DTE Energy

Utility Infrastructure

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DTE Energy gas & electric regulated businesses

Detroit Edison (Electric)

- Tenth largest US electric utility
- 2.2 million customers
- 7,600 square mile service territory
- $4.9 billion in revenue
- $13 billion in assets
- System Peak Load: 12,762 MW
- Annual Sales: 54,000 GWH

Michcon (Gas)

- Eleventh largest US natural gas utility
- 1.3 million customers
- 14,700 square mile service territory
- 679 bcf of gas sales
- Significant gas storage capacity
- 11% of total Midwest Northeast
- $1.8 billion in revenue
- $3.3 billion in assets

Brief History

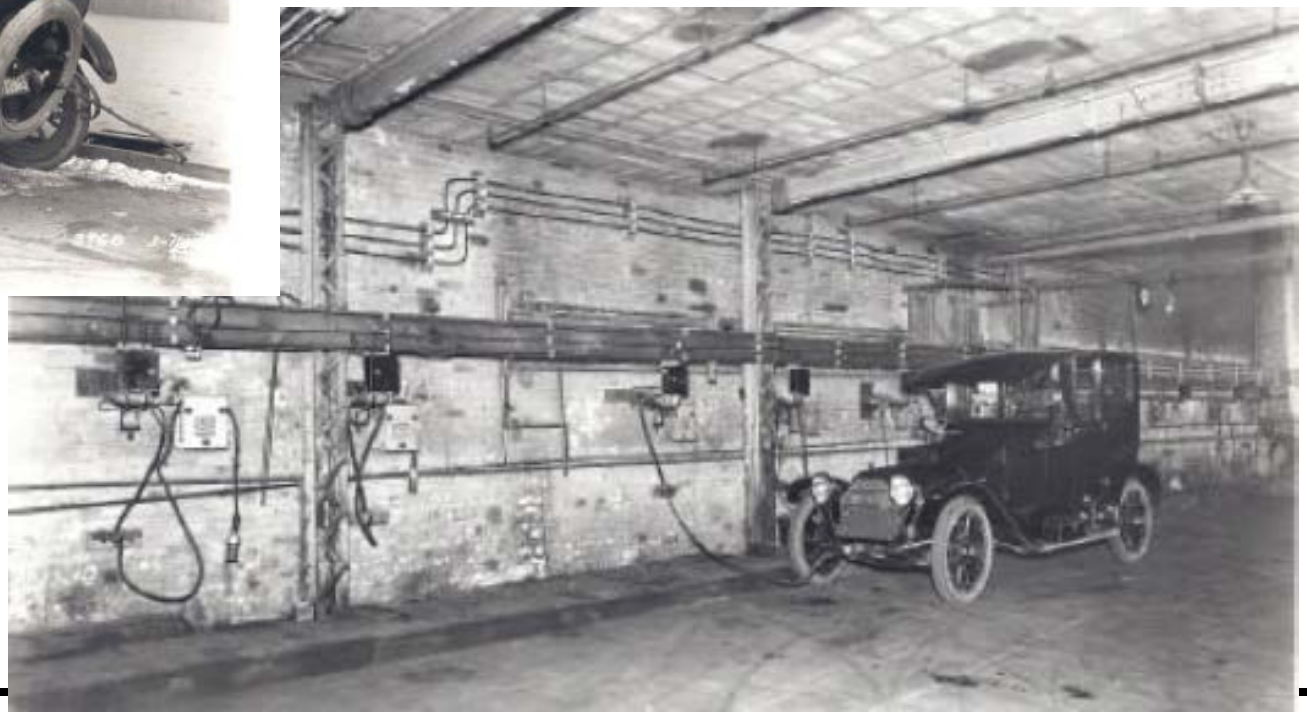
At the turn of the century, electric vehicles outnumbered gas-powered vehicles 2 to 1

Edison Illuminating Company electric ov*erh*ead line truck, 1915

In 1914, Detroit was the first American city to use electric taxi cabs

Detroit's first electric taxi accumulated more than 46,000 miles in its first two years of operation.

Note the curb-side charging port and main charging stations.



Detroit Edison's patented vehicle charging system called "Park & Charge"

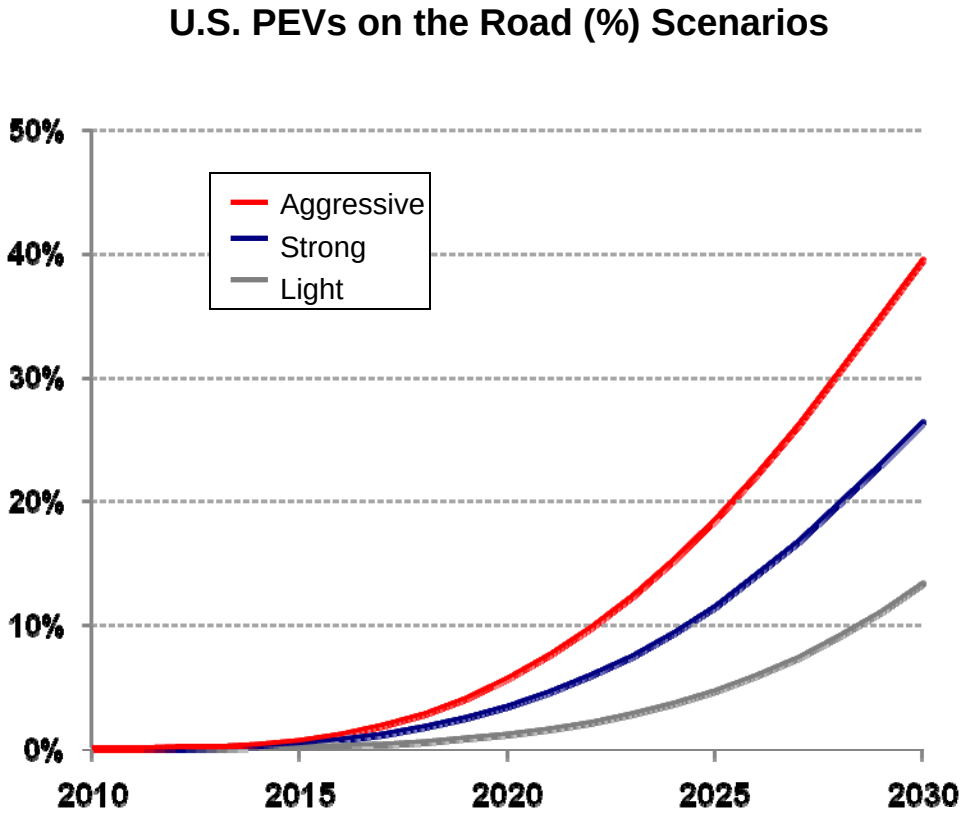
In 1983 a "park & charge" system, operated by a credit card, tracked energy usage and parking time for billing purposes.

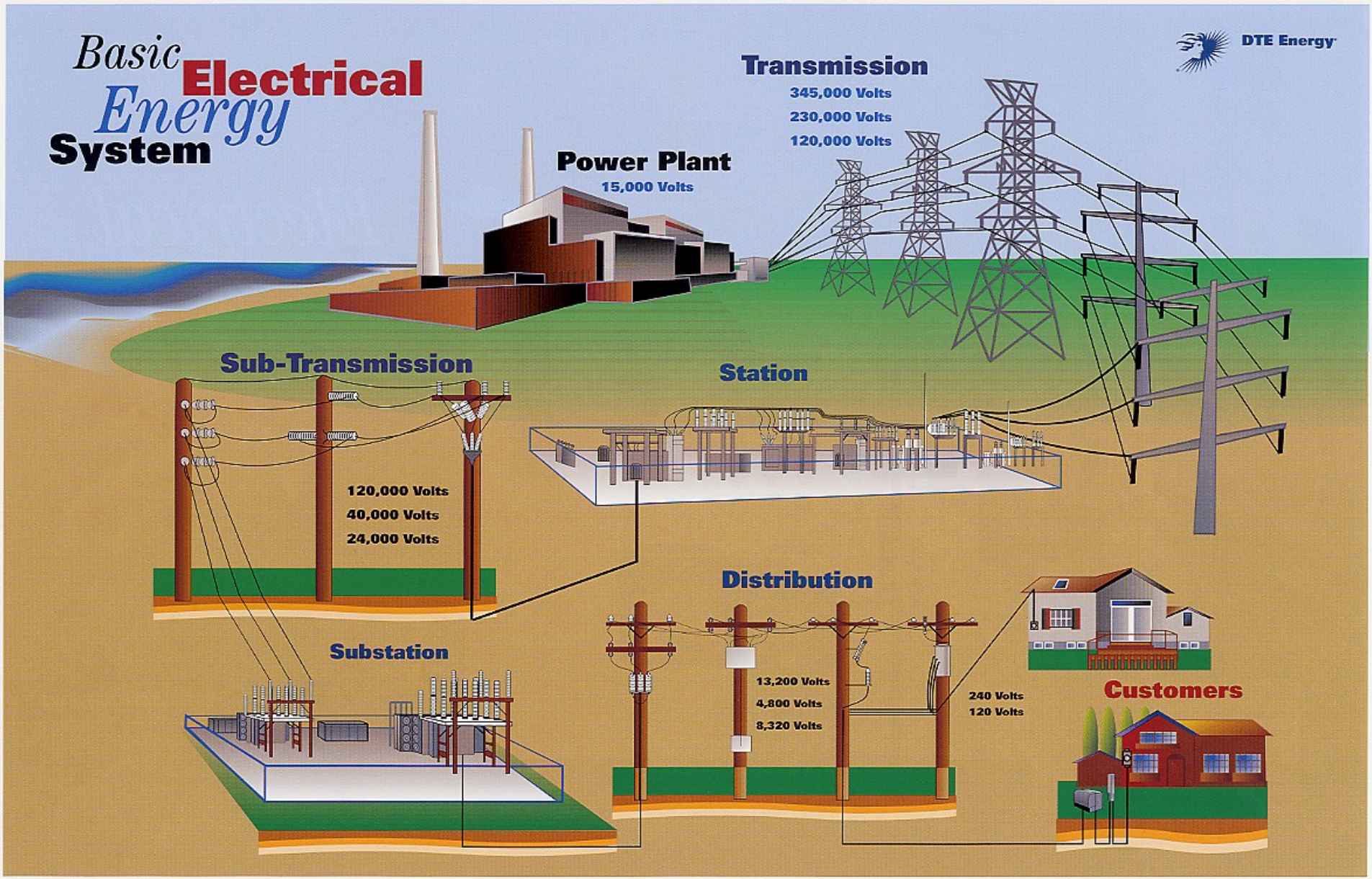
Interest in electric vehicles continues into the 1990s

At the 1992 North American International Auto Show, Detroit Edison and Ford Motor Company announce a 30-month demonstration program of the new Ecostar electric minivan in southeast Michigan

PEV Market Penetration

- What will the market penetration be?
- When will it occur?
- Market adoption will drive how utilities respond
- A 20% market penetration results in 3-6% revenue growth
- Electric grid can manage this growth, but …….
- Local issues close to the customer

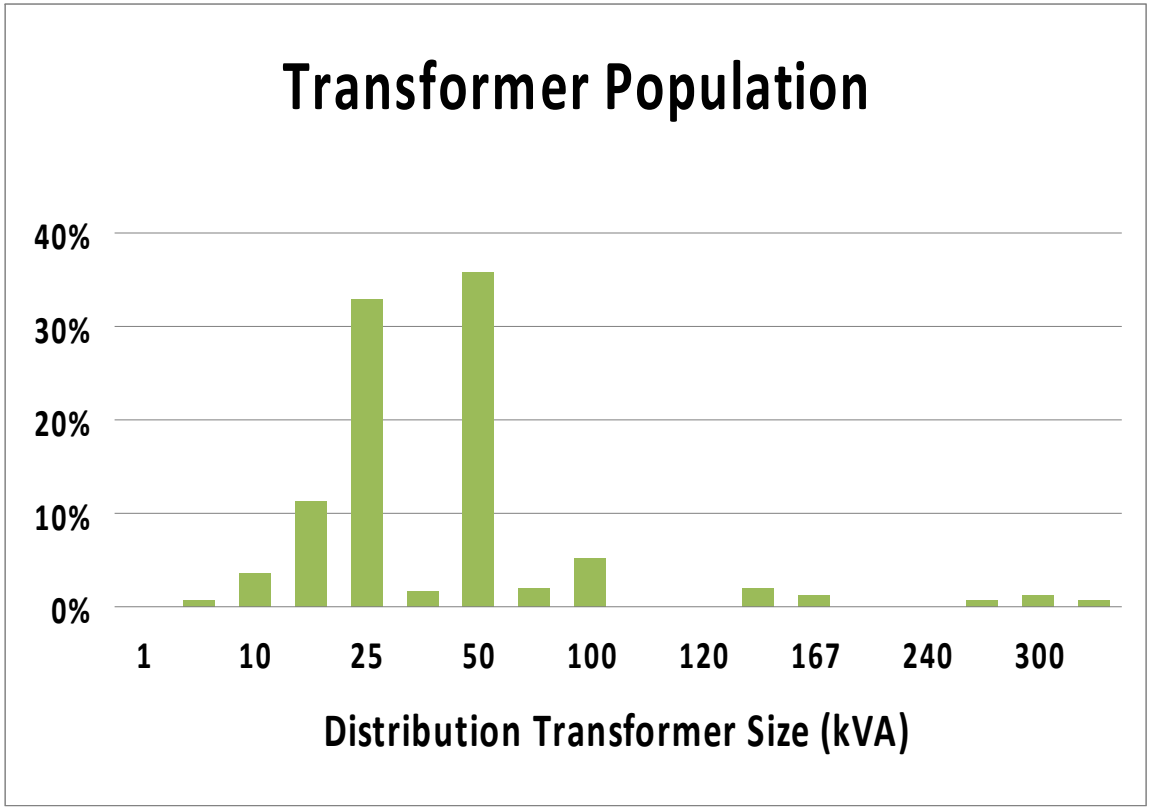



Basic Electrical Energy System
DTE Energy
Transmission
345,000 Volts
230,000 Volts
120,000 Volts
Power Plant
15,000 Volts
Sub-Transmission
120,000 Volts
40,000 Volts
24,000 Volts
Station
Distribution
13,200 Volts
4,800 Volts
8,320 Volts
240 Volts
120 Volts
Substation
Customers

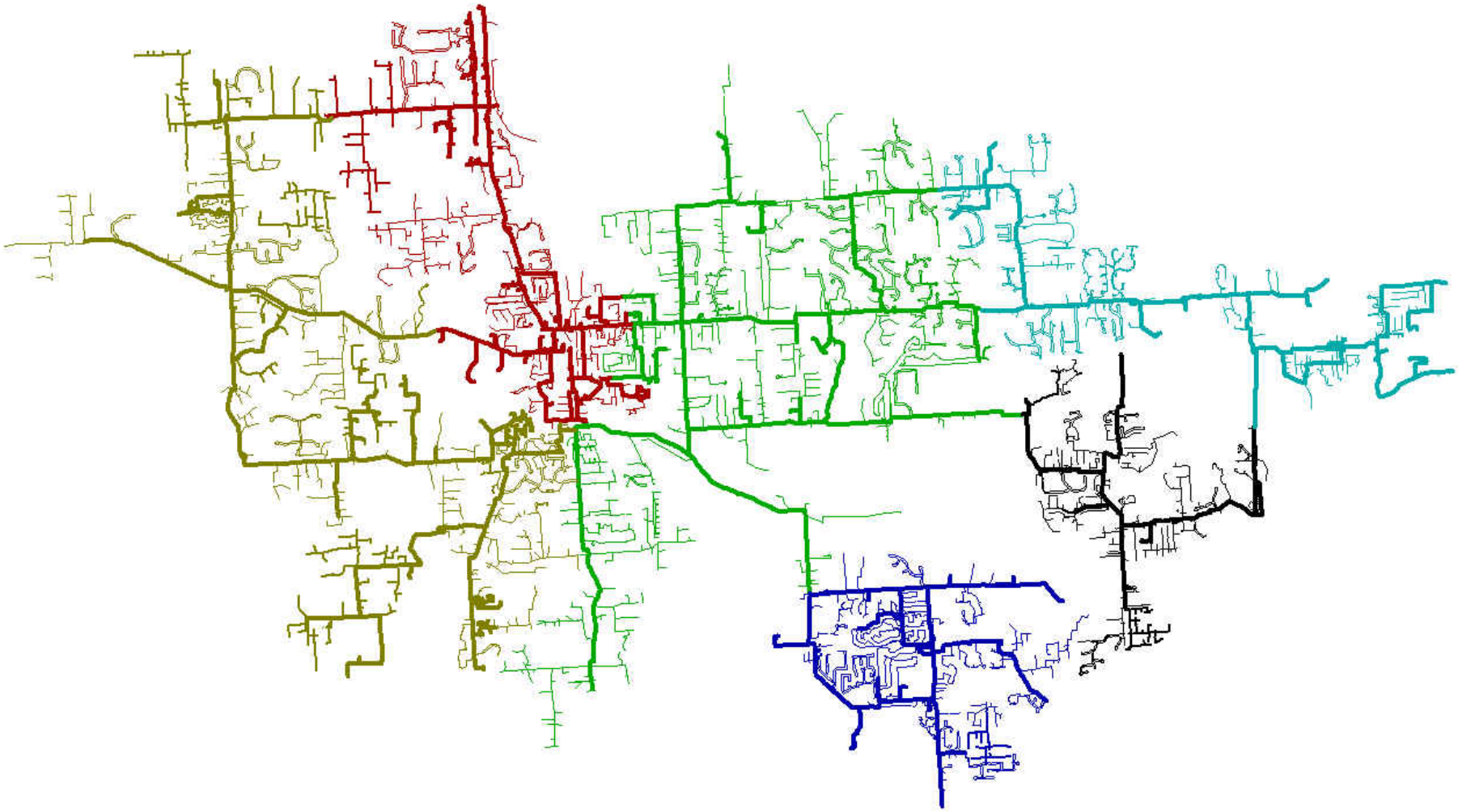
Distribution Type Transformers

Residential Transformers

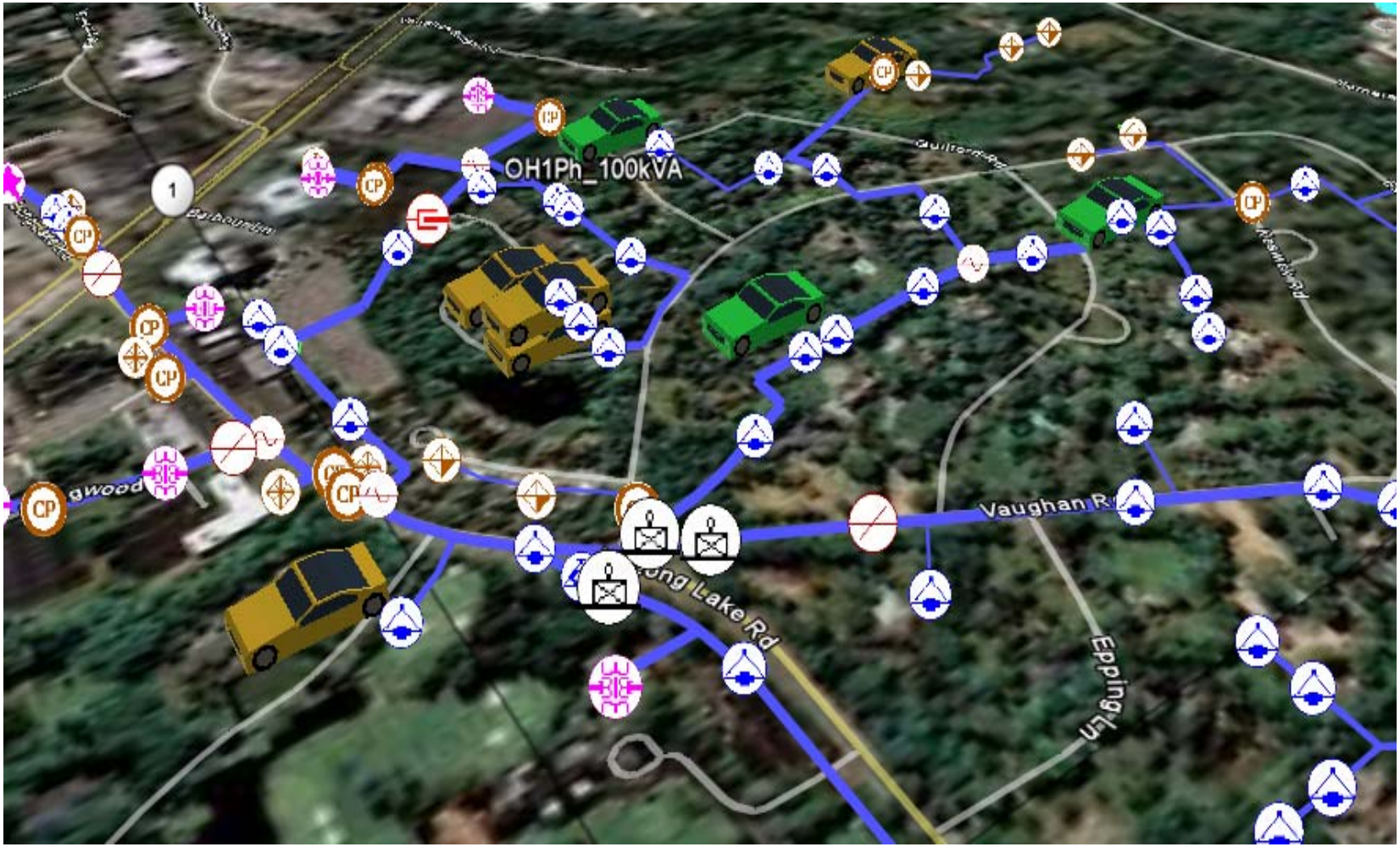
- 70% of transformers are 25 & 50 kVA
- Older residential installations 25 kVA
- New residential installations 50 kVA
- Total population ~400,000



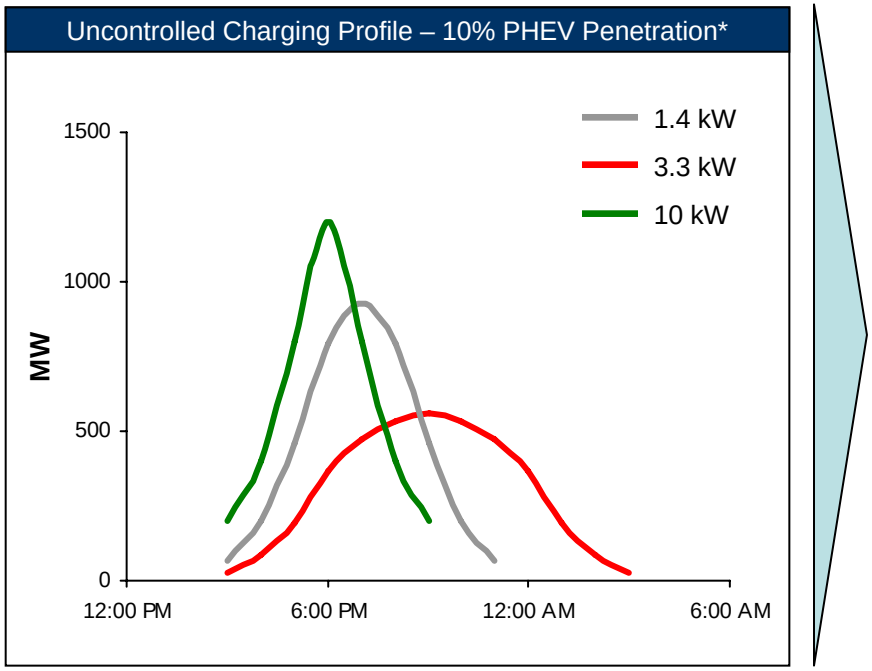
Substation Area

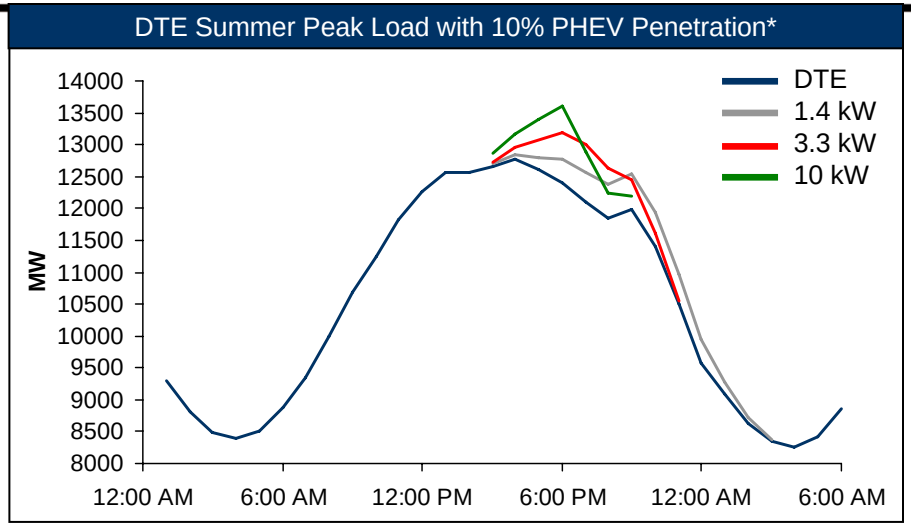


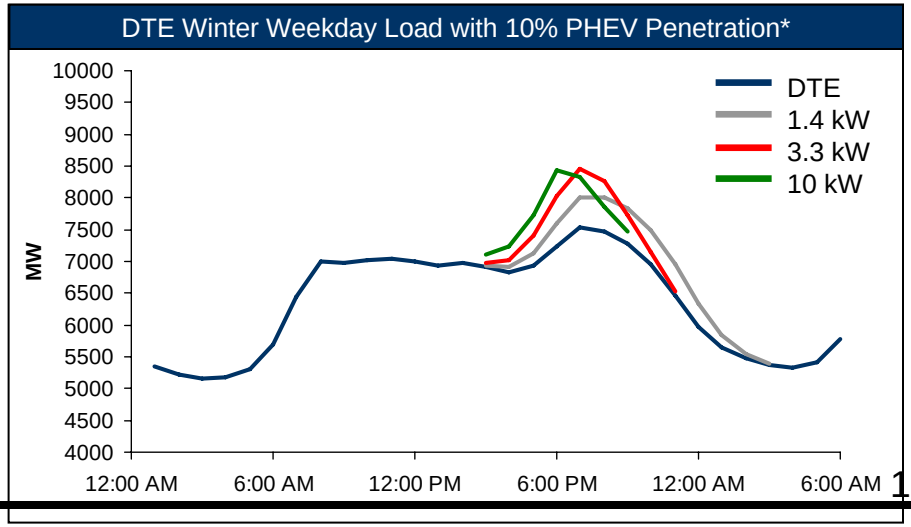
PHEV Modeling with DEW



What Impact Would Uncontrolled Charging Have on the Overall Electric Grid?







* Assumes all vehicles arrive home between 3 and 9pm and that arrival times are normally distributed

Uncontrolled Charging Could Lead to Localized Distribution Disruptions

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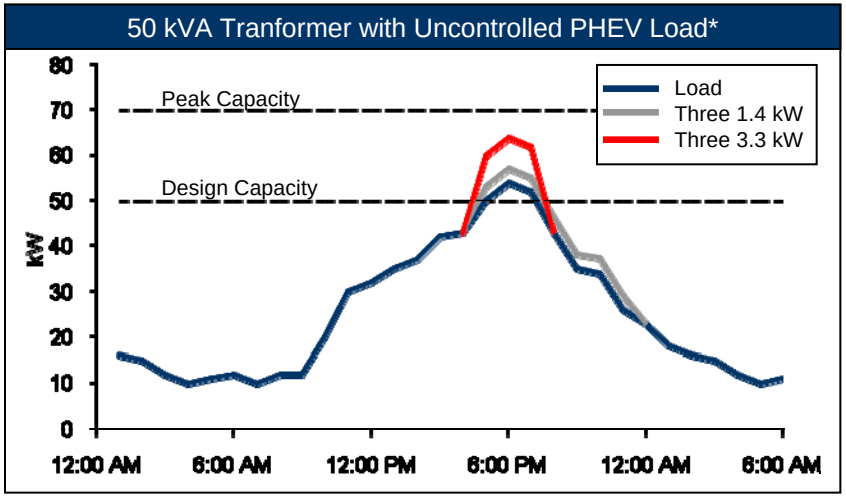
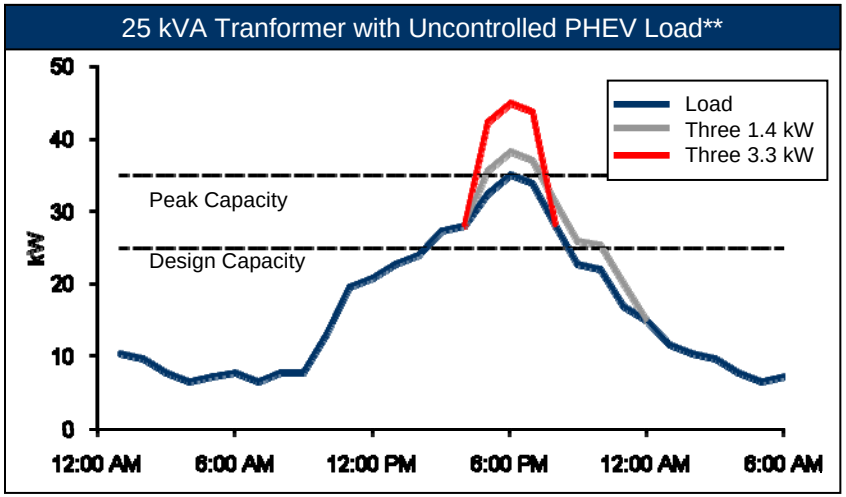
Confidential





- Peak loads in excess of 140% of design capacity or extended periods of time at peak loading can lead to localized electric service problems
  - Voltage dips (dimming lights, damage to expensive electronics)
  - Service interruption
  - Transformer failure
- Measures can be taken to mitigate potential grid issues from multiple vehicles charging on one transformer
  - On-vehicle charging control (time/date control)
  - SmartGrid technology will allow virtual real-time charging management and transformer troubleshooting

* Load shape for warm summer day. 6-10 homes per 50 kVA circuits in newer neighborhoods. 100% central AC penetration assumed. Current DTE planning standard.

** Load shape for warm summer day. 8-12 smaller, older homes per 25 kVA circuit. Most homes without central AC.

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