Richard Lewis – Aviation Sector Sales director

Ex Royal Navy marine Engineer

18 years in the refueller industry – Fluid Transfer – Flightline Support – Skymark 🙌 – Titan

Supplied 1st ‘modern’ electric refueller to Paris CDG 5 years ago

Joined Electra in September 2024


ELECTRA™
LJ73 CJV
Fully Electric and Hydrogen Fuel Cell Electric Vehicles by Electra

GROUND BREAKING COLLABORATIONS

ELECTRA™

2017 Creation of Electra - Production of first Mercedes platform vehicle

1 of only 3 companies World-wide to be supplied Glider chassis by Daimler

Global warranty carried over from Daimler

Small series type approval gained & Full EU road homologation

UK's 1st hydrogen fuel cell vehicle in operation

Global oil company , global approval of chassis for airside refuelling

Building chassis for applications in the Nordics to the Middle East

Global distributor/partner network

More electric 'Electra' Mercedes chassis than Mercedes

Vehicles now in their 7th year of operation

They just work !

WHO ARE WE?

ELECTRA™

100% Electric commercial vehicles for a cleaner future

- Electra creates fully electric, and hydrogen powered commercial vehicles for a global market and a cleaner future - all based on OEM glider chassis platforms.
- All our vehicles are small series type approved.
- 100% Electric (BeV) or Hydrogen Fuel Cell Electric (FCeV) Commercial Vehicles.
- 16,500lbs – 97,000lbs tonne weight range.
- Electra provides the ultimate clean vehicle technology combined with a body to your exact specification, supported by a high-quality maintenance package – we build to your specification!

Thermally managed operating temperatures from -22F to +140F

DAIMLER

IVECO

ISUZU

DENNIS EAGLE

NEW FACILITY

Increased capacity and workspace

- 21 bays
- New training room

Operational Efficiency

- Improved processes
- Shorter production lead time

Innovation and communication

- Enhanced collaboration
- Promotes new initiatives

Meeting demand

- Supports growing market
- Electra Exchange

A SELECTION OF OUR CUSTOMERS

ELECTRA™

BASILDON FLEET DATA SUMMARY

ELECTRA™

6 vehicles
over the last
6 months in service

Average daily
50 miles

Average return to
depot state of charge:
44.5%

Average daily
energy use:
87 kWh

Average daily
$29.05

Deliver-E Chassis

ELECTRA™

ISUZU base chassis

- 105 kWh - 140 kWh thermally managed batteries
- Completely modular design
- Tare weight of electrified chassis – 7,231lbs
- Giving payload parity with diesel equivalent
- 1200 NM DANA motor
- Can be built in any desired chassis length – 19,500 lbs GVW
- Available in right/left hand drive

SECTORS: Final Mile, Waste & Utilities, Traffic, Motorway /Highways Maintenance, Tipper, Drinks Logistics.

eCompact Chassis

ELECTRA™

DENNIS EAGLE Base Glider chassis

- Adaptability and flexibility
- 19t 4x2, 27t 6x2 chassis available
- 3-year chassis warranty
- Electra can build up to
  420 kWh on these platforms

SECTORS: RCV, Waste & Utilities, Local Authority, Airside

eStar Chassis

DAIMER TRUCK AG / MERCEDES BENZ Base Glider chassis

This chassis already exist in the USA under the Freightliner brand, Electra have already electrified over 100 of these, some are now already in their 6th year of operation

- Low and high cab models available
- Over 100 in Operation
- 19t 4x2, 27t 6x2, & 32t 8x4 chassis available
- Tested and approved at the Daimler factory
- 3-year chassis warranty
- Electra can build up to 420 kWh on these platforms

SECTORS: RCV, Waste & Utilities, Local Authority, Plant & Machinery, Construction – Mixers, Crane Grabs, Tankers, Refrigeration, Urban Delivery, - Ambient Logistics (Curtain-side & Box). Drinks Logistics. Motorway Maintenance, Highways and GSE.

ELECTRA™

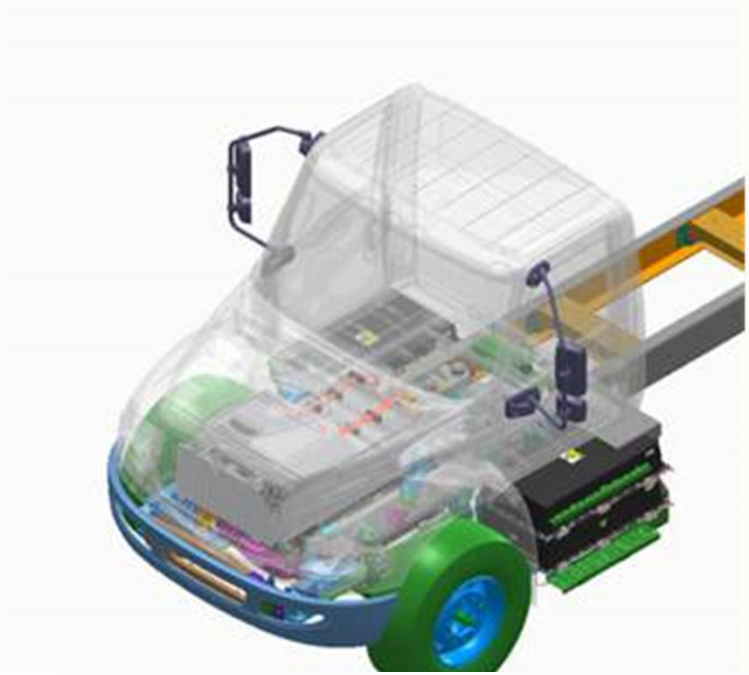
Electra Vehicle Production

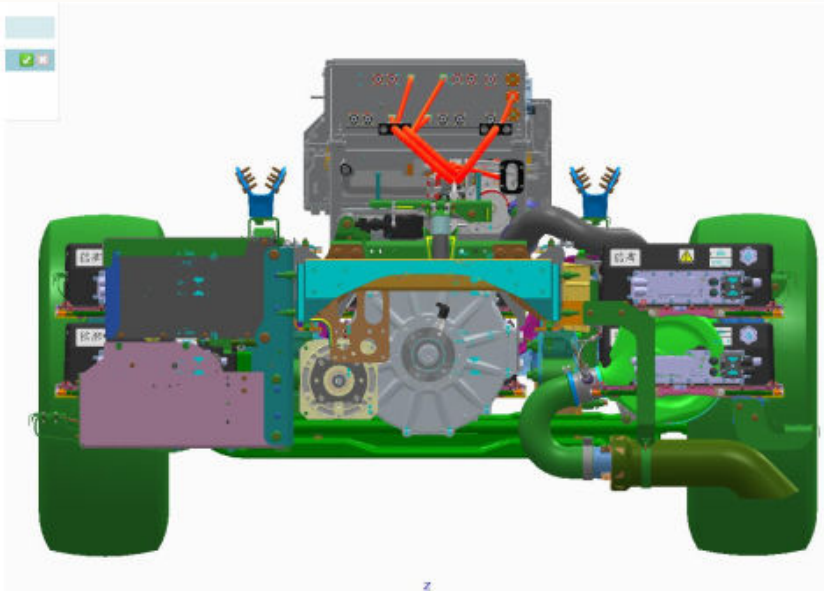
ELECTRA™

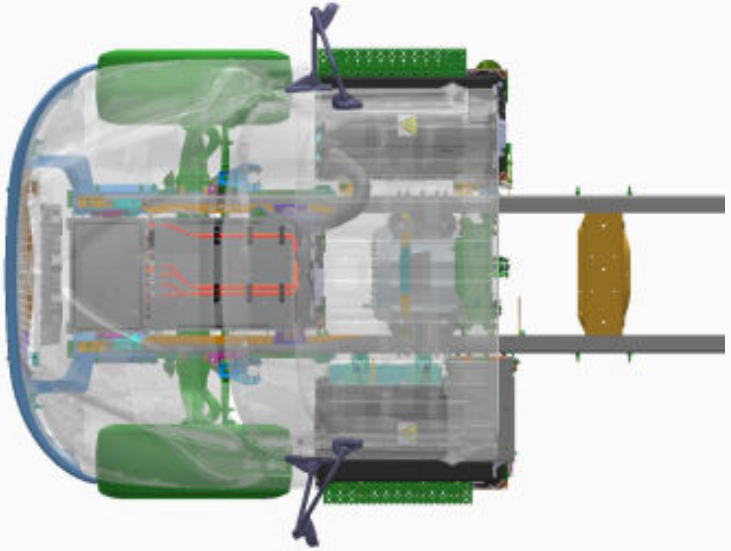
Electra Vehicle Production

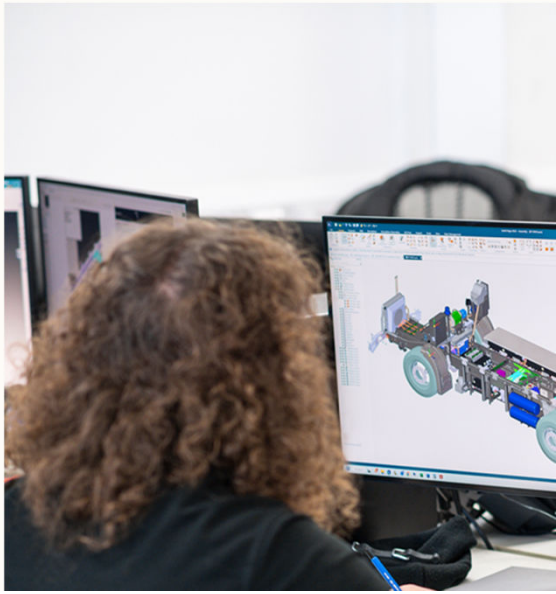
In-house:

- 3D CAD design team
- Software Engineers
- Electronic integration specialists
- Sub system manufacturing
- Reverse engineering of CANBus
- Global procurement
- After market support network and training









Refuelling Truck: 2024 Performance and Degradation Insights (01 Jan 24- 31 Dec 24)

Actual Vehicle Data collected from one of our refuelling vehicles in 2024

Refuelling Capacity
5283 U.S. gallons

GVW (Airside)
35.2 U.S. tons

Battery Size
140 kWh

Performance Analysis

- Key Metrics Overview
  (01 Jan 24- 31 Dec 24)
- Carbon Savings
- Recorded Route Example
- Refueller Key Metrics Analysis
- Aggregated Utilization Analysis
  - Monthly Utilization Insights
  - Yearly Utilization Summary
- Statistical Insights

2024 Year Analysis

ELECTRA™

Key metrics

Distance Covered (miles)

934

Energy Consumed (kWh)

4959

Energy Recovered (kWh)

147

Estimated Energy Cost ($)

843

Estimated CO2e Savings (pounds)

4480

Battery Degradation

1.4%

Carbon Savings

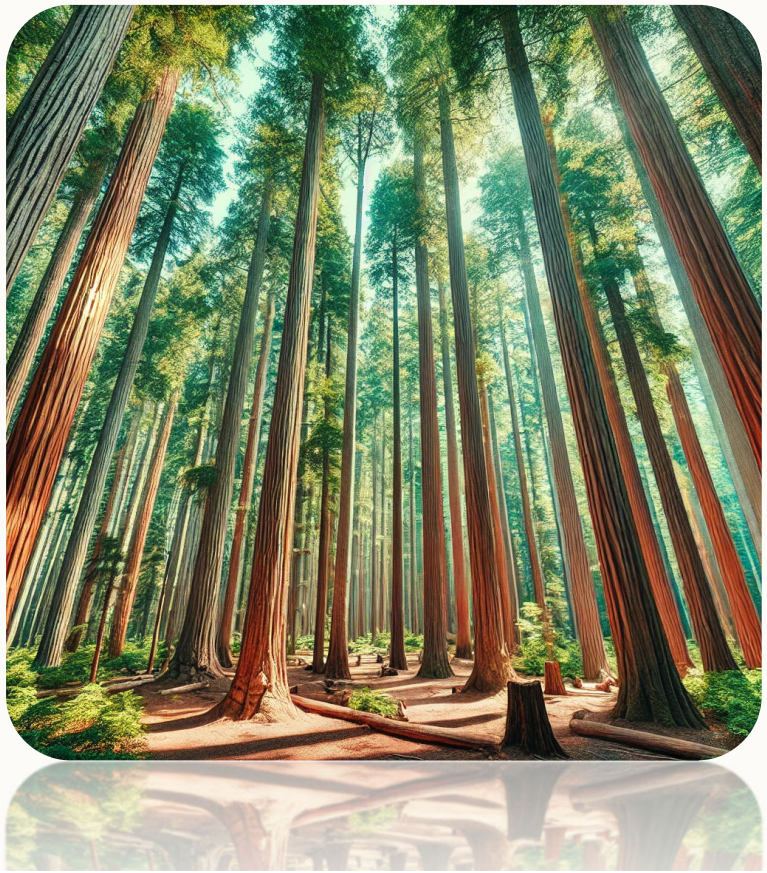
Carbon Savings

(01 Jan 2024 – 31 Dec 2024)

4480 pounds of CO2e Savings in 12 Months

- Volume of CO_2 at atmospheric pressure = 0.51 Cubic meter
- 2000Kg CO_2 = 1020 Cubic meter = 36,020 Cubic Foot

- On average, a mature tree can absorb about 48 pounds (approximately 21.8 kilograms) of CO_2 per year (Source: UCAR, 2023)*.
- 4480 pounds of CO2e is equivalent to the amount absorbed by **90 trees per year.**



Source: UCAR, 2023. Available at : What Can a Tree Do for You?

Routes examples

Recorded Routes Examples –

<u>All</u> chassis come with telemetry and full predictive maintenance as standard including a customer custom portal and dash board

**Data collected from our InfoCentre platform, estimated by tracker's GPS data*

Refueller Key Metrics Analysis

Real Life Example

- Key Metrics & Examples
- Flow Rate Factors
- SOC Usage Factors
- Detailed Day Example
- Most Recent Airport Data
  $(14\ \text{Jan} - 20\ \text{Jan}\ 2025)$
- Charging Capabilities & Cycles

Key Metrics & Examples

Key Metrics & Examples

Refueller Truck Performance	
Battery Size	140kWh
Useful tank Capacity	5,283 U.S. gallons
Max Flow Rate	237.7 GPM (U.S. gallons per minute)
Average Dispensing Energy Efficiency	1.02 Watt-hour per gallon (heater excluded)
Average Dispensing Time	5-10 mins (based on the airport usage)
Charging Cycle	Every 4-5 Days

Energy Consumption Example: Stansted Flight

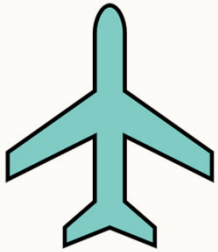
- For this flight, **1063 U.S. gallons** of fuel were required. At a maximum flow rate of **179 gallons per minute**, it took around **6 minutes** to dispense the fuel.
- Each gallon consumed approximately **1.02 watt-hours** of energy, meaning the total energy used for this operation was **1 kWh ($0.17)**.
- To put this into perspective, if the truck were to completely empty its **5283 U.S. gallon** tank, it would require about **5.5 kWh** of energy **($0.95),** excluding any aux energy or energy needed to drive the truck or refill the tank.

Imagine normally you're running a 5L diesel engine extremely inefficiently for 30 minutes to empty the tank!

Flow Rate Factors

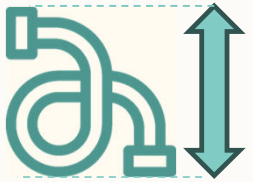
Factors Affecting Flow Rate

1. Aircraft Type



- Fuel Tank Restrictions: inlet restrictions (narrow openings, ..) can limit the flow rate.
- Height of Aircraft Tank: the higher the more gravity resistance, slowing airflow.
- Tank Venting: insufficient venting can create back pressure, slowing airflow.

2. Length and Elevation of Delivery Line



- Length of the Hose
- Elevation Differences: Elevation increases resistance, impacting flow rate efficiency

3. Weather (Fuel Viscosity and Temperature)

- Cold Temperatures: fuel becomes more viscous, slowing dispensing flow rate.

Other Considerations: other aspects can contribute to flow rate issues:

- Pump Performance
- System Blockages

SOC Usage Factors & Detailed Day Example

Factors Influencing Battery SOC Usage

Distance to Refill the Tank or Reach the Aircraft

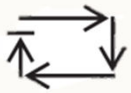
- Energy consumption increases with the distance the vehicle needs to travel, whether it's to refill the tank or to reach the aircraft. The motor typically consumes more energy than the dispensing system during these operations.

Heater Usage

- The vehicle’s battery capacity is 140 kWh, and the heater consumes up to 5 kWh at maximum power. Extended use of the heater can significantly impact energy usage – *we add extra cab insulation*

Weather Conditions

- The Battery Thermal Management System (BTMS) consumes extra energy to heat the battery. Heater usage tends to increase, further depleting SOC.

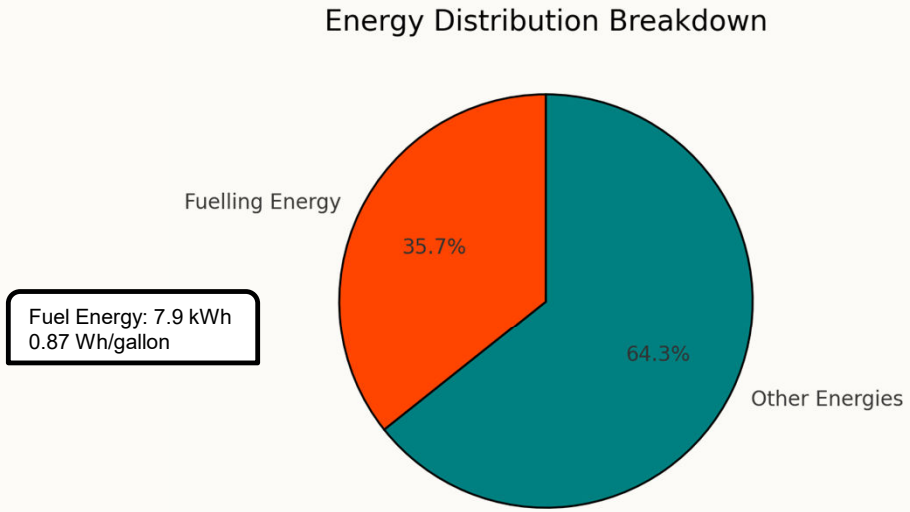


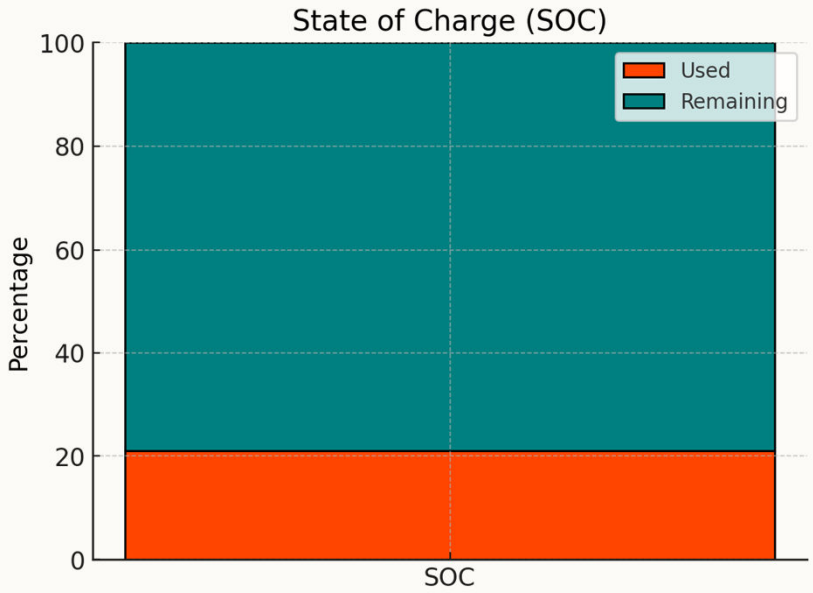
Charging Cycles

- Proper charging practices are essential for maintaining battery health.
- Periodically allowing the battery to reach 20% SOC can help preserve battery longevity. Poor charging habits or infrequent deep discharges may degrade the battery over time, reducing effective SOC and overall performance.

Detailed Day Analysis

- **9 Aircraft** were refuelled throughout a day, **8983 U.S. gallons** of fuel were pumped, utilizing only **21% SoC** of the **140-kWh battery capacity**.





*To ensure accurate aggregation and analysis, incomplete trips have been excluded or filtered from the data.

Recent Airport Data

Recent Airport Data

(14 Jan – 20 Jan 2025)

DATE	SOC USED (%)	MILES COVERED	KWH USED	US GALLONS PUMPED	N # AIRCRAFT	START CHARGE	END CHARGE
14-01-2025	11.6%	2	13	1843	4	78.8	67.2
15-01-2025	11.6%	1.9	12	2575	4	67.2	55.6
16-01-2025	8%	1.5	9	1984	3	55.6	47.6
18-01-2025	10%	1.7	10	2767	4	100	90
19-01-2025	15.6%	3.3	18	4822	6	90	74.4
20-01-2025	19.6%	3.2	20	4575	6	74.4	54.8

Heater Usage Observed on these days

An increase in energy on these days because of heater usage, and BTMS

Charging Capabilities & Cycles

Charging Capabilities (140kWh Battery)

ELECTRA™

AC Charging (Current Charger)

- 22kW AC*
- Fully charging the vehicle typically takes approximately 6 hours.

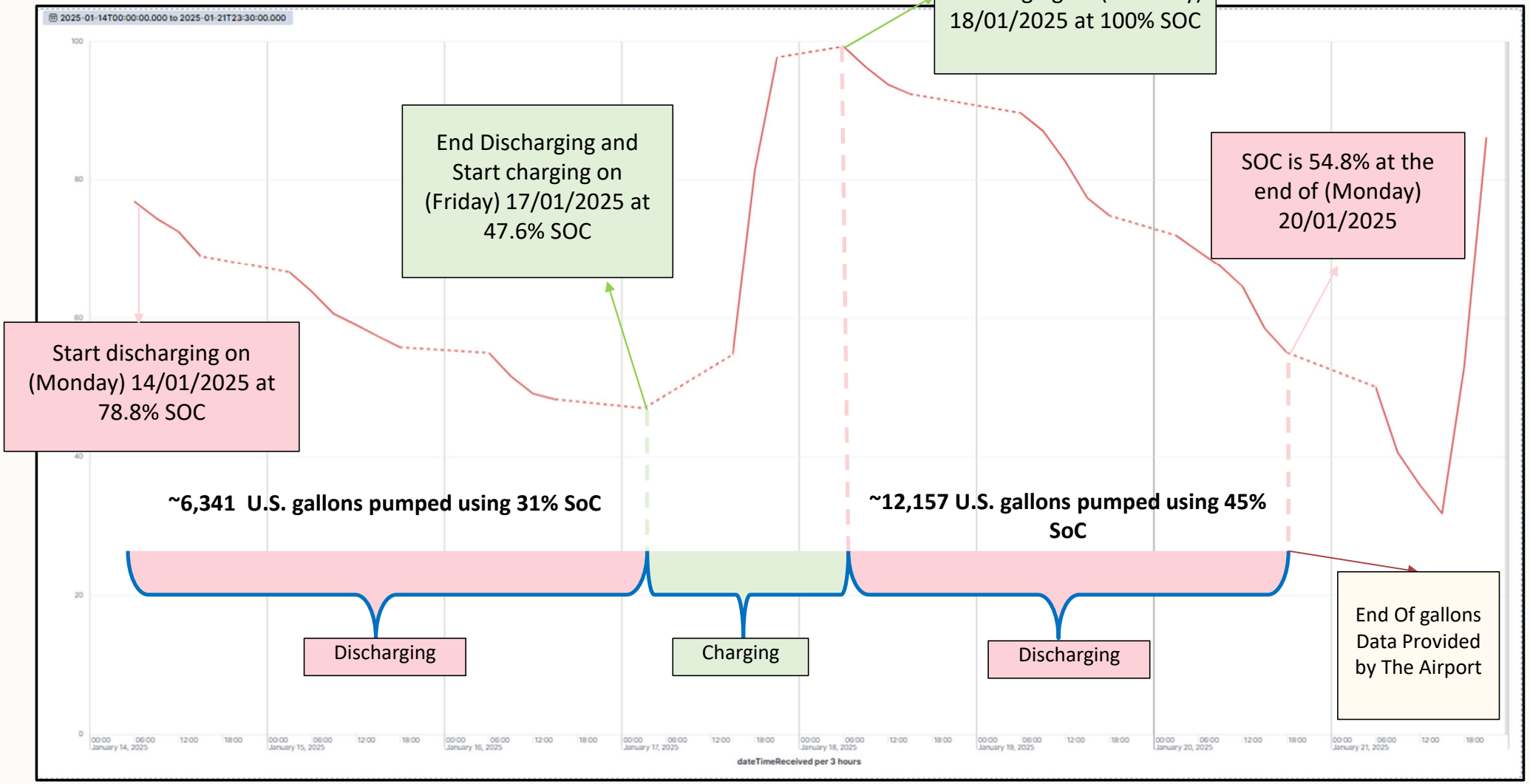
Fast Charging DC (Upgradable Option)

- Up to 120 kW DC
- Fully charging the vehicle typically takes approximately 1 hour.

So in this application we use daily approx. 1/5 of the available power – so we only need to top up 1/5 of 6 hrs = 1.2 hrs daily
OR
You can run for 4-5 days on a single charge

*In extreme weather conditions, the BTMS may activate heating or cooling to regulate the battery temperature while charging, reducing charging power.

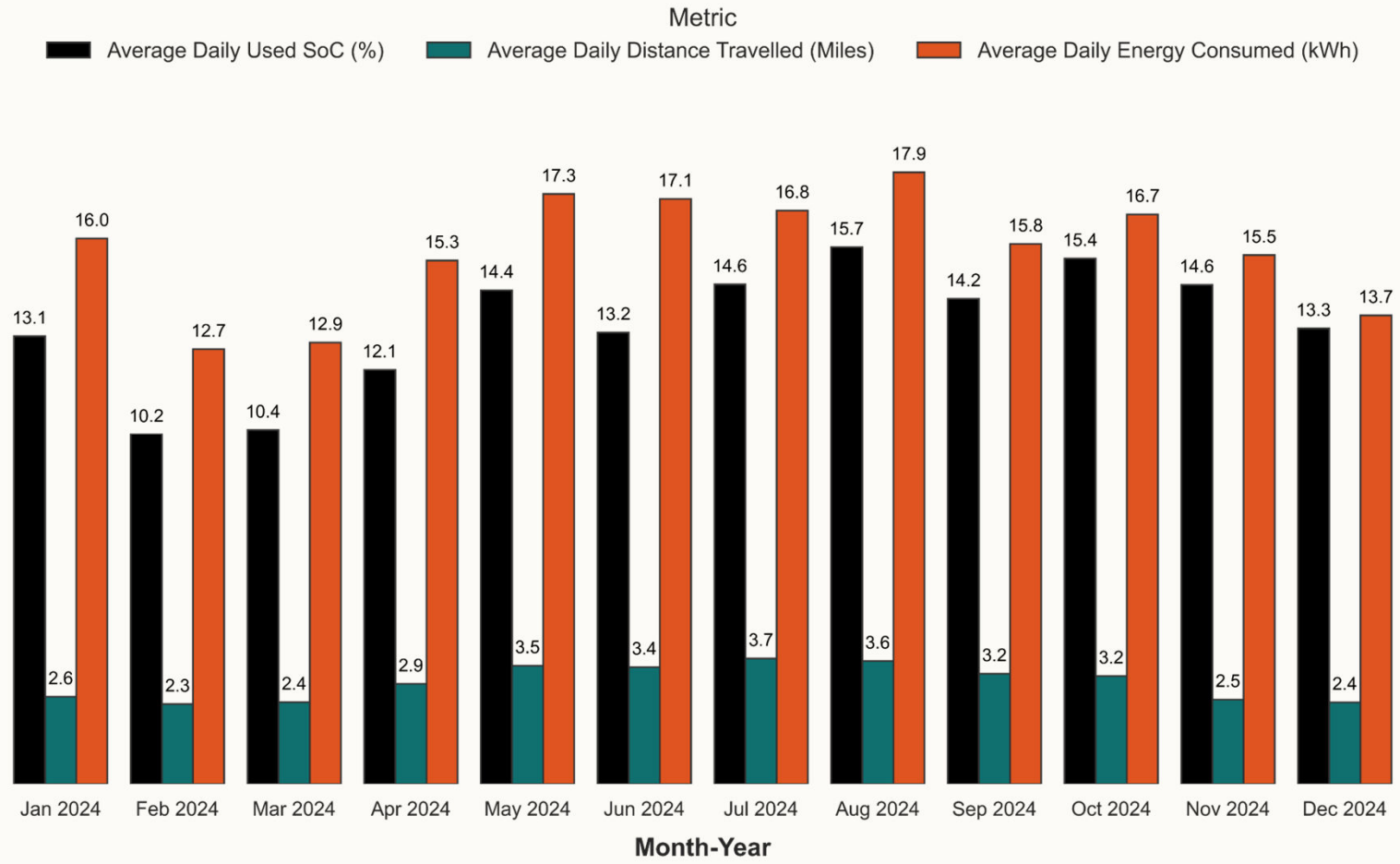
Charge Cycles



2024 Utilization Aggregated Analysis

(01 Jan to 31 Dec 2024)

2024 Monthly Utilization Insights

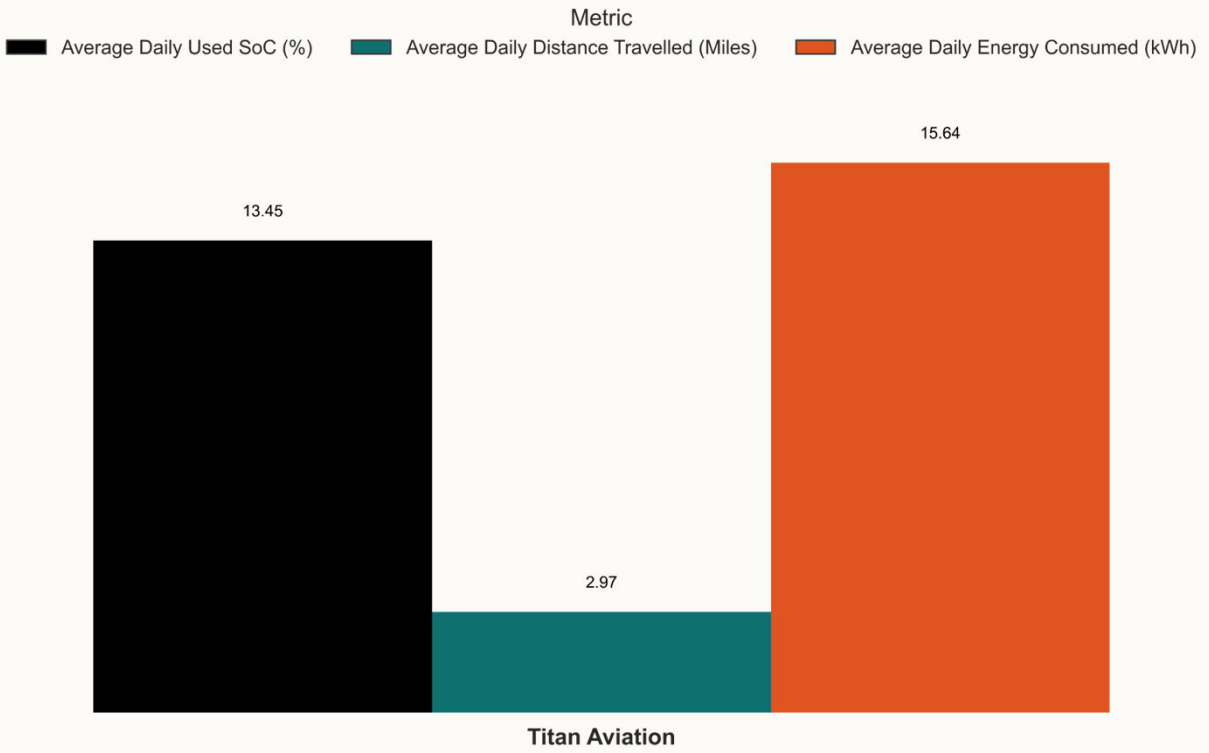


*To ensure accurate aggregation and analysis, incomplete trips have been excluded or filtered from the data.

2024 Yearly Utilization Summary

- The following plot summarizes the averages from **(01 Jan to 31 Dec 2024):**

- **Average Used SoC:** 13.4%
- **Average Daily Distance Travelled**: 2.97 miles
- **Average Daily Energy Consumed**: 15.6 kWh
- **Average Daily Operating Cost**: $2.65

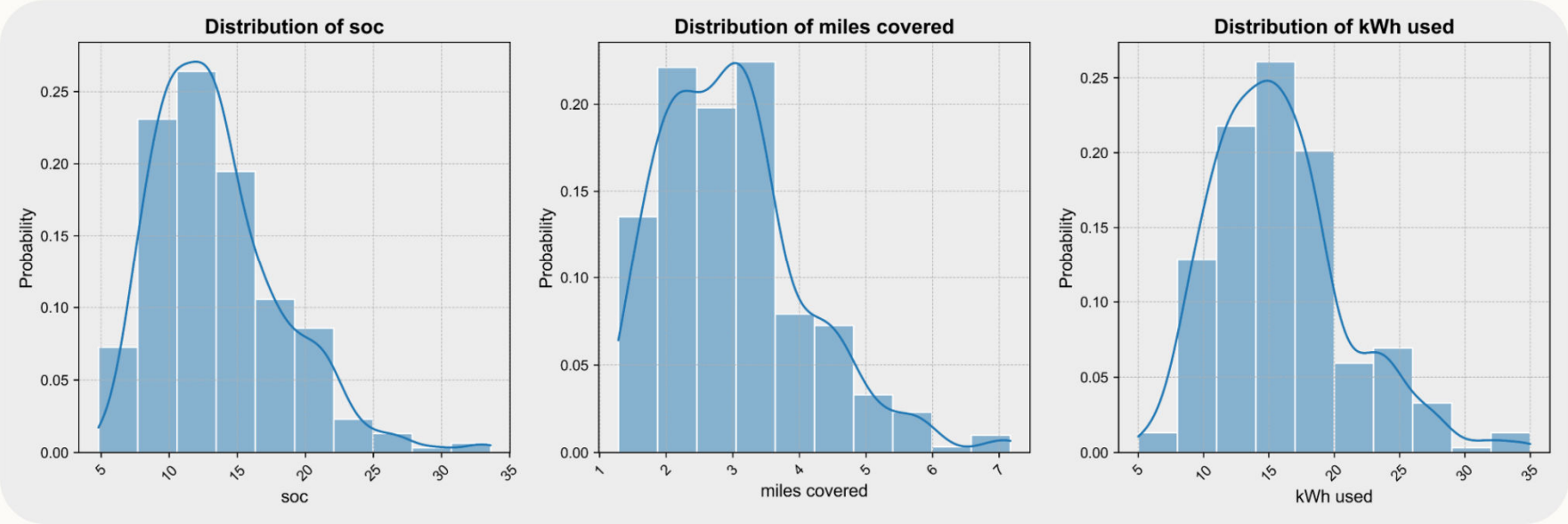


*To ensure accurate aggregation and analysis, incomplete trips have been excluded or filtered from the data.

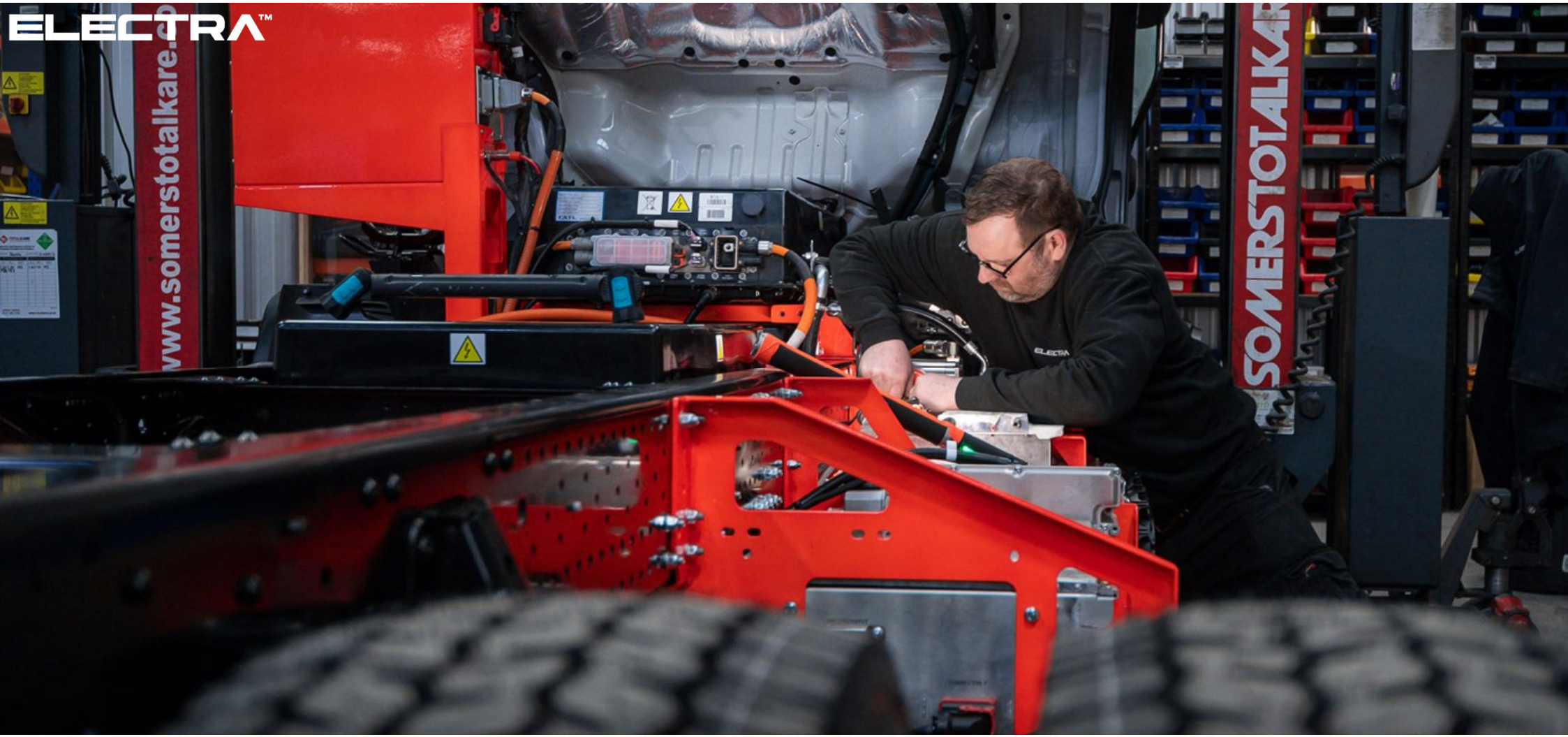
Statistical Insights

(01 Jan to 31 Dec 2024)

Distribution of Vehicle Utilization Metrics: SoC, Distance, and Energy



- Operating days utilized between 5% and 35% SoC.
- Indicating consistent low utilisation.
- The shortest distance covered in the analysed trips was 1.28 miles.
- Longest trip covered 7.17 miles.
- The vehicle's energy consumption ranged from 5kWh to 35kWh including ePTO energy.



Diagnostics, Faults, and Degradation Insights

Diagnostics, Faults, Observations and Future Improvements

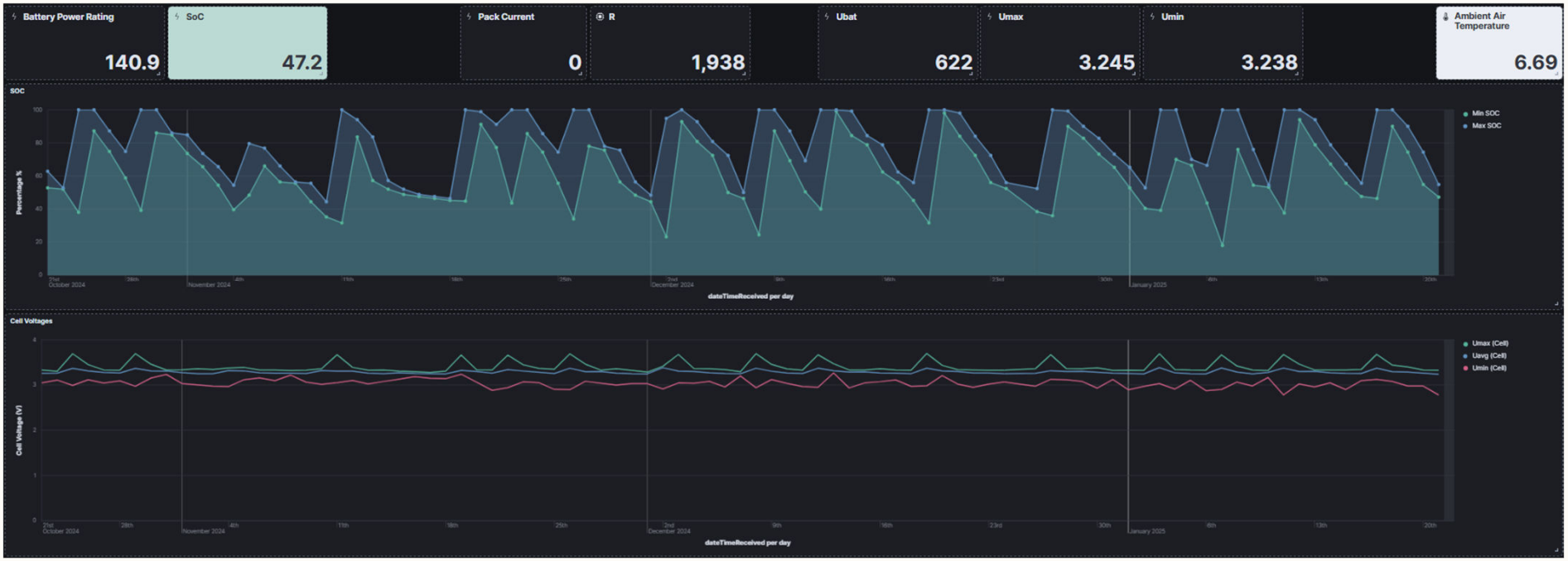
- Diagnostics Insights
- Degradation Analysis
- Recommendations

Diagnostics Insights

- Our engineering and data teams continuously monitor all aspects of vehicle performance, including comprehensive tracking of battery metrics and fault diagnostics.

- This system allows us to easily identify errors or faults, quickly determine the root cause of any issues, and take prompt, effective action, with an **alert system** in place to notify us of any major battery concerns.

- Below is an example of some of the key battery metrics we monitor:

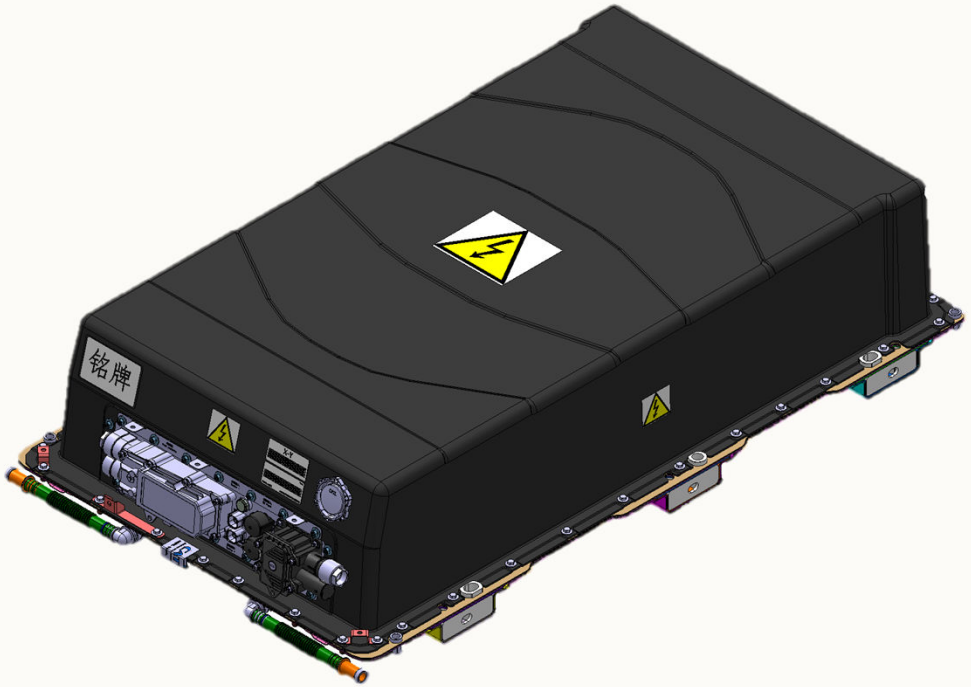


Degradation Analysis

Degradation Insights

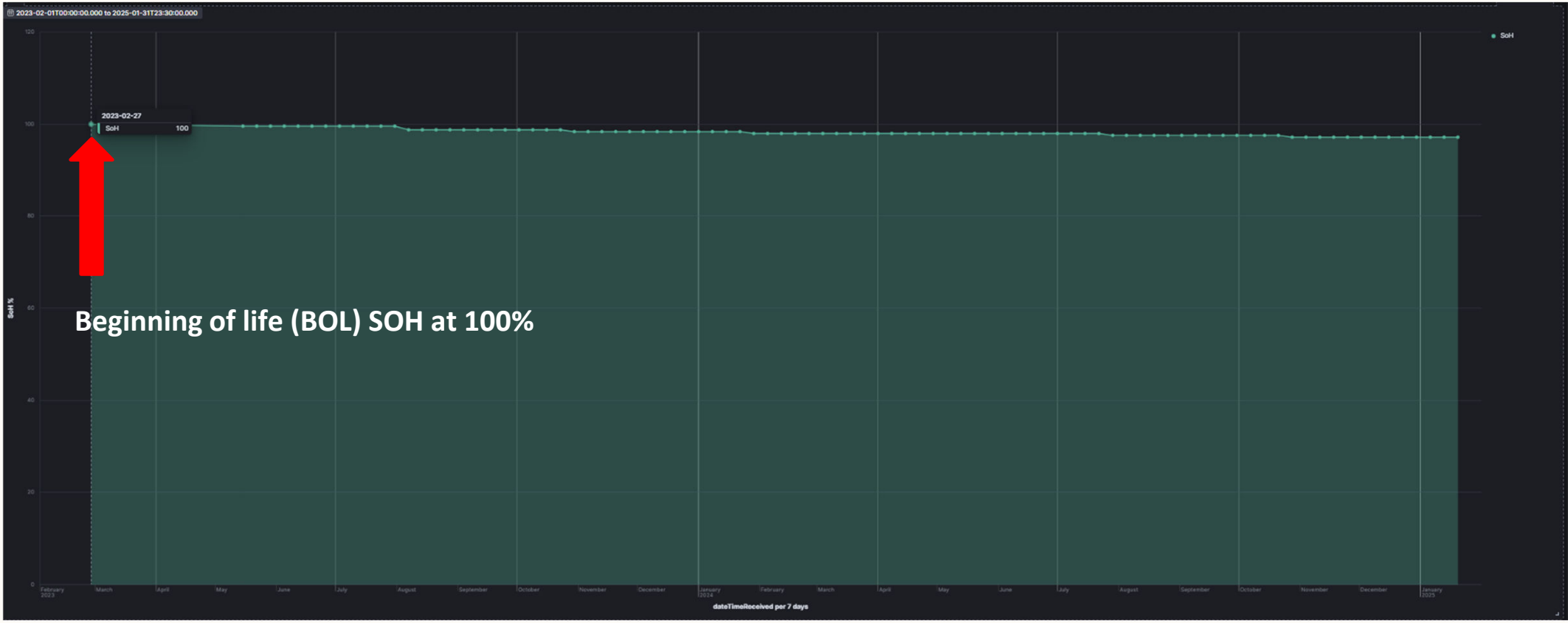
- Degradation data is calculated by the **CATL** algorithm over time and is only updated in **discrete steps**, with values only updated at specific increments rather than continuously.

- **2.8% degradation observed** over approx. two years as calculated from **SoH** (the ratio of usable capacity to nominal capacity)



Degradation Insights

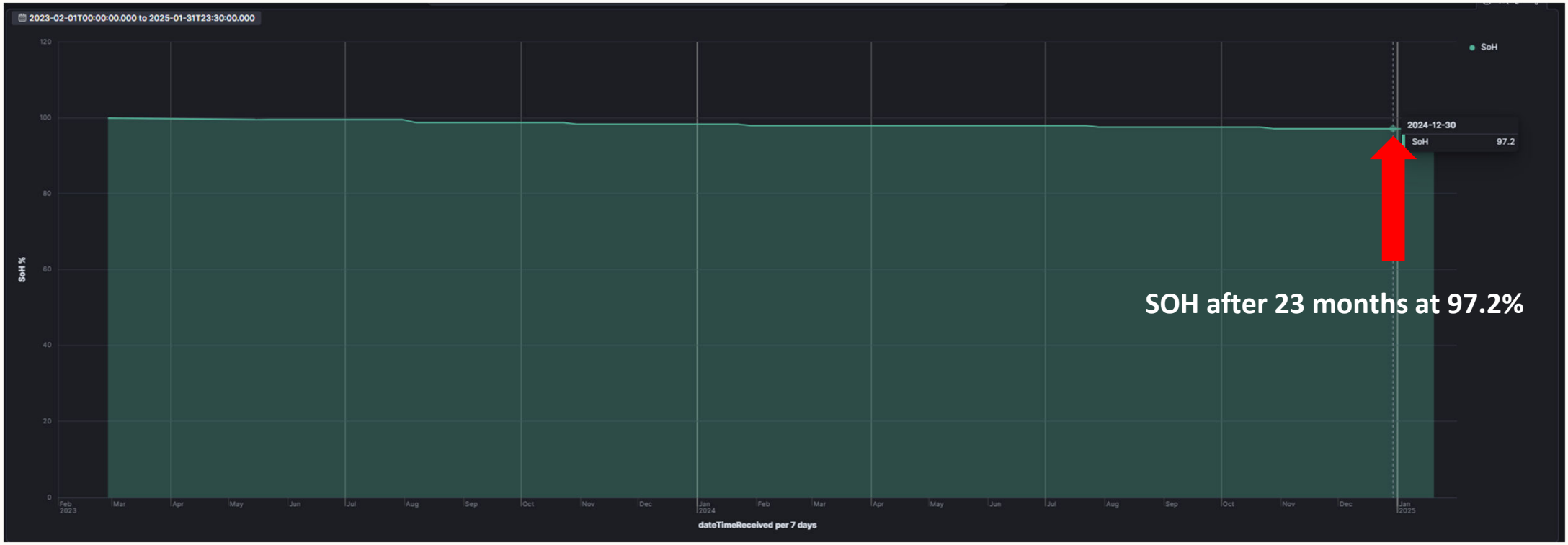
- Below is an example of the State of Health (**SoH**) monitored for the vehicle throughout its lifetime.



*the data was captured from our Elasticsearch platform which monitors the vehicle in real time.

Degradation Insights

- The data indicates that the battery experienced a **2.8% degradation** over a period of **23 months.**



*the data was captured from our Elasticsearch platform which monitors the vehicle in real time.

Recommendations

Battery Health Recommendations

- We recommend ensuring the vehicle reaches at least 20% state of charge and remains at that level for a minimum of one hour, at least once every four weeks.

- This practice is essential for optimizing battery health and longevity.

4 Weeks

20% SoC

1 Hour

Accelerating Toward a Net-Zero Future.