUSTOMER SUCCESS

>1200
Vehicles Deployed Since 2015

>275
Customers

>15.8M
Operational Miles

>5.9M
Key On Hours



BEHIND THE FENCE & OVER THE ROAD

Behind the Fence
Marine Terminals, Intermodal, Warehouse/Distribution Centers

Over the Road
Short Dray, Long Haul, Last Mile

EQUIPMENT SUPPORTING PORT CARGO MOVEMENT

Container Handling Equipment

- Ship to Shore Cranes (STS)
- Gantry Cranes
- Straddle Carriers
- AGVs
- Top & Side lifters/Forklifts
- Yard Trucks
- Drayage Trucks (Cargo delivery)

PORT OPERATIONAL DEMANDS

Ports are more complex and demanding than warehouses and distribution centers. **Battery Electric Yard Trucks must be engineered for these more demanding requirements.**

- Larger footprint – can be 400 acres plus
- Densifying/High-capacity utilization
- Productivity and equipment up time important
- Multiple shifts 8-12 hours with some 24x7 operations
- Ship, yard, and rail operations all have different energy consumption requirements depending upon speed driven, weight carried, and length hauled
    - Harsh operating environment (crane and lift operations, continuous operations, etc.)
    - Heavy loads often hauled over long distances (sometimes as much as 5 miles for on dock drayage)
    - Inclines, on ramps, and flyovers connecting to rail and satellite yards

WHAT IS NEEDED FOR SUCCESSFUL WIDE-SCALE ELECTRIFICATION?

For a successful electrification of Port Operations there must be a synchronization of equipment, charging solutions, and grid capabilities.

HUSK-E: PURPOSE BUILT FOR PORT AND RAIL OPERATIONS

HUSK-e for Rail:

- GCWR: 90,000 lbs
- Boom lift capacity: 60,000 lbs
- 32 MPH at full GCWR in < 60 sec.
- FOPS compliant; optional ROPS compliant container guard

HUSK-e for Port:

- GCWR: 180,000 lbs
- Boom lift capacity: 70,000 lbs
- 32 MPH at full GCWR in < 80 sec.
- ROPS/FOPS compliant

All HUSK-e Trucks

- 243 kWh battery pack
- 32 MPH top speed
- Charges in ~2 hrs with 100 kW CCS1 charger
- Continuous, full-length C-channel frame rails with full welds
- Customer-accessible telematics
- Liquid cooled motor

HUSK-E

Cab enhancements including larger windshield, increased leg room, and enhanced display

Four step entry

Powered, multi-view passenger-side mirror

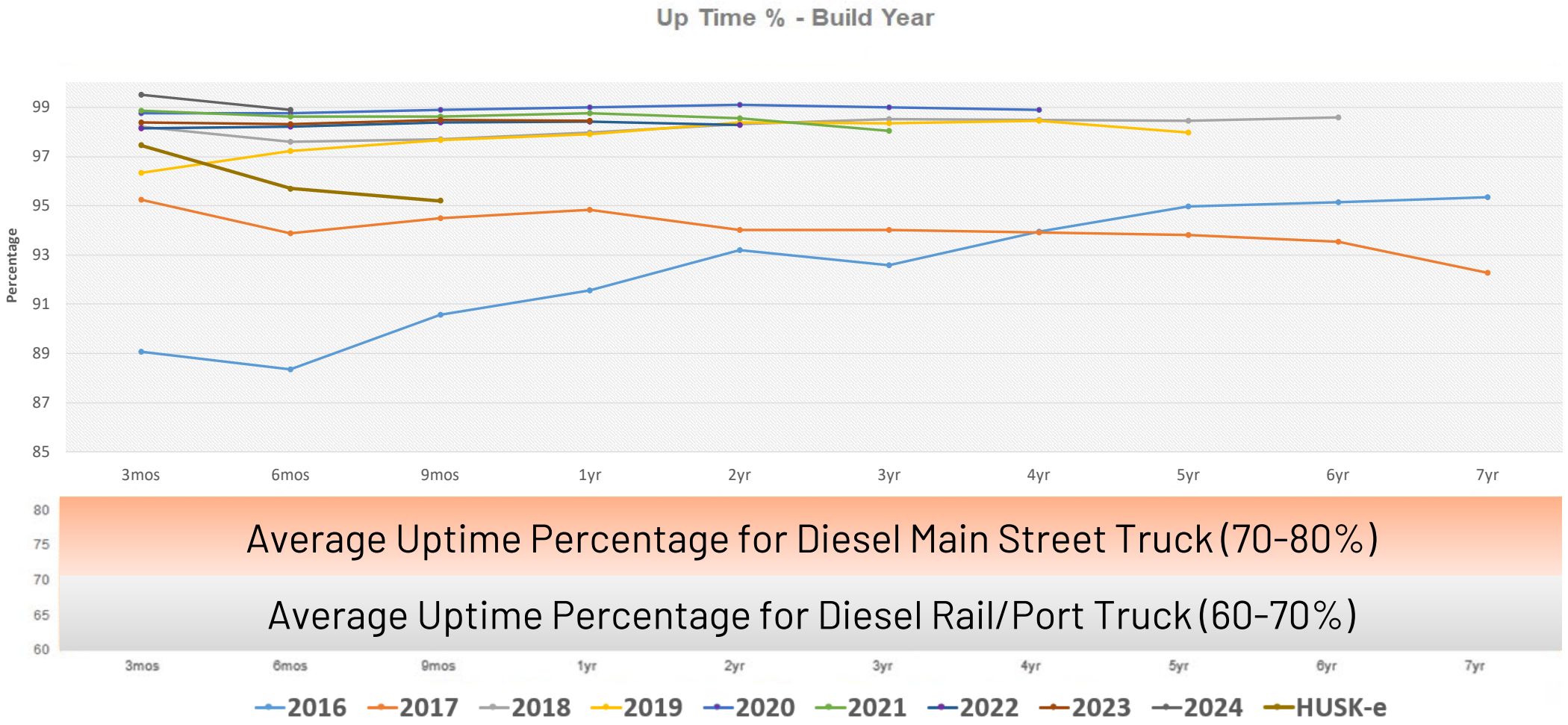
Heavy-duty bumper

FOR ELECTRIFICATION TO BE ACCEPTED, EQUIPMENT MUST PERFORM

- **Reliability Up Time (Higher vs. Diesel)**
- **Easy to Maintain and Repair (Training & Certification of Union workforce)**
- **Hours of Operation (Battery Life and Fast Charging)**
  - Meet duty cycle requirements (Multiple shifts, 16 HRS, 24x operations)
- **Productivity (Speed, Acceleration)**
- **Health and Safety (Better Driver Experience)**
  - Faster Braking
  - Smoother ride
  - No diesel fumes
  - Less heat
- **Must operate in harsh weather conditions**

ANNUAL E-TRIEVER & HUSK-E UPTIME PERCENTAGE

In-House Engineering and Direct Service Model Enables Industry-Leading Uptime



COMMITMENT TO PRODUCTION QUALITY

LFP Batteries and Yard Trucks: The winning combination

Apples-to-Apples Study

A recent study[1] performed at Sandia National Laboratory has shown Lithium Iron Phosphate (LFP) superiority versus Nickel Manganese Cobalt (NMC) and Nickel Cobalt Aluminum (NCA).

LFP Lasts Longer

As shown in the graph (left), most of the tested LFP cells lasted thousands of cycles longer than other chemistries, retaining greater than 80% of initial capacity.

[1] "Degradation of Commercial Lithium-Ion Cells as a Function of Chemistry and Cycling Conditions", Yuliya Preger et al 2020 J. Electrochem. Soc. 167 120532

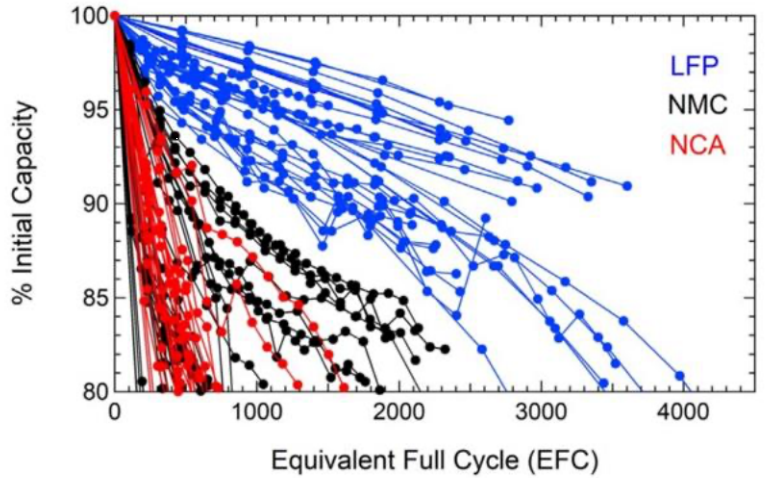


Figure 1. Discharge capacity retention for all LFP (blue), NMC (black), and NCA (red) cells relative to the initial capacity of each individual cell. Circles are data points from the capacity check at the conclusion of each round of cycling and lines are a guide to the eye.

	LFP	NMC	NCA
Can last 10+ years	✅	❌	❌
Retains 90% of capacity later in lifespan	✅	❌	❌
Does NOT contain cobalt or nickel	✅	❌	❌
More resistant to thermal runaway	✅	❌	❌

Compare Battery Chemistries

Compared to other battery chemistries (NMC and NCA), LFP is more durable and reliable, has better capacity-retention, and is safer and more environmentally friendly. Importantly, LFPs do NOT require complex cooling systems for safety and battery longevity.

LFP is the Best Choice

The battery is one of the most important components of a battery electric truck, and Lithium Iron Phosphate (LFP) is the superior choice for yard trucks.

Maintenance & Service: Data-Driven Improvement

Orange EV has an extensive database of all logged maintenance and service events across 1,200+ trucks, dating back to 2015

Total Fleet: > 15.8 million miles & 5.9 million hours
Early trucks exceeding 27,000 hours

Process:

Planned PM or issue identified and logged	Diagnosis	Service performed and issue resolved	Weekly Engineering & Service Team meeting
via telematics or customer call	via telematics, discussion, or site visit	by Orange EV service tech or by customer	**All** service events reviewed, root causes identified, and improvements planned for future builds

BATTERY DRAW

- **HUSK-e battery pack: 243kWh**
  - At 12% capacity truck enters 'limp mode' full function speed at 8 MPH
  - 214 kWh available energy
- **Battery Draw Impacted by three main factors**
  - Weight Pulled, Speed, and Distance
    - Regen braking impact and use of auxiliary power for heater/AC as well
- **Three basic types of Port Operations**
  - Pure yard work (Lighter average weights)
    - Most terminal operations between 15-25 MPH
  - Ship to yard and yard to ship (Various weights depending on vessel string)
  - On Dock Rail (Heavy and longer pull)

BATTERY DRAW EXAMPLES

Based on recent demos at Port terminal locations we are seeing ranges of battery draw

- Yard Operations: 9-12 kWh
- Ship Operations: 12-16 kWh
- On-Dock Rail Operations: 16-25 kWh

This range of draw can meet 17+ hours at low draw and 8 hours at high draw.

'Opportunity' charge with a 100kWh charger would provide a full recharge in around 2 hours. Even a 45-minute charge could result in an additional 4-5 hours of use.

OPERATIONAL DEMANDS AND OPPORTUNITY CHARGING

Shift Time	Yard Work	Ship Work	Rail/Heavy	Opportunity Charge @100kWh		
	9-12 kWh	12-16 kWh.	16-25 kWh.	1 Hr	45 Min	30 Min
▪ 8 hr Shift	Yes	Yes	Yes			
▪ 2X8 hr Shifts	Yes	Yes				X
▪ 10 hr Shift	Yes	Yes	Yes			X
▪ 2X10 hr Shifts	Yes	Yes		X		
▪ 24 hr Operations						
4X6 hr Shifts	Yes	Yes	Yes		X	X
3X8 hr Shifts	Yes	Yes		X		

Assumes 243 kWh Battery pack uses 88% of battery capacity, each category at highest kWh Draw

CHARGING SOLUTIONS – WHAT IS THE OPTIMAL SOLUTION?

- Plug In Conductive
- In Road Conductive
- Robotic
- Inductive (Bottom, Side)

Cost, infrastructure footprint, labor and operational requirements will determine the best options

CHARGING INFRASTRUCTURE IMPACT

GRID AND INFRASTRUCTURE CHALLENGES

For full-scale electrification and to handle peak charging periods, there may not be enough power in the grid to handle the requirements. What are the options?

Challenges in Ports for Micro Grids is space required for Solar and Wind Infrastructures.

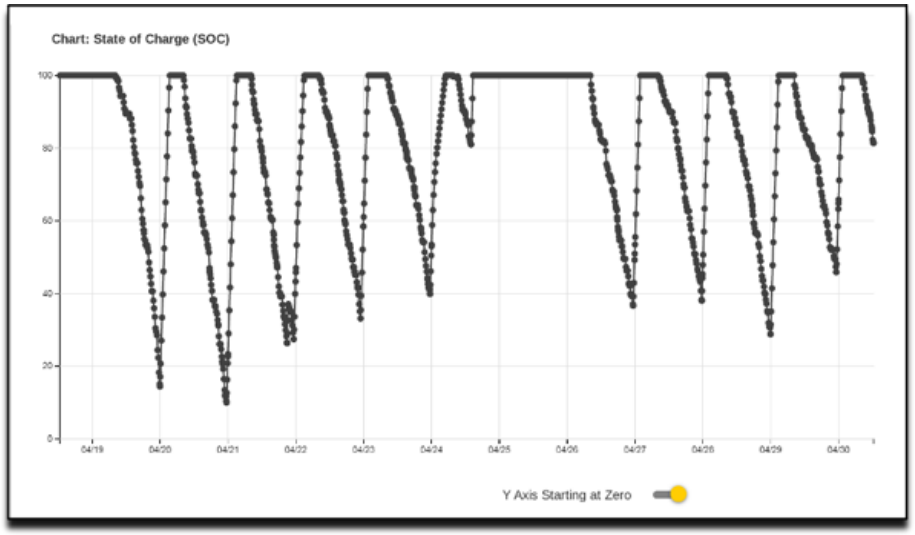
Fixed battery or mobile battery systems can provide supplemental power at peak times by drawing from the grid.

HOW DO WE PAY FOR ELECTRIFICATION & INFRASTRUCTURE

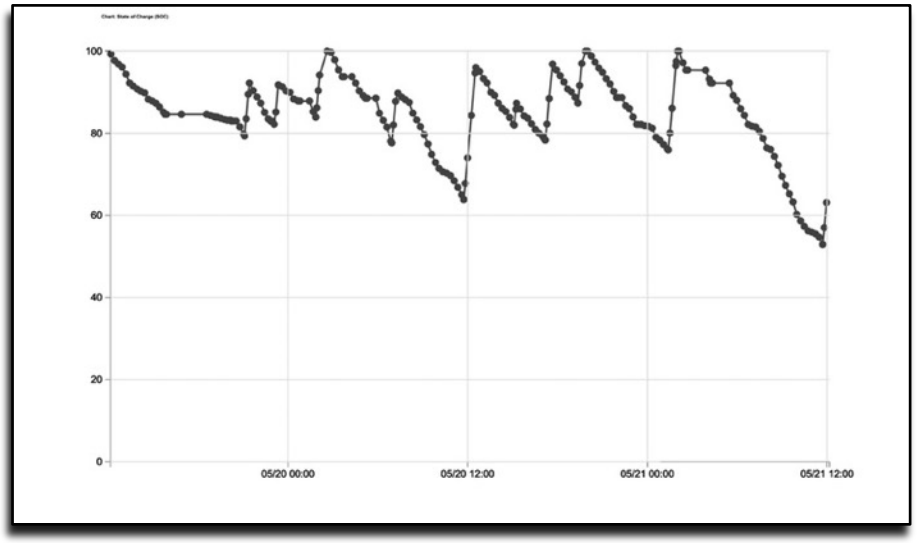
- Front-end investment costs are higher but long-term costs of ownership are attractive due to lower energy and maintenance costs. The more you use it, the faster it pays back!
- Grant and incentive programs to help offset costs:
  - EPA Clean Ports Program
  - DOT Carbon Reduction Program
  - FHWA Reduction of Truck Emissions at Port Facilities Grant Program
  - Various State-sponsored programs
  - IRS Credit $40k
- Rental, Lease, and Financing Programs

TELEMATICS

Access to real-time telematics including truck status and alerts, battery state of charge (SOC) data and history, truck usage (key-on hours, speed, distance, etc.), customizable reports, PM reminders, and more.



Example SOC without opportunity charging



Example SOC with opportunity charging

Capabilities

- GPS location on 15-minute timestamp or active events of key on/key off
- Battery State of Charge data and history via graph or export
- Truck usage: Distance Driven in miles, Key-On Hours via graph or export
- PM reminders: Set up to email - notify every 500 hours or show in portal
- Alarms for: TPMS/Temperatures on multiple systems/12V system

LOWER TOTAL COST OF OWNERSHIP

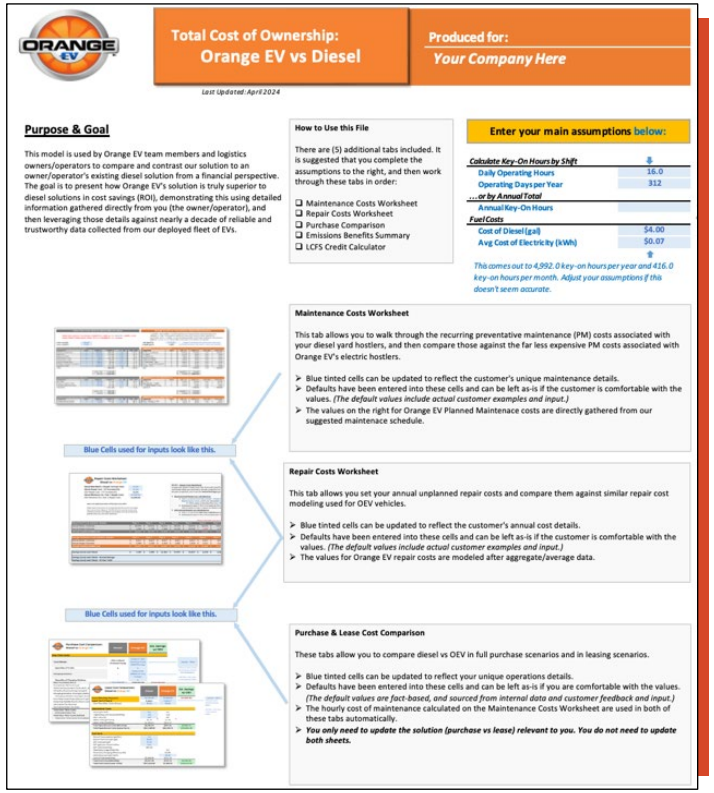
Full TCO model available to help quantify cost benefits of shift to Orange EV trucks

Hard Dollars:

- Diesel vs. electricity cost
- Maintenance savings*
- Downtime improvement
- DEF avoidance
- Haz Mat cleanup
- No more powertrain refurbs

Soft Dollars:

- Safety benefits
- Improved driver satisfaction



Customers report ~$2.50/hr of OEV operation vs. their diesel trucks at $5-9/hr, saving up to $90k annually on fuel, maintenance, and repair

CARBON REDUCTION IMPACT

- It is estimated that a diesel truck produces **45.9 metric tons of CO2 per year** operating at 3,000 hours and consuming 1.5 gal of diesel per hour.
- One EV yard Truck operating in California 3,000 hours per year at 6.5 kWh per hour and using an emissions factor for grid electricity in California of 0.225 metric tons CO2 MWh generates **4.39 Metric tons of CO2/yr.**
- **Orange EV has over 1,200 trucks in operation today and over 5M key on hours**

Better for the Environment, Better for the World!

Capacity to Deliver

440,000 square foot facility has capacity to deliver 2,400 units per year in a single shift, or 40% of the total US terminal truck market demand

New facility opened Summer 2023

- **Largest EV terminal truck production capacity in North America**
- **Supporting e-TRIEVER, HUSK-e, and future product development**
- **HQ, design, engineering, production, and support services at a single location**

Made in the USA

THANK YOU!

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