DRAFT FOR DISCUSSION

NAVIGANT

ENERGY

# Cost Allocation to Different Types of Streetlighting Configurations EB-2012-0383

*Presented to the Unmetered Load Working Group*

February 11, 2015

# Agenda

» Navigant Presentation:

1. Research – Board Decisions, Elenchus Report
2. Review of sample CAM models
3. Interviews with LDC's and Municipalities
4. Data Analysis and Findings
5. Conclusions & Recommendations

» Open discussion:

– seeking commentary, feedback and suggestions

# Purpose of the Study

Key Objectives:

1. Identify what utility assets and municipal assets are required for the two types of streetlighting configurations:
   I. 1:1 (one connection per device/ streetlight), and
   II. daisy chained (multiple devices / streetlights per connection),
2. Examine the existing cost allocation method and assess the appropriateness for the 2 streetlighting configurations,
3. Examine and classify the determinants relevant to the allocation of costs to common connection streetlighting systems and one-device-per-connection systems; and
4. Update the Cost Allocation Model, as required, with respect to the cost allocation to various streetlighting system configurations.

To be completed by Navigant:

» Finalize recommendations,

» Report, and

» CAM model update (if necessary).

# OEB Documents

EB-2005-0317

Cost Allocation Review - Sept. 29, 2006

» Peak Load Carrying Capability (PLCC) Adjustment (Section 7.5)
  – Reduces a classifications NCP's because a portion of the demand related costs are covered in the customer/connection minimum system allocation
  – Direction (Section 7.5.2) - The cost allocation filings must incorporate a common PLCC adjustment of 0.4 kW per customer or 0.4 kW per connection.
  – For street lighting and unmetered scattered loads, the number of connections will be used to determine the PLCC adjustment for these customers. It is expected that when these customers are in a separate rate classification, in some cases the PLCC adjustment will reduce the demand allocator to zero and thus no demand-related costs associated with the minimum system will be allocated to the rate classification. This is considered a reasonable outcome, as there are a number of cases where the connection will use less than 0.4 kW of load.

» Section 9.2 Definition of Customer and Connection for Filings - For unmetered loads, the number of connections will be used to allocate some customer-related costs. For street lights, sentinel lights and unmetered scattered loads, the number of connections will be the actual number of devices. In the case of street lights, one "connection" frequently links a number of fixtures to the distribution system and simply using the number of devices may overstate the number of physical connections to the distributor's system. Therefore, where better information is available, distributors must apply a *connection factor* to the number of streetlight fixtures for the purpose of determining the customer allocation factor.

# OEB Documents

Report of the Board EB-2012-0383

Review of the Board's Cost Allocation Policy for Unmetered Loads, December 19, 2013

» The specific issues addressed include 1) updating data, 2) Conditions of Service, 3) communication, 4) the cost allocation model and the cost allocation methodology; and 5) terminology and definitions.

» 4) CAM and cost allocation methodology
  – The Board remains concerned with the allocation of costs to daisy-chain configured systems. The disparity in the cost allocation result between a street lighting customer configuration with multiple devices per connection and a street lighting customer with a device to connection ratio close to 1:1 appears to be disproportionate when compared to actual costs to serve the street lighting rate class. The Board believes that further investigation is necessary before making a determination. The Board will issue a letter shortly to begin a consultation process for this single issue.
  – The Board does not believe that there is sufficient evidence at this time to narrow the revenue to cost ratio range for the street lighting class (i.e. the revenue to cost ratio range is to remain at 0.7 to 1.2).

# Elenchus Report - Review of Cost Allocation Policy for Unmetered Loads

(EB-2012-0383), May 17, 2013

Key Points:

» The move from bundled to unbundled rates and applying cost causality principles through the Board approved cost allocation (the "Cost Allocation") has resulted in significant bill impacts especially to Street Lighting … customer classes for some electricity distributors that previously were probably not recovering all the costs of providing electricity to these classes.

» A critical assumption with respect to the inputs for Street Lighting is the number of devices per connection. This assumption has the most significant impact on the revenue requirement for the Street Lighting customer class.

– The difference in revenue requirement between a device per connection ratio of 15:1 and a 1:1 is over 400%

Recommendations :

» Data – Customers' Responsibility - Recommendation that the distributors should update Load profiles reflecting energy efficiency improvements. Street Lighting consumption pattern should reflect any technology changes, (e.g. efficiency, dimming, under-driving, etc.).

» Communication – Distributors' Responsibility - The actual configuration used by the distributors in connecting Unmetered Loads should be reflected in their Cost Allocation Methodology. This leads to different cost allocation study results from one utility to another as the connection configuration of Unmetered Loads varies.

» Cost Allocation Model and Results – Board's Responsibility - Continued use of Minimum System Method in order to classify distribution lines and transformers as customer and demand related.

– Some distribution assets are used and expenses incurred regardless of how much electricity is consumed and these costs, based on cost causality principles, should be classified as customer-related.

– A change in the use of the Minimum System Method in the Cost Allocation Model should not be implemented without input from all affected stakeholders, and is outside the scope of this initiative.

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# Streetlighting Cost Allocation

## – 3 focus areas

1. Comparison of streetlighting data for a range of connection ratios
   - Demand
   - Revenue requirement
   - Split of demand and customer related costs
2. Customer Related Costs
3. Demand Related Costs -Peak Load Carrying Capability (PLCC)

# 1. Comparison of Streetlighting data for a range of connection ratios

| Physical Characteristics of LDC SL | | | | | | | |
|---|---|---|---|---|---|---|---|
| Connection Ratio (Devices/Connection) | **1.0** | **1.1** | **1.3** | **1.8** | **3.0** | **8.0** | **15.0** |
| **Operating Characteristics** | | | | | | | |
| Device non coincident peak (NCP4/Device) | 0.64 | 0.78 | 0.72 | 0.68 | 0.85 | 1.24 | 0.61 |
| Percent of LDC total non coincident peak | 0.74% | 0.99% | 0.90% | 0.60% | 1.09% | 0.70% | 1.16% |
| | | | | | | | |
| **Asset split and revenue requirement** | | | | | | | |
| % Primary | 59% | 60% | 54% | 56% | 74% | 58% | 66% |
| % Secondary | 22% | 16% | 23% | 23% | 2% | 7% | 14% |
| % Line Transformer | 19% | 25% | 23% | 21% | 25% | 35% | 21% |
| Revenue Requirement/Device | $115 | $75 | $64 | $128 | $20 | $81 | $16 |
| SL Revenue Requirement/Connection | $115 | $83 | $84 | $231 | $59 | $616 | $242 |

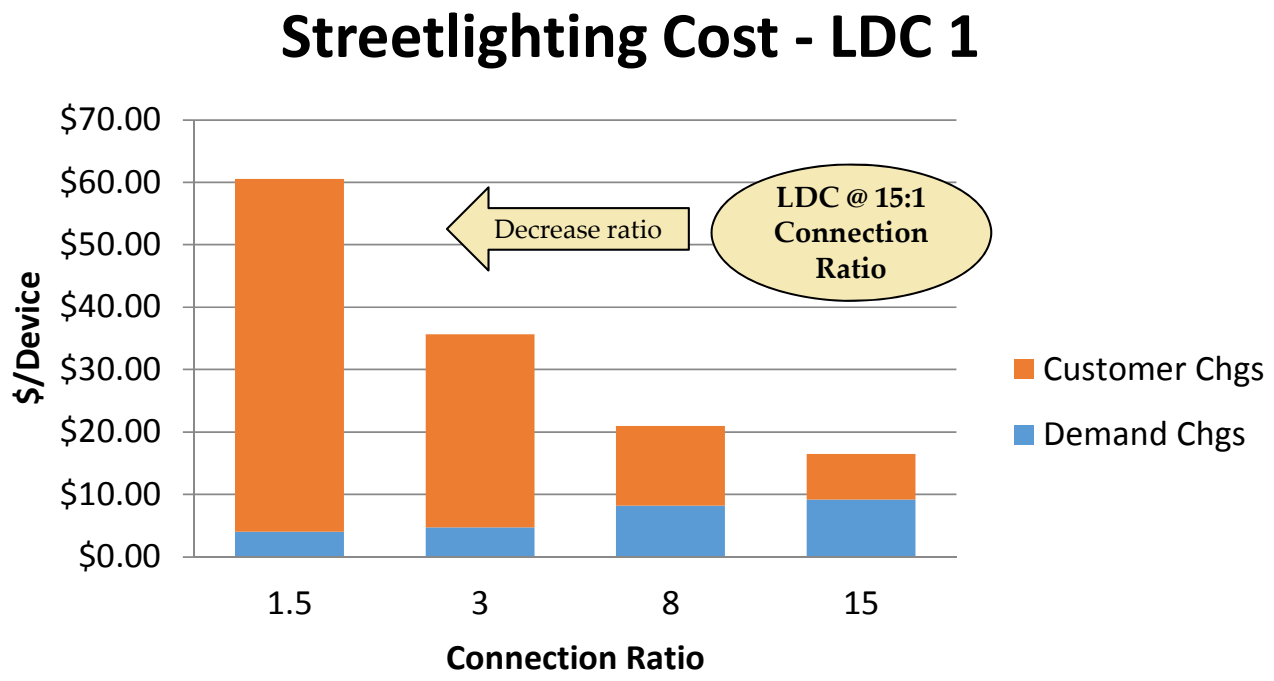
- The proportion of secondary assets tends to decrease as the connection ratio increases
- Comparing the SL revenue requirement on a per device basis, in general demonstrates that low connection ratio LDCs have a higher revenue requirement than high connection ratio LDC's

Note: NCP4 – is used to allocate demand related costs

# 1. Split of demand/ customer costs - cost per SL device

Sensitivity to change in connection ratio for an LDC with a **"daisy chain"** streetlighting configuration.

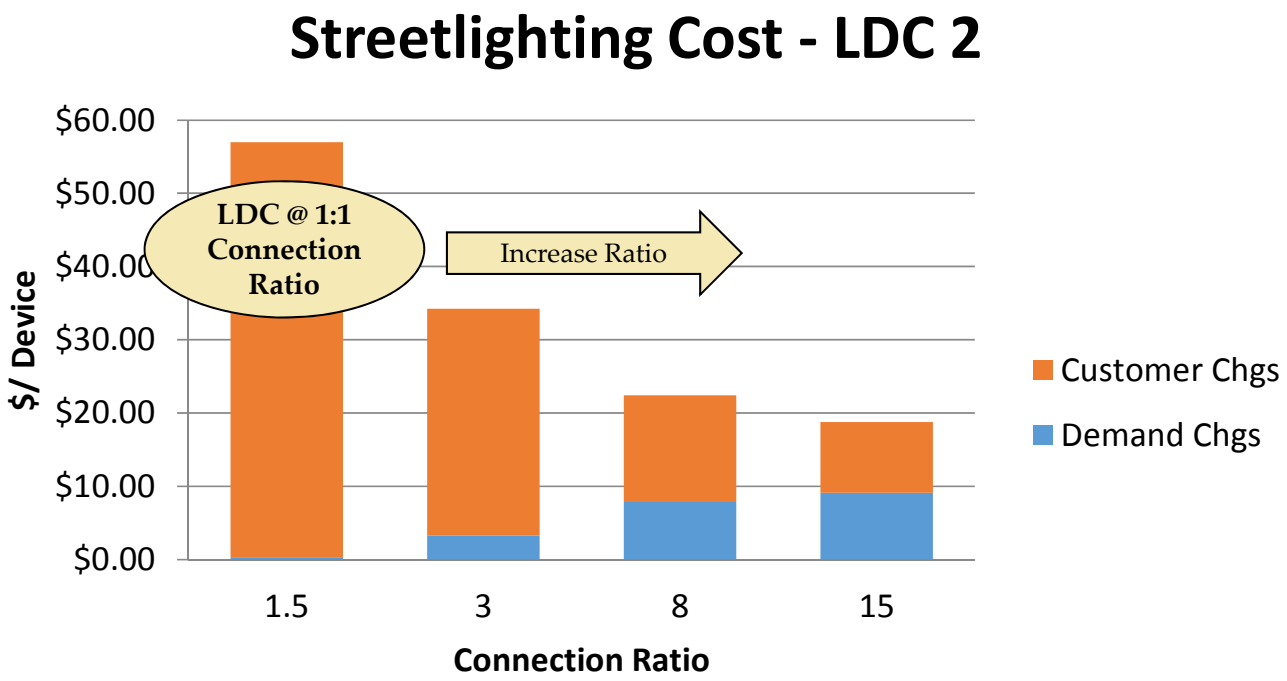
- Both customer and demand costs are very sensitive to the SL connection ratio, and are inversely related.
- Revenue requirement increases by a factor of 2.7 going from a connection ratio of 15:1 to 1.5:1.



# 1. Split of demand/ customer costs - cost per SL device

Sensitivity to change in connection ratio for an LDC with a **1:1** streetlighting configuration.

- As in the previous slide, both demand and customer costs are sensitive to the SL connection ratio.
- Revenue requirement increases by a factor of 3.3 going from a connection ratio of 1.3:1 to 15:1.



# 2. Customer Related Costs - the change in the customer related costs is related to the number of connections

» Illustrative example of the change in customer allocation to the number of SL connections

– SL connections are equivalent to a residential connection in the calculation of the Customer Count Primary/Secondary (CCP/CCS)

| **Connection Ratio** | | **15 : 1** | **1.5 : 1** |
|---|---|---|---|
| Devices | | 24,000 | 24,000 |
| SL Connections | CCP | 1,600 | 16,000 |
| Other Customer Connections | | 98,400 | 98,400 |
| Total Connections | CCS | 100,000 | 114,400 |
| | | | |
| SL Allocation | CCP/CCS | 1.6% | 14.0% |
| | | | |
| Customer Portion of Acct. 5125 | | | |
| Maint. Of Overhead Conductors and Devices | | $350,000 | $350,000 |
| | | | |
| **SL Allocation** | | **$5,600** | **$48,951** |
| **Multiple of Allocated Cost** | | | **8.7** |

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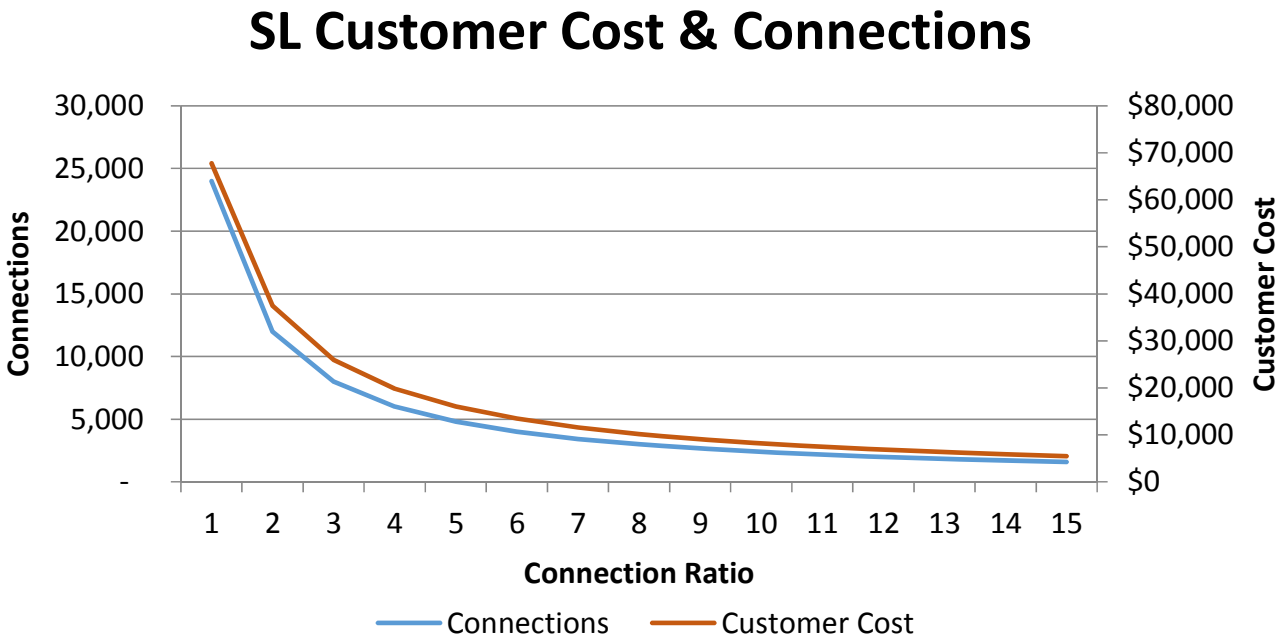
# 2. Customer Related Costs – at low connection ratios ranging from 1:1 to 3:1, customer related costs are very sensitive

- The SL allocation of customer costs is very sensitive for connection ratios of 1:1 to 3:1, and is relatively insensitive for high connection ratios.
- For the illustrative example below, a change in connection ratio from 1:1 to 2:1, decreases the allocation to SL for this customer account by 45% (~$68 k to ~$38 k).
- It is difficult to rationalize that the customer cost curve reflects actual LDC costs.



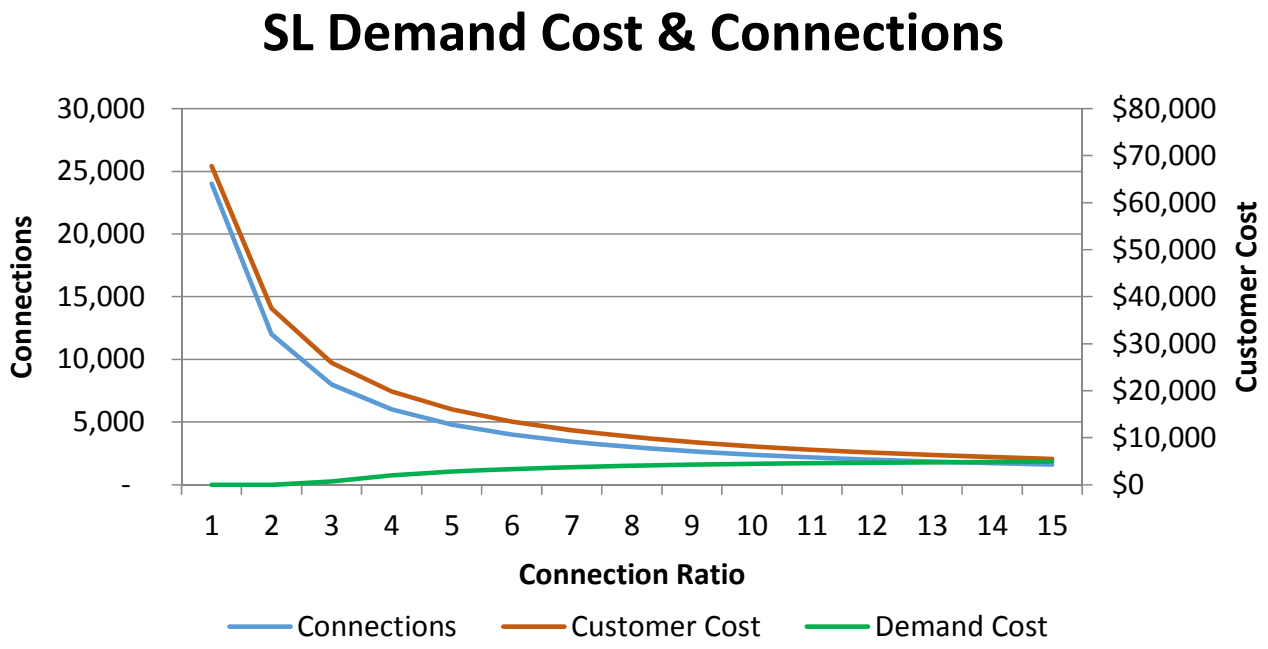
# 3. Demand Related Costs – relative to customer costs, demand related costs are much less sensitive to the number of connections

» Demand costs are inversely related to customer costs, and are less sensitive to changes in the number of connections.

» The change in the demand related costs is related to the Peak Load Carrying Capacity (PLCC) adjustment for Non Coincident Peaks (NCP)

– As the connection ratio decreases, the PLCC adjustment lowers the adjusted NCP and results in a lower demand charge, which serves to partially offset the increase in customer related charges.

– The adjustment results in a zero demand allocation (4NCPA) at low connection ratios of 1 to 2.



# LDC and Municipal Interview Summary

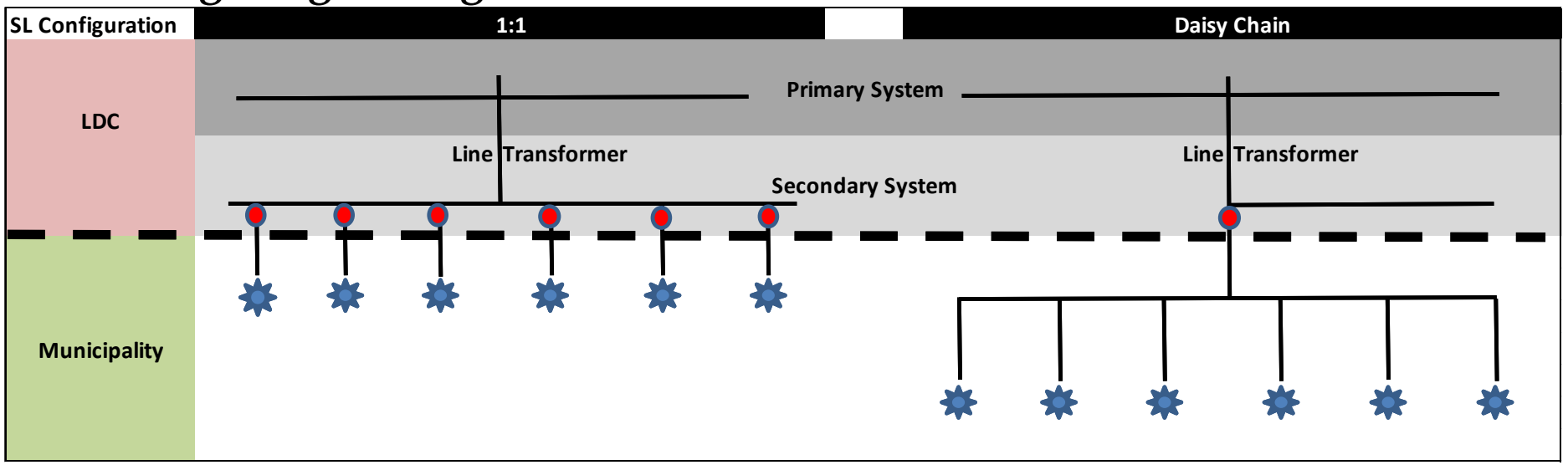
LDC Characterization:

- Most LDC's have a mix of both 1:1 and daisy chain streetlighting configurations, and are comprised of a mix of asset vintages or amalgamations.
- LDC owned streetlighting specific assets
  - Typically limited to a service connection or stub line, but there are exceptions (i.e., dedicated transformer )
- Streetlighting asset inventory
  - Most LDC's keep track of number of bulbs and wattage, however do not know specifically where these assets are located and what distribution assets they are connected to. There was no identification of assets used for 1:1 versus daisy chain.
- Use of the CAM model
  - For the small & medium LDC's the model appears in most cases to be used as a "black box" where the input cells are populated and the results are accepted without any detailed review of the model calculations.
  - Data input – some LDC's have entered devices / connections, others have used connections or devices for both inputs.

Municipal Characterization:

- Municipal streetlighting – additional assets and higher cost for daisy chain than 1:1
- Most municipalities are concerned over increasingly high streetlighting costs
- More information regarding the calculation of streetlighting costs needs to be communicated to municipalities as they have a limited understanding of the CAM and how streetlighting rates are determined
- Technology
  - Most are investigating LED technologies with some having replacement plans
  - LDC's need to be informed of these asset change outs in order to properly account for load forecasting
  - LED technologies also introduce reduced maintenance requirements for streetlighting

# Streetlighting Configurations




| Assets | Underground | Overhead | Underground | Overhead |
|---|---|---|---|---|
| LDC Primary | Station Equipment (T&D) | Station Equipment (T&D) | Station Equipment (T&D) | Station Equip. (T&D) |
| | | Poles/ Towers | | Poles/ Towers |
| | P Conductor/ Conduit | P Conductor | P Conductor/ Conduit | P Conductor |
| LDC Secondary | Line Transformer | Line Transformer | Line Transformer | Line Transformer |
| | S Conductor/ Conduit | S Conductor | S Conductor/ Conduit | S Conductor |
| | | Poles/ Fixtures | | Poles/ Fixtures |
| | Services Wires | Services Wires | Services Wires | Services Wires |
| Municipality | Poles | | Poles | |
| | | | Secondary conductors | Secondary conductors |
| | Luminares/ Brackets | Luminares/ Brackets | Luminares/ Brackets | Luminares/ Brackets |
| Comments/ Usage | Less common | Older Sub-d | Common (new sub-d) | Older Sub-d |
| | | Arterial roads | | Arterial roads |
| | | Utilize Primary poles | | Utilize Primary poles |
| | | SL makes greater use of secondary | SL makes less use of secondary | |

# LDC Secondary Assets

## Findings

- Configurations and demarcation points vary by LDC and municipality, and while there is no "set of rules", there are some generalizations:
  - For underground secondary lines a short service line or stub connection is typical for daisy chain configuration.
  - For overhead secondary lines there may or may not be a dedicated service line or stub connection (i.e. the demarcation point may be the LDC's secondary line).
  - One LDC cited an example where transformer assets were dedicated to streetlighting, but this was an anomaly on their system. Another LDC owned all of the streetlighting assets within its jurisdiction.
- Municipal asset ownership is higher for daisy chain than 1:1 i.e. the lines and poles on the municipal side of the demarcation point.
- Typically a standardized equipment specification using the same size or capacity of lines, poles, equipment etc. regardless of customer type. Voltage drop is typically the limiting factor for streetlight design.

# LDC Secondary Assets

## Conclusions

- Secondary assets (below the line transformer) are not the same for daisy chain and 1:1 streetlighting configurations. There are generally more LDC assets for 1:1 streetlighting configurations.
- The secondary system design is not dependent on the size of individual customer loads (residential and streetlighting) i.e. a standardized equipment specification for lines and poles etc. is used.
- The purpose of the secondary system is to connect all customers taking power at secondary voltage levels to the distribution system.
- The use of connections to allocate secondary costs (below the line transformer) is a reasonable approach

***For secondary assets and related costs, Navigant recommends the continued use of the existing connection based cost allocation methodology.***

# LDC Primary Assets + Line Transformers

Findings:

- Assets are designed for peak load (normal peak and contingency backup).
- Streetlighting demand is not considered in peak load (too small).
- For a given number of devices or load, the streetlighting configuration (daisy-chain or 1:1) has the identical impact on the primary system, and in both cases there is a single primary connection/ line transformer.
- Under the existing cost allocation methodology, a streetlighting connection is equivalent to a residential connection and attracts the same level of costs.

Conclusions:

- For a given number of devices, the impact on the primary distribution and line transformer assets is the same regardless of the streetlighting configuration (1:1 or daisy chain).
- A streetlighting connection is not equivalent to a residential connection in terms load and the impact on the primary distribution system.

***For the primary and line transformer asset related costs, Navigant recommends that the existing connection based allocation methodology be modified and that the actual number of streetlight connections should not be used to allocate costs to streetlighting.***

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# Primary & Line Transformer Allocation Methodology

## - What allocation to use?

Considerations:

» The allocation of primary system costs should not be impacted by the number of connections and streetlighting should attract the same level of costs regardless of configuration. In order to arrive at the same allocation of costs, the number of actual streetlighting connections can no longer be used.

» The existing CAM model uses connections to allocate costs. To deviate from this would be a significant change in cost allocation methodology with implications for all customer classes. In order to minimize the disruption, the continued use of connection based calculation is recommended.

***Navigant recommends that a connection factor be developed for streetlighting.***

» For the purpose of allocating the primary and line transformer assets and related costs to streetlighting, Navigant recommends that a connection factor be developed.

» In order to attract the same level of costs regardless of configuration and the actual number of connections, it is recommended that the number of devices or lamps be used to derive the connection factor (as an example, an LDC with 10,000 devices would have 1,000 SL connections using an assumed connection factor of 10).

» The proposed basis for the connection factor is an estimate for the number of streetlights that would be equivalent to an average connection, or effectively a residential customer.

» The question becomes - what is an appropriate number of devices per connection?

# Primary & Line Transformer Connection Factor

Streetlighting / Residential basis of comparison:

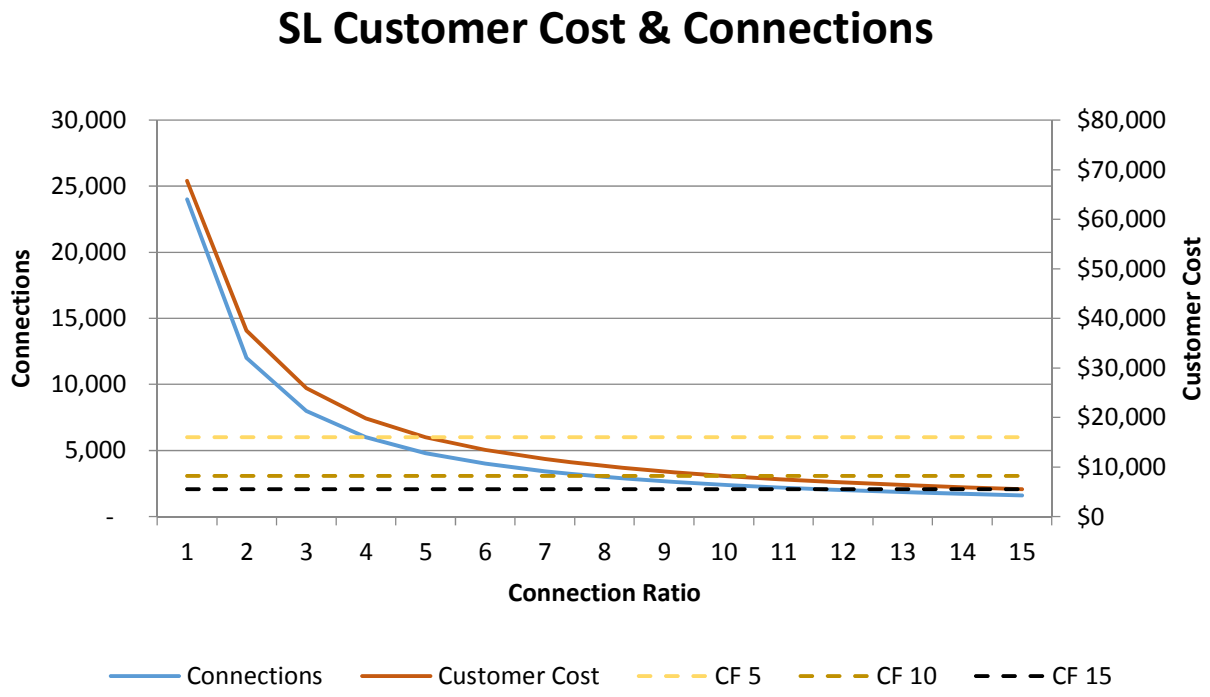
| Estimated Values | Demand watts | Energy kWh/day | Transformer (fraction of ) |
|---|---|---|---|
| Streetlighting | 100 | 1.2 | 1/40th |
| Residential | 2,500 | 27.0 | 1/12th |
| **Ratio** – devices/connection | **25** | **23** | **3.3** |

*In order to assist in the determination of an appropriate connection factor, Navigant completed a sensitivity analysis for streetlighting revenue requirement assuming 5, 10 and 15 devices per connection.*

# Connection Factor Sensitivity Analysis – Customer costs

The results of the sensitivity analysis for a Connection Factor (CF) of 5, 10 and 15 is shown below.

» The allocation for this illustrative primary / line transformer account is no longer sensitive to the number of connections.
  – For low connection ratios (actual) there is a significant decrease – compared to what is currently a high cost
  – At high connection ratios (actual) there is potentially a significant increase – compared to what is currently a relatively low cost

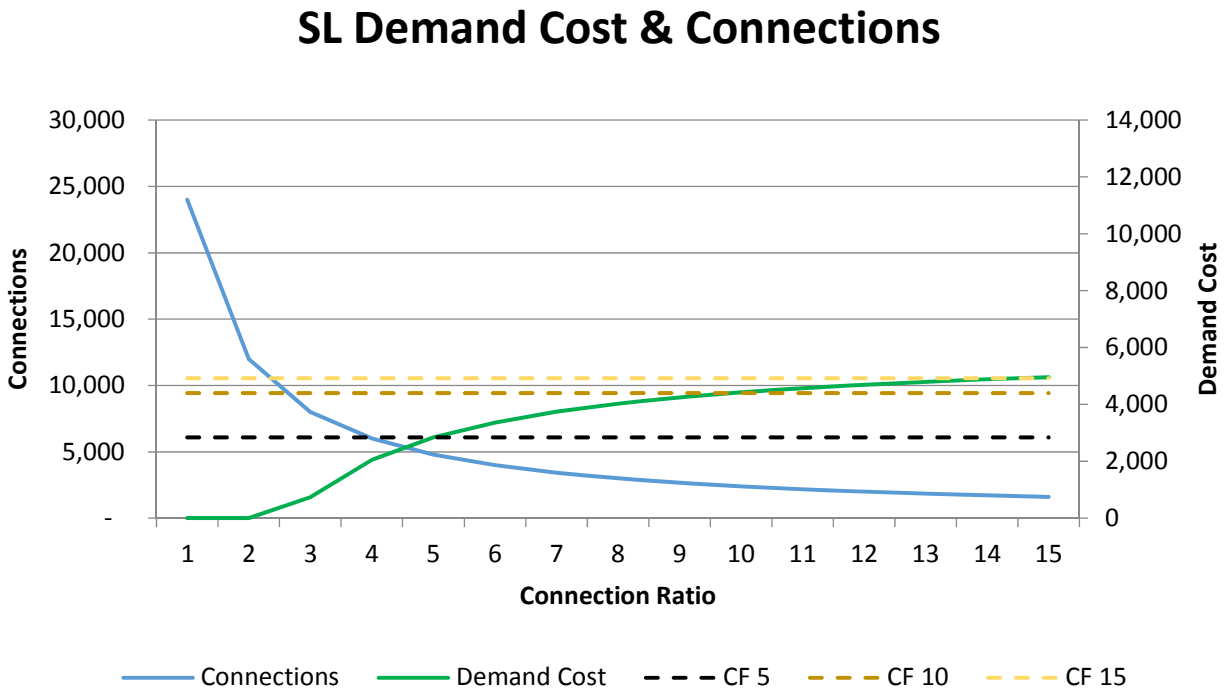


# Connection Factor Sensitivity Analysis – Demand costs

The results of the sensitivity analysis for a Connection Factor (CF) of 5, 10 and 15 is shown below.

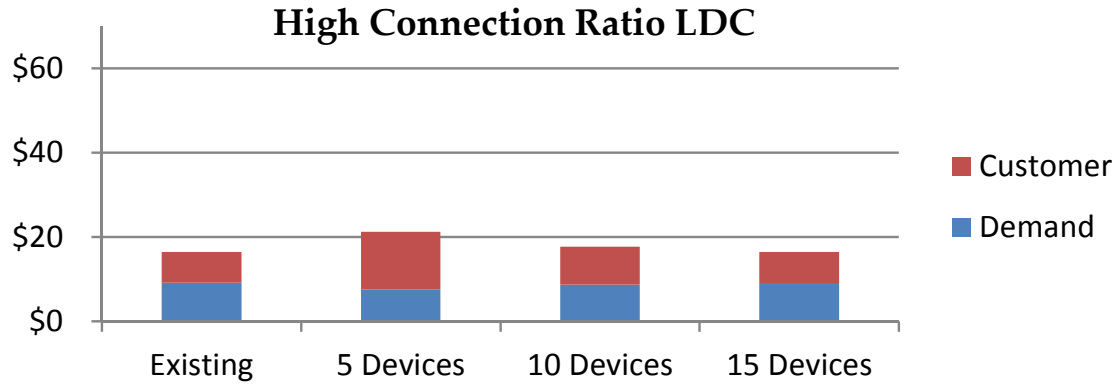
» The allocation for this illustrative primary line transformer account is no longer sensitive to the number of connections.
  – For low connection ratios (actual) there is a significant increase – compared to what is currently zero
  – At high connection ratios (actual) there is potentially a decrease – compared to what is currently a relatively low cost

» The change in the demand cost is inversely related to the connection cost

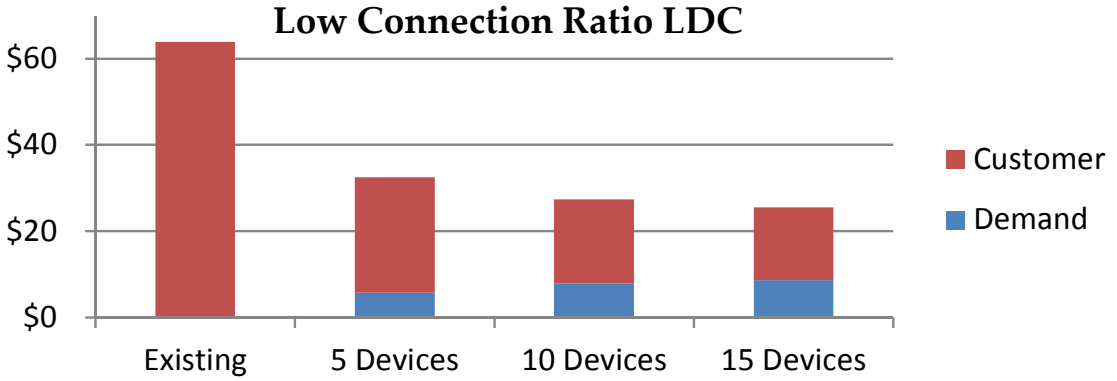


# Revenue Requirement per Device Sensitivity Analysis

- Sensitivity analysis for the customer and demand components of revenue requirement for a connection factor of 5, 10 and 5
- Beyond 10 devices, the change in revenue requirement per device becomes less and less sensitive.
- It may not make sense to calculate LDC specific CF's due to a combination of factors:
  - If the selected connection factor > 10, low sensitivity
  - Difficulty in determining CF for individual LDC's, lack of precision




| $ / Device | $ 17 | $ 22 | $18 | $17 |
|---|---|---|---|---|
| % Change | na | + 29% | + 6% | + 0% |




| $ / Device | $ 63 | $ 33 | $27 | $26 |
|---|---|---|---|---|
| % Change | na | - 48% | - 57% | - 59% |

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# Summary of Allocators and Proposed Changes by USofA

## High Connections LDC at a proposed Connection Factor of 10

| USoA # | Description | D Allocator | C Allocator | %D | %C | Proposed %D | Proposed %C |
|---|---|---|---|---|---|---|---|
| **Primary** | | | | | | | |
| 1815 | TS Equip | TCP12 | N/A | 0.8% | | 0.8% | 0.0% |
| 1820 | DS Equip | DCP12 | N/A | 0.8% | | 0.8% | 0.0% |
| 1830-4 | Poles, Towers and Fixtures | PNCP4 | CCP | 1.1% | 1.7% | 1.0% | 2.6% |
| 1835-4 | Overhead Conductors and Devices | PNCP4 | CCP | 1.1% | 1.7% | 1.0% | 2.6% |
| 1840-4 | Underground Conduit | PNCP4 | CCP | 1.1% | 1.7% | 1.0% | 2.6% |
| 1845-4 | Underground Conductors and Devices | PNCP4 | CCP | 1.1% | 1.7% | 1.0% | 2.6% |
| **Line Transformers** | | | | | | | |
| 1850 | Line Transformers | LTNCP4 | CCLT | 1.4% | 1.7% | 1.4% | 2.6% |
| **Secondary** | | | | | | | |
| 1835-5 | Overhead Conductors and Devices | SNCP4 | CCS | 1.4% | 1.7% | 1.4% | 1.7% |
| 1840-5 | Underground Conduit | SNCP4 | CCS | 1.4% | 1.7% | 1.4% | 1.7% |
| 1845-5 | Underground Conductors and Devices | SNCP4 | CCS | 1.4% | 1.7% | 1.4% | 1.7% |
| 1830-5 | Poles, Towers and Fixtures | SNCP4 | CCS | 1.4% | 1.7% | 1.4% | 1.7% |
| **Services** | | | | | | | |
| 1855 | Services | N/A | Wt Ser | | 1.9% | | 1.9% |

| | | | |
|---|---|---|---|
| **TCP12** | TS Coincident Peak | **CCP** | Customer Connections Primary |
| **DCP12** | DS Coincident Peak | **CCLT** | Customer Connections Line Transformer |
| **PNCP4** | Primary Non Coincident Peak | **CCS** | Customer Connections Secondary |
| **LTNCP4** | Line Transformer Non Coincident Peak | **Wt Ser** | Weighted Service |
| **SNCP4** | Secondary Non Coincident Peak | | |

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# Summary of Allocators and Proposed Changes by USofA

## Low Connections LDC at a proposed Connection Factor of 10

| USoA # | Description | D Allocator | C Allocator | %D | %C | Proposed %D | Proposed %C |
|---|---|---|---|---|---|---|---|
| **Primary** | | | | | | | |
| 1815 | TS Equip | TCP12 | N/A | 0.6% | 0.0% | 0.6% | 0.0% |
| 1820 | DS Equip | DCP12 | N/A | 0.6% | 0.0% | 0.6% | 0.0% |
| 1830-4 | Poles, Towers and Fixtures | PNCP4 | CCP | 0.0% | 14.0% | 0.8% | 2.1% |
| 1835-4 | Overhead Conductors and Devices | PNCP4 | CCP | 0.0% | 14.0% | 0.8% | 2.1% |
| 1840-4 | Underground Conduit | PNCP4 | CCP | 0.0% | 14.0% | 0.8% | 2.1% |
| 1845-4 | Underground Conductors and Devices | PNCP4 | CCP | 0.0% | 14.0% | 0.8% | 2.1% |
| **Line Transformers** | | | | | | | |
| 1850 | Line Transformers | LTNCP4 | CCLT | 0.0% | 14.0% | 1.2% | 1.7% |
| **Secondary** | | | | | | | |
| 1835-5 | Overhead Conductors and Devices | SNCP4 | CCS | 0.0% | 14.1% | 0.0% | 14.1% |
| 1840-5 | Underground Conduit | SNCP4 | CCS | 0.0% | 14.1% | 0.0% | 14.1% |
| 1845-5 | Underground Conductors and Devices | SNCP4 | CCS | 0.0% | 0.0% | 0.0% | 0.0% |
| 1830-5 | Poles, Towers and Fixtures | SNCP4 | CCS | 0.0% | 14.1% | 0.0% | 14.1% |
| **Services** | | | | | | | |
| 1855 | Services | N/A | Wt Ser | | 0.0% | | 0.0% |

| | | | |
|---|---|---|---|
| **TCP12** | TS Coincident Peak | **CCP** | Customer Connections Primary |
| **DCP12** | DS Coincident Peak | **CCLT** | Customer Connections Line Transformer |
| **PNCP4** | Primary Non Coincident Peak | **CCS** | Customer Connections Secondary |
| **LTNCP4** | Line Transformer Non Coincident Peak | **Wt Ser** | Weighted Service |
| **SNCP4** | Secondary Non Coincident Peak | | |

# Summary of Findings to Date

## Primary and Line Transformer Assets and Related Costs

- The existing methodology allocates a disproportionate share of costs to 1:1 streetlighting configurations
- For a given number of devices, the impact on the primary distribution system is the same for both daisy chain and 1:1 streetlighting configurations, and as such should attract the same level of costs
- Navigant recommends the development of a "connection factor" to replace the connection based cost allocation currently being used. The "connection factor" is independent of the actual number of streetlight connections, such that the streetlight configuration has no impact on the cost allocation.
- Navigant suggests a connection factor in the range of 5 to10
  - Values above 10 have only a modest impact

## Secondary Assets and Related Costs (excluding the Line Transformer)

- Navigant recommends the continued use of the existing connection based cost allocation methodology

# Next Steps for Navigant

- Finalize Recommendations
- Consultant's Report
  - first draft by the end of February,
  - finalize in March 2015.
- CAM model update
  - if necessary and pending OEB acceptance of Consultant recommendations.

**Open discussion:**

seeking commentary, feedback and suggestions

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# Appendix A – Summary of LDC and Municipality Interviews

# LDC Interviews

» The majority of the utilities interviewed did not own or operate/maintain any streetlighting specific assets

| Utility | Service Territory & Size of Utility | Ownership & Configuration of Streetlighting Assets | Cost Allocation Model Feedback |
|---|---|---|---|
| A | Urban/Rural – M | • No specific SL assets<br>• Combination of both 1:1 and daisy-chained (up to 10) configurations; split is unknown<br>• 1:1 typically is overhead and daisy-chained is underground, with new subdivisions mostly using daisy-chain<br>• # of bulbs tracked in GIS database, however no numbers were provided | • Does not perform O&M<br>• Load profile of streetlight used to determine billing (wattage, # of bulbs, technology etc.)<br>• Primarily using CAM as a "blackbox"<br>• Connection ratio used = 1.1-1.5 (estimation; utility did not provide) |
| B | Urban – L | • No specific SL assets<br>• Combination of both 1:1 and daisy-chained (up to 8) configurations; majority of which is 1:1<br>• 1:1 typically is overhead and daisy-chained is underground, with new subdivisions mostly using daisy-chain<br>• Transformer, secondary line, poles and lights used to be tracked until City took over O&M contract<br>• # of bulbs tracked as a result of a joint audit with City showed ~36,000 streetlights connected | • Does not perform O&M<br>• Load profile of streetlight used to determine billing (wattage, # of bulbs, technology etc.); legacy profiles from 2006 scaled up<br>• Primarily using CAM as a "blackbox", however has done extensive research into the inputs/outputs and is confident about utility CAM inputs<br>• Connection ratio used = 1.3 |
| C | Rural – XL | • No specific SL assets<br>• Combination of both 1:1 and daisy-chained (typically 6-12) configurations; majority of which is daisy-chained<br>• No distinction for overhead VS underground however majority of system is overhead<br>• # of bulbs tracked in GIS database shows ~155,000 streetlights connected | • Does not perform O&M<br>• Load profile of streetlight used to determine billing (wattage, # of bulbs, technology etc.); new smart meter data used for profiling<br>• Has done extensive research into the inputs/outputs and is confident about utility CAM inputs<br>• Connection ratio used = 1.8 |

# LDC Interviews

» The majority of the utilities interviewed did not have the configuration of the streetlights tracked (1:1 VS daisy-chain)

| Utility Name | Service Territory & Size of Utility | Ownership & Configuration of Streetlighting Assets | Cost Allocation Model Feedback |
|---|---|---|---|
| D | Urban/Rural – M | • No specific SL assets<br>• Combination of both 1:1 and daisy-chained (up to 10) configurations; majority is daisy-chained (>95%)<br>• # of bulbs tracked in GIS database shows ~24,000 streetlights connected | • Does not perform O&M<br>• Load profile of streetlight used to determine billing (wattage, # of bulbs, technology etc.)<br>• Primarily using CAM as a "blackbox" however 2013 filing involved re-analyzing weighting of streetlighting services/billing compared to residential service/billing costs<br>• Connection ratio used = 15.5:1 (estimation; utility did not provide) |
| E | Urban/Rural – S | • No specific SL assets<br>• Utility's entire system is 1:1<br>• Overhead/underground split is not tracked<br>• # of bulbs tracked, however the specific number was not provided | • Regulated wires company performs O&M on behalf of the City, however the City is in the process of converting all streetlights to LED technology, and it is expected that O&M will be very minimal in the future<br>• Load profile of streetlight used to determine billing (wattage, # of bulbs, technology etc.); legacy profiles from 2006 scaled up<br>• Primarily using CAM as a "blackbox", however has done a analysis into housing VS streetlighting costs<br>• Connection ratio used = 1.0 |
| F | Urban – L | • No specific SL assets<br>• Combination of both 1:1 and daisy-chained (typically 6-12) configurations; majority of which is daisy-chained<br>• All overhead is daisy-chained however underground is both 1:1 and daisy-chained<br>• # of bulbs tracked, however the specific number was not provided | • Regulated wires company performs O&M on behalf of the City<br>• Load profile of streetlight used to determine billing (wattage, # of bulbs, technology etc.)<br>• Connection ratio used = 1.1-1.5 (estimation; utility did not provide) |

# LDC Interviews

» Only one utility interviewed owned streetlighting assets (prior municipally owned)

| Utility Name | Service Territory & Size of Utility | Ownership & Configuration of Streetlighting Assets | Cost Allocation Model Feedback |
|---|---|---|---|
| G | Urban – XL | • Utility owns the majority of the streetlighting assets; the City sold off the assets to the utility<br>• Combination of both 1:1 and daisy-chained configurations; max # of connections not tracked<br>• Streetlighting assets are overhead and underground however this is not tracked<br>• # of bulbs tracked in GIS database shows ~52,000 streetlights connected (40,000 within utility wires company, 12,000 within affiliate) | • Utility contracts the City to perform O&M<br>• Load profile of streetlight used to determine billing (wattage, # of bulbs, technology etc.)<br>• Primarily using CAM as a "blackbox" however believes that the CAM is skewing costs towards streetlighting<br>• Connection ratio used = 1.8; inventory sampling used to obtain this number |

# Municipal Interviews

» All of the municipalities interviewed were concerned about their frequent increases in streetlighting costs

| Municipal | Service Territory & Size of Municipality | Ownership & Configuration of Streetlighting Assets | Feedback |
|---|---|---|---|
| 1 | Urban – XL | • Does not own streetlighting assets as it sold all of these assets to the utility in order to generate funds for budgeting purposes in 2006 | • The City receives two bills from the utility, one for the electricity used by the streetlighting luminaires and one for the O&M that the City performs on the streetlighting assets<br>• The City is the only streetlighting customer that the utility has and therefore any change in cost allocation will greatly affect the City<br>• The default streetlighting profile from the OEB is currently used to determine streetlighting costs<br>• City would be concerned if changes to the CAM would increase rates, and would actually like to see rates decrease as they are paying ~11c/kWh for off-peak use, which is significantly higher than TOU off-peak rates |
| 2 | Urban – L | • Owns and maintains streetlighting assets<br>• Most of the system is 1:1, with pockets of daisy-chain<br>• City operates its own secondary line that is connected to the streetlighting assets | • City is specifically interested in understanding utility billing practices, definition of connection/service fees, and demarcation rules<br>• Since the City contracted out O&M to separate company (not the utility), rates have increased significantly<br>• The City receives one bill per month from the utility<br>• There are no plans to convert streetlighting assets into LED technology, although pilot projects are being tested (~1,000 luminaires); City may also be looking into dimming technologies |

# Municipal Interviews

» All of the municipalities interviewed wanted more visibility into how their bills are calculated and specific explanations for rate increases

| Municipal | Service Territory & Size of Municipality | Ownership & Configuration of Streetlighting Assets | Feedback |
|---|---|---|---|
| 3 | Urban – M | • Owns and maintains streetlighting assets<br>• Most of the system is daisy-chained | • The City operating budget committee had concerns regarding the rate increases to streetlighting however the utility was able to provide answers to all of the City's questions<br>• The City contracts out O&M to a separate company (not the utility)<br>• The City receives one bill per month from the utility<br>• City is looking into dimming technologies |
| 4 | Urban – M | • Owns and maintains streetlighting assets<br>• Most of the system is daisy-chained and underground, however 1:1 connections also exist in small numbers | • The City is concerned about increasing streetlighting costs, in some cases bills have increased significantly, however in other cases they have not received bills in over a year<br>• The City contracts out O&M to a separate company (not the utility) and also performs some using own personnel<br>• The City receives 3 separate bills from different utilities, each of which uses different billing practices (OEB default streetlighting profile, metered daisy-chain, RPP) |