ABOUT
ATLAS PUBLIC POLICY

DC-based policy tech firm started in 2015
We equip businesses and policymakers to make strategic, informed decisions that serve the public interest

Our Key Focus Areas

• **Access**: Collect and disseminate publicly available information.

• **Interpret**: Create dashboards and tools to spur insights and conduct data-driven analyses.

• **Empower**: Strengthen the ability of policymakers, businesses, and non-profits to meet emerging challenges and identify opportunities that serve the public interest.
THANK YOU!

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- Greg Hintler, Mobility House
OVERVIEW

• High-level MD & HD truck results
• Methodology overview
• Results deep-dive
• Key policy takeaways
• Methodology appendix

Note all dollar values included here are in 2020 dollars, not nominal dollars.
WHY ELECTRIFY TRUCKS?

Climate: ~30% of ground transportation GHG emissions come from medium- & heavy-duty trucks

Health: High air pollutant emissions, linked to asthma, cancer, cardiovascular disease, premature death
- Disproportionately affects low-income communities and communities of color located near freight corridors, ports, depots
- Heavy-duty tractor-trailers are particularly high polluters: 13% of on-road MDHD trucks but ~60% of their GHGs & fuel use

Noise: Reduced noise pollution can benefit drivers, workers and nearby communities

Financial benefits: Studies predict that a number of depot-charging electric truck applications will be cost-competitive with diesel in the near future
STUDY OBJECTIVE

High-level assessment of charging infrastructure and associated investment commitments needed to support full electrification of medium- and heavy-duty trucks

Our analysis includes class 3 – 8 trucks using conductive charging, and does not estimate the benefits of electrification
$100B - $166B in charging infrastructure investment commitments are needed this decade to put the U.S. on the path to 100% electric truck sales by 2040.
METHODOLOGY
OVERVIEW
MODELING APPROACH

Calculate **daily energy need** for 37 truck use cases & classes

Develop **vehicle-to-charger ratios** for each use case-class-charging location combination, based on energy need & utilization assumptions

Model **EV adoption** for each use case-class, by state, using stock rollover

Calculate **charging ports needed** in each year, by state

Calculate **needed investment commitments** in each year, accounting for project development & utility connection timelines
We model 37 truck use case-class combos

Truck Charging Location Matrix (*by use case & class*)

<table>
<thead>
<tr>
<th>Use Case</th>
<th>Truck Class</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup</td>
<td>Depot, Home</td>
<td>Depot, On-road</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drayage</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Depot, On-road</td>
</tr>
<tr>
<td>SUV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Depot, Home</td>
</tr>
<tr>
<td>Terminal Tractor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Depot, Depot</td>
</tr>
<tr>
<td>Refuse</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Depot, Depot</td>
</tr>
<tr>
<td>Motor Home</td>
<td>On-road</td>
<td>On-road</td>
<td>On-road</td>
<td>On-road</td>
<td>On-road</td>
<td>On-road</td>
<td>On-road</td>
</tr>
<tr>
<td>Long Haul Truck</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>On-road</td>
</tr>
</tbody>
</table>

- Use cases are taken from the West Coast Clean Transit Corridor Initiative (‘WCCTCI’) report
- Analysis assumes that electric truck technologies continue to improve, enabling an expansion to all truck use cases
- Analysis of construction trucks does not include off-road equipment
- We model all use case-class combinations that exist in IHS’ 2019 vehicle stock data, excl. emergency vehicles
AFTER ASSESSING ENERGY NEED, WE ASSIGN EACH VEHICLE TYPE TO 1 OF 10 VEHICLE-CHARGING CATEGORIES

<table>
<thead>
<tr>
<th>Vehicle Category</th>
<th>Modeled Charging Type</th>
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</thead>
<tbody>
<tr>
<td>Class 3 trucks</td>
<td>Home Level 2 (11.5kW)</td>
</tr>
<tr>
<td></td>
<td>Depot Level 2 (10kW)</td>
</tr>
<tr>
<td>Class 4 – 6 trucks</td>
<td>Depot Level 2: 10kW &amp; 16.6kW (based on need)</td>
</tr>
<tr>
<td></td>
<td>Depot 50kW</td>
</tr>
<tr>
<td></td>
<td>On-road 150kW or 350kW</td>
</tr>
<tr>
<td>Class 7 – 8 trucks, excl. long-haul</td>
<td>Depot 50kW</td>
</tr>
<tr>
<td></td>
<td>Depot 150kW</td>
</tr>
<tr>
<td></td>
<td>On-road 350kW</td>
</tr>
<tr>
<td>Long-haul trucks</td>
<td>On-road 350kW truck parking or 2MW</td>
</tr>
<tr>
<td>Motorhomes</td>
<td>On-road 350kW</td>
</tr>
</tbody>
</table>
WE MODEL 100% EV SALES BY END OF 2040

Battery electric vehicle sales as percent of total sales

- In line with CA’s Proposed Advanced Clean Fleets Regulation, Action Plan from the U.S. House Select Committee on the Climate Crisis, Global Commercial Vehicle Drive to Zero, national Drive Electric Campaign, & goals from Walmart, FedEx
  - Electric sales % could differ if hydrogen vehicles are significantly adopted
  - We assume Class 7-8 on-road charging trucks are adopted at a slower initial rate than class 3-6 trucks and class 7-8 trucks that can charge at a depot
→ 17M ELECTRIC TRUCKS BY 2060

Cumulative modeled electric truck stock

- Motorhomes
- Class 7-8 trucks: personal
- Class 7-8 trucks: fleet
- Class 4-6 trucks: personal
- Class 4-6 trucks: fleet
- Class 3 trucks: personal
- Class 3 trucks: fleet

100% electric sales in 2040

→ 17M ELECTRIC TRUCKS BY 2060
WE INCLUDE HARDWARE, LABOR, PROJECT COSTS, & ELECTRICAL UPGRADES NOT COVERED BY UTILITIES

Included in analysis:
- Design
- Charger hardware
- Labor
- Electrical upgrades not expected to be covered by utilities
- Permitting
- Other site construction costs
- Project management

Electrical upgrades included:
- Make-ready (conduit, panel, switchgear)
- DCFC also includes front-of-meter customer transformers, conductor, utility poles (50% - 100% depending on scenario)
- Long-haul truck charging includes utility-side upgrades, incl. substation upgrades or new customer substations
WE DEFINE LOW- AND HIGH-COST SCENARIOS

<table>
<thead>
<tr>
<th>Location</th>
<th>Costs</th>
<th>Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>In both scenarios:</td>
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<td></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Personally-owned class 4 – 8 trucks &amp; all long-haul trucks use on-road charging</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• No utility upgrade costs included for Level 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 100% utility upgrade costs included for long-haul truck charging</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Utilization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 80% utilization of depot chargers during 9 overnight hours</td>
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<td></td>
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<tr>
<td>In low-cost scenario:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Class 3 personal &amp; class 3 – 8 fleet vehicles (excl. long-haul) charge 90% at depot/home, 10% on road</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Front-of-meter costs paid 50% by site host for DCFC depot charging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Smaller truck parking installations</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Utilization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 40% utilization of on-road charging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 70% utilization of long-haul truck parking chargers</td>
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<td></td>
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<tr>
<td>In high-cost scenario:</td>
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<td></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Class 3 personal &amp; class 3 – 8 fleet vehicles (excl. long-haul) charge 75% at depot/home, 25% on road</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Front-of-meter costs paid 100% by site host for DCFC depot charging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Larger truck parking installations</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Utilization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 20% utilization of on-road charging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 40% utilization of long-haul truck parking chargers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Biggest differences between low- and high-cost scenario results are due to
- For depot charging: differences in assumed charging location of fleet vehicles
- For on-road charging: differences in assumed utilization
RESULTS DEEP DIVE: HOME CHARGING
$600M NEEDED BY 2030 FOR HOME CHARGING OF ~250K CLASS 3 ELECTRIC TRUCKS

Cumulative 11.5kW charging ports needed to serve electric personal class 3 trucks in the U.S.

<table>
<thead>
<tr>
<th>Year</th>
<th>Pickup</th>
<th>On-road construction truck</th>
<th>Cargo van</th>
<th>Box truck</th>
<th>Step van</th>
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<tbody>
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<td>2022</td>
<td>3</td>
<td>10</td>
<td>23</td>
<td>44</td>
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<td>2023</td>
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<tr>
<td>2024</td>
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<td>23</td>
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<td>2025</td>
<td>107</td>
<td>73</td>
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<td>44</td>
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<tr>
<td>2026</td>
<td>152</td>
<td>107</td>
<td>73</td>
<td>44</td>
<td>23</td>
</tr>
<tr>
<td>2027</td>
<td>198</td>
<td>152</td>
<td>107</td>
<td>73</td>
<td>44</td>
</tr>
<tr>
<td>2028</td>
<td>254</td>
<td>198</td>
<td>152</td>
<td>107</td>
<td>73</td>
</tr>
</tbody>
</table>

Source: Atlas analysis of 2019 IHS Markit Vehicle Stock data
RESULTS DEEP DIVE: DEPOT CHARGING
MOST CHARGING PORTS ARE NEEDED AT DEPOTS: ~500K PORTS @ $31B – $35B

Cumulative ports & committed investment needed to support electrification of depot-charging trucks:

- **Low-cost scenario**
  - Investment committed 2 years ahead of adoption to enable planning, procurement & utility engagement
  - 90% of fleet vehicle charging is at depots; 10% on-road

- **High-cost scenario**
  - 75% of fleet vehicle charging is at depots; 25% on-road

Low-cost scenario assumes more depot charging, leading to less total investment needed
RESULTS DEEP DIVE: ON-ROAD CHARGING
LONG-HAUL TRUCKS: ENABLING GEOGRAPHIC COVERAGE OF THE U.S

An illustration of what geographic coverage could look like...

**Following the West Coast Clean Transit Corridor Initiative approach:**

- Installing 10 x 2MW ports every 100 miles of the Primary Highway Freight System would take 4,151 ports

- Expanding to the full National Highway Freight Network = 5,785 ports

**Using WCCTCI costs, doing so would require investment of $7.4 - $10.4B**

- This network would not need to be developed at once: it will be most cost-effective to first build out high-trafficked, complete routes that can serve early adoption

*Development & timing of electric long-haul trucks & 2MW stations depends on charger/vehicle technology development*
LONG-HAUL TRUCKS: MEETING ENERGY DEMAND

- Long-haul trucks drive an average of 545 miles day (WCCTI report)
- We modeled energy demand for these miles as eventually being met via:

  **350kW charging**
  - At truck parking spaces during drivers’ mandated 10-hour break
  - Class 8 truck with 2040 efficiency takes 7.4 hrs to charge 545 miles
  - Assume vehicles charge to full 100%; final 20% takes as long as first 80%

  **2MW charging**
  - Class 8 truck with 2040 assumed efficiency takes ~50 mins to charge to 545 miles
  - (Assuming vehicles make multiple daily stops or size battery to fit this mileage within 80% state of charge & avoid last 20% slowdown)

In reality, long-haul trucks will likely be charged by a combination of these or other charging levels; modeling these levels provides bookends.
$62B - $124B IN INVESTMENT COMMITMENTS NEEDED BY 2030 TO SUPPORT RAMP IN LONG-HAUL TRUCK CHARGING TO 2035

Cumulative charging ports needed to support electrification of long-haul trucking

To meet 2030 adoption:
- 53K – 93K 350kW ports @ $18B - $34B or
- 10 – 19K 2MW ports @ $17B - $34B

Additional $45B – $91B committed investments needed by 2030 to meet 2035 adoption

Significant lead time for planning, permitting & utility upgrades
→ committed investments of $62 - $124B needed by 2030 to support 2035 buildout of these high-powered charging sites

Development & timing of long-haul electrification & 2MW stations depends on charger/vehicle technology development. Charging port & investment ranges due to variation in assumed utilization.
$3B - $10B IN INVESTMENT COMMITMENTS NEEDED BY 2030 FOR ON-ROAD CHARGING OF OTHER TRUCKS

Cumulative ports & investment needed to support on-road charging of electric trucks, excluding long-haul trucks

Low-cost scenario:
- 10% of fleet vehicle charging is on-road (90% at depots)
- On-road charging class 3 – 6 trucks use 350kW ports
- 40% utilization of chargers

High-cost scenario:
- 25% fleet vehicle charging on-road (75% at depots)
- On-road charging class 3 – 6 trucks use 150kW ports
- 20% utilization of chargers

Investment committed 3 yrs ahead of commissioning to enable site selection, planning, contracting, permitting, utility upgrades

Both scenarios: All personally-owned class 4 – 8 vehicles charge on-road; Motorhomes & on-road charging class 7-8 trucks use 350kW

On-road charging ports needed:
- 350kW charging ports
- 150kW charging ports

Thousands of ports

$ Billions

2022 2023 2024 2025 2026 2027 2028 2029 2030
$0 $1 $2 $3 $4 $5 $6 $7 $8 $9 $10 $11

Low-cost scenario

High-cost scenario
KEY POLICY TAKEAWAYS
Reaching 100% electric sales by 2040 requires rapid ramp-up of charging for all vehicle segments.

Increasing utilization of charging can significantly reduce needed investments:
- At depots, by using chargers/software that enable sequenced/simultaneous charging, or by moving vehicles.
- At on-road chargers, by first targeting charging to high-traffic routes, building chargers that can serve multiple vehicle types, & using technology to allow drivers to reserve chargers.

Policies & incentives that encourage right-sizing of depot equipment can reduce needed investments.
Long-haul trucks will be able to replenish daily energy needs by charging at 350kW chargers during their mandated rest break

But preventing congestion & creating flexibility will require a mix of 350kW parking spaces and ultra-high-powered (1 – 2MW) stations

Investment commitments are needed by 2030 to support ramp in electric long-haul trucks through 2035, due to long project & utility lead times needed to build high-powered sites

Pre-planning today and streamlining development timelines where possible can lower needed investments

As adoption ramps, ultra-high-powered charging could be similarly cost effective for long-haul truck charging at some sites as electrifying truck parking spaces with 350kW chargers (depends on substation capacity, utilization & install sizes)

Our analysis assumes long-haul charging is installed to most efficiently use substation investments, & under our assumed utilization levels found similar investments needed to support long haul trucks using either kind of charging
INSITE: INVESTMENT NEEDS OF STATE INFRASTRUCTURE FOR TRANSPORTATION ELECTRIFICATION TOOL

- Charging investment need by state, charging type, year
- EV adoption by vehicle type, state, year
- Ports needed per vehicle by charging type, state
- Cost per port by charging type, state, year

Investment in charging is assumed to be needed ahead of adoption.

Scale labor costs by state differences; User can choose to reduce input costs over time.
ELECTRIC TRUCK ADOPTION

• We simulate adoption using a simplified stock-flow model that iteratively simulates year-over-year new truck stock due to retirement/replacement and overall stock growth
  • Starting truck stock is derived from 2019 IHS registered truck inventory
    • Class 7 and 8 freight trucks were split into regional and long haul categories using % of vehicles in each of the two categories in CA/WA/OR in the WCCTCI study
  • Stock growth is based on state population projections (for personal Class 3 trucks and motorhomes) or EIA projections of freight growth (for all other vehicles types)
  • Truck scrappage rates are based on NHTSA research of vehicle survivability
  • We assume that trucks are used for substantial revenue service for a maximum of 20 years based on similar assumptions taken by models like the California Air Resources Board's EMFAC mobile source emissions model.

• We then overlay electric truck adoption curves (slide 11) on new truck stock to estimate cumulative EV truck population over time
We use:

1. calculated energy demand, and
2. utilization assumptions

to create estimates of charging ports needed per vehicle for all 61 truck use cases

We then collapse these to ratios for each of our 10 vehicle-charging categories, using the number of vehicles in each of the 61 truck use cases in each state as weights.
CHARGING PORTS PER VEHICLE:
1. WE ESTIMATE AVERAGE DAILY ENERGY NEED FOR EACH USE CASE
   \[= \text{DAILY VEHICLE MILES} \times \text{KWH/MILES}\]

Table B-3: US Average Daily VMT per Segment

<table>
<thead>
<tr>
<th>Segment</th>
<th>Class 3</th>
<th>Class 4</th>
<th>Class 5</th>
<th>Class 6</th>
<th>Class 7</th>
<th>Class 8</th>
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<tbody>
<tr>
<td>Construction Truck</td>
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<td>34</td>
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<tr>
<td>Regional Truck</td>
<td>29</td>
<td>48</td>
<td>74</td>
<td>74</td>
<td>74</td>
<td>208</td>
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<tr>
<td>Motor Home</td>
<td>32</td>
<td>64</td>
<td>112</td>
<td>112</td>
<td>112</td>
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</tr>
<tr>
<td>Pickup</td>
<td>77</td>
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<tr>
<td>Long Haul Truck</td>
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<td>545</td>
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<tr>
<td>Drayage</td>
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<td>Bus</td>
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<td>Shuttle Bus</td>
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<td>Coach</td>
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<tr>
<td>Fire Truck</td>
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<td>SUV</td>
<td>42</td>
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<td></td>
</tr>
<tr>
<td>Terminal Tractor</td>
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<tr>
<td>Emergency Truck</td>
<td></td>
<td></td>
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<td></td>
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<td>243</td>
</tr>
</tbody>
</table>

Source: Analysis by HDR, CALSTART, S Curve Strategies, Ross Strategic in West Coast Clean Transit Corridor Initiative (WCCTCI) Report, June 2020

- For motor homes, we instead used 137 miles / day: average distance traveled to camping destination from 2017 Outdoor Foundation American Camper Report
- We were not able to account for state differences in vehicle miles traveled
- Further data and analysis on the distribution of trip lengths around these averages could allow for additional precision in the future
CHARGING PORTS PER VEHICLE:
1. WE ESTIMATE AVERAGE DAILY ENERGY NEED FOR EACH USE CASE
   (= DAILY VEHICLE MILES * KWH/MILE)

- For on-road charging, we assume 2040 kWh/mile
- For 2030 cost estimates of depot-charging vehicles, we assume kWh/mile in 2030
- We were not able to account for differences in temperature across states
- We assume 10% energy losses for depot charging and on-road charging up to 350kW; 5% losses for 2MW charging
CHARGING PORTS PER VEHICLE:
2. UTILIZATION -- DEPOT CHARGING

• We assume depot-charging trucks have 9 hours available to charge overnight (9pm – 6am)
  • Matches assumption used by the California Air Resources Board in Advanced Clean Truck Rule documentation

• Vehicles in depot-charging use cases are assigned to charger power levels (10kW, 16.6kW, 50kW, 150kW) that most efficiently cover their daily energy need

• In the low-cost case, vehicles efficiently share charging ports within the 9pm – 6am charging window

• In the high-cost case, one charging port is installed per vehicle
We use available data from TX & FL to anchor assumptions:

1) Statewide utilization of TX truck parking spaces = 18%
   - However, many sites in TX never fill beyond 30% or 50%
   - We assume these sites are unlikely to fully electrify

Therefore, we model utilization of 40–70% for parking spaces where charging is installed
   - Utilization at highest-utilization public TX rest area: 48%
   - Average utilization at lowest-utilization public truck parking district in FL: ~40%
   - Average utilization at highest-utilization private truck parking district in FL: > 80%

2) Average utilization in FL ranges from ~40–90% across all hours

Sources: Texas DOT, Feb 2020, “Truck Parking Inventory and Utilization Memo”
Florida DOT, April 2019, “Statewide Truck GPS Data Analysis”
CHARGING PORTS PER VEHICLE: 2. UTILIZATION -- ON-ROAD CHARGING

E.g. for 2MW charging of long-haul vehicles:

Class 8 truck w 2040 efficiency takes 46 mins to charge 545 miles (assuming driver stops multiple times or oversizes battery to meet these miles in first 80% state of charge)

Add 10 mins to each session for maneuvering, connect/disconnect, driver being away from vehicle

High-cost case: 20% utilization = 5 vehicles per EVSE per day

Low-cost case: 40% utilization = 10 vehicles per EVSE per day, May require economic incentives for drivers to charge late at night
CHARGING PORTS PER VEHICLE:
2. UTILIZATION -- MOTORHOMES

% of foot traffic in each hour at sample of > 100 US gas stations, Q1 2019

- Max 8.02% in a given hour suggests peak demand is double what it would be if demand was spread evenly over all hours (100%/24 = 4.2%)

→ We assume 50% utilization for motorhomes. This assumes that charging ports for these vehicles are added at existing locations with 350kW LDV and/or truck charging, i.e. geographic charging network coverage for these vehicles is provided by build-out for other vehicle use cases

Source: Gas Buddy Foot Traffic Report for the fuel & convenience retailing industry, Q1 2019
STATE DIFFERENCES IN LABOR COSTS

State Median Hourly Wage as % of National Average, Construction and Extraction Occupations

COST OF 350KW TRUCK CHARGING DEPENDS ON INSTALL SIZE

• Low-cost case: 65% lower-cost and 35% higher-cost electrified parking space sites
  • Small sites electrify 40-100% of their parking spaces – as many as they can until reaching a 10MW threshold for a substation upgrade or 40% [utilization assumption], whichever is higher
  • Assumes national distribution of parking site sizes looks like Minnesota (MN, CO and AZ are only states for which full data could be found)

• High-cost case: 30% lower-cost and 70% higher-cost electrified parking space sites
  • Small sites electrify 70% - 100% of their parking spaces – as many as they can until reaching a 10MW threshold for a substation upgrade or 70% [utilization assumption]
  • Assumes national distribution of parking site sizes looks more like Colorado

Average long-haul truck parking spaces per facility

<table>
<thead>
<tr>
<th>State</th>
<th>% of parking at sites less than 70 spaces</th>
<th>% of parking at sites less than 42 spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minnesota</td>
<td>65%</td>
<td>52%</td>
</tr>
<tr>
<td>Colorado</td>
<td>47%</td>
<td>30%</td>
</tr>
<tr>
<td>Arizona</td>
<td>48%</td>
<td>35%</td>
</tr>
</tbody>
</table>

* 70 spaces = [28 350kW EVSE that can fit below 10MW substation upgrade] / 40% utilization
* 42 spaces = [28 350kW EVSE that can fit below 10MW substation upgrade] / 70% utilization

Source: Jason's Law Truck Parking Survey Results and Comparative Analysis, 2015
% real cost decline is assumption used by the ICCT (2019) for their 2019 – 2025 charging cost analysis

- No further cost declines after 2030
- We do not reduce cost of labor or other materials over time