INTRODUCTIONS

Duke Kuvaas, PE
Project Manager/Senior Electrical Engineer

Ryan Vraa, EIT
Electrical Engineer
Electrification of Everything

The potential for electrification is vast, but it’s important to understand where to focus and why.

45,000+ Gigawatt-hours (GWh)

40 Technologies Assessed

Disclaimer. Real utility example assessment that is representative of mid-size to large IOUs across the country.
Ranking technologies based on potential GWh, barriers and load manageable to help set direction

Electronic Billboards
Casting
Heat Treatment
Boilers/Steam Tractors
Private Aircraft
Grain Dryers
Loaders/Excavators
Gas Clothes Dryer
School Buses
Combines
Garbage Trucks
Commuter Buses

Water Heating

Long Haul Trucking
Space Heating

Boilers/Steam Tractors
Private Aircraft
Grain Dryers
Loaders/Excavators
Gas Clothes Dryer
School Buses
Combines
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Large shapes have better load manageability than small shapes

*Vehicle classes described in the appendix

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Fleet electrification is a complex ecosystem to navigate.
There is disruption on both sides of the electric meter.

Impacts to the electric utility:
- Stress testing business processes & practices
- Evolving customer needs pushing utilities to rethink customer service
- Requires utilities to work across functional areas, not always easy

Impacts to fleet owner / operators:
- New fueling paradigm creates uncertainty
- Costly infrastructure that is nascent and still evolving
- Operational limitations impact ability to move people or goods
- Impacts to a well-developed, streamlined supply chain
First Generation Fueling Station

America’s first gas station, St. Louis, 1905 (MOhistory.org)
Next Generation Fueling Station
USPS – CURRENT FLEET

Fleet of nearly 215,000 vehicles
- 65% beyond their design life (139,750)
- 74% Long Live Vehicles (LLVs) (159,100)
- 83% of LLVs operate in an urban environment (132,053)

Intends to replace at least 160,000 vehicles in the next 10 years

Proposes to roll out 12,000 electric vehicles annually over the next seven years totaling 84,000
In 2015, USPS’s Next Generation Delivery Vehicle (NGDV) RFP stated the following requirements:

- 18-20 year expected lifetime
- 1500lb payload
- 330 – 440 ft³ cargo space
- 70 miles of minimum range over the course of eight hours

Among the list of final candidates is the Workhorse W-15 electric truck.
Typical design specifications were used to estimate the use, charging and battery capacity.

Parameters assumed:
- 35-mile average mail route
- 60kWh battery size and 80-mile full charge range
- 0.75% annual degradation
- 8-hour level 2 charging duration
- 7.5kW level 2 peak demand
- 1.2-hour DC fast charging (DCFC) duration
- 50kW DC fast charging peak demand
- 6pm–6am charging period charged daily
### Table 1. National Impact of USPS EV Implementation

<table>
<thead>
<tr>
<th>Category</th>
<th>Unit</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
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<td>New Vehicles</td>
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<td>48,000</td>
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<td>574,875</td>
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Figure 1. Major USPS Employee Locations Throughout the United States
USPS – MAX PEAK DEMAND BY CHARGER TYPE

- National peak demand would increase from 0 to 600 MW with Level 2 charging.
- Peak demand would increase from 0 to 4.2 GW with DCFC.

Figure 2. Max National Peak Demand by Charger Type
Average hourly charge potential based on the charge period 6 p.m. to 6 a.m.

Showcases the minimum demand which must be fulfilled.

Numbers will vary between this and that of max peak demand.
Figure 4. Major USPS Employee Locations Throughout the Midwest
# USPS – MIDWEST IMPACT

<table>
<thead>
<tr>
<th>Category</th>
<th>Unit</th>
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<td>[MWh]</td>
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<td>50,742</td>
<td>63,428</td>
<td>76,113</td>
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Table 2. Midwest Impact of USPS EV Implementation

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<th>2023</th>
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<td>594</td>
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<td>990</td>
<td>1188</td>
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<td>Annual load</td>
<td>[MWh]</td>
<td>1,897</td>
<td>3,794</td>
<td>5,691</td>
<td>7,588</td>
<td>9,845</td>
<td>11,383</td>
<td>13,280</td>
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Table 3. Minnesota Impact of USPS EV Implementation
**USPS – LOCALIZED PEAK DEMAND BY CHARGER TYPE**

**Figure 5.** Max Local Peak Demand by Charger Type (Midwest – Left, Minnesota – Right)
USPS – AVERAGE LOCALIZED DEMAND BY CHARGER TYPE

Figure 6. Average Local Demand by Charger Type (Midwest – Left, Minnesota – Right)
WHAT’S NEXT?

► Potential electrified fleets
► Ports – both air and sea – hot spots
► Stakeholder inclusion
Utilities must decide where, when, and how to participate in or influence this journey.

- Are they pushing for a carbon neutral or carbon free future?
- Are they prioritizing equitable solutions that benefit all customers?
- Will their needs differ today vs tomorrow?
- Does it differ across industries? Use cases?
- Does it differ across fleet size?
- Do we desire to be proactive vs reactive?
- Do we want to be viewed as an obstacle or enabler?
- Do we need press worthy success stories?
- Do we want to be viewed as advocating fuel switching?
- How to reduce barriers to beneficial electrification?
- How do we ensure that customers transition smoothly & not end up in no man’s land?
- Can wins in one area lead to bigger ones somewhere else?

<table>
<thead>
<tr>
<th>Regulators / Policy Makers</th>
<th>Customers</th>
<th>Utility</th>
<th>All Stakeholders</th>
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</thead>
<tbody>
<tr>
<td>• Are they pushing for a carbon neutral or carbon free future?</td>
<td>• Will their needs differ today vs tomorrow?</td>
<td>• Do we desire to be proactive vs reactive?</td>
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Fleet electrification challenges
Emerging industry creates opportunity for stakeholders

Enablers
- Limited consistent levers across jurisdictions that enable fleet electrification (policy, legislation, emission targets) especially in medium- and heavy-duty
- Grant funding can only go so far unless there is a compelling value proposition (cost savings, emission reductions, sustainability targets, etc.)

Technology
- Lack of charging standardization across vehicle categories
- Equipment maturity and availability (nascent or limited)
- Stated performance vs actual performance (environmentally challenging conditions)

Cost Vs Funding
- Upfront cost of vehicles and fueling infrastructure are underestimated, especially at scale
- Limited funding for vehicles and charging infrastructure across jurisdictions (federal, state, local, utility programs)
- Without enablers (mandates) or clear value proposition, adoption is challenging without grants or incentives

Facility Limitations Or Accessibility
- Constraints such as physical, electrical, grid capacity, operations, staging
- Identifying optimal sites for charging infrastructure (easement, access, power availability, etc.)
- Transitioning a facility while maintaining operations

Collaboration Of Stakeholders
- Identifying customers ready for transportation electrification programs and/or scaling
- Alignment of value propositions of all parties (fleet owners, OEMs, electric utility, constituents, etc.) isn’t there yet
- Proactive planning by and with all parties to achieve the common goal

Value Proposition
- Infrastructure costs of total cost of ownership are often underestimated – can be significant at scale impacting savings
- Value proposition may not be there for all fleet owners unless they value stack benefits (operational cost savings + emission reductions + renewable integration +... etc.)
Know & Educate Your Customers
- Evaluate who, where, what, when, and why.
- Learn the nuances of their operations. It will help you understand the value propositions of electrifying.

Proactive Planning
- Identify your system limitations both today and the future based on forecasted adoption.
- Refine planning and engineering standards to enable future EV (PV, and BESS) capacity through BAU upgrades.

Understand The Landscape
- Expand your knowledge beyond charging and network providers (vehicles, charging, software, storage, etc.).
- Customers will approach you for help. Enhance the customer experience.

Build Your Coalition
- Assess your and your customer’s needs. Identify the gaps and fill with both internal and external resources.
- Build your list of value, add stakeholders that can help you and your customers.

Develop Your Vision
- Understand where fleet fits and align your strategy with customer needs. Take small bits of the apple.
- Know your levers (legislation, emission reduction mandates, etc.).

Customer First Mentality
- Help your customers help themselves. Extending yourself beyond traditional relationship (education, consulting)
- Understand what matters to your customers so you can create educate and create solutions that support them.

Support The Journey
- This is a marathon, not a sprint. You need to engage and support your customers through their entire journey.
- Recognize that your customers will be in a constant state of flux for 10+ years and align your processes to support

Minimize the Distractions
- Keep it simple for your customers. There’s a lot of noise out there with managed charging, V2G, etc. While important, in some cases, for financial viability, we need to focus on refueling vehicles to sustain operations.