Overcoming Obstacles in Transitioning Fleets to Electric Vehicles: Mobile Charging Case Studies

Claire Hazzard
Program Administrator

November 6, 2025

Agenda

- Introduction to MassCEC
- Introduction to the Medium and Heavy-Duty Mobile Charging Solutions Program
- Technology Inventory
- Mobile Charging Panel
  - CALSTART
  - Xos Trucks
  - ElectricFish
- Question & Answer
- Closing

MASSCEC'S WORK BY FOCUS AREA

ACCELERATING DECARBONIZATION

We contribute to meeting our state's ambitious climate goals by tackling barriers to widespread use of clean energy and climate technology in buildings, transportation, and the grid.

EMERGING CLIMATETECH

We help new climate-focused businesses grow faster by backing a vibrant community of researchers, startups, and established industry players - creating an ecosystem where they connect and thrive.

LARGE SCALE DEPLOYMENT: OFFSHORE ENERGY

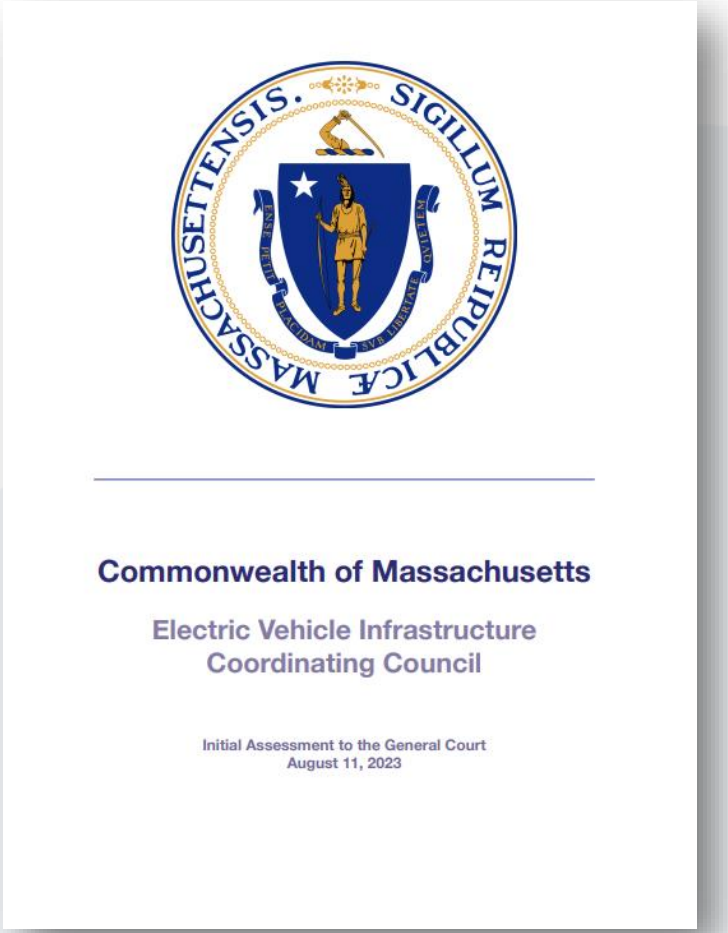
We're building a cutting-edge offshore energy industry, marshaling world-class ports while addressing supply chain and workforce development challenges.

CLEAN ENERGY & CLIMATE WORKFORCE DEVELOPMENT

We're growing a diverse and talented clean energy workforce by supporting a dynamic network of community-based organizations, labor, training providers, schools and employers committed to a sustainable future for all.

Electric Vehicle Infrastructure Coordinating Council (EVICC)

- In 2024, the EVICC awarded MassCEC $38M to increase access to charging infrastructure for various sectors
- EVICC identified **mobile charging** as a promising technology that can help fleet owners electrify without the need for immediate large-scale investment in charging infrastructure



Medium and Heavy-Duty (MHD) Mobile Charging Solutions Program

PROGRAM OVERVIEW

- The Program will accelerate the electrification of four MHD fleets (class 3-8) through the deployment of mobile charging stations

PROGRAM GOALS

- Increase access to Mobile Charging and reduce barriers to EV adoption for MHD fleet owners and operators in MA;
- Pilot innovative Mobile Charging stations that can be scaled across the Commonwealth; and
- Publish resources for MHD fleet owners and operators in MA to implement Mobile Charging solutions independently

PROGRAM SERVICES

- **Mobile Charger Deployment and MHD ZERO Emission Vehicles (ZEVs)**
  - Fund the deployment mobile charging stations and ZEVs for four participating fleets
  - Charging stations and MHD ZEVs will be deployed by February 2026
  - The Program is fully enrolled
- **Public Facing Resources**
  - Tools to support future MHD fleet owners and operators through mobile charger procurement and deployment
  - Resources will be published in December 2026. Visit our webpage to view the Technology Inventory

Mobile Charging Solutions Technology Inventory

- Designed as a tool to introduce fleets to charging units within the mobile and semi-permanent charging industry that fit their fleet needs.
  - Exclusively featuring assets with net-zero emissions

- The Technology Inventory identifies available Mobile Charging solutions
  - Asset types
  - Ownership models
  - Use cases
  - Storage capacity
  - Grid impacts
  - Deployment timelines

- What is Mobile Charging?
  - Mobile Charging refers to any type of semi-permanent, off-grid, and grid-flexible charging solution that can be disconnected and transported between locations

Panelists

Madeline Brown
Lead Project Manager
CALSTART

Aldan Shank
Director of Mobile Charging
Xos Trucks

Vince Wong
Co-Founder and COO
ElectricFish

Mobile and Semi-Permanent Charging Solutions – Bi-Coastal Lessons Learned

MassCEC Overcoming Obstacles

November 6, 2025

Madeline Brown, PhD

SJV Lead Project Manager

Thank you to our partners at the

MASSACHUSETTS CLEAN ENERGY CENTER®

Attribution and Disclaimers

Photos of various charging solutions are shared throughout this presentation. Photos have been pulled from public-facing websites of the respective companies.

This presentation features discussion and visuals of diverse charging providers. This presentation is not an exhaustive collection of all OEMs available on the market, nor is the inclusion or exclusion of any OEM or asset a formal endorsement or dismissal by MassCEC or CALSTART.

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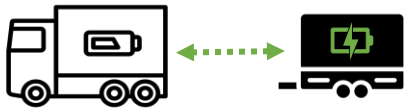


Who is CALSTART?

501(C)(3) nationwide and beyond zero-emission transportation and ecosystems organization. ~250 employees. Board oversight.

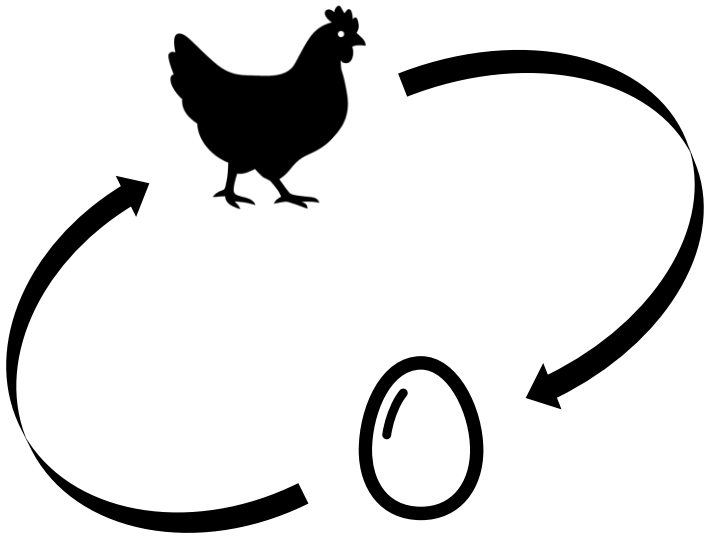
- **3 Regional Offices:** San Joaquin Valley, Midwest, *East Coast*
- **Activities:** Technology Development and Demonstration, Market Acceleration, Public Policy, *Data Insights* and Analytics (3rd Party Validation), Member Support
- **Initiatives:** Light Duty, Trucks, Buses, *Infrastructure*, Innovative Mobility

- **Global Engagement:** Global MOU Commercial Vehicle Drive to Zero program. 40+ countries' goal of 100% ZE truck and bus sales by 2040
- **Membership:** NOFOs, Partnerships, Policy, Consulting Hours, Leadership Circle, Marketing, etc.

The Challenge

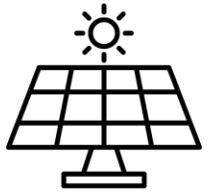
Fleets adopting electric vehicles face varied roadblocks in accessing charging infrastructure.

- Cost Barriers for Permanent Infrastructure
- Incentive Funding Requirements
- Duty Cycle Uncertainty
- Leased Facilities
- Timeline Misalignments
- Construction Disruptions
- Utility Delays
- Outgrowing Existing Infrastructure



Quick Terms

- **Mobile: Readily movable**
  - Trailer Mount
  - Skid Mount
  - Cart Mount
  - Palletized
- **Semi-permanent: no major permitting or construction required.**
  - Overhead on piles
  - Containerized



Today's discussion is specifically for electric vehicle charging. *Zero-emission* mobile and semi-permanent solutions can be energized through direct grid connection through an existing panel, solar array, containerized hydrogen, and daisy-chaining. Mobile and semi-permanent solutions can be pass-through, utilize battery storage, and/or include power generation.

Bi-Coastal Recognition

Two public agencies on opposite coasts of the U.S. recognize the critical gaps fleets face in accessing permanent infrastructure – from two *different perspectives*.

Result: Two pilot solutions that enable fleets to begin zero-emission adoption while permanent infrastructure and vehicle deployment catch up.

CARB

CALIFORNIA HVIP

MASSACHUSETTS CLEAN ENERGY CENTER®

Pilot Overview

East Coast – MassCEC
- 4 fleets ←→ Mobile or Semi-Permanent Charging
  - Charging as a Service, Lease, Own
- Identify and address gaps in accessing charging infrastructure, quantify emissions reductions

West Coast – CARB
- 4 fleets ←→ Mobile or Semi-Permanent Charging
  - Lease only
- Testing expedited HVIP vehicle access to charging through non-permanent solutions

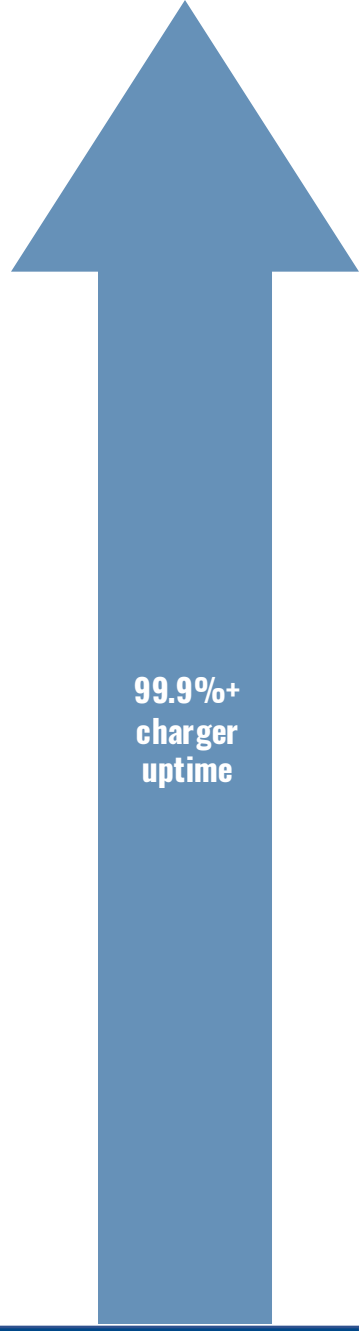
Early Success Indicators

Quantitative

- Cost Offsets and Financial Value: Avoids productivity losses by keeping vehicles on the road, reducing charging detours, downtime, and inefficient charging scenarios
- Fleet Uptime: Integrated smoothly into operations while awaiting permanent infrastructure
- Reliability: Units remain consistently operational with essentially zero downtime, demonstrating the efficacy of the solution
- Emissions Reduced: Cuts GHGs and pollutants, delivering health benefits for DACs/EJ communities near freight/transport hubs and corridors [MassCEC – metrics coming soon]

Qualitative/Experiential

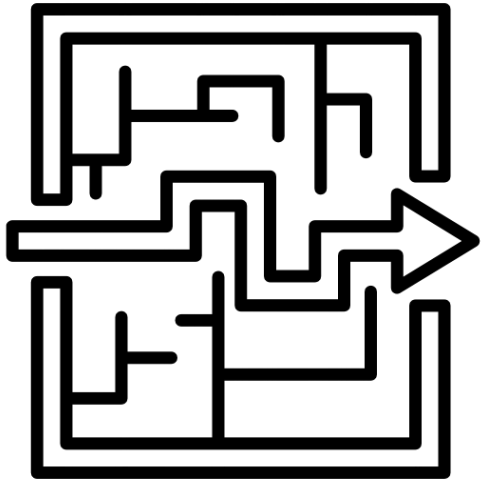
- Driver/Operator Experience: Easy to use, convenient, and supportive of paradigm shift from ICE to ZEV



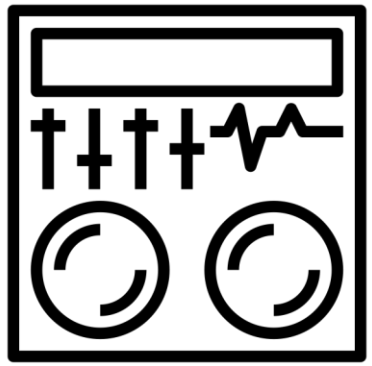
Three Themes to Prepare for Charging Success

Moving Beyond "It Depends"

Navigating Solution Selection(s)



Time to get Creative(?)



Fleet charging challenges are diverse…

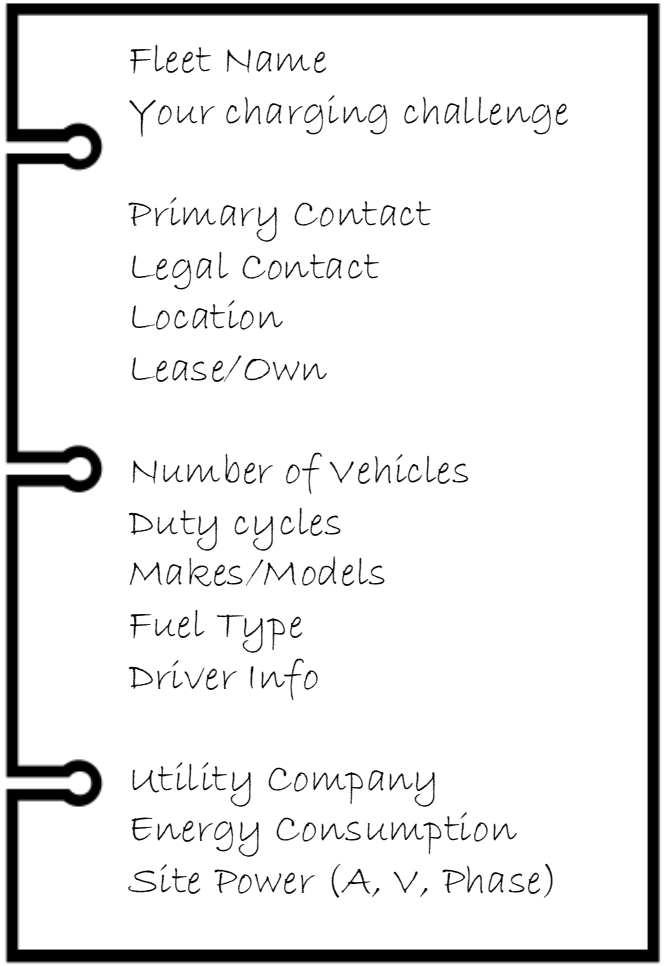
So are mobile and semi-permanent charging solutions!

How To Move Beyond "It Depends..."

More specifics lead to fewer surprises.

- Designate time to align on your fleet's big-picture goals and operational details.
- Engage your fleet managers, drivers, and operations staff to reflect on quick fleet considerations that may be siloed.

This supports productive conversations with potential charging providers, utilities, site engineers, construction teams, and your employees.

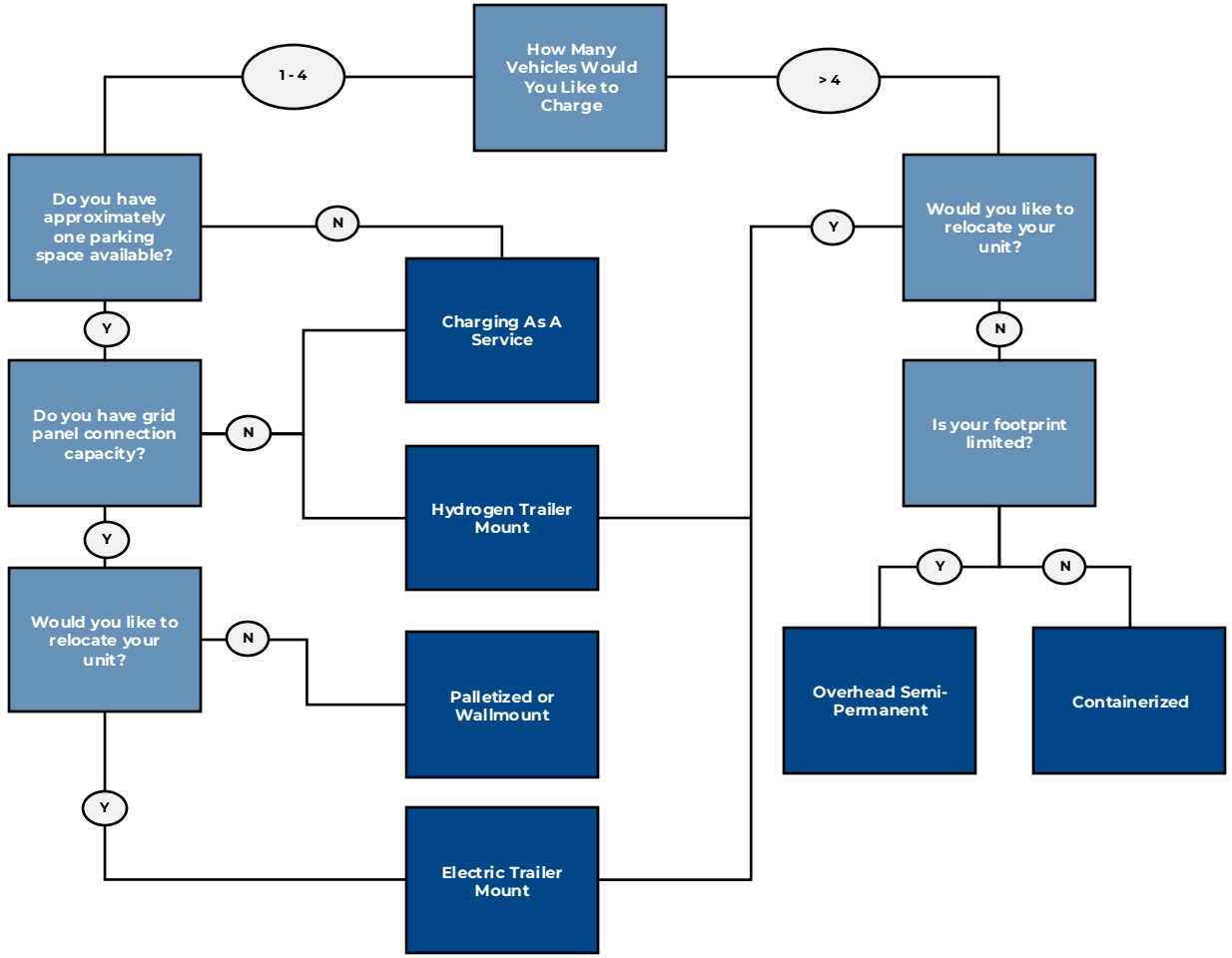


How to Navigate to a Charging Solution

A diverse ecosystem of charging providers offers solutions tailored to different fleet sizes, duty cycles, and operational needs.

Using your previously collected details, explore an exercise to steer towards, or eliminate, solutions that may not fit.

Solutions are generally scalable (i.e., additional units or onboard energy storage)



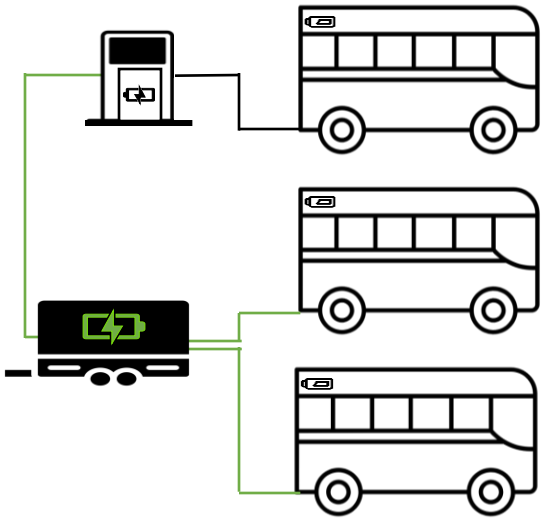
*not an exhaustive diagram

Mix, Match, Mobilize

Don’t be afraid to get creative in conceptualizing charging solutions. Blending mobile, semi-permanent, *and* fixed charging solutions can build a setup that fits unique operations.

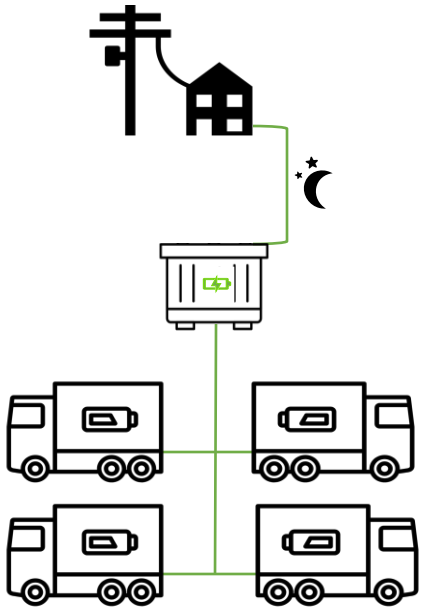
Insufficient *Existing* Charging Infrastructure?

A mobile unit may be connected to a permanently installed charger.



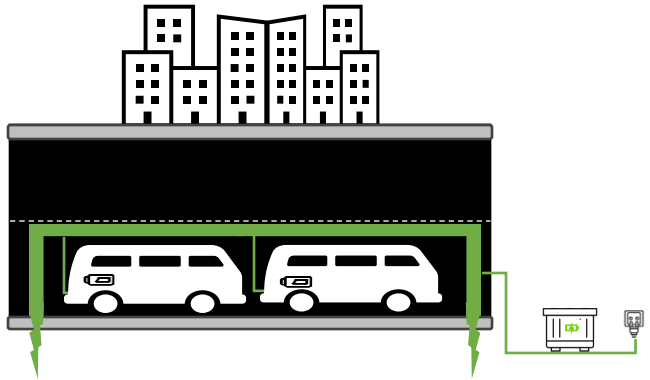
Insufficient Grid Capacity?

A skid-mounted or palletized battery + chargers can fill up overnight while grid demand is low.



Insufficient Footprint?

Overhead semi-permanent solutions can be rapidly deployed with just a few pylons (+ battery storage option).



Critical Fleet Reflections

- Foresight ~~Fad~~
  - Where is your fleet finding success or roadblocks to charging?

- Strategy ~~Stopgap~~
  - How could some of the solutions discussed today support your specific long-term goals?

- Transformative ~~Temporary~~
  - What partnerships or tools would help your region go further, faster?

Questions?

Madeline Brown, PhD

mbrown@calstart.org

Thank You

We change transportation for good.

CALSTART.org

Xos | November 2025

Xos Hub - Mobile EV Charging Station

Massachusetts CEC Charging Case Studies Webinar


ENABLING ELECTRIC FLEETS
RIGHT NOW
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100%
100% BATTERY-ELECTRIC | www.xostrucks.com

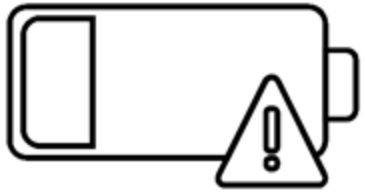
CHARGING INFRASTRUCTURE CHALLENGES

Costs

- Equipment
- Eng. / Project
- Peak demand

Time

- Up to 36 months
- Switchgear upgrades
- Permitting, supply chain, construction



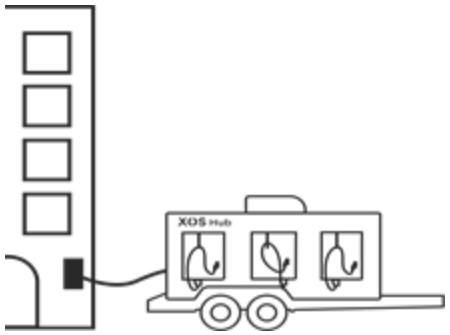
Flexibility

- Requires more current
- No energy storage
- Permanent


XOS Hub™
Mobile Charging Solution

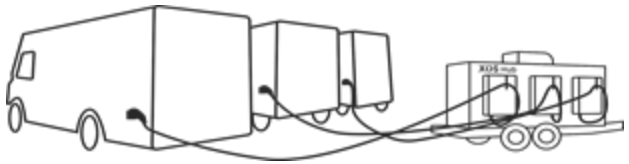

XOS
/ ek-sō-s /
XOS Hub™
/ ek-sō-s /
SCAN ME
Mobile Charging Solution
www.xostrucks.com
XOS 100% BATTERY ELECTRIC

OPTION 1: CHARGE AND TRANSPORT



1. Trickle Charge

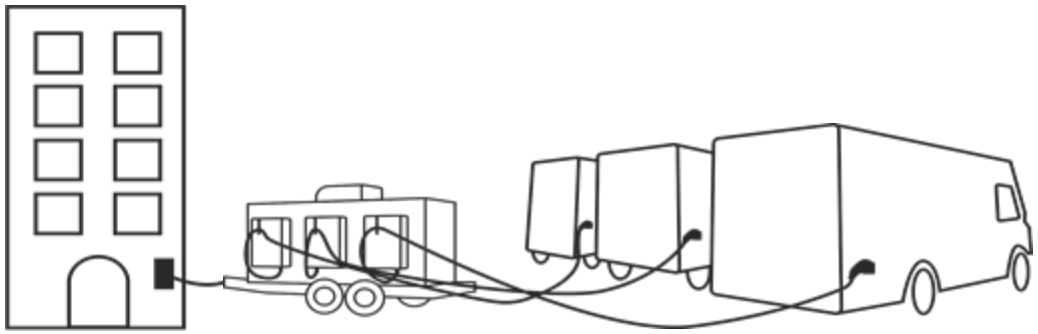
2. Deploy the Hub



3. Charge up to 4 EVs

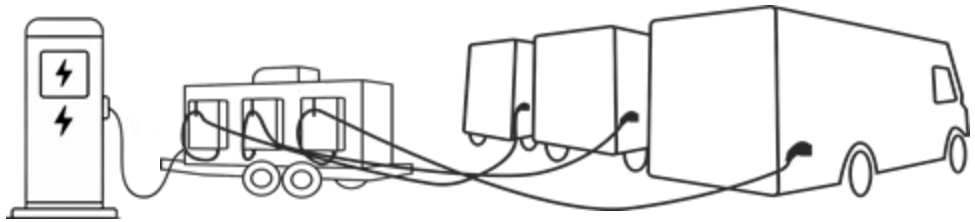
4. Remotely Monitor

OPTION 2: CHARGE IN PLACE



Charge from AC site power (480, 240, 208 V)

or



Charge from existing DC Fast Charger


XOS
100%
BATTERY
ELECTRIC
XOS
100%
BATTERY
ELECTRIC

COMMON APPLICATIONS

Stopgap Charging

Property Constraints

Remote Power

Backup Power

Stationary Installations

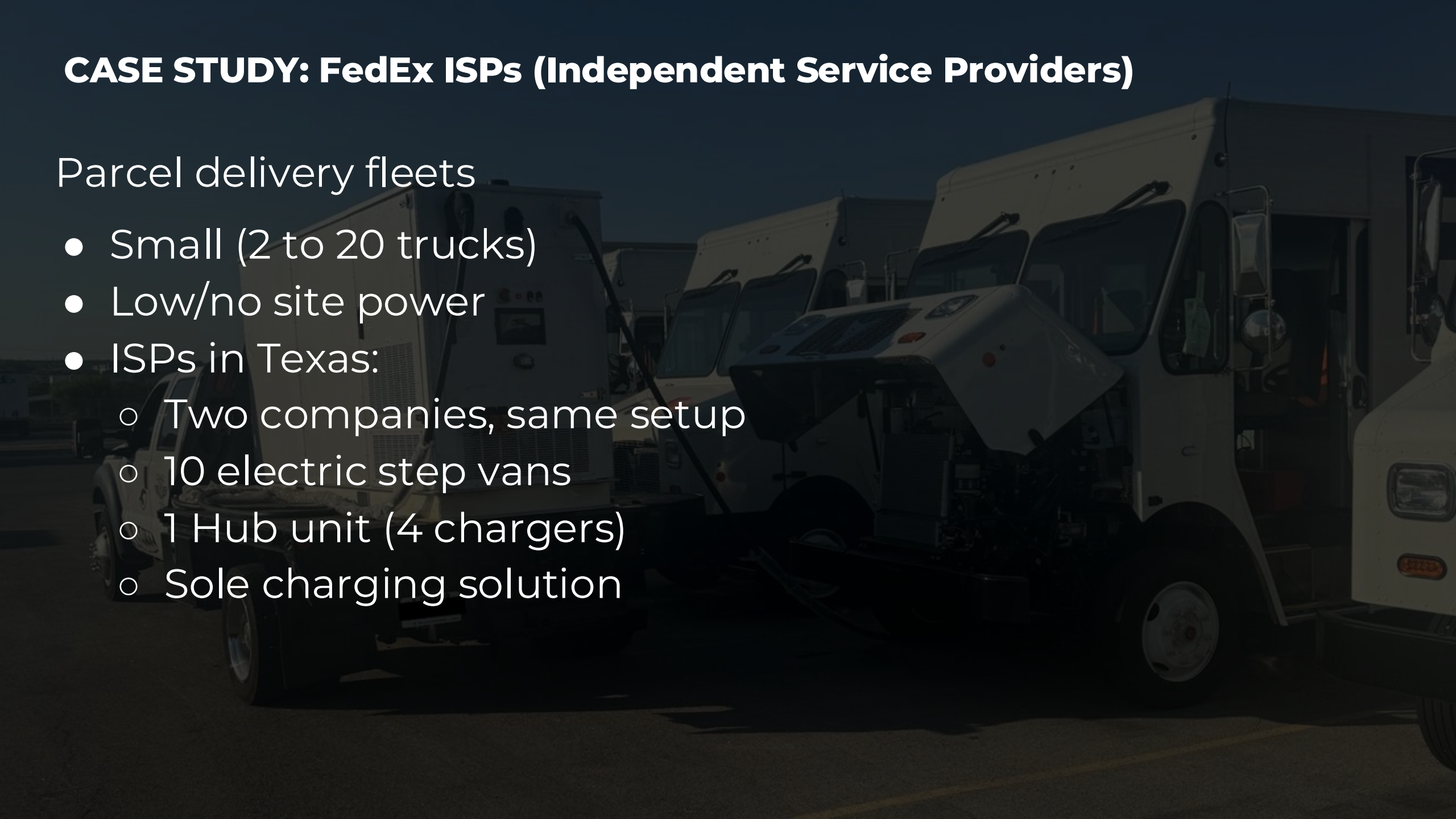
Emergency Response

CASE STUDY: FedEx ISPs (Independent Service Providers)

CASE STUDY: FedEx ISPs (Independent Service Providers)

Parcel delivery fleets

- Small (2 to 20 trucks)
- Low/no site power
- ISPs in Texas:
  - Two companies, same setup
  - 10 electric step vans
  - 1 Hub unit (4 chargers)
  - Sole charging solution



CASE STUDY: Autonomous Vehicle Charging Depot

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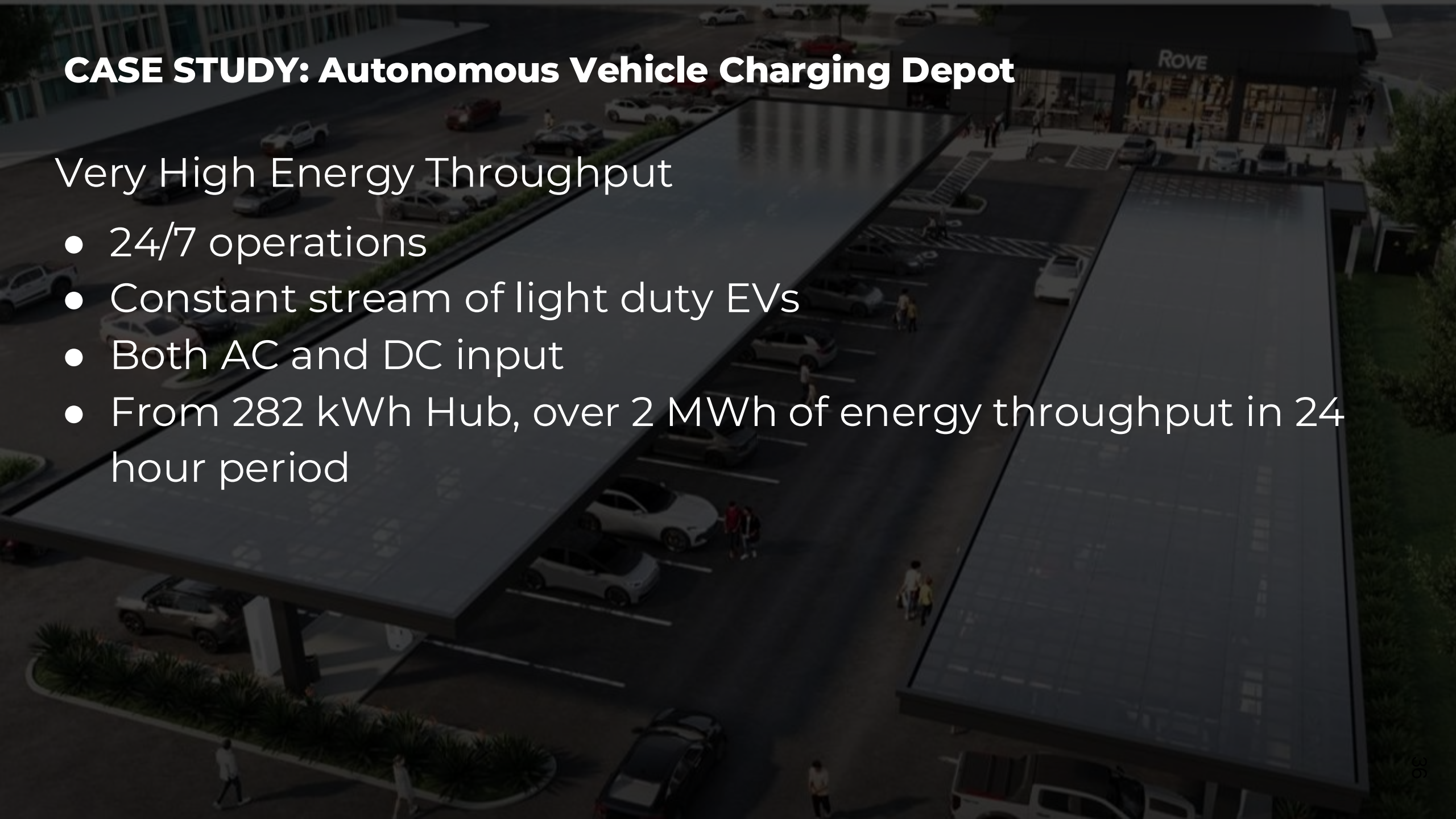
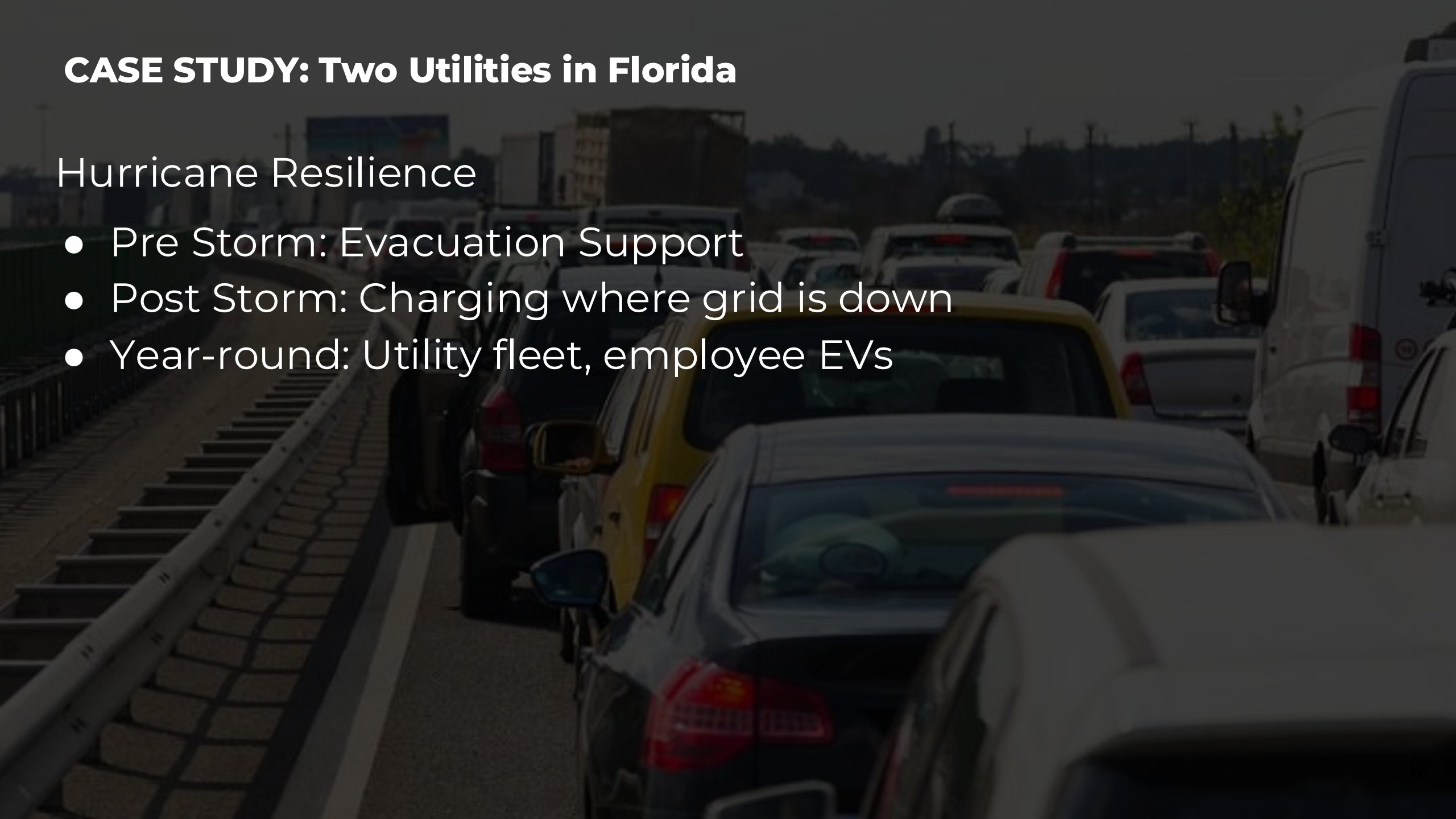


Very High Energy Throughput

- 24/7 operations
- Constant stream of light duty EVs
- Both AC and DC input
- From 282 kWh Hub, over 2 MWh of energy throughput in 24 hour period

CASE STUDY: Two Utilities in Florida

CASE STUDY: Two Utilities in Florida



Hurricane Resilience

- Pre Storm: Evacuation Support
- Post Storm: Charging where grid is down
- Year-round: Utility fleet, employee EVs

CASE STUDY: Two Ports (NorCal and SoCal)

CASE STUDY: Two Ports (NorCal and SoCal)

Heavy Duty Electric Forklifts

- West Sacramento
  - Legacy DCFCs
  - Far from vessel load/unload
  - Charge and shuttle Hub

- Long Beach
  - 5 forklifts
  - Site power for one DCFC only
  - Stationary Hub: 1 charger becomes 4

UPCOMING MODELS

Xos Hub - EV Charging Station

- Q1 2026: Additional Variants
  - 210 kWh
  - 420 kWh
  - 630 kWh
  - Q2: Super fast charging option

Xos MG01 - Energy Storage System

- Q2 2026: Zero-emissions battery powered generator
  - AC/DC import, AC export
  - Bi-directional

Scan for Xos Hub One-Pager

Contact: aldan.shank@xostrucks.com

XOS HUB SPECIFICATIONS

Charge Heads: 4

Plug Type: CCS1 (NACS available)

Output Charge: up to 160 kW

Battery Capacity: 280 kWh
Units linkable for double, triple, etc. capacity

Dimensions & Curb Weight
135” x 40” x 62”
<10,000 lbs (including trailer)

Tow Vehicle
½ to ¾ Ton Pickup

Input Charge Options
480, 240, or 208 Vac 3-Phase or CCS1 DCFC
Optional add-on: 208/240V Single Phase

Connectivity
4G / WiFi

Estimated Recharge Time
3.5 hrs via 480 V @ 80 kW
2.5 hrs via 120 kW DCFC

Expected Charge Times from 20% to 90% SOC @ 150 kW output speed:

Tesla Model 3 *(50-82 kWh)* - 14 to 23 min
Ford F-150 Lightning *(98-131 kWh)* - 28 to 37 min
Chevy Bolt *(55 kW max input)* ~1 hour
140 kWh Xos Step Van - 39 min

XOS HUB POWER OUTPUT

Output based on configuration (kW per chargehead)*

*Assumes Hub battery is fully charged

Configuration	Number of Connected Chargeheads			
	1	2	3	4
Disconnected from Power Source	150	75	50	38
Connected to grid @ 100A 480Vac 3P	160	115	77	58
Connected to grid @ 100A 240Vac 3P	160	95	63	48
Connected to 120 kW DCFC	160	150	80	68

ElectricFish

Case Studies Webinar: Overcoming Obstacles in Transitioning Fleets to EVs

November 6, 2025

In collaboration with:

MASSACHUSETTS CLEAN ENERGY CENTER

CALSTART

ElectricFish **at a glance**

Founded in **2019,**
based in California and Michigan

Backed by **5 issued US patents**

Proven with leading OEMs and government agencies

Built to endure the toughest environments

Select customers & partners

California Energy Commission
City of Detroit
Hyundai Cradle
Toyota Mobility Foundation
Keeling Curve Prize
Caltech
World Economic Forum
National Park Service
Argonne National Laboratory
San Francisco Chamber of Commerce
conEdison
LA DWP Los Angeles Department of Water & Power

Deployment at Tier 1 OEM fleet research facility

Located in the Mojave Desert, the facility provided the perfect test environment for high-performance fast EV charging

Limited grid infrastructure

Client sought to repurpose a 220V connection which served a defunct 30 kW EV charger

Constant cycling

Client engineers need to regularly conduct high performance tests charging at high speeds, depleting the EV battery quickly, and then repeating the cycle

Extreme heat

Temperatures often surge above 100° F for many consecutive days accompanied with dust storms

ElectricFish 350Squared™

Flexible, fast, resilient DC Fast Charging

AI-powered battery storage that does it all:
400 kWh for fleet charging, backup power, and grid services

Flexible grid inputs:
Integrates with 208V / 240V / 480V without transformer upgrades

Best-in-class power electronics:
High throughput up to 950V backed by liquid cooled cables
(200 kW with 2-port simultaneously; 350 kW with 1-port)

Easy to deploy and re-deploy:
Elegant container design for easy forklift and flatbed transport

The Build and Shipping

Built at ElectricFish HQ in San Carlos, CA in 6 weeks

Build America Buy America (BABA) compliant

Forkliftable and moveable via flatbed truck

Commissioning

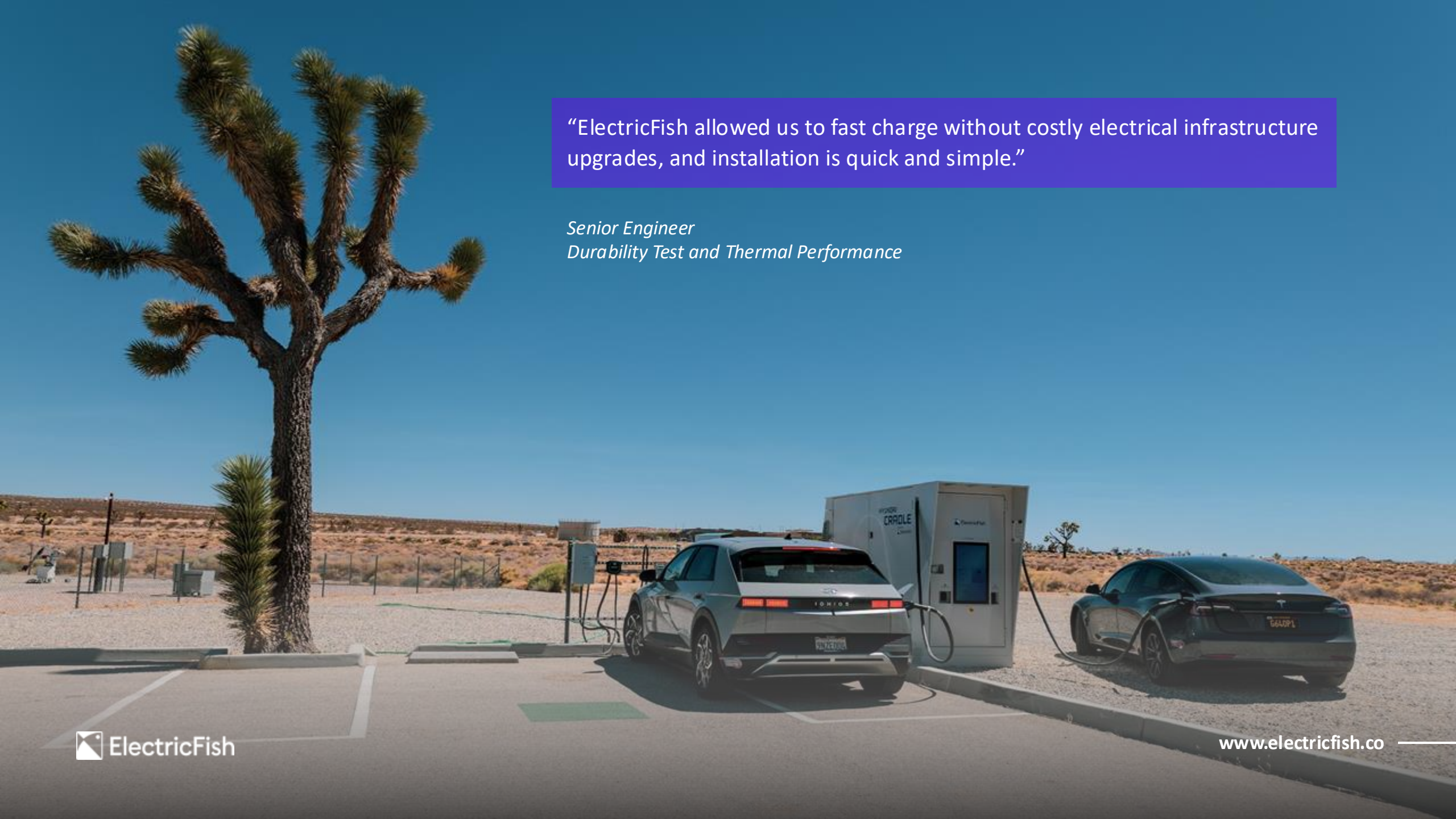
Installation only took 2 hours and only cost $500

Simple and rapid deployment

Client’s electrician partner Tower Electric repurposed the existing, defunct EV Box charger (30 kW) and wired it to ElectricFish’s system

No trenching or grid upgrades

The dual-port system (CCS + NACS) did not require any digging and rested securely on desert gravel



"ElectricFish allowed us to fast charge without costly electrical infrastructure upgrades, and installation is quick and simple."

Senior Engineer
Durability Test and Thermal Performance

ElectricFish

www.electricfish.co

KPIs Summary

In addition to deployment speed, we proved our performance, durability, and resilience

Best-in-class charging speeds

279 kW peak charging and 87 kWh max delivered in a single session

Robust capacity

Max of 283 kWh delivered in a single day; 7.4 Mwh delivered across charging and grid services

Beat the heat

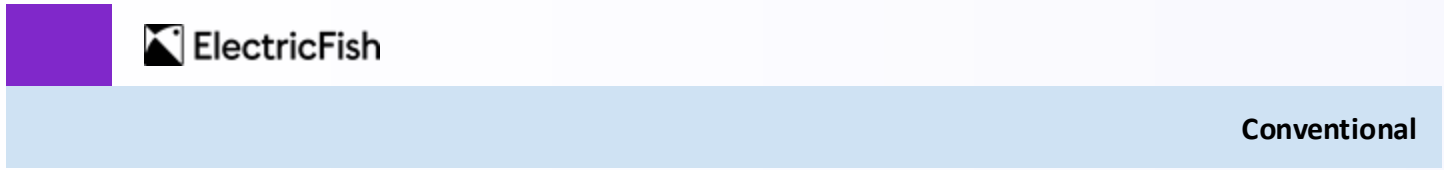
Innovative liquid cooled cables and air-cooled batteries for consecutive 100° F days without power electronics failures

Competitive Capex & Opex Comparison vs conventional non-BESS integrated dual-port DC Fast Charger

Budget*

$216,479 ($150,000 payment + $66,479 surplus expense)

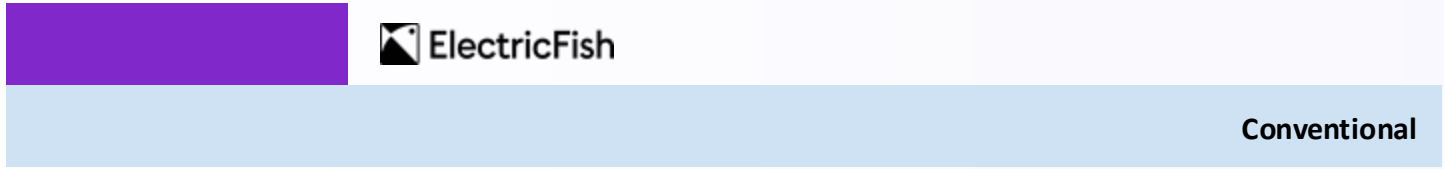
$290,000 ($140,000 DCFC + est. $150,000 grid upgrades, construction, install)



Deployment Timeline

4 weeks

Est. 24- 100+ weeks



DCFC electricity costs**

$5,635.27 (82% from demand charges)

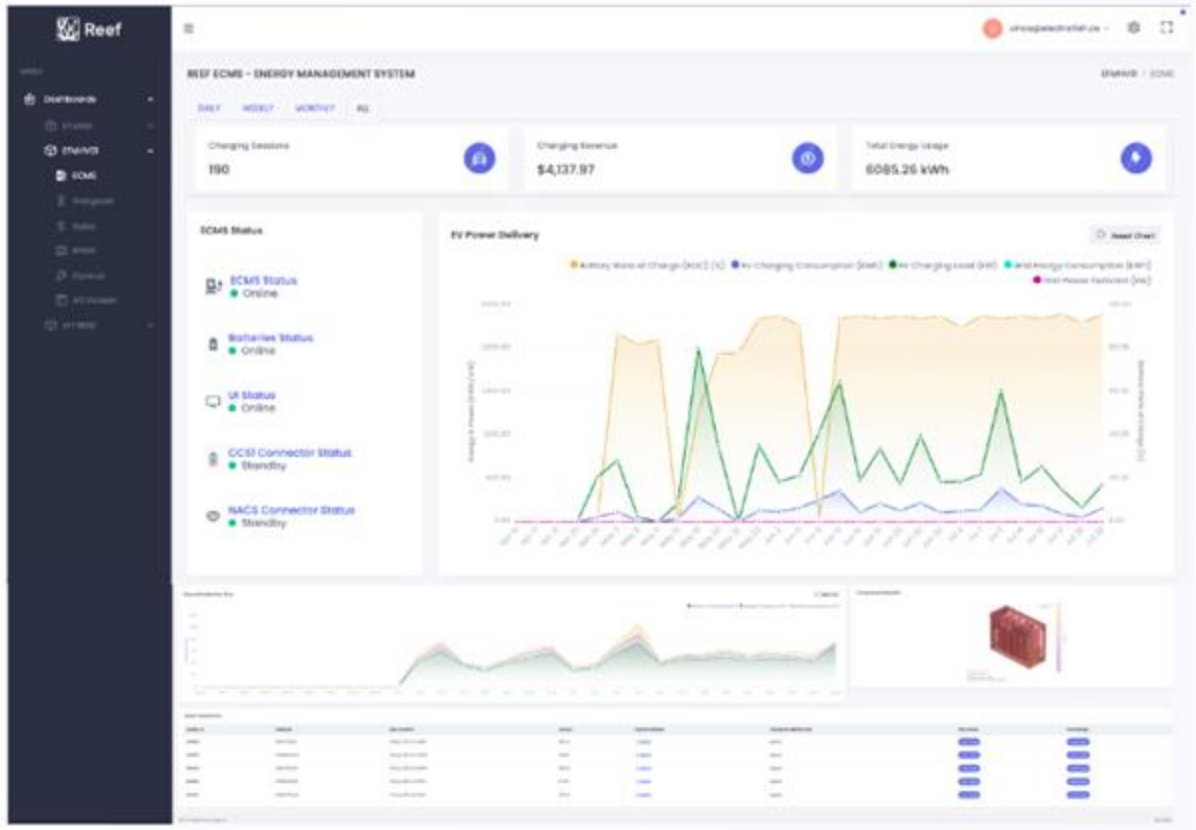
$21,820.24 (96% from demand charges)

**Client payment capped at $150,000 for this pilot; capex excludes cost of R&D as the unit delivered was a new product generation*

***EF costs calculated from utility bills from May 14 to August 18, 2025; Conventional costs estimated based on currently enrolled tariffs*

Reporting

ElectricFish's Reef dashboard provided comprehensive, real-time and longitudinal analytics and telemetry on system performance



Screenshot of Reef dashboard

Reef

- DC Fast Charging session data visualization (kWh, Voltage, kW, SOC)
- System status (SOC, CCS and NACS connectors, UI screen, grid input power)
- Thermal plots enabled by 12 installed heat sensors

User Experience

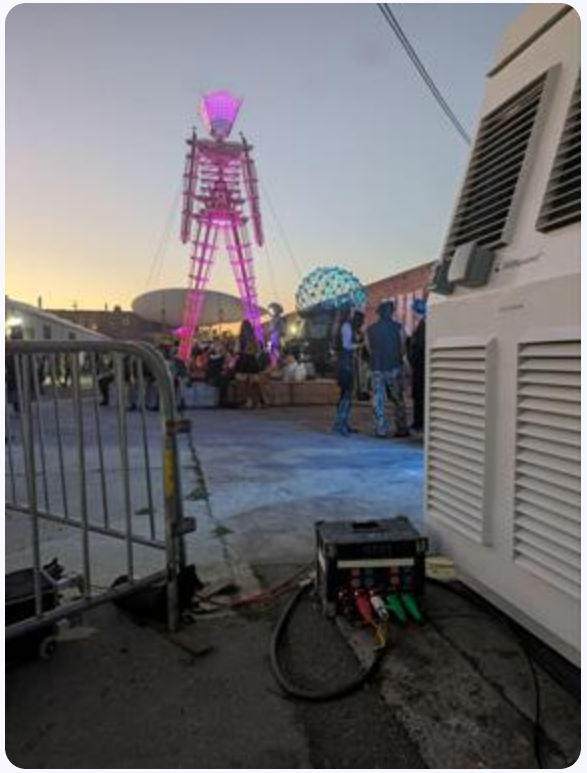
Seamless “arcade-style” button interface for simple charge initialization

How it works

1. Press either the CCS or NACS button to select connector
2. Press that same button again to initialize the session
3. Pay or use NFC keyfob (Client received free charging sessions)
4. Plug in and charge
5. Unplug when done

No mobile app downloads required

Additional Use Cases



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