Smart Electric Power Alliance

Site Capacity & the Importance of DCFC Load Modeling

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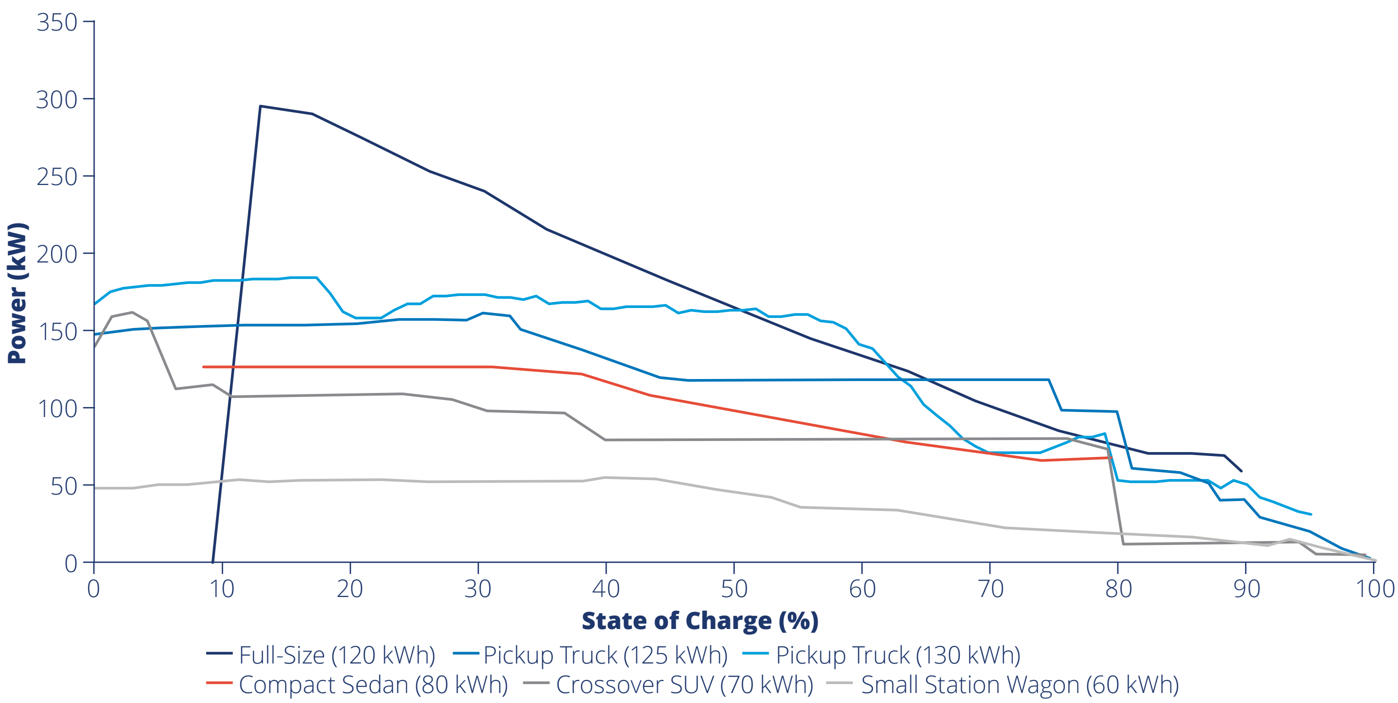
Site Capacity Utilization & the Importance of DCFC Load Modeling

U.S. utilities need to plan for hundreds of thousands of DC fast charging (DCFC) ports to meet the energy needs of over 26 million electric vehicles (EVs) by 2030. Many of these charging sites will easily have rated site capacities of over 500 kW, and some will range upwards of 1-3 MW and larger, all depending on the size of the DCFC ports. Current ports range between 50-350 kW. While these sites may have a high nameplate capacity, the majority of EVs on the market are limited in their ability to draw the maximum capacity of the site (Figure 1). Many of the light-duty EVs available on the North American marketplace have maximum power draws of less than 200 kW. For some vehicles their draw is even lower. This function may change as more vehicle manufacturers enter the market and develop new charging patterns. However, in the short-term, the current charging curves indicate that in most use cases the station's peak demand represents less than 33% of nameplate capacity (Figure 2).[1] SEPA's newest report "Exploring DC Fast Charging Load Profiles: Implications for Utilities, Operators, and Regulators",[2] identifies key takeaways that utilities and regulators should consider:

1. Short-term Capacity Allowances

Across a variety of DCFC use cases, including single-family, rural, fleet, and an emergency evacuation scenario, SEPA's modeling work indicates that current EV charging sites' capabilities are significantly underutilized compared to their rated capacity (Figure 2). Coupled with the growing market for software management services and the adoption of managed charging strategies, there is indication that DCFC site loads may be lower than

Figure 1. Power Draw of Individual Vehicles Compared to Their Current State of Charge (SOC)



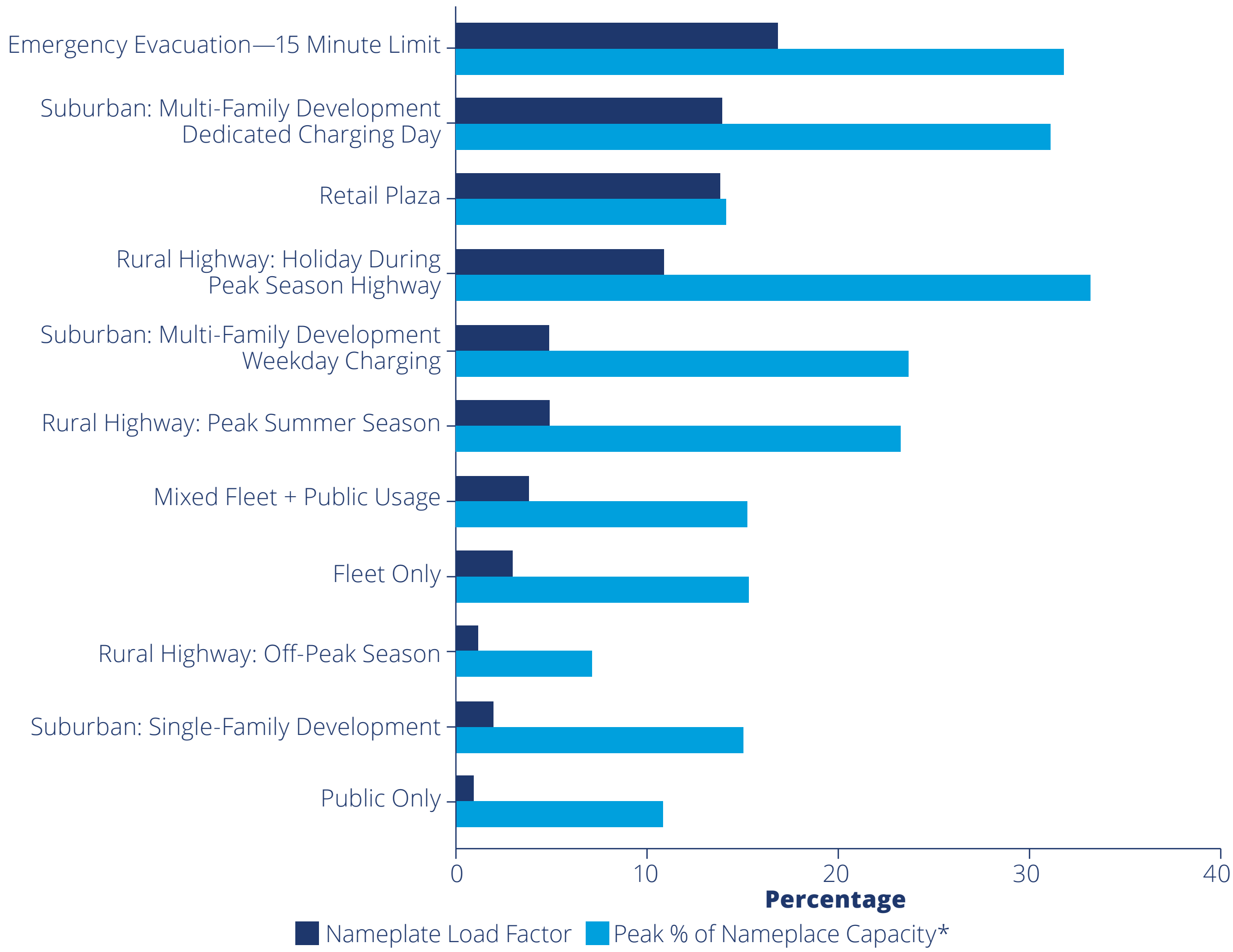
Source: SEPA, 2023.

1 **Nameplate load factor** [kWh/kWh] = Energy Delivered in 24 hour period / (Station nameplate capacity * 24 hours).
Peak % of Nameplate Capacity [kW/kW] = Peak demand within a defined period (kW) / Station nameplate capacity (kW)

Note, these are illustrative scenarios with hypothetical load profiles and peak demand.

2 The full version of this report is available for free by the Coordinating Research Council (CRC).

Figure 2. Summarized Scenario Results



*Based on 350 kW per port capacity and current vehicle charging curves.

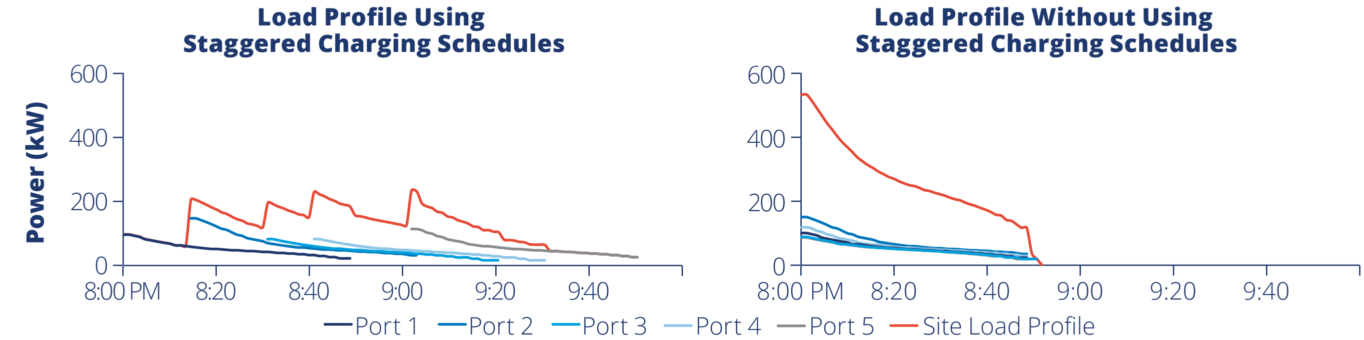
Source: SEPA, 2023.

anticipated and do not yet have as high an impact on the grid as some may expect based on peak nameplate capacity of the chargers. In the short-term, utilities should consider the actual peak demand that occurs with today's vehicle charging capabilities in addition to the chargers' nameplate capacity. With increased understanding of public charging, utilities can gain confidence around charging management strategies and better plan for actual site loads. This change in utility planning has implications for hosting capacity analysis and helps prevent the under-utilization of existing distribution infrastructure by capping distribution lines based on the site's nameplate capacity. Moving away from nameplate capacity towards realistic peak capacity could support the expansion of public, transit, and fleet DCFC and meet their growing charging needs.

2. Long-term Planning for Flat-Rate Charging & Other Innovations

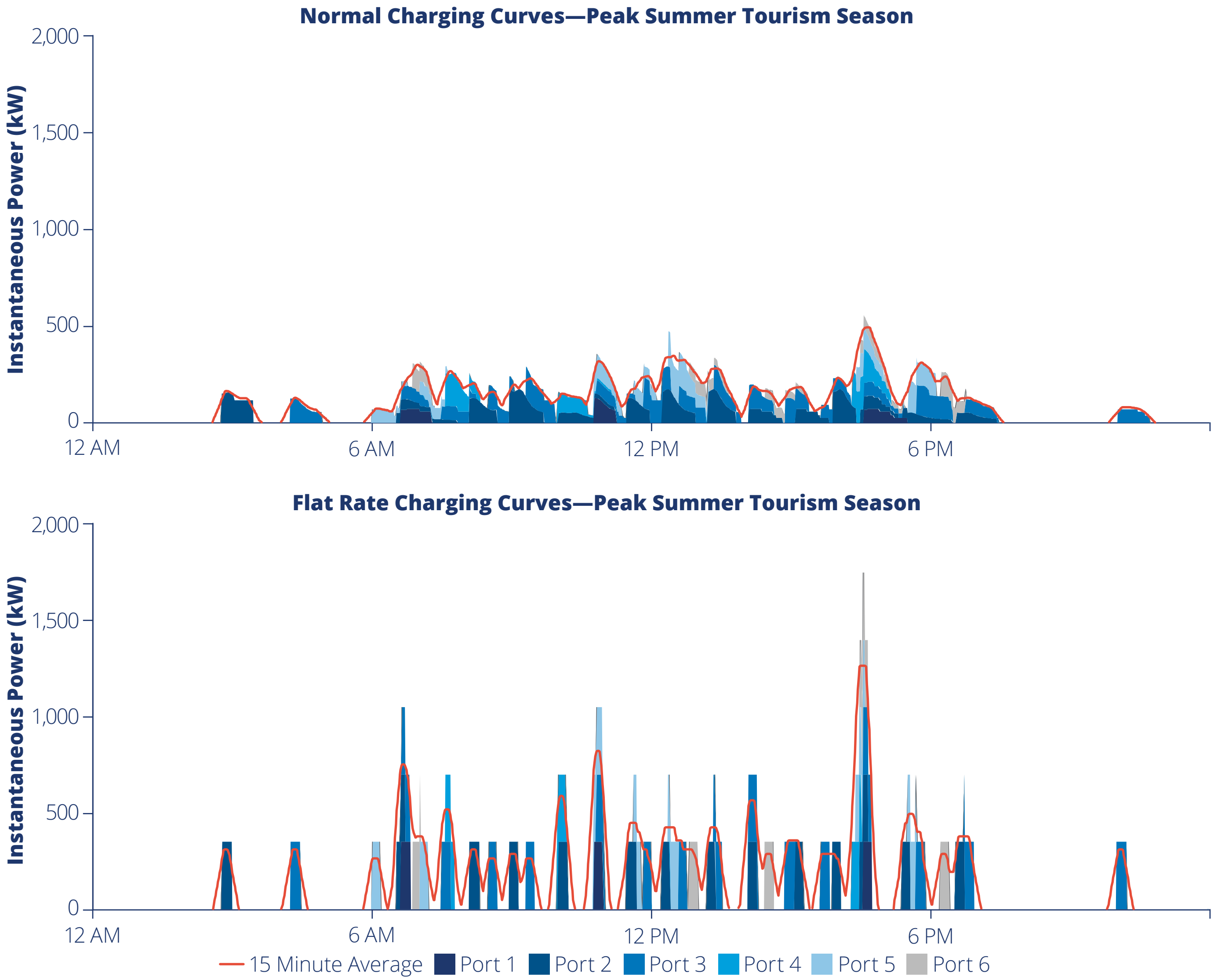
Managed charging strategies and current EV charging capabilities ensure sites perform at lower power levels than their rated capacity. The future of charging could be vastly different. As of 2023, most light-duty EVs use charging curves that start at or near the vehicle's maximum power draw and taper off over time. This charging pattern helps prevent load stacking, lowering the chances of a site reaching its nameplate capacity (Figure 3). However, if vehicle manufacturers move towards using flat-rate charging curves, the charging curves would lose the tapering effect. If batteries become larger and more accepting of higher power draws, then they will be charging closer to the site's rated capacity (Figure 4). Paradigm shifts can have significant impacts on grid planning and utilities should plan for a future when charging practices have more ability to impact the aggregate peak load of the site.

Figure 3. Effects of Staggered Charging Times on Site Load Profiles



Source: SEPA, 2023. Based on 350 kW per port capacity and current vehicle charging curves.

Figure 4. Effects of Different Charging Curves on Load Profiles



Source: SEPA, 2023. Normal Charging Curves: based on 350 kW per port capacity and current vehicle charging curves. Flat Rate Charging Curves: based on 350 kW per port capacity and constant rate vehicle charging curves.

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