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April 25, 2023

EV Electrification at PECO

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PECO Distribution Capacity Planning

Agenda

- **Introduction**
  - PECO Territory EV Adoption
  - Customer Incentive Programs
- **Capacity Planning & Connecting EV Chargers**
  - New Business Voltage Request Process
  - EV Load Estimating
- **Load Analysis & Case Studies**
  - Monitoring EV load
  - Case Studies
- **Long-Term Capacity Planning**
  - EPRI Fleet Study
  - Design Standard Updates
  - Load Growth Accommodation

Introduction

PECO Territory EV Adoption

- Of the 3.2 million passenger vehicles in PECO territory, only 0.5% are battery electric vehicles (BEVs)
- Every county in our territory has more than the National Renewable Energy Laboratory's (NREL) minimum 1.3 charging plugs per 1,000 BEVs
- Four of five counties exceed DOE's ideal ratio of 3.4 charging plugs per 1,000 BEVs

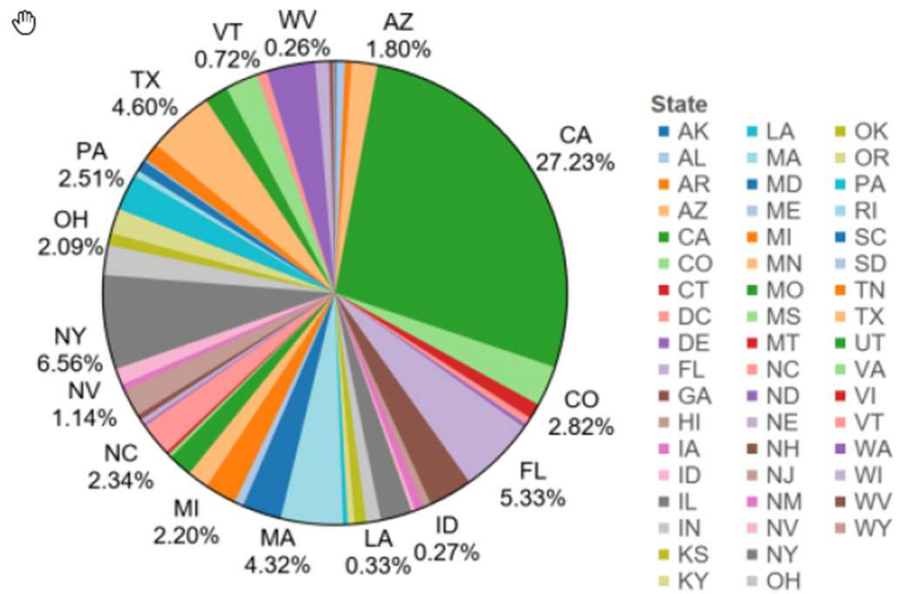
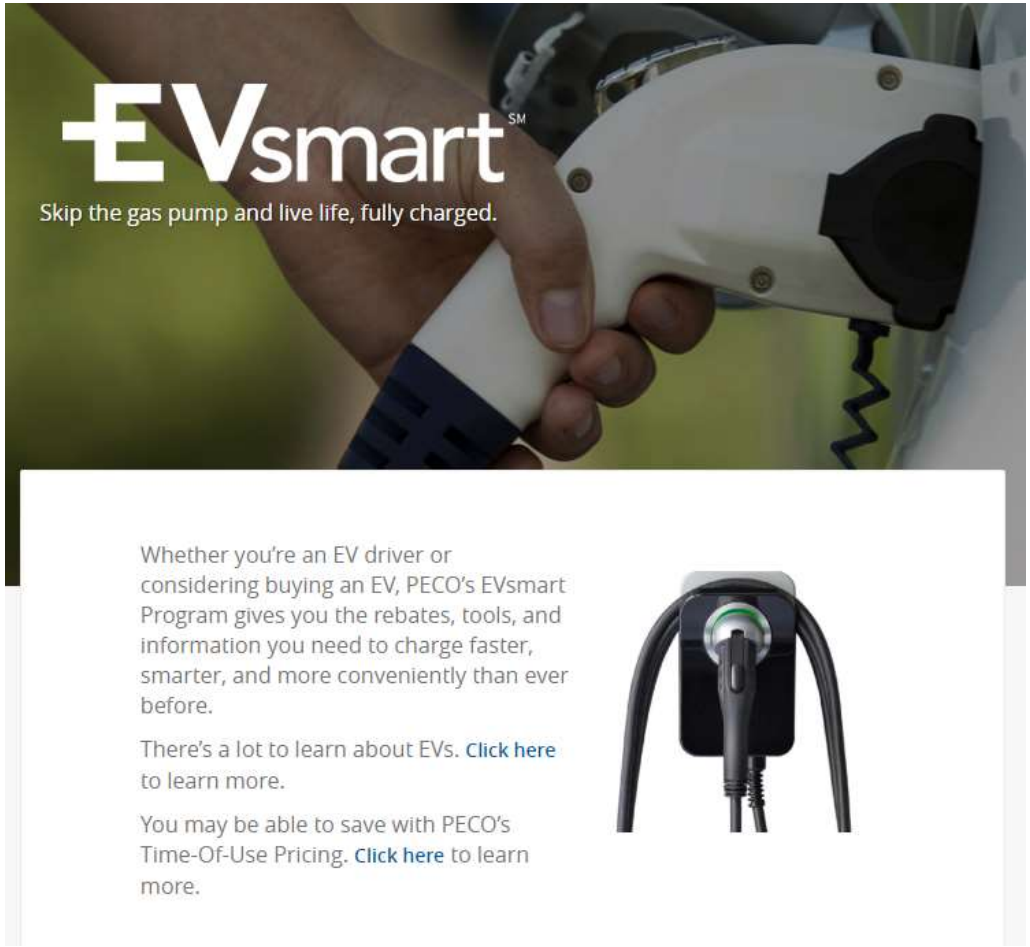


Figure: Distribution of public L2/DCFC chargers by US States in Dec 2022. Data Source: PlugShare [EPRI report 3002023601]

Customer Incentives

- Offerings available:
  - Time-of-use billing
  - Driver rebate
  - Level 2 commercial charging pilot program rebates
  - DC Fast Charge service rider



EVSmart Program

Incentive offerings available:

Time-of-use Pricing	Driver Rebate	Charging Pilot Rebates	DC Fast Charge Rider
• Generation-only rate for off-peak & super off-peak • Not exclusive to EVs	• $50 rebate for customer to notify they purchased EV • Allows for future load analysis	• Rebates for eligible make-ready costs for commercial Level 2 chargers	• Pilot distribution charge discount for commercial Level 3 DCFC installations • 50% nameplate

Capacity Planning & Connecting EV Chargers

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New Business Voltage Request Process

Customer submits service & meter application

New Business reviews application

- Refers to Capacity Planning (if needed)

Capacity Planning determines requirements

- Develop project diagram (if needed)

NB / Customer construct as designed

Service Applications by Charging Level

Level 1	Level 2 Residential	Level 2 Commercial	Level 3
• 120V • 1-2 kW • No application required	• 240 or 208V • 3-19 kW • Customer *should* file S&M application	• 240 or 208V • 3-19 kW • 80% nameplate capacity considered for load & cost estimates	• 208 or 480V three-phase • 50-150 kW • 80% nameplate • Polyphase line extension considered like other new busn.

- PECO generally will not provide separate service for EV chargers to a site, with exceptions

Service & Meter Application

- One-page summary application
- Supplemented with other required information
  - Site plan, units & size, etc
- Customer to specify service type & connected kW
  - Added new line item for L2 / L3 chargers

CHARACTERISTICS OF *NEW* OR *ADDITIONAL* LOAD:

TYPE OF CONNECTED LOAD (kW) *(Indicate 0 if not applicable)*		LARGE MOTOR SPECIFICATIONS:	
AIR CONDITIONING		FREQ. OF STARTING (per hr.)	
CAR CHARGERS L2		LOCKED ROTOR CURRENT	
CAR CHARGERS L3		MOTOR CODE LETTER	
ELEVATORS		PHASE	
GENERATORS		PURPOSE	
HEATING		QUANTITY	
LIGHTING		SIZE (HP)	
TANKLESS WATER HTR		VOLTAGE	
MISCELLANEOUS			
MISCELLANEOUS			

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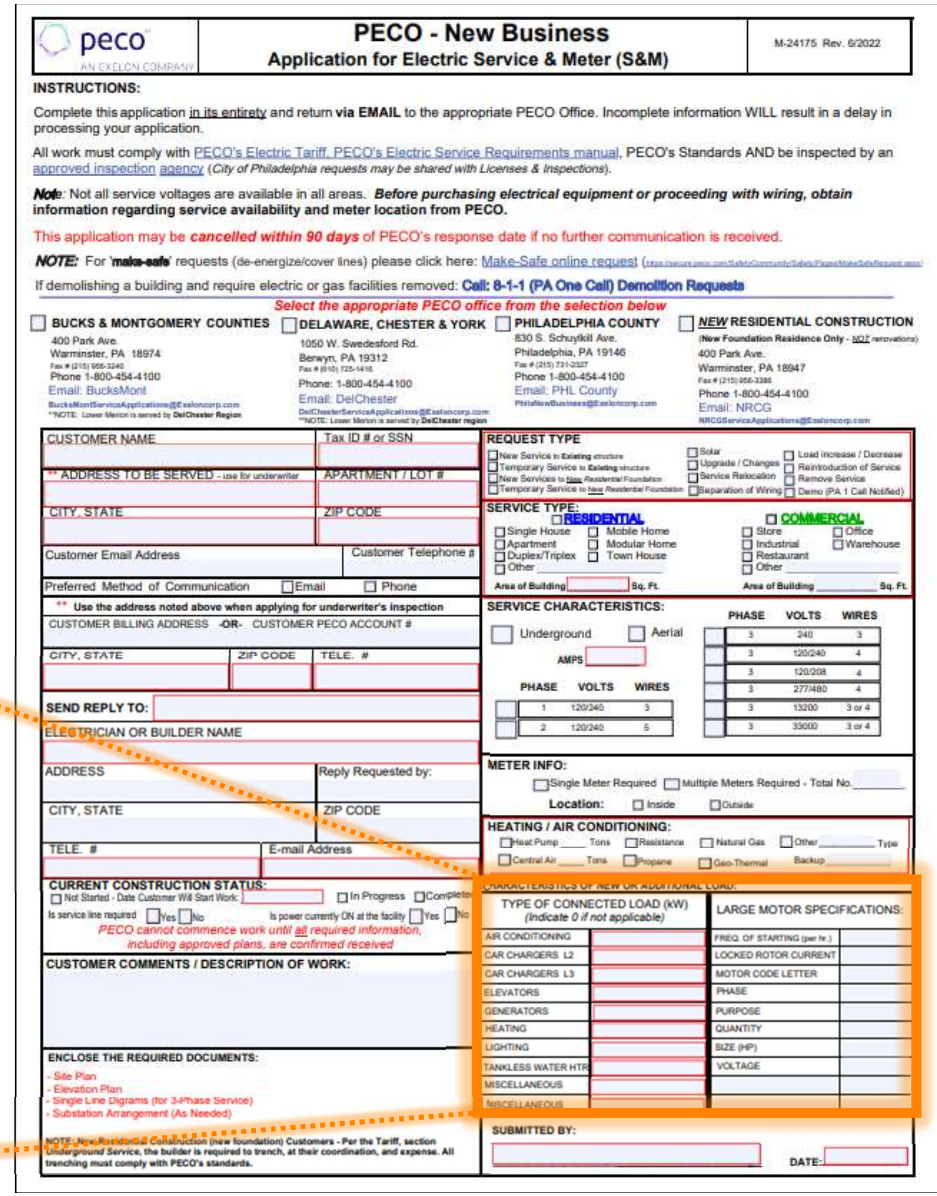

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PECO - New Business
Application for Electric Service & Meter (S&M)

M-24175 Rev. 6/2022

INSTRUCTIONS:

Complete this application in its entirety and return **via EMAIL** to the appropriate PECO Office. Incomplete information WILL result in a delay in processing your application.

All work must comply with PECO's Electric Tariff, PECO's Electric Service Requirements manual, PECO's Standards AND be inspected by an approved inspection agency (*City of Philadelphia requests may be shared with Licenses & Inspections*).

Note: Not all service voltages are available in all areas. ***Before purchasing electrical equipment or proceeding with wiring, obtain information regarding service availability and meter location from PECO.***

This application may be ***cancelled within 90 days*** of PECO's response date if no further communication is received.

NOTE: For '**make-safe**' requests (de-energize/cover lines) please click here: Make-Safe online request

If demolishing a building and require electric or gas facilities removed: **Call: 8-1-1 (PA One Call) Demolition Requests**

Select the appropriate PECO office from the selection below

☐ **BUCKS & MONTGOMERY COUNTIES**
400 Park Ave.
Warminster, PA 18974
Fax # (215) 956-3246
Phone 1-800-454-4100
Email: BucksMont
BucksMontServiceApplications@Exeloncorp.com
NOTE: Lower Merion is served by **DelChester Region

☐ **DELAWARE, CHESTER & YORK**
1050 W. Swedesford Rd.
Berwyn, PA 19312
Fax # (610) 725-1418
Phone: 1-800-454-4100
Email: DelChester
DelChesterServiceApplications@Exeloncorp.com
NOTE: Lower Merion is served by **DelChester region

☐ **PHILADELPHIA COUNTY**
830 S. Schuylkill Ave.
Philadelphia, PA 19146
Fax # (215) 731-2327
Phone 1-800-454-4100
Email: PHL County
PhilaNewBusiness@Exeloncorp.com

☐ ***NEW* RESIDENTIAL CONSTRUCTION**
(**New Foundation Residence Only** - NOT renovations)
400 Park Ave.
Warminster, PA 18947
Fax # (215) 956-3386
Phone 1-800-454-4100
Email: NRCG
NRCGServiceApplications@Exeloncorp.com

CUSTOMER NAME | Tax ID # or SSN
** ADDRESS TO BE SERVED - use for underwriter | APARTMENT / LOT #
CITY, STATE | ZIP CODE
Customer Email Address | Customer Telephone #
Preferred Method of Communication ☐ Email ☐ Phone
** Use the address noted above when applying for underwriter's inspection
CUSTOMER BILLING ADDRESS -OR- CUSTOMER PECO ACCOUNT #
CITY, STATE | ZIP CODE | TELE. #
SEND REPLY TO:
ELECTRICIAN OR BUILDER NAME
ADDRESS | Reply Requested by:
CITY, STATE | ZIP CODE
TELE. # | E-mail Address

CURRENT CONSTRUCTION STATUS:
☐ Not Started - Date Customer Will Start Work: ☐ In Progress ☐ Complete
Is service line required ☐ Yes ☐ No Is power currently ON at the facility ☐ Yes ☐ No
PECO cannot commence work until all required information, including approved plans, are confirmed received

CUSTOMER COMMENTS / DESCRIPTION OF WORK:

ENCLOSE THE REQUIRED DOCUMENTS:
- Site Plan
- Elevation Plan
- Single Line Digrams (for 3-Phase Service)
- Substation Arrangement (As Needed)

NOTE: New Residential Construction (new foundation) Customers - Per the Tariff, section Underground Service, the builder is required to trench, at their coordination, and expense. All trenching must comply with PECO's standards.

REQUEST TYPE
☐ New Service to Existing structure
☐ Temporary Service to Existing structure
☐ New Services to New Residential Foundation
☐ Temporary Service to New Residential Foundation
☐ Solar
☐ Upgrade / Changes
☐ Service Relocation
☐ Separation of Wiring
☐ Load increase / Decrease
☐ Reintroduction of Service
☐ Remove Service
☐ Demo (PA 1 Call Notified)

SERVICE TYPE:
☐ **RESIDENTIAL**
☐ Single House ☐ Mobile Home
☐ Apartment ☐ Modular Home
☐ Duplex/Triplex ☐ Town House
☐ Other
Area of Building _____ Sq. Ft.

☐ **COMMERCIAL**
☐ Store ☐ Office
☐ Industrial ☐ Warehouse
☐ Restaurant
☐ Other
Area of Building _____ Sq. Ft.

SERVICE CHARACTERISTICS:
☐ Underground ☐ Aerial
AMPS

PHASE	VOLTS	WIRES
1	120/240	3
2	120/240	5

PHASE	VOLTS	WIRES
3	240	3
3	120/240	4
3	120/208	4
3	277/480	4
3	13200	3 or 4
3	33000	3 or 4

METER INFO:
☐ Single Meter Required ☐ Multiple Meters Required - Total No. _____
Location: ☐ Inside ☐ Outside

HEATING / AIR CONDITIONING:
☐ Heat Pump ____ Tons ☐ Resistance ☐ Natural Gas ☐ Other _____ Type
☐ Central Air ____ Tons ☐ Propane ☐ Geo-Thermal Backup _____

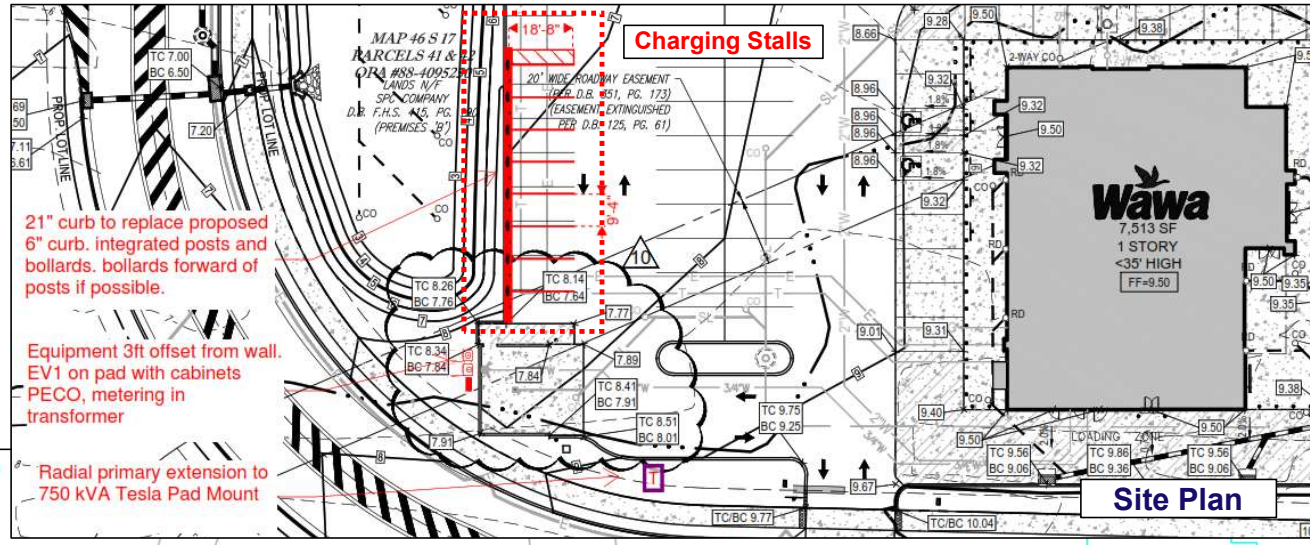
CHARACTERISTICS OF NEW OR ADDITIONAL LOAD:

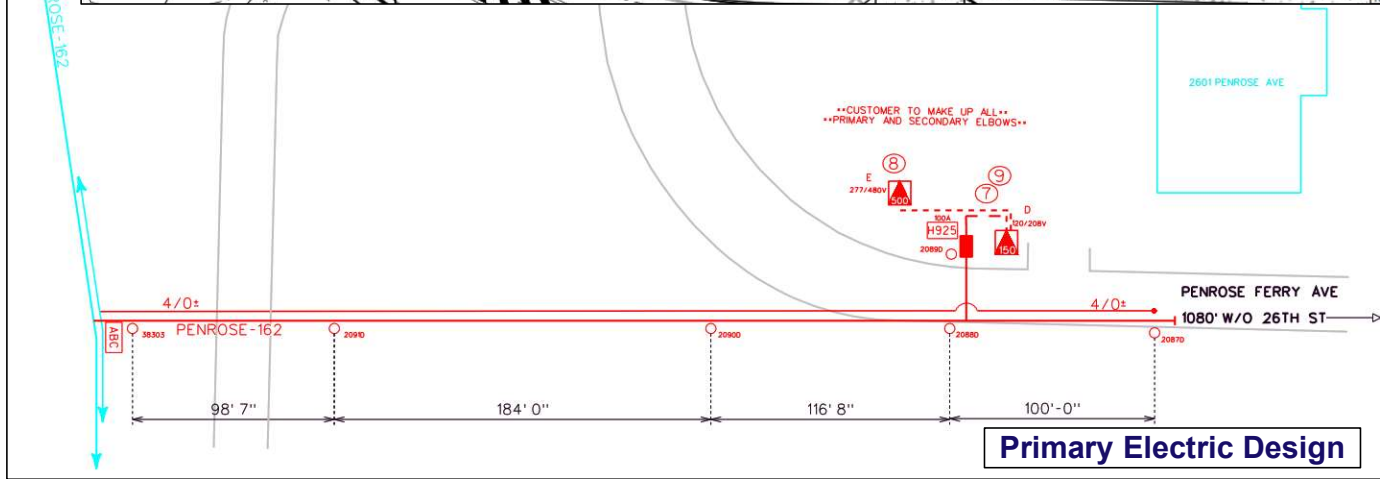
TYPE OF CONNECTED LOAD (kW) *(Indicate 0 if not applicable)*		LARGE MOTOR SPECIFICATIONS:	
AIR CONDITIONING		FREQ. OF STARTING (per hr.)	
CAR CHARGERS L2		LOCKED ROTOR CURRENT	
CAR CHARGERS L3		MOTOR CODE LETTER	
ELEVATORS		PHASE	
GENERATORS		PURPOSE	
HEATING		QUANTITY	
LIGHTING		SIZE (HP)	
TANKLESS WATER HTR		VOLTAGE	
MISCELLANEOUS			
MISCELLANEOUS			

SUBMITTED BY: **DATE:**

Site Plan & Electric Design

- Customer provides information:
  - Site plan, load estimate, equipment specs (inc. EV charger nameplate)
- Capacity Planning:
  - Estimates load
  - Identifies primary service point & required primary work
- NB creates detailed design & cost estimate





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EV Charger Service Point

- PECO tariff rules to EV charging stations applied as any other new services
- Current tariff allows only one service to a customer property, with some exceptions
- Application *may* qualify for second service to a site, provided:
  - Ownership (same or different customers / accounts)
  - Structures (distant or separated by firewall)

Tesla charging station – Penrose Avenue, South Philadelphia

EV Load Estimating

- PECO considering **80%** of EV charger nameplate kW for:
  - Transformer sizing
  - Circuit load forecasting / planning, as applicable
- Recently increased from **60%** factor previously considered
- Result of load analysis of charging station installations over time

Load Analysis & Case Studies

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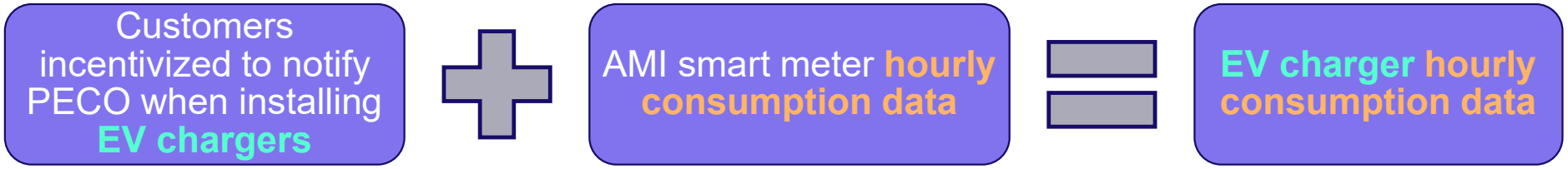
Monitoring EV Load

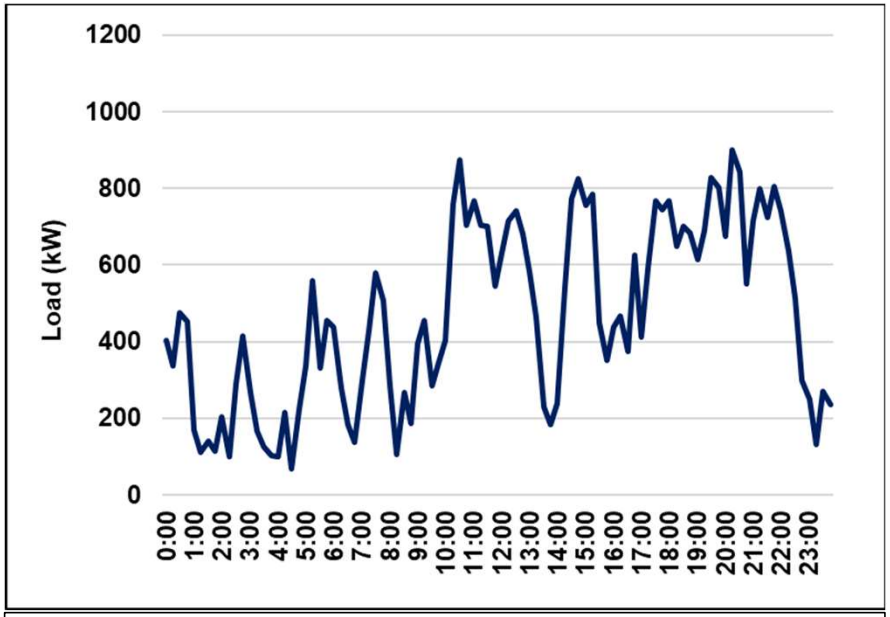
- Customers incentivized to notify PECO of EV charger installation
  - Enables PECO to monitor EV load using smart meter data

- Capacity Planning has been monitoring charger loads regularly
  - Analyzing trends for load estimating / forecasting purposes

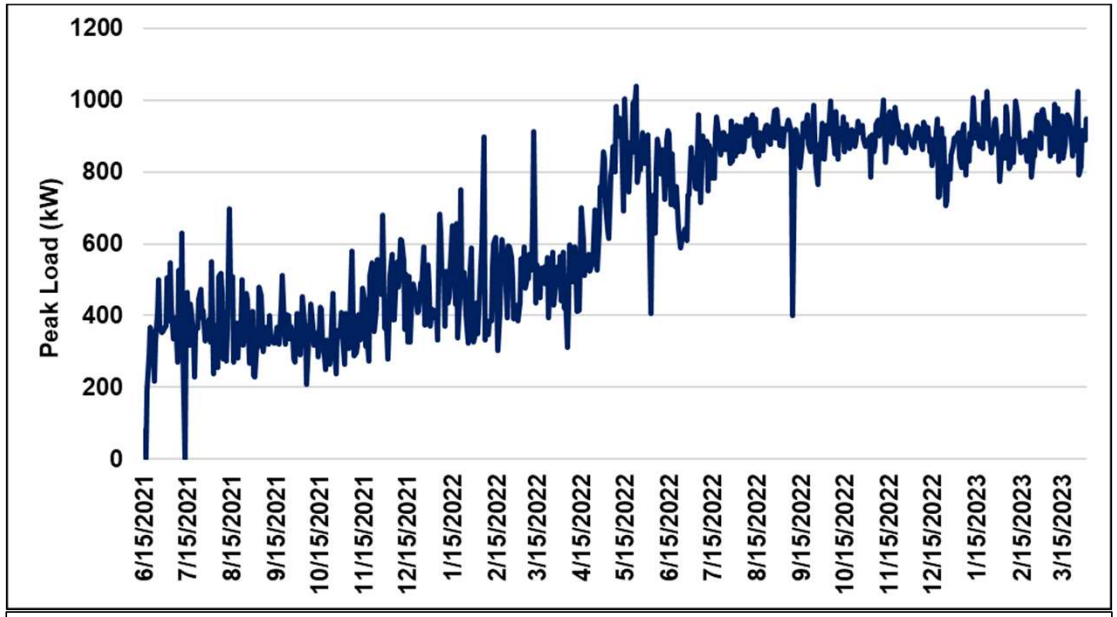


Case Study – Tesla at Airport Wawa

- Installation: **1100 kW** nameplate Tesla chargers (12 total outlets)



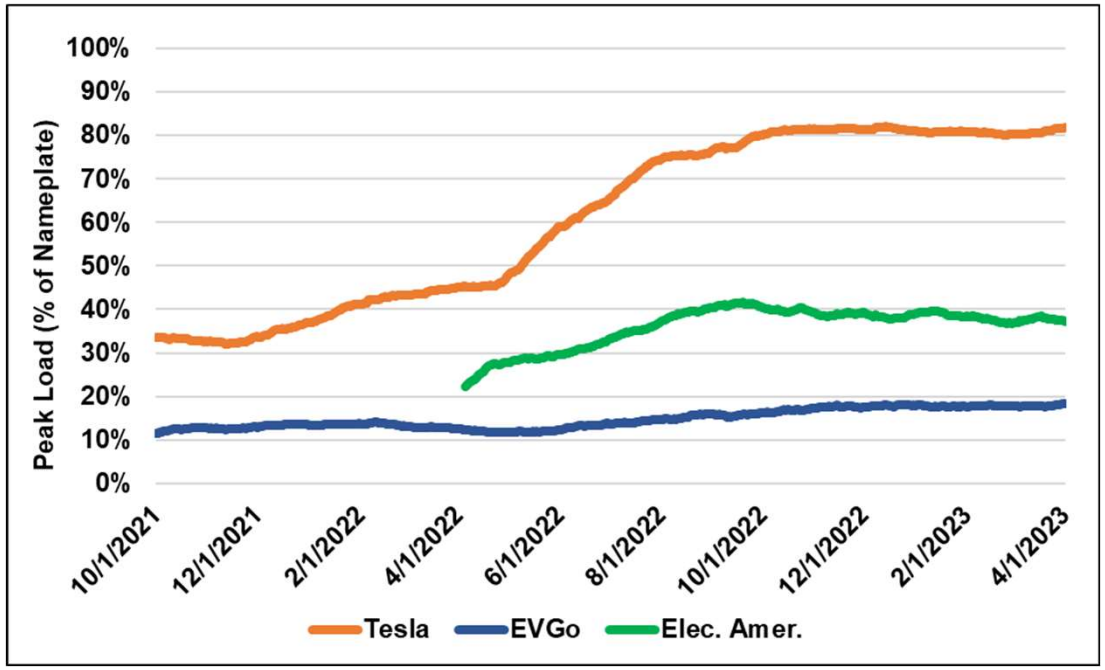
Airport Wawa Tesla 24-hour load 8/9/2022



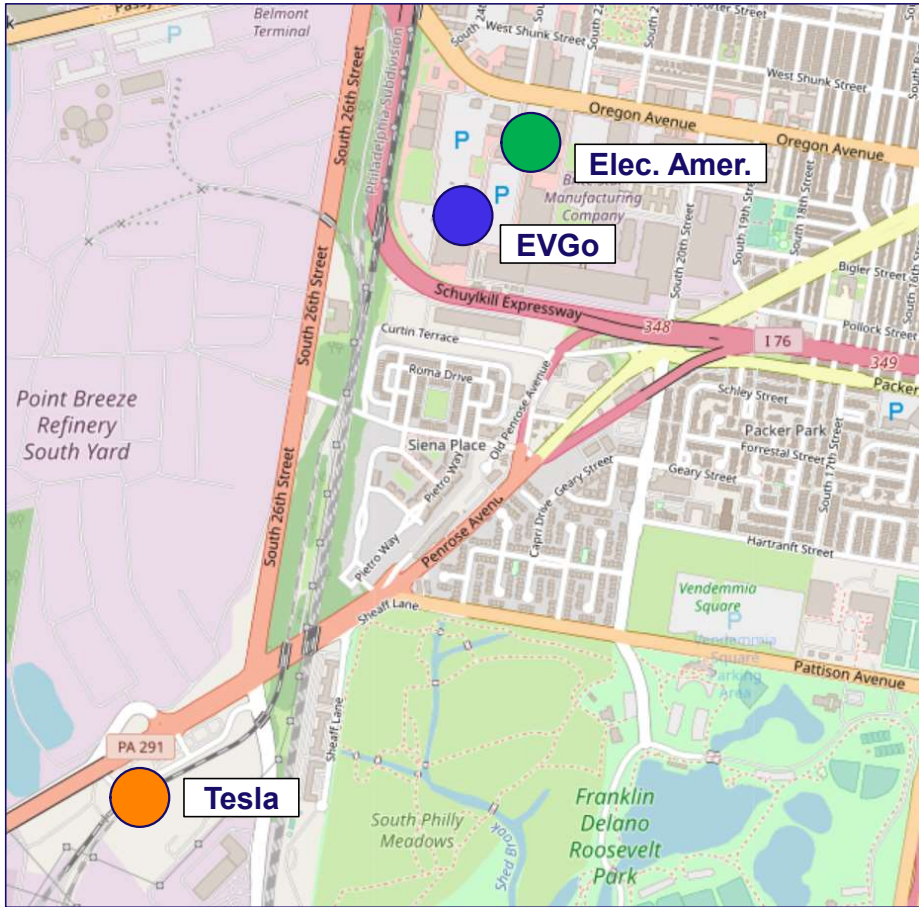
Airport Wawa Tesla daily peak load June 2021 – Mar 2023

Case Study – Charging Station Usage

- Tesla, EVGo, & Electrify America (EA) chargers in close proximity
- Tesla along major thorofare
- EVGo & EA in same large shopping center



Peak load – percent of nameplate



Long-Term Capacity Planning

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Long-Term Capacity Planning

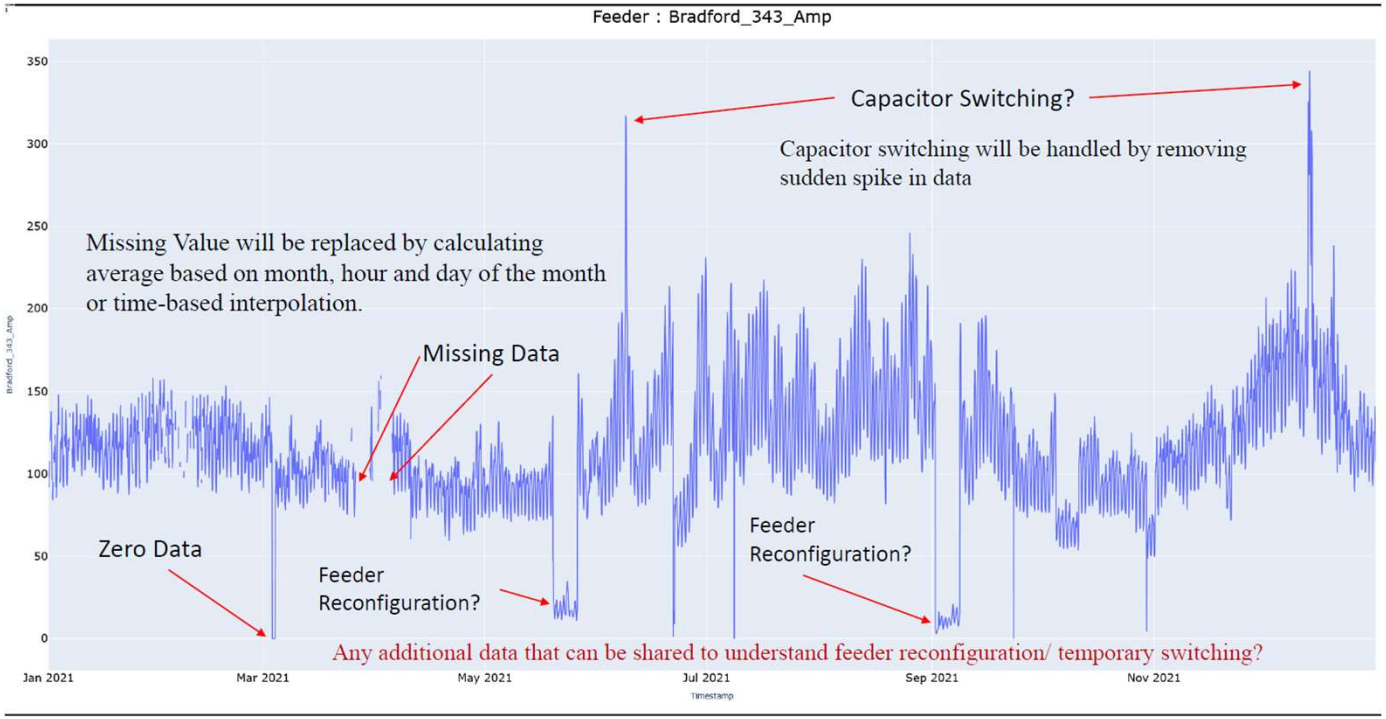
- PECO Capacity Planning's efforts include:
  - Continued monitoring of adoption rates & load
  - EPRI study participation
  - Design standard review & updates
  - Load growth accommodation using traditional planning process
  - New Load Forecasting Tool in the process of being implemented
    - Ability to better analyze various EV aspects

EPRI: Fleet Electrification Planning and Assessment Supplemental Project

- Objectives: Supporting PECO in planning and preparing the grid for **fleet electrification** using advanced analytics and tools
- Approach:
  - **Fleet Electrification Characterization**
    - Fleet travel Patterns and Needs Assessment
    - Technology Maturity Assessment
    - Charging Strategies and Applications
  - **Grid Planning for Fleet Electrification**
    - Assess system-wide grid electrification opportunity
    - Future fleet electrification assessment
    - Grid readiness and integration assessment

EPRI: Fleet Electrification Planning and Assessment Supplemental Project

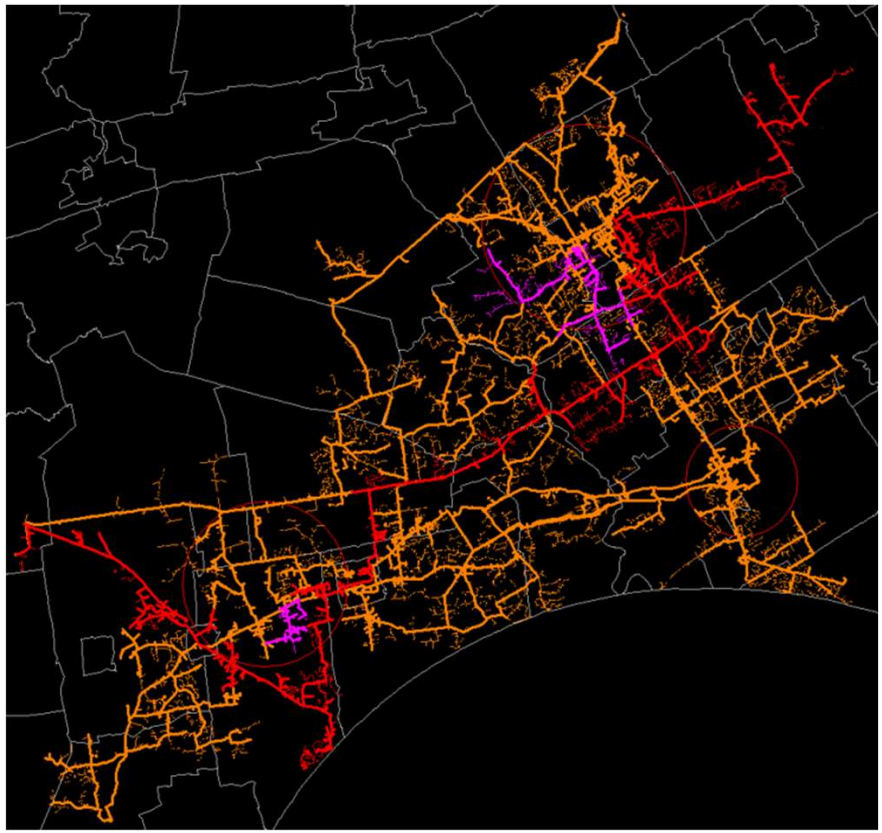
- PECO provided data for 26 feeders
  - SCADA 8760 profile data
  - CYME feeder model files
- CYME model results agreed +/- 10% with SCADA values



EPRI: Fleet Electrification Planning and Assessment Supplemental Project

- Location
  - Proximity to Delaware River and Phila Ports
  - Major thru-ways such as I-95, Rte. 1, 202 and 322
  - Towns/cities with distribution sites

- Observations to-date:
  - Study found feeders constrained by voltage & thermal ratings
  - Increased capacity off-peak, although still limited



2021 EV Distribution Impact Study

- Evaluated impact of 100% EV adoption on distribution system
- Potential widespread overloads found on transformers & secondary mains
  - Exacerbated by residential customer density

Changes Implemented:

Design Procedures	Operations Procedures
• Residential load estimating factors increased • Developments to be built to accommodate higher loads	• Opportunistic replacement of undersized secondary mains • New criteria for upgrading failed transformers

Load Growth & Traditional Planning

- Capacity Planning will address load increases as they are realized
- Actual circuit / substation loads used for forecasting
- Traditional area planning process to dictate projects for new circuits / substations

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Thank you

Appendix

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Procedure Update: AM-PE-9049-R1017 PECO URD Design

- Section 8.4 Transformer Selection
- No updates
- Preference for 100kVA with remains
- Section 12.1 Table A – Electric Heating
- Increased added kVA per unit by 7kVA to anticipate future EV Charger Load
- No diversity due to cold load pick up
- Section 12.2 Table B – Air Conditioning
- Increased added kVA per unit by 4kVA to anticipate future EV Charger Load
- Diversity of 60% included
- Section 12.3 Notes for Tables A & B
- Added Note (e) to explain why there is added kVA per unit
- Added Note (f) to call out using full EV Charger load for service cables

- Section 12.4 Table C Single-Phase Pad-Mount Transformer Ratings
- S-5501 Standard Rating for URD Transformer
- 13kV Summer 130% Winter 180%
- 34kV Summer 140% Winter 190%
- Current revision of PECO URD Design (Reduced winter loading by 15%)
- 13kV Summer 130% Winter 165%
- 34kV Summer 140% Winter 175%
- New revision of PECO URD Design (Reduced summer loading by 15% also)
- 13kV Summer 120% Winter 165%
- 34kV Summer 125% Winter 175%

AM-PE-9049 – Table A

12.1. Table A – Residential Electric Heating Estimating

For sizing transformers, secondary & service cables and calculating voltage drops (a) (b) (d)

Type of Residence	Required Capacity per Residence (kVA) (e)
Single Houses (f), Twin Duplexes	0.007 kVA/Sq. Ft. plus 9 kVA
Row Houses, Townhouses, Row Duplexes	0.006 kVA/Sq. Ft. plus 9 kVA
Apartment Buildings	0.005 kVA/Sq. Ft. plus 1 kVA

() – See corresponding note for Tables A & B, Section 12.3

12.3.5. (e) Added kVA accounts for washer/drier, range top, and other appliances. This number was increased in 2021 to allow for future growth due to EV Level 2 Charger installation (+7 kVA for Heating, +4 kVA for AC)

Assumptions:

- 100% residential customer penetration
- Level 2 EV Chargers (12kW, pf=1)
- 60% Nameplate
- 60% AC Diversification (no diversity for heating due to cold pick up)

12.3.6. (f) Consider using the full EV Level 2 Charger load (7kVA) for sizing dedicated service cables: add 9 kVA for Electric Heat or 7kVA for Air-Conditioning

AM-PE-9049 – Table B

12.2. Table B – Residential Air-Conditioning Estimating

For sizing transformers, and primary, secondary & service cables and calculating voltage drops (a) (b) (d)

Air-Conditioning Requirements Per Residence (tons)	Size of Residence (Sq. Ft.)	Type of Residence	Required Capacity per Residence (kVA) (e)	
			Without Range and Water Heater (c)	With Range and/or Water Heater
1	<799	Apartment	2.7	3.5
1-1/2	800-999	Apartment	3.5	4.5
1-1/2	800-999	Row Duplex	3.5 plus 4 kVA	4.5 plus 4 kVA
2	1,000-1,500	Apartment	4.0	5.0
2	1,000-1,500	Twin Duplex, Single House (f)	4.0 plus 4 kVA	5.0 plus 4 kVA
See Note (d)	>1,500	Row, Single House (f)	0.003 kVA/Sq. Ft. plus 4 kVA	0.003 kVA/Sq. Ft. plus 5 kVA

() - See corresponding notes for Tables A & B, Section 12.3

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Fleet Electrification

- Exelon working to electrify vehicle fleet
  - Full EV, Plug-in hybrid, & jobsite energy management systems
  - 30% by 2025 & 50% by 2030
  - Level 2 chargers installed at service buildings

Company and Operations

Planned Emissions-Reduction Actions

Advance our vehicle fleet electrification to electrify 30% of our vehicle fleet by 2025 and 50% by 2030

Continue to focus on efficiency, conservation and clean electricity for our operations

Invest in equipment and processes to reduce SF6 leakage from our systems

Modernize our natural gas infrastructure to minimize methane leaks and increase safety and reliability

Time of Use Pricing

Shift Your Energy Use and **Save**

Time-Of-Use (TOU) Pricing is an optional, generation-only rate for Advanced Metering Infrastructure metered, non-Customer Assistance Program, residential and small commercial customers. Time-Of-Use Pricing offers different supply prices at varying times of the day and week:

- **Peak** Weekdays: (2 p.m. – 6 p.m.)
- **Off-Peak** Weekdays: (6 a.m. – 2 p.m. & 6 p.m. – 12 a.m.)
- **Off-Peak** Weekends and Holidays: (6 a.m. – 12 a.m.)
- **Super Off-Peak** All Days: (12 a.m. – 6 a.m.)

(1) Participation requires choosing PECO for your electric supply. If you currently have an agreement with an alternative supplier, check your supplier contract or ask your supplier to see if there are any penalty/switching fees or cancellation fees before switching or cancelling.

(2) Holidays include New Year's Day, Martin Luther King Day, President's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day after Thanksgiving, Christmas Day and New Year's Day Observed.

You could see potential savings on your energy bill by shifting use of electric appliances, such as your washing machine, dishwasher, or air conditioner, to times when demand is lower.

TOU Generation Charge per kWh

Effective March 1, 2023 - May 31, 2023

Rate Class	TOU Peak Price	TOU Off-Peak Price	TOU Super Off-Peak Price
Residential/Residential Heating (R/RH)	$0.29859	$0.06733	$0.04182
General Service (GS)	$0.22878	$0.07014	$0.04078
Primary Distribution (PD)	$0.22485	$0.06894	$0.04008
High Tension (HT)	$0.21565	$0.06612	$0.03844

Current State – BEVs & Chargers

	PECO		Bucks	Chester	Delaware	Montgomery	Philadelphia	York
PECO Territory Passenger Vehicles (estimate)	3,155,316		545,355	469,799	454,573	735,493	950,096	13,135
PECO Territory BEVs (estimate)	16,719		2,996	3,602	2,228	4,901	2,993	28
EV Penetration Rate	0.5%		0.5%	0.8%	0.5%	0.7%	0.3%	0.2%
Public DCFC Plugs (NREL Minimum Ratio)	1.3	per 1,000 BEVs						
Needed # of Public Charging Plugs	22		4	5	3	6	4	-
Installed # of Public Charging Plugs	205		24	8	15	66	92	-
Over/(Under) Build relative to current BEVs	832%		500%	60%	400%	1000%	2200%	0%
Public DCFC Plugs (DOE Ideal Ratio)	3.4	per 1,000 BEVs						
Needed # of Public Charging Plugs	57		10	12	8	17	10	-
Installed # of Public Charging Plugs	205		24	8	15	66	92	-
Over/(Under) Build relative to current BEVs	260%		140%	-33%	88%	288%	820%	0%