Poll #4

What is the biggest need for scaling?

a. Incentives for trucks or charging
b. Regulatory mandates
c. National charging network
d. Supply side incentives

https://io.cvent.com/polling/v1/api/polls/sp2fgvrx

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Freight Electrification and the role of telematics

Charlotte Argue Sr. Manager, Sustainable Mobility

GEOTAB

Big Data @ Geotab

connected vehicles, globally

>50 Billion

data points collected daily

Richest telematics dataset
in the world including GPS, traffic, accelerometer, engine data, weather, driver behaviour, and more.

Electrification Dataset (truck movement)

Aggregated Vehicle Usage

Vehicle Behaviour

- Distance Distribution
- Duration Distribution
- Idling / Stops Distribution
- Stop Locations
- Fuel Consumption

Vehicle Segments

- Weight Classification
- Fuel Type
- Vocation / Industry
- Domicile Location
- Travel Location
- Urban / Rural Travel

Regional Characteristics

- Corridor Utilization
- Commercial Traffic Volumes
- Elevation Changes
- Temperature Variations

Electrification Insights

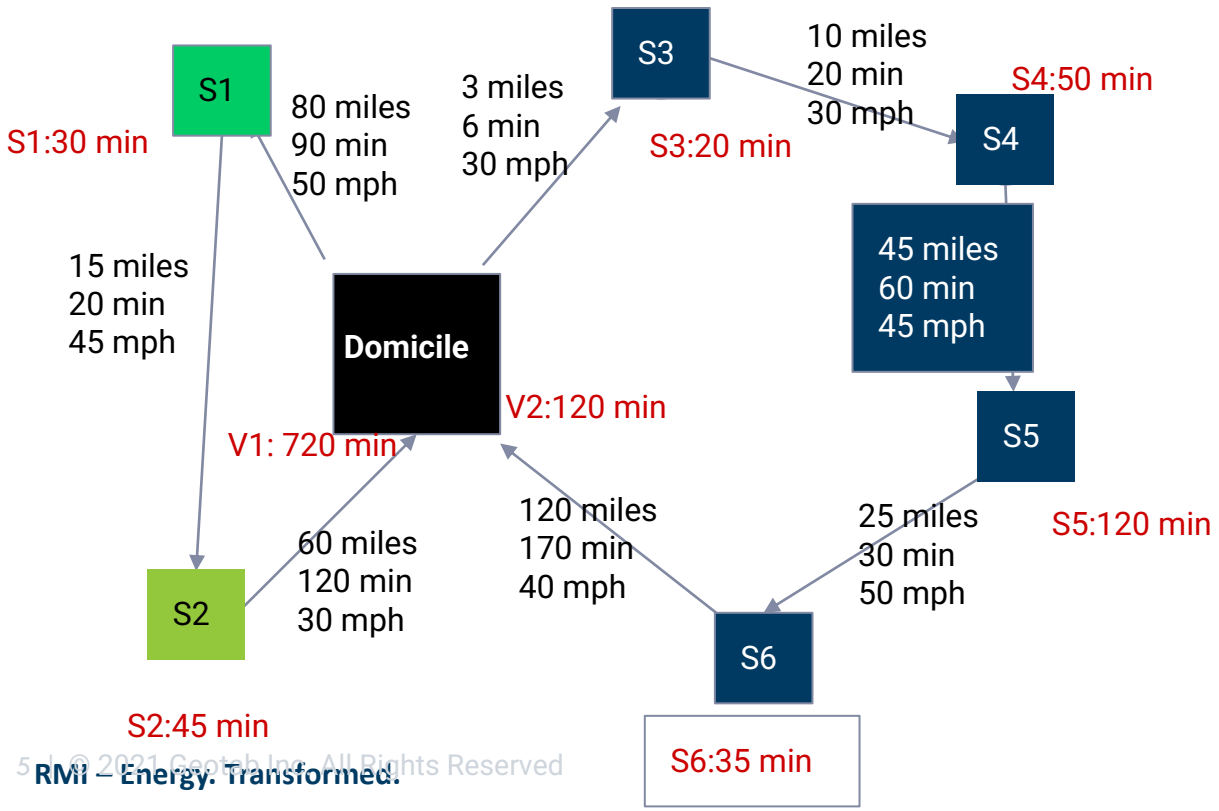
- Vehicle Duty Cycle Analysis
- EV Functional Suitability
- Vehicle Movement Density

- EV Adoption Forecasting
- Electrification Scenario Analysis
- Charging Station Locations
- Electrification Incentive Design
- Regional GHG Reduction

RMI Project - Data Overview

Built around domicile meaning that the assumption is that charging stations will be available at domiciles only

- **Domicile: a location (geohash 5) where the vehicle has stopped the longest in it during the past month.**



Based on **daily duty cycle** and **distance driven between domicile visits:**

- The diagram shows 2 trips and how the duty cycles are calculated.
- Data is aggregated to provide summary statistics
- Distance travelled must be less than 300 miles to be considered electrifiable

	Trip 1	Trip 2
Distance Traveled	155 miles	203 miles
Total Distance	358 miles	
Domicile Time	720 min	120 min
Total Travel Time	516 min	
Stops out of Domicile	6 stops	

Charting the Course for Early Truck Electrification

Dave Mullaney

May 2022

Just How Many Trucks Can be Electrified Anyways?

Using Data to Answer a Critical Question

Some Trucks Can Be Electrified Today and Some Can't. The ratio is not known, but it matters.

ACT Required Sales Trajectory in California

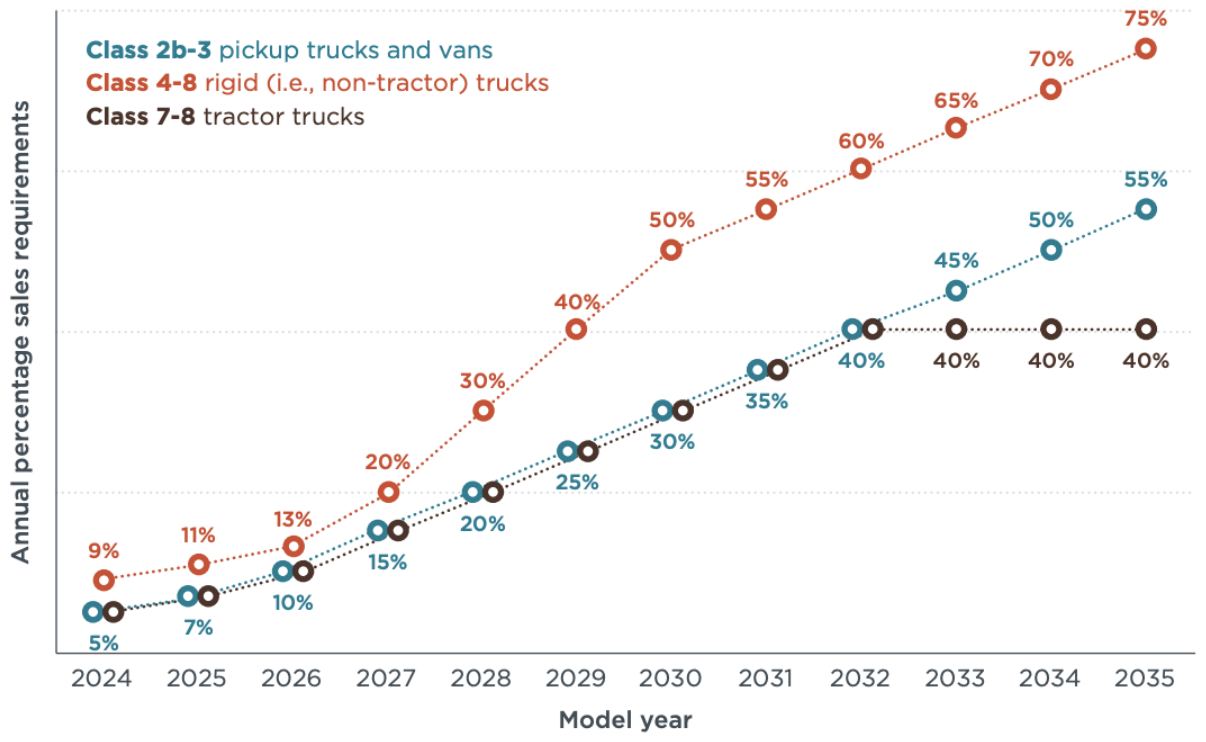


Figure 1: Zero-emission sales percentage schedule by vehicle group and model year.

Source: ICCT

California has set aggressive zero-emission truck (ZET) sales targets, which other states have committed to adopt. By 2035 CA will require sales of:

- **75% of Class 4-8 rigid**
- **40% Class 7&8 tractors**

Hypothesis: We can use anonymized to telematics data, aggregated at the country level, to estimate what levels of electrification are feasible.

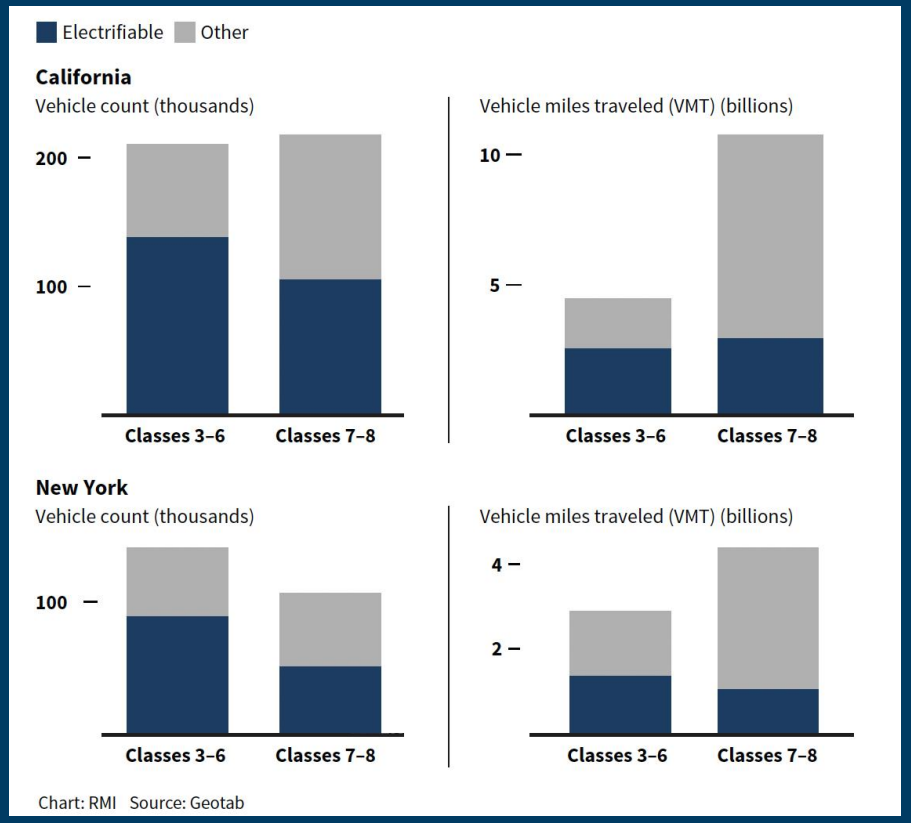
RMI and Geotab Tried to Estimate that Ratio

Can existing electric trucks like the Volvo VNR Electric or the Nikola Tre deliver the sales shares required by ACT?

What we analyzed:
Electrifiability is primarily (although not exclusively) a function of range between charges – which will likely be at domicile in the foreseeable future. We defined an 'electrifiable truck' to be one who traveled less than 300 miles between domicile returns in the vast majority (>95%) of trips.

What we did not analyze:
Electrifiability is also a function of payload, power availability at depots, cost effectiveness, and other variables.

We found that about half of HDTs and nearly 75% of MDTs were electrifiable



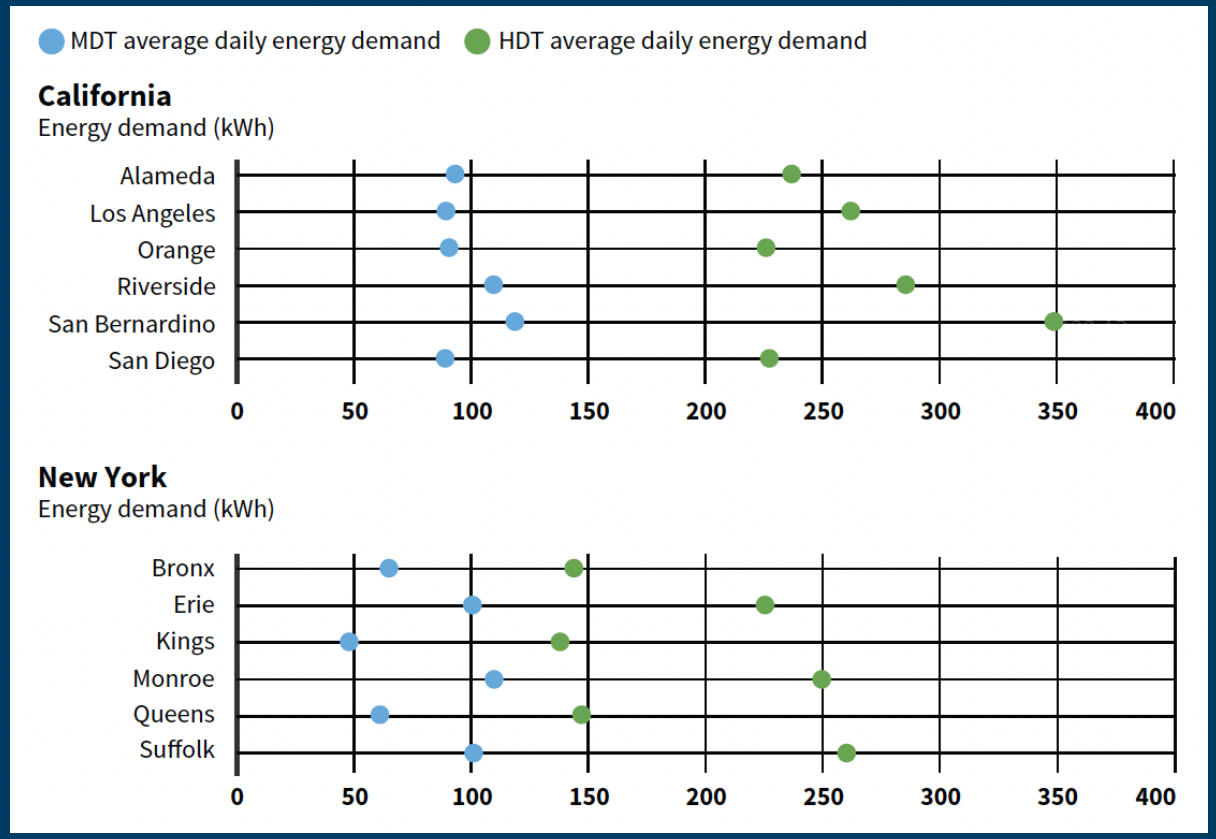
High level findings:

- **65% of medium-duty and 49% of heavy-duty trucks are traveling 'electrifiable' ranges on most trips.**
- **244k vehicles in CA and 145k vehicles in NY are in the electrifiable market segment.**
- **Electrifiable trucks account for approximately 30% of vehicle miles traveled**

How Are We Going to Charge All those Trucks?

Estimating Systemic Impacts of Truck Electrification

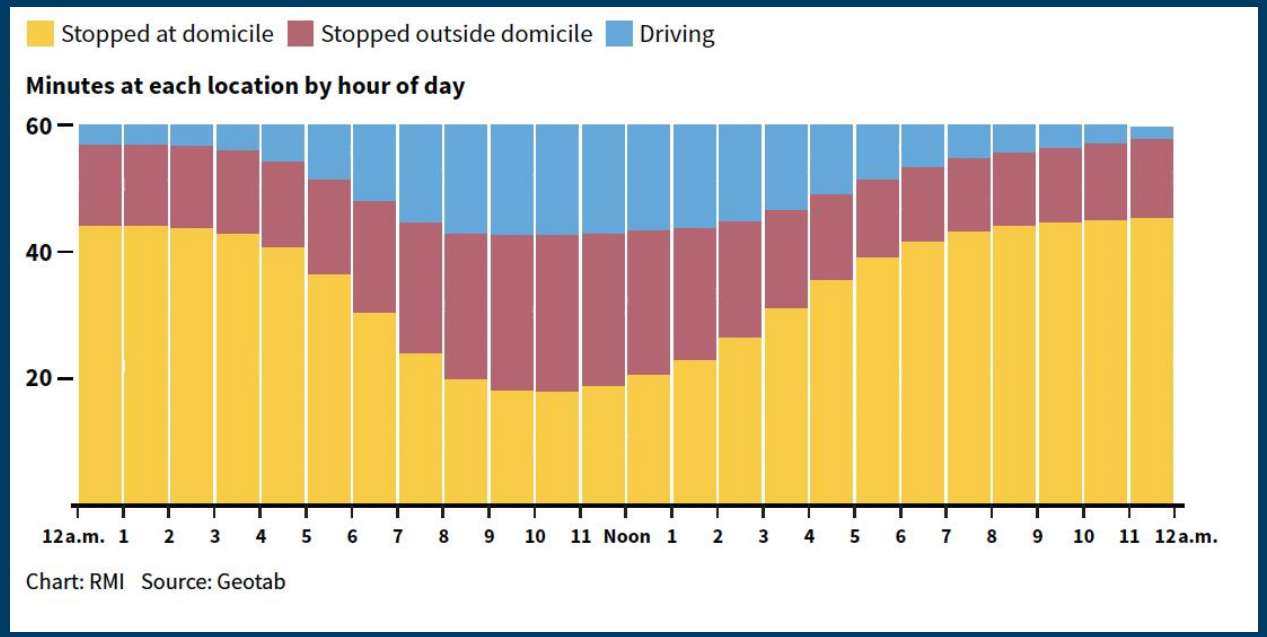
Each Electric Truck Will Require the Power of Several Homes

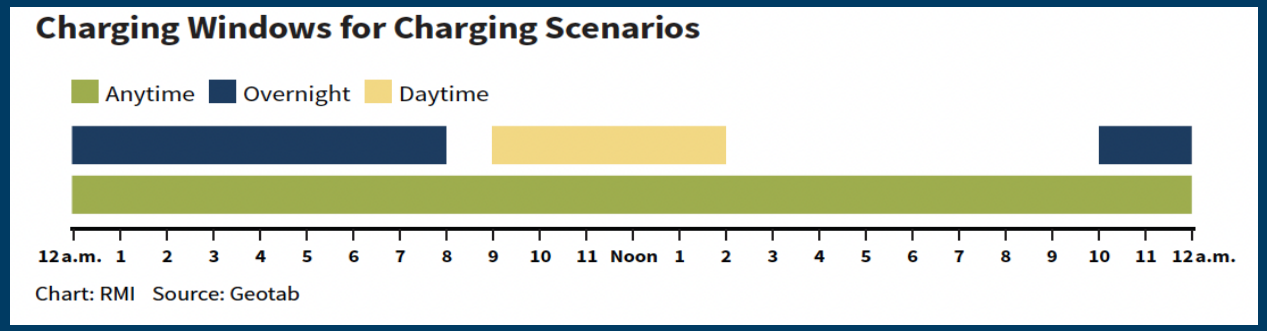


Expected Energy Demands:

- **MDTs will need, on average, around 100 kWh per day.**
- **HDTs will require, on average, around 250 kWh per day.**
- **Battery packs will need to be more than double that capacity to accommodate longer range requirements on days when they are more heavily used.**

That Power Can Only be Delivered to Trucks in Certain Windows

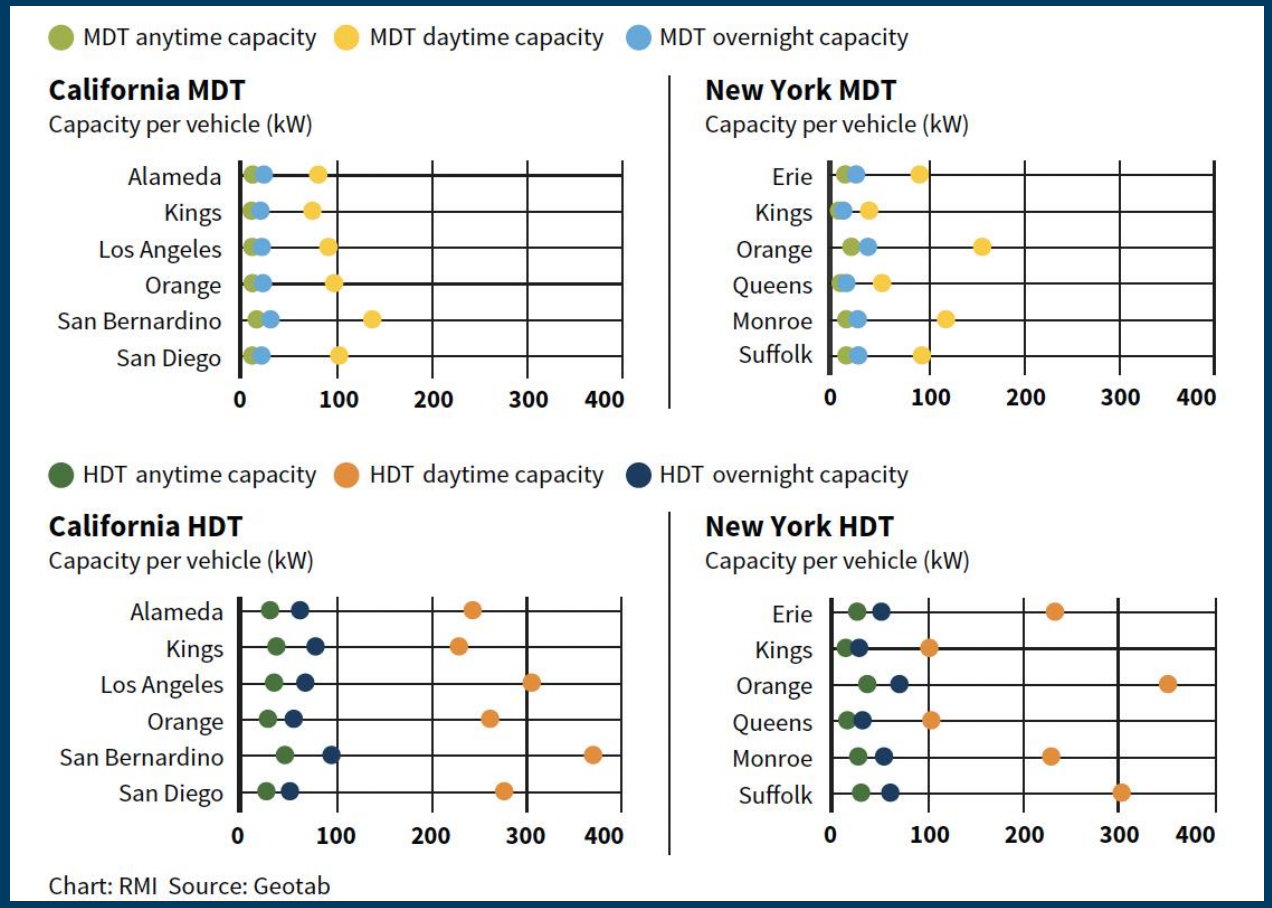




To estimate charging needs, we assume that trucks can only charge when at domicile. Furthermore, we assume truck owners will adopt one of the three following charging strategies:

- Anytime: plug the truck in whenever it is at domicile – this may not be feasible in the real world.
- Overnight: Plug in the truck when it is at domicile overnight – this is likely to be the most common approach.
- Daytime only: Charge the truck in mid-day domicile stops to take advantage of cheap solar - this may gain popularity when utilities aggressively lower prices during peak solar generation times.

In Most Scenarios, Trucks Can be Charged with Commonly Available Charger Technologies



In both the anytime and overnight scenarios required chargers would be readily available:

- **MDTs would likely need high powered L2 (19.2 kW) and HDTs would need low to moderate power DCFC (50 kW to 100 kW)**

In daytime only charging much higher power chargers would be needed:

- **Moderate power DCFC for MDTs**
- **350 kW for HDTs**

Daytime charging is unlikely to be cost effective no matter how cheap TOU rates become. Equipment and demand charges are too costly.

So What Does it all Mean?

Key Takeaways

Trucking is Poised to Electrify, but our Systems Need to Evolve to Enable it.

- **Rules like ACT will not fail because of vehicle range – targets could largely be met with today's vehicles. However, non-range factors matter:**
  - *Battery energy density must improve* to relax payload constraints.
  - *Cost must come down* to enable TCO competitiveness.
- **In theory, depot charging looks like a solution that can carry us a long way, but implementation problems must be addressed:**
  - *Near term* - Power delivery will be a challenge. A depot of 100 trucks charging at 100 kW means a 10 MW load. That is a small town.
  - *Medium term* - We need to look beyond depots to other private sites. During the daytime trucks spend as much time stopped away from depot as at it.
  - *Long term* - Solar integration will be a challenge. Developing and using infrastructure to fit needed charging into peak solar generation windows is prohibitively costly.

Fleet Electrification Waves

Electrification waves

1. Forklifts
2. ***Terminal Tractors***
3. ***MD Urban Delivery***
4. ***Beverage & Drayage***
5. ***Regional Haul Tractors***
6. Long Haul Tractors

Group Discussions

Stage

Right Applications

Implementation

Data

Support

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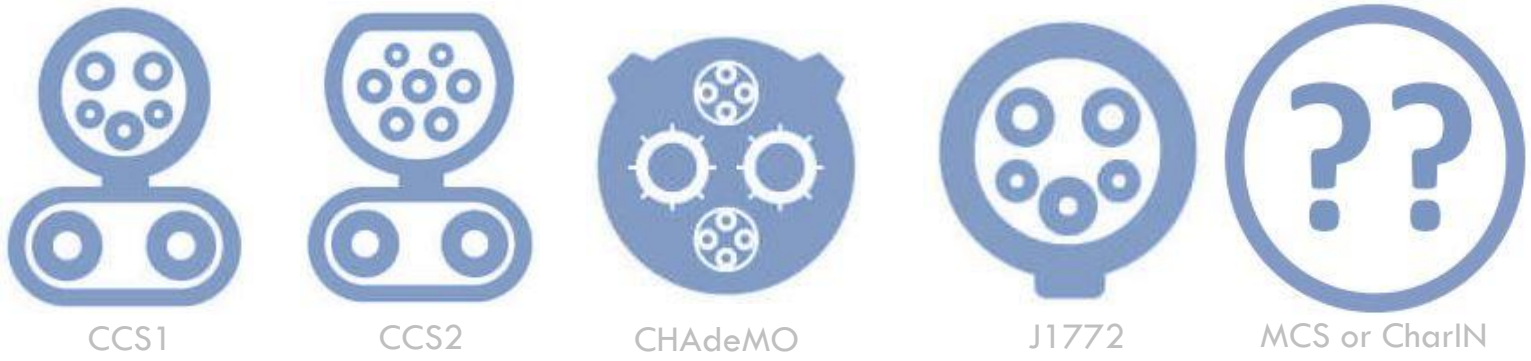

Let's Stay Connected…
… And charged up!

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