PECO Backcasting Methodology
Effective 2/13/2015

Version 4.0, Revised 4/9/2018

The backcasting process is based on the PECO load shapes available on the SUCCESS web site under general reports Backcasting/Load Shapes/<rate class_strata>.xls. Each strata has its own shape. PECO provides all information required for an EGS to independently arrive at the same backcast with the exception of the actual weather data. Weather information for PECO's service territory is commercially available through a variety of sources. The weather station used in the backcasting process is Philadelphia International Airport.

Annual Customer Stratification

Each year in the October/November timeframe, PECO analyzes customer usage and demand for the past year, and places the customer into the appropriate strata to ensure a more accurate backcast for the customer. These strata are effective for the next calendar year, or until the customer changes its rate class, in which case the customer will be assigned an average strata for the class. A list of Rate Class / Strata definitions is located on SUCCESS in the Backcasting folder.

At the same time, PECO calculates seasonal backcasting scale factors for each customer except those in rate classes R and RH. PECO also calculates average scale factors for all strata which relates the customer's actual historical energy usage to the projected usage based on the strata load shape and actual weather. These values are effective for the upcoming calendar year. More detailed information on the backcasting scale factors is provided later in the document.

Account Types for Backcasting

1. Aggregate Account – Aggregated AMR metered or unmetered accounts.
   Example: Rate class/strata = R113

2. Individually Modeled Account - Generally commercial / industrial 100 KW or larger, or a legacy MV90 interval metered Customer. These account types are displayed as actual customer account numbers in PECO's settlement system.

Aggregate Account Customers

The backcast for an Aggregate Account metered customer, or   and Individually Modeled customer that does not have historical interval demands, is calculated using a generic class load shape, seasonal scaling factor, and loss factor.

The formula for this calculation is:
Customer backcast kw = Kw at the customer meter * seasonal scaling factor * loss factor

Load Shape Model

Load curves were developed through a load study, and are split into various seasons / day-types for each strata. Each season/day-type/strata/hour contains one or more regression segments, which represent the best fit piece-wise linear regression based on load study data and actual weather.

Load Shape Seasons

Winter (December through February)
Spring (March through May)
Summer (June through August)
Autumn (September through November)

Load Shape Day-types

Weekday
Saturday
Sunday
Holidays are treated as Sundays.

	A	B	C	D	E	F	G	H	I	J
1	Rate						lower_bound	upper_bound		linear
2	Class	strata	day_type	season	hour	segment	effective temp	effective temp	constant	coefficient
3	GS	107	WEEKDAY	SPRING	1	1	-200	54.890587	0.698744	-0.005202
4	GS	107	WEEKDAY	SPRING	1	2	54.890587	200	0.398954	0.00026
5	GS	107	WEEKDAY	SPRING	2	1	-200	53.091522	0.755604	-0.006721
6	GS	107	WEEKDAY	SPRING	2	2	53.091522	200	0.403604	-0.000091
7	GS	107	WEEKDAY	SPRING	3	1	-200	50.026981	0.702187	-0.006116
8	GS	107	WEEKDAY	SPRING	3	2	50.026981	200	0.355737	0.000809

Effective Temperature

In order to calculate the kw at the customer meter using the load shapes, the effective temperature for the hour must be calculated. The method for this calculation is shown below. All weather readings are for hour ending format and the weather station is Philadelphia International Airport. The backcasting process normally uses actual weather, or forecast weather if actual weather is not available due to system problems.

For October through May:

Temperature Index = Temperature

Effective temperature for hour h = 0.7*Temperature hour h + 0.2*(temperature hour h(-1)) + 0.1*(temperature hour h(-2))

Where temperature(hour h(0) = the temperature for hour h on the current day (day 0)
temperature(hour h(-1) = the temperature for hour h on the previous day
temperature(hour h(-2) = the temperature for hour h on day-2

<u>For June through September</u>

If the temperature is ABOVE 75$_o$ F, then apply the Heat & Humidity Index adjustment (otherwise use unadjusted temperature):

Temperature Index = 16.923 + (1.85212 * 10^{-1} * T) + (5.37941 * RH) - (1.00254 * 10^{-1} * T * RH) + (9.41695 * 10^{-3} * T^2) + (7.28898 * 10^{-3} * RH^2) + (3.45372 * 10^{-4} * T^2 * RH) - (8.14971 * 10^{-4} * T * RH^2) + (1.02102 * 10^{-5} * T^2 * RH^2) - (3.8646 * 10^{-5} * T^3) + (2.91583 * 10^{-5} * RH^3) + (1.42721 * 10^{-6} * T^3 * RH) + (1.97483 * 10^{-7} * T * RH^3) - (2.18429 * 10^{-8} * T^3 * RH^2) + (8.43296 * 10^{-10} * T^2 * RH^3) - (4.81975 * 10^{-11} * T^3 * RH^3)

Where
RH = Relative Humidity (RH=75 is input as 75, not 0.75)
T = Temperature

Effective temperature for hour h = 0.7*Temperature index hour h(0) + 0.2*(temperature index hour h(-1)) + 0.1*(temperature index hour h(-2))

Where temperature index (hour h(0) = temperature index for hour h on the current day (day 0)
        Temperature index (hour h(-1) = the temperature index for hour h on the previous day
        Temperature index (hour h(-2) = the temperature index for hour h on day-2

By using the actual weather and the applicable load shape, a "generic" load shape for each strata can be developed for a specified period.

Deriving kw at customer meter from Load Shapes

1. Determine the date (season), hour , rate class/strata, and day-type for the account
2. Calculate the effective temperature for the hour
3. Calculate the kw value at the customer meter by using the linear equation that corresponds to the date, hour, day-type, strata, and effective temperature

Lower bound effective temperature< Effective Temperature<= upper bound effective temperature

KW at the customer meter = effective temperature * linear coefficient + constant

Example:
Strata = 107
Day-type= Weekday
Season = Spring
Hour = 1
Effective Temperature = 70

KW at the customer meter = effective temperature * linear coefficient + constant
KW at the customer meter = 70 * .00026 + .398954
KW at the customer meter = 0.417154

Application of seasonal scaling factors

Rather than simply using the "generic" load shape determined from the load profiles and actual weather, a seasonal factor will be incorporated to further adjust the amplitude of the shape based on the historical usage of the customers the supplier is serving.

For rate classes R and RH a single scaling factor for the strata will be used. For all other rate classes and strata, each non-hourly metered account will have an account specific seasonal factor.

Example:
A GS 004 schedule will be created by determining the "typical customer" load shape, multiplying by the number of customers and then by the GS 004 scaling factor. For each of the 24 hours:

Hour N load at customer meter = (# customers)*(scaling factor)*(hour N typical customer load)

Accounts in all rate classes except R and RH that had incomplete or no historical data have been assigned the default factors for their respective strata. New accounts (premises) will be assigned the default factors for their respective strata. The effective dates for the seasonal scale factors correspond to the dates for the seasonal load shapes.

Winter (December through February)
Spring (March through May)
Summer (June through August)
Autumn (September through November)

Example:
For customer group with specific scale factors, a TL 175 schedule is created by determining the "typical customer" load shape and then multiplying the sum of the scaling factors for each of the accounts in that strata that the EGS is currently serving.

Hour N load at customer meter = (sum of individual scaling factors)*
(hour N typical customer load)

Strata default factors files are located in the General Reports\Backcasting folder on the SUCCESS web site as file name Scale_factor_defaultYYYMMDD.txt.

Account specific scaling factors will be placed in each EGS' specific reports folder on the SUCCESS web site under the name YYYMMDD<EGS name>factors.txt. This will be provided for all customers the supplier is serving that have a customer specific scaling factor.

Rate Class Loss Factors

Since the load shape equations provide load at the customer meter and do not include losses, the results from the load shape equations need to be grossed up by the loss factor, which includes all transmission and distribution losses. The rate class loss factors should be applied as:

Customer backcast KW including losses = customer load at meter * rate class loss factor

The loss values for each rate class are shown in the file on the SUCCESS website in the Backcasting folder.

Individually Modeled Accounts

Backcasts for Individually Modeled customers will be provided by the EGS to PECO via SUCCESS web site upload process. These backcasts should include all losses. If the EGS does not upload a backcast for an Individually Modeled customer, PECO will provide a backcast for the Individually Modeled customer on the SUCCESS website. The EGS may use this backcast, or override the PECO-provided backcast with their own backcast. PECO will not overwrite a backcast that has already been uploaded by the EGS.

Scheduling and Unaccounted-For-Energy (UFE)

For the backcast scheduling process, UFE will be applied to all customers by load share ratio, and added to the customer backcast KW each hour. The schedule that is uploaded to PJM will include this UFE for each hour. This uploaded schedule is viewable on SUCCESS by running the Settlement A report on the Settlement Download screen.

PJM Schedule Deration

After PECO uploads the backcast schedules, PJM will derate these schedules to remove marginal losses on an hourly basis. This derated schedule at PJM is the energy schedule that EGSs must meet. SUCCESS does not show these derated schedules, they are available at PJM.