QUANTA TECHNOLOGY

Localizing Electrification Grid Impacts and Whether Storage can Support EV Integration

New Mexico Energy Storage Webinar Series

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Topic Summary

- **Introduction**

- Estimating EV Charger Load Impact on Electricity Grids

- Can or How Can Storage Technologies Help?

- Niche Areas of Electrification May Offer Earliest Opportunities

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Its Not Hard to Understand the Benefits of Electrification?

- Cities do not reach their emission goals without a large increase on EV adoption
- But rarely is a benefit so visually apparent as with city Electrification of Transportation – thanks to COVID, folks in Los Angeles got a glimpse of this future!

Los Angeles Before Lockdown

Los Angeles After Lockdown

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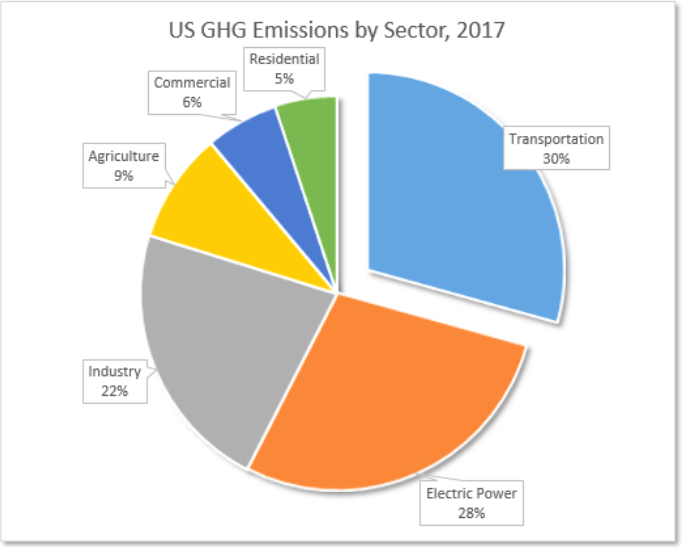
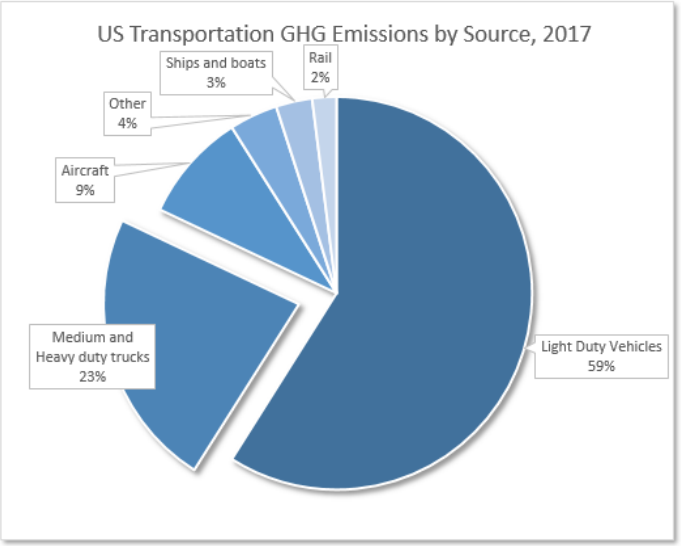
Electrification From an Electricity Grid Perspective

- We know the benefits that electrification can provide – emissions goals drive us to target light-duty vehicles – in the U.S. LDVs are the largest producers of the largest segment of Emissions





- But from the perspective of our electricity grid – we need to be more insightful on what is happening
- For grid operators, electrification means chargers! Chargers are increasing in speed and size, and clustering to support fleets – it is a must to understand where they are going to be installed
- As an example, we may have ¼ the number of heavy-duty vehicles, but their chargers may be 50X or 100X greater in size

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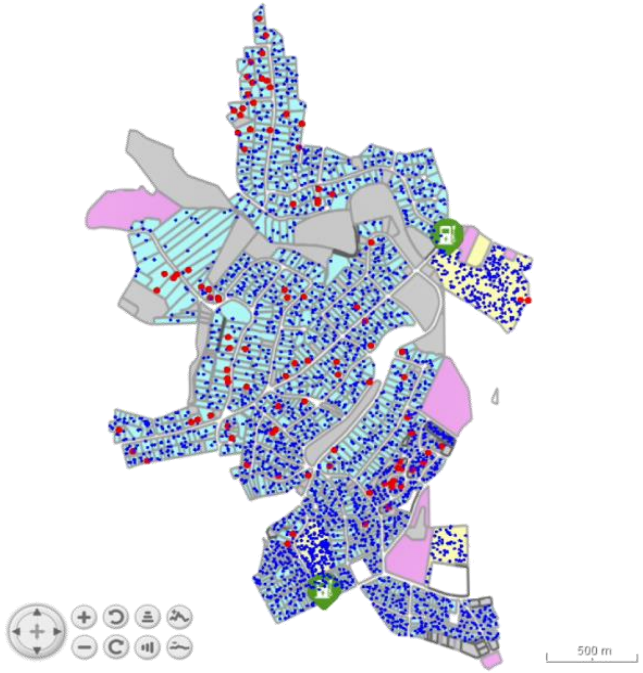
Localizing Charging Load to Specific Areas of the Grid

- If all charging is for single-resident home, off-street, then estimating charging load is fairly simple!
  - Homes are stationary, charging loads are predictable and actually somewhat uniformly spread across regions
  - *Picture is difficult to see but it is a picture of a residential area where red dots indicate expected chargers*
- However, focusing only on LDVs can underestimate changes we expect to see as electrification extends to fleets, public areas, and vehicle classes
  - Outside of residential home charging, which is typically Level II, 7.2KW chargers, public as well as fleet charging will introduce faster, larger chargers (50 to 150kW)
  - Fleets, heavy-duty fleets can introduce clusters of 500kW+ chargers as buses, delivery fleets, and trucks enter markets
- ***Challenge is how to estimate this impact on the grid as both vehicles and charger technologies are still rapidly evolving!***



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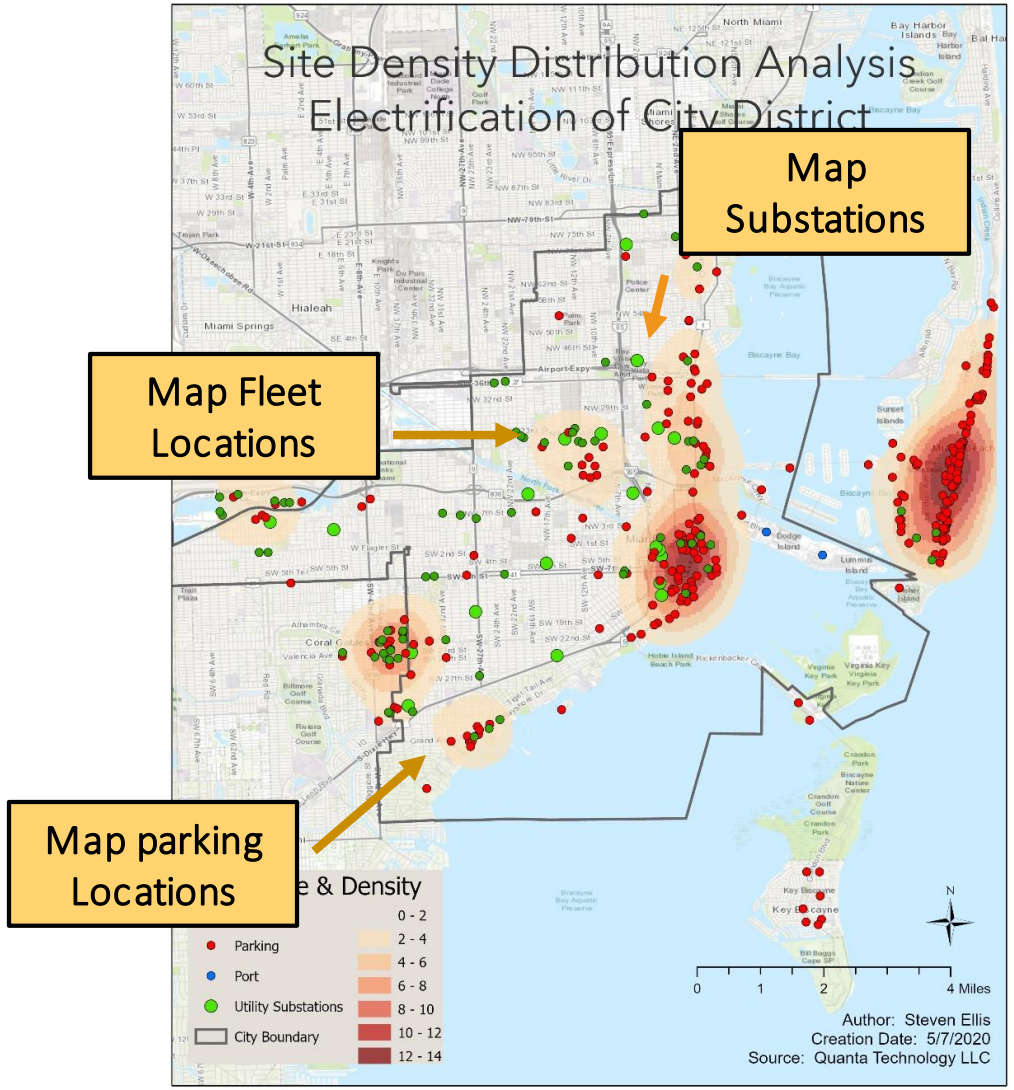
Using Big Data to Find Loads and Link to Substations

A "Ground-Up" approach can be utilized to localize future, projected charger load impacts on substations in utility territories. The process:

1. Utility Substations can be identified and mapped via GPS or Latitude / Longitude Coordinates
2. Facilities where charging is likely to occur (parking, retail, multi-unit housing, fleets) can also be map via coordinates
3. With locations known, facilities can be linked to specific substation of feeder nodes
4. New load growth from electrification is added to current substation rating and compared against its max rating
5. Substations are then ranked against their MAX rating to determine whether substation is at risk due to load



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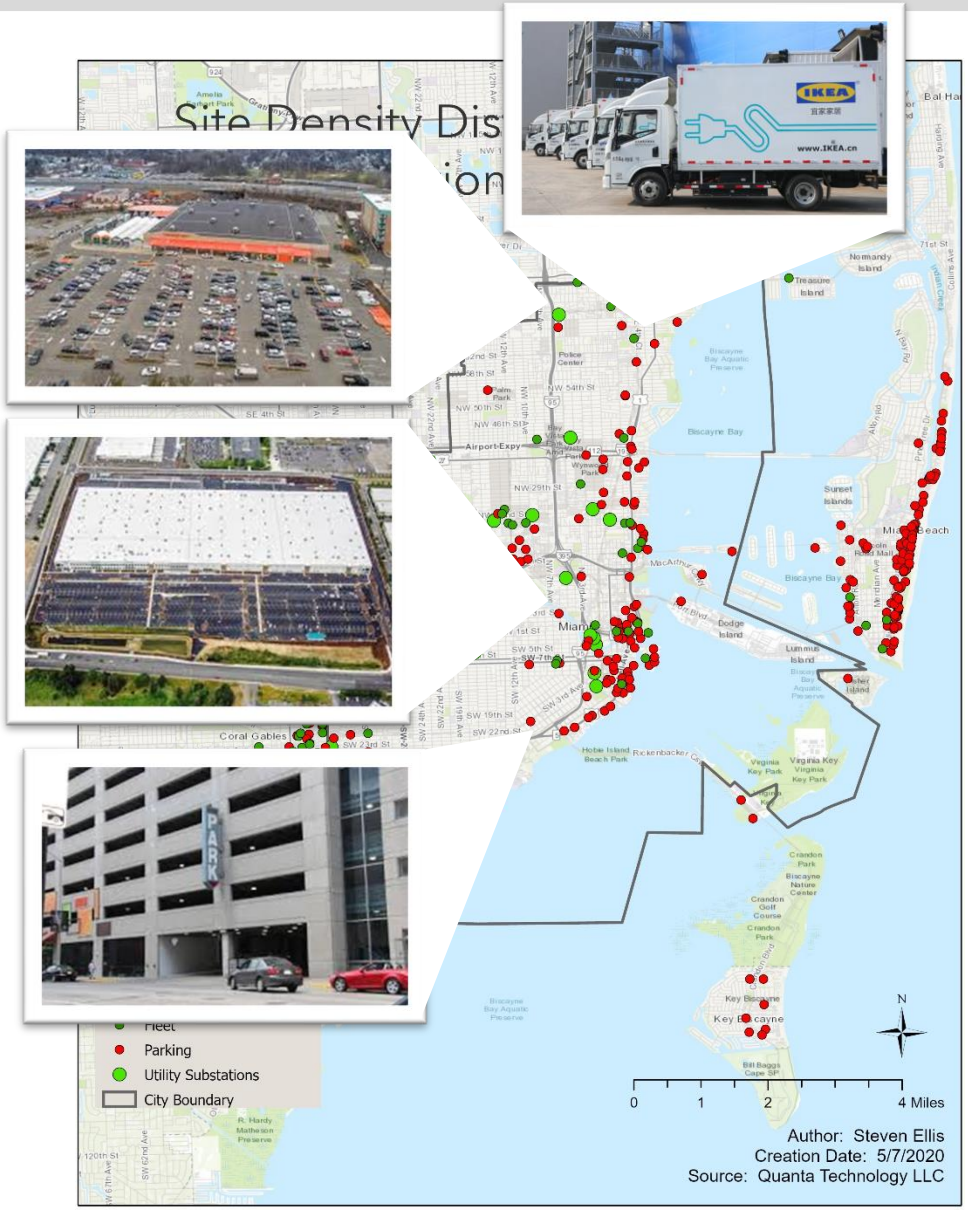
Impact analysis - Mapping commercial facility locations to substations

- Types of Facilities Targeted in Approach
  - Illustration of process shown where facility types can be identified and then located via SIC codes and corresponding GPS coordinates
    - Process Identifies commercial fleets sites, retail parking, office buildings, parking structures, multi-unit dwellings, and gas stations
- Charging loads are estimated for each of the facilities
  - Estimates can be made for charger deployments 5, 10, and 15 years into the future
  - Charging sizes (level II and fast chargers) are estimated based on facility types – and increasing charger sizes are incorporated as well
- *Charging loads for commercial facilities are based on expected charger deployments based on site motivations – different than with residential choices*



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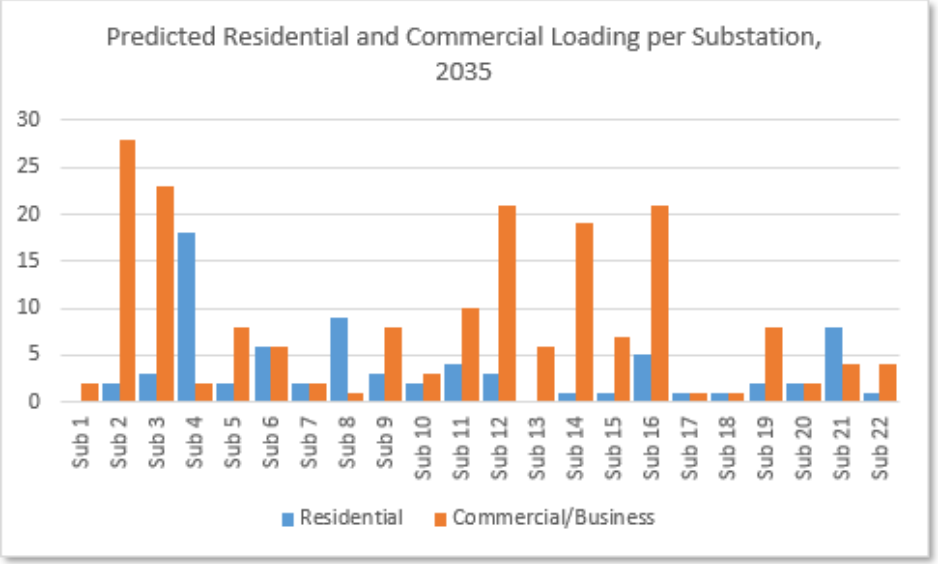
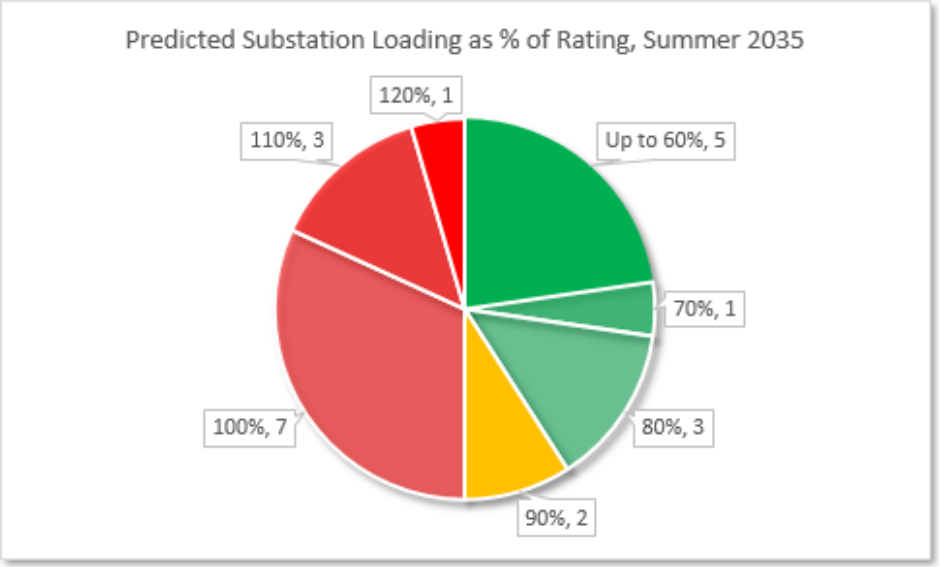
Impact analysis - Estimating impact on substations

- Chart shows how predicted commercial and residential loads are aggregated to specific substations
  - Expected charging loads for each of the substations are determined for future years
  - Commercial and residential loads are separated for each substation
- Determining "at risk" substations
  - Transportation electrification is added to current rating of the substation and compared against the max rating
  - "At risk" substations are listed for utilities to incorporate into planning activities
    - Approach is scaled for city, state, or multi-state evaluation of a utility territory





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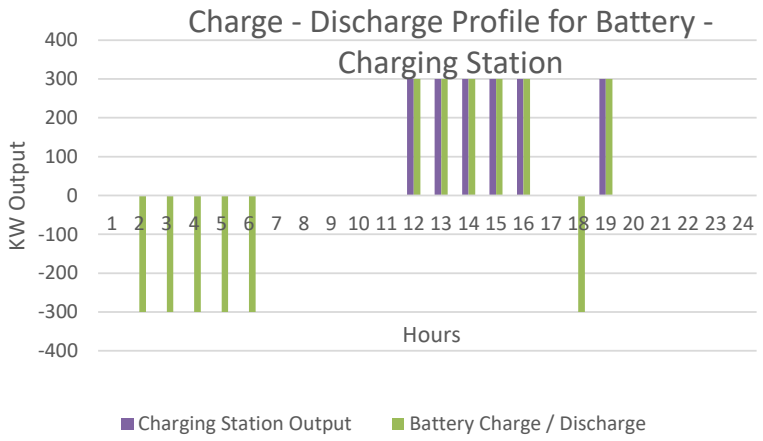
Are Renewables the Answer to the Increasing Load?

- Ideally, renewable energy is a great complement for EV charging, but this assumes charging load is spread evenly across a service territory
- Renewable Energy Options
  - Wind - typically highest at night (in U.S.) and complements home charging which typically occurs at night
  - Solar – can be installed at workplaces to mitigate daytime charging
  - Storage can store wind/solar and discharge when needed
- However, solutions are not perfect fits
  - Charging technologies are getting faster (50-350kW), opportunity charging is becoming more available, more vehicle types and fleets are electrifying
  - Storage may misalign – storage may support charging when utilization is low, but may also simultaneously charge with chargers when utilization is high
  - ***Bottom line: It can help when applied properly, but charging habits may change as vehicle batteries and chargers get larger and chargers become more ubiquitous***
    - There is little data to guide planners on how potential changes to charging patterns may happen due to rapidly evolving vehicles and EVSE technologies



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Do We Need Long Duration Storage For it to Support Charging?

- When facilities are offering level II charging, storage can act as viable, complementary device
  - Containerized units will be able to support multiple charging stations
  - Solar energy can be captured and used to support charging
  - Whether lithium or alternative technologies (flow batteries), storage can support charging
- However, as charging size increases, requiring more kW and KWh – footprint and cost may stress the solution
- Alternatives still being vigorously pursued as need for multi-hour storage has not gone away
  - Lithium costs continue to rapidly fall and innovation is still occurring with battery technologies

form energy

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Distribution 2.0 – Integration of Facility DER – EVSE Electrification – Utility Impact

- What is Distribution 2.0? Integrating facility DER with EVSE to mitigate impacts created by electrification – ***Mobility of Freight!***
  - Amazon, Ikea, DHL, FedEx are already developing facilities to meet their future needs
  - Focuses on electrification of hub and spoke distribution. Facilities designed to meet requirements of automation, robotics, and charging ports for delivery and short-haul trucks
- What is the Utility impact?
  - Increased load from combination of short haul trucks, forklifts, delivery trucks at facilities
  - ***This will create unique opportunity for utilities to support! Creates its own Non-wires Solution to mitigate potential issues from electrification initiatives***

→ Value of DER monetizes incentives for utilities to promote electrification at facilities

→ Optimizes integration - Facilities will act as their own Non-wire alternatives solution to their electrification

Combining Facility EVSE Optimization with Quanta Value of DER Tool

Summary

Building Load (MWh):	4,971
EV L2 (MWh):	1,278
EV DCFC (MWh):	548
Total Load (MWh):	6,796
Total EV Load (MWh):	1,825
Total Solar (MWh):	3,839
EV/Building Load:	**37%**
Solar/Total Load:	**56%**

Charging Station Input

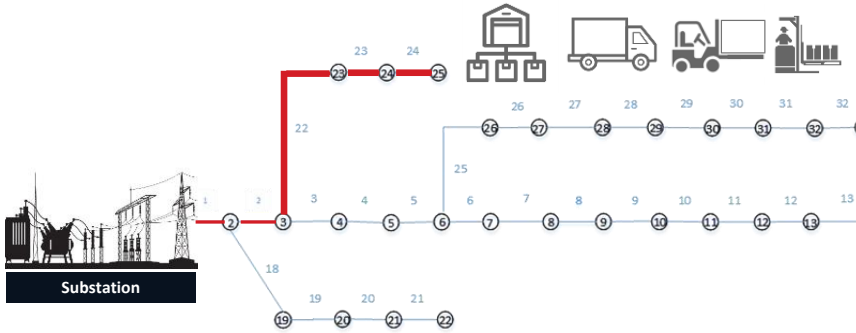
Level II Charger Raing (kW):	10
# of II Chargers:	35
Reference:	35
DCFC Rating (kW):	50
# of DCFC:	5
Reference:	5
Total Charger Rating (kW):	600
Total # of Chargers:	40

Solar System Input

Rooftop Size (sqft):	1,000,000
Max # of Panels:	47,829
Panel Rating (W):	300
# of Panel:	10,000
PV System Size (MW):	3
PV System Efficiency:	90%

Energy Storage Input

Rating (kW):	1500
Hour:	4
Round Trip Eff:	85%
Rating (kWh):	6,000



Facility peak load without electrification: 1,500 kW

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Example – Creating Public Fleet Charging for Mobility of People

Process 1

Divide Groups

Data Preparation
(Monte-Carlo simulation to capture variations and stochasticity)

Process 2

Local Optimization
(Optimal number & size of chargers per group)

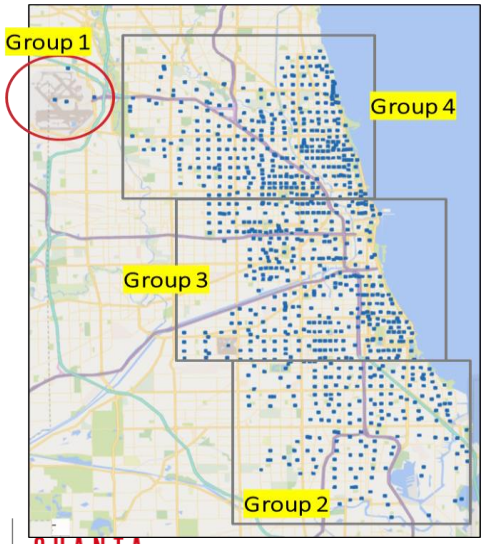
Network Simulation
(capture the interaction among different groups)

Process 3

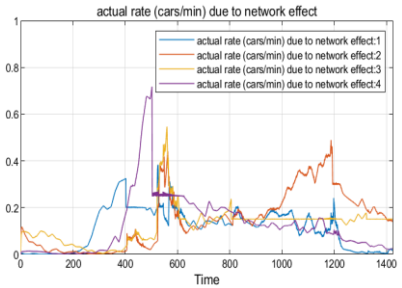
Criteria Table
(Ranking the potential locations consider criteria like low income, feasibility)

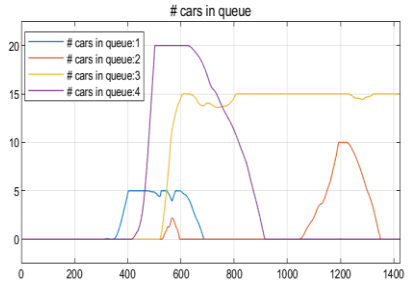
Allocating Chargers
(Locate chargers at highest rank places)

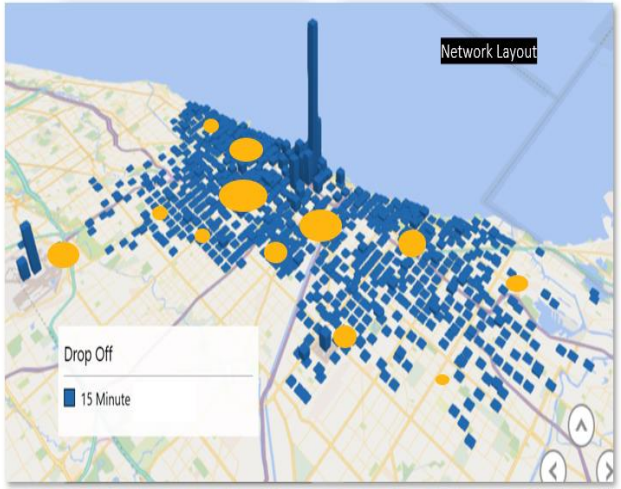
Illustrative Example



	Number of chargers	Size of chargers (kW)	Annual Opp. loss ($K) - from local OPT
Group 1	6	50	107
Group 2	8	50	119
Group 3	66	50	919
Group 4	68	50	972
Total			2117







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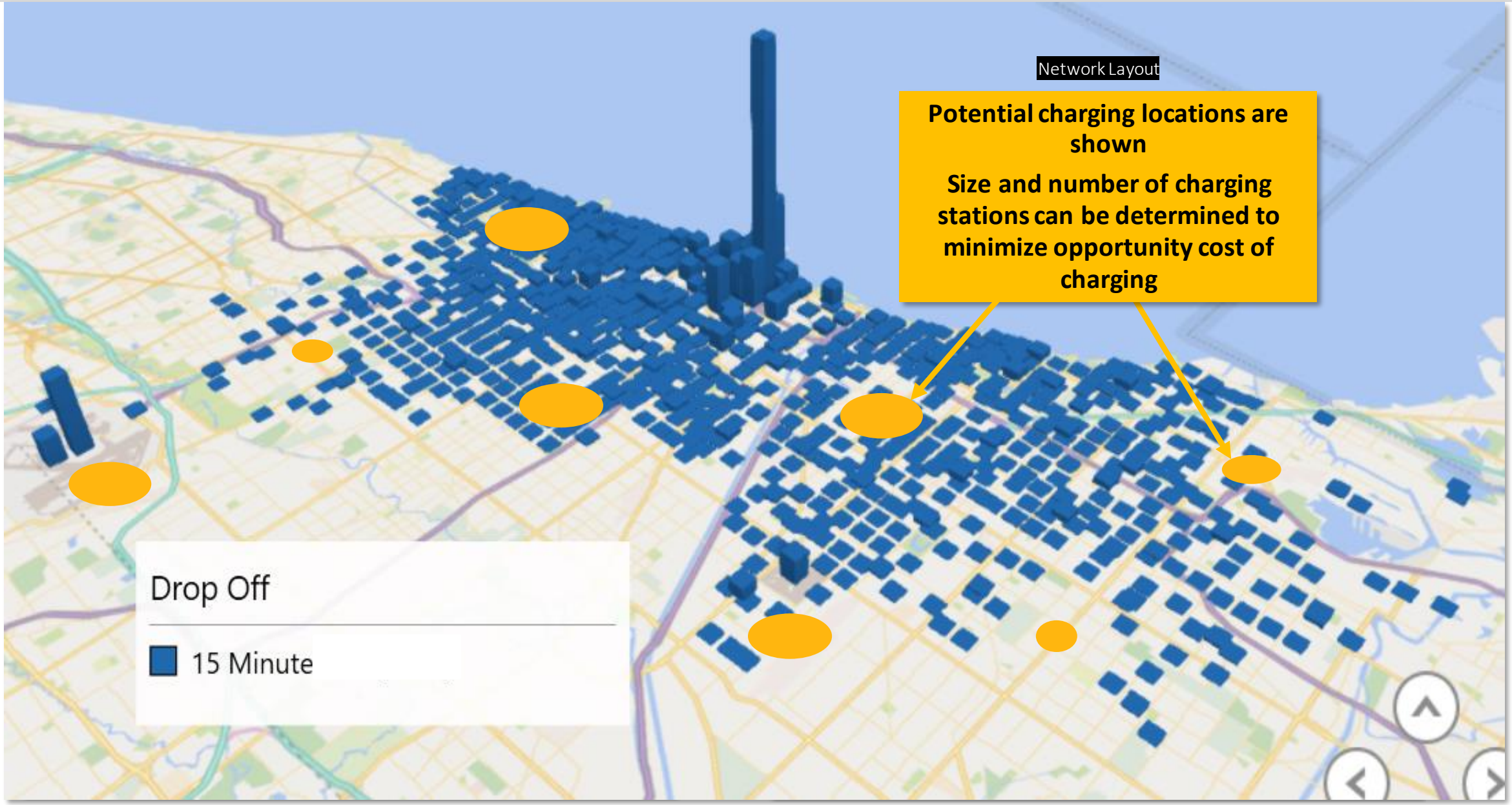
Ridesharing - How to deploy charging stations to accommodate fleets



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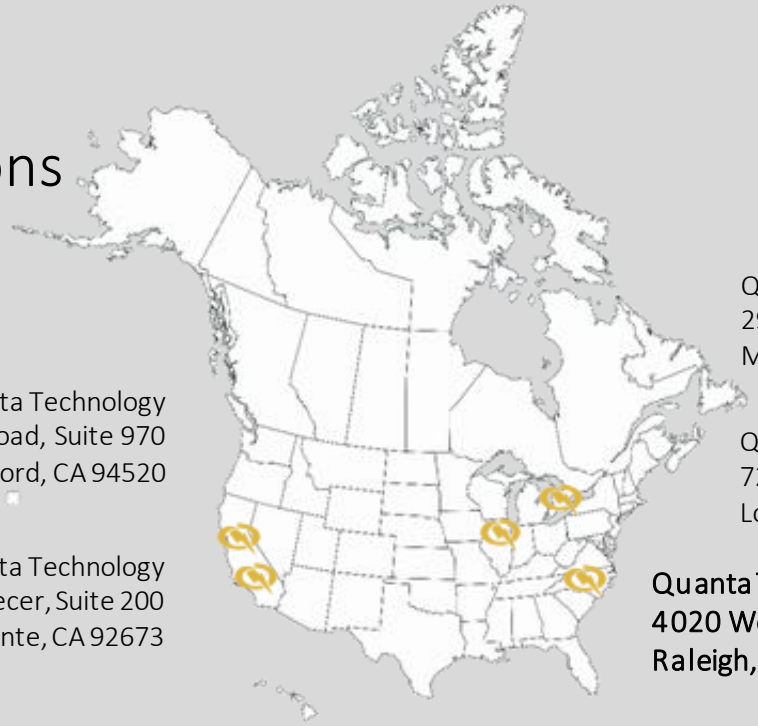
Office Locations



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