

# **EV charging impacts on Distribution System at scale through propensity analysis**

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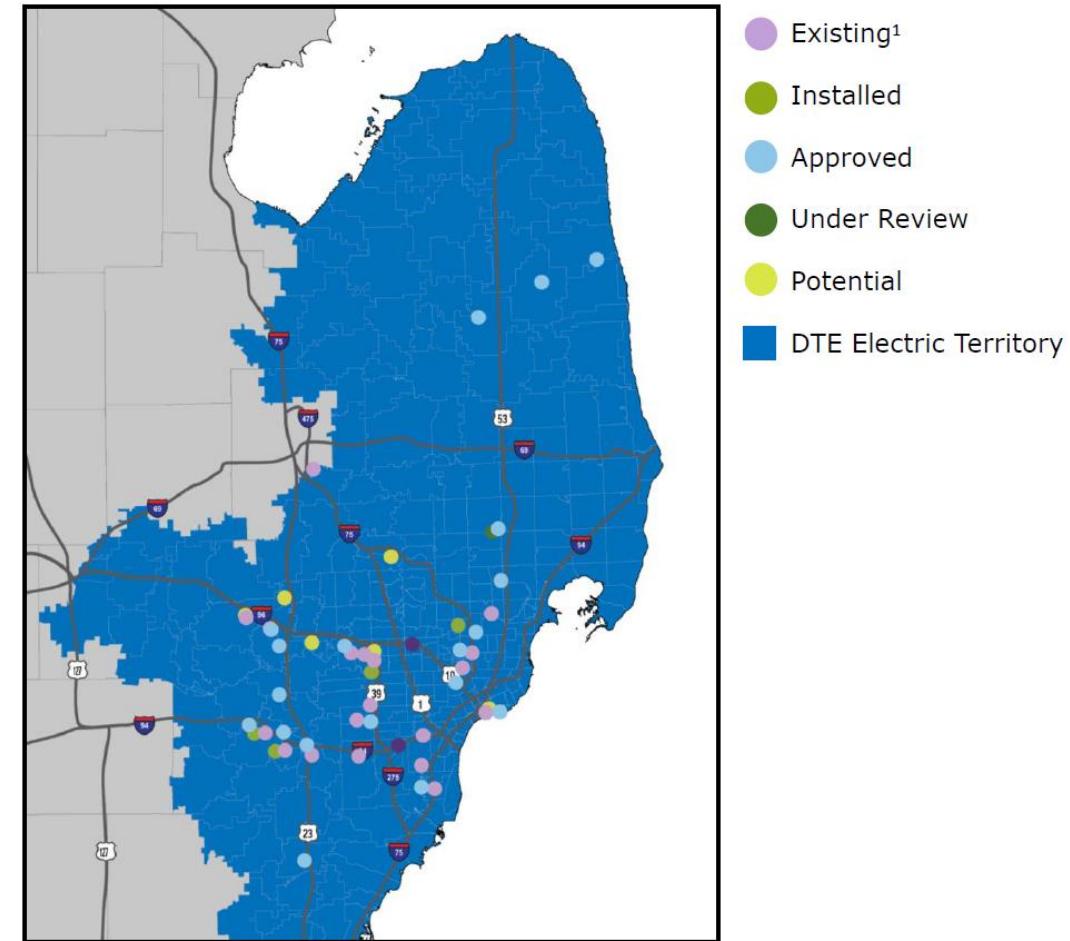
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# DTE at a glance

- Southeast Michigan and Detroit Area
- 2.1 million electric customers
- 5M+ registered vehicles
- 11 GW peak load: heavy industry, Advanced manufacturing and logistics
- Service territory ranges from very urban to very rural
- Substantial Vehicle OEM, supplier EV technology, batteries and autonomous vehicle R&D
- DTE Charging Forward program (rebates and make ready)

Fast Charging (DCFC) Applications and Existing Infrastructure



1. Existing infrastructure includes any public, non-Tesla DCFC installed outside of the Charging Forward program  
Source: Alternative Fuels Data Center



# Propensity analysis allowed for a deep dive of potential EV use cases and scenarios

- Look at adoption impacts to distribution system decoupled from EV sales projections
- How many vehicles do business have (This wasn't a electric utility problem before, where do we get the data?)
- Investigate when vehicles were at various locations and how they were used.



# In Distribution, everything is local due to equipment vintage and configuration. Impacts may not be seen in the highest concentration areas

Common issues at low penetrations:

- Clustering can quickly overload poletop and padmount transformers, Secondaries, service,
- Feeder imbalance can multiply the localized effects.

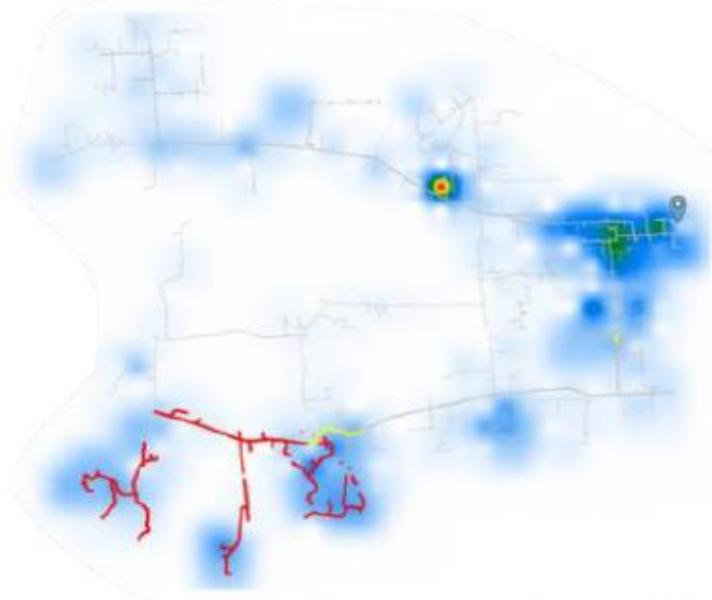
Propensity model at 10% vehicle penetration



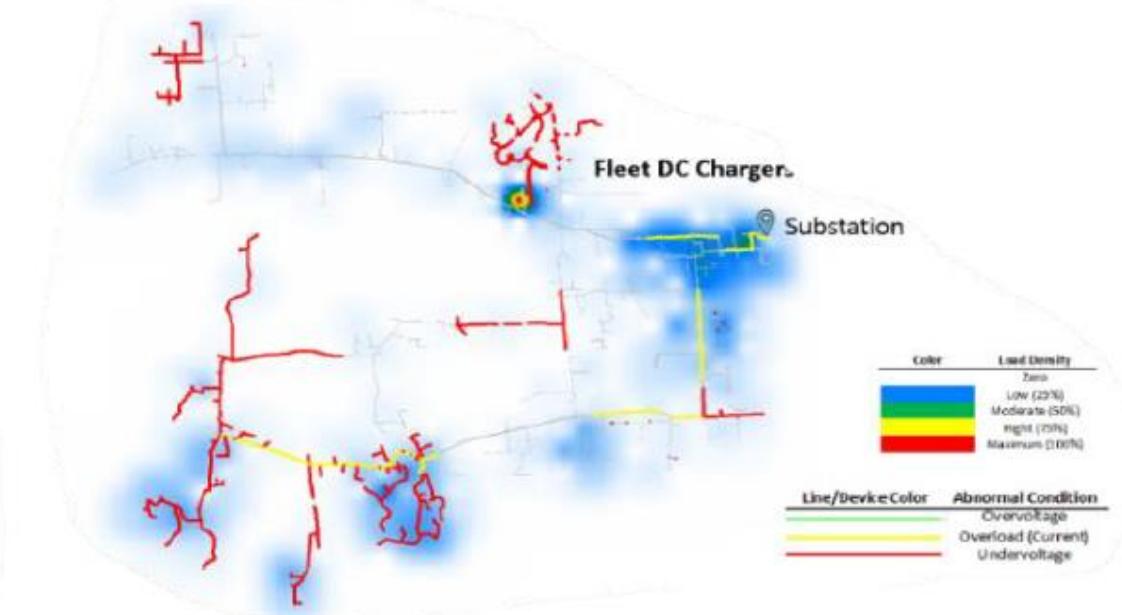
■ Phase A  
■ Phase B  
■ Phase C  
■ 3-Phase

**In Distribution, everything is local due to equipment vintage and configuration. Impacts may not be seen in the highest concentration areas**

**Figure 4: Summer Night Circuit Impacts from Increased EV Penetration<sup>4</sup>**



**10% EV Penetration**



**30% EV Penetration**

# **A number of utilization scenarios came from the propensity analysis that present interesting challenges for load managing EVs at scale.**

## Lawn Service + Snowplowing

- May have minimal to no load at an existing gravel lot or pullout yard
- Heavy duty Pickups towing trailers with equipment every day (100% charge need each night?)
- Additional Electric lawn equipment
- Plowing snow in the winter (high torque needed, cold weather impact on batteries, could be all hours until snow is cleared)

## School, Church or youth activity buses

- Most of these locations have nearly no electrical load today
- Some non-municipal locations had multiple medium sized buses that served the community in multiple ways at unpredictable times (deliveries, tours, shuttles)
- Big Opportunity for V2G

# A number of utilization scenarios came from the propensity analysis that present interesting challenges for load managing EVs at scale.

## Rural Agricultural Electrification

- Multiple small and large tractors likely all DC 50-150KW under daily use
- Multiple heavy duty pickup trucks (minimum 20KW level II AC)
- Heavy duty tractors, Harvester Combines with long duration use (DC 150KW – 1MW)
  - Some Farms had on 5-10 self propelled diesel units @ 400 HP likely these will need to be Xtreme fast charging as well
- Loads already very seasonal to meet harvest, Pumping in Spring, processing, grain drying in Fall
- *Time critical* planting, harvest and Hauling of fertilizers, agricultural products with heavily loaded Class 9 vehicles.

Opportunities for local charging pools?

# Conclusions and Questions that came up from the analysis

- At high penetrations Hot summer nights and Cold winter nights become the most interesting cases to study
  - Time shifting is a great tool to move the load off of peak, but what happens at high penetration when EVs are causing the peak?
- What are the long term impacts of Covid?
  - Charging intensity?
  - Charging location?
  - Free up more opportunities for vehicle utilization?
- What role does autonomy and changing ownership models bring?
- *Managed charging needs to be a lot more dynamic and much more local and customer need focused*