Understanding Grid Impacts of Fleets

NASEM - Electricity Demand for Charging at Mass Market EV Deployment

By Matthew Cloud

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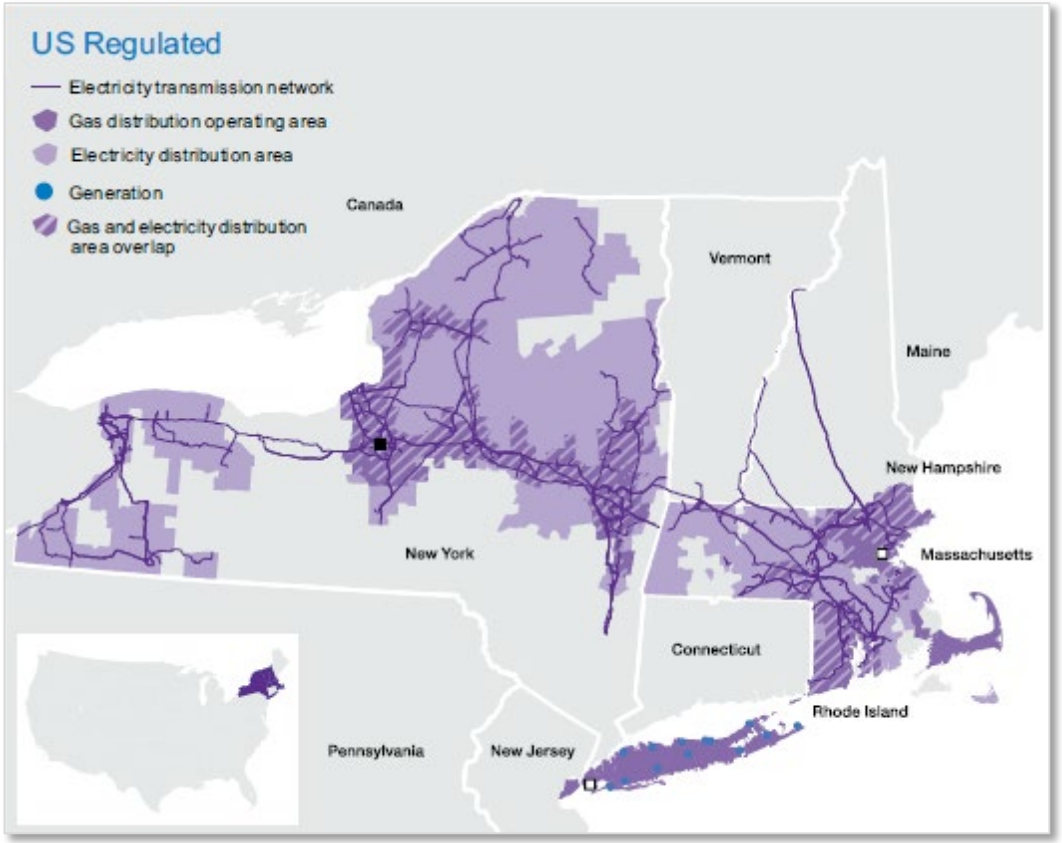
National Grid USA: Who we are



Electric and gas utility delivering energy to 20+ million people in New York, Massachusetts, and Rhode Island

Largest electric transmission network and gas distribution businesses in the Northeast US

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Why EVs?

The Drive to Beneficial Electrification

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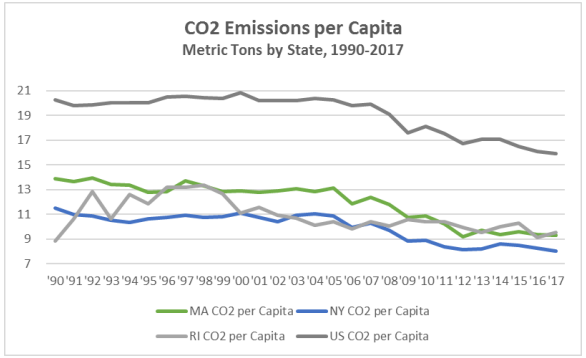
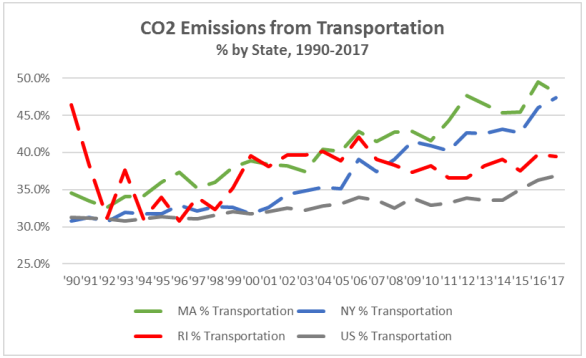
Decarbonization: Transportation is a key market segment





- **Great story!** US down 22% since 1990
- All 3 states >40% below US avg.
- MA and NY >30% decline, better than US

- Transport much larger contributor to CO2 than US avg. in all 3 states
- **MA up 13 pts**, from 35% to 48%
- **NY up 16 pts**, from 31% to 47%
- RI down 5 pts, from 46% to 40%
- US up 6 pts, from 31% to 37%

National Grid's Vision: To be at the heart of a clean, fair and affordable energy future

Source: US Energy Information Administration (EIA)

External Context: The drive to accelerate vehicle electrification

Federal/ Multi-State Action

- Biden Administration: Committed to electrify federal fleet and install 500k fast chargers nationwide
- Zero Emission Vehicle (ZEV) MOUs: 15 states, 3.3M light-duty EVs by ’25 and 30% EV trucks & buses by ‘30

State Commitments

- NY: Law banning ICE sales by ’35, CLCPA goal of 85% GHG reduction by ‘50
- MA: Goal of 750k ZEV by ‘30, committed to net-zero by ‘50

Corporate Actions

- Corporate EV100: >100 companies committed to 100% EVs by ’30 (incl. National Grid)
- Fleets: Amazon 100K E-Vans by ‘30, UPS 10k by ’27, Uber & Lyft 100% EV by ’30, Walmart 100% EV by ’40 (incl. long-haul), Hertz 100k Tesla order

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Key Markets

Fleet Electrification

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Why Fleets: High impact segment poised for electrification

Fleet electrification expected to rapidly accelerate

Public and private fleet operators' - commitments to decarbonize

Public policies mandating changes to transportation - broad GHG mandates and fleet requirements, such as for public transit agencies

Fleet use cases are suitable for electrification - high utilization, predictable travel distances, and regular return to depots

Total cost of ownership of electric vehicles is approaching cost parity - some market segments have already achieved this

Equitable access to clean transportation - reduced CO_2 and air pollution in disadvantaged communities

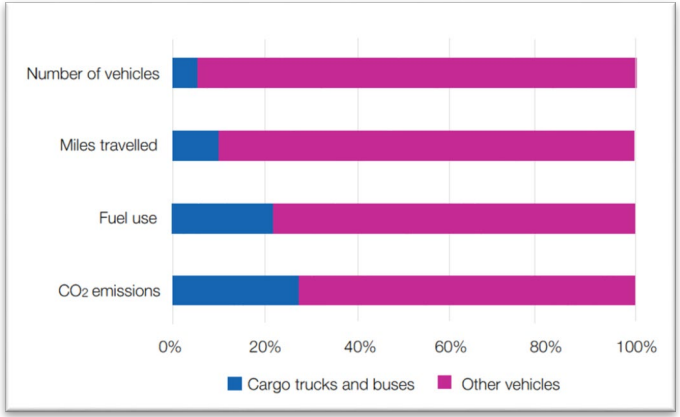

Chart Source: Nadel and Huether 2021

A fleet vehicle emits up to

150X

as much PM2.5 pollution as a passenger car

Source: Union of Concerned Scientists 2019

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Grid Planning

Long-Term System Impacts

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Grid Planning : Long-term fleet impacts

System impacts can be substantial, but vary based on season and geography

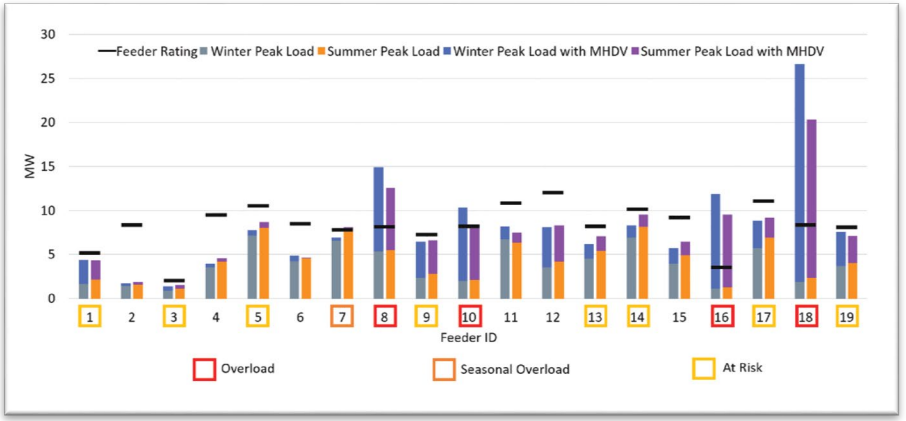
National Grid & Hitachi ABB Power Grids Analysis – evaluated grid impacts of large-scale fleet electrification on a Top 100 metro region in the US[1]

Service for fleets requires T&D solutions – many fleets able to be served via existing feeder capacity, but "cluster" locations require alternative solutions

Seasonality significantly impacts peak load – higher efficiency achieved in warmer temperatures with need to charge 35-40% less than in winter

In fleet "cluster" locations, peak load could increase by over

300%



[1] https://www.nationalgridus.com/ev-fleet-hub/Tools/Case-Studies

Grid Planning: Benefits of fleet charge optimization

Optimization of charger utilization yields significant reduction in grid impacts

Minimum Charging Strategy – assumes total facility charging needs are met at the lowest rate possible to fully charge vehicles prior to scheduled departure

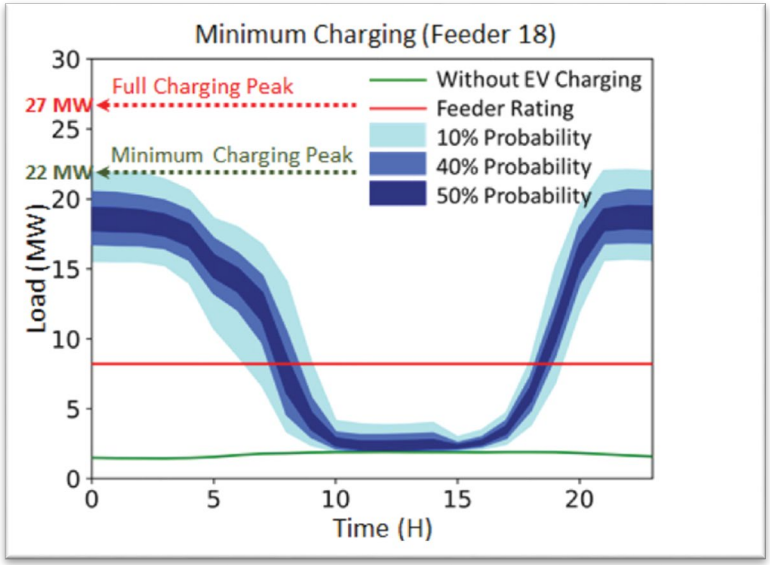
Grid and Customer benefits – reduction in peak demand lowers customer power payments and grid infrastructure investment

Simple implementation – feasible with only local control of charging

Fleet Advisory Services – fleet & utility collaboration opportunity through existing programs

Minimum charging strategy reduces peak by

~5MW (17%)



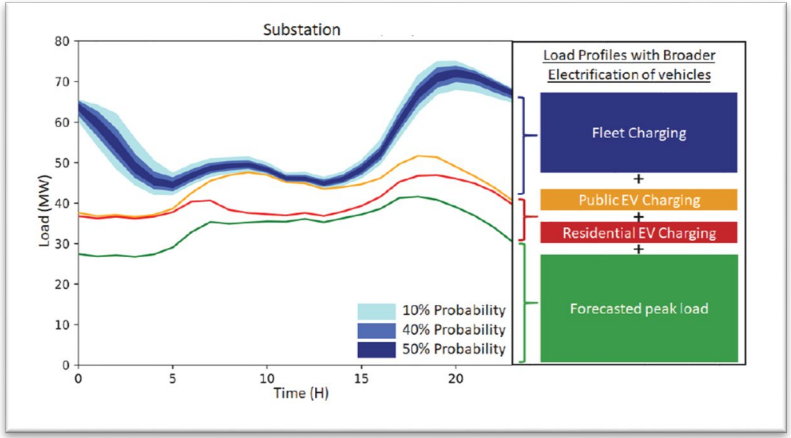
Grid Planning: Fleet impacts significant at substation level

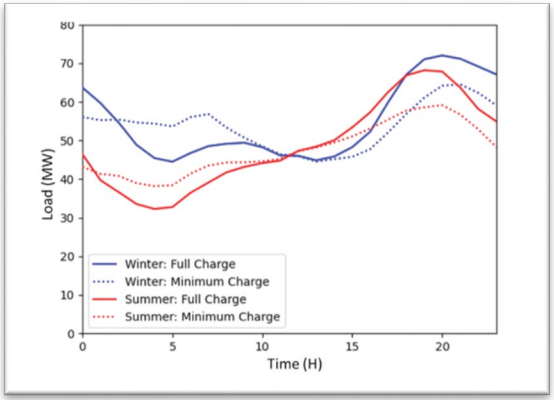
Substation level impacts significant, but minimum charging strategy beneficial

Fleet "clusters" aggregate at substation level – system impacts amplified when served by single substation

Charging profiles influence peak – residential and fleet charging more common during nighttime, public relatively higher in daytime, all share peak in evening

Minimum charging strategy – reduced peak load of the substation by ~10MW





Residential & Public charging peak increase: 20%

Fleet charging peak increase: 60%

Grid Planning: Long-term system planning is key

Fleets present a major opportunity for **GHG reductions** but can result in significant grid impacts in **clustered locations** that necessitate **proactive long-term system planning** informed by close **collaboration** between fleet operators and utilities

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