

# **USL Load Data Study**

## **February to May 2006**

### **Background**

This report documents a load study performed for various types of unmetered scattered loads (USL), involving a number of local distribution companies (LDC) in Ontario. The study was conducted to determine a load profile for the different types of USLs. The results of the study were then analyzed to determine if any suitable conclusions could be drawn and used in the OEB cost allocation model.

Because USL is by definition unmetered, prior to this study no data had been available as to the load shape of any type of USL. USL connections controlled by a photo sensor could be estimated as to load shape with some degree of confidence by reference to the daylight hours through the year. USL connections which are not photo sensor controlled were not well understood as to their load shape by the LDCs. Various estimation approaches are being used by different Ontario LDCs to estimate the monthly energy consumption of USL connections.

As part of the Ontario Energy Board's Cost Allocation Review process, a technical advisory group was asked to examine the issue of whether USL should be a separate class and if so, what rate structure is appropriate. In order to analyze USL as a separate customer class, load and load shape data specific to the class are required.

It was agreed among the participants, including representatives of customer groups that an attempt would be made to gather load shape data over a short period, and to develop an approach that would enable that data to be translated into a demand allocator for the cost allocation model with some degree of confidence.

### **Participation**

All LDCs were asked if they would be interested in participating in the study. Over twenty-five LDCs indicated an interest. Fifteen agreed to install interval meters or electronic recording ammeters (ERA). In the end, only ten LDCs were able to provide readings. Results were obtained for:

- 55 cable TV power supplies (due to data limitation, 32 cables were used in the final analysis)
- 2 telephone booths
- 4 pipeline cathodic protection devices
- 3 billboards

The duration of the collected data ranged from one day to three months.

Rogers' Cable Communication Inc. (RCCI) provided detailed information on its equipment, its usage, and battery heater mats.

## **Collected Data**

All gathered data has been forwarded to the Load Research group at Hydro One Networks Inc. (HONI) for analysis. During the collection process meetings were held between HONI Load Research staff, LDC representatives and RCCI to work through collection issues and initial interpretation of results.

The data files and results are held by HONI Load Research.

## **Initial Observations**

Development of values for demand allocators (1 NCP, 4 NCP, 12 NCP, 1 CP, etc.) would require estimated load shapes for each type of USL, and an estimate of the total consumption which could then be allocated over the hours in the year according to the load shape. It is intended that the generic load shapes be developed by Hydro One, and then applied to an estimate of consumption data provided by the LDCs for each type of USL.

The following section discusses the issues with regard to development of both the load shape and consumption estimate for each of the major types of USL.

### Cable TV Power Supplies

The load shape for cable TV USL connections includes the load shape for the power supply itself and the load shape of battery mats, if installed. Battery mats are not present in the service territory of all LDCs, and in LDCs where they are present, they are not present at all cable TV power supply connections. The basic power supply and the battery mat(s) where present can thus be regarded as separate components in terms of their consumption and load shape. Once a load level and load shape are established for the power supplies themselves, a load shape for the battery mat would be built on top to create the total load and load shape for cable TV USL connections in each LDC.

Where battery mats are not used in the LDC, only the basic power supply load shape would be needed. Battery mats were not in place anywhere in Ontario in 2004, which is the test year for 2006 rates for most LDCs. It was agreed by the working group that no LDC with a 2004 test year will therefore consider battery mats in its USL load shape for these informational filings. For those small numbers of LDCs using a 2006 test year and with battery mats in their service

territories, a load shape will be constructed based on operating data supplied by the cable company, and normalized for weather. The battery heater mat usage would be agreed upon by the LDC and the cable TV company, and estimated separately as part of the load data analysis. The battery heater mat usage is small in comparison to the amplifier annual usage, with many (if not most) LDCs having no battery heater mats in their service areas.

For determination of the demand allocator for the basic power supplies, the following options were considered as to the magnitude of the load:

Option 1 - Profile based on a percentage of the nameplate rating of the power supply.

Option 2 - Profile based on a percentage of the current kWh consumption estimate used by the LDC

Option 2 is the information that each LDC is currently using for billing purposes. It is recognized that the kWh being used for billing purposes is estimated, and that there are a variety of estimation approaches being applied in different LDCs.

#### Other USL Loads

Billboards – Since they have photosensitive devices, their usage should closely track the daylight hours with a load shape similar to the existing deemed streetlight profile.

Cathodic protection devices – The usage might vary by location, but the hourly profile should be relatively flat.

Telephone Booths (non-photosensitive) – The usage should be relatively flat.

## **Findings**

#### Cable TV Power Supplies

- Based on monitored data, the cable loads are very flat (see Appendix A);
- Energy consumption level for cable TV equipment, however, varies substantially (see Appendix B);
- Nameplate information varies by equipment and this information is difficult to obtain;

Recommendation:

- Sample size under study is small and mostly contributed by one LDC, further monitoring and/or study is recommended if defensible estimates are required for rate submission;
- In the short-term, recommend to use current energy estimates provided by LDCs and Cable companies;
- LDCs and cable companies should work together in future study (such as monitoring and audits);
- There is a need to document how energy consumption estimates are established by Cable companies and LDCs;

### Battery Heater Mats

- Data provided by RCCI shows significant correlation with hourly weather data;
- Weather normalized load shapes have successfully been generated (see Appendix C for sample load shapes on a weather normalized basis);
- Sample used for analysis is limited to selected areas, further analysis with a larger sample and other areas may improve the load shapes;

#### Recommendation:

- In the short-term, recommend to use the generated weather sensitive load shapes for informational filings to OEB;
- Further study with larger sample is recommended.

### Other USL Loads

- The loads are relatively flat;
- Since the sample under study is very small, this finding may not be statistically significant;

#### Recommendation:

- In the short-term, recommend to use current energy profiles provided by LDCs;
- Further study with larger sample is recommended.

**Appendix : A (i) Power Supply As A Percentage Of The Nameplate Rating**

	Hydro One Nameplate rating = 0.900 kwh (15A, 60V)								
Meter number	1	2	3	4	5	6	7	8	9
Monitored consumption	0.25	0.33	0.37	0.61	0.14	0.36	0.68	1.27	0.66
Percentage of nameplate	28.0%	36.9%	41.4%	67.8%	16.0%	40.5%	75.1%	141.3%	73.3%

	Hydro One Nameplate rating = 0.900 kwh (15A, 60V)								
Meter number	10	11	12	13	14	15	16	17	18
Monitored consumption	0.77	0.51	0.22	0.41	0.40	0.75	0.24	0.54	0.43
Percentage of nameplate	85.3%	56.8%	24.8%	45.5%	43.9%	83.4%	26.2%	60.2%	47.8%

	Hydro One Nameplate rating = 0.900 kwh (15A, 60V)								
Meter number	19	20	21	22	23	24	25	26	27
Monitored consumption	0.34	0.33	0.18	0.77	0.16	0.52	0.42	0.62	0.59
Percentage of nameplate	37.4%	37.0%	20.4%	85.5%	17.8%	58.0%	46.5%	69.3%	65.3%

**Appendix : A (ii) Power Supply As A Percentage Of The Nameplate Rating**

Chantam Kent -1		
Nameplate = 15 A 60 V		
Monitored Kw	Frequency	% of Nameplate
0.27	0.7%	30.0%
0.28	0.8%	31.1%
0.29	1.5%	32.2%
0.55	9.2%	61.1%
0.56	19.3%	62.2%
0.57	22.2%	63.3%
0.58	32.8%	64.4%
0.59	9.4%	65.6%
0.6	4.1%	66.7%
1.14	0.1%	126.7%

Chantam Kent -4		
Nameplate = 15 A 60 V		
Monitored Kw	Frequency	% of Nameplate
0.33	0.6%	36.7%
0.34	1.3%	37.8%
0.35	0.8%	38.9%
0.36	0.3%	40.0%
0.66	5.8%	73.3%
0.67	24.3%	74.4%
0.68	36.8%	75.6%
0.69	1.7%	76.7%
0.7	7.0%	77.8%
0.71	20.9%	78.9%
0.72	0.2%	80.0%
0.73	0.1%	81.1%
1.35	0.1%	150.0%
2.79	0.1%	310.0%

Chantam Kent -2		
Nameplate = 15 A 60 V		
Monitored Kw	Frequency	% of Nameplate
0.34	0.1%	37.8%
0.35	1.8%	38.9%
0.36	1.0%	40.0%
0.37	0.1%	41.1%
0.66	0.2%	73.3%
0.69	0.9%	76.7%
0.7	21.5%	77.8%
0.71	72.4%	78.9%
0.72	1.9%	80.0%
0.77	0.1%	85.6%
0.78	0.1%	86.7%

Chantam Kent -4		
Nameplate = 15 A 60 V		
Monitored Kw	Frequency	% of Nameplate
0.29	0.5%	32.2%
0.3	1.9%	33.3%
0.31	0.4%	34.4%
0.32	0.3%	35.6%
0.57	0.1%	63.3%
0.58	45.0%	64.4%
0.59	20.1%	65.6%
0.6	0.9%	66.7%
0.61	1.1%	67.8%
0.62	19.7%	68.9%
0.63	10.1%	70.0%

Chantam Kent -3		
Nameplate = 15 A 60 V		
Monitored Kw	Frequency	% of Nameplate
0.37	1.2%	41.1%
0.38	1.8%	42.2%
0.66	0.1%	73.3%
0.68	0.1%	75.6%
0.73	0.1%	81.1%
0.74	1.1%	82.2%
0.75	49.9%	83.3%
0.76	45.4%	84.4%
0.78	0.1%	86.7%
0.8	0.1%	88.9%
0.81	0.1%	90.0%

Gravenhurst -1		
Nameplate = 15 A 60 V		
Monitored Kw	Frequency	% of Nameplate
0.53	0.1%	58.9%
1.05	0.1%	116.7%
1.08	2.9%	120.0%
1.09	29.6%	121.1%
1.1	55.7%	122.2%
1.11	11.6%	123.3%
1.12	0.1%	124.4%

New Market 2		
Nameplate = 15 A 60 V		
Monitored Kw	Frequency	% of Nameplate
0.06	0.2%	6.7%
0.44	23.9%	48.9%
0.46	74.7%	51.1%
0.48	1.0%	53.3%
0.52	0.2%	57.8%

Gravenhurst -1		
Nameplate = 15 A 60 V		
Monitored Kw	Frequency	% of Nameplate
0.48	0.1%	53.3%
0.53	0.1%	58.9%
0.67	0.1%	74.4%
0.68	1.5%	75.6%
0.69	28.8%	76.7%
0.7	42.5%	77.8%
0.71	22.3%	78.9%
0.72	4.6%	80.0%
0.73	0.1%	81.1%

New Market 2		
Nameplate = 15 A 60 V		
Monitored Kw	Frequency	% of Nameplate
0.48	0.0%	53.3%
0.52	0.1%	57.8%
0.88	0.0%	97.8%
0.9	26.2%	100.0%
0.92	63.2%	102.2%
0.94	10.2%	104.4%
0.96	0.1%	106.7%
1	0.0%	111.1%
1.12	0.0%	124.4%

New Market 1		
Nameplate = 15 A 60 V		
Monitored Kw	Frequency	% of Nameplate
0.32	0.2%	35.6%
0.42	22.0%	46.7%
0.44	76.3%	48.9%
0.46	1.0%	51.1%
0.48	0.2%	53.3%
0.5	0.2%	55.6%

Whitby 1		
Nameplate = 0.417Kwh (6.6A, 63.2)		
Monitored Kw	Frequency	% of Nameplate
0.38	0.3%	91.1%
0.39	0.3%	93.5%
0.4	0.1%	95.9%
0.41	2.0%	98.3%
0.42	1.2%	100.7%
0.43	4.2%	103.1%
0.44	6.0%	105.5%
0.45	9.6%	107.9%
0.46	13.0%	110.3%
0.47	13.1%	112.7%
0.48	13.3%	115.1%
0.49	7.1%	117.5%
0.5	7.2%	119.9%
0.51	6.5%	122.3%
0.52	5.1%	124.7%
0.53	5.8%	127.1%
0.54	1.5%	129.5%
0.55	2.3%	131.9%
0.56	1.0%	134.3%

**Appendix B : Power Supply As A Percentage Of The Current kWh Consumption Estimate Used By LDC**

<b>ACCOUNT NO.</b>	<b>COMPANY NAME</b>	<b>Kw Measured</b>	<b>Monthly billed Values in Kw</b>	<b>Measured Kw / Billing value.</b>	<b>Average by cable company</b>
<b>HYDRO ONE</b>					
1	Company A	0.25	0.18	138%	
2	Company A	0.33	0.26	129%	
3	Company A	0.37	0.59	63%	
4	Company A	0.61	0.65	94%	
5	Company A	0.14	0.47	31%	91%
6	Company B	0.51	0.44	116%	
7	Company B	0.22	0.18	128%	
8	Company B	0.41	0.76	54%	
9	Company B	0.40	0.47	85%	
10	Company B	0.75	0.77	97%	96%
11	Company C	0.24	0.23	102%	102.2%
12	Company D	0.54	0.63	86%	86.5%
13	Company E	0.43	0.33	130%	130.2%
14	Company F	0.34	0.39	85%	85.4%
15	Company G	0.33	0.40	83%	83.2%
16	Company H	0.18	0.23	80%	
17	Company H	0.77	0.79	97%	88%
18	Company I	0.16	0.07	235%	235%
19	Company J	0.52	0.19	272%	272%
20	Company K	0.42	0.47	89%	89%
21	Company L	0.62	0.24	261%	261%
22	Company M	0.59	0.82	71%	71%
23	Company N	0.36	0.25	144%	
24	Company N	0.68	0.63	108%	
25	Company N	1.27	0.73	174%	
26	Company N	0.66	0.63	104%	
27	Company N	0.77	0.16	494%	205%
<b>NEW MARKET</b>					
1	Company N	0.44	0.44	101.0%	
2	Company N	0.92	1.22	75.1%	88.1%
<b>WHITBY</b>					
1	Company N	0.48	0.62	76.8%	76.8%
<b>WASAGA</b>					
1	Company N	0.55	0.90	61.3%	
2	Company N	0.45	0.48	95.2%	143%
<b>TOTAL</b>		<b>15.72</b>	<b>15.60</b>		
<b>Total measured kw/Total billed kw</b>		<b>100.8%</b>			



## Appendix C: Battery Heater Mats Profile

Table 1

Unmetered Scattered Load, Battery Mats Count 1 - Monthly Electricity Consumption (Wh)

Month	Hour																								Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Jan	113	124	169	159	190	246	293	284	290	284	261	254	251	188	172	155	140	130	125	144	117	116	113	96	4414
Feb	100	107	138	132	153	193	224	219	222	217	200	196	194	148	137	126	116	107	104	118	100	100	99	86	3535
Mar	51	53	67	64	72	89	102	100	101	99	91	90	89	69	65	61	56	52	51	57	50	51	50	45	1674
Apr	11	11	13	13	14	16	18	18	18	17	16	16	16	13	12	12	11	10	10	11	10	11	11	10	319
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov	18	18	22	21	23	27	30	30	30	29	27	27	27	21	20	20	18	17	17	19	17	18	18	16	530
Dec	45	46	56	54	60	72	80	80	80	78	72	72	72	56	53	51	47	44	43	48	43	44	44	40	1381

Note. All figures are weather-normal.

**Appendix C: Battery Heater Mats Profile**

Table 2

Unmetered Scattered Load, Battery Mats Count 2 - Monthly Electricity Consumption (Wh)

Month	Hour																								Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Jan	169	205	197	201	209	241	228	231	179	197	183	186	123	124	95	105	92	92	122	108	118	138	154	137	3833
Feb	155	179	172	170	178	199	188	188	147	166	154	155	109	107	84	92	83	84	106	97	106	122	136	125	3303
Mar	83	93	90	87	92	101	96	95	75	85	79	79	57	56	44	48	44	45	55	51	56	64	71	66	1713
Apr	18	19	18	17	18	19	18	17	14	16	15	15	12	11	9	10	9	10	11	11	12	13	15	14	342
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov	30	32	30	28	30	31	30	28	23	27	25	25	20	19	16	16	16	16	19	18	20	22	25	24	569
Dec	74	81	78	74	79	84	80	78	62	72	66	67	51	48	39	42	39	40	48	45	50	56	63	59	1475

Note. All figures are weather-normal.

**Appendix C: Battery Heater Mats Profile**

**Table 3**

**Unmetered Scattered Load, Battery Mats Count 3 - Monthly Electricity Consumption (Wh)**

Month	Hour																								Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Jan	177	220	220	187	264	262	386	305	365	414	346	368	391	343	270	312	244	342	239	239	213	234	235	211	6786
Feb	169	189	185	165	222	207	287	241	284	321	276	312	347	296	235	262	212	281	196	221	193	191	212	207	5709
Mar	119	116	112	106	132	112	138	131	150	168	152	188	224	183	148	156	133	162	112	151	128	109	140	150	3421
Apr	29	25	24	24	28	21	22	25	27	30	29	40	51	40	33	32	29	33	23	36	29	22	32	37	719
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov	66	55	51	53	59	43	41	51	55	60	60	86	112	87	72	70	64	69	48	80	65	46	72	84	1548
Dec	130	115	108	109	127	98	107	116	129	143	137	183	229	182	149	150	133	152	105	160	133	101	145	165	3305

Note. All figures are weather-normal.

## Appendix C: Battery Heater Mats Profile

Table 4

Unmetered Scattered Load, Battery Mats Count 6 - Monthly Electricity Consumption (Wh)

Month	Hour																								Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Jan	125	152	211	243	287	289	310	336	323	323	276	294	290	246	206	199	180	169	156	146	162	148	143	129	5346
Feb	102	122	163	186	218	218	231	250	240	240	210	222	220	187	159	154	140	135	125	118	129	120	117	109	4114
Mar	53	63	81	93	108	107	113	121	116	117	104	109	108	92	80	77	71	69	64	61	66	62	61	58	2051
Apr	4	5	7	8	9	9	9	10	10	10	9	9	9	8	7	6	6	6	5	5	5	5	5	5	170
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov	12	14	17	20	23	22	23	24	24	24	22	23	23	19	17	17	15	15	14	14	15	14	14	14	438
Dec	34	41	51	59	68	67	70	76	73	73	66	69	68	58	51	49	45	44	41	40	42	40	39	38	1302

Note. All figures are weather-normal.