NC STATE UNIVERSITY

SUSTAINABLE FLEET TECHNOLOGY

WEBINAR SERIES 2023

Session #9: Charging Resiliency & Off-Grid Charging

October 11, 2023

NC CLEAN ENERGY TECHNOLOGY CENTER

NAFA FLEET MANAGEMENT ASSOCIATION

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STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

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Deadline: Nov. 10

Upcoming Webinars

NAFA Green Fleet Webinars

- **Top Green Fleets of 2023** • Oct. 26, 1:00 p.m. ET
- *Featuring the City of Phoenix and Alameda County*
- **San Diego: Getting to Zero Emissions by 2035** • Oct. 27, 1:00 p.m. ET
- *Featuring the City of San Diego*
- **Lessons From Green Fleet Universities** • Nov. 1, 1:00 p.m. ET
- *Featuring the University of Virginia and the University of California Davis*
- **Rookie of the Year** • Nov. 2, 1:00 p.m. ET
- *Featuring the Town of Warrenton*

SFT Webinars November 8 and December 14

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Format

- Q&A at the end
- Submit questions and comments in the “Chat”
- Scheduled for 2:00p-3:15p
- Handout
- Recording

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https://www.sustainablefleetexpo.com/

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Charging Resiliency & Off-Grid Charging
October 11, 2023

2:00-2:07 **Rick Sapienza, NCCETC**--Introduction and Welcome

2:07-2:17 **Todd Ritter, Evstructure**—High Power Inductive Charging, Micro Grids, Resiliency & Their Infrastructures

2:17-2:28 **Michele Delafontaine, Sustainable Westchester**— Sunshine to EV – How storage brings multiple secure revenues to DC Coupled Fast Charging and Community Solar

2:28-2:39 **Patrick Mitchell, Merchants Fleet**—Clear Charge Drop Station Off Grid Charging

2:39-2:49 **Monte McLeod, Thompson AutoGas**—Alternative Fuel Solutions: Networking, Resiliency, and Sustainability

2:49-3:00 **Michael Winter, Jolt America**—Bringing Fast Charging to Cities

3:00-3:15 **Q&A**

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Driving Clean Air & Renewable Energy

CleanTransportation.org

Supported by the NC Clean Energy Technology Center with funding from the North Carolina Department of Transportation

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NC Clean Energy Technology Center
Clean Transportation Program
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Today's Speakers

Todd Ritter
Evstructure
Co-Founder
todd@evstructure.com

Michel Delafontaine
Sustainable Westchester, Inc.
Director of Business Development
michel@sustainablewestchester.org

Patrick Mitchell
Merchants Fleet
Mgr. Electric Vehicle Charging Infrastructure
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Monte McLeod
Thompson AutoGas
Director of AutoGas
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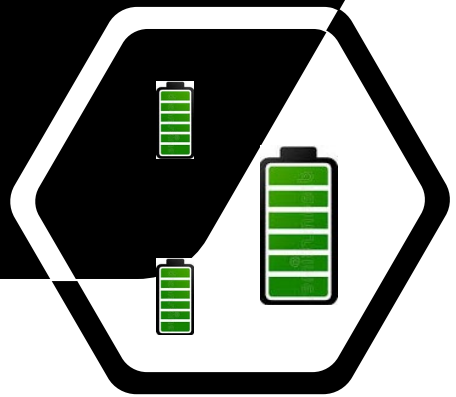
Michael Winter
Jolt America
President & CEO
michael.winter@jolt.energy

High Power Inductive Charging
Micro Grids , Resiliency
& Their Infrastructures'

H2o



Presenter : Todd Ritter Co-Founder
The Evstructure Inc.

EV STRUCTURE™

The Evstructure Inc.

Kickin Gas Since 1998

Founders
Todd Ritter C.E.M.
Andrew D'Alfonso P.E.

www.evstructure.com
www.hydrogenstructure.com
Ph. 833-Ev-Install (

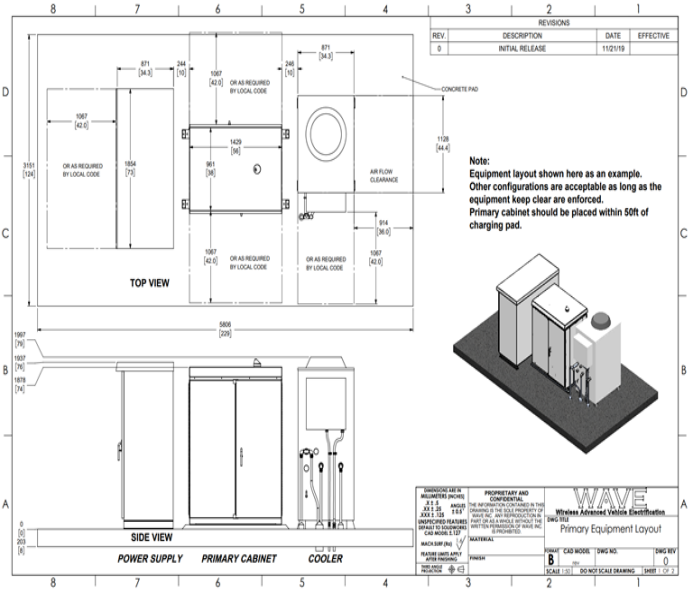
WAVE

by Ideanomics

HIGH POWER WIRELESS INDUCTIVE EVSE 250kw +

WAVE
by Ideanomics

250kW Wireless Charging System



WAVE'S 250KW WIRELESS CHARGING SYSTEM:

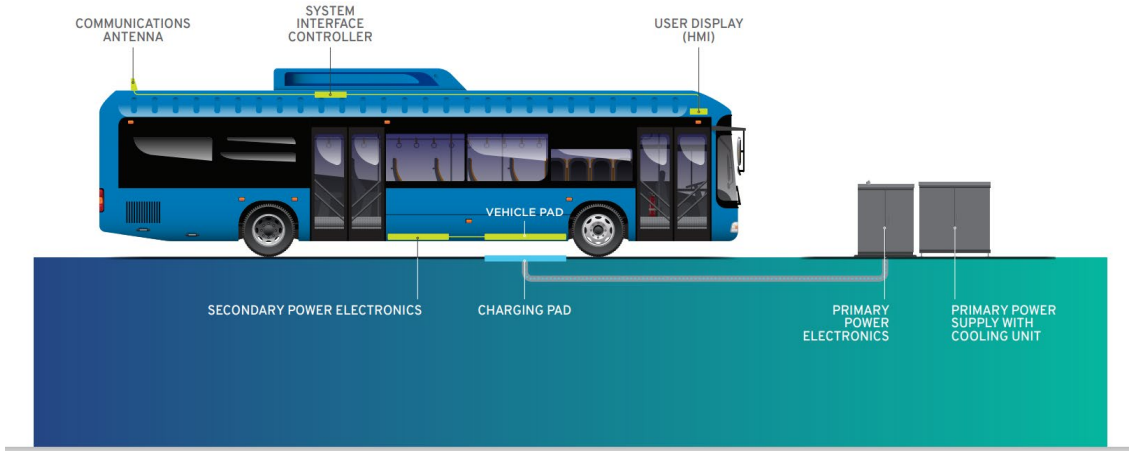
- Initiates in seconds during scheduled stops or natural dwell times
- Eliminates the need to handle high-voltage cables and connectors for improved safety
- No moving parts, connectors, or cables
- Minimal impact on existing operations
- Removes the collision risks and unsightly presence of legacy chargers

TRANSIT

SEAPORTS

WAREHOUSE + DISTRIBUTION OPERATIONS

> When you integrate wireless in-route charging into your scheduling and make it a routine part of how you do business, you can just eliminate the whole concept of range anxiety.
>
> MACY NESHATI | EXECUTIVE DIRECTOR/CEO | AVTA



Deploying WAVE high-power wireless charging helps:

- reduce battery size requirements
- extend vehicle range
- increase battery life
- lower maintenance cost
- eliminate labor relating to fueling
- improve safety

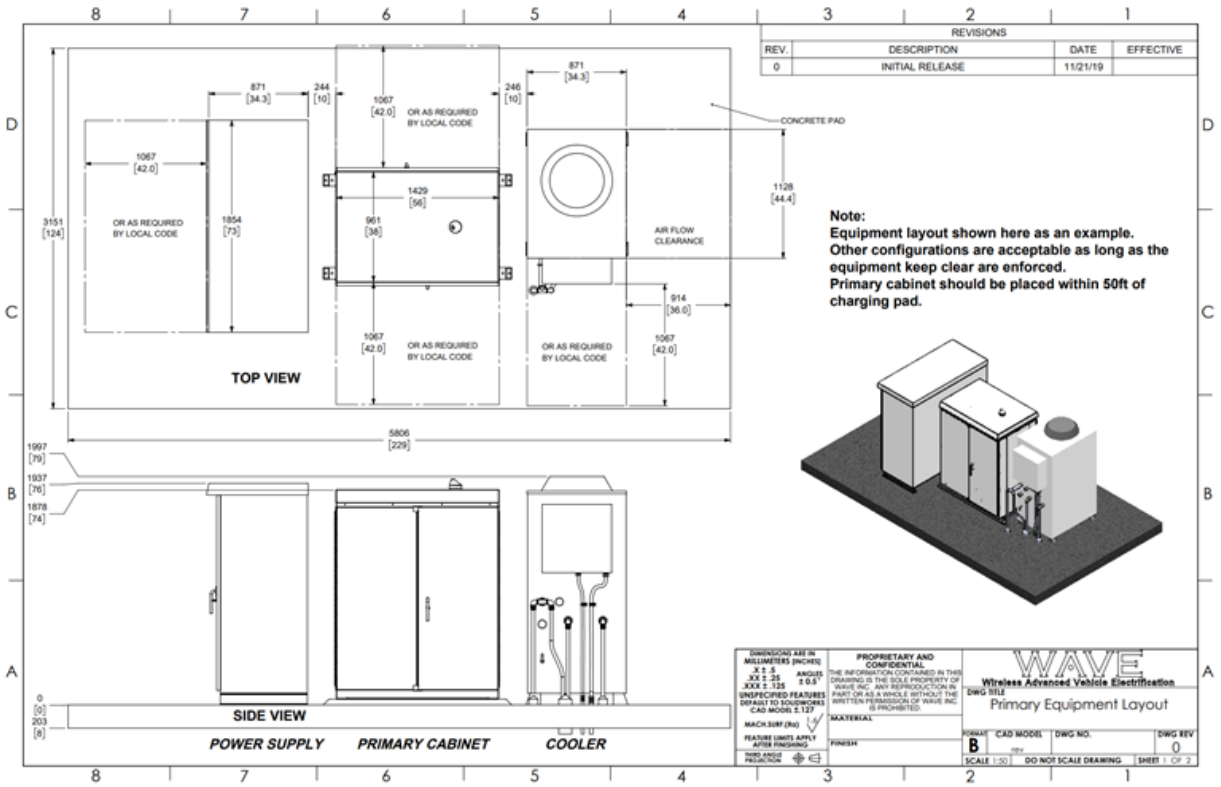
WAVE CHARGING

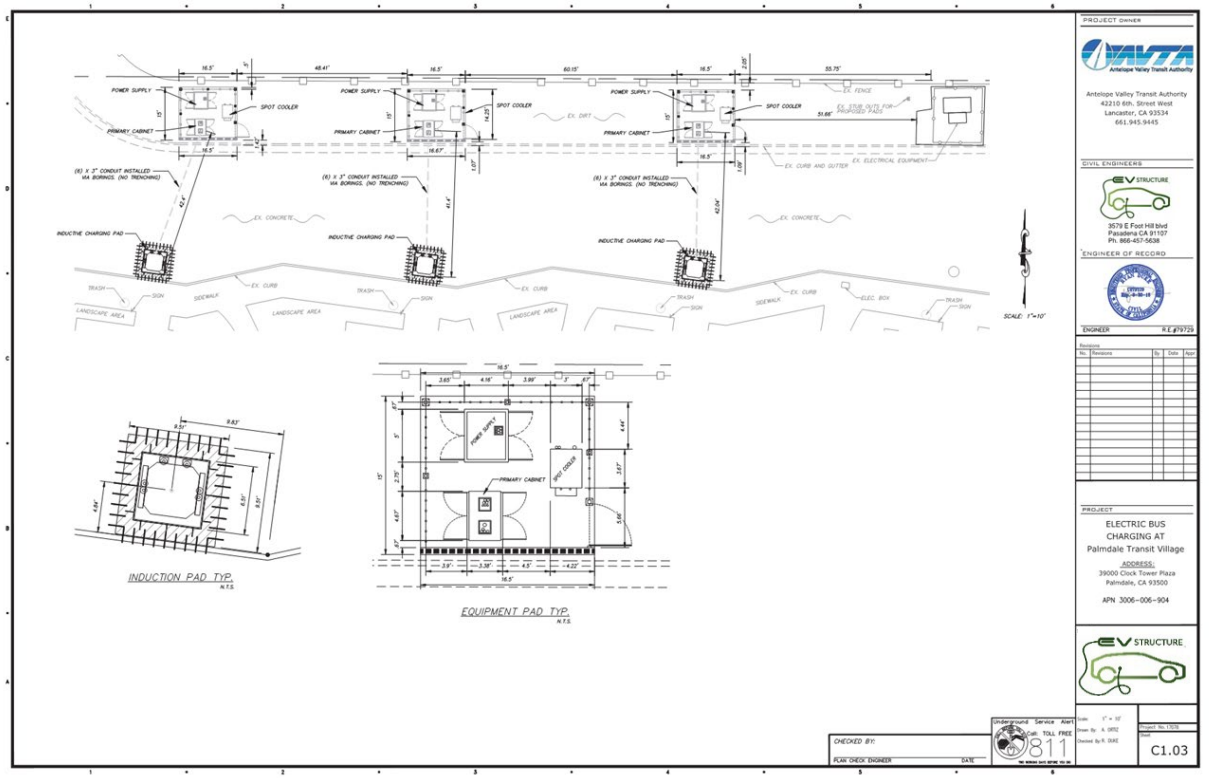
APMT Shuttle Project

Charging pad images have been altered to replace WAVE's former logo with WAVE's current logo.

Phase 1 and 2 Designed & Built by Evstructure Inc.

V6-Ph3





Infrastructure

(Per site Basis)

15-20% less then a Pentagraph Infrastructures
Most Agencies did not consider EVSE when their facilities were constructed

16”x 15” Pad needed for electrical cab’s
6’x6’ Inductive Pad

* Electrical Feasibility Study Needed (EE)

- CAD Design / PE Stamps & SE Stamps If adding Batts for off grid
- Planning (EE Time with Utility Planners)
- Plan check/Permitting
- (24/7 active Bus Site) Traffic Management needed

  Construction Time 4-6mos
- Commissioning On -line testing (2weeks Fleet Mgr)

VEHICLE OVERVIEW

I. DRIVE SYSTEM SPECIFICATIONS:

Chassis:

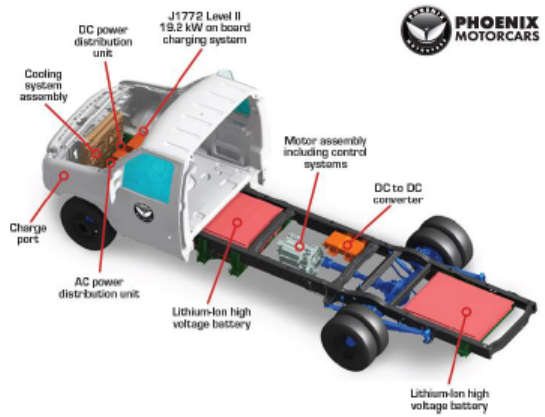
- 2022 or later Ford E-450 Superduty Chassis – 158" WB

Phoenix All – Electric Drive System:

- Permanent high power magnet motor + inverter
- **Up to 100 Miles All Electric Range per Charge**
- Dual charging capability
  - CCS Level III – 100kW
  - J1772 level II charging -19.2 kW
- GVWR 14,500 lbs.
- Dual Mode Regenerative Braking
- Max Speed 65mph
- Phoenix Telematics System – **Phoenix Connect**

Miscellaneous:

- Electric Heater, 20K Max BTU (Standard)
- Reverse Alarm
- Back Up Camera
- First Aid Kit 16 Unit
- Weight Certificate
- Fire Extinguisher 5 lbs. with Reflective Flare Kit



II. BODY SPECIFICATIONS:

Shuttle

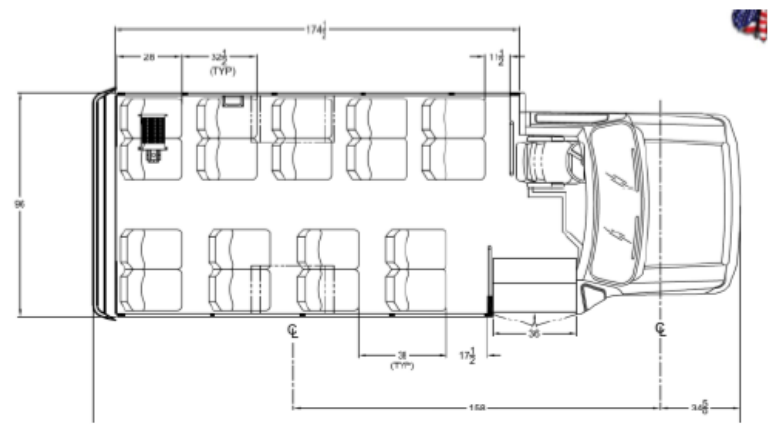
Exterior:

- Door, Entry A-M Electric
- Tinted Solid Window PKG

Interior:

- Passenger Seating:
  - 18 Forward Seats
- Seat Covers
- Driver's seat, cover to match passenger seats
- Passenger Retractable Lap Belts
- Stanchion, vertical with modesty panel
- Handrail, right hand entry assist
- 36" Wide Door
- LED Interior Lighting
- Air Conditioning, Rooftop Mounted 70K Max BTU

Vehicle Floor Plan:



ADS-TEC ChargeBox®

Gentle on the grid.

Gentle on the wallet.

German Technology- EVSTRUCTURE Approved Distributor and Infrastructure Commissioning Company

adstec Energy

EvStructure & Leading DC battery-buffered Ultra Fast Charging for Porsche North America

Meeting The Challenging Requirements of the New Porsche Taycan even at power limited grids

- Charge Time 0 to full 10 mins
- Efficient Ultra Fast Charging without Dependency from High-Power Grids
- Delivering up to 320KW even on power limited grids

Infrastructure Needed: Engineering both EE-SE , 100amp min Breaker

WATT MATTERS MOST , $aving On Demand

ChargeBox Removes Demand Charge Headwinds

SoCal Edison TOU-EV-4
$15.51 / kW Demand Charge

ChargeBox requires only 50 ~ 110 kVa input.

- ✓ Minimal three-phase power supply
- ✓ Gentle on the grid
- ✓ Reduced peak demand fees
- ✓ Deploy almost anywhere
- ✓ 320 kW speeds (or 2x 160 kW)
- ✓ Ultra-fast for new crop of EVs:
  - Kia/Hyundai (230 kW)
  - Chevy Silverado (350 kW)
  - Porsche Taycan (270 kW)
  - Tesla Model 3 (250 kW)*

* With CCS adapter

From 39 kW - 110 kW
Input of 480 V grid AC

Up to 320kW
Output and 920V DC

LOW POWER INPUT-58KW up to 116KW

HIGH POWER OUTPUT – even up to 270KW output with 58KW input

Aggregate Site Speed	ChargeBox Demand $/ yr.	Unbuffered Demand $/ yr.
300 kW	$9,300	$55,830
600 kW (NEVI)	$18,600	$111,670

* Assumes one 50 kW feed per 300 kW requirement with ChargeBox.
Double these figures for high-traffic sites requiring 100 kW input for faster buffer replenishment.


ecamion

eCAMION

DC2DC Integrated Solutions

Electric Vehicle Charge Station Networking

Bus & Fleet Charging

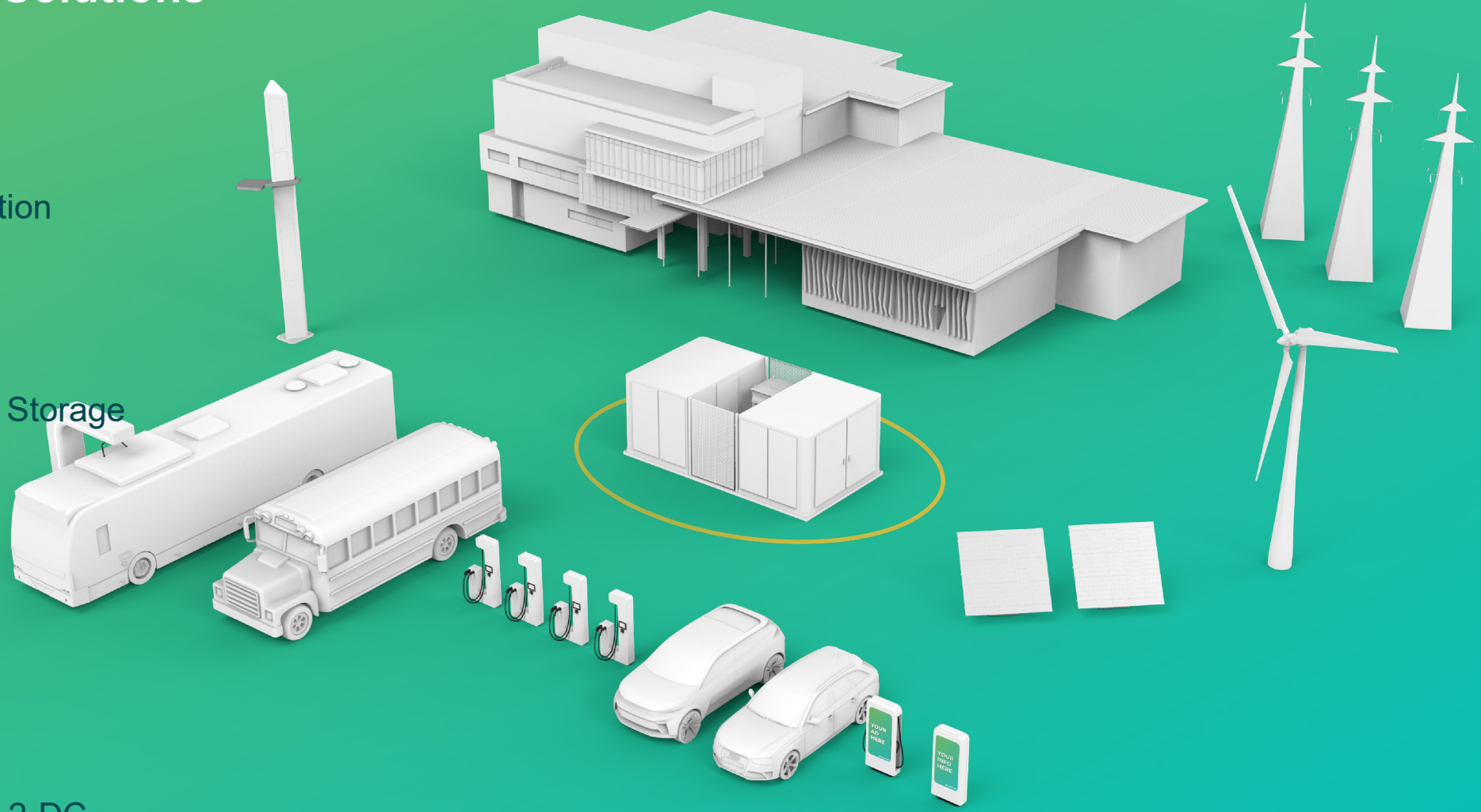
Upto 600kw Battery Energy Storage

Vehicle-To-Grid (V2G)

Grid Interface (CPPM)

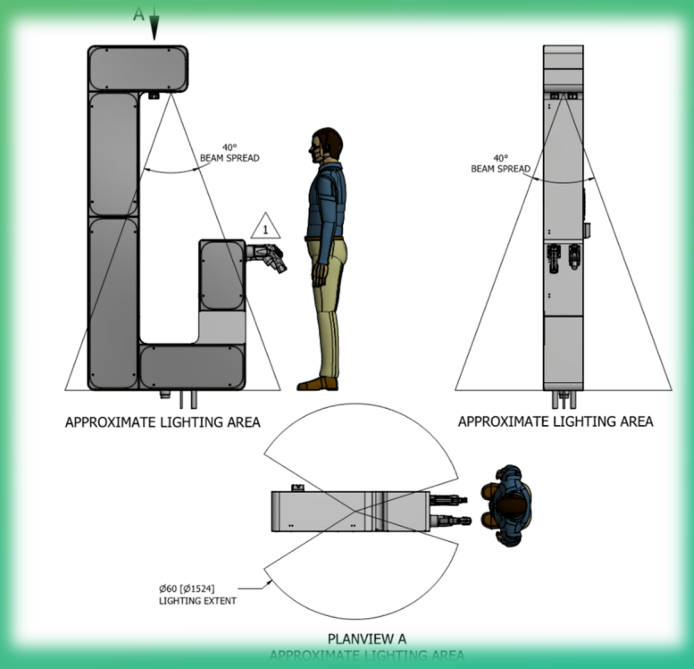
Renewables Integration (CPEM)

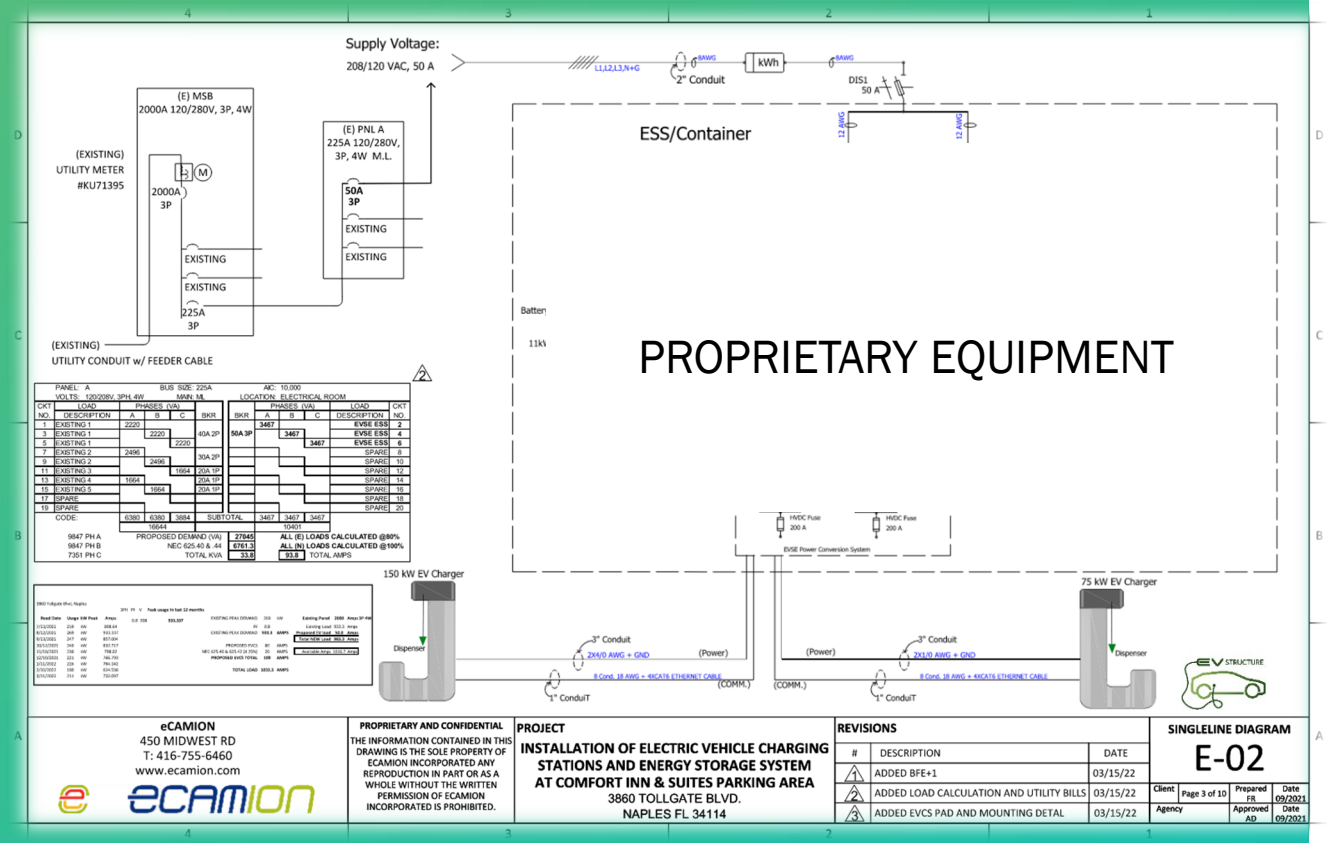
Use Other DCFC Untis DC-2-DC



eCAMION

Integrated Solution





Infrastructure 25% less
No Utility Wait Times

11’ x 8’ Pad needed for ESS
2’ x 4’ Needed for Dispenser

NO Electrical Feasibility Study Needed (EE) on Renewable Applications

- **EvStructure -CAD Design / PE Stamps/ Structural Engineering**
- **Construction Time 2mos**
- **Commissioning On -line testing (Minimal)**

H20 The Path to a Zero Carbon Future

RI, EVSC and GM Solutions for a Green and Energy Independent Future

NO Electrical Feasibility Study Needed (EE)
Zero Electrical CAD Design or EE Stamps

- Structural Engineering (Parking Garages)
- Plan check/Permitting for Structural
- MINIMAL Traffic Management needed
- Construction Time =2day and a crane
- Commissioning On -line testing (Minimal)
- Operation and Maintenance H2o $8.67 a KG delivered

RENEWABLE INNOVATIONS

Renewable Innovations – Rapid BEV H2 Charging Solutions

RENEWABLE INNOVATIONS
renewable-innovations.com
Clean
Scalable
Power

Mobile

Empower MPG 60 KW

- 80kW Fuel Cell
- 180kW Inverter
- 180kWh Li Battery array
- Up to 70 kg H2
- 180 kW DC Fast Charger Can

Connect to a facility for backup Power

- Can connect to Utility for Grid Services
- Outputs can be paralleled
- **Batt &FC =70 EV's- FC only 35 EV's**

Power 8 EVS A HR @ 50% SOC

Renewable Innovations Proprietary

MEC-H2RC ¾ MEG OF POWER

- 250kW H2 Power (Fuel Cells)
- 560 kW Scalable Inverter Power
- 700 Kwh Battery Storage
- Dual 180- kW DC Rapid Chargers (4 Charge

- Ports)
- Advanced local and remote Power management & control
- Up to 180 kg H2
- 80-100 HOMES @ 8kw -5 HRS
- 184 KW DCFC X2
  100KW BATT 50% soc =70 EVS

- 200 X 100KW 50% soc @11 KW L2 EVSE
  In 2hrs receive each EV receives 17kwh

Fixed

Empower H2RC ½ meg

- 700 kg H2 Min
- 700 BAR
- 500kW up to 700kW Power
- (4) Dual Port DC Fast Chargers with Point-of-Sale Option
- Utility Interface for Backup or Bi-Directions Utility Connection
- Optional Canopy
- Optional Lighting Package

- Less power , more time 500kw
- 8 Ports x184 @100kw 50% soc = 96 EV
- 700kw = 136 EV continuously

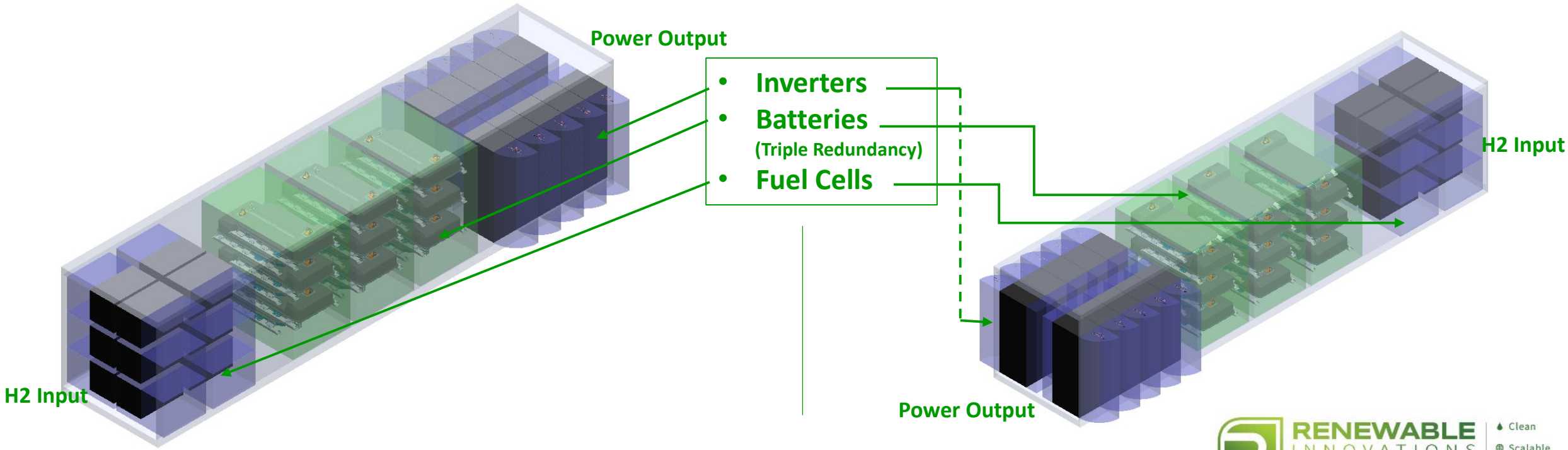
Renewable Innovations – H2 Primary & Backup Scalable Power

1 to 1.5 MW Module

Modular H2 Storage

- **Up to 500kg per 20' module**

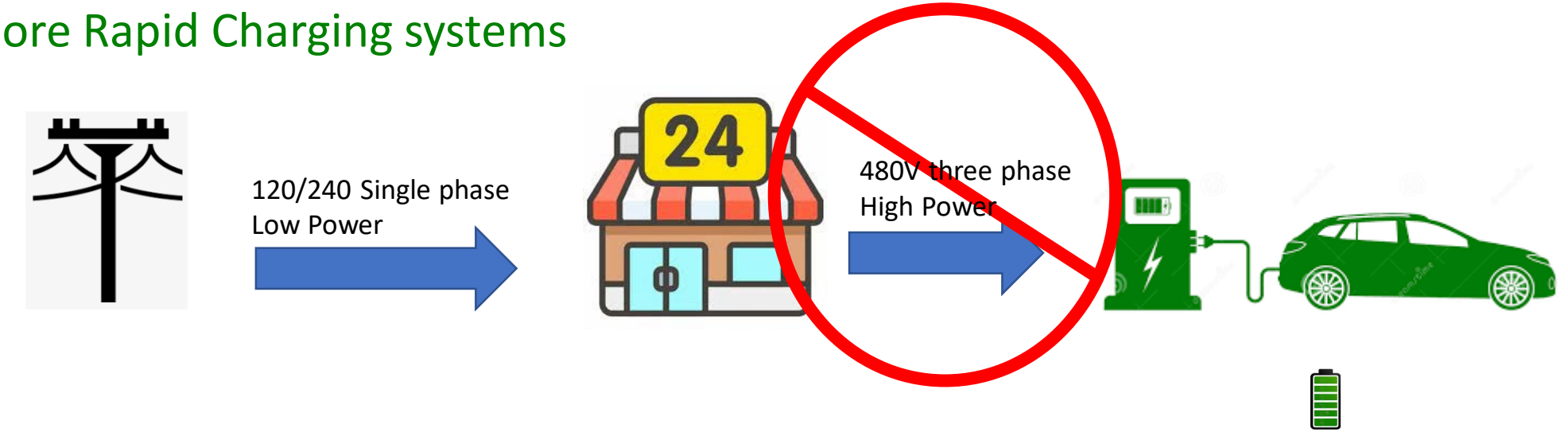
- $3.50 / Watt - single units (excluding H2 Storage)
- $1.50/ Watt large volume purchase (excluding H2 Storage) PER WATT FOR UNIT (COSTS)
- HYDROGEN $8..00 DELIVERED



RENEWABLE INNOVATIONS
renewable-innovations.com
Clean
Scalable
Power

In closing Micro Grids enable ANY location EVSE Charging w/ Resiliency

Both ADS –TEC , Ecamion and Renewable Innovation H2o Systems allows any location with single phase or low voltage 3 phase power to provide 3 phase 480 V power for 150kw or more Rapid Charging systems



EV STRUCTURE

New Flyer- a bus OEM estimates 150 MWh daily for a fleet of 300 buses to keep them charged fully at the depot (Marshall, 2019)

CONTACTS

The Evstructure Inc.

Todd Ritter Co- Founder
todd@evstructure.com
Call 385-881-7610

THANK YOU

NCSU

SUSTAINABLE WESTCHESTER

Sunshine to EV

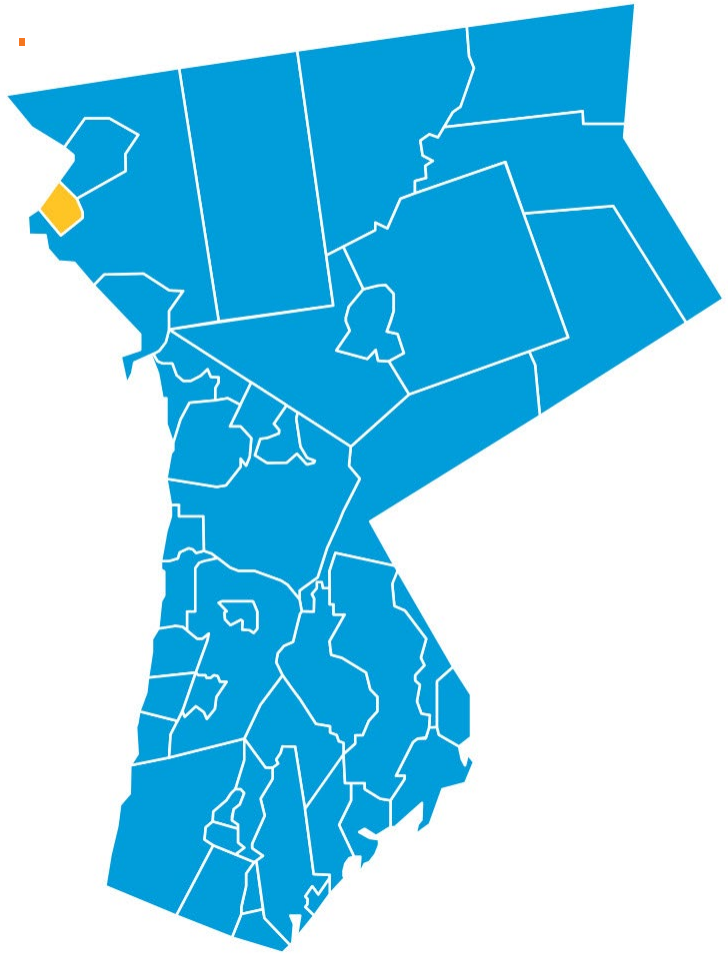
Business Model Innovation with EV Charging

NY BES+ NEW YORK BATTERY AND ENERGY STORAGE TECHNOLOGY CONSORTIUM

NY-BEST Fall Energy Storage Technology & Innovation Conference 2023

SUSTAINABLE WESTCHESTER

SUSTAINABLE WESTCHESTER



MUNICIPAL PARTICIPATION

Ardsley	Hastings-on-Hudson	North Castle	Rye Brook
Bedford	Irvington	North Salem	Rye City
Briarcliff Manor	Larchmont	Ossining Village	Rye Town
Bronxville	Lewisboro	Ossining Town	Scarsdale
Cortlandt	Mamaroneck Village	Peekskill	Sleepy Hollow
Croton-on-Hudson	Mamaroneck Town	Pelham Manor	Somers
Dobbs Ferry	Mount Kisco	Pelham Village	Tarrytown
Eastchester	Mount Pleasant	Town of Pelham	Tuckahoe
Elmsford	Mount Vernon	Pleasantville	White Plains
Greenburgh	New Castle	Port Chester	Yonkers
Harrison	New Rochelle	Pound Ridge	Yorktown

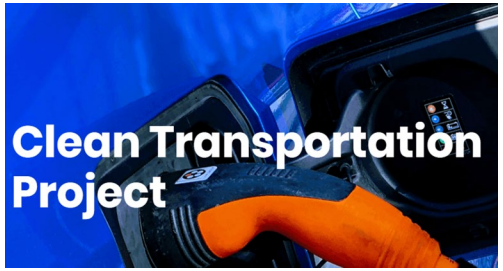
& the County itself!

SUSTAINABLE WESTCHESTER

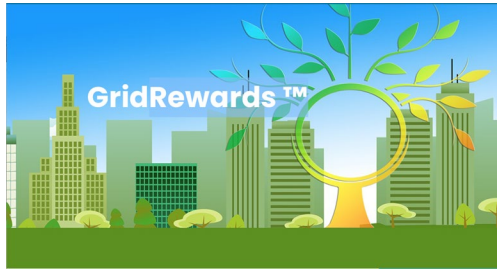
OUR PROGRAMS

Community Energy

Electrification Solutions



Grid Efficiency



Zero Waste

SUSTAINABLE WESTCHESTER

THE PROJECT: description

Three parts:

- 85 kW Solar PV
- 180 kWh Storage
- Two DCFC Ports, each $75 kW

Revenue Capture:

- Community Solar
- DC Fast Charge

Business Model for Sunshine to EV:

- avoids high demand charges for the owner (up to $300 per $kW*y^{-1}$) and reduces the Grid impact by 80%.
- Secured revenue from Community Solar: makes money from Day 1.

Full Community Solar Subscription Sustainable Westchester has subscribed and provides credits to Households in LMI communities.

SUSTAINABLE WESTCHESTER

THE PROJECT: issues

Location:

- Need to involve municipalities (PPP)

Permitting:

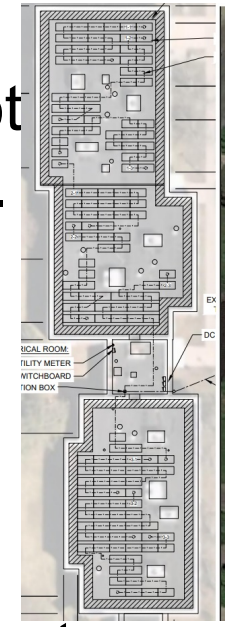
- Solar + Storage + DC Fast Charge guidance not always available. Fire Code based on UL Certs.
- Watch for essential buildings (Class IV)

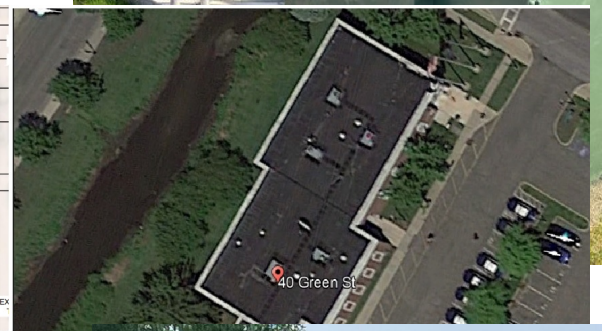
Grid Interconnection:

- Interconnection application process (CESIR).
- True impact on the grid.
- Interconnection execution.
- Management by obstacle: meter pending certificates.

ITC or PTC Capture

- Documenting for a Tax Equity provider.
- Is Direct Pay less cumbersome?
- Transaction agreements.





SUSTAINABLE WESTCHESTER

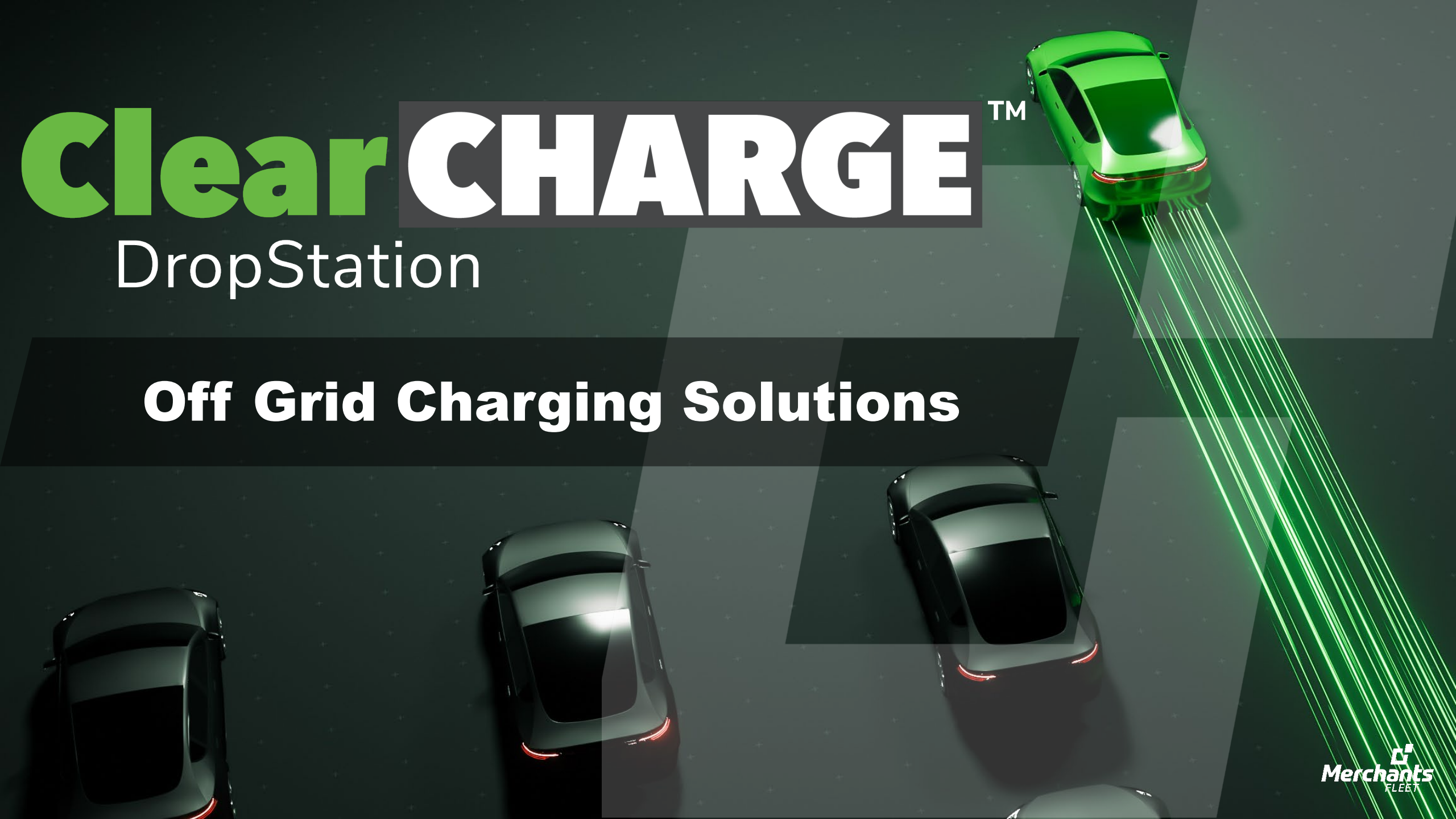
THANK YOU !

SUSTAINABLE WESTCHESTER

ClearCHARGE™

DropStation

Off Grid Charging Solutions



Merchants FLEET

OFFERING

Mobile charging systems support rapid EV deployments &

Off grid solutions

VALUE

Towable

No Grid Connection

Low Carbon Fuel

CONFIGURATIONS

Mini: (2) 11.5kW Level 2 Chargers

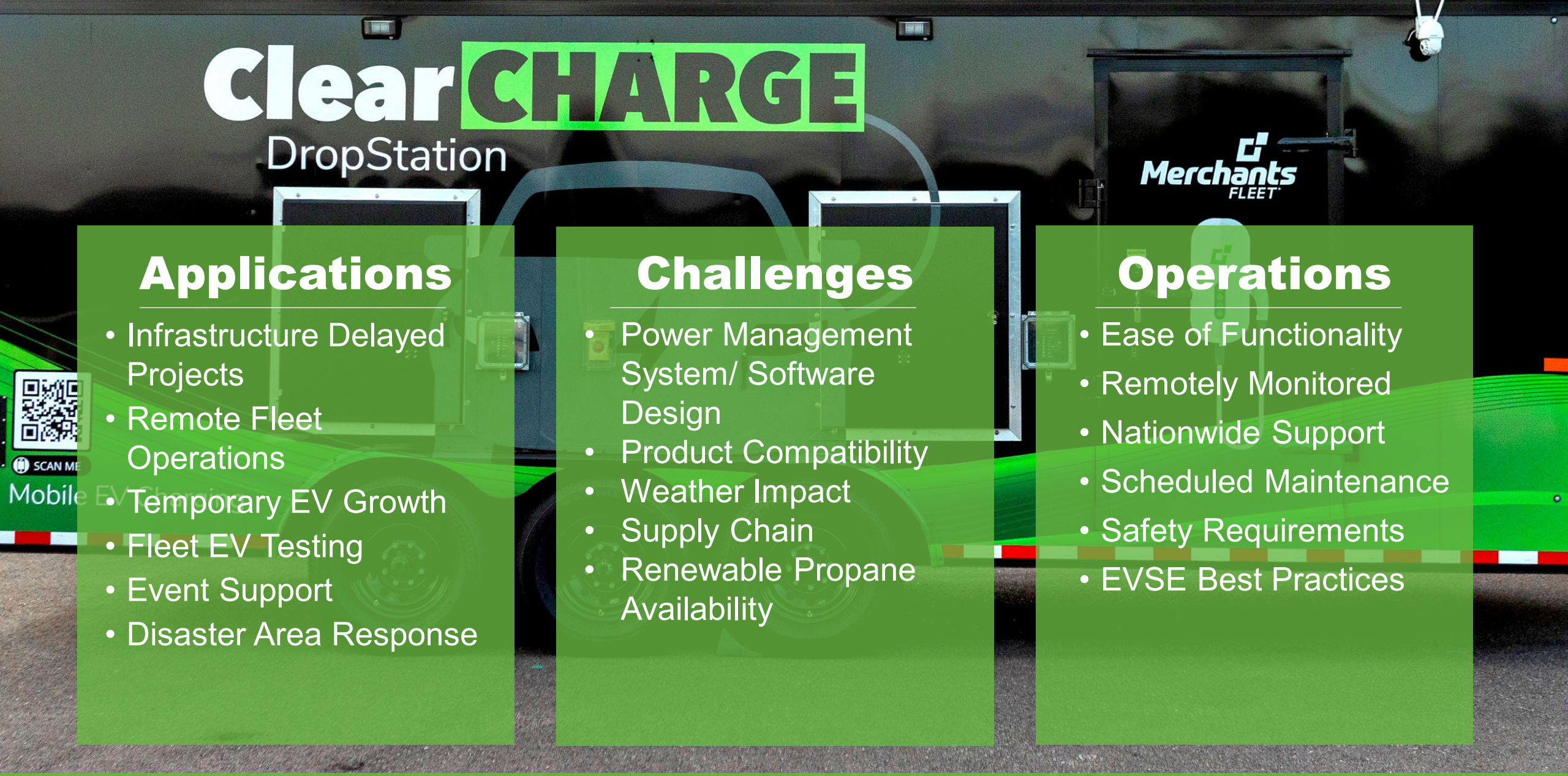
Flex: (4) 11.5kW Level 2 Chargers + 60kW DCFC

Propane Fuel - Cleaner than grid in 38 states

Renewable Propane - Cleaner than grid in 49 states

READY FOR TRIALS **OCTOBER 2023**

Merchants FLEET



Applications

- Infrastructure Delayed Projects
- Remote Fleet Operations
- Temporary EV Growth
- Fleet EV Testing
- Event Support
- Disaster Area Response

Challenges

- Power Management System/ Software Design
- Product Compatibility
- Weather Impact
- Supply Chain
- Renewable Propane Availability

Operations

- Ease of Functionality
- Remotely Monitored
- Nationwide Support
- Scheduled Maintenance
- Safety Requirements
- EVSE Best Practices

OFF GRID CHARGING SOLUTIONS

Merchants FLEET

Alternative Fuel Solutions: Networking, Resiliency, and Sustainability

THOMPSON AutoGas

EV Charging

THOMPSON AutoGas
Powered by Clean American Energy

Off Grid Propane Dispenser

THOMPSON AutoGas
Powered by Clean American Energy

Sustainability

THOMPSON AutoGas
Powered by Clean American Energy

Off-Grid Hybrid Fueling Station

Autogas/EV

PROPANE AUTOGAS

App-based,
fuel-management system

Pumps 15 gal/minute

1,000-gallon propane capacity

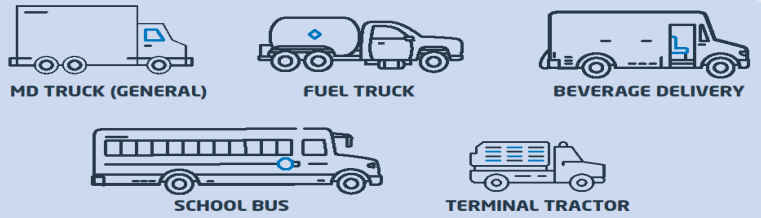
ELECTRIC VEHICLE CHARGER

DC Level III Dual Hose Charger

60kWh Battery Storage

- Solar 2kW
- Wind 1kW
- Propane 60kW

APPLICATIONS



propane autogas

Monte McLeod
mmcleod@thompsongas.com
803-609-1172

JOLT

Bringing Ultra-Fast Charging to Cities!

2023

JOLT focuses on (1) Ultra-Fast-Charging & (2) Minimally-Intrusive Deployments for Urban Destinations

In the future, we won't go to fuel, we'll fuel where we are!

A widely distributed charging system is the key to success

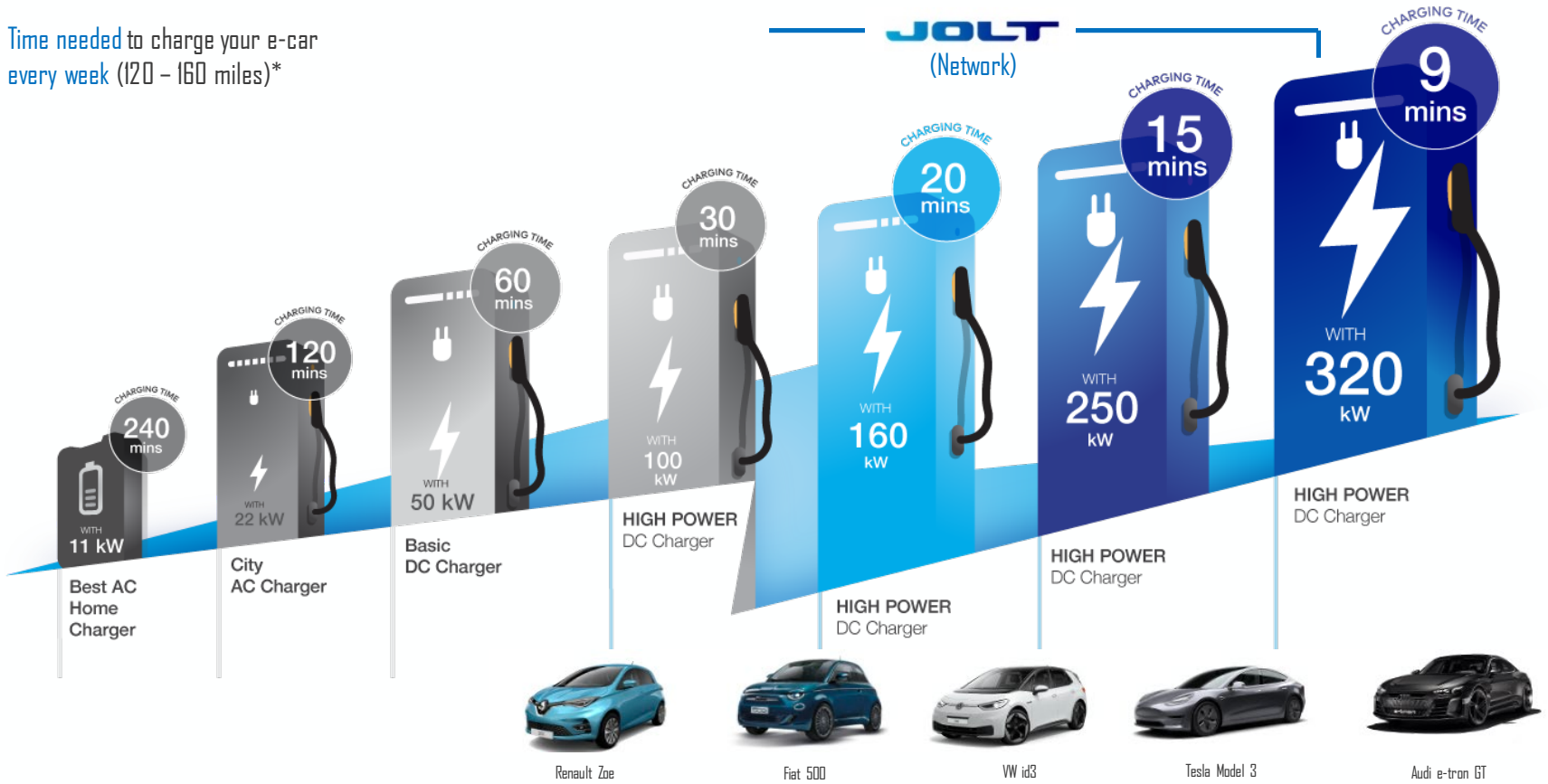
We deploy ultra-fast-charging EV infrastructure that is minimally-intrusive to cities and utilities

Our chargers can be installed without extensive planning or disruptive construction

We install in urban and suburban areas by tapping into the low voltage commercial grid where others cannot operate

JOLT and its partners are deploying a network of ultra fast chargers, addressing the needs of urban EV drivers

Time needed to charge your e-car every week (120 – 160 miles)*



A reliable charging infrastructure requires differentiation:

- AC chargers work for long-stay locations such as homes & offices
- DC-grid chargers work well on highways and in rural areas with easy grid access
- JOLT's flexible approach using minimally-intrusive chargers is key to providing ultra-fast charging in grid-limited areas, such as towns, cities & suburbs

*JOLT Research

Deployment Modes for JOLT charging-as-a-service
Public vs. Fleet Charging

	"ChargeMyCity"™ Mode Public Charging with Site Hosts	Fleet Charging Mode / Behind-the-Fence
JOLT AMERICA (JOLT) invests in hardware	✓	✓
JOLT installs & carries cost	✓	✓
JOLT operates, maintains & carries cost	✓	✓
JOLT partners with site hosts, selects high frequency locations based on market economic variables in long-term partnership	✓	N/A
JOLT recovers investment / expenses by selling ultra-fast-charging kWh to wholesale and electric vehicle customers	✓ (profit share with site host)	N/A
JOLT recovers investment / expenses by selling ultra-fast-charging kWh to wholesale customer (20 years)	N/A	✓ (/kWh + minimum annual consumption threshold)
Additional JOLT DOOH advertisement placement where permitted and via 75" screens.	✓	TBD


JOLT uses grid boosting technology to deploy ultra-fast chargers in urban areas where traditional technology faces grid limitations
JOLT
The integrated battery pack allows chargers to be connected to low voltage grid in cities
Our Ultra-Fast Charging dispensers allow charging of 150 miles in 10 minutes
Diese ultraschnelle Ladesäule befindet sich im Testbetrieb. Eröffnung in Kürze.
JOLT
Wir installieren diese Ladesäulen in deutschen Großstädten, um die E-Mobilität dort zu ermöglichen, wo du bist.
Begleite uns auf dieser Reise, um den Übergang zur nachhaltigen Energie zu beschleunigen.
Ultra-schnelles Laden
Lade 100km in 5 Minuten
Spart bis zu 50 Tonnen CO_2 pro Jahr
Hergestellt in Deutschland
Jetzt Online Investieren
Hinweis: Dieser Prozess dauert 10 Minuten.Manche Abschnitte sind optional.

Example spec using smart technologies:
JOLT delivers minimally-intrusive ultra-fast-charging

Features	▪ Integrated storage ▪ High Power Charger ▪ 10” sunlight readable HD touch screen ▪ Outdoor installation at limited-power distribution grid ▪ Micro Grid
Charging	▪ 150 – 920 V car platforms ▪ High Power Charging up to 320 kW DC ▪ CCS1 (open standards) / 2024 NACS added
Battery	▪ Integrated – 140 kWh
Environment	▪ -22°F to +122°F ▪ Low Noise
Grid Connection	▪ 400 – 480 V ▪ 50 or 110 kVA ▪ 60 Hz
Health & Safety	▪ Regional: UL, CE, ▪ Transport: UN 38.3 ▪ TÜV-certified safety for installation in public domain
Lifetime	▪ 10-year battery performance warranty
Production	▪ In-house manufacturing in Germany

Merlin ChargeBox (CBX)

- Battery buffered charger for urban, low voltage grid
- Up to 320 kW (or 2x160kW) ultra-fast performance
- Deployment <2 weeks*, light construction
- US production to be launched in 2024
- Payments: Pay by App, Credit & Debit Card, Apple & Google Pay
- Optional delivery of DOOH advertisement via 75” screen

*local permitting and infrastructure partner timelines apply

Example: Startup Site Study

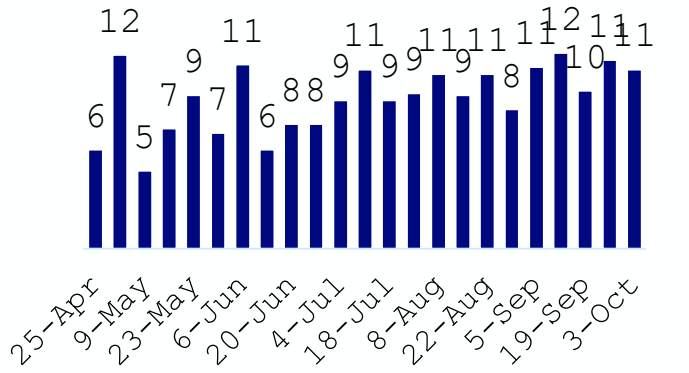
Overview

Description: Gas / service station / convenient store, in a city with high level of EV registrations. JOLT deployed one ultra-fast charger system to this site with two charge towers/outlets

Charger model / speed: ChargeBox with 1x 320kW / 2x 160 kW (dynamic)performance

Construction time: 8 days

First 5-Month Average Daily Sessions each Week



Sources: Company information; Operational data collected by JOLT

MerlinOne: 2024 Outlook for North America

This semi-mobile solution reduces installation time and effort significantly and will be available to the North America Market in mid-2024.

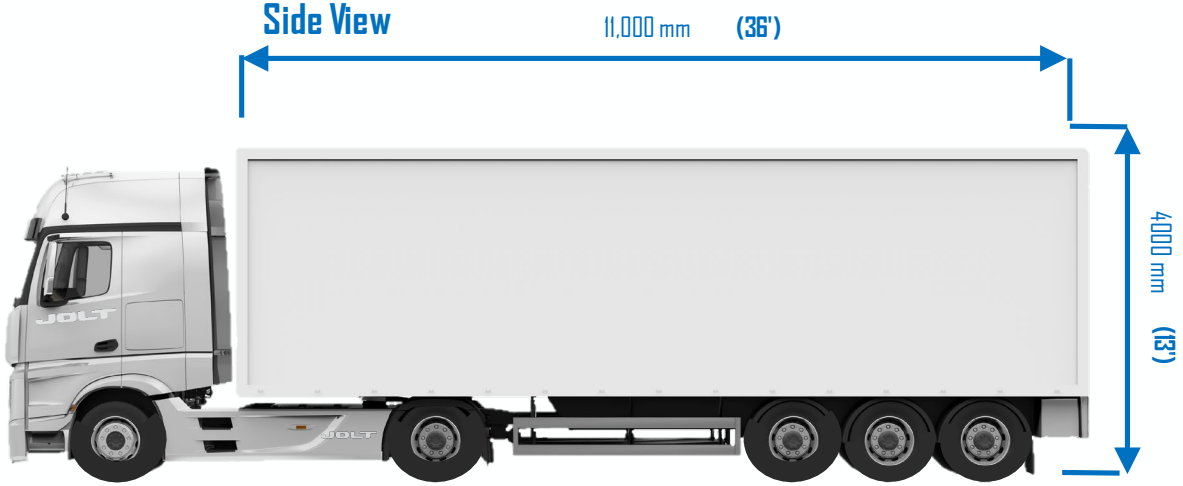
- Semi-Mobile 200kWh battery buffer ultra-fast-charger that operates minimally-intrusive to the electricity grid
- 300kW performance "up to 150 miles in 10 minutes" (2 x 150kW if charging 2 EVs concurrently)
- 1 MerlinOne charger – if disconnected e.g. during a power outage – can charge up to 8 cars with a range of 100 miles
- Fast installation on ground bracket, recommendation: movable <10 times

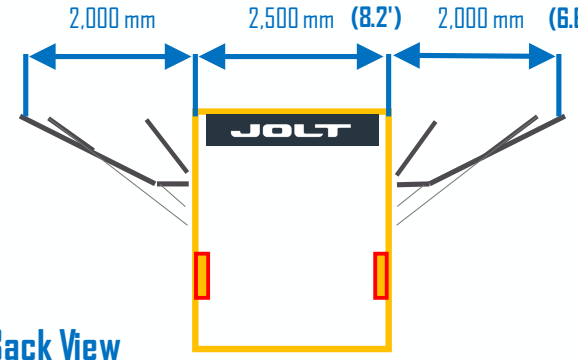
MegaMerlin: Glimpse into the Future Emergency Response

Mobile Charge Park charges 4 simultaneously at 240 kW / 8 at 120kW

Dimensions

Side View





Back View

In the Field

8 ports / 120 kW for 8 Vehicles

if only 4 Vehicles charge concurrently --> up to 240kW

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