Preparing for Electric Vehicles: The Distribution System Perspective
Con Edison Provides Electricity to New York City and Westchester

- Service Area: 604 square miles
- 3.24 million customers, 9.2 million people
- 2.4 million customers are in Networks
- System is 86% underground and 14% overhead
- NYC Energy Density: 235 MW/sq mi
System Wide Smart Grid

- Generation
- Transmission
- Substation
- Distribution
- Customers

Future Smart Grid

- Energy Storage Integration
- Renewables Integration
- Load Management & Control
- PEV Integration

AMI
Smart Grid
Smart grid puts information and communication technology into electricity generation, delivery, and consumption, making systems cleaner, safer, and more reliable and efficient.

**Smart Building Technology** including web portals and in-home displays will eventually allow customers to track their energy use and give them the tools to change their energy-using habits.

**Intelligent Underground Systems** use sophisticated communication technology to monitor, isolate, and correct problems and improve reliability.

**Greener Energy Sources** are more readily integrated into the smart distribution grid.

**Smart Meters** gather information about customers’ energy use — so customers can use electricity more efficiently and may enable the utility to identify system problems.

**Plug-In Electric Cars** can connect to the grid to charge and one day may even provide power from their battery packs when the cars are not in use.

**Customer Energy Generators** enhance system reliability.
Why do Electric Vehicles Make Sense for NYC and Con Edison Customers?

Wheel-to-Well Emissions Comparison for Combustion Engine and Electric Driving in New York City

- Conventional Gas Vehicle: 417 Grams CO2/mile
- Best Case Gas Engine Technology (2030): 200 Grams CO2/mile
- Plug-in Hybrid Electric Vehicle: 116 - 232 Grams CO2/mile
- Electric Vehicle Charged on NYC Grid: 116 Grams CO2/mile
- Electric Vehicle Charged from Renewable Resource: 0 Grams CO2/mile

Source: “Exploring Electric Vehicle Adoption in New York City”, The City of New York, January 2010
New Yorkers Own Fewer Vehicles

Households by Number of Vehicles Owned

Source: 2000 US Census
Electric Vehicle Sales in the Next 5 Years Likely to be Modest

Electric Vehicle Projections in NYC

Number of Electric Vehicles


Low
Mid
High
Distributed According to National Driving Patterns - NYC Peak is Increased by 9%

Probable Scenario
BTS PHEV Load on an Average NYC Day

Illustrative

Assumptions:
NYC Follows BTS driving statistics
6 hour charging period
Universal charging access

Sources: Energy Management, National Renewable Energy Laboratory, Energy Information Administration, US Census Bureau, Bureau of Transportation Statistics
Commuter Traffic Patterns Could Create Two Daily Charging Peaks

Worst Case Scenario
PHEV Load Creates Two Charging Peaks

Assumptions:
- All PHEVs charging at same time
- 6 hour charging period
- Universal charging access

Illustrative

Morning Commute: Charge at Work
Evening Commute: Charge at Home

Sources: Energy Management, National Renewable Energy Laboratory, Energy Information Administration, US Census Bureau, Bureau of Transportation Statistics
Managing Demand Will Require Careful Coordination Between Utilities and Auto Manufacturers

Best Case Scenario
PHEV Load Fills The Load Valleys

Assumptions:
Utility manages PHEV load
6 hour charging period

Sources: Energy Management, National Renewable Energy Laboratory, Energy Information Administration, US Census Bureau, Bureau of Transportation Statistics
Impact on Grid Infrastructure Challenges

Percent of area substations impacted by low and high scenarios of EV adoption

- Low scenario = 140,000 EVs in 2018
- High scenario = 230,000 EVs in 2018

With smart charging:
- Low: 33%, High: 33%
- Low: 14%, High: 14%
- Low: 4%, High: 4%
- Low: 50%, High: 50%
- Low: 60%, High: 60%
- Low: 86%, High: 72%
- Low: 51%, High: 47%

Without smart charging:
- Low: 33%, High: 33%
- Low: 14%, High: 14%
- Low: 29%, High: 29%
- Low: 50%, High: 53%
- Low: 60%, High: 40%
- Low: 57%, High: 43%
- Low: 45%, High: 41%

Source: ConEd analysis, New York City Electric Vehicle Adoption Survey, 2009

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Con Edison is Taking a Leadership Role

Con Ed is actively engaged in a number of PEV-related initiatives, to prepare itself to respond knowledgeably and quickly to PEV market development.

- Utility and auto OEM planning
  - Inter-industry, utility/OEM working group
- Infrastructure development
  - Inter-industry Infrastructure Working Group
  - Active dialogue with new technology vendors
- EPRI
  - Ford Pilot Program
  - GM Electric Infrastructure Study
  - BMW Electric Mini Pilot
- PEV pilot testing and demonstration
  - Prius fleet demonstration – Astoria
  - Ford Escape SUV testing and demonstration
- Distribution grid impact analysis

The Con Ed PEV program provides an opportunity to learn through inter-industry and utility collaborations what it needs to know for system and fleet planning.
Technical Challenges

• Battery Technology
• “Plug” - the utility interface
  – Metering
  – Smart interface
  – Monitored and controlled charging
  – Vehicle-to-grid
• Reconfiguring network protectors for reverse power flow (V2G)
New Operational Challenges

• Increased off peak load reduces opportunities to perform maintenance at night

• The thermal cycling of delivery assets will be changed and may adversely effect the useful life of existing assets

• Current rate structure will need to be evaluated to accommodate new PEV load
Conclusion

- PEVs are real and currently being sold to customers in low volumes
- In the short-term, PEV markets will be driven by government policies and programs
- In the long-term, PEV markets will become sustainable as technology improves and commodity and carbon costs increase
- Con Edison will face new challenges as PEVs come onto our grid, however PEVs also represent a real opportunity
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