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LOAD PROFILING: ISSUES, RULES AND GAP ANALYSIS

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Appendix A. Supplier Operating Manual for Atlantic City Electric Company, Delmarva Power and Pepco. Procedures for Determining Peak Load Contribution for Capacity and Transmission Service and Hourly Energy Obligations.

Attachments:

Central Maine Power, Load Profile Data, Copy of Settlement 2010, required by Maine Public Utilities Commission, Footnote 2.

Maine Public Utilities Commission, Load Obligation and Settlement Calculations for Competitive Providers of Electricity, Chapter 321, Footnote 8.

Public Utilities Commission of Texas, Electric Substantive Rules, Chapter 25, Footnote 9.

I. Executive Summary

The settlement process among market participants requires timely, accurate, and verifiable data about the electricity usage of end use customers. Because not all end use customers have meters that can provide “real time” data to the DSO or ISO concerning their usage, load profiling is an essential (and likely permanent) requirement for extending eligible customer status to small business and household customers. **The essential function of load profiling is to assign responsibility for the consumption of energy and ancillary services among customers, and thus among Suppliers (including both Suppliers of tariff customers and Suppliers of eligible customers), in a manner that reasonably and transparently reflects both the amount and timing of that consumption.**

There is, at present, virtually nothing in the codes in BiH addressing load profiling and how load profiles should be used in settlement. Fortunately, because load profiles are essentially a surrogate for actual meter data, codes and rules concerning load profiling can be added to, rather than require the revision of, the BiH codes in place for settlement, data exchange, verification, and dispute resolution. Over time, as “interval” and “real time” metering (i.e. “telemetry”) become more prevalent, the number of customers for whom load profiles are used in the settlement process will decline. In light of the limits on telemetry, however, it is likely that, at least for many if not most household customers, load profiles will remain a permanent feature of the market.

II. Background on Basic Market Structure

Except in the case where a Supplier’s customer connects directly with the ISO-operated transmission system, and thus does not interconnect with a DSO operated system (in which case no load profiling will be necessary because the ISO will have the real time interval meter data), all customers interconnect through the distribution system operated by the DSO. Where there is only a single Supplier within the DSO territory, there is no need to allocate imbalance costs, losses or the cost of ancillary services among multiple Suppliers; load profiling will, in that situation, provide a basis for allocating such costs among customers of the Supplier. Once customers become eligible to purchase electric energy from other Suppliers, however, the ISO no longer has access to telemetered data that would show which Supplier is responsible for which portion of the load that appears on the ISO/DSO meter, and load profiling becomes important for allocating responsibility for such costs among Suppliers as well as among individual customers.

There may be instances where a Supplier is also the Balance Responsible Party, or where the Balance Responsible Party is an intermediary between the Supplier and the DSO/ISO. Because load profiling is used to allocate responsibility and costs among customers, and thus among Suppliers, this analysis focuses on the role of Supplier as the relevant role. It will be important, as the market matures, to ensure that imbalances are commercialized to at least the Supplier level: i.e., even if a BRP “nets” the imbalances of the Suppliers and customers within the BRP territory, the allocation of the costs (or benefits) of the BRP net position should be established in a way that reflects the individual Supplier and

customer circumstances. Regardless of the particular BRP/Supplier relationship, load profiling provides essential data for allocating costs in an economically rational way among customers.

Thus the DSO plays a central role in providing the data to the ISO concerning the load responsibility of each Supplier and each BRP within the DSO’s territory. For each settlement period, the DSO provides to the ISO the hourly (if that is the appropriate interval) load for each Supplier (and/or BRP), and the ISO then calculates the net position of that Supplier based on the relationship between the scheduled energy injection/ scheduled load and the actual injection/load. As noted above, where all loads are telemetered, the DSO task is straightforward, because the sum of the telemetered Supplier loads will, when DSO system losses are added, equal the load at the DSO/ISO meter. Where, however, as is likely to be the case as eligible customers migrate to competitive Suppliers, there are customers who are not telemetered, some method of estimating the loads of those customers is necessary. That method is load profiling.

III. What is a load profile?

A load profile is simply an assumed level of usage, by interval (hourly is typical) and season (e.g., winter, summer), for a customer of a particular size. Every customer to be profiled is assigned to a specific class, usually based on monthly usage or maximum KW demand. Sub-groups based on geography (rural/urban, mountains/plains, north/south) may also be established if there is reason to believe that the usage characteristics vary significantly and predictably along those divisions. There is virtually no theoretical limit to the number of customer groups, but as the number of groups increases, so does the burden of establishing the profile and the complexity of application and verification. For that reason, it would be reasonable for BiH to adopt (similar to the state of Maine, which in some respects has similar geography and urban/rural divisions) relatively few customer profile classes. The groups used in Maine are:

- Residential (i.e. household)
- Small commercial (for example, a small retail business with less than 10 KW maximum demand)
- Medium commercial (for example, a small industrial customer with demand between 10 and 200 KW)

These groups are essentially the same as the classes discussed at the BiH Load Research Subgroup Meeting (i.e. one class for household, two classes for commercial). For each group, a usage value is assigned for each month and each hour, with further divisions between weekday (M-F) and weekend (S-S). By way of example, here is a portion of a load profile table:

Household:

		HR1	HR2	HR3	HR4	HR5
January	Weekday	0.67	0.64	0.62	0.64	0.69
January	Weekend	0.73	0.69	0.67	0.66	0.68
February	Weekday	0.56	0.53	0.52	0.54	0.58
February	Weekend	0.62	0.58	0.56	0.55	0.57
March	Weekday	0.54	0.51	0.50	0.52	0.56
March	Weekend	0.58	0.53	0.52	0.51	0.52

April	Weekday	0.45	0.43	0.41	0.43	0.47
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Each number represents KWh usage for the hour: Thus, for a customer in this profile group, the usage for 0100 to 0200 hours on a weekday in February would be 0.53 KWh. The figures in the table are based on the average load profile found in the load profile research for the household class.

Here is similar data for the medium commercial group:

Medium Non-Household:

		HR1	HR2	HR3	HR4	HR5
January	Weekday	15.65	15.08	14.73	14.86	15.28
January	Weekend	14.90	14.74	14.34	14.25	14.47
February	Weekday	15.18	14.65	14.32	14.44	14.84
February	Weekend	14.40	14.22	13.93	13.87	13.99
March	Weekday	14.72	14.08	13.83	13.69	14.31
March	Weekend	14.14	13.70	13.27	13.19	13.45
April	Weekday	13.47	12.91	12.54	12.39	13.10
April	Weekend	12.65	12.45	12.01	11.85	12.15

Thus for a “profiled” medium commercial group customer, the usage for the same hour would be 14.65 KWh.¹

a. Creating Load Profiles

Load profiles are created using the same tools as load research generally (see, e.g., Load Research Guidelines, USAID REAP, December 2012), but with particular customer groups in mind. For each group, the researcher develops a random sample of group members. Each customer in the sample is then measured (using interval meter data) to indicate usage over the sample period (optimally a full year, though statistical methods may be available to extrapolate from shorter periods). Usage from the samples is then combined for the group profile; this can be accomplished by a variety of statistical methods, including simple or weighted averages of the sum of each customer’s time-differentiated usage. Sample sizes should be large enough to ensure a high level of confidence (+/- 10% is appropriate). It is also important to re-sample periodically (every two years is reasonable) to account for changing usage patterns.

Load research in general serves a variety of vital purposes, including rate design (to allow for economically rational assignment of costs in transmission, distribution and energy rates) and system planning. Data from load research has a particular role in load profiling because it is essential for opening the market to eligible customers who do not have telemetering (i.e., interval meters transmitting real time data to the ISO). Load profiles allow settlement calculations for Suppliers with customers without telemetering, and in particular allow the ISO to calculate the share of imbalance,

¹ The full set of load profiles used in Maine is attached (CMP Load Profile Data. Copy of Settlement 2010.)

losses and ancillary services for such Suppliers. Without consistent, transparent and reasonably current load profiles, there would be no practical way for Suppliers to serve any eligible customers who are not telemetered.

b. Use of Load Profiles in Settlement

If every Supplier had a real time interval metering point with the ISO or DSO for every customer served by the Supplier, load profiling would not be necessary: all of the data needed for settlement would be available in real time, because the load for which each Supplier is responsible would be immediately available. Because there may be eligible customers served by one or more Suppliers (and/or BRPs) within the territory of a DSO, however, and some or all of those customers will not have a real time interval meter, the customer’s load profile must be used instead. In broad outline, the usage for each relevant settlement interval (e.g. hour) as measured at each metering point into the ISO transmission system must satisfy the following:

$$\begin{aligned} \text{Total metered interval usage} = & \text{Supplier A [real time interval meter recorded usage} + \Sigma \\ & \text{profiled household customers' usage} + \Sigma \text{ profiled commercial} \\ & \text{customers' usage]} \\ & + \\ & \text{Supplier B [real time interval meter recorded usage} + \Sigma \\ & \text{profiled household customers' usage} + \Sigma \text{ profiled commercial} \\ & \text{customers' usage]}. \end{aligned}$$

Because the profiles will virtually never equal the exact customer usage, and because for settlement purposes the total usage on the right side of the equation must equal the total metered usage at the interconnection point, the profiled customers’ usage figures must be “scaled” to fit the equation. This “scaling” is done proportionately as in the following example:

$$\begin{aligned} \text{Total metered interval usage} &= 100 \text{ MWh} \\ \\ \text{Supplier A real time interval meter recorded usage} &= 20 \text{ MWh} \\ \text{Supplier A } \Sigma \text{ profiled household customers' usage} &= 10 \text{ MWh} \\ \text{Supplier A } \Sigma \text{ profiled commercial customers' usage} &= 25 \text{ MWh} \\ &+ \\ \text{Supplier B real time meter recorded usage} &= 15 \text{ MWh} \\ \text{Supplier B } \Sigma \text{ profiled household customers' usage} &= 25 \text{ MWh} \\ \text{Supplier B } \Sigma \text{ profiled commercial customers' usage} &= 25 \text{ MWh} \end{aligned}$$

Under this condition, the equality is not achieved:

$$[20+10+25] + [15+25+25] = 55 + 65 = 120 \neq 100$$

Because the metered data are assumed to be correct, the profiled data are adjusted to achieve equality. In this example, the sum of metered data is 35, leaving a total of 85 from load profiles. Because the total of load profiled customers' usage must be 65, however, the profiled usage is reduced by a factor of 65/85 ($13/17 = .765$), resulting in the following usage for settlement purposes. For the Supplier charges to each customer, the total usage for the billing period would be used; this will account for usage differences between members of the profile group. It would also be possible to "true up" imbalance, losses and ancillary services settlements among Suppliers once actual usage is determined, though this will add a level of complexity to the process. Thus, the initial settlement will be based on the following usage:

$$\text{Supplier A} = 20 \text{ MWh (from meters)} + 0.765(10) + 0.765(25) = 20 + 7.65 + 19.12 = 46.77 \text{ MWh}$$

$$\text{Supplier B} = 15 \text{ MWh (from meters)} + 0.765(25) + 0.765(25) = 15 + 19.12 + 19.12 = 53.24 \text{ MWh}$$

$$46.77 + 53.24 = 100.01 \text{ (difference due to rounding)}$$

This "scaling" also permits the assignment of an appropriate share of imbalance costs (or credits) to the profiled customers and, in turn, the Suppliers with profiled customers in their groups. Scaling would also be used in determining customer (and Supplier) peak loads, which are likely to be important in assigning cost responsibility for capacity charges. With respect to the use of profiling to determine customer capacity peak load contributions,² in addition to energy load responsibility, here is language governing a DSO within the PJM Interconnection³ territory:

(ATLANTIC CITY ELECTRIC COMPANY) PROCEDURES FOR DETERMINATION OF PEAK LOAD CONTRIBUTIONS AND HOURLY LOAD OBLIGATIONS FOR RETAIL CUSTOMERS

These calculations are performed on an annual basis and are fixed until the rollover to the new summer data occurs. A complete description of the procedures, together with examples and details on customer load profiles and customer classes, is maintained at Atlantic's web site, www.conectiv.com.

DETERMINATION OF CUSTOMER CAPACITY PEAK LOAD CONTRIBUTIONS

The annual calculation of Customer Capacity Peak Load Contributions (Capacity PLC) is a two-step process: (1) compute the Customer Peak Load Contributions, and (2) scale the Customer PLC's so that they sum to the allocated PJM zonal peak.

1. Five hours of customer loads are gathered, coincident with the time of PJM's five highest daily peak demands during the summer peak. Actual metered loads for (hourly) interval-metered customers are adjusted to include any load curtailed as a result of active load management initiatives, voltage reductions, manual load dumps, or other load restrictions. These adjusted loads are referred to as "unrestricted loads". For non-interval metered customers (demand-metered and monthly-metered), the customers' loads are the hourly profiled kilowatt-hour quantities for the

² "Contribution" in this context means the peak load imposed on the system by the customer (or Supplier, or BRP).

³ PJM Interconnection is the Regional Transmission Organization for a portion of the eastern and mid-west United States. The PJM web page is at <http://www.pjm.com/>

billing cycles in which the five daily PJM peaks occurred. Individual customer loads are scaled up or down, using a ratio of the customer's monthly usage to the profiled class' average monthly usage. Using industry standard profiling techniques, and grouped by rate class, weather-normalized kilowatt-hour usage in the five peak load hours is determined for these demand-metered and monthly-metered customers.

2. Interval-metered customer loads are weather normalized if their profiled usage is weather sensitive. Non-interval metered customer loads are scaled according to local weather patterns.

3. Each customer's loads are adjusted for losses, consistent with the customer's Service Agreement and the loss factors in the most recent state commission filing of loss factors by voltage classes.

4. The customer loads are then scaled so that the totals for the Atlantic zone matches the Atlantic unrestricted weather-normalized zonal peak on each of the five PJM (unrestricted) peak load days. The arithmetic average of these (unrestricted) hourly values for the five PJM peak hours is the Customer's Capacity PLC. These Capacity PLC's are again scaled so that the sum of all Customer Capacity PLC's equals the zonal peak allocated by PJM.

Atlantic will aggregate the customer Capacity PLC's daily, by Supplier, and report the data to PJM, as well as make it available to the retail customers. Until individual data is available, new customers are assigned a Capacity PLC according to their profile class.

DETERMINATION OF CUSTOMER NETWORK PEAK LOAD CONTRIBUTIONS

Each customer's Network Peak Load Contribution (Network PLC) is calculated using a method similar to the two-step approach for determining Capacity PLC's. However, instead of using PJM determinants, the hourly loads are associated with the five highest (unrestricted) peaks for the Atlantic zone.⁴

1. For retail customers, five hours of loads are gathered, coincident with the time of the five highest (unrestricted) daily peak demands for the Atlantic zone. Actual metered loads for (hourly) interval-metered customers are adjusted to include any load curtailed as a result of active load management initiatives, voltage reductions, manual load dumps, or other load restrictions. These adjusted loads are referred to as "unrestricted loads". For non-interval metered customers (demand-metered and monthly-metered), the customers' loads are the hourly profiled kilowatt-hour usage for the billing cycles in which the five daily peaks occurred. Individual customer loads are scaled up or down, using a ratio of the customer's monthly usage to the profiled class' average monthly usage.

2. Each customer's loads are adjusted for losses, consistent with the customer's Service Agreement and the loss factors in the most recent state commission filing of loss factors by voltage classes.

3. The customer loads are then scaled so their total on each of the five days matches the corresponding unrestricted Atlantic zonal peaks.

4. The arithmetic average of the hourly values at the time of the five Atlantic daily peaks is defined as the customer's Network PLC. These values are again scaled so that the sum of all customers Network PLC's equals the retail portion of the annual Atlantic zonal peak.

Atlantic will aggregate the customer Network PLC's daily, by Supplier, and report the data to PJM on a timetable established by PJM. Until individual data is available, new customers are assigned an average Network PLC for the customer's load profile class.

DETERMINATION OF HOURLY ENERGY OBLIGATIONS

⁴ The Atlantic "zone" is the area covered by the Atlantic City Electric Company.

Hourly energy obligations also are addressed in a two-step process. In Settlement A, Atlantic will determine the “day after” energy responsibility. The load characteristics of the operating day in question will be recreated using the known, preliminary, and historically based information available.

1. Preliminary daily read hourly interval meter data will be adjusted for losses using established loss factors, with totals reported for each Supplier. [Note: in the PJM system, there is an algorithm to determine loss factors for each location based on the location and size of each generating asset and each load zone. This calculation is extremely complex, and it may be appropriate to use simplifying assumptions about losses.]
2. For groups of customers, who do not have interval metering, Atlantic’s load profiles will be adjusted to account for factors such as weather and losses [as determined by the PJM algorithm for losses and by historical weather data correlated to customer usage for weather]. The adjusted profiles will be applied to the profiled customers based on rate class. The assigned profile shall be scaled by customer usage factors, which are based on historical customer energy consumption. These results will be compiled by rate class and Supplier. [This scaling preserves the shape of the profile but allows for recognition of differences in usage among customers and suppliers. For example, there may be two household customers within the same load profile class, and who thus have the same load profile, but one customer uses, on average (based on monthly usage), 20 kWh during the day and the other uses 10kWh. Scaling means that, at each point on the profile curve, the first customer would have “profiled” usage twice that of the second. Scaling adds accuracy but also complexity to the settlement calculations, and it may be appropriate to limit its application in the early stages of market development.]
3. The aggregate load value for all the adjusted profiled and adjusted interval metered loads will be scaled so that the sum of all hourly loads in the Atlantic zone equals the metered zonal load.

Atlantic will aggregate the hourly energy obligations, by Supplier, and report the totals to PJM as their “day after responsibility”.

Settlement B occurs after all actual monthly energy usage data has been processed for the day in question (approximately 45 – 60 days later) and occurs between the Supplier and PJM.

1. Atlantic will calculate the difference between the final hourly load obligation and the “day after” estimated load obligation previously determined in Settlement A.
2. After a calendar month becomes fully metered, Atlantic will compute and submit to PJM the complete hourly adjustments for that month.

Atlantic will aggregate the hourly energy adjustments, by Supplier, and submit to PJM a calendar-month file containing Supplier hourly energy obligation amounts. PJM will then issue a final bill reflecting any adjustments.

If any adjustments need to be made to a customer’s data after the regular monthly reconciliation in Settlement B, then the Parties involved will agree on the adjustment. Atlantic will then forward the information to PJM. PJM will place the final adjustments on the appropriate Party’s bill. Any disputes shall be resolved through the PJM Dispute Resolution Process.

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Once the BRP “scaled” loads are established, they are transmitted to the ISO for the calculation of each Supplier’s settlement obligations.

⁵ The document from which the Atlantic City Electric Company material was drawn is no longer available on the web. A more complex and comprehensive document concerning the same company’s procedures can be found in Appendix A and also at: <http://cpd.conectiv.com/cpd/tps/NJ/forms/PHIoperationsmanual2007.pdf>

The “losses” referred to in this section and elsewhere in this analysis are the reduction in available energy due to the transmission and distribution of that energy. Losses typically vary with voltage, type of equipment, ambient temperature and distance from source(s) to sink(s). The simplest way of determining the losses within any system, or relating to any customer or group of customers, is to sum the injections (i.e., the energy flowing over the meter from all generation and all transmission input points) and subtract all the actual consumption within the relevant system or among the relevant end use customers. Where all customers are metered, aggregate losses for the system can be readily calculated. Where some customers are profiled, the scaled profiled usage must be used to allocate losses among Suppliers and BRPs. Allocation of losses among customers within a Supplier or BRP group requires a detailed study of the customer’s usage, voltage, and placement on the system relative to the injections into the system. As indicated in Section 9(C) of the Model Code, below, DSOs can reasonably be required to prepare and submit a “line loss” study that provides information on the level and nature of losses. The results of the line loss study can then be used to assign losses among Suppliers and BRPs within a DSO territory. Similar calculations must be made by the Transco in assigning transmission losses.

In some markets, the cost of line losses is assigned on a “marginal loss” basis. The calculation of “marginal losses” requires a calculation of the degree to which the system losses increase or decrease with the usage (or production) of any particular customer (or generator). These calculations are extremely complex (for an example, see

http://www.iso-ne.com/support/faq/lmp/loss_component_lmp_faq.pdf)

and are most useful in markets using marginal cost dispatch algorithms. It is reasonable, as markets are developing, to use average loss factors and allocate losses based on load (KW or KWh).

IV. Establishing Codes for Load Profiling

Load profiling is done at the DSO level, because all points of interconnection between the DSO and the ISO-operated transmission system are metered in real time.⁶ For this reason, the rules and codes governing load profiling and its use in settlement are best established in the Distribution Grid Codes administered by the DSOs and approved and supervised by FERC and RSERC (and SERC for the Brčko District). The rules and codes should cover the following subjects; draft language is included here in the text (“Model Code”):⁷

⁶ Where the metering points are owned and read by the Transco, as in BiH, the Transco must provide the data to the ISO and to a DSO. The Regulator has a role here in ensuring that the data is provided to the DSOs in a timely and accurate way. Coordination and communication among SERC, RSERC and FERC on these “overlapping” issues is vital to ensure that the information flows can be effective and efficient.

⁷ The Model Code is based upon Chapter 321 of the Maine Public Utilities Commission Rules : LOAD OBLIGATION AND SETTLEMENT CALCULATIONS FOR COMPETITIVE PROVIDERS OF ELECTRICITY. These are available at <http://www.maine.gov/mpuc/legislative/rules/part3-electric.shtml>

MODEL CODE FOR LOAD PROFILING

§ 1 DEFINITIONS

Important definitions include:

Telemetering. “Telemetering” means the remote reading or gathering of metered load data no less frequently than daily, to obtain hourly loads.

Deemed Load Profile. “Deemed load profile” means a load profile defined by engineering estimates.

Dynamic Load Profile. "Dynamic load profile" means a load profile whose hourly load levels are assigned no less frequently than daily based on actual conditions.

Load Profile. “Load profile” means an estimate of the hourly load levels of a group of customers during a specified time period such as a day or a month, at the point of delivery, measured with either static metering or telemetering.

Static Metering. “Static metering” means the reading or gathering of metered load data less frequently than daily, such as at the end of each month, to obtain hourly loads.

§ 2 DSO OBLIGATION

The purpose of this provision is to require the DSO to fulfill all load profiling and related obligations.

Each DSO shall ensure that the provisions of this Chapter are carried out in its service territory.

§ 3 TELEMETERING

This provision allows a Supplier to request, for large customers, the installation by the DSO of a real time interval meter (thus removing, for that customer, the need for the use of a load profile).

- A. **Large Non-Residential Customers.** For the purposes of this Chapter, the DSO shall use telemetering to measure hourly loads of all non-residential customers that are not within the small non-residential or medium non-residential profiling classes as they are defined in subsection 4.A.2. The DSO shall recover the reasonable costs of equipment and data processing required by this provision. These costs will be recovered from the classes containing customers affected by this provision.
- B. **All Other Customers.** Suppliers may request that a DSO use telemetering to measure the hourly loads of any customer that receives generation service from that Supplier and that is not telemetered pursuant to subsection 3.A. The DSO shall charge the requesting Supplier the resulting incremental cost of equipment and data processing. The DSO shall accommodate requests for telemetering as

quickly as practicable. The DSO shall telemeter hourly loads of all customers as long as the telemetering equipment remains installed.

- C. Phase-In of Telemetering. Upon a finding that DSO cannot accommodate requests for telemetering in a reasonably timely manner, the [regulatory] shall implement a phase-in approach that shall limit telemetering requests to customers using a prioritizing process to be determined by the [regulator].

§ 4 LOAD PROFILES

This portion of the code describes the development of the load profiles.

- A. Load Profiles for Customer Groups.
 - 1. Each DSO shall develop a set of load profiles for each of the three customer profile groups defined in Section 4.A.2. Each customer profile group's load profile set will contain 24-hour profiles that may be used to represent each day of a year. Each daily profile will represent an average per-customer load, at the point of retail delivery. Each profile will represent a 24-hour day that may be identified through some indicator such as month, day of the week, weather condition, or any other indicator that significantly affects load. Profiles may be created by combining the metered loads from more than one day. Each customer profile group will be used to represent those customers not telemetered.
 - 2. The three customer profile groups shall be [note: these are examples; specific groups for each DSO should be developed consistent with the rate design of each DSO]:
 - a. Household. This profile group shall contain all customers defined as household by the terms and conditions of the DSO. The profile group shall exclude customers with deemed load profiles and customers who are telemetered.
 - b. Small Non-Household. This profile group shall contain all non-household customers that meet the availability criteria to take service under a core customer class of the DSO that does not include a demand charge. The profile group shall exclude customers with deemed load profiles and customers who are telemetered.
 - c. Medium Non-Household. This profile group shall contain all non-household customers that do not meet the criteria for a small non-household customer and that meet the availability criteria to take service under a core customer class of the DSO that includes a demand charge and in which a customer's maximum demand shall

not exceed 500 kW, or the kW breakpoint that is closest to but does not exceed 500 kW. The profile group shall exclude customers with deemed load profiles and customers who are telemetered.

3. Deemed load profiles are permissible but not required for customers whose loads are easily estimated through engineering characteristics.

B. Profiling Methodology

1. For each DSO, samples in each customer profile group will be designed to produce the following accuracy:
 - a. a 90% confidence level with plus or minus 10% error margin in hourly load at the time of the DSO's peak.
 - b. to the extent that it is practicable, a high level of accuracy in the peak hours of all months in the year should be achieved, while maintaining the provisions in Section B.1.a; and
 - c. to the extent that it is practicable, a high level of accuracy in all hours of the year should be achieved, while maintaining the provisions in Section B.1.a.
2. DSOs shall re-sample each customer profile group no less frequently than every two years. This provision will be waived if the DSO demonstrates to the [regulator] that the current sample represents the customer profile group with reasonable accuracy.
3. Network operators shall use either simple random sampling or stratified random sampling to select samples of each customer profile group.
4. Network operators shall use either ratio analysis or mean-per-unit analysis to create load profiles from the samples of each customer profile group.

§ 5 DAILY ESTIMATION OF SUPPLIER HOURLY LOADS

This section describes how hourly loads for each Supplier are developed by the DSO:

- A. Calculation of Customers' Hourly Loads. After each day, the DSO shall estimate hourly loads in that day for each customer at the point of delivery.
 1. For customers that are telemetered, the estimate shall equal the customer's telemetered usage.

2. For customers that are not telemetered, including those with deemed load profiles, the estimates shall be equal to a load profile, from the appropriate customer profile group's set of profiles, that represents the day being estimated, based on the indicator(s) used to create the load profiles pursuant to Section 4.A.1; adjusted for the customer's estimated daily energy use (i.e., the use may be adjusted for variations of average use within the profiled group, based on historical data available to the Supplier and provided to the DSO). The profiles may be adjusted, as appropriate, in accordance with the approved profiling methodology to account for weather or other conditions that significantly affect load. [It is at this stage that "scaling" of the estimated loads may be required.]

B. Calculation of Suppliers' Hourly Load Responsibilities

1. After each day, transmission and distribution utilities shall estimate hourly load responsibilities in that day for each Supplier. The estimate shall equal:
 - a. the sum of the telemetered hourly loads of the Suppliers' telemetered customers, calculated pursuant to Section 5.A, and adjusted for line losses attributable to those customers between the customer delivery point and the point of bulk system metering; plus
 - b. the sum of the estimated hourly loads of the Suppliers' profiled customers, calculated pursuant to Section 5.A, and adjusted for line losses attributable to those customers between the customer delivery point and the point of bulk system metering; plus
 - c. the hourly difference between the portion of the bulk system hourly metered loads attributable to retail sales [i.e. the usage as measured at the interconnection point with the ISO-operated system] and the total system estimated hourly loads calculated pursuant to Sections 5.B.1.a and 5.B.1.b, allocated to Suppliers based on sales to profiled customers.
2. The calculations described in Section 5.B.1 shall be used to determine Supplier load obligation settlements.
 - a. Each DSO reports the hourly load responsibilities of each Supplier operating in its territory to the ISO (as well as to the BRP and Supplier) in conformance with ISO requirements as they may be changed from time to time.
 - b. All hourly load responsibility reported to the ISO pursuant to this paragraph shall be differentiated by Load Asset I.D. Number or

other unique identifying number used by the ISO (e.g., the ID based on the EIC coding system). All Suppliers operating within the ISO control area must be assigned at least one valid ISO Load Asset I.D. Number or other identifying number.

3. Line losses that occur when delivering a Supplier's energy within a DSO's local network are the sole responsibility of the Supplier, and will be allocated in a manner consistent with this principle. Line losses will reflect, at a minimum, variation between summer and winter and variation among voltage levels.

§ 6 MONTHLY SETTLEMENT OF SUPPLIER ENERGY USE

The purpose of this section is to permit a “true up” of settlements to reflect actual usage among the various Suppliers based on the meter data used for billing purposes (i.e., including meters for profiled customers that are read monthly or that do not have interval data).

- A. Recalculation of Supplier Hourly Loads. After each calendar month, DSOs shall re-estimate the hourly load responsibilities for each Supplier, to reflect monthly energy use most recently metered for billing purposes. The re-estimate shall be done in a manner that duplicates the hourly load responsibilities calculated pursuant to Section 5 in all respects except that customers’ estimated daily energy use used in each day's calculations shall reflect the most recent meter reading done for billing purposes.
- B. Calculation of Hourly Load or Monthly Energy Differences.
 1. After each calendar month, the DSO shall be capable of calculating two energy difference estimates for each Supplier:
 - a. the hourly load differences between hourly loads estimated pursuant to Section 6.A and hourly loads estimated pursuant to Section 5; and
 - b. the monthly energy differences, equal to the sum of the hourly load differences within the month calculated pursuant to Section 6.B.1.a.
 2. The calculations described in Section 6.B.1 shall be used to adjust the financial settlement associated with each Supplier’s regional load obligation and generation delivery. The ISO will determine whether hourly load data or monthly energy data will be used for this purpose.
 - a. Each DSO located in the ISO control area shall report the hourly load data or monthly energy data of each Supplier operating in its

territory to ISO in conformance with ISO requirements as they may be changed from time to time.

- b. All load data reported to the ISO pursuant to this paragraph shall be differentiated by Load Asset I.D. Number or other unique identifying number used by the ISO.

§ 7 INFORMATION ACCESS

Access by market participants to information relevant to load profiling is essential for transparency:

- A. Access to Each Day's Hourly Load Estimates.
 1. After each day, the DSO shall provide an estimate of each Supplier's hourly loads, within 36 hours of the end of the day or at such time as the ISO requires, to the ISO, as specified in Section 5.B.2.
 2. The DSO shall provide to each Supplier and each BRP its estimated hourly loads as reported to the ISO as soon as practicable, but no later than two business days after providing that data to the ISO.
 3. Upon request by a Supplier, the DSO shall provide to the Supplier and the BRP its customers' estimated hourly loads for any days within the previous 12 months, for any customer receiving service from that Supplier.
- B. Access to Month-End Energy Differences
 1. After each month, the DSO shall provide an estimate of each Supplier's monthly or hourly energy data (s) to the ISO, within 45 days of the end of the month or at such time as the ISO requires, as specified in Section 6.B.2.
 2. The DSO shall provide to each Supplier its estimated monthly or hourly data as reported to the ISO as soon as practicable, but no later than two business days after providing those data to the ISO.
 3. Upon request by a Supplier, the DSO shall provide to the Supplier its customer's estimated monthly or hourly data within the previous 12 months, for any customer receiving service from that Supplier.
- C. Access to Load Profiles

The DSO shall make public the load profiles of each customer profile group. This provision does not apply when publication may reasonably reveal an individual customer's load characteristics.

Here is a "screen shot" of the web page used by Maine's largest DSO - the url for the site is <http://www.cmpco.com/SuppliersAndPartners/MainesElectricityMarket/LoadProfillingSettlement.html>:

load profiles



- Competitive Electricity Market
- Doing Business in Maine
- Standard Offer Service
- Competitive Provider Service
- Load Profiling and Settlement
- EBT and EDI
- Transmission Services
- ELP
- JUMS
- Pole Set Form
- Pole Removal Form
- Pole Attachment Services

Load Profiles for Settlement

Deemed profiles for unmetered loads for residential, small commercial and industrial, and medium commercial and industrial accounts.

- [2012 Load Profiles.xls](#) (XLS, Effective April 1, 2012)

Loss Factor Data

Non-PTF line loss factors applied by CMP to individual customer energy usage for load settlement purposes are as follows:

Service Classification	Annual Average	Summer	Winter
Transmission	1.003017	1.003379	1.002351
Subtransmission	1.014599	1.015085	1.013918
Primary	1.040785	1.040236	1.040232
Secondary	1.081299	1.082998	1.078346

Note: PTF line losses are applied by the ISO, in addition to the above.

§ 8 DATA TRANSFER

This provision requires electronic transfer of the information relating to load profiles:

Each DSO and each Supplier shall transfer data among one another in accordance with procedures and formats specified [by the Grid Code as approved by the regulator].

§ 9 REPORTING

A. Methodology Report

1. Prior to [date], each DSO shall file a report that will allow the [regulator] to verify compliance with this Chapter. The report will describe the methods by which sampling and data validation will be performed.
2. Prior to [date], each DSO shall file a report that will allow the [regulator] to verify compliance with this Chapter. The report will describe the methods by which the DSO will create profiles from samples, estimate daily supplier loads, and estimate month-end energy difference.

B. Annual Report. Annually on June 1, each DSO shall file a report that describes its benefits and costs of complying with this Chapter and that recommends changes to methods or procedures.

C. Line Loss Study. Each DSO shall file a line loss study before [date]. The Commission shall approve line loss values to be used in calculations made pursuant to this Chapter no later than [xx] months after each filing.

§ 10 WAIVER OR EXEMPTION

It is generally useful to have provisions permitting a waiver of code provisions where good cause is shown:

Upon the request of any person subject to the provisions of this Chapter or upon its own motion, the regulator may waive any of the requirements of this Chapter that are not required by the [governing law]. Where good cause exists, the regulator may grant the requested waiver, provided that the granting of the waiver would not be inconsistent with the purposes of this Chapter or [governing law].⁸

⁸ For another example of rules relating to load profiling, see the rules adopted for the Texas market, attached. Public Utility Commission of Texas, Electric Substantive Rules, Chapter 25; <http://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.131/25.131ei.aspx>.

V. Training

It is important to provide for training of the Suppliers, the ISO and the DSOs with respect to the use of load profiling. Training should be overseen by the regulator.

VI. Role for the Regulator

Because the principal load profiling activities take place at the distribution system level, the primary regulatory role in BiH with respect to load profiling will fall to the regulators with authority over the DSOs. The regulatory functions relating to load profiling and related settlement issues fall into three broad categories:

- Establishing the framework for load profiling and settlement. This includes developing, through a transparent process, the codes and other documents that describe the methods to be used in developing load profiles; the groups to be profiled; the frequency of studies establishing profiles; and required level of accuracy. Suggested language to be included in such codes is set forth above.
- Ensuring transparency and non-discrimination. Where the entity that is acting as the DSO is also a Supplier in competition with other Suppliers for eligible customers, it is obviously vital that load profiling and data flows are accomplished in a manner that does not favor the Supplier affiliated with the DSO. [The concern that a DSO acting also as a Supplier may act to favor its own customers over customers of other Suppliers is a principal reason to unbundle the DSO and Supplier functions.] For this reason, all activities relating to the development of load profiles, scaling of profiled loads, and data transfer relating to Supplier loads must be available to the regulator, and to the public, to ensure that no discrimination takes place, and that the same load profiles are used for customers in the same groups regardless of the identity of the Supplier. Making load profile information public, and requiring all Suppliers to use the same profiles for the same groups of non-telemetered customers, is an important method to assist the regulator in ensuring non-discrimination. Sections 7, 8 and 9 of the rule quoted above reflect a useful approach to achieving this objective.
- Dispute resolution. Any disputes among market participants concerning the development or application of load profiles and related settlement issues should be resolved in the first instance by the regulator. It would be useful to have a time-limited process (i.e., resolution within 60 days), as long as that can be accomplished with sufficient transparency, because these issues will impact the cash flows, and thus the financial viability, of the competing Suppliers.

VII. Process and Time Line

What follows is a step-by-step timeline showing where load profiling fits within the overall settlement process:

Prior to market opening

- Regulator, through transparently enacted codes and rules, establishes the methods and protocols for load profiles and their use. This includes at least identifying the relevant customer groupings, sampling and statistical methods, frequency of updating, required level of accuracy, and the responsibilities of the various market participants.
- DSO, in a transparent manner, performs load profile sampling, and publishes the load shape and expected usage for each profiled class.

Prior to Operations Day

- Each Supplier provides ISO and DSO with balanced schedule, including information on telemetered customers and number of customers within each profile group located within the DSO's territory.

Operations Day

- ISO dispatches the system to ensure reliability, and collects data from DSO/Transco meter points.
- DSO collects all data from telemeters.
- DSO collects data from DSO/Transco meter points.

Day following Operations Day

- DSO calculates share of each Supplier of the DSO/Transco load (as indicated at the DSO/Transco meter points), using load profiles and scaling as necessary to ensure that the sum of Supplier loads (once distribution losses are factored in) equals the DSO/Transco load
- ISO calculates net position of each Supplier based on responsibility for losses, ancillary services, transmission costs, and imbalances.
- Preliminary financial settlements are made based on this preliminary settlement data (to avoid cash flow lags that would occur if financial settlements had to wait for final reconciliation).

1-2 months following Operations Day

- DSO collects all meter data (including monthly) and recalculates Supplier load shares. Interval (but non-telemetered) meter data is substituted for load profile where available.
- DSO provides each Supplier with the recalculated share and individual customer share data.
- Suppliers bill their customers based on actual usage according to the tariff or contract with the customer.
- DSO transmits recalculated data to ISO.
- ISO recalculates each Supplier's net positions.
- Final financial settlements among market participants.
- DSO and ISO provide reports to regulator.

VIII. Gap Analysis and Recommendations

Issue	Responsible Party	Federation (FERC)	Republika Srpska (RSERC)	State (SERC)	Comment	Recommendation
Principles and Objectives						
1. Are the rules for load profiling clear and nondiscriminatory?	It is the responsibility of the regulator to ensure that rules are clear, transparent and non-discriminatory	None	GC Art. 115 (documents harmonized and reviewed by regulator)		Apart from general admonitions, there are currently no relevant provisions in the BiH codes and conditions.	Adopt Model Code (generally)
2. Are the responsibilities and processes for load profiling and the implications of load profiling for settlement clearly established?	Regulators	None			Apart from general admonitions, there are currently no relevant provisions in the BiH codes and conditions	Adopt Model Code (generally)
3. Is there a transparent process for review and dispute resolution concerning the development and use of load profiles?	Regulators	None	GC Art. 111 (general authority for dispute resolution)		Apart from general admonitions, there are currently no relevant provisions in the BiH codes and conditions	Cross reference dispute resolution procedures in Load Profiling code

Issue	Responsible Party	Federation (FERC)	Republika Srpska (RSERC)	State (SERC)	Comment	Recommendation
4. Development of load profiles (by customer group, by DSO territory)	DSO	None	None		Larger customers should be metered directly; profile groups could be, for example, household; small commercial; medium commercial.	Adopt Model Code §4
5. Sample customers from each profile group	DSO	None	None		Samples must achieve a 90/10 level of accuracy. Accuracy is assigned based on the estimate of load in a particular hour. 90/10 means that the utility is 90% confident that the error of the sample estimate of the summer peak hour is within $\pm 10\%$. Samples should be repeated every 2 years.	Adopt Model Code §4(B)
Market participant activities						

Issue	Responsible Party	Federation (FERC)	Republika Srpska (RSERC)	State (SERC)	Comment	Recommendation
6. Training	All market participants and regulators	None	None			Develop training materials once settlement structures and responsibilities are settled. See ISO-NE materials for examples: http://www.iso-ne.com/support/training/courses/
7. Enact codes and rules relating to load profiling	Regulators	None	None			Adopt Model Code (generally)
8. Collect meter data for metered customers	DSO	GC Art. 5(l) (obligations of the DSO)	GC Art. 9(g) (DSO obligations); Art. 83 (supplier uses data to calculate end user bill)			Adopt Model Code §3(B) and §3(C)

Issue	Responsible Party	Federation (FERC)	Republika Srpska (RSERC)	State (SERC)	Comment	Recommendation
9. Apply load profiles for non-metered customers to allocate “remaining” load to profiled loads.	DSO	None	None		Sum of metered loads plus profiled loads = sum of loads at DSO/Transco meter points. Initial calculation will require estimation of some metered loads; final calculation and settlement will follow collection of all customer meter data.	Adopt Model Code §5
10. Obligation of supplier to provide data on customers to enable DSO to calculate load shares	Suppliers	GC Art. 15	None			Adopt Model Code §5(B)

Issue	Responsible Party	Federation (FERC)	Republika Srpska (RSERC)	State (SERC)	Comment	Recommendation
11. Estimate load (for Suppliers with load profiled customers)	DSO	None	None		<p>Actual load used for telemetered interval customers.</p> <p>Estimates based on load profiles used for all other customers. Class average profiles will be adjusted for individual customers based on a usage factor that reflects the customer's most current monthly meter readings.</p> <p>The load estimation will be the sum of the telemetered load, adjusted losses and the profiled load adjusted for losses. This sum will be compared to actual system load for the day.</p> <p>OPTION: Any differences will be applied to profiled customers only. The reason for this approach is that utilities know more accurately what the telemetered customers used than the profiled customers. Said in another way, the</p>	Adopt Model Code §5(B)

Issue	Responsible Party	Federation (FERC)	Republika Srpska (RSERC)	State (SERC)	Comment	Recommendation
12. Account for line losses in load estimate	DSO	None	None			Adopt Model Code §5(C)
13. Provide hourly load data to ISO for all Suppliers within the DSO's territory	DSO	None	None			Adopt Model Code §5(B)(2)
14. Meter reads from load settled on actual usage		None	None			
15. Data transfer protocols: a. Timing of flows from meter points b. Technical protocol c. Opportunities for and limits on corrections		None	None			Develop protocols consistent with final market design and information flow processes
16. Scaling of customer usage to match DSO/ISO meter (i.e. account for share of distribution losses)	DSO	None	None			Adopt Model Code §5(A)(2)

Issue	Responsible Party	Federation (FERC)	Republika Srpska (RSERC)	State (SERC)	Comment	Recommendation
17. Calculation of amounts due and owing for imbalances	ISO	None	None	Market Rules (PR) Art. 8; also Art. 30 (price formula for charges for imbalance); also Art. 34	ISO is also the Administrator of Balancing Market in BiH	Adopt Model Code §5(B)
18. Initial settlement of imbalances	ISO	None	None	Market Rules (PR) Arts. 28-29 (Market Participants are responsible to Supplier, Supplier to ISO)		Address this issue in general settlement codes

Issue	Responsible Party	Federation (FERC)	Republika Srpska (RSERC)	State (SERC)	Comment	Recommendation
19. Calculate corrected loads to reflect meter readings and report to ISO	DSO and BRP	None	None		Once all meter readings are available, the usage factor for profiled customers is recalculated and the hourly load estimation is performed again for each day of the month. The revised hourly loads are reported to each Supplier so that the Supplier can sum hourly loads. DSO will report the revised total monthly energy to ISO and ISO will calculate any necessary financial adjustments.	Adopt Model Code §5(B)(2)
20. Verification of data for settlement purposes	ISO	None	None	Market Rules (PR) Art. 34		Adopt Model Code §9

Issue	Responsible Party	Federation (FERC)	Republika Srpska (RSERC)	State (SERC)	Comment	Recommendation
21. Reconciled settlement	ISO	None	None	Market Rules (PR) Art. 34	Revised month-end energy values are reported within 90 days after the end of the month. This information is the total energy for the month that was calculated using the most recent monthly meter reads. ISO will compare this to the monthly total from the daily settlements reported to calculate a difference. Settlement will be made for any adjustments using the average balancing energy price during the month.	Address in general settlement codes

Issue	Responsible Party	Federation (FERC)	Republika Srpska (RSERC)	State (SERC)	Comment	Recommendation
22. Information provided by DSO to Supplier	DSO	None	None		Example: DSO provide all information to ISO and Suppliers at the same time by email. Suppliers can request hourly loads for Supplier customers for any day within the previous 12 months and the DSO will provide it.	Adopt Model Code §7
23. Transparency of balancing market (public availability of information)		None	None		EREG 6.2 for sample list of data and timing of release	Adopt Model Code §§7 & 9
24. Monitoring by regulator		None	None		EREG 6.3; regulators must have access to all ISO data	Adopt Model Code §9

IX. Next Steps

As suggested by the discussion and gap analysis, the codes and rules currently in force in BiH do not provide guidance or direction on the development or use of load profiles. As also indicated above, however, the mechanics of load profiling, and the use of load profiling information, are reasonably straightforward and can be applied in a variety of market structures. The principal tasks relating to load profiling, in anticipation of the full opening of the BiH market, include:

- Each regulatory jurisdiction should adopt rules appropriate to load profiling. Because the load profiling issues principally relate to the distribution side (rather than the transmission side) of the market, FERC and RSERC should consider adopting rules that contain the elements described in section IV, above. SERC should consider rules that ensure that information in the hands of Transco (for example, metering data concerning flows through the interconnection points) are made available to the DSO and BRP.**
- The key market participants – including Suppliers, BRPs, DSOs, ISO and the Transco, together with the regulators – should convene meetings to ensure that each understands its roles in developing load profiles, exchange of information, and the use of the information in settlements. These meetings should be in conjunction with discussions resolving the settlement processes and the treatment of imbalance energy and losses.**
- Each DSO should prepare an operations manual (along the lines of the manual attached as Appendix A) describing the load profiling process. The regulator should have authority to review and approve or disapprove the contents of any such manual.**

APPENDIX A

PEPCO HOLDINGS, INC. Supplier Operating Manual

<http://cpd.conectiv.com/cpd/tps/NJ/forms/PHIoperationsmanual2007.pdf>