

# *Electric Yard Trucks: Viable Electrification of Fleets*

Mid-America Freight Coalition and the Institute for Trade and Transportation Studies – “Linking the Chain”

August 13, 2024



Most Deployed, 100% EV Heavy-Duty Truck in The World



We build better terminal trucks

Safer. More reliable. Lower cost.

[OrangeEV.com](http://OrangeEV.com)

2/14/24

# Accelerating Vehicle Sales & Relationships



>1110

Vehicles Deployed  
Since 2015

>260

Customers

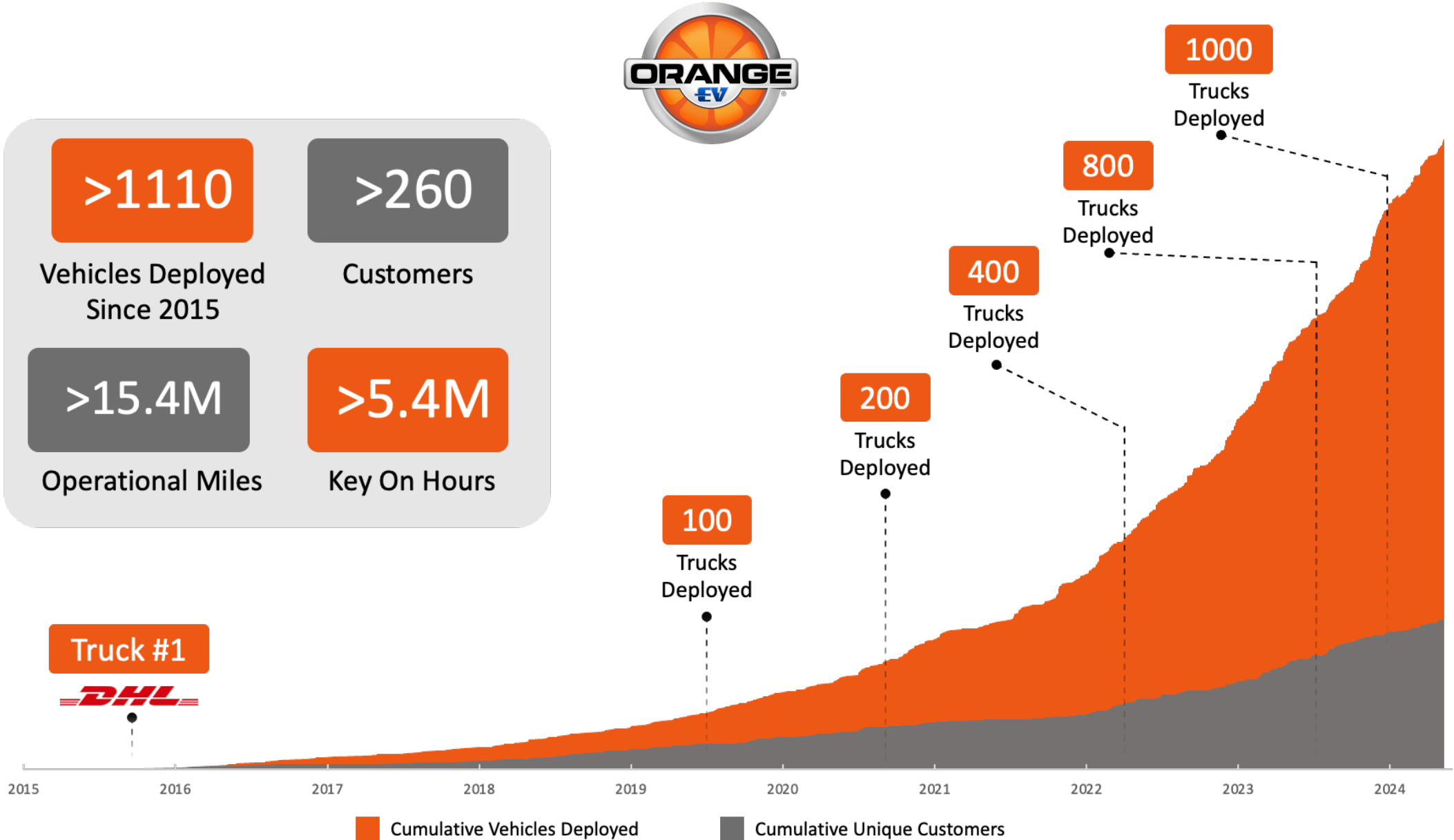
>15.4M

Operational Miles

>5.4M

Key On Hours

Truck #1





# #1 Electric Terminal Truck Manufacturer

**Founded in  
2012**

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*

**> 1,110  
deployed**

Growing exponentially since first deployment

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

**> 260 fleets**

Chosen by more than 260 fleets across 37 states, Canada, and the Caribbean

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

**> 15.4 million  
miles**

Commercially deployed fleet has surpassed 15.4 million miles and 5.4 million hours

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

# Proven across Goods Movement Operations

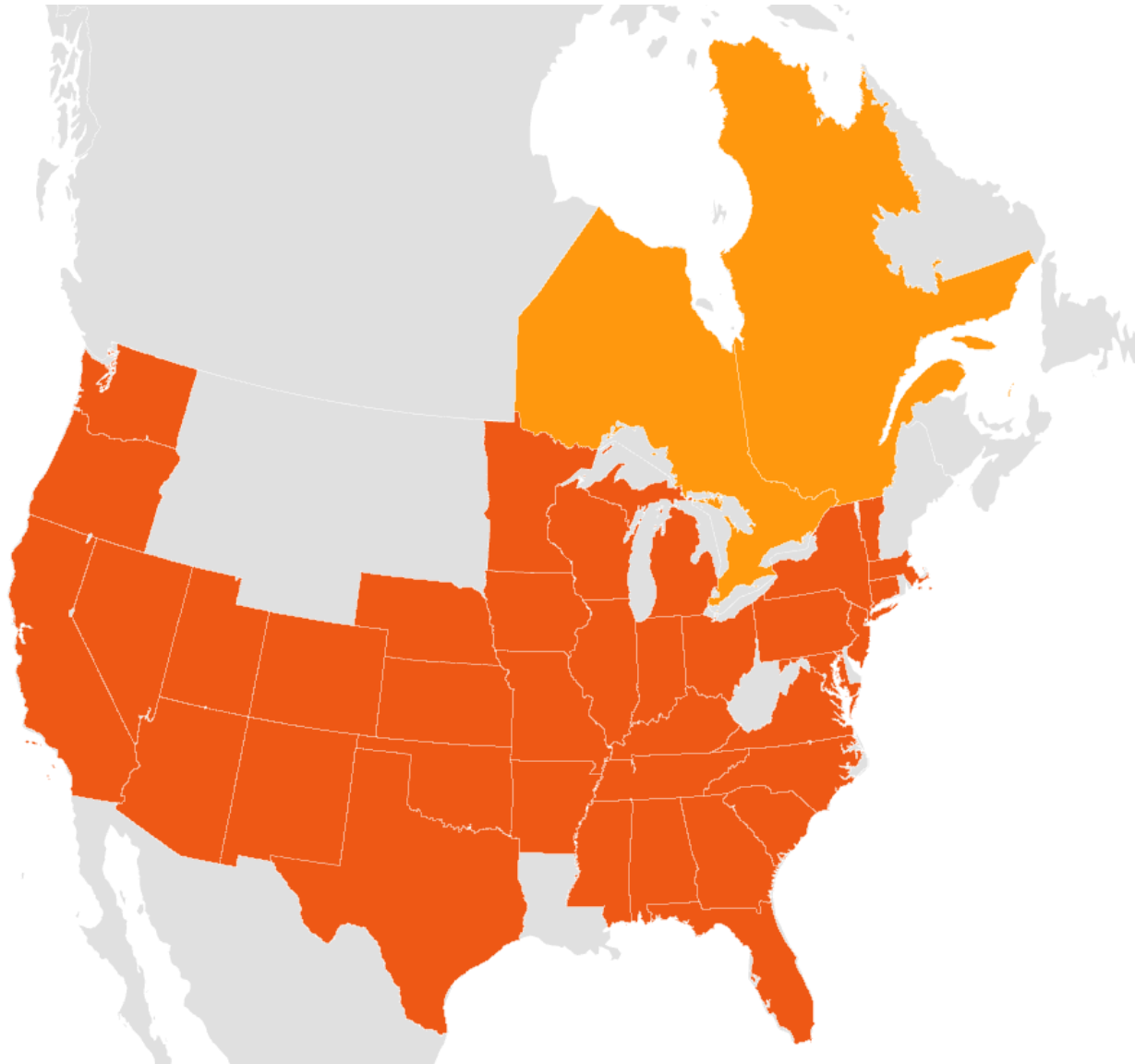


Orange EV trucks are working daily in all sectors of container handling, supporting 24x7 operations



Warehouse/DC  
Manufacturing  
Rail Intermodal  
Parcel  
Agriculture  
Seaport  
Waste Management  
3PL firms  
Cross-docking  
Spotting

# Proven across the United States and in Canada



- ✓ Deployed in **37 states** across the U.S. and in **Ontario and Quebec, 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

# Capacity to Deliver



**New 440,000 square foot facility has the capacity to deliver 2,400 units per year or 40% of the total US Terminal Truck market demand**

- **Opened Summer 2023**
- **New 36,000 square foot HQ offices completed in February 2024**
- **HQ, design, engineering, production, and support services at a single location**
- **Supporting e-TRIEVER, HUSK-e, and future product development**
- **Largest EV terminal truck production capacity in North America**



# Orange EV HUSK-e® Series

Built for the most demanding duty cycles, including **rail** and **ports**. **PRE-ORDER TODAY >>**



## HUSK-e Rail:

- GCWR: 81,000 lbs
- Boom lift capacity: 60,000 lbs
- 32 MPH at full GCWR in < 60 sec.
- FOPS compliant; optional ROPS compliant container guard



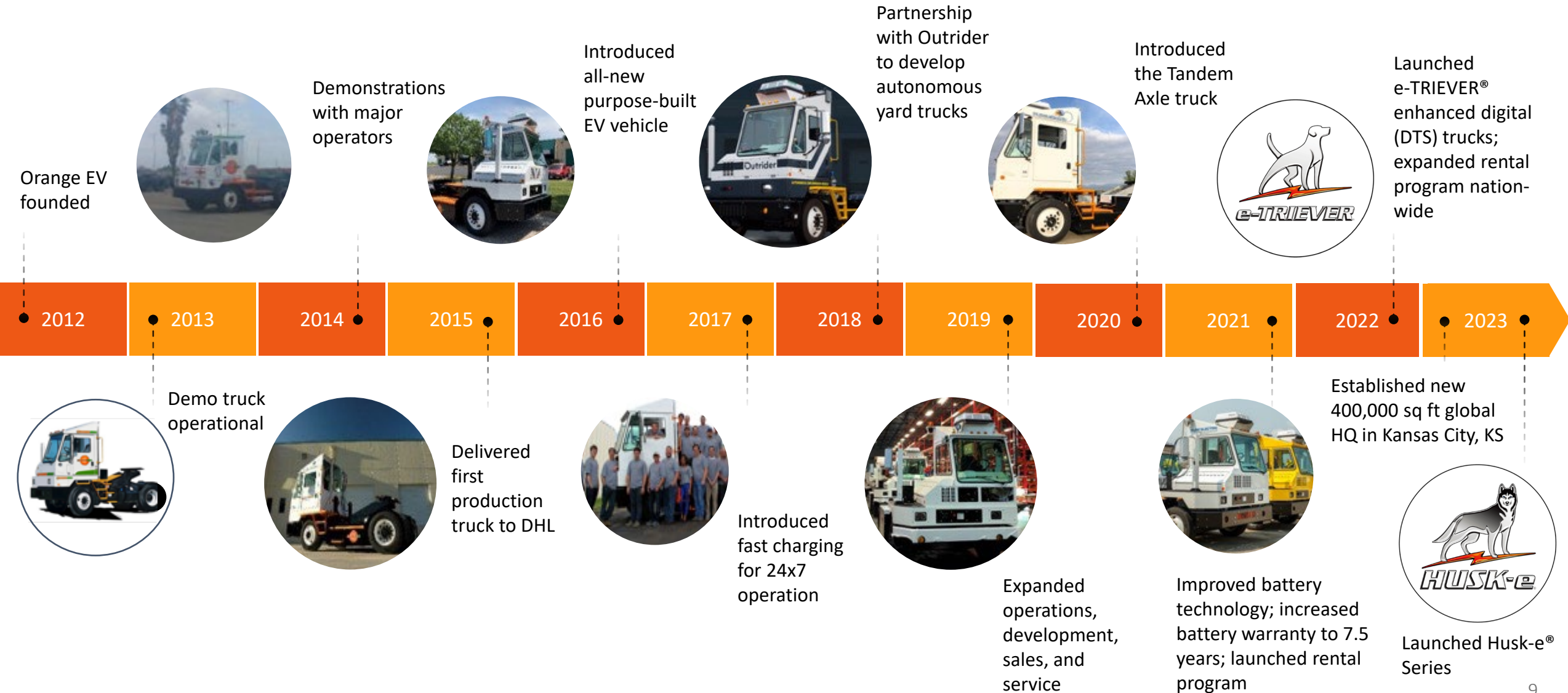
## HUSK-e Port:

- 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 105 kW CCS1 rate of charge
- Continuous, full-length C-channel frame rails with full welds
- Customer-accessible telematics with real-time data
- Liquid cooled motor

# Key Milestones



# Orange EV Pure Electric Terminal Trucks



- Safer, cooler, smoother, quieter, cleaner
  - Zero emission
  - No diesel engine, transmission, cooling, or emission control
  - All brushless induction motors
  - Regenerative braking
  - 50% shorter stopping distance
- Operate up to 24+ hours on a single charge
- Lower total cost of ownership
- Telematics provide real time operating data





# EV Trucks are our Future, But What About Right Now??

Brad Whäm

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# Agenda

- Environmental, Social, and Governance (ESG) Goals and Accountability
- Zero Emission Trucks as the Lead Solution
- Barriers (there are a lot)
- First Steps on a Path to Success
- Electrification Considerations

# Typical Barriers to EV Adoption

1. Range anxiety
2. Unproven technology
3. Higher up-front cost
4. ROI
5. Concerns about battery life
6. Driver skepticism
7. Utility Provider Lead Time
8. Product Availability

# Why EV?

Four quick questions to help frame this discussion:

1

How are diesels negatively impacting your business?

2

Why are you looking into electric?

3

What doubts do you have about switching to electric?

4

What does a successful EV deployment look like?

# ESG & Sustainability Goals Have Been Set

## Emissions and Greenhouse Gas (GHG) Examples

Reduce Scope 1 and 2 GHG emissions by 60% by 2025 compared with 2015

75% Reduction of Greenhouse Gases by 2030

Reduce corporate GHG emissions by 80%

Reduce GHG emissions by 25% by 2025 (baseline 2017)

Reduce our Carbon Footprint by 25%

Help reduce customers' GHG emissions by 20 million metric tons

Reduce carbon emissions (scope 1 and 2) by 40% by 2030

**What commitments have your organization made?**

# ESG & Sustainability Commitment Accountability



## **SEC Announces Enforcement Task Force Focused on Climate and ESG Issues**

Washington D.C., March 4, 2021

The Securities and Exchange Commission today announced the creation of a Climate and ESG Task Force in the **Division of Enforcement**.

## **SEC Proposes Rules to Enhance and Standardize Climate-Related Disclosures for Investors**

Washington D.C., March 21, 2022

The Securities and Exchange Commission today proposed rule changes that would require registrants to include certain climate-related disclosures in their registration statements and periodic reports... **The required information about climate-related risks also would include disclosure of a registrant's greenhouse gas emissions...**

**“...help protect investors from “greenwashing,” or exaggerated or false claims about ESG practices.”**

– SEC Commissioner Allison Herren Lee, May 25, 2022

# The Pressure is On

## Comments we hear:

- “We can’t wait until 2025 or right before reduction commitment date to suddenly replace our whole fleet”
- “Our CEO needs some tangible examples of success for investors, employees, customers, and other stakeholders”
- “I need some tangible examples of success and to be sure I’m not letting us fall behind our competitors”
- “Our company needs learning today. Give our operators and technicians time to get familiar with EVs”

**"Is there anything I can do (and get internal support for) today?"**

# Progress not a “Nice to have” but a “NEED to have”

## **Transportation/Trucking/Logistics:**

- A Primary Contributor to Emissions
- A Primary Opportunity for Improvements

The Solution? **Electrification.**

**But...**

# Barriers to Electrification

- **Love our current diesel trucks they're operationally superior**
- EV Trucks can't yet do the full job they are replacing
- **Upfront cost is much higher and our CapEx budget can't handle it**
- Our drivers have range anxiety and aren't comfortable being far from base
- **ROI takes too long and trucks require grants to pay back**
- Batteries are too heavy so we can't pull our full loads
- **Batteries don't provide enough range**
- Public charging network doesn't really exist yet
- **EV Trucks we thought would be ready are still in development**
- OEMs say it will be 1-2 years until we can get our first trucks
- **Utility companies say they need 2-3 years before they'll have capacity and infrastructure for us**
- Our consultants say that our infrastructure upgrade will cost \$3 Million so we've put everything on hold

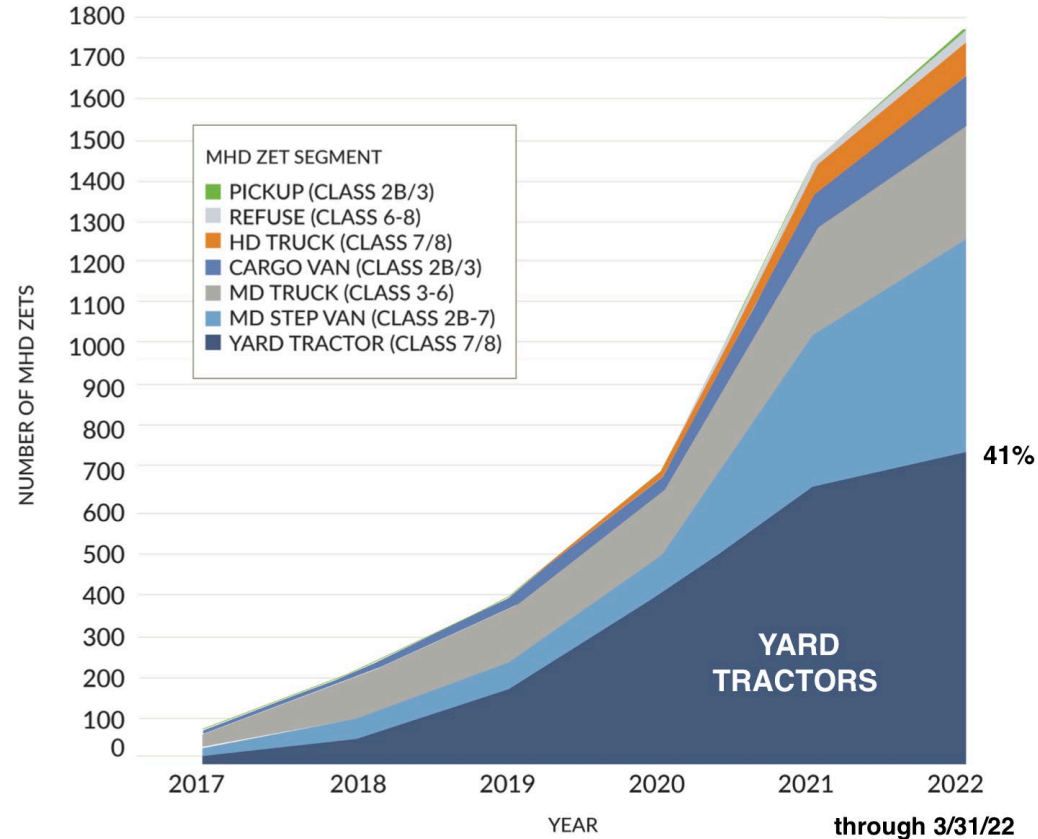
**Any of these sound familiar?**

# There is a heavy-duty truck that can be your first step

\*CALSTART “Zeroing in on Zero-Emission Trucks”

June 2022 Market Update

Cumulative U.S. MHD ZET Deployed Sales (January 2017 - March 2022)



**41% of ALL medium and heavy-duty zero-emission truck deployments in the US are YARD TRACTORS (YARD TRUCKS)**

# What's so different about yard trucks?

- Why are yard trucks converting to electric faster than all other truck types?
- What led NACFE to declare yard trucks as:

**“One of the best, if not THE best, vehicles for electrification”**



NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

# Electrification Consideration: Proven Success

- Deployed since 2015
- Just from Orange EV:
  - Over 1,000+ trucks deployed
  - In over 230+ fleets
  - More than 4.4 Million hours and 12.8 Million miles of use
- Delivering Trucks and Cabinets in 90 days from order
- **Why don't people talk about them more?** They're often behind the scenes.





## Where are Fleets Deploying Yard Trucks?

- Warehouses
- Distribution Centers
- Manufacturing Plants
- Agriculture Sites
- Recycling/Waste Centers
- Cross-dock Operations
- Rail Intermodal Sites
- Ports
- and more...
- Hot climates
- Cold climates
- Snowy climates
- Rainy climates

# Proven and Preferred

By these customers and more:



**RMS**  
Rail Management Services



# Proven and Preferred

By these customers and more:



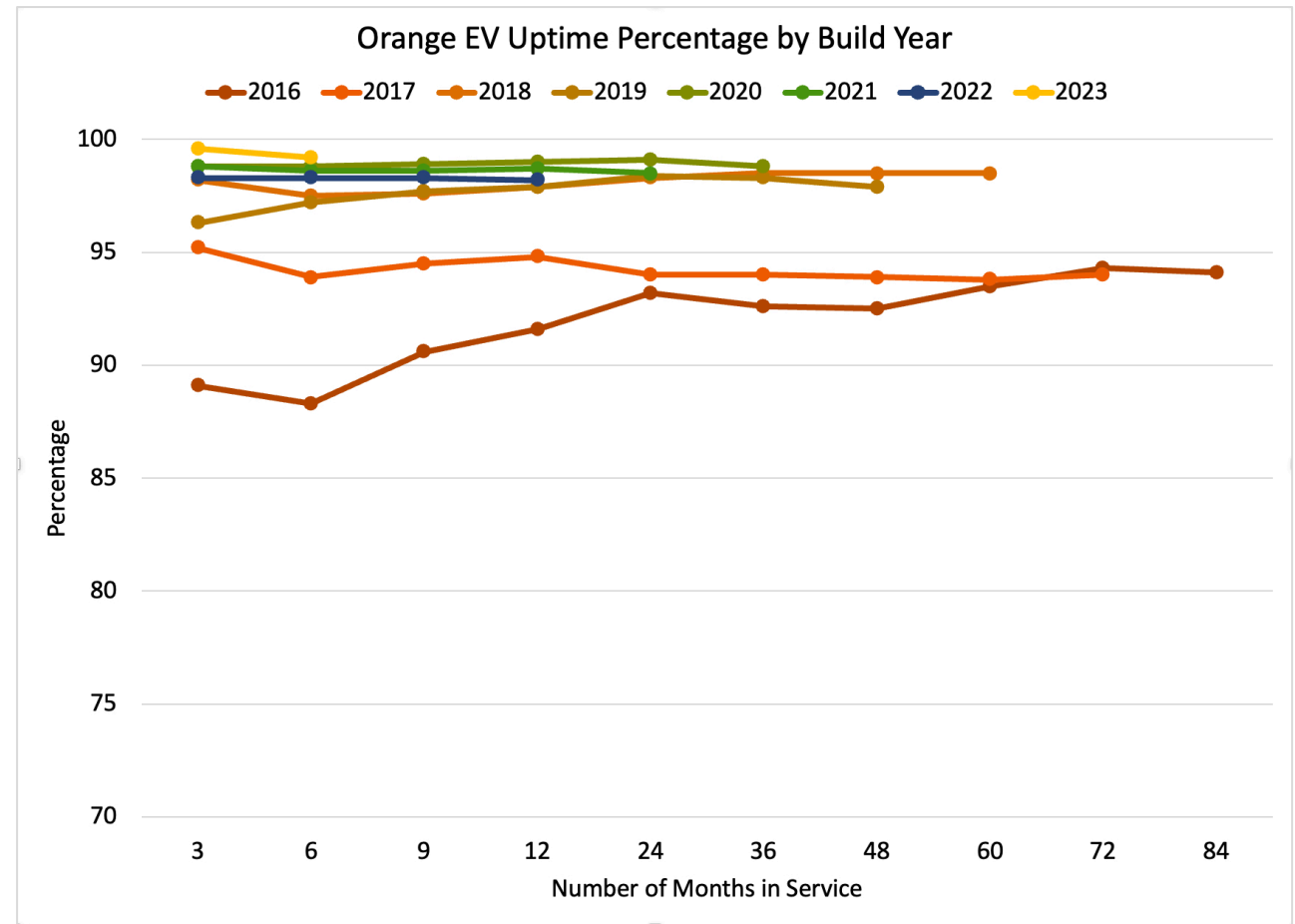
# Electrification Consideration: Range Anxiety

- Trucks and chargers stay in the same lot!
- Yard trucks rarely go far from home base so are never far from their charger
- Most common reason for diesel trucks to leave their lot is to go to the fueling station, which isn't necessary with EVs



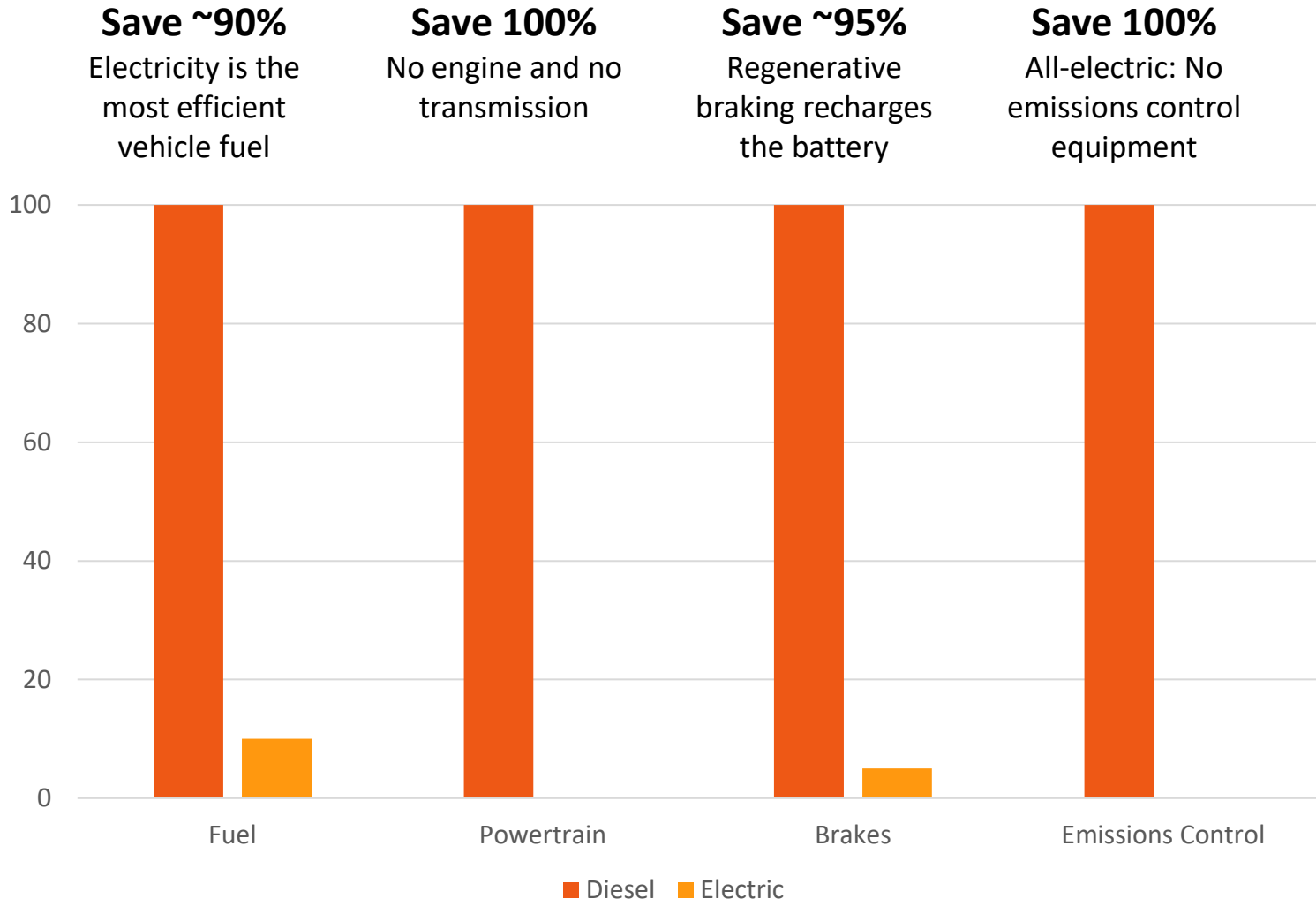
# Electrification Consideration: Uptime vs. Diesel

- Diesel versions with latest emissions-reduction technology break down often and can take a long time to repair
- Diesel versions are loud, lots of vibration, driver breathes plenty of exhaust when hooking/unhooking trailers
- Orange EV trucks in 2015 were around 90% uptime versus diesels often in the 75% uptime range
- Current Orange EV trucks average 98%+ uptime with 8 years of data.



*Percent uptime represents the average percentage of in-service days for trucks in their respective build year. Out-of-service events are counted as at least 1 day of out-of-service even if, for example, the truck is only out of service for 1 hour. Note that uptime percentages are calculated using only repair orders handled by Orange EV service. Repairs done externally by customer or third party without notifying Orange EV are not incorporated.*

# Reduced Costs



Save even more on a broad range of diesel-related costs including:

- Liability/work comp
- Safety
- Health care
- Absenteeism/retention
- Fuel management
- Emissions compliance
- Tier-related downtime

## Electrification Consideration: Investment Payback

- Diesel yard trucks are especially inefficient with constant start/stop and plenty of idling
- Diesel yard truck costly breakdowns are mostly from engine, transmission, radiator, and emissions aftertreatment systems. EV yard trucks don't need any of those parts.
- Common for a yard truck to be used 2 or 3 shifts per day for EV version's fuel and repair savings to add up fast
- Fuel savings alone could be \$50K+ per year. Repair/maintenance and other savings are significant, too.

**7280 hours** (20 \* 7 \* 52)

Electricity 7 kWh/hr      \$0.11 /kW      \$5,606

Diesel 1.5 gal/hr      \$5.25 / gallon      \$57,330

**\$ (51,724) Savings from fuel alone**

- Lease options available to avoid upfront payment and cost less than diesel from the start

What can “help”?



# Regulation and Grants

# Grants & Incentives change the economics



	DERA	CORE	TX REBATE	NJ ZIP
Scrap Required?	Y	N	N	N
Approx Yard Truck Savings	\$ 150,000	\$ 120,000	\$ 150,000	\$ 175,000
Add'l for EVSE/Infrastructure?	Y	Y	Y	N
Savings Timing	Reimbursement	Upfront	Reimbursement	Upfront

- **Cost becomes very similar to diesel version**
- **Payback becomes almost immediate**

## Electrification Consideration: Batteries

- EV yard trucks don't need massive battery capacity so the trucks can weigh very similarly to diesel versions (load restrictions aren't an issue)
- Orange EV Battery Warranties are already at 7.5 years and potentially up to 50K hours of use, which is longer than most fleets run their diesel trucks.
- Current battery technology is already supporting fleets operating 24/7, with charging taking place only during driver break times



# LFP Batteries and Yard Trucks: The winning combination



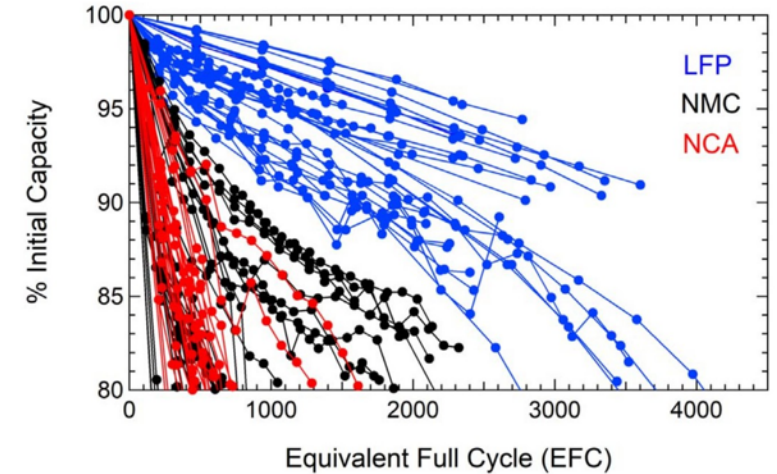
## Apples-to-Apples Study

A recent study<sup>1</sup> 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.

<sup>1</sup>"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.

# Batteries: Proven to go the Distance

Orange EV trucks operate very efficiently, achieving high use time per kW

- Hours per charge vary based on site conditions, load, speed, distance traveled, etc.
- Opportunity charging makes a full recharge more efficient

Batteries have been in use 7+ years and all trucks are still on their original battery pack. Multiple trucks have > 23,000 hours with batteries measured above 80% SOH.

- **Battery warranty: 7.5 years** or
  - 220,000 kWh (100kWh battery)
  - 396,000 kWh (180kWh battery)
  - 410,000 kWh (243kWh battery)
- End-of-life recycling plan options available

## Operating hours on a single charge

*Examples from current fleets. Figures are based on available kWh before reaching “limp mode”.*

### **e-TRIEVER® Extended Duty (180 kWh) Battery:**

Muni Waste Transfer & Consolidation <i>- Low speed, long idle times</i>	<b>36.8 hours</b> (4.3 kWh)
3PL Global Distribution <i>- Moderate speed and load</i>	<b>30.5 hours</b> (5.2 kWh)
National LTL Freight <i>- Moderate speed and load</i>	<b>27.5 hours</b> (5.8 kWh)
Global Manufacturing Spotter Services <i>- Fast pace, high use, rough lot</i>	<b>17.6 hours</b> (9.0 kWh)
National Rail Intermodal <i>- Top speeds, heavy loads, large rough yard</i>	<b>13.5 hours</b> (11.7 kWh)
Global Retail Distribution <i>- Top speeds, long moves, large yard</i>	<b>12.8 hours</b> (12.4 kWh)

### **e-TRIEVER® Standard Duty (100 kWh) Battery:**

Regional Trucking <i>- Slow pace, long idle times, small lot</i>	<b>17 hours</b> (5.2 kWh)
---------------------------------------------------------------------	---------------------------

# Electrification Consideration: Using Current Electrical Infrastructure

- Yard trucks could operate on chargers that require a fraction of the electrical capacity of over the road trucks.
  - 22kW for 1-2 shift operations
  - 70kW for 3 shift operations
  - Compare to chargers at 250kW and 350kW or discussion of 1M (megawatt) chargers that would require **10X to 40X the electricity**
- Demo and Rental trucks move to new sites every week and can be up and running same day
- **Utility company engagement is the rare exception on Orange EV yard trucks**

# Electricity-Related Savings from the Right Charging Solution



## Requires less grid power supply

Lower maximum power draw chargers allow for more chargers (trucks) to be supported on existing building power supply



## In-building infrastructure less expensive

Max output of 22kW or 70kW chargers keeps wiring/cabling and breaker costs much lower than a 150kW-350kW charger



## Cost of Charger itself

Orange EV chargers are about \$10K, compared to other Chargers that range from \$30K-\$50K+



## Peak Demand Multiplier Cost

High kW chargers can drive peak demand charges

# EV Yard Truck Case Study



Bolthouse Farms faced an aging diesel fleet with increasing downtime. Due to increased costs and regulatory pressure, they looked to electric. Bolthouse commercially deployed three (3) Orange EV pure electric yard trucks in April 2018. Deploying a new diesel yard truck at the same time allowed for direct cost comparison.

Key findings:

**Reduced downtime**, tracked over 2-year period:

- 261 hrs/yr (diesel) vs. 67 hrs/yr (Orange EV electric)
- **75% reduction**

**Reduced maintenance and repair costs:**

- \$3.93/hr (diesel) vs. \$0.78/hr (Orange EV electric)
- **80% reduction**

# You CAN Make Great Strides Toward Emission Reductions Today

- Understand sustainability goals and accountability
- Address or avoid common barriers that can delay electrification
- Take first steps to start learning today
- **Have tangible examples of ESG progress and impact to make your whole organization proud!**



# Lease Program

Orange EV Operating Lease programs are helping fleets to deploy 100% electric, zero emission yard trucks, providing a financial and operational boost while realizing the many benefits Orange EV trucks have to offer.

## Turnkey Solution

- ✓ Trucks built to fit your needs
- ✓ Charging equipment included
- ✓ Operator training
- ✓ Truck telematics

## Lease Benefits

- ✓ Flexible monthly leasing terms
- ✓ Increase cash flow
- ✓ No capital outlay
- ✓ Eliminate residual risk
- ✓ On-site maintenance plans available

# Rental Program

Orange EV provides a turnkey solution that includes truck, offboard charging cabinet, and onsite driver training.

Experience best-in-class truck utilization and reliability, zero-emissions, and rental costs that are competitive with diesel alternative rentals.

- Minimum 1-month rental requirement
- Schedule a call to take get an Orange EV 100% electric yard hostler rental cost comparison to an IC rental truck



## Truck Specifications:

- ✓ *Single Axle/Extended Duty*
- ✓ *Enhanced Charging Cabinet*
- ✓ *On Road / DOT*
- ✓ *GCWR: 81,000 lbs*
- ✓ *WB 122"*
- ✓ *High Torque 18 MPH max*
- ✓ *A/C & Cold Weather Package*
- ✓ *Air Ride Cab*
- ✓ *Air Ride Heated Driver Seat*
- ✓ *Heated Mirrors; Passenger Side Motorized*
- ✓ *Truck Telematics*

# Demo Program

Why have fleets across the U.S. switched to Orange EV pure-electric yard trucks? Find out why with our demo program. A demo provides first-hand analytics of the Orange EV value proposition. Put Orange EV into action at your facility to meet the demands of your site and duty cycle.

With each demo:



Orange EV conducts on-site training and talks with drivers, maintenance crews, fleet managers, safety teams, and other key personnel to ensure your team understands our trucks.



A portable charging cabinet is delivered with each Orange EV truck. Our team works to ensure that you have everything needed to begin operation.



Demo data is gathered via on-board telematics (standard on every OEV truck) and shared upon demo completion, giving a picture of the yard perhaps never seen before.





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[OrangeEV.com](http://OrangeEV.com)

# Battery End of Life Plans

Orange EV batteries come with a warranty of 7.5 years or

- 220,000 kWh (100 kWh battery pack) useful life cycle
- 396,000 kWh (180 kWh battery pack) useful cycle life
- 410,000 kWh (243 kWh battery pack) useful cycle life

If batteries need replacement during the warranty period, Orange EV will handle at no cost to the customer. If batteries need replacement sometime after the 7.5-year warranty period, customers may:

- Swap and update for a brand-new battery. Current pricing:
  - 100 kWh battery pack: \$45,000 + transport
  - 180 kWh battery pack: \$80,000 + transport
  - 243 kWh battery pack: \$105,000 + transport
- Recycle the old battery. Current estimates (excluding packaging and transport) from  Li-Cycle®
  - 100 kWh battery pack: ~\$1,100
  - 180 kWh battery pack: ~\$2,000
  - 243 kWh battery pack: ~\$2,700

*Note that by the time fleets need to address this issue, there will likely be more and better options available. Costs are expected to decrease, and second-life/recycling options should be more plentiful.*



# Cold Weather Operation

OEV trucks have been proven over years of winter operation in MN, NY, IL, Canada, and more

In cold weather, fleets no longer have to deal with:

- Gelled diesel fuel
- Cold diesel engines that won't start
- Extended idling
- Increased emissions

For EV cold weather operations, fleets should consider:

- Spec'ing battery size to account for additional power consumption from battery and cabin heaters (could be 4-9 kW)
- Keeping trucks plugged in when not in use
- Opportunity charging to keep battery state-of-charge high

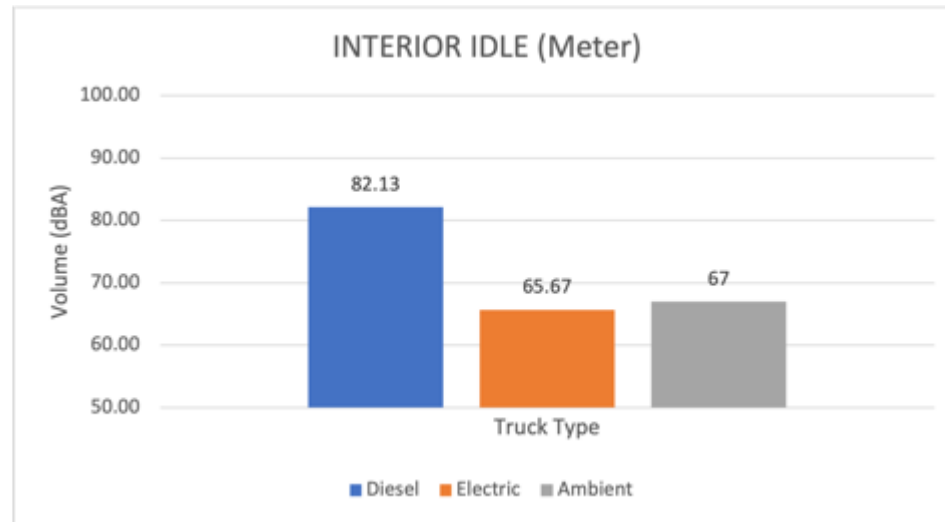
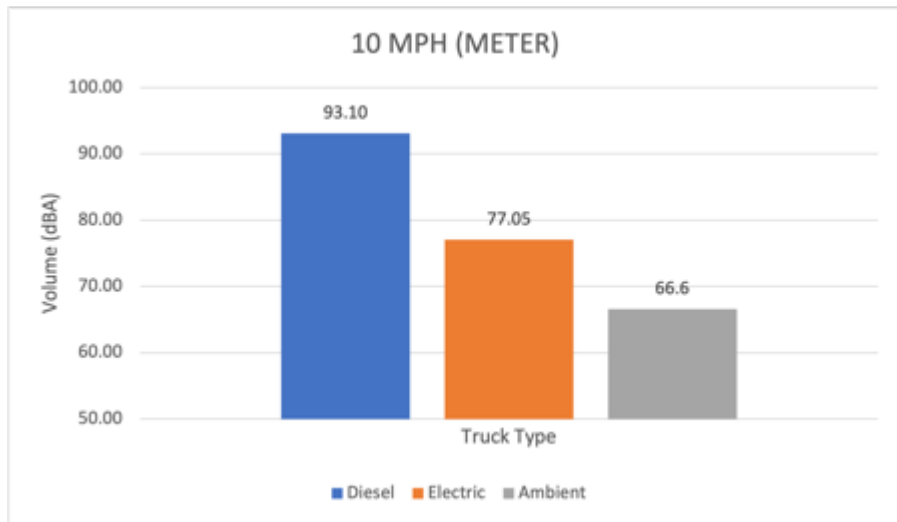
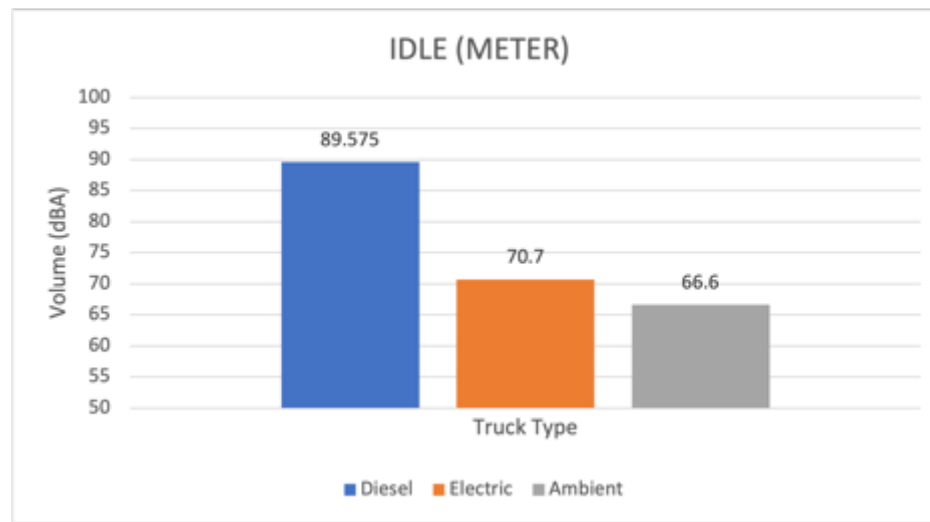
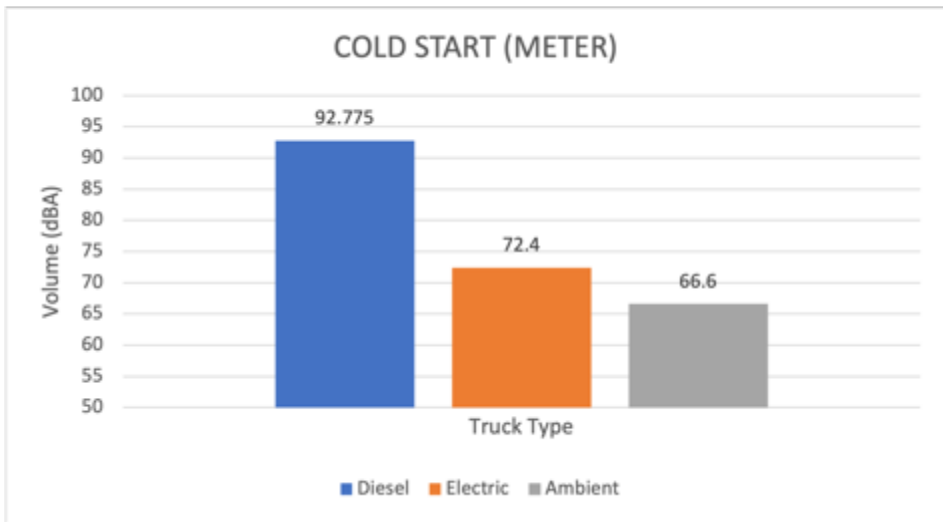
Orange EV trucks have:

- 781,000 hours of operation in cold climates as of June 2023
- 1.7-2.7kW battery pack heater consumption that auto turns on when min cell temp at 57°F
- 2-6kW in-cab heat system for driver comfort and defrost
- DCDL for increased traction
- Winter-ready components/options: Heated seat, heated mirrors, perforated platform, special hydraulic fluid, 4-step design, floor mat



# How Loud? Orange EV Electric vs Diesel

*Orange EV e-TRIEVER® trucks are dramatically quieter than their diesel counterparts, providing a safer, healthier environment for operators, site personnel, and the surrounding community.*



*Data was collected by Orange EV using a decibel meter. Each test was conducted 6 feet away from the vehicle, capturing peak volume data within a 10-second frame. For more details, contact Orange EV.*